Lithic and Raw Material Variability in the Mesolithic of the Western Isles: Contextualising "The Hybrid Industries of the Western Seaboard"

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Lithic and Raw Material Variability in the Mesolithic of the Western Isles: Contextualising "The Hybrid Industries of the Western Seaboard"

(Lacaille 1954:288)

Volume 1 of 2

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Thesis submitted for the qualification of Doctor of Philosophy

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Abstract

This thesis assesses the lithic technology of the recently established Mesolithic of the Western Isles of Scotland, and how this technology fits into the occupation of these new sites. Moreover, it addresses whether the Western Isles sites are representative of the Scottish Mesolithic and how they fit within the Mesolithic of the north-east Atlantic façade.

Extensive investigations into the Mesolithic of western Scotland and the Inner Hebrides have revealed widespread coastal occupation, however, large areas are still devoid of such evidence. Until recently the Western Isles were one such instance, despite long-held assertions of anthropogenic vegetation disturbance inferred from pollen diagrams. The lithic assemblages analysed in this thesis represent the first definitive evidence for Mesolithic occupation in this region. These are contextualised within the current understanding of the Mesolithic in Scotland and its closest Atlantic neighbours – Ireland and Norway.

The assemblages demonstrate that locally available quartz was expediently worked to produce informal flake-based technology. Small quantities of flint were heavily curated and may have been imported from distant sources. This fits within a broad trend of an increased uptake in local raw materials and subsequent technological adjustment that occurs around the 7th millennium cal. BC, across the Atlantic seaboard. The import of exotic raw materials also indicates connections with other islands.

The exceptional organic preservation at these sites provides a rare insight into hunter-gatherer economy in western Scotland. The Mesolithic inhabitants of the Western Isles appear logistically organised, exploiting a broad-spectrum economy. This is supported by the generalised and expedient lithic technology.

The lack of microliths suggests insular technological developments in the later Mesolithic toolkit of the outer isles. This raises questions regarding our current understanding of the microlith as a symbol of Mesolithic technology and the validity of using microliths as definitive evidence for Mesolithic occupation. Consequently, this may aid future recognition of new Mesolithic sites where previously they may have been dismissed as undiagnostic scatters.

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This thesis is dedicated in loving memory of Cass.

Chapter 1 Introduction

1.1. Research Context

The quote contained within the title of this thesis refers to the description of the lithic industries of prehistoric western Scotland by A. D. Lacaille, in his *magnum opus*, '*The Stone Age in Scotland'* (Lacaille 1954; Morrison 1996). Within these "hybrid industries" of the "post-Mesolithic survivals" is a description of an undated lithic facies on the Bhaltos peninsula of Lewis, which bear the hallmarks of a Mesolithic industry (Lacaille 1954:288). A little under 60 years later, the Mesolithic was confirmed in this region.

The Mesolithic occupation of the Western Isles was only initially identified in 2001 (Gregory *et al.* 2005). Below a well-known Neolithic and Beaker settlement at Northton, Isle of Harris, Mesolithic-age occupation deposits yielded a small quartz, flint, and hornfels lithic assemblage, with no diagnostic artefacts present (Nelis 2006b). It was suggested that this undiagnostic assemblage might indeed be representative of the Mesolithic of the Western Isles (Gregory *et al.* 2005:948). Following further excavation of the site in 2010, a pilot study was conducted on a sample of the lithic assemblage from Northton (Piper 2011). A small number of microliths were identified; however, the assemblage largely conformed to the undiagnostic flake-based industry described by Nelis (2006b). Since Northton was the only known Mesolithic site in the Western Isles at the time the pilot study was conducted, the validity of a largely non-microlithic Mesolithic industry in the Western Isles could not be tested. With the discovery of further Mesolithic sites from the Western Isles during the subsequent four years of fieldwork, this suggestion can now be revisited in addition to other aspects of the study. The conclusions and interpretations can therefore be tested more thoroughly, through comparison with other Western Isles Mesolithic assemblages on a site-by-site basis.

1.2. Research Questions

The original contribution to knowledge contained within this thesis, and the overall aim of this PhD research is: *to contextualise the lithic assemblages from the newly established Mesolithic of the Western Isles of Scotland, within a holistic framework that explores the nature of hunter-gatherer interaction with the environment at the extreme edge of the north-east Atlantic façade*. Specifically, this will be addressed through the analysis of six lithic assemblages from dated Mesolithic sites on the Isles of Harris and Lewis. These represent two different types of sites – open-air 'camps' and shell middens. Two further instances of eroding shell midden deposits were sampled during the investigation of the primary Mesolithic sites on Lewis. Very small lithic assemblages were recovered from these samples, which are as yet undated, but they contain the same material which characterises the Mesolithic midden deposits further along the headland. Each site is then contextualised more widely in terms of how it fits within the Mesolithic of the north-east Atlantic seaboard, first with Scotland and the Inner Hebrides, before broadening out into the Mesolithic of western Europe.

The following research questions have been formulated based on the results of a pilot study conducted on the lithic assemblage from the first Mesolithic site identified in the Western Isles, at Northton, Isle of Harris (Piper 2011). Within the first two questions, a series of sub-questions are set in order to focus the main question more clearly. The third question is much broader in its scope.

QI. What is the nature of the lithic technology of the Mesolithic in the context of the Western Isles of Scotland?

- What raw materials are utilised, and where are they sourced from?
- What reduction strategies are employed, and are they material specific?
- Are there microliths present at the midden sites and bevel ended tools at the open air sites?
- Is the assemblage an expedient or curated technology?

QII. How do the lithic assemblages fit into the occupation of the Western Isles sites?

- What activities are being conducted at each site?
- Are these activities reflected in the composition of the lithic assemblage?
- How does this fit within models of Mesolithic settlement patterns?

QIII. Are the Western Isles sites representative of the Scottish Mesolithic, and how do they fit within the Mesolithic of the north-east Atlantic façade?

1.3. Thesis Structure

Chapter Two provides a broad overview of the history of Mesolithic research in western Scotland and the Hebridean Islands. The purpose of this is to establish the current picture of the Mesolithic in western Scotland and the Hebrides, and how this came to be. Research into the Mesolithic of this region has changed significantly since the 19th Century, both in terms of its aims and the methods employed. By providing a picture of the research *longue duree* it is possible to observe the constant shifting of perceptions and ideas. From the culture-historical perspective of Lacaille searching for the Tardenoisians and the Maglemosians, to the multi-facetted approach of the Southern Hebrides Mesolithic Project, the continual discovery of new Mesolithic sites in the region has challenged previous ideas and reinforced others.

The chapter is broken down on a county-level basis in order to better understand research outputs. The effect of large-scale projects by academic institutions is significant, but the contribution of local enthusiasts should not be overlooked. It is these amateur investigations that have enlarged the body of Mesolithic evidence, and created a more balanced picture of hunter-gatherer occupation in western Scotland by exploring the interior region, away from the coast to which the academic gaze has been drawn. Despite the advance in interest, it is clear that some areas remain devoid of Mesolithic evidence, either due to the neglect of researchers or challenging preservation conditions. Until the turn of the millennium the Western Isles were a case in point. Mesolithic occupation was presumed likely, but remained unproven (Edwards & Sugden 2003:18).

In the face of unfavourable preservation conditions for organic remains, the largest body of evidence are the hundreds of (frequently unstratified) Mesolithic lithic scatters. Tracing human movement through the distribution of the scatters and their raw materials provides further insight into the lives and activities of hunter-gatherers, of which well-preserved evidence is restricted to the shell middens of the Oban coastline and Inner Hebridean islands.

It is only within the last decade that the Mesolithic period in Europe has been synthesised through a multitude of narratives and perspectives (Conneller & Warren 2006; Spikins 2008b). The traditional perception of this period as an “impoverished” hiatus between the Palaeolithic and Neolithic – simultaneously in terms of theory, evidence, culture and economy – has long been entrenched in the attitude of many renowned prehistorians (Childe 1935; Roe 1970:74; Wheeler 1954); discovery of the rich Mesolithic sites in the Western Isles stand starkly against this backdrop. Only by understanding the basis on which the current picture of the Mesolithic in Scotland is formed is it possible to recognise how this influences our interpretations of new data. The exceptionally preserved faunal material at the ‘open air’ sites of Harris is largely unparalleled within Scotland, highlighting how the bias in organic preservation has so far restricted a fully holistic understanding of Mesolithic occupation. The presence of shell middens on Lewis is indicative of sustained later Mesolithic economic practices throughout the coastal chain. The significance of the similarities and differences between the Western Isles and western Scotland and the Inner Hebrides will be drawn upon again more fully in Chapter Eight.

Chapter Three expands on the themes of colonisation, coastal occupation and raw material movement initially raised in Chapter Two, but on a broader geographical scale along the north-east Atlantic façade. Ireland and Norway were carefully selected as two regions that can be compared closely with Scotland as geographical neighbours to the south-west and north-east respectively, with similarities beyond physical geography and climate emerging in terms of Mesolithic settlement and subsistence. The importance of boats and specialised marine adaptation to the Mesolithic colonisation of Ireland and Norway is described, followed by the significance of the contribution of a fishing economy to the changing nature of occupation throughout the period in these two regions. The centuries around 7000 cal. BC signify major transitions in both Ireland and Norway. In the former, a significant shift in technology marked the transition between the Early and Later

Mesolithic. This millennium in Norway is identified as the change between the Middle and Late Mesolithic Chronozone. Although the chronozones are an artificial construct, there is a marked increase in the number of well-preserved sites indicating an increasingly sedentary hunter-gatherer-fisher population, and large scale movement of raw materials occurring at this time. The occupation of Northton, the first known Mesolithic site in the Western Isles, also spans this date.

This chapter forms the foundation for further discussion in Chapter Eight, in which the newly discovered sites from the Western Isles are contextualised within Mesolithic occupation of the Atlantic edge. It is possible to draw parallels between the similar physical geography of south-west Norway and western Scotland and the delayed colonisation of these areas following de-glaciation. The Mesolithic inhabitants of the north-east Atlantic broadly share advanced maritime adaptation and delayed-return marine-based economies. This is characterised by island and coastal occupation associated with boat technology capable of crossing open sea, shell midden formations, shared funerary traditions and changing raw material procurement.

Chapter Four details the recovery and recording methods used to analyse the lithic assemblages excavated in the Western Isles. The formulation of the recording methodology was based on the methodologies used in the specialist analyses of lithic assemblages excavated from Scottish sites detailed in Chapter Two. However, these methodologies are largely flint-derived. In light of the dominance of quartz, rather than flint, at the Western Isles sites the methodology used to analyse the assemblages in this thesis also draws heavily on the work of Torben Ballin, who has published extensively on quartz assemblages in Scotland, and is therefore most familiar with Scottish quartz material (e.g. Ballin 2001; 2002; 2004; 2008; 2016a; 2016b). A brief summary of the debates surrounding quartz analysis is also included in respect of this, which particularly emphasises the issues of a quartz-only typology in a mixed raw material assemblage, and what constitutes the definition of a ‘tool’. By combining these approaches the methodology was tailored to answer the first of the research questions detailed above, and also to ensure the analysis was comparable with other sites in western Scotland and the Inner Hebrides in order to provide a holistic answer to the final research question.

In Chapters Five and Six the results of the lithic analysis are presented. These results chapters are divided by island. Chapter Five focusses on the assemblages from the two open-air sites in Harris, Northton and Tràigh an Teampuill. In Chapter Six the assemblages are presented from the shell midden sites on Lewis, the five sites along the Cnip headland at Tràigh na Beirigh and Pabaigh Mòr South on the small island of Pabaigh Mòr. For each site the circumstances of discovery, site stratigraphy/matrix and dating evidence is outlined prior to the results of the lithic analysis. These chapters are purely data-oriented. The interpretations of the reduction strategies employed and the technology produced are presented in Chapter Eight alongside contextualisation within the wider Mesolithic site assemblage. A full discussion of how these technological traditions fit within the Mesolithic of the Atlantic façade is presented in Chapter Nine. An executive summary of the main findings is therefore presented at the end of each site for reference.

Chapter Seven departs from the main objective of the thesis but is intrinsically important. I designed a survey which was conducted during the 2013 field season to test some of the issues that became apparent during the writing of Chapter Two, and were reinforced by the discovery of the Mesolithic sites in the Western Isles. There is an evident bias in our understanding of Mesolithic occupation, which is concentrated along the coast. This may, in part, be a consequence of mid-Holocene sea level rise in coastal areas, but is also a direct result of research interests. As a consequence, there is a lack of evidence for the Mesolithic inland. To some extent this has been resolved on the mainland of Scotland, with the identification of Mesolithic sites in the lowland interior of the south-west. The survey along the River Barvas was implemented to evaluate whether the same traces of Mesolithic occupation could be identified in the *interior* of Lewis.

The chapter is a self-contained piece which describes the rationale, research questions, methodology and results of the survey in which a flood deposit containing Mesolithic-age palaeoenvironmental material was identified. Although the charred heathland material within the deposit is not direct evidence of Mesolithic human activity in the interior of the island, the importance of this cannot be overestimated. The material sheds light on the palaeoenvironment of Lewis, beyond the pollen and microcharcoal studies of the late 1980's. The possibility of human impact on the environment is also suggested.

Chapter Eight provides an extensive discussion of the full Western Isles Mesolithic dataset as it stands. In terms of the lithic assemblages**,** it is clear that technology and raw materials used by the Mesolithic inhabitants of the Western Isles are inextricably linked with subsistence and mobility. Each lithic assemblage is therefore placed within the wider activities conducted at each site by synthesising the results thus far post-excavation analysis of the floral, faunal and malacological assemblages. Although as yet incomplete, this provides a more holistic overview of the nature of Mesolithic occupation in terms of settlement and subsistence practices on the islands and affords the information required to address the first and second research questions of this thesis.

A number of themes arise from this, which facilitate a more in-depth discussion in Chapter Nine that pertains to the nature of the *chaîne opératoire* within settlement and subsistence strategies. Significantly, by comparing and contrasting the data from the Western Isles within our current understanding of the Mesolithic evidence of Scotland, Norway, and Ireland (as presented in Chapters Two and Three) it becomes evident that several of these themes are comparable across the north-east Atlantic seaboard. A general trend towards the use of locally available raw materials is noted, alongside which is an adaptation in the employment of differing the reduction strategies to suit their varying fracture mechanics. The lack of formal tool production in the Western Isles and Ireland appears related to this in some respects; however several other factors, such the absence of large terrestrial game and changing social networks, may also be connected with this. The mobility of groups and existing connections between islands and regions is likely to have been affected by increasing sedentism, which was facilitated by intensive exploitation of abundant coastal resources. Another significant theme is the collective evidence for the continuity of Mesolithic lifeways beyond the traditional start of the Neolithic in these regions. By drawing these parallels, a conclusion is reached by which the third research question of this thesis can be answered.

Chapter Ten concludes this thesis by answering each of the research questions presented in this chapter with a summary of the major findings. The analysis of the lithic assemblages from the first sites in the Western Isles of Scotland have contributed significantly to our understanding of the variability in Mesolithic technology and raw material use within western Scotland. This variability is echoed by the activities and nature of occupation at the sites as a whole, each of which highlights a unique aspect of Mesolithic settlement and subsistence. The importance of these sites within the context of the north-east Atlantic seaboard cannot be underestimated, as the results that lie within have the potential to change our understanding of the Mesolithic in this region.

1.4. A Caveat

The lithic data, upon which the research in this thesis is based, derives from small assemblages. No large-scale excavations were conducted at Tràigh an Teampuill or a Tràigh na Beirigh 2, 3, 4 and 9 due to their position under several metres of machair overburden. Tràigh na Beirigh 1 was excavated in its entirety, however the site has suffered from aggressive coastal erosion and is known to have been much larger (Armit 1994:90; Burgess & Church 1997:117). The area excavated at Northton was restricted in its size owing to time constraints in the field; similarly the length of time available to access Pabaigh Mòr contributed to the small sample size. Consequently, the lithic dataset has been recovered from very small areas of deposits that are much greater in extent, and reflects the activities conducted within those sampled areas. It is probable that further lithic evidence, indicative of other activities to those interpreted in this thesis, may exist beyond the excavated areas, or indeed have already been lost to the sea. Furthermore, the supporting information regarding the nature of subsistence has been obtained from sub-samples of a vast palaeoenvironmental and zooarchaeological assemblage that awaits full analysis. Whilst this thesis presents a comprehensive synthesis of the data to date, it is undoubtable that the conclusions of this thesis may need to be revised or rejected pending the completion of this project.

Chapter 2 Mesolithic Research in Western Scotland and the Hebrides: A Synthesis

2.1. Introduction

The earliest evidence for the Mesolithic in Scotland is at Cramond, Edinburgh which is dated to c.8500 cal. BC, around 1,100 years after the end of the Loch Lomond stadial and the beginning of the Holocene epoch (Ballantyne 2007:3135). In Scotland the transition to the Neolithic is traditionally ascribed to 3800 cal. BC, although earlier evidence in the form of Breton Middle Neolithic style pottery from a chambered tomb at Achnacreebeag, Argyll suggests 'Neolithisation' as early as 4300-4000 cal. BC (Ashmore 2004a:100; 2004b:92; Schulting & Richards 2002:167; Sheridan 2010).

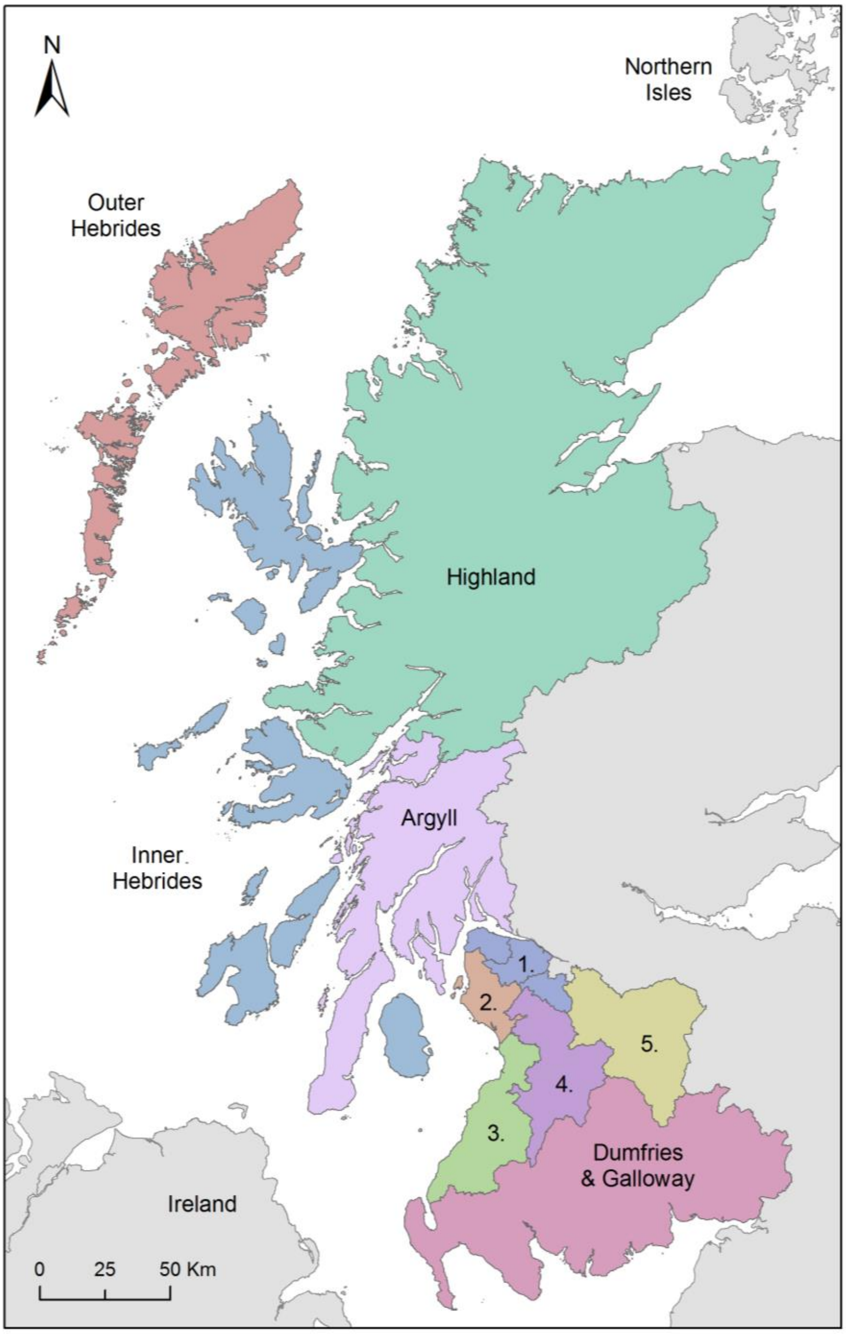

Figure 1. Overview map highlighting the regions of western Scotland discussed in the chapter

1. - Renfrewshire and Inverclyde

2. - North Ayrshire

3. - South Ayrshire

4. - East Ayrshire

5. - South Lanarkshire

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The aim of this chapter is to provide an overview of the current picture of the Mesolithic in western Scotland and the Hebrides (Figure 1). The most recent, historical, overview of the Mesolithic in Scotland was published over a decade ago (Saville 2004). During this time a substantial body of data has been published and significant new discoveries have been made. This chapter therefore builds upon the results of a pilot study on the movement of Mesolithic communities around the west coast of Scotland and the Inner Hebrides, which forms the basis of this PhD (Piper 2010). It is not within the remit of this synthesis to represent the vast volume of published and unpublished data in existence. As such, only a very general regional overview will be provided in this chapter. Where individual sites are discussed, these are instances where detailed typological and technological analyses have been conducted, or where exceptional remains have been preserved. Such sites are subsequently drawn upon in Chapter Eight for more detailed consideration in order to contextualise the Western Isles sites under analysis in this thesis.

In order to fully understand the impact of the addition of the Western Isles to the body of evidence for Mesolithic occupation along the Atlantic edge of Europe, the changing nature of archaeological investigation should be acknowledged. Moreover, in light of recent methodological and theoretical advances, it is important to understand on what basis the current understanding of the Mesolithic in Scotland is formed, and how this affects our current understanding of the Mesolithic. The dataset contained within this chapter largely comprises hundreds of unstratified surface lithic scatters, with very few sites that have been excavated; the number of sites with dating evidence and other cultural remains that could provide a broader context for understanding and interpretation are few. Additionally the problems of archaeological visibility in the Western Isles (Outer Hebrides) are discussed.

Significant advances in archaeological science and excavation methods have been made since the 19th Century; furthermore, the nature of the evidence for the Mesolithic of western Scotland and the islands of the Inner Hebrides has grown significantly since then. As such, the most influential research conducted over the last 150 years in this region will be explored. During this age of antiquarianism, excavations were conducted on shell midden deposits found in caves around the Oban coastline and the island of Oronsay (Anderson 1895; 1898; Grieve 1883; Levine 1986; Saville 2004). Anderson (1898:313) first recognised these as "a horizon which has not heretofore been observed in Scotland…filling up the hiatus that had been supposed to exist between the palaeolithic and the neolithic". However, the term 'Mesolithic' was not used with regards to Scottish material until 1929 (Lacaille 1930:34). Lacaille's (1954) seminal work '*The Stone Age in Scotland*' presented a compendium of the Mesolithic evidence in Scotland that was known to c.1940, following on from an equally pivotal publication on the Irish Mesolithic (Movius 1942). Lacaille's research, however, has been criticised as causing a stagnation of Scottish Mesolithic studies (Saville 2004:9). Lacaille sought to identify the Larnian (Irish), Tardenoisian (French) and Maglemosean (Baltic) cultural origins of Scottish lithic industries, and proposed an exclusively coastal subsistence economy (1954). These archaic chronological ideas endured for some time (Morrison 1996:14; Saville 2004:11; Woodman 1989:4). It was not until the 1960's that renewed research interests into the Mesolithic gathered pace, with numerous excavations conducted on the islands of the Inner Hebrides (Affleck *et al.* 1988; Bonsall *et al.* 1991; 1992; McCullagh *et al.* 1989; Russell *et al.* 1995; Saville 2004:5). The dataset contained within this chapter therefore largely consists of discoveries made within the last 60 years.

Finally, and most specifically to the nature of this thesis, the extent to which raw material evidence presented indicates Mesolithic mobility in the region is also considered. To some degree this has already been answered. In 2009-2010 I conducted a meta-analysis of the available Mesolithic evidence in western Scotland and the Inner Hebrides, in relation to the distribution of raw material sources (Piper 2010). The purpose of the research was to test a 'Canoe Indian' hypothesis of maritime adaptation in the region, rather than represent a complete archaeological picture, hence the restricted geographical range. The resulting catalogue comprised 259 published lithic assemblages and their raw material composition with two distinct distribution patterns in evidence. First, the vast majority of sites were located within c.5km of the coastline. Where sites were located inland (particularly in Dumfries and Galloway) they were situated beside lochs and major rivers (Piper 2010:57-59). These riverine locales would have enabled Mesolithic communities to easily travel across-country between the Ayrshire coast and the Solway Firth (Edwards *et al.* 1983:13). This is supported by recently discovered Mesolithic evidence from the Biggar Gap, South Lanarkshire, which connects the Clyde and Tweed Rivers as likely route-ways (Ward 2010:4). Second was the extensive range of mobility of Mesolithic communities, evidenced by the wide distribution of stone raw materials. This was particularly significant in the case of 'exotic' stones such as pitchstone or bloodstone, which have very specific sources. Remarkably, this pattern was also observed in flint, which is traditionally perceived as more commonly available, yet is restricted to the coast (Piper 2010:57-59). It is against this backdrop of evidence for 'island hopping strandloopers' that the newest, and furthest, frontier of Mesolithic occupation in Europe will be contextualised.

2.2. Methodology

2.2.1. Site Catalogue Data Collection

This chapter presents a fully revised and updated catalogue of Mesolithic sites in western Scotland and the Hebridean islands, listed in full in Appendix One. The focus of this thesis is much broader than Piper (2010), which prescribed more stringent criteria for the inclusion of sites within the catalogue. Consequently, sites which were omitted from that study have now been added, with the resulting number of sites in the catalogue currently standing at 391. The data has been collated by conducting an extensive literature review of archaeological journals such as *Discovery and Excavation in Scotland*; *Glasgow Archaeological Journal* – later the *Scottish Archaeological Journal*; *Scottish Archaeological Review*; *Proceedings of the Society of Antiquaries of Scotland* and *Transactions of the Dumfries and Galloway Natural History and Antiquarian Society*. Major edited volumes on the Mesolithic in Scotland and Europe were explored in addition to project-specific monographs and on-line publications through the online *Scottish Archaeological Internet Reports* where every reference was followed.

The information required for the catalogue included: site name and location; National Grid Reference (NGR); raw material composition (noted if not given); nature of initial identification; subsequent interpretation and any further action taken; reference. The catalogue was divided into three sections following Hardy and Wickham-Jones (Hardy & Wickham-Jones 2009b): Mesolithic, 'Early Prehistoric' (Mesolithic - Neolithic) or 'Prehistoric' (Mesolithic – Bronze Age). Sites were allocated to the latter two categories where they contained mixed assemblages and could not be securely categorised as Mesolithic on typological grounds. The sites under discussion in this chapter and detailed in Appendix One only represent the 'Mesolithic' category unless otherwise stated.

2.2.2. Radiocarbon Dates

Appendix Two details the sites from the study region that have been radiocarbon dated to the Mesolithic and are drawn upon throughout the thesis. These dates were compiled from the original publications, as detailed above, using Ashmore's (2004a) comprehensive catalogue of dated sites in Scotland (to October 2002) between c.40,000-3500 cal. BC in order to trace the source material, and for supplementary context information. Excavated sites and dates published post- October 2002 were also included to ensure the list was up-to-date, using recent publications on Bayesian modelling of Mesolithic population and settlement patterns in Western Scotland (Wicks & Mithen 2014; Wicks *et al.* 2014). These dates were subjected to strict chronometric hygiene criteria to provide a rigorous method of identifying the most chronologically secure Mesolithic sites in the region (Fitzpatrick 2006; Spriggs 1989).

All radiocarbon dates presented have been calibrated using Oxcal 4.2 and the Intcal 13 curve (Bronk Ramsey 2014; Reimer *et al*. 2013). Only Mesolithic dates are included[1], although many sites contain dates from later phases of occupation and occasionally redeposited material. Material that is not directly associated with anthropogenic activity is also excluded.

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[1] Older than 4000 cal. BC, with the exception of the skeleton from Tràigh na Beirigh 9

2.3. The Post-Glacial Colonisation of Scotland

The evidence for a Palaeolithic presence in Scotland is sparse. Deposits of reindeer antlers at Creag nan Uamh (Cave of the Crags), Inchnadamph were initially interpreted as a cache for antler working during the Late glacial in Scotland (Morrison & Bonsall 1989:136-137). This interpretation endured from the time of their initial excavation in the 1920's (Callander *et al.* 1927; Cree 1927) until re-analysis of the deposits, including radiocarbon dates, proved the material accumulated over the course of several millennia, with no evidence for anthropogenic activity until the Neolithic (Murray *et al.* 1993; Saville 2005a:351, 354). Lithic material with Late Upper Palaeolithic affinities has only recently been confirmed from western Scotland at sites such as at Sheildaig, Wester Ross; Ballevullin, Tiree (Ballin & Saville 2003); Kilmelfort Cave, Argyll (Saville & Ballin 2009), Howburn Farm, South Lanarkshire (Ballin *et al.* 2010) and Rubha Port an t-Seilich, Islay (Mithen *et al.* 2015). Three possible tanged points from Lussa Wood I and Lussa Bay were considered to be Upper Palaeolithic by Mercer (1969:21; 1980:26), however this interpretation has been rejected by various individuals on the basis of the poor condition of the artefacts (Ballin & Saville 2003:5; Edwards & Mithen 1995:351; Morrison & Bonsall 1989:137). These occasional glimpses of Scotland's Palaeolithic past are likely to become clearer and more frequent with future research. In the interim, the archaeological evidence suggests that widespread human occupation in post-glacial Scotland was long-delayed in the wake of the Last Glacial Maximum (referred to as LGM hereafter; Sturt 2015).

It is well-established that the earliest dated evidence for Mesolithic occupation on the western coastline of Scotland is from the Inner Hebrides at Kinloch, Rum, c.7500 cal. BC (Wickham-Jones 1990c). Further evidence from recent excavations at Rubha Port an t-Seilich, Islay and Fiskary Bay, Coll have demonstrated that Mesolithic people were frequent visitors to, or more probably inhabitants of, this island chain at the same time (Wicks & Mithen 2014). The Mesolithic activity on these islands dates to over a thousand years later than the earliest known Mesolithic sites in the east of Scotland, at Cramond and Daer Reservoir (Ashmore 2004a). Currently, there are no securely-dated inland sites beyond Daer, and little evidence for over-land colonisation routes. As such, it would appear that the time-lag between the colonisation of the east and west of Scotland was of intermittent and transient occupation. It has been suggested that the most auspicious places were selected for habitation by small, sea-faring groups navigating north-west Britain before eventual population expansion led to an "extensive and intensive" settlement of the region (Finlayson 1999; Waddington 2015). Radiocarbon dates from the recent excavation at Creit Dhubh, Mull have now challenged this perception. The dates suggest two phases of occupation – the first contemporary with those at Cramond and Daer during the 8th millennium BC and the second occurring during the 7th millennium BC - at the same time as sites on neighbouring islands (Mithen & Wicks 2011a; Wicks & Mithen 2014). This evidence therefore suggests that Mesolithic occupation in Scotland reached the west coast far sooner than traditionally perceived (Finlay *et al.* 2002:105; Wickham-Jones & Woodman 1998).

2.4. The Scottish Mainland – From Dumfries to Durness

2.4.1. East Ayrshire and Dumfries and Galloway

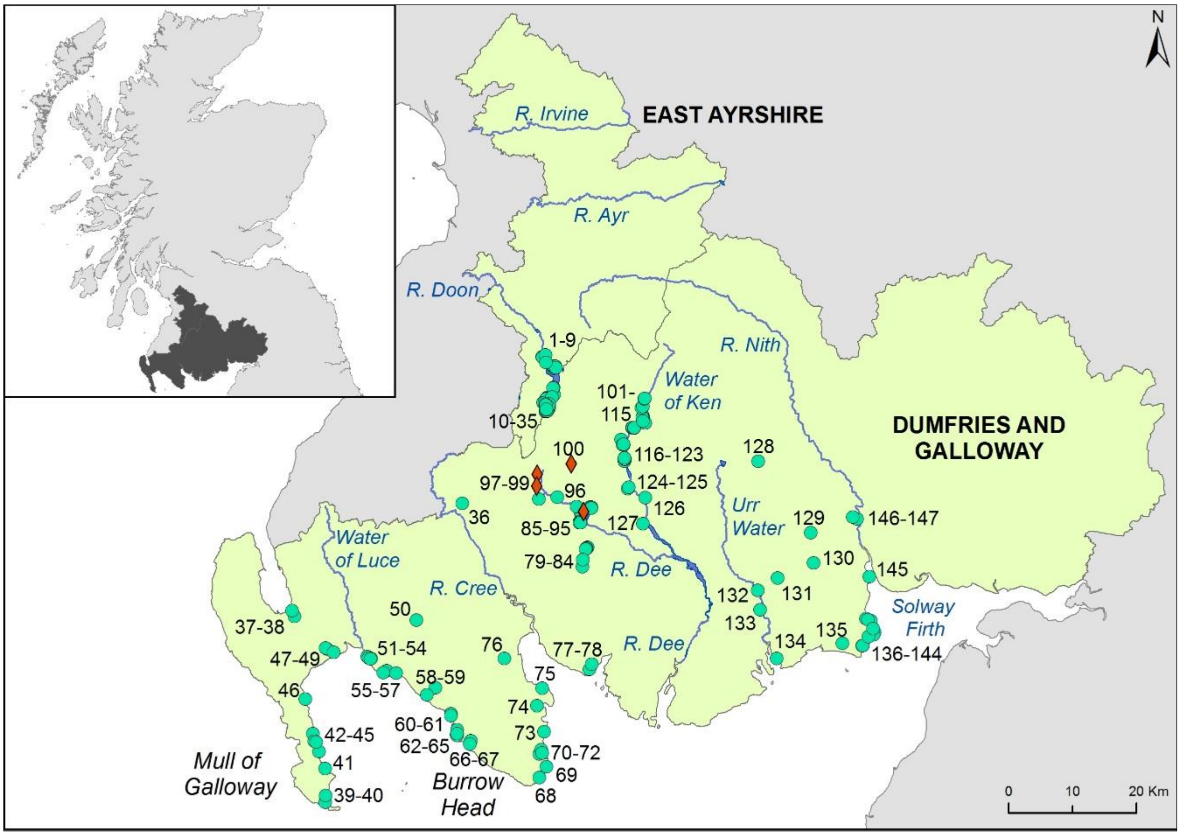

Figure 2. Mesolithic sites in the regions of East Ayrshire and Dumfries and Galloway. 1. Loch Doon A; 2. Loch Doon B; 3. Loch Doon C; 4. Loch Doon D; 5. Loch Doon E; 6. Loch Doon F; 7. Loch Doon G; 8. Loch Doon S; 9. Loch Doon T; 10. Black Craig; 11. Donald's Isle; 12. Loch Doon H; 13. Loch Doon I; 14. Loch Doon J; 15. Loch Doon K; 16. Loch Doon L (Starr); 17. Loch Doon M; 18. Loch Doon N; 19. Loch Doon O; 20. Loch Doon P; 21. Loch Doon Q; 22. Loch Doon R; 23. Loch Doon Starr 1a; 24. Loch Doon Starr 1b; 25. Loch Doon Starr 1c; 26. Loch Head A; 27. Loch Head B; 28. Loch Head C; 29. Loch Head D; 30. Portmark A; 31. Portmark B; 32. Portmark C; 33. Starr A; 34. Starr B; 35. Starr C; 36. Bargrennan White Cairn; 37. Aird; 38. Low Balyett; 39. Mull Glen; 40. Portankill; 41. Drummore; 42. Grennan; 43. Terally A; 44. Terally B; 45. Balgown; 46. Kirkmabreck; 47. Luce Sands A; 48. Luce Sands B; 49. Torrs Warren Site J; 50. Barmore Moss; 51. Kilfillian A; 52. Kilfillian C; 53. Stairhaven North; 54. Stairhaven South; 55. Auchenmalg; 56. Gillespie; 57. Sinniness; 58. Barhobble; 59. Chippermore Fort; 60. Low Clone North; 61. Low Clone South; 62. Airlour; 63. Barsalloch; 64. North Barsalloch; 65. Pate's Port; 66. Bairbuy; 67. Monreith; 68. Morrach; 69. Isle Farm; 70. Portyerrock; 71. Shaddock; 72. Sheddock; 73. Cruggleton; 74. Kilfillan B; 75. Innerwell; 76. Bladnoch; 77. Mossyard; 78. Newton; 79. Loch Grannoch A; 80. Loch Grannoch B; 81. Loch Grannoch C; 82. Loch Grannoch D; 83. Loch Grannoch E; 84. Loch Grannoch F; 85. Clatteringshaws Loch J*; 86. Clatteringshaws Loch A; 87. Clatteringshaws Loch B; 88. Clatteringshaws Loch C; 89. Clatteringshaws Loch D; 90. Clatteringshaws Loch E; 91. Clatteringshaws Loch F; 92. Clatteringshaws Loch G; 93. Clatteringshaws Loch H; 94. Clatteringshaws Loch I; 95. Moss Raploch; 96. Black Water of Dee; 97. Loch Dee; 98. Snibe Bog*; 99. Cooran Lane*; 100. Loch Dungeon*; 101. Smeeton; 102. Smittons; 103. Stroanpatrick; 104. Water of Ken J; 105. Water of Ken K; 106. Water of Ken L; 107. Water of Ken M; 108. Water of Ken N; 109. Water of Ken O; 110. Water of Ken P; 111. Water of Ken Q; 112. Water of Ken R; 113. Water of Ken S; 114. Water of Ken T; 115. Water of Ken U; 116. Polmaddie Farm; 117. Stroangassel; 118. Water of Ken H; 119. Water of Ken I; 120. Water of Ken D; 121. Water of Ken E; 122. Water of Ken F; 123. Water of Ken G; 124. Water of Ken B; 125. Water of Ken C; 126. Balmaclellan; 127. Water of Ken A; 128. Bogrie; 129. Lochfoot School; 130. Loch Arthur; 131. Kirkguneon Parish; 132. Motte of Ur; 133. Buittle Castle Bailey; 134. Mote of Mark; 135. Cowcorse Farm; 136. Gillfoot; 137. Maxwellfield; 138. McCulloch's Castle; 139. Stony Park; 140. Tallowquhairn; 141. Carsethorn Beach; 142. Borron Point; 143. Carsethorn A; 144. Carsethorn B; 145. Powillimount; 146. 73-75 Irish Street; 147. Millhill. * - palaeoenvironmental cores. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

Understanding of the Mesolithic occupation of south-west Scotland changed significantly during the early 1960's due to a plethora of new sites discovered in the East Ayrshire and Dumfries and Galloway region (Figure 2). Prior to this, only five Mesolithic sites had been recognised in south and west Scotland – the Campbeltown sites of Dalaruan, Millknowe and Albyn Distillery, and Ballantrae and Luce Sands on the coast (Lacaille 1954:140-154). The sites and lithic scatters from this region were fundamental in challenging the culture-historical dogma instituted by Lacaille.

The number of known sites increased dramatically in the 1960's. In Wigtownshire, 17 unstratified lithic scatters were identified on, or close to, the raised beach deposits. The assemblages all shared similar typologies and the material comprised almost entirely flint (Coles 1964:68; Cowie 1996:66; Truckell 1963:44-45). Detailed typological examination of the Wigtownshire material and re-examination of the Campbeltown material was conducted following their discovery, comparing them with Scottish 'Obanian' sites (discussed in Section 2.4.4.1) and Larnian sites from Ireland (discussed in Chapter Three; Coles 1964). The results suggested that Scottish material was not sufficiently chronologically or typologically similar to the Irish Larnian that it could be labelled as such, and that the evidence to suggest any connection between Ireland and Scotland during the early Mesolithic was negligible – instead, the term "south-west Scottish Coastal Mesolithic" was introduced (Coles 1964:89; Morrison 1982:1; Saville 2004:10).

One of these scatters, Low Clone, was the first Mesolithic site in the south-west of Scotland to be excavated, yielding the first, unequivocal evidence of Mesolithic structural remains on the Scottish mainland, and a predominantly flint assemblage that included microliths (Cormack & Coles 1968:53). The assemblage challenged the perception that lithic industries in south-west Scotland were very different to those in England and Wales, due to the apparent "extreme rarity of microlithic forms" in Scottish assemblages (Cormack & Coles 1968:67). This was highlighted as an artefact of bias inherent in surface collection, which significantly under-represented the presence of chips, utilised blades, and retouched pieces – especially microliths. Consequently, comparisons were successfully made between Low Clone and Welsh and English assemblages resulting in a greater understanding of the typological nature of the site (Cormack & Coles 1968:67). Furthermore, the evidence bolstered Coles' challenge against the contribution of the Northern Irish Larnian to the lithic industries in Scotland (Coles 1964; Cormack & Coles 1968:67-69).

Another misconception to be challenged was that of a solely coastal Mesolithic presence. Truckell predicted that searching the "tops of river terraces" in the valleys of the south-flowing rivers would populate the regions' "blank" inland areas (1963:46). Following this, a substantial number of Mesolithic flint and chert lithic scatters were identified around the loch and river systems of the River Doon, the Black Water of Dee and the Water of Ken as a result of peat erosion from fluctuating water levels (Affleck 1983:5-6; 1984a:6; 1984b:6; 1984c:34; 1984d:33-34; 1985a:11; 1985b:49;

Anonymous 1975:60; Ansell 1966:33; 1967:32; 1968a:24; 1968b:24; 1968c:13; 1969a:12; 1969b:31; 1969c:31; 1971:26; Ansell & Conary 1974:42; Edwards *et al.* 1983:9; Finlayson 1990b; McFadzean *et al.* 1984b:28). It is pertinent to note that there are a number of chert sources in the area around Loch Doon, the High Bridge of Ken, and Deugh, which may have provided the raw material for lithics found at the sites nearby (Edwards *et al.* 1983:13; Wickham-Jones 1986).

The recovery of so many Mesolithic assemblages in this area is significant. Several palaeoenvironmental cores have been taken in the vicinity of these sites (Birks 1972; 1975). At Snibe Bog there is evidence for probable human disturbance of the vegetation in pollen Zone SB3. Birks, however, attributed this to early Neolithic clearance as the evidence for Mesolithic occupation was, at the time, restricted to the coast (Birks 1972:206). The Cooran Lane site contained a large quantity of charcoal within pollen Zone CL-4, which was dated to 6641-6106 cal. BC. Again the fire was interpreted as a natural phenomenon, rather than caused by Mesolithic interference, based on the same reasoning that no inland evidence for Mesolithic occupation had been found (Birks 1975:206). Low levels of charcoal have also been detected at Loch Dungeon and Clatteringshaws Loch (Birks 1972; 1975). These interpretations can subsequently be revised in light of the evidence presented above – this area of the Galloway Hills was certainly occupied in the Mesolithic period, with evidence for significant episodes of burning recovered at Starr and Loch Dee (Affleck 1984b; 1984d; Edwards *et al.* 1983:14).

Cormack noted that to the west of the Urr Estuary, the assemblages known up to that time were typologically very similar and the raw material was comprised exclusively of flint. This contrasted markedly with sites to the east around the River Nith, all of which contained a high proportion of non-flint, and non-local raw materials which may have been traded from neighbouring Annandale and Eskdale (Cormack 1970:77-78; Morrison 1982:3). Following the discovery of numerous sites post-1970, it is evident that Cormack's findings still stand. All Mesolithic sites to the west of the Urr only contain flint. The one exception is Aird, where a single pitchstone flake was recovered (Edwards *et al.* 1983:12). With regard to the sites east of the Urr, the majority have mixed raw material assemblages – namely flint, chert and quartz. The few flint-only sites are un-representative isolated find-spots (Anonymous 1968a:25; 1968b:45; 1975:58; 1976:71; Bain 1995:22; Blackett 1967:32; Cachart 1989:12; Coles 1964; Cormack 1963:52; 1964a:34; 1964b:53; 1965a:41; 1965b:25; 1965d:25; 1965e:26; 1967:55; 1968a:46; 1968b:46; 1969a:51; 1969b:51; 1982a:9; 1982b:9; 1983a:4; 1983b:4; 1984:6; 1985a:11; 1985b:11; 1995; Cormack & Coles 1968; Cowie 1996:66; Cullen & James 1995:22; Cunningham 1984:6; Edwards *et al.* 1983; Livens 1956b:31; Mackenzie 1995:19; 2002; McCracken 1967:55; Penman 1994:14; 1995:21; Saville 2005b:38; Truckell 1955:175; 1962:49; 1963; 1973:30; 1974:41; Williams 1966a:32; 1966b:32; 1967a:31; 1968:24).

2.4.2. Renfrewshire and South Lanarkshire

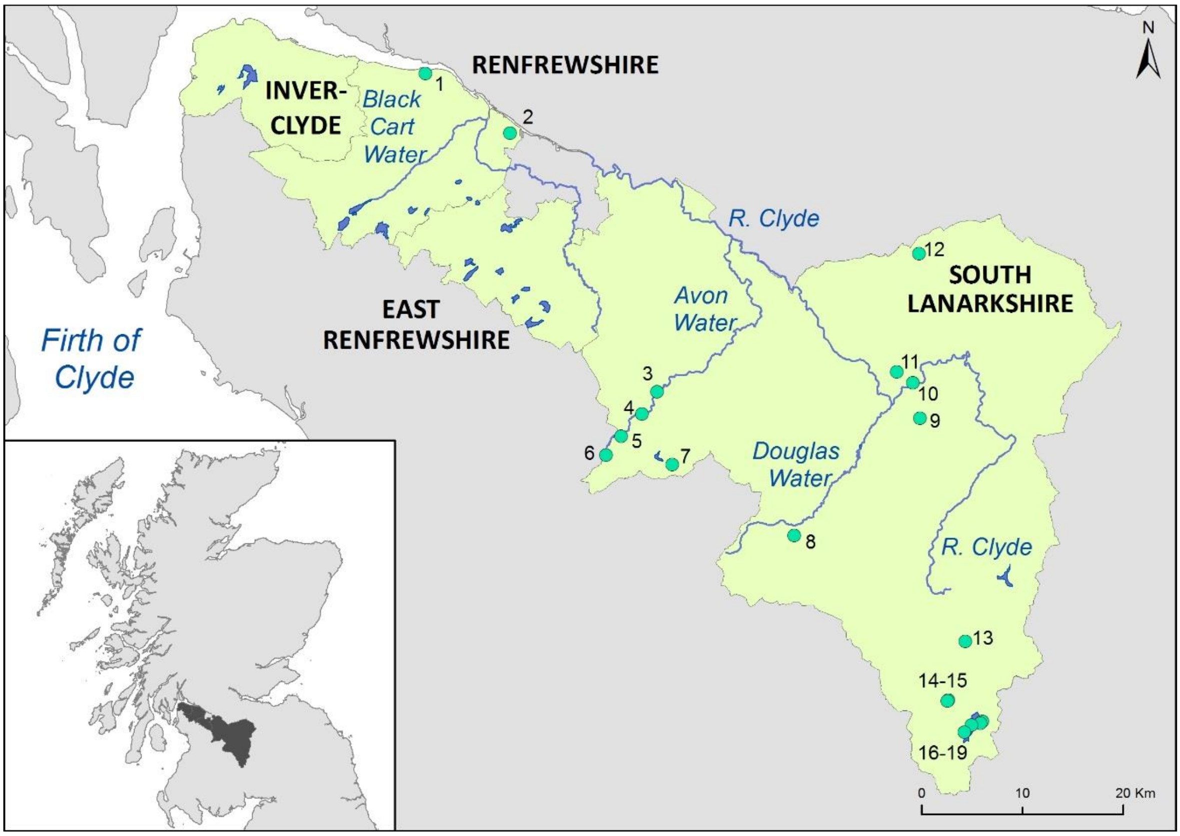

Figure 3. Mesolithic sites in the regions of Renfrewshire and South Lanarkshire. 1. Bishopton; 2. Renfrew; 3. Midlinbank Farm; 4. Snabe Gravel Pit; 5. Shieloans; 6. Avondale Parish A; 7. Brown Hill; 8. Glentaggart; 9. Carmichael Church; 10. Charleston Farm; 11. Lanark Racecourse; 12. Hare Hill/Climpy; 13. Crookedstane Farm; 14. Coom Rig (Daer Valley) Site 84; 15. Coom Rig (Daer Valley) Site 85; 16. Daer Reservoir 1; 17. Daer Reservoir 2; 18. Daer Reservoir 3; 19. Daer Reservoir O. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

The nature of the assemblages recovered from the two inland counties of Renfrewshire and South Lanarkshire is comparable to the inland assemblages of East Ayrshire and Dumfries and Galloway discussed above, both in their location and raw material composition (Figure 3). A significant number of Mesolithic sites and lithic scatters were exposed due to low water levels over a number of years around Daer Reservoir (Ward 2001:86). Excavation of several lithic scatters recovered flint, chert, and siltstone artefacts, in addition to charcoal-filled pits and possible stake-holes. The radiocarbon-dates obtained from these sites span the early to late Mesolithic, between 8544-4052 cal. BC (Ward 1995:87; 1997:75; 1998a; 1998b; 2001:86; 2002:91-92, 127; 2004:124; 2006c:134).

Where details are provided for other sites identified in these regions, all of the assemblages are dominated by flint and chert, and occasionally agate (Archer 1985:41; 87; Ballin & Johnson 2005; Duncan 1997:75; Lelong *et al.* 1999:82; Macneill *et al.* 1994:75; McFadzean *et al.* 1984a:31-32; Mitchell 2002:92; 2003:111). The excavation at Glentaggart provided a much needed opportunity to study a Mesolithic chert assemblage from stratified contexts. There is little detailed information on this raw material, despite its common occurrence in Mesolithic sites in south-west Scotland, and this assemblage has been presented as a starting point for a future regional comparisons between the chert-dominated assemblages of the south-west interior, to the flint and flint-and-chert assemblages along the coast (Ballin & Johnson 2005:85).

2.4.3. North and South Ayrshire

2.4.3.1. North Ayrshire

There is little information regarding the sites in North Ayrshire (Figure 4). The earliest identified Mesolithic site in the Ayrshire region was at Shewalton Moor where an assemblage of flint, quartz, jasper and chalcedony geometric microliths were recovered eroding from sand dunes, however the assemblage was originally interpreted as Bronze Age (Lacaille 1930). Finds of Mesolithic material from the dunes have also been made subsequently (Macneill 1965d; Williams 1967b:16). A barbed antler harpoon was found in the River Irvine, which runs through the moor. Although Lacaille compared it closely to a similar artefact from MacArthur's Cave, Oban, and even suggested a possible association with the microlith assemblage, he dismissed it as post-Mesolithic in date (Lacaille 1930:49-50; 1954:288). It has subsequently been directly dated to 4901-4499 cal. BC (Ashmore 2004a:122) and its Mesolithic date is thus affirmed.

The remaining sites in the north Ayrshire region are simply recorded as "Mesolithic flints", presumably from surface scatters collected during the late 1960's and 1970's (Anonymous 1976; Macneill 1965c; 1973). It should be noted that the primary raw material composition of these assemblages is flint, however there are few flint sources recorded in this area. Lacaille stated that flint is not native to the region and must have been imported from elsewhere, which is attested by the differing colours and varieties of flint present in the Shewalton Moor assemblage (Lacaille 1930:45).

2.4.3.2. South Ayrshire

Ballantrae, like Shewalton Moor to the north, was also identified early in the 20th Century as one of only two microlithic sites on the west coast (Figure 4; Edgar 1939; Lacaille 1954). Over 3000 tools and debitage fragments were recovered from the plough-soil above the raised beach, with flint the dominant raw material but also including quartz, chert, chalcedony and pitchstone (Lacaille 1945:84-86). The material occurred in concentrations, suggesting disturbed working sites, and the assemblage comprised tools from the Mesolithic to the Bronze Age (Edgar 1939:185; Lacaille 1945:87). Further flints have since been recovered from the area (Macneill 1965a).

Again the records for the remainder of the flint surface scatters, or isolated finds in the region are sparse in detail, precluding any further comparisons (Addyman 1998; Anonymous 1976; Cameron 2001; MacGregor 2002; Macneill 1965b; St Joseph & Maxwell 1982).

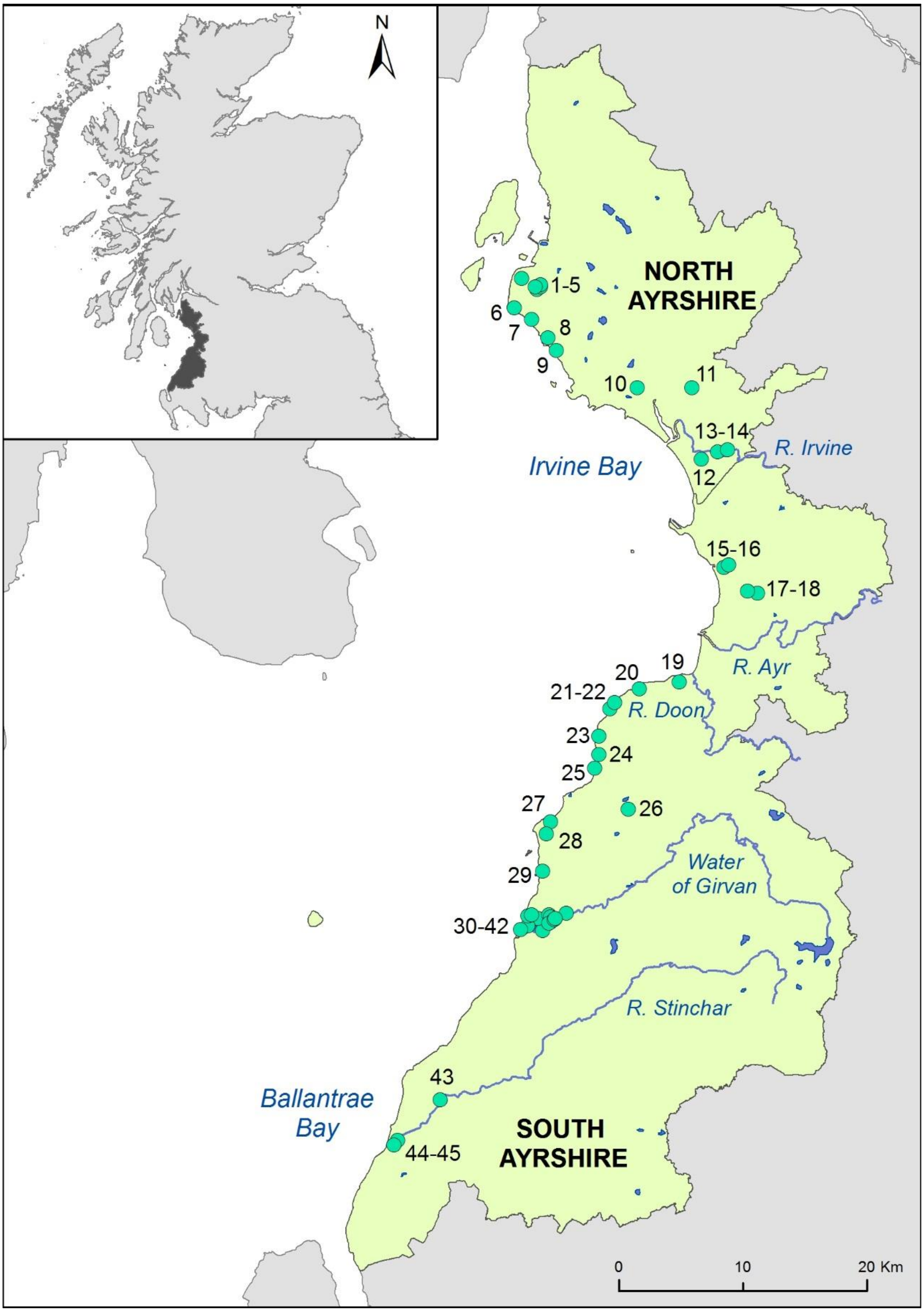

Figure 4. Mesolithic sites in the regions of North Ayrshire and South Ayrshire. 1. West Kilbride A; 2. West Kilbride B; 3. West Kilbride C; 4. West Kilbride D; 5. West Kilbride E; 6. Portencross; 7. Seamill B; 8. Seamill A; 9. Glenhead Farm; 10. Stevenson; 11. Kilwinning; 12. Shewalton Moor; 13. Dreghorn A; 14. Dreghorn B; 15. Monkton A; 16. Monkton B; 17. Prestwick A; 18. Prestwick B; 19. Greenan; 20. Bower Hill; 21. Dunure B; 22. Dunure C; 23. Dunure A; 24. Dunre D; 25. Culzean Bay; 26. Crossraguel Abbey; 27. Maidens; 28. Turnberry Hotel; 29. Dowhill Farm; 30. Enoch Farm; 31. Girvan A; 32. Girvan B; 33. Girvan C; 34. Girvan D; 35. Girvan E; 36. Girvan F; 37. Girvan G; 38. Girvan H; 39. Girvan Mains; 40. Girvan Mains Farm A; 41. Girvan Mains Farm B; 42. Girvan Mains Farm C; 43. Knockdolian; 44. Ballantrae A; 45. Ballantrae B. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

2.4.4. Argyll and Bute

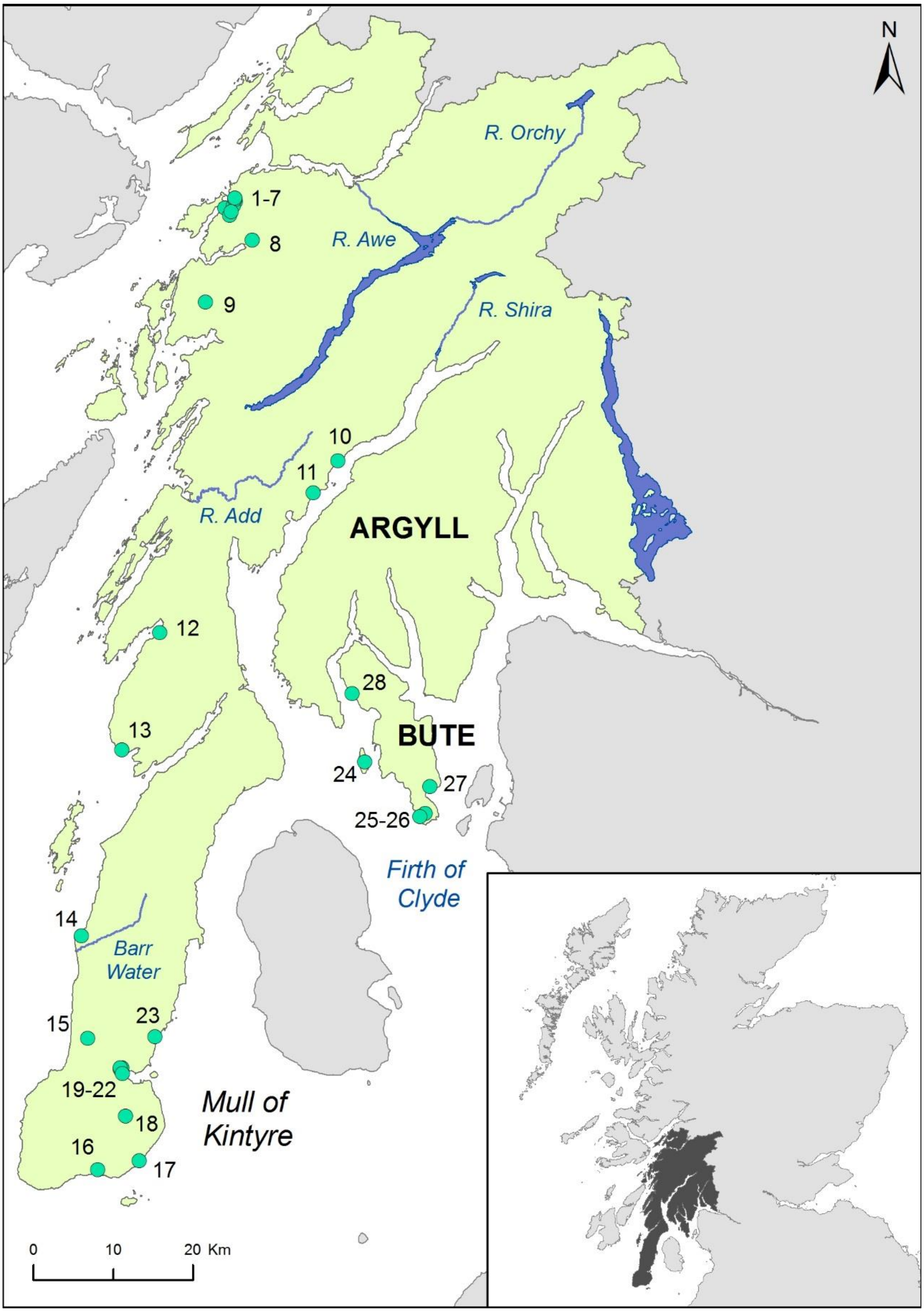

Figure 5. Mesolithic sites in the regions of Argyll, Bute and Inchmarnock. 1. Carding Mill Bay; 2. Distillery Cave; 3. Druimvargie; 4. Lón Mór; 5. MacArthur's Cave; 6. Mackay Cave; 7. Raschoille Cave; 8. Kilmore; 9. Cave of the Crags; 10. Balaghoun; 11. Sron-a-Bruic; 12. Clachbreck; 13. Tiretigan Cave; 14. Rusehill; 15. Lange Links; 16. Machribeg; 17. Macharioch Field 1; 18. Arinarach Hill; 19. Albyn Distillery; 20. Dalaruan; 21. Millknowe; 22. Sprinkbank Distillery; 23. New Peninver Farm; 24. Inchmarnock; 25. St. Blane's Church; 26. The Plan; 27. Little Kilchattan; 28. Glecknabae. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

The earliest investigations into the Mesolithic in Scotland were conducted in the caves and rock-shelters of the Argyll coastline uncovered during development around Oban, and followed by excavations at Campbeltown, on the Mull of Kintyre (Figure 5).

2.4.4.1. The 'Obanian' Cave Sites

During the late 1800's several archaeological deposits were found within rock-shelters and caves around Oban. These exceptionally preserved sites contained distinctive deposits of substantial 'middens' – or refuse heaps. These largely comprised marine mollusc and crustacean remains; mammal bone (both land and sea); fish and bird bone; worked bone and antler tools such as points, mattocks and harpoon-heads, and very small chipped flint assemblages (Anderson 1895; 1898; Lacaille 1954; Turner 1895). The material from these sites was compared closely with shell middens excavated on the islands of Oronsay and Risga (Anderson 1898), which Movius termed the "Obanian culture", after the area in which the sites were found (Bonsall 1997; 1942). The 'Obanian' was defined by five characteristics:

- A limited geographical range around the Argyll coastline
- A limited chronological range, post-c. 5500-5000 cal. BC
- Microliths and retouched stone tools are absent
- Bone and antler artefacts are present
- Sites with microlithic industries are not present where Obanian sites are found (Bonsall 1997:28).

The concept of the 'Obanian' has now been all but refuted (Bonsall 1997:28). Radiocarbon dates from Druimvargie rock-shelter of 7569-6467 cal. BC make this one of the earliest Mesolithic sites in Scotland, and the earliest 'Obanian' site by over 1000 years. This certainly repudiates the suggestion that the 'Obanian' was a distinct, late, Mesolithic phenomenon (Bonsall 1997:29; Bonsall & Smith 1989; Bonsall *et al.* 1995; Connock *et al.* 1992:37). In contrast to the dating evidence from Druimvargie, Carding Mill Bay produced terminal Mesolithic dates between 4236-3796 cal. BC[2] for the occupation of the midden layers. This extends the occupation of Mesolithic midden sites up to, and possibly beyond, the earliest dates for the Neolithic in Scotland (Connock *et al.* 1992:36).

More recently, two excavations near Oban have indicated that the final 'Obanian' assumption is no longer valid. Flint and quartz assemblages containing classic narrow blade microliths have been excavated from *in situ* occupation horizons at Kilmore and Lón Mór – the latter site is situated less than a kilometre from the 'Obanian' sites of Carding Mill Bay and Raschoille Cave (Bonsall *et al.* 2009; Bonsall *et al.* 1993:76). Carbonised hazel nutshell from Lón Mór dated to 6395-6095 cal. BC

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[2] This date is obtained from OxA-3740 which has the highest integrity rating for the Mesolithic dated material from this site.

only marginally post-dates the 'Obanian' site at Druimvargie (Bonsall *et al.* 2009:71; Bonsall *et al.* 1993:76). The close proximity of these two open air sites to the 'Obanian' caves, in both time and space, therefore indicates that the Mesolithic inhabitants of the Argyll region were not culturally separate groups. A more satisfactory suggestion is that the different site types are a result of different activities being conducted at each of the sites by one group. These differences are exacerbated by the differing preservation conditions provided by an enclosed cave versus an exposed site (Bonsall 1997:36).

It is pertinent to note that the assemblage recovered from Kilmelfort Cave was noted as distinctly untypical of the known microlithic or west coast Scottish Mesolithic industries at the time of excavation, as it contained backed points (Coles 1959; 1983). The points have since been identified as curve-backed points of the Late Upper Palaeolithic *Federmessergruppen*, and as such it has been removed from the catalogue (Saville & Ballin 2009).

2.4.4.2. Mull of Kintyre

As mentioned previously (Section 2.2.1) the three sites at Dalaruan, Millknowe and Albyn Distillery in Campbeltown were amongst the earliest excavations of Mesolithic material on the mainland (Gray 1894; McCallien & Lacaille 1941). The assemblages at these sites are dominated by flint, which is not native to the Kintyre area. Gray (1894:272) dismissed the idea that the flint may have been transported by ice, as this could not account for the uniformly small nodules and an absence of other types of other stones. Nor could the vast quantity of flint debitage found at Dalaruan and Millknowe have been supplied by chance nodules washing up on the beach. Furthermore, there is no geological evidence supporting the movement of ice from Antrim (the nearest source of flint) to the Firth of Clyde, rather it was the other way around (McCallien & Lacaille 1941:60-61). The second suggestion was that flint had been transported by floating seaweed (Smith 1895:42). However, later discoveries of several large flint nodules excavated from Millknowe – one weighing in excess of 10lbs (4.5kg) ruled this idea out "as no amount of *Fucus* which could find root-hold on a 10lb. nodule could ever possibly float it up" (Gray 1894:274). As such the early explanations for the presence of flint on the Kintyre beaches was that it had been imported from Antrim by the prehistoric occupants of the beaches (Gray 1894:274; McCallien & Lacaille 1941:61). As discussed in Section 2.4.1 however, the evidence for any connection with Ireland remains unproven.

The remarkable absence of flint raw material in this area is reflected in the remaining surface scatters identified around the Mull of Kintyre, which contain small flint assemblages supplemented, in some cases, by quartz (Campbell 1962:9; Cummings & Robinson 2007:45; Gladwin 1993:74; Lacaille 1954; Purvis 2002:20; Scott 1956:3; Siggins 1991:55; Webb 2007:35).

2.4.4.3. Bute and Inchmarnock

The evidence for Mesolithic settlement on the Isle of Bute is circumstantial. Only three lithic scatters and a single flint core with diagnostic bladelet removals have been found there. An isolated Mesolithic flint core has also been recovered within re-deposited material on Inchmarnock – Bute's small western satellite island (Conolly 2005:33; Cormack 1986a:26; 1986b:26; Finlay 2004:36; McFadzean 1987:42; McFadzean *et al.* 1984c:22). The presence of microliths within the assemblages at Little Kilchattan and St. Blane's Church are the most tangible evidence thus far (Cormack 1986b:26; McFadzean 1987:42; McFadzean *et al.* 1984c:22).

2.4.5. The Highlands

The region of the Highlands covers a vast area of north-western Scotland (Figure 6). Despite this, there are only two areas towards the south of the Highland area where Mesolithic sites proliferate.

2.4.5.1. The Morvern and Ardnamurchan Peninsulae

One of the most important sites in this region is Risga, situated on a tiny island in Loch Sunart. The shell midden site was initially excavated in the early 1920's, although the site was not published (Atkinson *et al.* 1993:45). A synthesis of the site is provided by Lacaille, who describes the archaeological material as "virtually the same as the relic-beds of the Oban caves and Oronsay shell mounds" (1954:229-239). Subsequent excavation at the site, however, went further in disproving the 'Obanian' misnomer. Within the previously excavated areas of the midden, basal deposits retaining their stratigraphic integrity were detected, and Mesolithic occupation activity was also identified beyond the main midden area. A lithic assemblage in excess of 5000 pieces was recovered with quartz the most dominant raw material but also containing flint and bloodstone. Significantly, microliths of various forms were also found on the site (Atkinson *et al.* 1993:45; Banks & Pollard 1998:46; Pollard *et al.* 1994:36). This evidence has therefore provided irrefutable evidence that invalidates the assumption "Obanian cultures" did not produce microlithic technology (Bonsall 1997; Mithen *et al.* 2007c:515).

The ten other sites in the region are worth briefly discussing in terms of their raw material composition. While flint and quartz are present at most, if not all of the sites, it is interesting to note that bloodstone also frequently occurs in many of the assemblages. Bloodstone is a form of hydrothermal chalcedony that only outcrops on the island of Rum (Durant *et al.* 1990). Its occurrence on the western mainland clearly demonstrates this raw material was being exported from the island. Mudstone, which is largely found on Skye, was notably recovered from the inland site at Acharn A (Crerar 1961:12; Lacaille 1954:290-297; Mercer 1979; Pollard 1993:45; Rich Gray 1977; Robertson 2004:90; Thornber 1974a:19; 1974b:22).

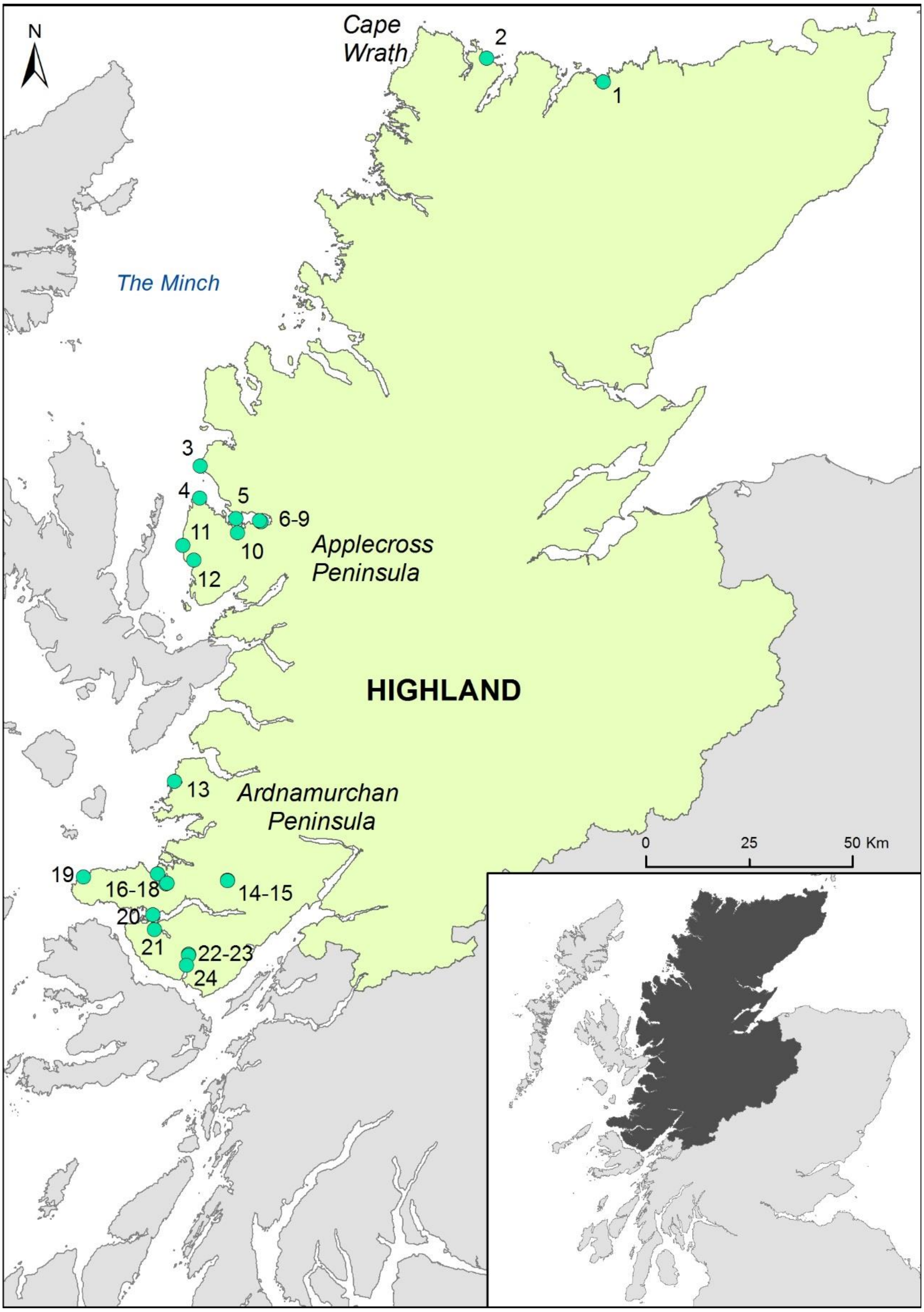

Figure 6. Mesolithic sites in the Highland region. 1. Baile Mhargait; 2. Smoo Cave; 3. Redpoint; 4. Fearnmore; 5. Shieldaig (upper); 6. Lub Dubh Aird 1; 7. Lub Dubh Aird 2; 8. Lub Dubh Aird 3; 9. Lub Dubh Aird 4; 10. Shieldaig (lower); 11. Sand; 12. Applecross Manse; 13. Rubh'an Achaidh Moir; 14. Dahl Lay-by; 15. Loch Doilean; 16. Cul na Croise/Drynan Bay; 17. Brach na Maorach; 18. Kentra Bay; 19. Sanna Bay; 20. Risga; 21. Barr River; 22. Acharn Farm A; 23. Acharn Farm B; 24. Kinlochaline Cottages. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

2.4.5.2. Sand and the Scotland's First Settler's Project

The Scotland's First Settler's Project (hereafter referred to as SFSP), which ran from 1998 to 2004, aimed to survey the Isle of Skye and the adjacent mainland for Mesolithic occupation evidence through walkover survey, test pitting and excavation. In total over 129 new archaeological sites – 13 of which could be positively assigned to the Mesolithic – were identified including several rock-shelters, lithic scatters, and midden deposits (Finlayson *et al.* 1999a:50; Hardy & Wickham-Jones 2001:507-510; 2009c:45).

The most significant of these finds was the Sand 1 rock-shelter. Excavation at the entrance revealed extensive midden deposits comprising c.90% limpet shells, bone, antler, and a narrow-blade lithic assemblage (Finlayson *et al.* 1999a:50). The deposits contained both 'Obanian' style bone artefacts and bevel ended tools as well as narrow-blade microliths, again nullifying the 'Obanian' argument (Hardy & Wickham-Jones 2001:45). The raw material composition of the flaked stone tool assemblage varied. Imported baked mudstone dominated the assemblage, followed closely by locally available quartz/quartzite. Flint and bloodstone made up the remainder of the assemblage (Wickham-Jones 2009b). It is notable that there is little evidence for primary knapping of bloodstone at Sand, and generally across the sites to the east of the Inner Sound, suggesting it has been imported in a semi-prepared state (Hardy & Wickham-Jones 2003:380; Hardy & Wickham-Jones 2009a:96-97, 161-163). With the exception of Sand, quartz and quartzite are the most commonly used raw materials around the central islands and east coast of the Inner Sound, which most likely reflects the local abundance of these raw materials in contrast to the sites to the west (Wickham-Jones 2009c:459). Analysis of the material recovered from Redpoint during the late 1950's indicated that 80% of the assemblage was quartz, and further investigation of the site during the SFSP returned an assemblage of 95% quartz (Clarke 1990b:154; Gray 1960:236-237). A similar pattern was identified at Sheildaig where 88% of the assemblage excavated in 1973 was quartz (Clarke 1990b:154; Walker & Jardine 1974:59).

2.4.5.3. The Northern Coast

Beyond the sphere of investigation by the SFSP, there are no Mesolithic sites recorded along the north-western extent of the Scottish mainland, until the coast of the landmass faces north. Here, two small sites – Smoo Cave and Baile Mhargait – fall within the remit of this analysis. The former site is a well-known Iron Age shell midden within a cave. Possible evidence for Mesolithic occupation has been recovered from the lowest deposits which overlie marine sand, including 'Obanian' stone and bone artefacts, quartz flakes, and "butchered bones" (Keillar 1972:41; Pollard 1992:48). At Baile Mhargait an extensive scatter of flint and chalcedony artefacts was recovered from a fluvio-glacial outwash plain. The presence of blade cores, blades, and a narrow blade microlith indicate the presence of Mesolithic material in the scatter (Wickham-Jones & Firth 1990:28). Given the high concentrations of Mesolithic sites identified during the course of various projects, this distribution 'gap' must be artificial.

2.4.6. The Inner Hebrides – Skye and the Small Isles

2.4.6.1. Skye

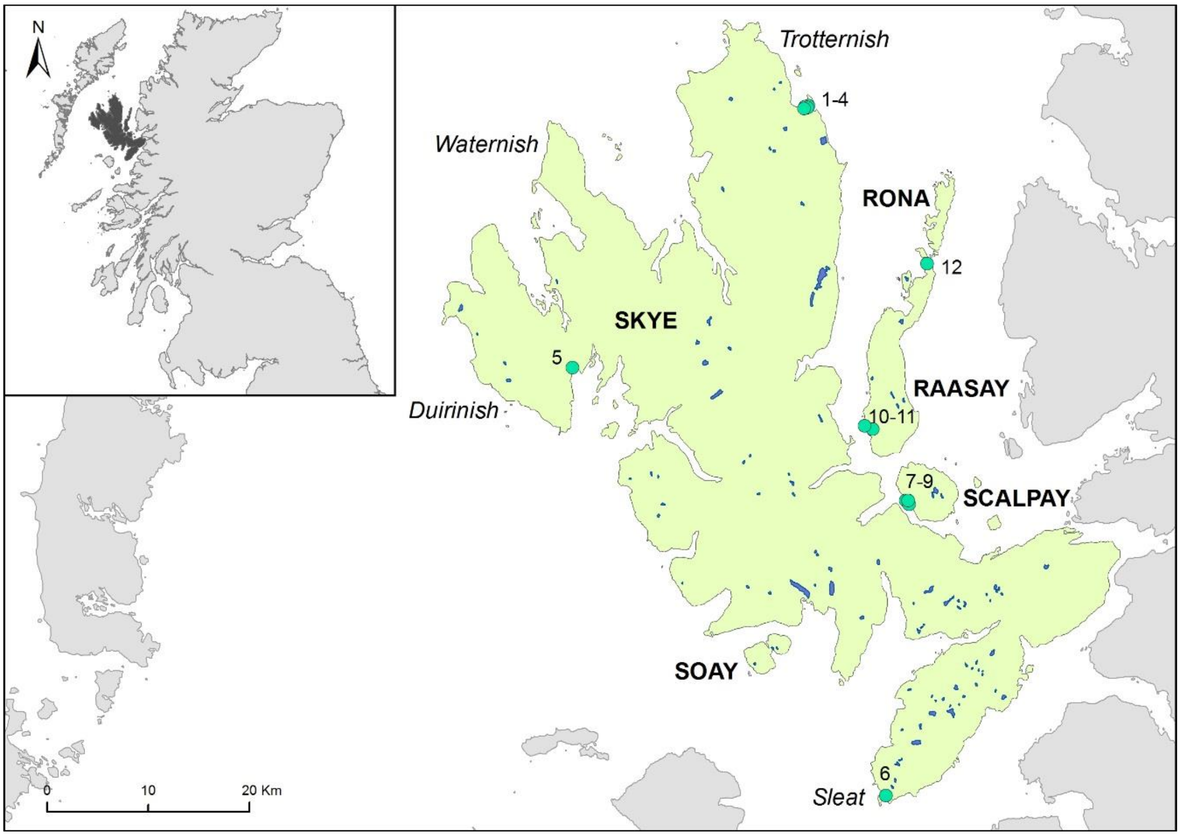

Figure 7. Mesolithic sites on Skye, Raasay and Scalpay. 1. An Corran A; 2. An Corran C; 3. An Corran E; 4. An Corran E; 5. Kati's Bay; 6. Camas Daraich; 7. Scalpay 6a; 8. Scalpay 7; 9. Scalpay 8; 10. Clachan Harbour; 11. North Bay; 12. Loch a Sguirr 1. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

The island of Skye also fell under the remit of the SFSP, whereby several new Mesolithic sites dominated by locally available raw materials were identified (Hardy & Wickham-Jones 2009c:508-509; Wickham-Jones 2009c:460). Two of the most significant sites were identified on separate occasions (Figure 7).

2.4.6.1.1. An Corran

The rock-shelter at An Corran was excavated ahead of cliff-face blasting works for road construction (Saville & Miket 1994a; 1994b). A multi-period shell midden containing Mesolithic organic 'Obanian-style' artefacts was uncovered below more recent occupation debris. These artefacts, which included bone and antler points, and bevel ended tools span a date range of 6607-3807 cal. BC. The site comprised a large faunal assemblage in addition to "an absolutely conventional Mesolithic [lithic] industry", dominated by locally available baked mudstone tools including broad-blade microliths (Hardy *et al.* 2012:29; Saville & Miket 1994a:10; 1994b:41). The site was ground-breaking, as it was the first site in which a typically 'Obanian' assemblage was found *with* a microlithic assemblage (Saville & Miket 1994a). Subsequent radiocarbon-dating of bones from the midden has yielded a very inconsistent set of dates for the occupation of the site; therefore the lithic data cannot be interpreted on anything more than typological grounds (Saville & Hardy

2012b:76). Despite this, the broad blade nature of the assemblage conforms to an Early Mesolithic typology, with no evidence for later material, although this cannot be ruled out (Finlay *et al.* 2002:107). The earliest deposits at An Corran have been interpreted as a palimpsest of shell processing and lithic working activity that accumulated over an extended period of repeated occupation (Hardy & Wickham-Jones 2009c:33; Saville & Hardy 2012a:81). The SFSP surveyed the area close to An Corran around Staffin Bay. Several lithic scatters were recovered, but only sites C, E and F produced diagnostic Mesolithic material, while the others could only be assigned a circumstantial Mesolithic date on the presence of blades within the assemblage (Hardy & Wickham-Jones 2002a:62; 2009c:508-509).

2.4.6.1.2. Camas Daraich

An eroding lithic scatter was excavated at Camas Daraich in 2000. Hazel nutshell recovered from a hearth and scooped area above raised beach deposits returned consistent dates for occupation during the mid-7th millennium BC (Birch *et al.* 2001:57; Wickham-Jones & Hardy 2004b:58). The lithic assemblage highlighted interesting patterns in the distribution of raw materials. While locally available chalcedonic silicates dominated, supplemented to some extent by quartz, imported bloodstone was well represented (Birch *et al.* 2001:57; Wickham-Jones 2004a:19). The bloodstone had clearly been imported from Rum, 25km away, as un-knapped nodules that were worked at the site. This contrasts with the overall pattern from around the Inner Sound where bloodstone appears to have been imported in a pre-prepared state (Hardy & Wickham-Jones 2003:380; Wickham-Jones 2004a:22). Mudstone, of which the only workable source lies 70km to the north, displays little evidence of primary working and must have been brought to the site as pre-formed tools (Wickham-Jones 2004a:21-23).

2.4.6.2. Raasay and Scalpay

Three sites have been located on the small island of Raasay (Figure 7). The first, at North Bay was identified during the construction of an outdoor centre and is simply noted as a probable Mesolithic occupation site on the platform under investigation (Wildgoose 2004).

The second, a rock-shelter at Loch a Sguirr 1, was investigated during the SFSP. Shell midden deposits contained a worked stone assemblage of baked mudstone, quartz and flint. Despite the absence of microliths the presence of three bevel ended bone tools suggested that the site may be Mesolithic. Radiocarbon dates of 6640-6020 cal. BC from these bone tools indicated that activity at the site was indeed such (Hardy & Wickham-Jones 2009a:169-173).

A single baked mudstone flake was found among intertidal peat deposits at Clachan Harbour, and the area is well known locally for stone tool finds (Hardy 2009a:64). Clachan Harbour fell under investigation again in 2007 (Ballin *et al.* 2011:94). 27 lithics were recovered from compacted silt lenses and overlying inter-tidal peat deposits. The assemblage is almost exclusively Skye tuff, with only a single core identified as potentially of baked mudstone (Ballin *et al*. 2011:98-100). Due to the broad blade nature of the lithic assemblage, an Early Mesolithic date is postulated. This is corroborated by radiocarbon dates on birch wood from the overlying peat deposits which dated to 7598-7085 cal. BC, providing a *terminus ante quem* for the majority of the lithic assemblage (Ballin *et al*. 2011:96, 101).

The island of Scalpay was surveyed by a local inhabitant. Of the nine lithic scatters identified, three contain microliths (Scalpay 6a, 7, 8; Figure 7) indicating a Mesolithic presence on the island, the rest however could not be categorised any further than 'prehistoric'. Notably, within the assemblages of local raw material there were also a number of Rum bloodstone pieces (Hardy 2009a:64; Hardy & Wickham-Jones 2009a:195-201).

2.4.6.3. Rum

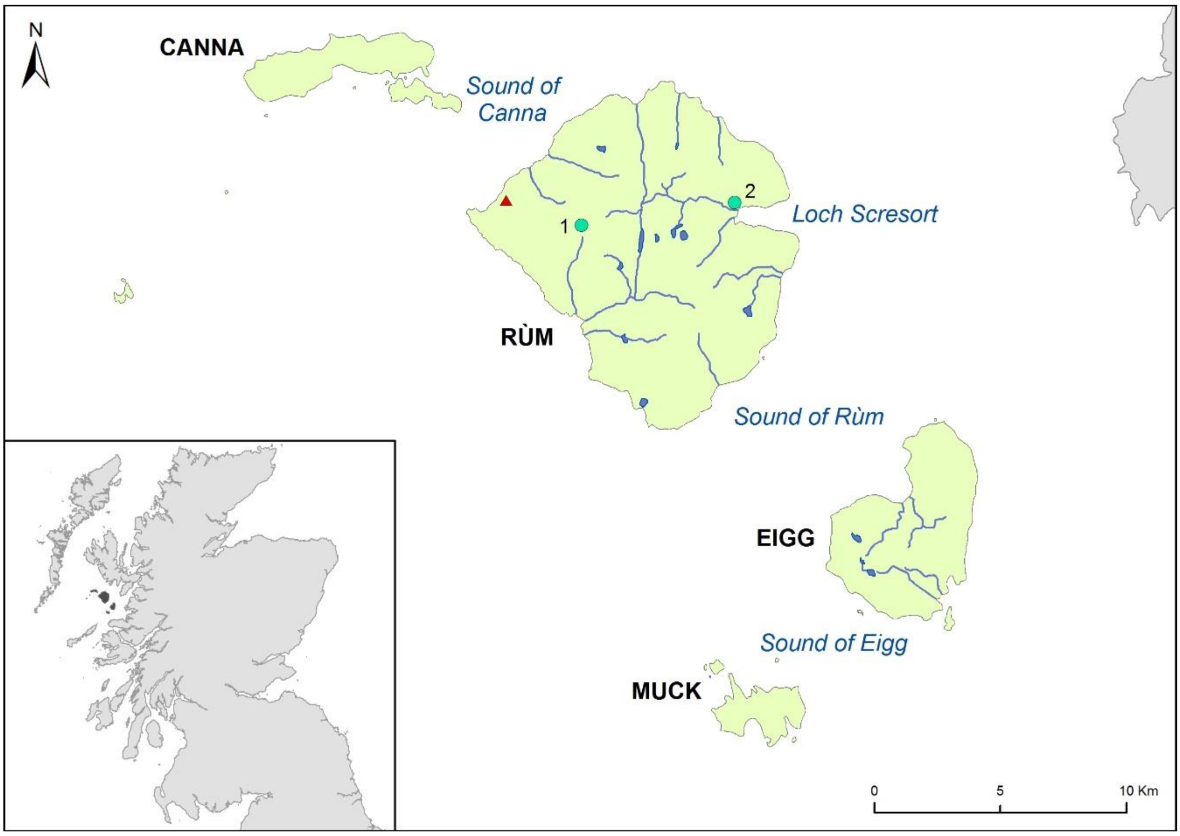

Figure 8. Mesolithic sites on Rum. 1. Bealach a'Braigh Bhig; 2. Kinloch. The source of bloodstone at Bloodstone Hill is indicated by the red triangle. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

Bloodstone Hill, Rum is the only known source of workable bloodstone in the Inner Hebrides and general consensus is that this is where bloodstone was obtained during the Mesolithic (Clarke & Griffiths 1990:156). Only one Mesolithic site is known from the island, beyond an isolated find of a flint blade recovered from Bealach a'Braigh Bhig (Saville 2008:123; Figure 8).

Kinloch, Rum, dated to 7608-6394 cal. BC is one of the oldest Mesolithic sites in Scotland (Ashmore 2004a:101; 2004b:92; Wickham-Jones 1990c:163). The excavation was conducted amidst a high density lithic scatter which, when combined, produced an assemblage of c.140,000 pieces and contained a substantial proportion of local bloodstone, flint, agate, quartz, silicified limestone, and volcanic glass (Wickham-Jones 1990c:52; Wickham-Jones & Pollock 1985:21; 1986:14; Wickham-Jones *et al.* 1984:14). Structural remains including pits, stake-holes, and hollows were also identified and although there were no discernible hearth features, a quantity of charred hazel nutshell was recovered from a pit (Wickham-Jones 1990c:157; Wickham-Jones & Pollock 1985:21). The dates from the nutshell indicate Kinloch was occupied from the beginning of the Late Mesolithic and was occupied over a significant time-frame during this period (Wickham-Jones 1990c:38). This is supported by the lithic technology which contains a broadly geometric microlith assemblage (Myers 1988:25). It should be noted that of the lithic assemblage, only the flint and bloodstone component was analysed. This indicated that the flint nodules were small, but of high quality. Although the bloodstone nodules were larger, these were of lesser quality (Zetterlund 1990:64). Despite this there is clear evidence for the export of this material off the island, as many assemblages around Skye and the Inner Sound contain bloodstone (Hardy & Wickham-Jones 2003:380). It is also pertinent to note that alongside the excavation coring was conducted nearby, with the aims of reconstructing the vegetation profile of the area and to identify whether any evidence for human impact on the environment could be discerned (Hirons & Edwards 1990:715). The resulting profile indicated changes in alder, willow, grass, and hazel that corresponded to the time of Mesolithic occupation at Kinloch, and could not be fully explained as a natural ecological phenomenon. Added to this, a rise in charcoal indicated localised burning that may have derived from domestic fires, providing “circumstantial evidence for Mesolithic age human interference with the local vegetation. This is…comparable to findings from the Outer Hebrides” (Edwards & Sugden 2003:15; Hirons & Edwards 1990:723).

2.4.6.4. Coll

Fiskary Bay is the only confirmed Mesolithic site on Coll, identified during the Inner Hebrides Archaeological Project (hereafter IHAP), following the local collection of lithics around the inter-tidal zone (Mithen *et al.* 2007a; Figure 9). Excavation revealed a substantial artefact assemblage, charcoal, and fish bones from raised beach deposits (Mithen & Wicks 2009:36). The lithic assemblage comprised bladelet technology and microliths typologically diagnostic to the Scottish Mesolithic narrow blade tradition; however there is no detail of the raw material composition (Mithen *et al.* 2007a:28; Mithen & Wicks 2009:36). Charred hazel nutshells were dated to 7351-6236 cal. BC, which supports the late Mesolithic occupation suggested by the artefact assemblage (Mithen 2008:36).

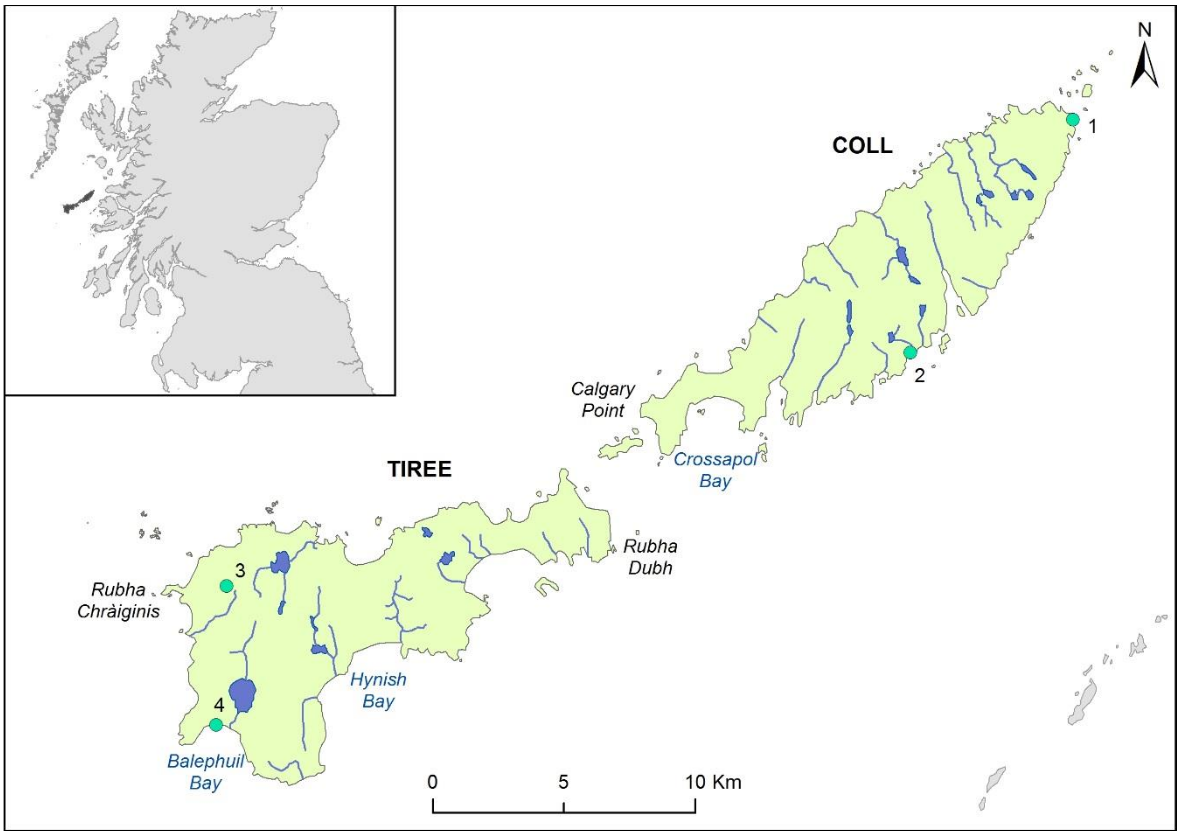

Figure 9. Mesolithic sites on Coll and Tiree. 1. Rubha Sgor-innis; 2. Fiskary Bay; 3. Ballevullin; 4. Balephuil Bay. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

Possible Mesolithic remains were recovered from an old ground surface eroding from sand dunes at Rubha Sgor-innis, including eight elongated bevelled pebbles, flint pebbles, and flint flakes (Ritchie *et al.* 1978:85). The bevelled pebbles are comparable to the coarse stone "limpet scoops", which have only been recovered from Mesolithic contexts at sites such as the Oronsay and Risga shell middens, and in the absence of any diagnostic pieces within the lithic assemblage this site is assigned a Mesolithic date by association.

2.4.6.5. Tiree

Further work by the IHAP on Tiree has investigated lithics collected by George Holleyman during the 1940's around the Ballevullin and Balephuil Bay areas, some of which are likely to be Mesolithic (Mithen *et al.* 2007c; Figure 9). Survey work in 2005 identified several possible new Mesolithic sites, most notably T1 – a bipolar technology dominated lithic scatter on raised beach deposits at Balephuil Bay (Mithen *et al.* 2007c:530; Mithen *et al.* 2005). A single tanged point was recovered at Ballevullin in 1912 which has been identified as a probable Ahrensburgian-style point (Ballin & Saville 2003; Livens 1956a:439; Morrison & Bonsall 1989).

2.4.6.6. Mull

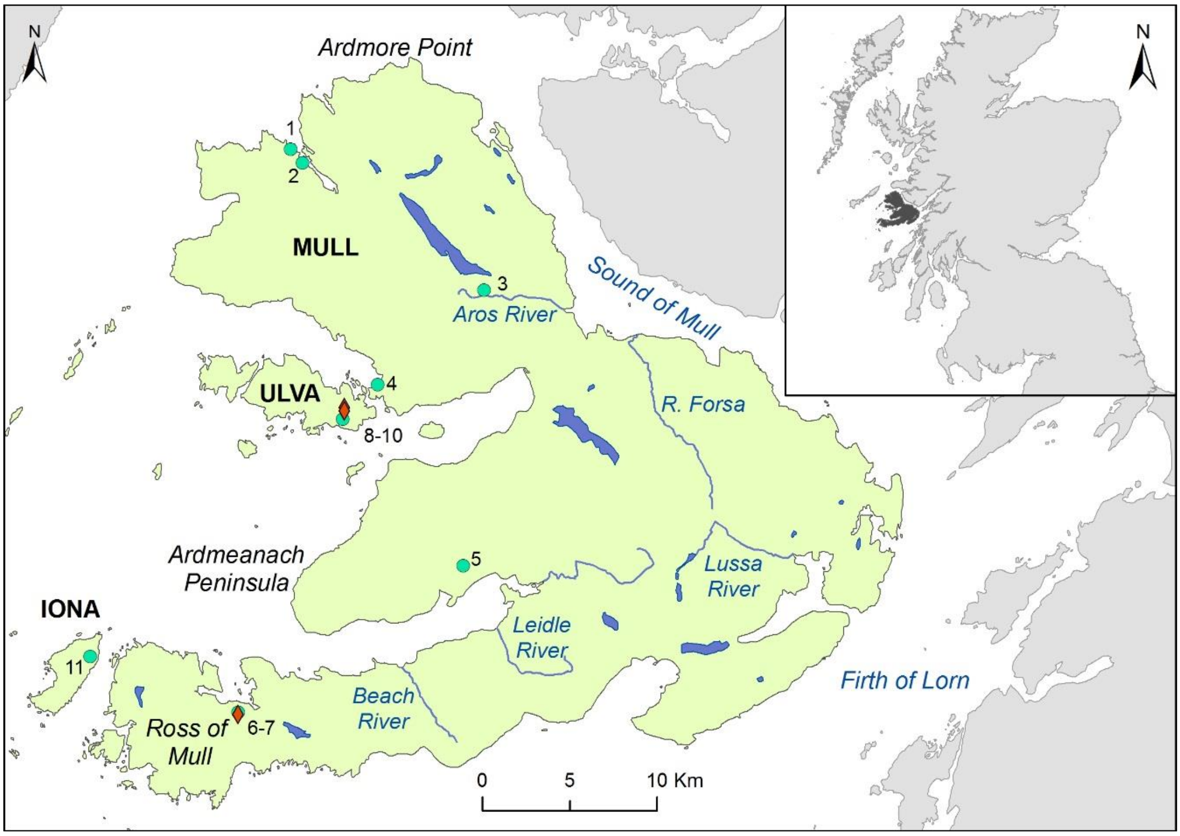

Figure 10. Mesolithic sites on Mull, Iona and Ulva. 1. Croig; 2. Crait Dubh; 3. Tenga; 4. Torr Daraich; 5. Various field-walking locations, Mull; 6. Loch an t-Suidhe*; 7. Suidhe; 8. Ulva Cave; 9. A'Chrannag 1*; 10. A'Chrannag 2*; 11. Relig Odhran. * - palaeoenvironmental cores. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

The IHAP identified three Mesolithic sites on Mull: Crait Dubh (Creit Dhu), Tenga and Croig (Mithen 2008; Mithen *et al.* 2007b; Mithen & Wicks 2010; Figure 10). All three were initially identified through the collection of lithics by local residents and further investigated through excavation. Unfortunately no raw material information was detailed in the publications. Although the lithic scatters are likely to be contaminated with later prehistoric material, there is a high component of bladelet technology at all of the sites, with microliths recovered from Tenga and Croig (Mithen *et al.* 2007b:28; Mithen & Wicks 2010:46). Radiocarbon dates from two phases of Mesolithic occupation at Crait Dubh span 8419-6481 cal. BC, which indirectly supports the interpretation of the above sites as Mesolithic (Mithen *et al.* 2007b:28; Mithen & Wicks 2010:46). The later phase of occupation from Crait Dubh coincides with the dates for significant vegetation disturbance obtained from pollen cores taken from Loch an t-Suidhe c.6900-5780 cal. BC, whereby an increase in heather and grass pollen, coupled with an increase in charcoal, and declining birch and hazel pollen taxa has been interpreted as anthropogenic in origin (Edwards & Sugden 2003:15; Sugden 1999:111-113). A series of small pits were excavated at Suidhe, close to the site of the coring location. Although only a single unstratified flint blade was recovered from the site, the charred contents of the pit certainly derive from human activity. Oak charcoal from one of the pits was dated to 4791-4615 cal. BC, although there is no clear evidence within the pollen core to indicate significant anthropogenic impact on the surrounding environment at that time (Ellis 2009:40; Sugden 1999:119).

Details of several isolated finds, including a Mesolithic flint core recovered from a ditch at Torr Daraich, and several Mesolithic blades with no specific provenance were also reported to National Museums Scotland (Anonymous 1993a; 1993b).

2.4.6.7. Iona

There appears to be only a single reference to Mesolithic activity on Iona (Figure 10). During the excavation of a Monastic enclosure at Relig Odhran, raised beach deposits containing charcoal spreads and Mesolithic flints were identified (Barber 1979:28).

2.4.6.8. Ulva

Ulva is a small island to the west of Mull (Figure 10). Excavations at Ulva Cave began in 1987, but ceased in 1991, and have since been resumed (Bonsall *et al.* 1994:20; Pickard 2013). The cave deposits contained a marine shell-rich midden in addition to crustacean remains, large mammal bones, fish bones, hazel nutshell, and seeds; artefacts include a perforated cowrie shell and an antler bevel ended tool (Bonsall *et al*. 1992:7; Bonsall *et al.* 1994:20). A small quantity of flint, quartz, pitchstone, and possible bloodstone debitage has also been recovered. The presence of pottery in the highest levels of the midden attests to its continued use into later prehistory, therefore some post-Mesolithic contamination of the lithic assemblage is likely (Bonsall *et al.* 1994:17). Limpet shells from the midden have been dated to two phases: c.6800-6460 cal. BC, which corresponds to the early dates from Druimvargie rock-shelter, and 4770-4400 cal. BC – contemporaneous with the Oronsay middens (Bonsall *et al.* 1992:11; Wicks & Mithen 2014). Unlike the other large 'Obanian' sites on the mainland and Oronsay, however, the small midden in Ulva Cave accumulated over the course of millennia (Bonsall 1997:31-33).

A pollen core was taken 500m north of the site at A'Chrannag. There is clear evidence for the burning of *Calluna* heathland and a decrease in woodland species from Mesolithic dated levels of the core. Despite the suggestion that anthropogenic activities may have contributed to these palaeoenvironmental signatures the dates from Ulva Cave do not coincide (Edwards & Sugden 2003:15; Sugden 1999:142, 160).

2.4.6.9. Colonsay

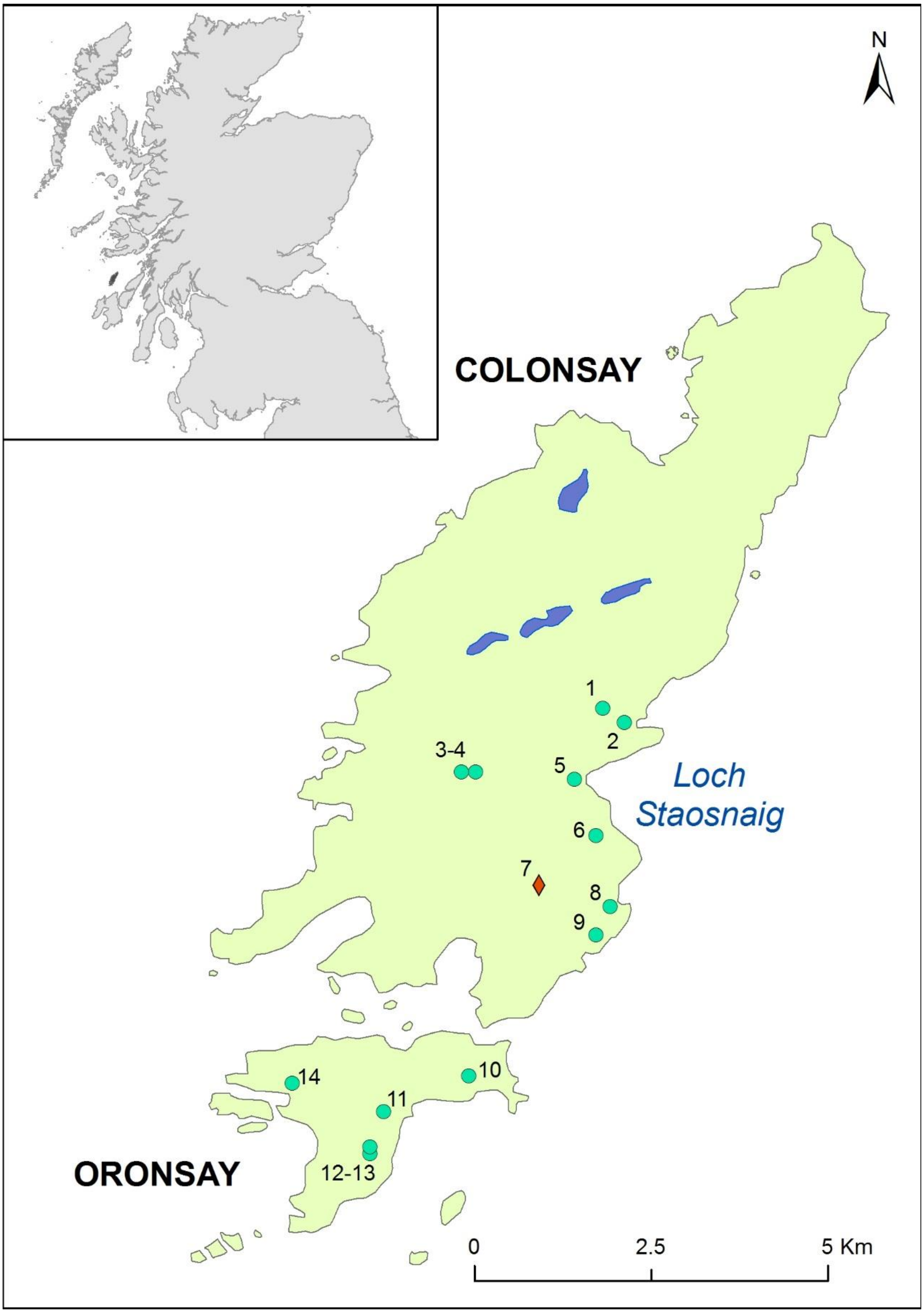

Figure 11. Mesolithic sites on Colonsay and Oronsay. 1. Scalasaig 2; 2. Scalasaig Hotel; 3. Machrins A; 4. Machrins 3; 5. Staosnaig; 6. Baleromindubh 5; 7. Loch Cholla*; 8. Baleromindubh 4; 9; Baleromindubh 2; 10. Cnoc Sligeach; 11. Cnoc Coig; 12. Caisteal nan Gillean I; 13. Caisteal nan Gillean II; 14. Priory Midden. * - palaeoenvironmental core. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

As part of the Southern Hebrides Mesolithic Project (hereafter SHMP), field-walking and test-pitting surveys were undertaken on the small island of Colonsay, in addition to the main work on Islay (Figure 11; and see Section 2.4.6.11). Three areas – Machrins 3, Scalasaig 2 and Staosnaig –

produced definite evidence of Mesolithic occupation with strong evidence for Mesolithic activity also present at Baleromindubh (Marshall 2000a:358; Mithen 1989b; 1989d; Mithen & Lake 1996). Flint was the primary raw material found at these sites, supplemented by a small quantity of quartz. Overall the assemblages were dominated by bipolar reduction techniques which enabled the small beach pebbles to be utilised immediately (Mithen 1989a; 1989b; 1989c).

The site at Staosnaig is one of the most important Mesolithic sites excavated in the Inner Hebrides. *In situ* Mesolithic deposits including worked lithic debris, coarse stone artefacts and several pit-like features, some of which were stone-lined, have been recovered (Mithen & Lake 1996:138-139). The largest pit, F24, measured c.4.5m in diameter and has been interpreted as a probable hut structure. The fill comprised a chipped stone assemblage, coarse stone tools, and a significant quantity of charred hazel nutshell, which is estimated to have comprised 30,000-40,000 whole hazel nuts (Mithen *et al.* 2001:225, 227). Nut shells from the pit have indicated that episodes of deposition occurred between 7320-5792 cal. BC, and are representative of intensive and systematic exploitation over a short period of time that likely involved a degree of resource management (Edwards & Sugden 2003:15; Mithen *et al.* 2001:232-233). The lithic assemblage totals in excess of 68,000 pieces and is dominated (98.9%) by flint; however, quartz, Arran pitchstone, and an unprovenanced siltstone were also recovered from the features (Mithen *et al.* 2000a:394).

A palaeoenvironmental core taken from Loch Cholla, 2km to the south of the site indicates an extremely sudden decrease in tree pollen of *Corylus* and *Betula* c.6600-5200 cal. BC (Andrews in Mellars 1987:66). The original interpretation of this signature favours a statistical issue in absolute abundance percentages in order to explain the decrease in tree pollen i.e. that the reduction in the proportion of tree pollen is only perceived due to increased percentage data for grass, sedge, and heather pollen through the course of natural re-vegetation (Mellars 1987:66). Edwards and Sugden (2003:15-16), however have argued that the dates coincide with the deposition of the large charred hazelnut assemblage at Staosnaig, and by implication the exploitation this resource may have affected the pollen record.

2.4.6.10. Oronsay

Oronsay has a long history of archaeological investigation into the shell mounds on the island and the surrounding area (Anderson 1898; Bishop 1914; Grieve 1883; Mellars 1987). Three of the five Mesolithic middens – Caisteal nan Gillean I, Cnoc Sligeach and Cnoc Coig – have been excavated intermittently since 1881, with two further Mesolithic middens and subsidiary occupation identified during excavations in the 1970’s at Caisteal nan Gillean II and Priory Midden (Jardine 1972; 1973; 1974; 1975; Jardine & Jardine 1976; 1978; 1983; Mellars 1971; 1987; Figure 11).

The Mesolithic shell middens on Oronsay are very similar in their composition. They consisted largely of deposits of dense occupation debris – primarily of marine molluscs, often interspersed by wind-blown sand (Anderson 1898; Bishop 1914; Jardine & Jardine 1983; Lacaille 1954; Mellars 1987). The midden layers also included hearth deposits, which are present in all but Caisteal nan Gillean I, and structural evidence in the form of stake holes at Cnoc Sligeach and Cnoc Coig (Lacaille 1954:213, 222; Mellars 1987:237-240). Excellent preservation conditions created by the shell matrix allowed for large faunal assemblages of terrestrial and marine mammal, fish and bird bones to be recovered (Anderson 1898; Grigson & Mellars 1987; Lacaille 1954). Tools of bone and antler including barbed harpoon heads/fishing spears, awls, points, and bevel-ended pieces were also preserved; the typology and function of which has been discussed and length (Anderson 1898:307-313; Bishop 1914:68; Clark 1956; Jardine & Jardine 1978; Lacaille 1954:211-219). Fifty-five human bones, predominantly from the hands and feet were recovered from Cnoc Coig, Caisteal nan Gillean II and Priory midden, which has provided isotopic evidence on the diets of the individuals (Anderson 1898:311; Meiklejohn & Denston 1987:296; Mellars 1987:119; Richards & Schulting 2003; Richards & Mellars 1998).

The stone tool assemblages from the middens primarily consisted of bevel-ended stone tools made of elongated pebbles and small quantities of flint debitage, which attests to the working of this material on the sites (Anderson 1898:307-313; Lacaille 1954:220, 227). There is very little evidence for secondary working of the flint – less than 1% of the assemblage from Cnoc Sligeach is retouched, however it has been suggested that the flint chips would have been suitable for use without modification (Bishop 1914:91; Coles 1964:82). Flint itself is only occasionally found on Oronsay, with the nearest sources at Carsaig, south Mull, and the Morvern and Ardnamurchan peninsulae on the mainland (Lacaille 1954:216). As such the material has been intensively reduced and the small numbers of blades recovered suggest that the raw material was not conducive to producing such technology (Coles 1964:96; Lacaille 1954:218; Mithen *et al.* 2007c:516). This information on the lithic assemblages has only been gleaned from the early excavations by Grieve and Galloway, and Bishop and Buchanan. Regrettably, the lithic report from Mellars' excavation still has not been produced (Mellars 1987). A pilot study on a small sample of material recovered from test-pits across Cnoc Coig has since been conducted, revealing an assemblage of flint (64%) and quartz (36%) artefacts, both derived from beach pebbles (Pirie *et al.* 2006:6). A careful reduction strategy is evident alongside deliberate production of narrow blades, which compares to the assemblage from the shell midden at Risga, and also the much earlier dated midden at Sand (Pirie *et al.* 2006:10).

2.4.6.11. Islay

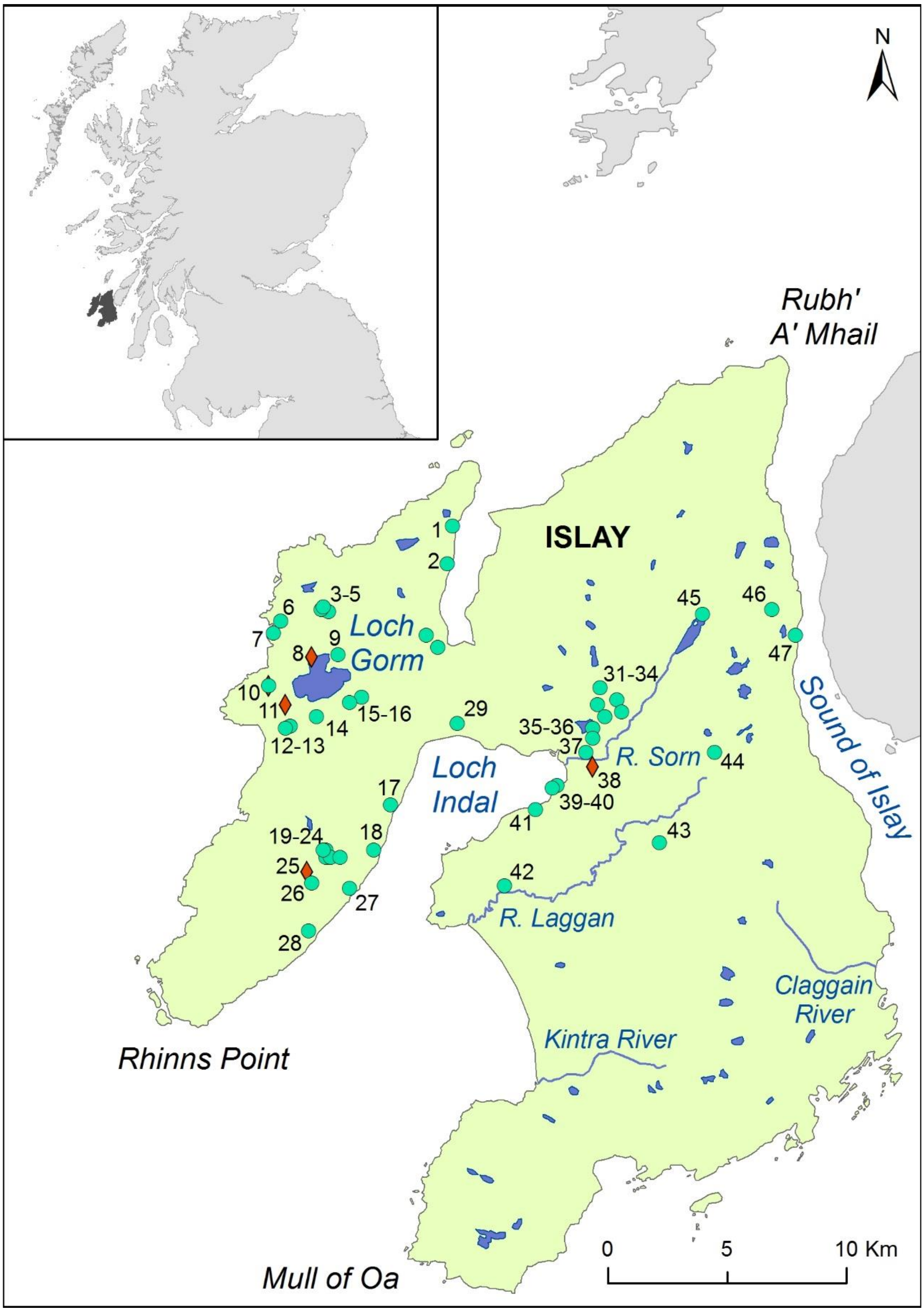

Figure 12. Mesolithic sites on Islay. 1. Kilellan Farm; 2. Gruinart B; 3. Kindrochid; 4. Kindrochid 4; 5. Kindrochid Ditch; 6. Kindrochid Area 3; 7. Loch Grom 5; 8. Loch Gorm B*; 9. Kindrochid Area 2; 10. Coulererach (*); 11. Loch Gorm A*; 12. Loch Gorm 2; 13. Rockside; 14. Loch Gorm 10; Loch Gorm 9; 16. Loch Gorm 1; 17. Port Charlotte 3; 18. Port Charlotte; 19. Gleann Mor Site A; 20. Kilchiarain Road Stone Quarry A; 21. Kilchiarain Road Stone Quarry B; 22. Kilchiarain Road Stone Quarry C; 23. Kilchiarain Road Stone Quarry D; 24. Kilchiarain Road Stone Quarry E; 25. Loch a'Bhogaidh*; 25. Bolsay Farm; 27. Cill Michael; 28. Low Nerabus; 29. Black Park Quarry; 30. Scarrabus; 31. Bridgend 11; 32. Bridgend 9; 33. Bridgend 14; Bridgend 7; 35. Bridgend 1; 36. Bridgend 5; 37. Newton; 38. Sorn Valley*; 39. Bowmore 16; 40. Bowmore 4; 41. Bowmore 10; 42. Bowmore 9; 43. Mulindry 10; 44. Storakaig; 45. Cnoc Seanda; 46. Kiells 3; 47. Rubha Port an t-Seilich. * - palaeoenvironmental core. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

Archaeological investigation into the Mesolithic of Islay has been conducted since the 1950's, which resulted in a high number of Mesolithic lithic scatters being recorded (Burgess 1973:8; 1976:13; Caldwell 1997:19; Newall 1960:16; 1962a; Newall & Newall 1961b; Figure 12). Over the last quarter of a century the approach changed to encompass large-scale projects such as the SHMP, conducted between 1988 and 1998 (Mithen 2000c), and the on-going IHAP and East Islay Mesolithic Project (Mithen & Wicks 2013; Mithen *et al.* 2005).

The SHMP investigated several sites that had previously been identified through local field-walking activities. Bolsay Farm was known to be an extensive site of Mesolithic occupation (Newall 1962b; 1963; Newall & Newall 1961a). Excavation recovered in excess of 300,000 lithics, in addition to *in situ* stake holes, pits, and hearth deposits. Radiocarbon dating of charcoal from the pits suggested the Mesolithic phase of occupation occurred between 6425-5623 cal. BC (Mithen 1990a; 1992; Mithen & Lake 1996:135). The relative *in situ* nature of the occupation deposits at Bolsay Farm has been interpreted as representative of a residential camp, or a palimpsest of multiple, smaller occupation episodes (Mithen *et al.* 1992; Mithen & Lake 1996:136-137; Mithen *et al.* 2000d:289).

A dense concentration of Mesolithic flint artefacts had also been identified eroding from a disused sand quarry at Gleann Mor (Davies 1970:6; Newall 1959:12; 1960:16). Subsequent excavation by the SHMP revealed “a well preserved, discrete and high-density artefact scatter” totalling c.13,000 artefacts confined to an area of only 6m^2 (Mithen 1989a; 1990b:32; Mithen & Lake 1996:131-132). Although no archaeological features were detected, a single piece of charcoal recovered from within the artefact scatter was radiocarbon dated to 6222-5737 cal. BC (Mithen & Lake 1996:132). Based on the small area of highly concentrated artefacts Gleann Mor has been interpreted as having been occupied on only a few, short occasions (Mithen & Finlayson 2000a:204; Mithen & Lake 1996:134).

At Coulererach, to the west of Loch Gorm, an assemblage of c.2500 artefacts were identified sealed below thick peat deposits (Mithen 1993:68). The scatter predominantly comprised primary stage knapping debris, with many small beach flint pebbles exhibiting single flake removals. Additionally, re-fitting pieces, good quality blades, and several retouched tools including tanged microliths were also recovered, providing a striking contrast to the other Islay assemblages. A piece of charcoal from within the lithic scatter was dated to 6561-6228 cal. BC (Mithen 1993:68; Mithen & Lake 1996:143). The site has been interpreted as an area primarily used for flint knapping, given its close proximity to flint-bearing beaches on the west coast. Furthermore, the position of the site beside the loch would also have provided access to a rich and diverse range of game, fish, and fowl for exploitation (Mithen & Finlay 2000:229; Mithen & Lake 1996:145). A similar interpretation has been made for the site excavated at Kindrochid. The site is well placed in the landscape for the observation of game towards Loch Gorm, and the high density of knapping debris associated with microlith production has led to the interpretation that this site functioned to repair and manufacture such tools (Marshall & Mithen 2000:249).

Numerous areas were field-walked during the project, which identified several areas of potential Mesolithic activity. Two further Mesolithic sites at Rockside and Aoradh were also excavated, however the deposits were high highly disturbed (Lowe & Dalland 1996; Mithen *et al.* 2000b; Mithen & Lake 1996; Mithen *et al.* 2000f).

Palaeoenvironmental investigations have also been conducted close to many of the sites. Although cores from Loch Gorm and Coulererach produced inconclusive evidence for human impact, previous pollen studies can be related to Mesolithic activity within their locality (Bunting *et al.* 2000:147-148; Edwards & Berridge 1994; McCullagh *et al.* 1989; Sugden & Edwards 2000). The core from Loch a'Bhogaidh indicates a high presence of hazel (*Corylus*) within the immediate vicinity and fluctuations in the pollen record for this species is interpreted as reflecting anthropogenic disturbance to the local vegetation, especially in the later stages of the profile, where a marked reduction in *Corylus* pollen correlates with an increase in charcoal. This phenomenon occurs in two stages – one between c.6300-6050 cal. BC and another c.6000-6400 cal. BC, which coincides with confirmed Mesolithic activity on the island at Bolsay Farm and Gleann Mor, less than kilometre away (Edwards & Berridge 1994:760-761, 768; Mithen *et al.* 1992:252; Sugden 1999:95-101; Sugden & Edwards 2000:135).

A palaeoenvironmental core was also taken from the Sorn Valley, close to the excavation of a Mesolithic site at Newton. The site comprised pits and gullies filled with carbonised material (hazel nutshell, charcoal, and bone) in addition to a large flint assemblage. Radiocarbon dates indicate occupation occurred between 7305-6216 cal. BC (Andrews in McCullagh *et al.* 1989:25, 47). These dates do not closely correspond directly with the possible anthropogenic disturbance to local vegetation indicated by the Sorn Valley core (Ballantyne 2004:27-29; Conneller & Warren 2006:7; Andrews in McCullagh *et al.* 1989:49). Despite this, the number of sites identified through field-walking activities of the SHMP along the Sorn Valley indicates a high concentration of Mesolithic activity in the area.

2.4.6.12. Jura

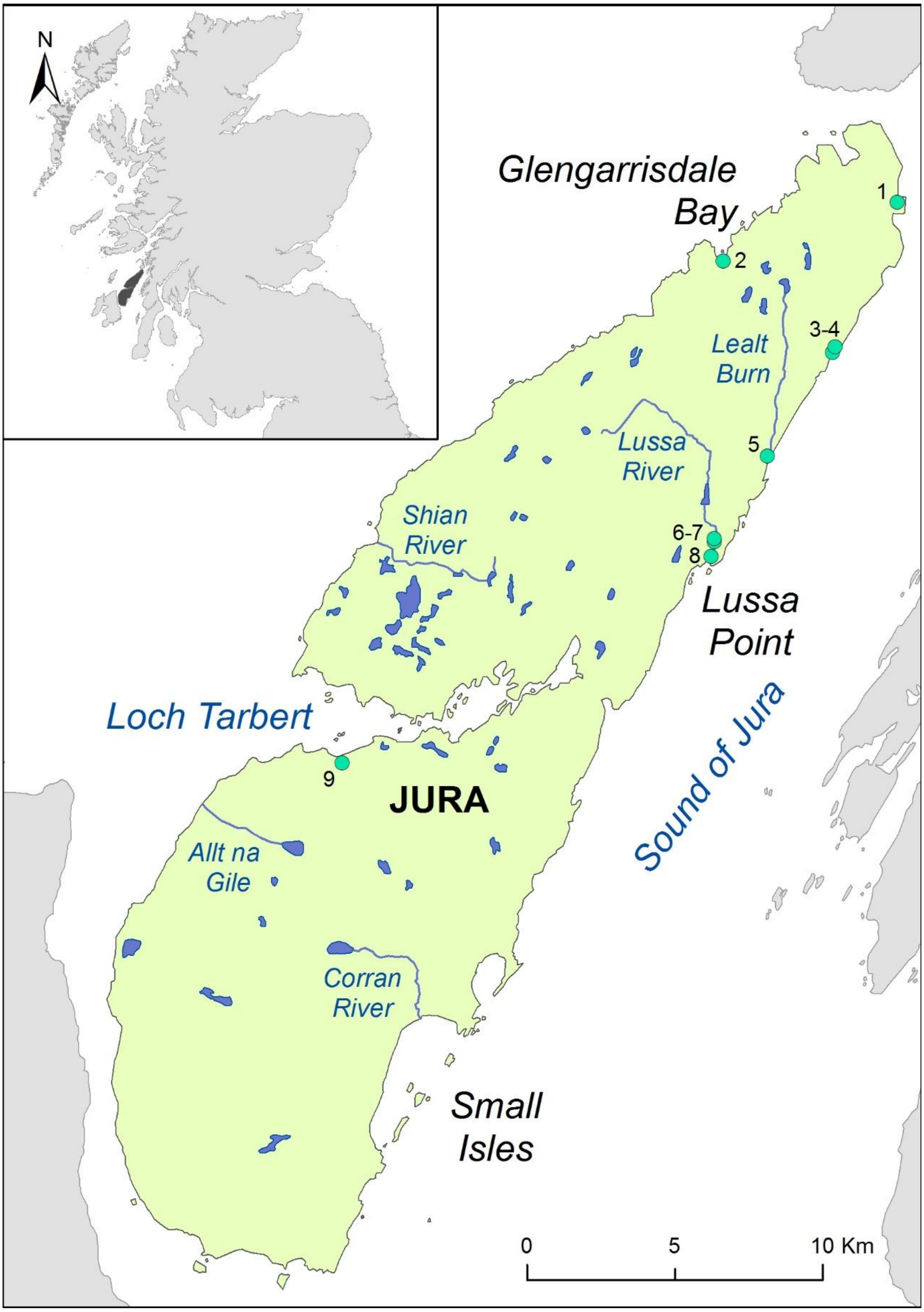

Figure 13. Mesolithic sites on Jura. 1. Kinuachdrach; 2. Glengarrisdale; 3. North Carn; 4. Carn Southern Raised Beach; 5. Lealt Bay; 6. Lussa River; 7. Lussa Wood; 8. Lussa Bay; 9. Glenbatrick Waterhole. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

The first campaign investigating the Mesolithic occupation of the Inner Hebridean islands was conducted by John Mercer on Jura between 1966 and 1982 (Figure 13). Seven 'transgression-time' sites containing thousands of microliths were excavated during this period, and further information on two of the sites was published subsequently. Unfortunately, none of the lithic assemblages can be confirmed as *in situ*, and represent material from the Mesolithic to the Bronze Age (Mercer 1968:7; 1969; 1971; 1972; 1974; 1980; Searight 1984; 1990:7; 1993).

A number of dates were obtained from some of the sites which reinforced Mercer's three-phase microlithic chronology (Mercer 1972; 1974). However, the dates and their association with the microlithic forms have since been disputed (Myers 1988:25; Searight 1993:8; Woodman 1989:11-13). The radiocarbon dates from Lussa Wood were originally interpreted as support for the continuation of broad-blade technology beyond c.7500 cal. BC, which has since been disproved, and the Neolithic dates for the microlithic assemblage at Lussa River are believed to derive from a later occupation phase (Woodman 1989:12, 16). Mercer's precise system of categorising microlith typology, based on morphological characteristics, has been criticised as risking "a normalisation of the data", which would disguise morphological variability (Finlayson *et al.* 1996). Microlith 'types' actually grade between forms and simplification of Mercer's system indicated the majority of the Jura assemblages broadly conform to a similar typological group (Finlayson *et al.* 1996; Woodman 1989:12-13). Overall it appears that the assemblages represent a mix of both earlier and later Mesolithic occupation due to erosion and re-deposition of deposits (Bonsall 1988:33; Saville 2004:11).

Flint dominates the assemblages, despite the absence of naturally occurring nodules on the island. The nearest sources are Mull and the Morvern and Ardnamurchan peninsulae on the mainland (Mercer 1968:45). Comparison with sources of corticated pieces from Glenbatrick indicated that the larger flints were likely to have been sourced from south Mull. However no provenance has been suggested for the smaller, water rolled pebbles which seem to have supplied the majority of the assemblages (Mercer 1974:16-18). Locally available quartz and quartzite cobbles are present in all assemblages, with the exception of Lussa Bay, and this is the only site that does not contain Arran pitchstone (Mercer 1968:20, 45; 1969). Mudstone has been recovered from Glengarrisdale (Mercer & Searight 1986:47) and, although not used as a tool, it is interesting to note the presence of red ochre at Lussa River and North Carn, which is likely to have been imported from Mull or Skye (Mercer 1971:28; 1972:8).

Despite the problems inherent in the chronology of the Jura material, comparison of the bipolar 'chisels' present in the microlithic assemblage at Lussa River with those from the 'Obanian' shell middens of Oronsay (which lie in close proximity; contra. Bonsall 1996:188), led Mercer to suggest "…that known 'Obanian' material from Oronsay and, by extension, other similar Argyll 'Obanian' material, was the product of the region's microlithic period, evidenced by the Jura excavations. In this case the claim of the 'Obanian' material to culture status in its own right would no longer be supportable…" (Mercer 1971:27). This suggestion was made over a quarter of a century before it became fully acknowledged (Bonsall 1997).

2.4.6.13. Arran

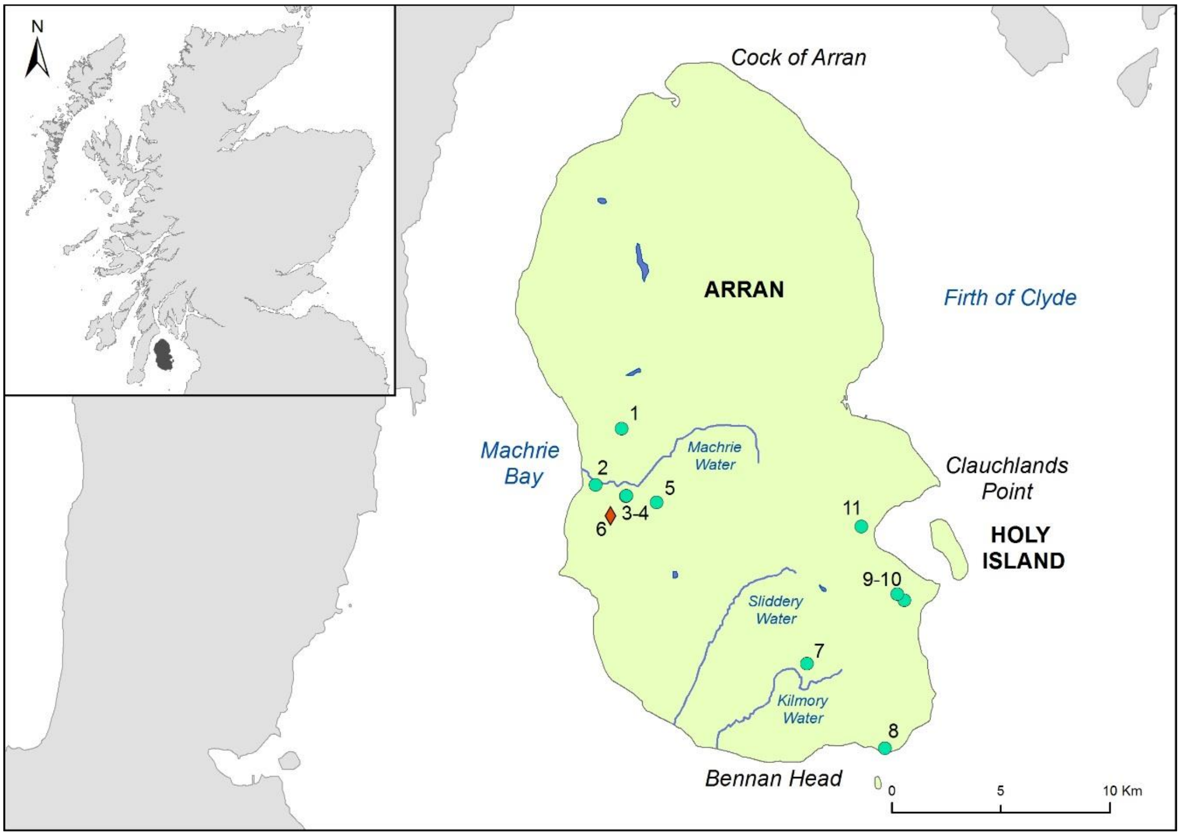

Figure 14. Mesolithic sites on Arran. 1. Machrie North Test Pit 0610; 2. Machrie; 3. Moss Farm Site 1; 4. Moss Farm Site 11; 5. Bridge Farm; 6. Machrie Moor*; 7. Auchareoch; 8. Kildonan; 9. Knockenkelly 12; 10. Knockenkelly 15; 11. Lamlash. * - palaeoenvironmental core. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

The first indication of Mesolithic occupation on Arran was hinted at by the recovery of several 'Late Larnian' flints around the north-west coast (Lacaille 1954:154; Figure 14). Yet considering well-documented Mesolithic presence on the mainland surrounding Arran, and the other nearby islands discussed above, such fleeting evidence for Mesolithic occupation appeared anomalous in light of the island's topography and environment, which would certainly have appealed to hunter-gatherer communities (Robinson 1983a:1).

2.4.6.13.1. West Arran - Machrie Moor

Peat coring activity on Machrie Moor in 1980 provided circumstantial evidence that the Mesolithic occupation of Arran may have been more substantial than the lithic evidence suggested (Robinson 1983a; 1983b; Robinson & Dickson 1988). Within the peat core a significant episode of coinciding elements was seen, which were interpreted as indicative of human vegetation disturbance. These elements included the presence of charcoal, a reduction in tree pollen supplemented by a rise in pollen of species such as hazel (*Corylus*) and heather (*Calluna vulgaris*) – which is associated with fire resistance and open-area habitat (Robinson 1983a:3). The first episode of this nature occurred at a level dated to 8234-7482 cal. BC, which was concurrent with the earliest known Mesolithic occupation in Scotland at the time (Robinson 1983a:3; Robinson & Dickson 1988:229). A second episode of possible anthropogenic vegetation disturbance was also detected c.6800 cal. BC: charcoal was again present, *Calluna* pollen levels remained constantly high and pollen values representing a suite of plants suited to woodland-clearing increased (Robinson 1983a:3; Robinson & Dickson 1988:229). A further discussion on the debate surrounding fire ecology is contained within Chapter Seven. The evidence was taken to suggest that Arran must have been populated during the Mesolithic (Fairhurst 1982; Robinson 1983a).

Several Mesolithic sites and lithic scatters have subsequently been identified near Machrie, Moss Farm and Bridge Farm that validate the above interpretations (Baker 1999:65; Ballin-Smith *et al.* 1999:64; Gorman *et al.* 1993a:79; 1993b:80; 1995b:72; Haggarty 1991:83).

2.4.6.13.2. East Arran - Auchareoch and Knockenkelly

More substantive evidence was recovered from Auchareoch and Knockenkelly that supported Robinson's prediction. During forestry commission quarrying works at Auchareoch flint and pitchstone artefacts were identified (Affleck *et al.* 1985:41). Ensuing excavation yielded in excess of 4400 flint and pitchstone lithics, including microliths (Affleck *et al*. 1985:41; 1988:38). Significant quantities of charred hazel nutshell and bone fragments were excavated from fire-pits which dated the period of activity to between 7303-6015 cal. BC (Allen & Edwards 1987:20). The lithic assemblage from Auchareoch was overwhelmingly dominated by flint (90%), whereas pitchstone made up just under the remainder (9.4%) – both of these raw materials were derived locally from beach and fluvioglacial deposits within the kame terrace on which the site is located (Affleck *et al.* 1988:46, 54). Overall the site is interpreted as a palimpsest of small, short, but frequently occupied camps which were geared towards the specialised production of blades and microliths – in particular scalene triangles (Affleck *et al*. 1988:50, 56).

Several other flint and pitchstone lithic scatters and isolated finds have been recovered within the vicinity of Auchareoch and the Kilmory Water area, although none are diagnostically Mesolithic (Allen & Edwards 1987:20-21).

Twelve lithic scatters were noted in the Knockenkelly area; however only two of the sites contained diagnostic flint microliths like the ones identified by Fairhurst (1982). The other scatters, predominantly of pitchstone, also include artefacts relating to post-Mesolithic occupation (Allen & Edwards 1987:21). Another occupation site was also excavated at Lamlash (Ballin-Smith *et al.* 1999:64).

On the south east point of Arran at Kildonan a large, concentrated Mesolithic artefact scatter was identified during field-walking; the main raw material in the assemblage was flint, although a small number of pitchstone and quartzite tools were also recovered. The site appears to represent a knapping area, with a large quantity of tested flint pebbles in addition to cores, blades, burins and finished tools such as scrapers and microliths. Shell fragments were also identified (Gorman *et al.* 1995a:72).

2.4.7. The Western Isles – Outer Hebrides

2.4.7.1. Palaeoenvironmental Indicators

To suggest the Western Isles were not occupied during the Mesolithic, in the words of Woodman (1996:156) "is to accept a proposition that some areas of Scotland were the only regions in Northern Europe to remain unoccupied…". Considering that the offshore islands in Norway and Scandinavia were colonised within a few hundred years of the retreat of the ice sheets (discussed in Chapter Three), this seems highly improbable (Bang-Andersen 2003b; Bjerck 1995; 2008b; 2009; Larsson 1996).

The difficulty of finding Mesolithic sites in these islands rests on three primary issues. First is the post-Mesolithic development of blanket peat (sometimes several metres thick) across the majority of the islands' interior (Bennett *et al.* 1990:281; Bishop *et al.* 2011a:1; Edwards 2004:61; Edwards & Mithen 1995:349). This has obscured early Holocene ground surfaces and the acid nature of the soils creates inappropriate conditions for the preservation of organic materials such as bone (Edwards 1996:34). Second, post-glacial sea level changes have had significant effects on the preservation of Mesolithic sites in this region (Bishop *et al.* 2011a:1; Edwards 2004:69; Edwards & Mithen 1995:349). In some areas of the Inner Hebrides and mainland Scotland, the land is 'rebounding' from the weight of the LGM ice sheets following de-glaciation (isostasy) at a rate quicker than that of sea level rise (eustasy). This has formed raised beaches that have benefitted the preservation of early Holocene sites (Armit 1996:28; Bjerck 2009:120). In the Western Isles however, isostatic uplift is minimal, with the land 'sinking' in relation to sea level rise (Ashmore 2003a:2). As a result of coastal inundation, possibly caused by the Storegga tsunami, the Mesolithic shoreline between 6398-6032 cal. BC is estimated to have been c.-2.17m OD (Mean High Water Springs) than at present in Harris, and perhaps as much as -5m in the Uists (Jordan *et al.* 2010:131; Ritchie 1979; 1985:174-175). A consequence of marine transgression is the third issue – the inland incursion of machair (calcareous shell sand), which has also buried evidence of Mesolithic occupation (Bishop *et al.* 2011a:1; Edwards 1996:34; Edwards & Mithen 1995:349; Edwards *et al.* 2005:436). The machair dunes are constantly changing and burying the landscape. Coastal Mesolithic sites are therefore submerged under the Atlantic or covered by machair, with inland sites buried beneath the peat (Armit 1996:28, 34). Ironically, where sites can be found under the peat and machair they are well preserved and have suffered very little post-depositional disturbance (Edwards & Mithen 1995:349).

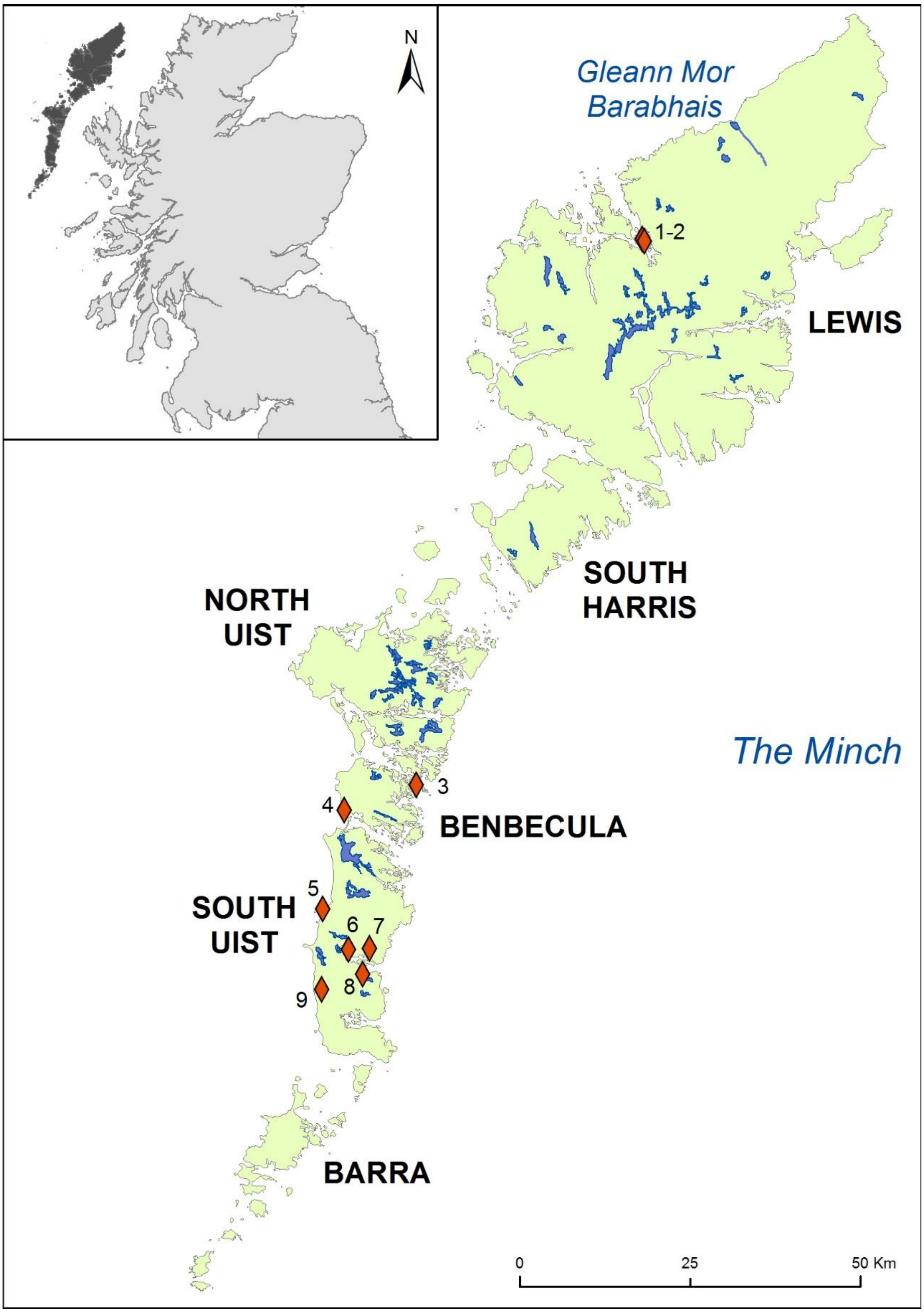

Figure 15. Palaeoenvironmental indicators of Mesolithic activity in the Western Isles. 1. Aird Callanais; 2. Callanish; 3. Kallin; 4. Borve; 5. Peninerine; 6. North Locheynort; 7. Loch Lang; 8. Loch Airigh na h-Aon Oidhche; 9. Loch an t-Sil. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service

There have been a number of palynological studies conducted on lake sediment cores in the Western Isles since the 1980's (Figure 15). Anomalies in the representation of pollen and charcoal in these cores have been suggested by some as indicative of evidence for Mesolithic impact on the environment. This is most convincing when compared to evidence for vegetation disturbance and burning close to known Inner Hebridean Mesolithic sites is identified, such as on Arran, Islay, and at Loch Doon in the Galloway Hills on the mainland (Affleck *et al.* 1988:56; Armit 1996:24; Bennett *et al.* 1990; Birks 1972; 1975; Bohncke 1988; Edwards 1990:73; 1996; 2000; 2004; Edwards & Berridge 1994:768; Edwards & Mithen 1995:355-357; Edwards & Sugden 2003; Andrews in McCullagh *et al.* 1989:42; Robinson 1983a). However, others have argued that the variations detected in vegetation patterns were ecological responses to early Holocene climate change or natural alterations in woodland ecosystem dynamics (Tipping 1996; 2004).

A core taken from North Locheynort, South Uist (where there is no archaeological evidence of Mesolithic presence) exhibited evidence for burning and changes to the local woodland environment that dated to the Mesolithic period (Edwards 1990:77). The profile compared very closely to palynological evidence for early human interaction with the environment from the Inner Hebrides at Kinloch, Rum, which was taken near to a key Mesolithic site of the same name and date (Edwards 1990:77; Hirons & Edwards 1990:721). This close parallel in palynological and micro-charcoal evidence between the Western Isles and the Inner Hebrides has been used “to justify the notion of a human presence in Mesolithic times” in the Western Isles (Edwards 1996:34). Until 2001, however, no archaeological sites had been found in the region that could substantiate this argument, and evidence for Mesolithic occupation remained contentious.

Slightly less circumstantial evidence was identified at Aird Calanais, Lewis when a dry-stone hearth feature with charcoal deposits was observed eroding from the north facing coastal edge of East Loch Roag in 1997. The excavation aimed to investigate the deposits for their palaeoenvironmental and dating potential, as the site was likely to be prehistoric in nature (Flitcroft & Heald 1997; O’Brien *et al.* 2009:5). The stratigraphic position of the deposits concerned, under c.1m of peat, indicated they might be of a similar date to the Callanais stone circles, and associated Neolithic and Bronze Age landscape and field systems in the area (Ashmore 1995; O’Brien *et al.* 2009:5). A 100% sampling strategy of the deposits was employed to maximise the recovery of material, which has formed the basis for the sampling strategy developed in the region (Church 2002b; Jones 1991). Underlying the hearth feature which initiated the investigation of the site was a buried relic ground surface of bioturbated early to mid-Holocene organic soil, incorporating burnt material of charcoal and charred hazel nutshell (O’Brien *et al.* 2009:7-9). Two radiocarbon dates obtained from the buried ground surface yielded dates of between 5659-4456 cal. BC. Although it is not clear whether the hazel nutshells derive from ephemeral traces of Mesolithic food-gathering activities and burning, it is certainly possible, making Aird Calanais a likely Mesolithic site (Church pers. comm.; Bishop *et al.* 2012a:7; O’Brien *et al.* 2009:17).

2.4.7.2. Coastal Erosion

Coastal erosion is a serious issue in Scotland. Continually causing significant damage to archaeological sites, the Western and Northern Isles are affected the most (Armit 1994:72-73; Ashmore 2003a:2; 2003b:203; Burgess & Church 1997; Finlayson *et al.* 1999b). However, it has also played an important role in *exposing* archaeological sites that were not previously visible – especially after periods of extreme weather (Barrowman 2000:99-103; Bell *et al.* 2013:37; Fairnell & Barrett 2007:466; Milner 2002:226; Woodman 1989:6). Several significant Mesolithic sites in Britain and Ireland have been discovered as a consequence of erosion: the Mesolithic flint scatters at Lussa Bay and North Carn, Jura derive from eroded deposits washed downstream by river action (Mercer 1969:5; 1972:9); changes in upslope drainage caused an erosion scar on a cliff edge at Belderrig, Co. Mayo, Ireland where a Mesolithic quartz scatter was identified (Warren 2008:1); erosion of windblown sands revealed Mesolithic sites at the Sands of Forvie and Culbin Sands (Warren 2005b:9). Survey of sites around Skye, Raasay, the Crowlin Islands and the Applecross peninsula of the Inner Sound indicated almost all are threatened from various forms of erosion, which has facilitated the continual recovery of lithics at the well-known Mesolithic sites of An Corran and Staffin (Finlayson *et al.* 1999b; Hardy & Wickham-Jones 2009c:12).

Coastal erosion has also contributed to the discovery of the first Mesolithic sites in the Western Isles, which are described in Chapters Five and Six.

2.5. The Current Picture of the Mesolithic in Western Scotland

This review has aimed to provide an overview of the current picture of the Mesolithic in western Scotland and the Hebrides through several key aspects. The first, and most notable, is the way in which investigation of the Mesolithic in western Scotland has changed. Small, isolated explorations of shell middens by antiquarians on the island of Oronsay, and in the caves and rock-shelters around the coastline at Oban, Argyll have retained their status as some of the most important sites in Mesolithic Scotland (Anderson 1895; 1898; Grieve 1883; Saville). However, the contribution of large-scale surveys such as the SHMP, and the SFSP within the last 30 years has taken an entirely holistic view of the archaeological record in their respective areas. Together, these intensive investigations of vast tracts of the Inner Hebrides have resulted in an exponential rise in the contribution of new information to our current understanding of Mesolithic occupation at the most north-western corner of Europe (Hardy & Wickham-Jones 2003; Hardy & Wickham-Jones 2009b; Mithen 2000c; Mithen *et al.* 2006). Alongside this, culture-historical perspectives of the 'Larnian', 'Tardenoisian', and 'Obanian' – the latter of which endured into the mid-1990's – have also been refuted (Morrison 1996:14; Saville 2004).

The influence of developer-funded excavation through NPPG5 and PAN42 (The Scottish Government 1994; 1998) legislation has also paid dividends in contributing to the archaeological record (Phillips & Bradley 2004; Saville 1998b:214); however, rescue excavations were being conducted far in advance of their implementation in 1994. This has primarily been a consequence of local interest and amateur collection, which has resulted in the positive identification of hundreds of new sites. The recovery of potential material by local inhabitants has not only 'filled in' regional gaps where academic research has not taken place, but has highlighted the potential of areas for future research (Barrowman 2000:36-38, 104-108).

Despite this, there are still large areas where there is little or no evidence for Mesolithic occupation. The absence of evidence for the Mesolithic in the north-west Highlands, for example, contrasts markedly with the vast corpus of evidence recovered from the Inner Hebrides and the south-western Scottish mainland. There are a significant number of instances discussed above where palaeoenvironmental data has hinted at human interference in local vegetation; however the physical evidence to support this has not been uncovered until sometime afterwards.

The second aspect concerned the nature and composition of the dataset presented. Related to this was the issue of how archaeological methods and recovery techniques affect our understanding of the Mesolithic in the region. In terms of distribution, the data collected so far is an excellent indication of Mesolithic presence throughout the area under study, and to a certain extent the activities undertaken there (knapping and creating new tools, hunting etc.). However, in terms of securely dated contextual information, the picture is much sparser. Overall, just under 75% of the archaeological sites in the database were initially identified through *ad hoc* surface collection or organised field-walking activities[3]. Unstratified surface scatters therefore account significantly for the highest proportion of sites in the region under study and only 13% of these were subsequently excavated. As a result, 67% of the total number of identified archaeological sites[4] lack any secure contextual information with which to interpret them, thus their use as comparative material is compromised.

Only 33% of sites from the catalogue have been excavated, either by accident (i.e. though building works), or intentionally (i.e. through archaeological research, targeted test-pitting strategies, or developer funded). Only where there are exceptional preservation conditions is any cultural information other than lithic debris or charcoal preserved. Consequently, the greatest source of information relating to the subsistence of Mesolithic people in Scotland is derived from very specific

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[3] Where information regarding recovery of the material was given.

[4] Including those with no information regarding how the material was recovered.

site-types – shell middens and occupation deposits – which merely comprise 8% of the total dataset, and only appear to reflect coastally-based activities.

Furthermore, although coastal dominance has long been known for Mesolithic sites, it has not readily been established whether this is genuinely reflects the preference of Mesolithic settlers or is the artefact of research bias (Edwards 1989:144; 1983:13; Wickham-Jones & Firth 2000:122). This data review suggests that it may indeed be the latter – where work has taken place to investigate the interior of mainland Scotland, especially in the south-west of Scotland, extensive evidence for Mesolithic occupation has been identified (Edwards *et al.* 1983:13; Mulholland 1970). This study was hampered by the absence of any synthetic review of Mesolithic sites in Scotland, unlike in England and Wales (Saville 1998b; Wymer & Bonsall 1977). However, archaeological investigation is hindered by the "Catch-22" situation of modern agriculture. Intensive ploughing in the lowlands makes the likelihood of early sites surviving minimal, whereas 'greening' of the highland landscape (leaving it to pasture) results in minimal plough soil that can be investigated through traditional techniques, such as field-walking, in order to find new sites (Barrowman 2000:34-35, 65-99; Edwards & Mithen 1995:349). The imbalance between coastal and inland representation of Mesolithic evidence in Scotland has been heavily criticised as insufficient in terms of pace and academic acknowledgement (Ward 2010:14). Recent work by the Biggar Archaeology Group has provided a large body of new data that would contribute significantly to readdressing the coast-inland settlement dichotomy. However, this remains as unpublished interim reports and with the scant resources of the voluntary sector unlikely to be widely disseminated (Ward 2010:14).

The final issue to be raised is how the movement of raw materials over significant distances from their sources attests to the mobility of Mesolithic groups (a full discussion on this is presented in Piper 2010). Flint is clearly the most widely used raw material overall, despite the fact it is not commonly available, with sources generally restricted to the western coasts of islands such as Islay and Mull (Marshall 2000b; 2000c; Mercer 1968). Despite the notable absence of a natural flint supply around the south west mainland it is often exclusively used in that region, which poses interesting questions regarding distribution. The assemblages in the south-west are also often supplemented by chert, which is readily available in that area. It is interesting to note that use of this raw material is restricted to the south-west, where it does not appear to be as widely exploited as flint, despite being commonly available and considering the absence of a flint source in the region. Quartz is ubiquitous in terms of both raw material sources, although it is certain not all sources have been catalogued, and usage. Raw materials with more restricted sources, such as bloodstone, baked mudstone and pitchstone are present within clearly localised areas of distribution. The implications for the distribution of these raw materials in terms of Mesolithic mobility is discussed more fully in Chapter Nine.

2.6. Conclusions

To summarise, the intensive investigation into the Mesolithic of western Scotland and the Inner Hebrides over the last 30 years has resulted in an archaeological record that is no longer as "dull and impoverished" as traditionally perceived by some of our greatest archaeological forebears (Conneller & Warren 2006:7). The results of these projects have provided a rich volume of evidence for occupation in specific areas where Mesolithic people were exploiting both locally available raw materials, and material brought, or traded, from further afield. The picture, however, is far from complete, with vast tracts of Scotland entirely unrepresented.

The following chapter follows closely on from the synthesis of Scottish Mesolithic evidence presented here. It considers the evidence for Mesolithic colonisation, maritime adaptation and regionalisation in two neighbouring regions of the north-east Atlantic façade – Ireland and Norway. The similarities and differences that can be illustrated between these regions will be outlined in detail, before being drawn upon again in Chapter Eight to provide a contextual backdrop for the Western Isles and Scottish Mesolithic as a whole.

Chapter 3: Colonisation and Regionalisation: Themes in the Mesolithic of the Ireland and Norway

3.1. Introduction

Following Chapter Two, which described the background to the Mesolithic in western Scotland, this chapter provides an overview of the Mesolithic in Ireland and Norway. It forms a research backdrop to contextualise the Mesolithic in the Western Isles of Scotland. Ireland and Norway were chosen as they are Scotland's nearest neighbours on the north-eastern Atlantic seaboard, bracketing the west coast of Scotland to the north-east and south-west. Furthermore, these regions provide comparable environments and coastal geographies – namely a "fiord/skerry seascape" (Bjerck 2009:118). The modes of colonisation and occupation along the western fringes of the continent are also analogous, linked intrinsically with the development of a marine adapted economy. Although regional differences in lithic technology are evident, changes in raw material procurement follow a similar trend. Comparisons between Scotland, Ireland and Norway will be drawn upon and explored fully in Chapter Eight in order to address the third research question of this thesis.

The chapter is divided into four sections. First, the Early Mesolithic in these regions are summarised with particular regard to early Holocene colonisation and the type of environment early settlers encountered. Technological developments pertaining to the successful colonisation of these regions by pioneering groups hinges on the Holocene development of "elaborate marine relations" (Bjerck 2009:122). Inextricably linked with the maritime adaptations that facilitated the colonisation of these areas is a marine-oriented mode of subsistence, which forms the second section of this chapter. In both Ireland and Norway, fishing contributed to a significant proportion of Mesolithic diet, owing to the restricted availability of terrestrial fauna.

The third section describes trends in the regionalisation of lithic technology during the Later Mesolithic of Ireland and Norway. These changes are manifest through differences in lithic traditions in each country, however similarities are also observed. The transition from the Early to Later Mesolithic in Ireland, and the Middle to Late Mesolithic Chronozone in Norway occurs c.7000 cal. BC – the date of the earliest known occupation in the Western Isles at Northton. This date is therefore significant when potential comparisons between the three regions are drawn in the fourth section of this chapter. This provides a basis for further discussion in Chapter Eight, which will focus in greater detail on the environment, technology and subsistence of these three key areas of the north-east Atlantic façade.

The whole of Ireland, with occasional reference to the Isle of Man, will be considered (Figure 16). Given the vast size of Norway, which encompasses wide variation in topography and environment over several degrees of latitude, and consequently a highly varied archaeological record, only the Mesolithic of south and west Norway between Kristiansand (Vest-Agder county) and Trondheim (Sør Trøndelag county) will be discussed (Figure 18). Only a brief reference to the Mesolithic-Neolithic transition in the centuries following 4000 cal. BC will be made, as a full discussion is beyond the remit of this thesis.

3.2. Boats, Colonisation and Maritime Adaptations in the Early Mesolithic

This section considers the colonisation and specialised marine developments of the Early Mesolithic in Ireland, which ends c.7000 cal. BC; and the Early to Middle Mesolithic Chronozone in Norway, which terminates 500 years later. This marks the transition to the Irish and Norwegian Later Mesolithic (Bjerck 2008b; Costa *et al.* 2005).

The most probable models for how these regions were colonised are presented against the early Holocene environmental setting. The cause and effect of these conditions are evident in Early Mesolithic adaptations pertaining to lithic technology and economy (Woodman 2015); the latter of which is discussed further in Section 3.3.

3.2.1. Ireland

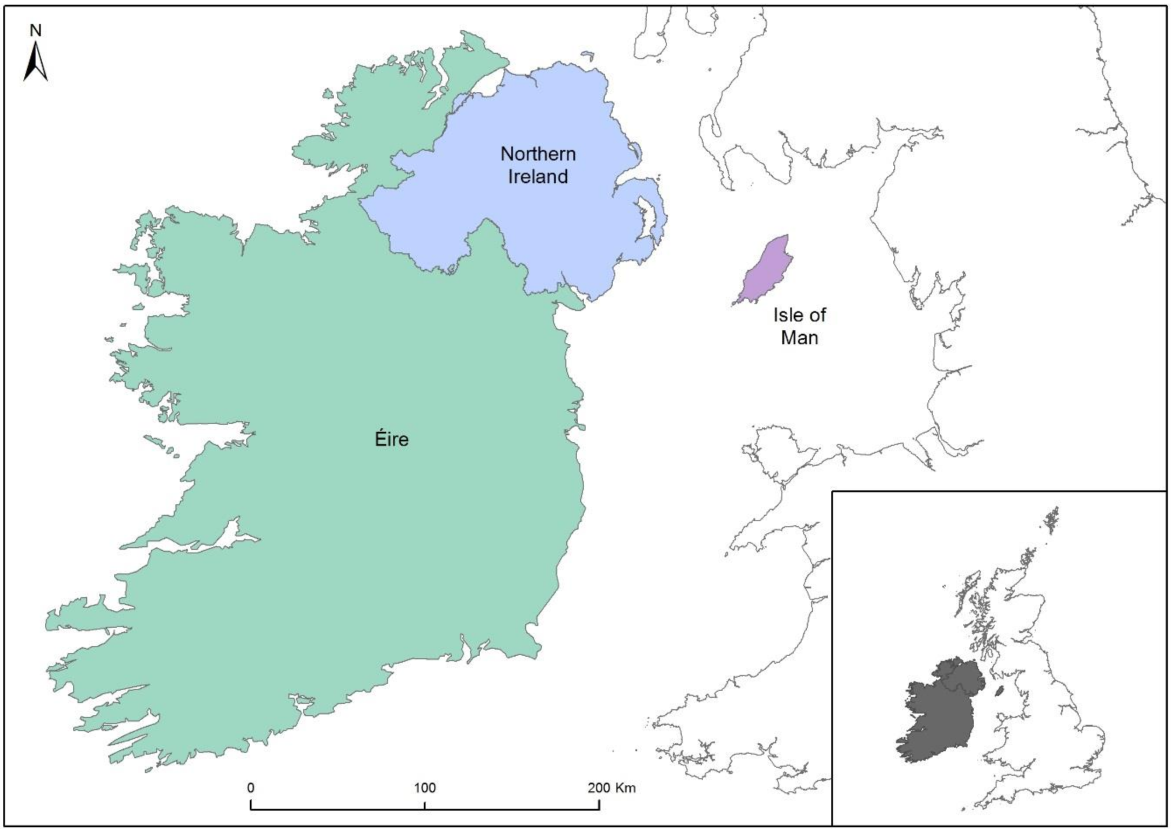

Figure 16. Ireland and the Isle of Man. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

The earliest evidence for the occupation of Ireland known to date is from Mount Sandel, Co. Derry (Woodman 1985b). Recent re-assessment of the radiocarbon dates from the site places the duration of Mesolithic activity between c.7700-c.7500 cal. BC (Bayliss & Woodman 2009). There are two significant lines of evidence which suggest Mount Sandel was not inhabited by the first Mesolithic pioneers. One is the presence of hut structures, which are traditionally perceived as evidence for a more settled, or permanent, occupation (Waddington 2015:226; Woodman 2012:14). This does not fit with what would be expected from an initial "pioneer" phase of colonisation, but is more in line with consolidation of an area. Housley *et al*. (1997:44-45) describe the presence of such structures as indicative of a post-colonisation "residential camp phase" and is a pattern which is reflected throughout the north-west European fringe (Åkerlund *et al.* 2003; Bjerck 2008a:38; Woodman 2012:13-14). The repertoire of lithic tools from Mount Sandel, appear to suggest a local, regional lithic tradition had already developed by people already familiar with their surroundings. Implements include needlepoint microliths, flake axes, and ground/polished stone axes that are unknown from anywhere else in Britain at this time (Bayliss & Woodman 2009:117; Woodman 1978:49, 201-203). These insular adaptations of the Mesolithic island inhabitants to their environment conforms to behavioural ecology and optimization models (Phillips 2011:6, 47-48; Winterhalder & Smith 2000).

These arguments are compelling. However there is, as yet, no indication for any earlier 'pioneer' stages, represented by small ephemeral sites of very brief and sporadic periods of habitation (Housley *et al.* 1997:44-45). It is likely that any early material is deeply stratified or submerged, precluding its recovery (Pollard 2011; Woodman 1978:150; 2004:40). The exact mode of colonisation has been widely debated. One favoured suggestion is a land-bridge connection to Britain via which early post-glacial mammal species, and eventually people, came to Ireland (Devoy 1985; Mitchell 1976; Movius 1942; Wingfield 1995; Yalden 1981). This has been long disputed however; in Hodges' (1953) review of the state of Irish Mesolithic research, a little after the tenth anniversary of Movius' (1942) seminal publication, he states that in the absence of any evidence for "traces of early human activity in the bridgehead areas of Co. Dublin and Co. Donegal…we can, therefore, only assume that Ireland's earliest in habitants came by sea." The land-bridge hypothesis has ultimately been overturned by more recent palaeogeographic reconstructions, which suggest that Ireland would have been separated from mainland Britain by c. 14,000 cal. BC (Edwards & Brooks 2008). That Ireland was colonised by boat is now beyond doubt, and the insular developments at Mount Sandel may have only taken a few generations to emerge (Hodges 1953; McCartan 2004; Tolan-Smith 2008; Woodman 1978:207, 203). Questions still remain, however, over why the colonisation of Ireland was long-delayed following deglaciation, and from where Mesolithic people came.

Neither question can be answered in full. Traditionally, the perceived locus for colonisation was the north-east of Ireland, with its rich flint deposits and close proximity to Scotland (Movius 1942;

Tolan-Smith 2008:151); however, Early Mesolithic sites have been identified along the length of the south and east coasts of Ireland, which suggests that this long-held view is likely a matter of research bias (Woodman 1978:140). Irrespective of where the first Mesolithic colonists came from, the presence of Early Mesolithic sites throughout Ireland shows that settlement spread quickly across the island (Costa *et al.* 2005:24; Woodman 2012:11-14).

Several suggestions have been made as to why there was such a delay in the colonisation of Ireland following the late post-glacial. The persistence of the land bridge hypothesis has been criticised by Woodman (2003:58-59) as representing an "implicit assumption" that the Irish Sea would have presented an impenetrable obstruction to early Mesolithic pioneers. This sentiment is echoed by Warren (2015a:49) - "The evidence of human ingenuity and diversity at this time is at odds with a failure to colonise an island simply because it was an island." Woodman (2012:10) suggests two possible scenarios regarding the cause of this delay. The first simply pertains to a slow, northward migration of people from the south and east of England – potentially pushed by displaced occupants of Doggerland retreating from rising sea levels (Woodman 2012; Warren 2015a:51). The second is that Mesolithic people had not yet developed the skills and technology associated with advanced marine relations that facilitated successful open-sea faring (Bjerck 2009; Woodman 2012:11).

Mesolithic occupation of the Inner Hebridean islands of Islay and Rum as early as the 8th millennium BC does indicate that the movement of people into north-west Scotland after the LGM was certainly delayed, but not a slow process (Mithen *et al.* 2015; Tolan-Smith 2003:125). Furthermore, maritime technology was sufficiently developed enough at this early stage to settle these islands. From the evidence in western Scotland it would seem unlikely that these issues would apply to Ireland, especially given the presence of Early Mesolithic lithics on Inishtrahull, c.10km north of the northern coast of Ireland, which prove "settlement made by a people who had already become adapted to a water-edge way of life" (Hodges 1953; Woodman 2012:11). The absence of large terrestrial game on Ireland, including red deer, upon which Late Upper Palaeolithic and Early Mesolithic hunters of the Continent and Britain relied, may have meant that Ireland was initially out-with the conceptual world view of Mesolithic people (Warren 2015a:48). Importing wild boar could have been a means of mitigating this, facilitating successful colonisation in combination with heavy reliance on aquatic resources, which is discussed further in Section 3.3.

Early Mesolithic technology in Ireland is characterised by the production of small, standardised narrow blades for the manufacture of geometric microliths, which were used in composite tools. Recent analysis of an Early Mesolithic assemblage from Eleven Ballyboes, Co. Donegal has indicated that the mode of reduction was through direct percussion using a soft stone hammer (Costa & Sternke 2009:797; Costa *et al.* 2001; 2005:24-25); rather than indirect punches as previously believed (e.g. Waddell 2000:14; Woodman 1987:138). This would seem more plausible in the absence of large game that could provide the raw materials, such as antler, for these tools (Woodman 2009a). As mentioned above, the Early Mesolithic in Ireland has already been shown to have developed insular traits not seen anywhere else in the British Isles, although microlithic forms found in mainland Britain also occur in Ireland at similar times. The lithic repertoire of the Early Mesolithic inhabitants in Ireland appears to have been used as a direct means of resource procurement (Costa *et al.* 2005:30). Microwear analysis of the Mount Sandel assemblage supports this notion, with the needle and rod microliths bearing evidence for use as projectiles. The flakes and blades were used in scraping and planing of bone, meat, wood and hide, all of which attests to direct actions of hunting, gathering and processing (Dumont 1985; 1988).

Flint and chert are the two primary raw materials utilised during this period, with other raw materials only occasionally used (Costa *et al.* 2005:28). The high quality flint available in the north-east of Ireland (Figure 17) has been described as “a silicious ‘Eldorado’”, which created a flint-centric focus for theories over how and why Ireland was colonised, as discussed above (Woodman 1987:138). Furthermore, occupation was seen as restricted to County Antrim simply because of the abundant raw material availability, which resulted in a region-specific development of (or, as Movius saw it – degeneration to) the heavy bladed industries of the Late Larnian (Movius 1942; Woodman 1978:140, 203; 1987:138). The subsequent identification of Early Mesolithic sites throughout Ireland, however, has refuted this notion. Moreover, it appears that raw material had little influence on the technology produced (Little 2009b:135). Instead, it was the “standardised, inflexible production” of Early Mesolithic tool types that substantially limited the use of raw materials to a selection of high quality sources (Costa & Sternke 2009:797-798). This is exemplified where flint from particular sources appears to have been preferred at the expense of more local raw materials, including lesser-quality flint available as erratic nodules and in drift deposits on beaches (Woodman 2015; Woodman 1987:140). It is the mode of procurement therefore, rather than technological adaptation, which had to ensure this need was met. During the Early Mesolithic, the whole *chaîne opératoire* was conducted at a single location. Semi-prepared cores or raw nodules were transported to sites if the raw material source was some distance away, with the aim of producing the elements of composite tools that required repair or replacement (Costa *et al.* 2005:27-28; Finlay 2003:89, 92). Furthermore, the size of artefacts within assemblages do not diminish with distance from the source (Woodman 1987:140-142). This is indicative of embedded raw material procurement, whereby resources are acquired during the execution of other subsistence activities (Binford 1979:259). This would have required a large and extensive social network that would allow groups access to raw material sources, particularly since flint is rarely found further than 25km inland (Costa & Sternke 2009:797-798; Woodman 2015:33; Woodman 1987:142).

The presence of core and flake axes in the north east of Ireland are perhaps the only examples of raw material influence on technology. These tools, which are only found in the north-east region, have been interpreted as local adaptations to the vast supply of flint available in the area. Beyond the zone of flint supply, ground stone axes of other raw materials appear as probable substitutes (Woodman 1987:142). The flake axes are used throughout the Mesolithic period – a pattern reflected in the flint-rich areas of Mesolithic southern England (Woodman 1978:203; 1987:142). Microwear analysis of these tools have demonstrably shown flake axes were used for planing/adzing and core axes exclusively for chopping (Dumont 1985; 1988). It is also likely that these axes were an insular development in response to the absence of antler-bearing fauna, as these axes are not found in Scotland or England, where red deer antler was readily available to use for working wood (Elliott 2012; van Gijn 2007). Without this resource, other raw materials would have been utilised to this end (Saville 2003:20; Woodman 2012).

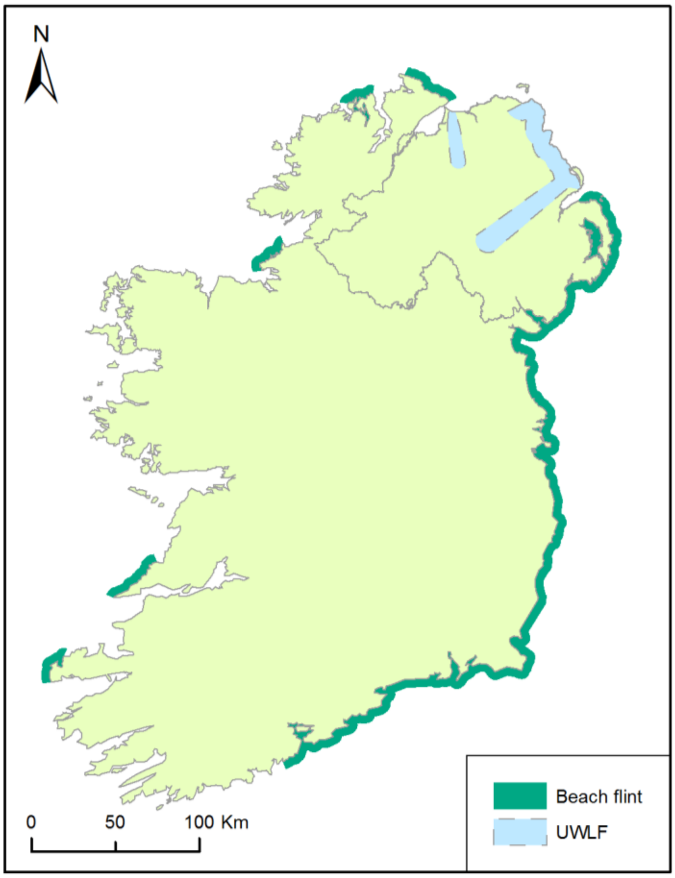

Figure 17. Approximate distribution of flint in Ireland. Beach flint occurred in drift deposits on beaches. The approximate extent of outcrops of the Ulster White Limestone Formation (UWLF) are depicted. Despite the ubiquity of this formation, there is little evidence of quarrying for flint due to the hardness of the deposits (after Woodman 2015:32). Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

3.2.2. Norway

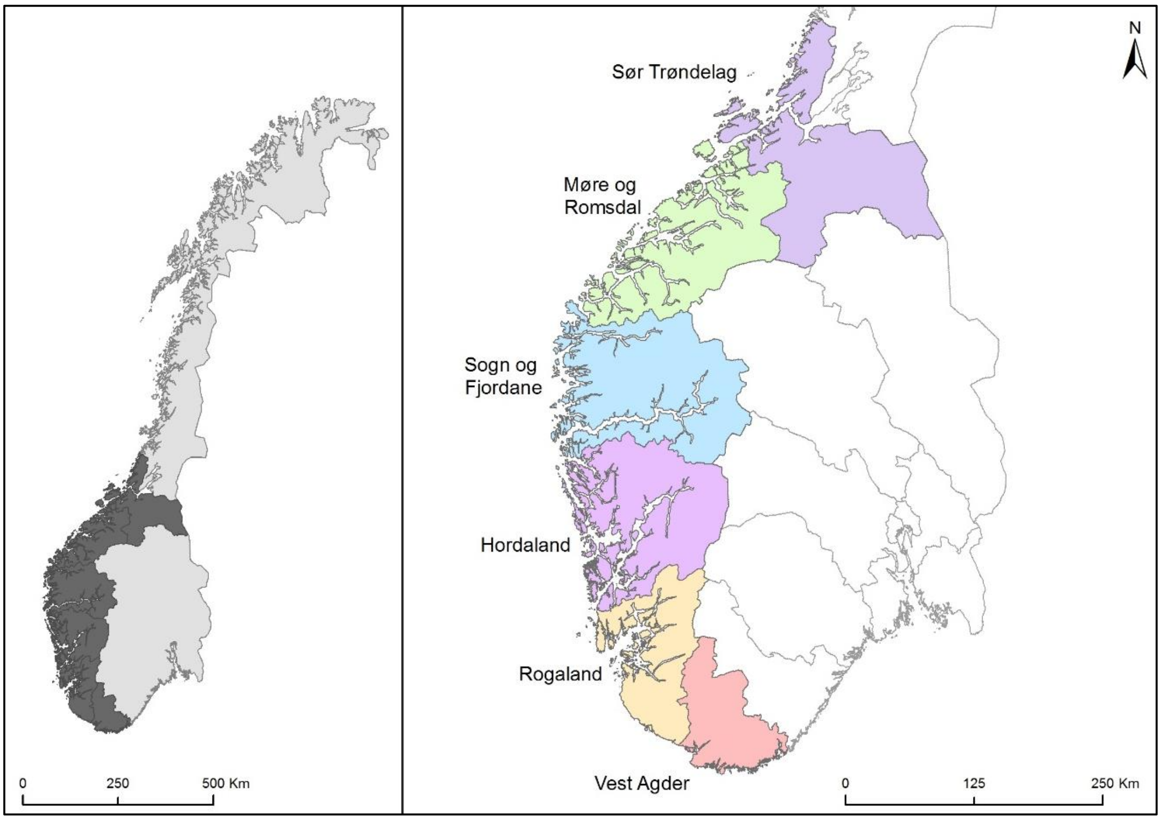

Figure 18. Norway. Counties within south-west Norway that are considered within this chapter are highlighted. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

The early Mesolithic in southern Norway is characterised by the Fosna tradition, a culture-historical term, which refers to the settlement pattern, subsistence strategy and suite of lithic implements representative of early post-glacial pioneers in the region. The Fosna were traditionally seen to have been superseded by the Nøstvet tradition c.7000 cal. BC. However, a lack of clarity over the transition period (labelled by some as the 'Early Microblade Tradition', Figure 19) led to a critical re-assessment of the way Norwegian Mesolithic chronology was approached (Bjerck 1986; Bjerck *et al.* 1987; Indrelid 1975; 1978). The Early Mesolithic and Middle Mesolithic Chronozones ae dated to 9500-8000 cal. BC and 8000-6500 cal. BC respectively (Bjerck 2008b). Debates surrounding the application of these chronological units notwithstanding, this method provides coherent phasing based on absolute time units rather than interpretative cultural nuances that have led to multiple chronological sub-divisions and/or names of cultural traditions in different regions by individual authors (Bjerck 1986; Bjerck *et al.* 1987; Figure 19). These are the chronological units that will be used in the following outline of the Norwegian Mesolithic.

The Norwegian coastline was de-glaciated c.12,000 cal. BC, during the Bølling interstadial and remained largely ice-free during the subsequent Younger Dryas glaciation. Climatic amelioration during the pre-Boreal, which followed the Last Glacial Maximum of the Younger Dryas, led to rapid deglaciation of the interior region and by c.9000 cal. BC the mountain plateaux in southern Norway were almost entirely free from ice, the landscape covered by Boreal pine forests (Andersen *et al.* 1995; Nesje & Dahl 1993). The nature of post-glacial colonisation by hunter-gatherers in the pre-Boreal landscape of southern Norway has been extensively hypothesised. The tanged arrowheads and evidence for direct, soft hammer lithic reduction methods in the Early Mesolithic toolkit are widely accepted as evidence for a direct association with the Late Upper Palaeolithic Ahrensburgian reindeer hunters of the North European plains (Åstveit 2009; Bang-Andersen 1996a; 2003b; Bjerck 2009; Fuglestvedt 2012; Indrelid 1975:3; 1978; Nygaard 1987:150). As such, it has been suggested that the Norwegian post-glacial pioneers of the 'Fosna' culture, along with the technologically similar western Swedish 'Hensbacka', may have been dispersed Ahrensburgian groups. These groups reached these regions by seasonally following reindeer herds north along their migration routes either from the continent to the east, or retreating from the rising sea in the North Sea basin to the west (Bang-Andersen 1996a; 2003b; Bjerck 2009:124; Fuglestvedt 2012; Glørstad 2013; Indrelid 1975:4, 15; Schmitt 2015; Schmitt *et al.* 2009).

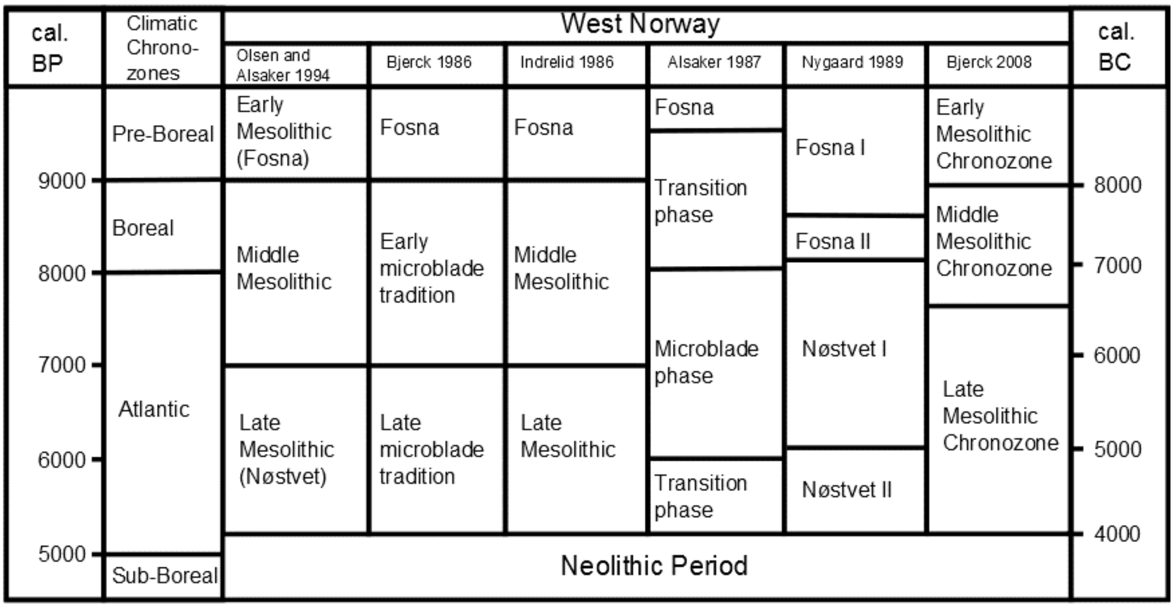

Figure 19. Norwegian Chronozones (after Bjerck 2008b)

Despite the de-glaciation of the coastal fringes during the Bølling interstadial, initial settlement of this environment is not in evidence until the Younger Dryas/Holocene transition (Gulliksen *et al*. 1998). Galta 3, Rennesøy is dated by shoreline chronology to c.9300 cal. BC and is the earliest known evidence for human occupation in the region (Glørstad 2015:13; Prøsch-Danielsen & Høgestøl 1995). The c.3000 year delay in the settlement of the ice-free coasts by early pioneers is comparatively similar to Ireland and Scotland, albeit longer (Bang-Andersen 2003b:21; Bjerck 2009). The favoured interpretation regarding the delayed colonisation of south-west Norway is that during the Younger Dryas, this area of Scandinavia was a 'no man's land' – visible and accessible from the North Sea Continent but remained "unexplored and unexploited" (Bang-Andersen 2003b:11). Bjerck (1995:141; 2009) suggests that this delay was due to cultural choices, dependent on the development of “elaborate marine relations” that could facilitate successful colonisation of new lands beyond the barrier of the Norwegian Trench (Bang-Andersen 2003b:10). Furthermore, Bjerck (2009) suggests that seals may have been the ‘pull-factor’ which drove the advancement of marine technology, such as sea-going boats, in this period; supported by the location of Early Mesolithic sites on the outer coast (Bjerck 2016). He states that the characteristics of these sea mammals are likely to have “aroused the curiosity of people specialized in the hunting of large terrestrial mammals”; developing boat technology that enabled post-glacial pioneers to continue hunting these mammals was predicated on seals’ propensity to avoid former kill-sites (Bjerck 2009:126). This builds upon a suite of new economic and cultural adaptations that would have been required by early colonists of the Norwegian coast to enable successful colonisation and habitation of a newly emerged environment – the fjord-skerry seascape (Bang-Andersen 2003b; Bjerck 2008a; 2009:127; Erlandson 2001). Another, more practical, suggestion regarding the delayed colonisation of Norway relates to new evidence for deglaciation of the Oslo Fjord, which occurred much later than previously assumed, precluding access to the ice-free coast of western Norway via the Bohuslän area of Sweden. It was not until after the Oslo Fjord Glacier had melted, creating “a sheltered passage of islands and peninsulas” could Early Mesolithic colonists expand into these new lands (Glørstad 2015:25). Ultimately, the archaeological evidence indicates that once pioneer populations were able to access and exploit the potential of this region through advanced maritime adaptation, colonisation occurred quickly along the Norwegian and Swedish seaboard, in perhaps fewer than 200-300 years (Bang-Andersen 2003b:8-9; Bjerck 1995:138; 2009:124-125; Fuglestvedt 2012:6; Glørstad 2013).

The Early Mesolithic occupation of Norway is not restricted to the coast, however. At the mountain lakeside sites of Myrvatn and Fløyrlivatn, tent-rings have been identified within a proximity of 20-25km of the then still-retreating inland ice cap (Bang-Andersen 2003a). The lithic evidence from these sites attests to the movement of people between the coast and the interior. Early Mesolithic assemblages in Norway are characterised by an almost exclusive use of flint, which can only be found on the coast (Bang-Andersen 1990:225; 2003b:13; Berg-Hansen 1999; Bjerck 1986:104; Indrelid 1978:151). The presence of flint dominated assemblages at interior sites such as Myrvatn and Fløyrlivatn (Bang-Andersen 1990; 2003a); Knappskog (Nærøy 1995) and Skarvatnet, Gjvilvatnet and Sprikletjørnin, Sør-Trøndelag (Pettersen 1999:158) is clearly indicative of connections between groups, or the seasonal movement of groups between the coast and the interior (Bang-Andersen 1990:225). In some instances, there is evidence for the use of local raw materials such as quartz or rock crystal; however, this is explained in terms of transport costs or a temporary unavailability of flint, perhaps during a marine transgression (Bang-Andersen 1996b:439). A lack of flint around the islands of Flora, Sogn og Fjordane and Bømlo, Hordaland has been suggested as the reason for quarrying of diabase from the Stakaneset quarry on Flora and greenstone from the Hespriholmen quarry on Bømlo. This practice began late in the Early Mesolithic and lasted for 5000 years until the Middle Neolithic, with interesting implications for evidence of group mobility during the Middle and Late Mesolithic, discussed below (Bergsvik & Olsen 2003; Olsen & Alsaker 1984).

The technology and typology of Early Mesolithic assemblages in western Norway is primarily macrolithic. Flake adzes prevail, with core adzes also present to a lesser extent. Coarse macroblades were manufactured from unifacial blade cores, and projectile points comprising small tanged, single-edged points and lanceolate 'microliths' are also present in abundance, although it must be emphasised that these are not true microliths made through the microburin technique. True microliths appear to be unique to eastern Norway, although the technique becomes more frequently used in south-west Norway during the transition from the latest Early Mesolithic to the Middle Mesolithic. Burins and, to some extent, scrapers were also characteristic of the Early Mesolithic toolkit (Bjerck 1986:104, 107; Indrelid 1978:151; Nygaard 1990:229). This suite of expediently produced flint implements, supplemented by non-flint raw materials such as quartz or rock crystal that were reduced by bipolar technology, have been recovered from the inland mountain sites around Rogaland (Bang-Andersen 1990:222; 2003a:200; Fuglestvedt 2012). The use of the bipolar reduction technique, which increases in the Middle Mesolithic, is seen as an adaptation to non-flint raw materials by early settlers more familiar with flint and is closely correlated to the scarcity or absence of this raw material in parts of Scandinavia and Britain (Ballin 1999a).

The archaeological evidence from the Middle Mesolithic has been severely affected by the Tapes Transgression, and is consequently significantly under-represented in the archaeological record (Ballin 1999b). This period is marked by significant regional variation in lithic assemblages, thus differently named phases have been attributed to different areas (Bjerck 2008b:78). As such, the Middle Mesolithic Chronozone spans 8000-6500 cal. BC, and broadly encompasses the *Early Microblade Tradition* (Bjerck 1986), *Fosna II* (Nygaard 1987; 1990) and the early part of the 'Nøstvet' tradition (Indrelid 1975; 1978; Figure 19). In south-west Norway there are gradual changes to the lithic repertoire, with the introduction of tools more closely associated with the later Mesolithic 'Nøstvet' tradition such as conical microblade cores, and ground or pecked axes and adzes. The characteristic blade technology of the 'Fosna' tradition still endures, albeit smaller and more regular in form (Ballin 1999b; Bergsvik 1999; Bjerck 1986; 2008b; Nygaard 1990). These changes are interpreted as an increasing trend towards specialisation of the lithic toolkit, especially in terms of blade production (Bjerck 1986; 2008b; Nygaard 1990:232). The use of microblades and associated modification marks "a broadening and refinement of composite stone tools" during this period in south-west Norway, in line with the rest of southern Scandinavia (Bjerck 2008b:87-89).

Just as in the Early Mesolithic, understanding settlement and subsistence strategies for the Middle Mesolithic is based on conjecture due to “the general lack of sites” (Bergsvik & Storvik 2012:33). The continued occupation of the coastline by people during this period is certain, however (Bergsvik 2009:602); furthermore, the sustained dominance of flint within the lithic assemblages of inland sites attests to the continued mobility of these people between the coast and interior during the Middle Mesolithic (Ballin 1999b:210; Pettersen 1999:162-163). Although flint still comprises the highest proportion of the lithic raw material present at sites such as Hå Old Vicarage, Rogaland, the use of a wider variety of raw materials, including local sources, increases in this period (Ballin 1999b:210; Bang-Andersen 1995a:118). The intensified extraction of greenstone from the quarry at Hespriholmen, and diabase from Stakaneset, for the production of ground axes and adzes towards the end of the Middle Mesolithic is also of note. The distribution of these different raw materials testifies to the development of distinct social territories and regionalisation with two clear zones of distribution – diabase to the north and greenstone to the south, overlapping at Nordhordland district in Hordaland county (Figure 20; Bergsvik & Olsen 2003; Gjerland 1990; Nygaard 1987:150-152; Olsen & Alsaker 1984). The implications for this in terms of social territories is discussed in more detail in Section 3.4.

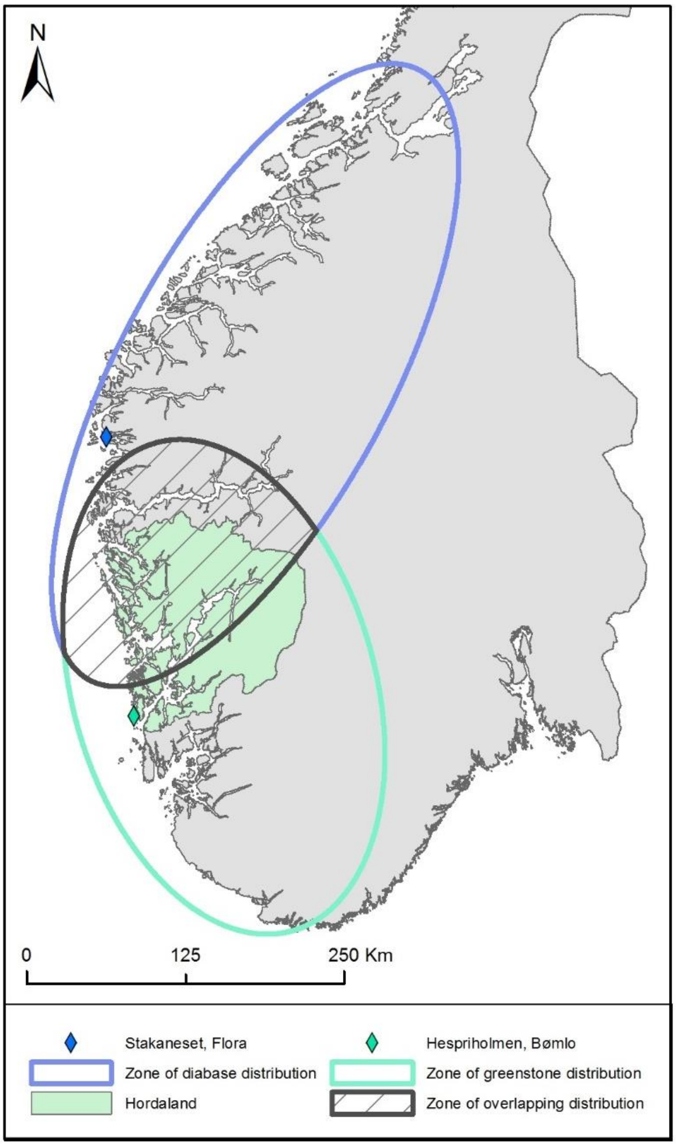

Figure 20. Greenstone and diabase distribution in Mesolithic Norway. The zone of contact in northern Hordaland is interpreted as evidence for overlapping social territories, especially in the Late Mesolithic (after Olsen & Alsaker 1984). Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

3.3. The Importance of Marine Resources

3.3.1. Ireland

One consequence of Ireland's early separation from the European continent is that only a very narrow range of native terrestrial fauna was available for Mesolithic colonists to exploit. The 'big-game' species such as aurochs and red deer, which formed the staple of Mesolithic economy on the Continent, were absent from the Holocene faunal stock on this island (McCormick 2007; Warren *et al.* 2014; Woodman *et al.* 1997). Despite this, there is a very high presence of wild boar (*Sus scrofa*) at Mount Sandel, a species which is not native to Ireland that must have been imported. The deliberate introduction of boar to Ireland during the Early Mesolithic is interpreted as a "conscious and deliberate" effort at niche enhancement by Mesolithic inhabitants in an attempt to fill the 'prey gap' (Rowley-Conwy & Layton 2011; Sleeman 2008; Warren *et al.* 2014). The presence of boar at this site is a further indication that Mesolithic colonisation took place much earlier than the dates from Mount Sandel suggest. Enough time must have passed for early colonists to perceive the need for boar to be introduced, for the introduction to successfully take place, and for a viable population to become established that it could be exploited.

The extreme importance of fishing in the Irish Mesolithic economy, which is attested throughout the duration of the period, is another adaptation in response to the lack of large terrestrial game to exploit on the island. Fish remains are the most frequently occurring bones in Irish Mesolithic sites (Woodman 2015:271). The importance of this resource is most clear from the position of Early Mesolithic sites in strategic fishing locations along low-lying riverine or lacustrine areas such as the Bann Valley and the Midlands, as well as along the coast, with a notable absence of Mesolithic sites from the uplands (Costa *et al.* 2005:23; Little 2009a:698,702-694; Woodman 1978:184; 2003:59). The range of inshore fish and shellfish species present at coastal shell midden sites compares closely to the 'Obanian' middens in Scotland (Woodman 1978:165; 1989:19; 2004:42). Inland, vast quantities of salmon and eel bones have been recovered, most notably from the Early Mesolithic sites of Mount Sandel and Lough Boora (van Wijngaarden-Bakker 1985; 1989:129-131). The large quantity of burnt salmon bones at Mount Sandel indicates they were being processed on a large scale – likely for storage of surplus for consumption at a later date. A large ash layer at Newferry, also on the River Bann, is interpreted as indirect evidence for storage through smoking (Movius 1937; Rowley-Conwy & Zvelebil 1989). At Killuragh Cave, in the interior of Ireland, the isotope data from an Early Mesolithic individual indicates a terrestrial-based diet, however this signature is likely to have been caused by a diet high in freshwater fish and eels (Meiklejohn & Woodman 2012:26; Woodman 2004:49). This mode of subsistence was facilitated by the "extensive river and lake network" of early Holocene Ireland, in which the great loughs of the Shannon River basin in central Ireland coalesced on a seasonal basis (Mitchell & Ryan 1997; Woodman 2015:24-25, 29).

A significant number of preserved fish traps and weirs have also been recovered, which further augment the continued importance of fishing during the Later Mesolithic of Ireland. A basket trap and a number of stake and wattle weirs were recovered during development of Spencer Dock/North Wall Quay in Dublin City (McQuade *et al.* 2007; McQuade & O'Donnell 2007; 2009). These would have been strategically placed along the shoreline of the River Liffey estuary and were used for a substantial period of time c.6100-5720 cal. BC (McQuade & O'Donnell 2007). Several Late Mesolithic structural features including a fish weir were excavated at Toomebridge (Dunlop 2010:14-21), and well preserved Late Mesolithic fish baskets and platform were identified at Clowanstown, Co. Meath (FitzGerald 2007; Mossop 2009). Causeways and platforms have also been found at Derragh, Co. Longford and Inch Island, Lough Gara (Fredengren 2002; 2003). These artificial platforms and lake islands are interpreted as specialised, task-specific sites associated with fishing activities throughout the Mesolithic (McCartan 2000:20). Access to these specialist fishing facilities, and general movement around the landscape may well have relied on boats. A preserved Later Mesolithic logboat was recovered from Brookend on the shore of Lough Neagh, Co. Tyrone which dates to 5490-5246 BC[5] (Breen & Forsythe 2004:31).

The North Wall Quay traps were predominantly made of hazel stakes. The size and straightness of these stakes suggested they were carefully selected from woodland, coppiced almost every decade (McQuade & O'Donnell 2007; 2009:891). A recent review of the palaeobotanical evidence has indicated that human impact on the woodland landscapes of Ireland during the Mesolithic was likely to have been far greater than previously assumed (Warren *et al.* 2014). Careful management of resources on such a long-term basis would require a significant investment of time and committed re-visitation. As such, this suggests the Mesolithic occupants of Ireland were more sedentary than often supposed (O’Sullivan 2000:155; Woodman 2009b:xliv; contra. Woodman & Anderson 1990:382). It is clear therefore, that the limited range of large terrestrial fauna on Ireland, in combination with a heavy reliance on fishing influenced settlement patterns. The resultant effect on lithic technology and reduction strategies during the Early Mesolithic has already been described, used as a direct means of resource procurement (Costa *et al.* 2005:23, 30). The changes in lithic technology during the Later Mesolithic are discussed in Section 3.4, and whilst subsistence may have partially influenced these changes, the importance of fishing is one factor which remains constant throughout this period.

3.3.2. Norway

The ‘marine relations’ of the Early and Middle Mesolithic in Norway are evident in the distribution and location of sites, which indicate a clear coastally-oriented settlement pattern. Despite the

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[5] The original radiocarbon date, including laboratory code, could not be located. It is uncertain whether this date is calibrated.

destructive effect by the Tapes Transgression on many Early Mesolithic sites, isostatic rebound has also meant that some sites have been sealed and preserved by the transgressed sea, which occurred c.8000-5500 cal. BC (Anundsen 1996; Bang-Andersen 1995a; 1995b:108; Bjerck 1986:107). As such, hundreds of sites situated on the small exposed islands and skerries along the outer fringes of the Norwegian coast, along inlets and bays, close to the water's edge have been identified. These sites are in positions that overlook large expanses of sheltered sea, which would have provided a stable and predictable abundance of resources, in addition to natural harbours to safely launch boats (Åstveit 2009:414; Bang-Andersen 1996a:429; 1996b:225-227; 2003b:11; Bergsvik 2001:13; Bjerck 1995:139-140; Fuglestvedt 2012:5-6; Nærøy 1995:59; Nygaard 1987:150; 1990:231).

These coastal sites are generally small, with very low artefact density and variability (Bang-Andersen 1996a:431; 1996b:227; Bjerck & Zangrando 2013:83; Nygaard 1987:150; 1990:231). Occasionally, evidence of a hearth and stones demarcating the tent area have been identified, as at Knappskog on Sotra Island in Hordaland, and Aukra Island in Møre og Romsdal (Åstveit 2009; Fuglestvedt 2012:5; Nærøy 1995). The position and artefact composition of coastal sites have led to the interpretation that they functioned as "sea-hunting stations", ideally situated to exploit coastal resources. The presence of projectile points, with evidence they have been used and re-tooled at Knappskog, implies that terrestrial hunting was also conducted from these sites (Bang-Andersen 1996a:431; 1996b:228; Indrelid 1975:15-17; Nærøy 1995; Nygaard 1987:150). In the highland interior these small sites are echoed in size and composition. Myrvatn and Fløyrlivatn, are interpreted as "extraction camps", where small task-groups may have stayed for a few days in pursuit of reindeer (Bang-Andersen 1990; 2003a; 2003b:14-18). Overall, the occupation evidence suggests that Early Mesolithic Norwegian colonists were small, highly mobile social groups with low population density, primarily inhabiting coastal sites, albeit for a very short period of time, with seasonal exploitation of the interior mountain regions (Åstveit 2009; Bang-Andersen 1996a:431; Bjerck 1995:138; Fuglestvedt 2012:12; Indrelid 1975:15-16; Nygaard 1987:150; 1990:232). Åstveit (2009:420) notes the ephemeral nature of tent rings in the interior and on the outermost skerries of the coast clearly highlights the importance of mobility to Early Mesolithic people. Dwellings were intended to be light and portable, easy to construct/dismantle, and suitable to transport in a kayak whether hunting reindeer in the interior or seals on the coast.

Due to poor preservation conditions, the absence of any organic remains from Early Mesolithic sites unfortunately renders understanding of Early Mesolithic subsistence strategies moot (Bang-Andersen 1996b:436; Fuglestvedt 2012:11). Some argue that the Early Mesolithic inhabitants of Norway practised a 'residential' mode of subsistence (*sensu* Binford 1980), with whole groups moving between the coast and the interior and conducting different activities within these different environments, and occasionally aggregating with other family groups at larger sites (Bergsvik &

Olsen 2003:398; Bergsvik & Storvik 2012:32; Indrelid 1975; Nygaard 1987:150). The evidence used to support this is that few species other than reindeer and elk would have colonised the recently post-glacial landscape of the pre-Boreal period. As such, the limited resources available demanded a *generalised* economy: opportunistic exploitation of unpredictable terrestrial resources, with a dependence on reliable coastal resources, and reflected in the generalised toolkits that have been recovered (Bang-Andersen 1996a; Nygaard 1990:232).

Bang-Andersen (1990:224; 1996b:228) agrees that Early Mesolithic subsistence was opportunistic. However, he argues that Early Mesolithic communities practiced a seasonal 'logistic' subsistence strategy between the coast and inland (*sensu* Binford 1980; Woodburn 1980). From this perspective, task-groups occupying the specialised reindeer hunting camps in the mountains would have had home-bases situated on the coast (Bang-Andersen 2003a; 2003b). This interpretation has also been supported by the findings at Knappskog (Nærøy 1995:76). As part of a logistic subsistence strategy transitory sites would be expected, in addition to special purpose sites for specific activities and base-camps (Bang-Andersen 1996a:437). Geita in Orkdal, Sør-Trøndelag has been interpreted as a possible transitory site, based on its position far into the Orkdalsfjord (Pettersen 1999:156-157). As part of the marine adaptations that facilitated the colonisation of Norway, Bjerck (1995:139) argues that coastal pre-Boreal sites must represent a *specialised* marine economy, on which the colonisation of this region depended (Bjerck 1995; 2009).

It has been suggested that the changes in the Middle Mesolithic lithic repertoire are linked to an increasingly selective subsistence strategy influenced by the onset of the Atlantic climatic optimum during this phase (Nygaard 1990:233). The absence of projectile points is proposed to indicate a shift away from terrestrial hunting of reindeer, and later, red deer and wild boar, focussing on more intensive exploitation of marine resources at coastally based sites. These sites are generally larger, with higher artefact densities, and interpreted as evidence for base camps occupied more frequently and/or for longer by larger groups of people (Nygaard 1987:150-152; 1990:232). Nygaard (1987:150-152; 232) suggests that groups were still mobile, but as the abundance of coastal resources increased with climatic amelioration there was less need to move such long distances between the coast and the interior. Recently, it has been proposed that communities during the Middle Mesolithic may have become sedentary (Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012). 'Sedentary' in this sense is defined as "allow[ing] for mobility, but requires at least half a year of continuous occupation at the residential sites" (Bergsvik 2001:11). Intensive investigation of caves and rockshelters in western Norway has revealed an apparent change in settlement patterns c.8000 cal. BC, when these places are used for the first time (Bergsvik & Storvik 2012:33). This is argued as evidence for reduced whole-group residential mobility from the Early Mesolithic to a logistically organised settlement pattern which incorporated large coastal base-camps and pre-determined specialist task-sites, such as caves or rockshelters, within regionally identifiable territories (Bergsvik & Storvik 2012:32-33; Bjerck & Zangrando 2013:84 contra. Bang-Andersen 1990:224; 1996b:228).

The trend towards increasing sedentism, which begins in the Middle Mesolithic, continues during the Late Mesolithic (Bergsvik 2001; Bergsvik & Olsen 2003; Gundersen 2009:237; Nærøy 1995:74). There are a significant number of sites that date to Late Mesolithic and have well-preserved organic remains. As such, the economic basis can be more fully understood for this period, with clear evidence for continued settlement along the coastline. Semi-permanent residential base-camps were situated in the outer coast, and a greater number of sites were located in the inner coast at the mouths of fjords. In the inner coast, stronger tidal currents would favour fishing and the sites here are interpreted as summer extraction camps frequented by task-groups (Bergsvik & Hufthammer 2009:445-447; Bjerck 2007:19).

The faunal evidence from Kotedalen, Nordhordland is often cited as evidence for overall continuity in general subsistence and settlement between Middle and Late Mesolithic communities in Norway (Bang-Andersen 1996a:433); however the radiocarbon dates from the layers which contain faunal material at the site fall solely into Bjerck's (2008b) Late Mesolithic Chronozone. The evidence suggests that the community utilising Kotedalen frequently re-occupied the site and were resident there for sustained periods of time (Bergsvik 2001; Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012; Warren 1994). This builds upon the evidence from two cave sites at Viste, Rogaland, and Skipshelleren, Hordaland that were excavated early in the 20th Century, and which influenced the understanding of Late Mesolithic economic strategy for several decades (Bergsvik & Hufthammer 2009).

The occupation of Viste cave spans the terminal Middle to mid-Late Mesolithic, c.7000-6000 cal. BC (Bergsvik & Hufthammer 2009). Skipshelleren rockshelter dates slightly later than Viste – c.5300-4000 cal. BC (Bergsvik & Storvik 2012:27). Significant quantities of marine mollusc – primarily limpet (*Patella* sp.) and periwinkle (*Littorina* sp.) were recovered from these sites in addition to a range of fish species, mammals, and birds (Indrelid 1978:161). Both these sites are situated close to the shoreline, yet the economy appears dominated by forest-dwelling terrestrial mammals such as boar and elk, with only small contributions of fish and seal to the diet of the caves' occupants (Bergsvik & Storvik 2012:27, 31). The majority of the faunal data strongly indicates that these caves were occupied during the summer, whilst the presence of over-wintering bird species and seal pups in the assemblage at Viste also indicates winter usage, potentially as a base-camp for year-round (re)occupation (Bang-Andersen 1996a:433; Bergsvik & Storvik 2012:24; Indrelid 1978:162). In terms of artefacts, the small number of projectiles present belie the apparent focus on terrestrial hunting, as evidenced by the faunal assemblage (Indrelid 1978:160). Furthermore, whilst terrestrial resources dominate the faunal remains the organic artefact assemblage attests to the importance of marine resources, with a number of fish-hooks, harpoon heads, leister prongs, slotted-points, and needles (Bergsvik & Hufthammer 2009:436; Indrelid 1978:162). This contrast may not be so tangible had sieving been employed at the sites – the recovery methods implemented at the time of the caves' excavation have clearly biased the faunal representation. Without sieving of the soil it is almost certain that a high proportion of small faunal remains, such as fish bone, were not recovered, thus any interpretation regarding economy from this site is heavily skewed towards the representation of larger, terrestrial, species (Bergsvik & Storvik 2012:436-437).

Human remains were also recovered from the caves. At Viste, isolated hand and foot bones of an adult individual were identified, in addition to a skeleton of an adolescent male dated to 5725-5558 cal. BC (Bergsvik & Storvik 2012). A δ^{13}C value of -17.1‰ represents a diet balanced between terrestrial and marine resources (Hufthammer & Meiklejohn 1986). Disarticulated hand and foot bones were also found within the Mesolithic deposits at Skipshelleren (Bergsvik & Storvik 2012:27).

Two sites which occupy similar geographical positions to Viste and Skipshelleren have been excavated very recently from Hordaland, and present a more balanced picture of Late Mesolithic economy in Norway. Sævarhelleren rockshelter is broadly contemporary with the occupation at Viste cave, dating between c.7000 cal. BC – c.5800 cal. BC. Olsteinhelleren is situated <100m from Sævarhelleren and dates to c.5600-4800 cal. BC, similar to Skipshelleren (Bergsvik & Storvik 2012). There is a very low density of lithic material from the caves, which primarily comprise microblades, blades, flakes, and cores. There is greater artefact diversity at Olsteinhelleren where a grinding stone and a soapstone net sinker were also found. Significantly, exceptional preservation conditions have also ensured organic components of the Mesolithic toolkit have survived, including fishhooks, awls, a needle, and a pendant (Bergsvik & Storvik 2012). The fishhooks from Sævarhelleren closely resemble those found at Viste, whereas the fishhooks and preforms for fishhook production from Olsteinhelleren are very similar to those recovered from Skipshelleren (Bergsvik & Hufthammer 2009:440-443). Small fish (<500mm) overwhelmingly dominate the faunal assemblages at both sites with cod (Gadidae) and wrasse (Labridae) the most frequently represented, in addition to a high volume of marine molluscs such as common mussel (*Mytilus edulis*), and periwinkle (*Littorina* sp.). There is a slightly wider range of species present at Olsteinhelleren, which includes a number of deep-water species such as skate (*Hypotremata*) and ling (*Molva molva*). The range of terrestrial fauna exploited at both sites is limited, with small numbers of wild boar (*Sus scrofa*), elk (*Alces alces*), red deer (*Cervus elaphus*) otter (*Lutra lutra*) and red squirrel (*Sciurus vulgaris*) present. Wolf or dog (*Canis* sp.) was also found at Olsteinhelleren (Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012). Overall, the Mesolithic activity at Sævarhelleren is interpreted as evidence for small, mobile groups occupying the rockshelter during the summer, perhaps as a specialist site for shallow-water fishing during a seasonal move along the fjord (Bergsvik & Storvik 2012). It is suggested that Olsteinhelleren was also occupied during the summer but by larger, more stable groups over a longer period of time (Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012). In terms of fauna, the contrast with Viste and Skipshelleren must simply be a consequence of the recovery methods employed – the similarity between organic artefacts at these four sites indicates that fishing at Viste and Skipshelleren must have contributed far more economically than the faunal record demonstrates. A human skull fragment and finger bones were also recovered from the Mesolithic layers at Sævarhelleren which is also comparable with the other sites (Bergsvik & Storvik 2012:29).

These sites clearly attest to a coastally-based, broad spectrum hunter-fisher economy, practised by sedentary groups occupying residential sites with little need to move far inland (Bergsvik 2001; Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012; Gundersen 2009:239; Indrelid 1978:166; Nygaard 1990:233). The importance of fish during the Later Mesolithic is interpreted as having a "stabilising effect" on the population of this period, as fish are a predictable and abundant resource that enabled groups to spend considerable lengths of time in the same place (Bergsvik 2001; Bjerck 2007; Gundersen 2009). The investment of time and resources evident in the stone-lined post-holes, sunken floor, and air channel leading to the fireplace of Site 68, House 5 on Aukra, Møre og Romsdal further supports this (Åstveit 2009).

In sum, marine specialisation and the role of fishing in both these regions cannot be underestimated in terms of its influence on settlement patterns, group mobility and the procurement of lithic resources. This is directly comparable with western Scotland, as will be elaborated on in Chapter Eight.

3.4. Regionalisation in Lithic Traditions of the Later Mesolithic

The Late Mesolithic in Ireland and Norway begins in the centuries following 7000 cal. BC, ending c.4000 cal. BC at the traditional start of the Neolithic. In neither region does this date signify the arrival of agriculture however, with evidence indicating that hunter-gatherer lifeways continued for a significant period of time, alongside communities with domesticated animals (Meiklejohn & Woodman 2012:28; Olsen & Alsaker 1984:92; Prescott 1996; Rowley-Conwy 1995; Whitehouse *et al.* 2014). This section details the regionally exclusive changes in technology that developed, following the successful colonisation of Ireland and Norway by coastally adapted pioneers.

3.4.1. Ireland

The form and nature of the transition between the Early and Later Mesolithic in Ireland remains an enigma due to the lack of sites which date to this period. A "significant chronological gap" has traditionally been perceived between the end of 'Early' microlith use and the development of 'Later' Bann flakes (Woodman 1987:142; 2004:287). More recently, Woodman (2012) has suggested that the search for a ‘missing link’ is a futile endeavour and reviewed the evidence from key sites and assemblages as one of continuous change.

The change in lithic technology during the Later Mesolithic is exceptional, given that there appears to be little change in environment or subsistence strategies at this time (Wickham-Jones & Woodman 1998:19; Woodman 2015:284). The same range of environments were exploited, with Later Mesolithic sites concentrated in the lowland flood plains, as opposed to slightly higher ground as in the earlier period (Costa *et al.* 2005:23). This is reflected in stable isotope data from coastal midden sites. Human remains recovered at Ferriter’s Cove, and dog remains from Dalkey Island, both yielded signatures which indicated a high marine contribution to their diet. The signature from human remains at the Rockmarshall midden indicates a more mixed diet, whilst the Later Mesolithic individual from the interior site at Killuragh Cave again suggests a terrestrial or freshwater diet (Meiklejohn & Woodman 2012; Milner & Woodman 2007:109; Woodman 2004:45; 2009b:xl). It should be noted however, that the nitrogen values are not reported for any of these individuals.

The change from microlithic to macrolithic technology with the advent of the Later Mesolithic in Ireland is unparalleled anywhere except the neighbouring Isle of Man (McCartan 2003; 2004). Soft hammerstone technology was replaced by hard hammer percussion, used to detach large blades and blade-like flakes from uniplane, or ‘Larnian’ cores. Microliths and associated composite tools fell out of use, and artefacts display little secondary working. Bann flakes – large, leaf-shaped flakes which are characteristic of the Late Mesolithic – were modified very simply to butt-trimmed or tanged forms. These appear across Ireland in a variety of different raw materials. Elongated pebbles are found both inland and on the coast, often appearing at midden sites with a ground or chipped bevel at one end; the use of stone axes strongly endured (Costa & Sternke 2009:799; Woodman 1978:82, 115; 1987:142; 2012:31; Woodman & Anderson 1990:378-379).

There have been numerous attempts to explain why this change took place, with theories ranging from functionalist to social models. At a simplistic level, this “technological homogeneity” across Ireland may have been a response the limited range of fauna available to exploit, and therefore an adaptation to capitalise on the few resources which were present – namely fishing (Kimball 2000:41; Movius 1942:172). However, considering the Early Mesolithic spanned at least a millennium, the use of Bann flakes as such an adaptation seems significantly delayed (Woodman 2009b:xxxix).

Functionalist interpretations lead on from this. It has been widely argued that the larger, broader blades of the Later Mesolithic were the result of a deliberate de-specialisation of lithic technology to create more generalised and flexible tools, which were geared towards “the production of the means of production” (Costa *et al.* 2005:30). The large assemblages of Bann flakes and polished stone axes recovered from river valley sites such as Newferry have been interpreted as woodworking tools for the production and maintenance of traps and weirs at specific fishing sites (Costa *et al.* 2005; Finlay 2003:89; Movius 1942:172; Tolan-Smith 2008:151; Woodman 1978:93-94; 2004:289; 2009a:210; Woodman & Anderson 1990:381, 385).

This change in lithic technology is also intrinsically linked with a diversification in the use of local raw materials during the Later Mesolithic, including quartz at Belderrig, Co. Mayo; silicified dolomite at Lough Allen, chert at Corralanna, Co. Westmeath, and rhyolite and siltstone around the Midlands (Costa & Sternke 2009:799; Driscoll *et al.* 2013; Little 2009b; Warren *et al.* 2009; Woodman 2015:165; Woodman 1987:142; Woodman & Anderson 1990:377). The simple technological requirement to obtain large flakes and blades facilitated the exploitation of non-flint raw materials. The Late Mesolithic silicified dolomite assemblage from Lough Allen, Co. Westmeath consisted of the same types of cores, and consistently sized flakes and blades observed in flint and chert assemblages of the north-east and midlands. The silicified dolomite was reduced using the natural bedding planes of the raw material as guides for blade removal, which demonstrates undoubtedly that Mesolithic people had an intimate knowledge of the fracture mechanics of this raw material, and their "technical know-how was adapted to the raw material at hand" (Driscoll *et al.* 2013:25, 30).

Social factors have also been proposed in influencing the change in technology. The Early Mesolithic communities of Ireland were well established, so a complete population replacement by a new, macrolithic using community is an unlikely explanation (Costa *et al.* 2005; Mitchell 1976). Instead, significant changes in technology came from *within*. The insularity of the island community accelerated these changes as outside influences – such as the continuation of microlith use – no longer influenced, or was actively discouraged from influencing, technological tradition (Costa *et al.* 2005:289; Woodman 1981; 1987:142; Woodman & Anderson 1990:377).

Changing social relationships may also have affected access to raw materials in flint-poor regions. The generic, non-specialised technology of the Irish Later Mesolithic did not necessitate the use of specific, high quality raw materials such as flint. Therefore, it has been suggested that the exploitation of local raw materials, and the associated change in technology, absolved the requirement for communities to spend time maintaining large, expensive social networks that facilitated access to distant flint sources through embedded procurement during the Earlier Mesolithic (Costa & Sternke 2009:799). Instead, embedded procurement was conducted on a much smaller scale, with some exchange of tools made from non-local raw materials, such as axes, conducted by boat (Costa & Sternke 2009:799; Little 2009b; Woodman 2015:258-259).

Where alternative raw materials are not immediately available, such as in the Bann valley, hoards or caches of flint blades have been recovered from sites like Lough Beg and Newferry, Co. Antrim

(Woodman 1978:67, 72). Later Mesolithic industrial 'workshop' sites, such as Bay Farm, Co. Antrim have been identified close to coastal flint sources, where the raw material was reduced to pre-prepared blanks then transported to these occupation sites inland (Costa & Sternke 2009:799; Costa *et al.* 2005:28; Woodman 2009a:209). This could reflect a shift towards increasingly more organised procurement strategies where required, with specific task-groups directly acquiring raw materials as part of a logistic subsistence strategy, in which blanks were curated and stored in caches for later use. The evidence above largely supports this, as significant investments in permanent technology such as fish traps and boats attest to a 'delayed-return' economy, and imply a degree of territoriality or ownership over such facilities (Costa *et al.* 2005:30; Finlay 2003:92; Rousseau 2006; Tolan-Smith 2003:124; 2008:152; Woodburn 1980; Woodman 1987:144; Woodman & Anderson 1990:383). It should be noted, however, that expedient technology was still present in the form of Bann flakes (Finlay 2003). Furthermore, small amounts of non-local raw materials found at Lough Allen, Bay Farm, and Corralanna also suggest that exchange networks may still have been open to an extent (Driscoll *et al.* 2013:30).

The Irish Later Mesolithic is evidently a complex and unique situation, borne from insular developments that are rooted in the island's early separation from the continent, and which varied dependent on social responses to local conditions (Woodman 2015:232). However, it should not be assumed that because of these local developments Ireland was cut-off from Mesolithic communities elsewhere. The presence of domesticated cattle bones at Ferriter's Cove, dating to 4450-4270 cal. BC, indicates connections with the Continent over 500 years before there is unequivocal evidence for the agriculture on the island, c. 3750 cal. BC (Whitehouse *et al.* 2014; Whittle 2007; Woodman *et al.* 1999).

3.4.2. Norway

The Late Mesolithic Chronozone begins at 6500 cal. BC (Bjerck 2008b). However, this section contains sites that date from slightly before (c. 7000 cal. BC), in line with the division of this chapter outlined above. Traditionally, the Late Mesolithic Chronozone ends at c. 4000 cal. BC when the Neolithic begins, and that is where this chapter will stop. It should be noted, however, there is a long continuation of hunter-gatherer practice into the Middle Neolithic. The earliest evidence for domesticated plants and animals is not recorded until c. 2400 cal. BC, when it appears a very rapid transition occurs, as in Ireland and Scotland. This is uncharacteristic of the rest of the Atlantic seaboard, where there is evidence for a sustained period of co-existence between hunter-gatherer and farming economies within close proximity of each other (cf. Arias 1999; Armit & Finlayson 1992; Glørstad 2009; Høgestøl & Prøsch-Danielsen 2006; Lidén *et al.* 2004; Olsen 2009; Prescott 1996; Richards *et al.* 2003; Rowley-Conwy 1995; Schulting & Richards 2002).

The ‘Nøstvet’ tradition is characteristic of the Late Mesolithic Chronozone lithic assemblage in southern Norway. Classic stone tools include the continued use of microblades struck from conical microblade cores that developed during the preceding Middle Mesolithic phase; borers or engravers; grinding tools; line-sinkers and, most diagnostically, ground and polished adzes made from basaltic rock (Bjerck 1986:104; Nygaard 1990:230-234). The decline in the use of flint continues as the diversity of raw materials present in Late Mesolithic assemblages becomes more common to include quartz, slates, and basalts (Bergsvik & Olsen 2003; Gjerland 1990; Nygaard 1990:230; Olsen & Alsaker 1984). Bipolar reduction also increases significantly in this period. Bipolar cores comprise over 75% of cores in southern Norwegian assemblages, and is likely to be associated with raw material availability (Ballin 1999a).

As mentioned previously, the distribution of greenstone and diabase adzes and axes further substantiates the evidence for increasing regionalisation between the Middle and Late Mesolithic. Diabase, quarried from Stakaneset, Flora accounts for over 60% of Mesolithic adzes in the northern zone of distribution (Romsdal, Sunnmøre, and Sogn og Fjordane). Stylistically, these adzes are “generally short and blunt with rounded necks” finished by grinding (Bergsvik & Olsen 2003:399; Olsen & Alsaker 1984:97). The Hespriholmen quarry on Bømlo is the source for 47% of Mesolithic greenstone adzes within the southern zone of distribution (largely within Rogaland and Hordaland counties). These adzes differ in form and finishing technique, being “predominantly long, narrow adzes with pointed necks” often finished by both pecking and grinding (Bergsvik & Olsen 2003:399; Gjerland 1990; Olsen & Alsaker 1984). A clear zone of overlap is evident at Nordhordland (the northern district of Hordaland), where adzes made from both raw materials are present (Bergsvik & Olsen 2003). This area is equidistant from the raw material sources and there is no gradual fall-off up to this point, which would be expected if the overlap were coincidental. Instead, it appears that the exclusive use of diabase in the north, and greenstone in the south, merge in this area (Bergsvik & Olsen 2003:399; Olsen & Alsaker 1984:85). Artefacts made from these raw materials are found up to 600-650km from their respective sources, however they are most frequently recovered within the first 100km of the quarries. There is a clear fall-off curve towards the interior, which may represent an eastern border defined by the central mountain plateau. The fall-off to the north and south of the distribution zones, however, is unaffected by geographical or ecological barriers and probably represents the limits of the territories, which further emphasises the deliberate merge at Nordhordland (Olsen & Alsaker 1984:83, 97).

Overall, the distribution of greenstone and diabase reflects the mobility of Late Mesolithic groups around the western coast of Norway, who had direct access to the raw material quarry. Finished artefacts were transported by these groups from the source to their place of deposition (Bergsvik & Olsen 2003:401; Olsen & Alsaker 1984:96). However, some small-scale exchange may have taken place, especially within Nordhordland, which served as a contact zone at the territorial boundary between two different groups (Bergsvik & Olsen 2003:402; Olsen & Alsaker 1984:95). The use of these quarries and distribution of raw materials continued unchanged until the introduction of agriculture in the Middle Neolithic (Olsen & Alsaker 1984:92-93).

A large number of single stone adzes and axes made from these raw materials have been found along fjords. Initially, this was interpreted as evidence of seasonal movement into the inland mountain plateaux, however there is little evidence for Late Mesolithic occupation in the interior or at the axe/adze find-spots (Gundersen 2009; Nygaard 1990:233). Study of the distribution of these isolated finds around Sogn og Fjordane, and the Sunnmøre region of Møre og Romsdal, has revealed deposition in unusual and often impractical places such as water (ponds, streams or fjords), bogs, under boulders, and in scree slopes (Bergsvik 2009; Gundersen 2009:239-240). This has been interpreted as deliberate ritual activity, potentially connected to rites of passage in a liminal environment or in maintaining an egalitarian society within an increasingly sedentary population (Bergsvik 2009; Gundersen 2009:239-240).

One final development during the Late Mesolithic, potentially connected to the ritual deposition of adzes/axes in terms of ideology, is the presence of the earliest rock art in Norway (Bergsvik 2009). Panels of motifs occur in high densities around Trøndelag, depicting boats, animals, and hunting activities. The appearance of rock art at this time has been attributed to socially complex groupings and religious ideology, associated with drastic social change surrounding the transition from mobile to sedentary populations, and between hunter-gatherer to agricultural modes of subsistence during the Neolithic. These changes heralded the arrival of new subsistence strategies, social order, technology, and raw material exploitation (Bergsvik 2009:607; Lødøen 2003; 2009; Nygaard 1987:153-154; 1990:234; Olsen & Alsaker 1984:100; Sognnes 1994; 1995).

3.5. Drawing Potential Parallels

This chapter has described in detail the processes of colonisation, settlement, subsistence, and technological developments for the Mesolithic period in Ireland and Norway. Despite the differing models and theoretical stances that have been presented, and the independent nature of the two regions, there appear to be striking similarities between the Mesolithic populations occupying these extreme outposts of the north-east Atlantic seaboard.

The evidence presented above suggests that colonisation of Ireland and the western coast of Norway directly resulted from the development of advanced maritime adaptations. Early Mesolithic communities could not successfully colonise these islands and archipelagos until they had moved beyond land-based lacustrine or littoral relations; “elaborate marine relations” such as boats capable of crossing open sea were key to this success (Bjerck 2009). Methodological problems aside, this is seen as the primary factor in the apparent delayed colonisation of these rich biotopes following de-glaciation, which is also applicable to western Scotland (Bang-Andersen 2003b; Bjerck & Zangrando 2013; Warren 2015a; Wickham-Jones & Woodman 1998; Woodman 2012). Advanced marine adaptations and the importance of aquatic resources are reflected in the clear distribution of Mesolithic sites along coastal and riverine environments in Ireland, Norway, and Scotland. Whilst research bias may be a significant contributing factor in this distribution pattern, especially for Scotland and Ireland, the number of Mesolithic coastal sites in Norway considerably outweighs those identified inland despite the destructive effect of marine transgressions and intensive investigation of the interior (Bang-Andersen 2003b:15; Boaz 1998a:63; Wickham-Jones 1990c:168). This is of exceptionable note, especially given the higher faunal diversity with regard to terrestrial 'big game' available to Mesolithic hunter-gatherers of Norway, in contrast to Ireland. It would appear that, irrespective of the breadth of resources available, marine relations endured. The differing availability of resources appears to have had a significant effect on the development of economic systems in these three areas.

In Ireland it is clear that, once at their destination traits of a delayed-return economy developed rapidly, evidenced by an investment in fixed technology such as fish traps, weirs, and house building, and storage/caching of resources (Tolan-Smith 2008:152; Warren 2015a:51; Woodman 2004). The Mesolithic economy in Ireland was focussed largely on fish and shellfish exploitation, with a deliberate introduction of wild boar during this period to mitigate the lack of terrestrial resources. The evidence for specialised extraction sites suggests that Mesolithic inhabitants were well adapted to capitalise on resources as they became available, resulting in regionally-specific variations in settlement duration (Woodman 2015).

In Norway, the dearth of organic remains makes it difficult to interpret the economic strategies of early settlers. Despite this, there is a strong argument for highly mobile, residential groups who moved seasonally between the coast and interior. This is based upon the presence of small, ephemeral tent structures in both the interior and outermost coastal zone, and the absence of any evidence for large aggregation sites (Åstveit 2009; Bang-Andersen 1996a; 1996b; 2003a; 2003b; Bjerck 2008b; contra. Indrelid 1975; Nærøy 1995; Nygaard 1987). In the Norwegian Early Mesolithic, it appears that all aspects of subsistence are immediate-return – the size and location of sites mentioned above, and a lack of evidence for the storage of food or investment in fixed-facilities that implies a degree of territoriality or ownership (Woodburn 1980). The only exception to this is boats, which are undeniably a delayed-return adaptation. The manufacture and maintenance of boats – which ethnographic evidence demonstrates must be frequently repaired and re-waterproofed – requires a certain period of scheduled 'down time' in order to conduct these activities (Binford 1979; Bjerck 2016; Gusinde 1961; Lothrop 1932; Schmitt 2015; Speck 1911;

Torrence 2001). This ‘down time’ cannot be spent hunting or gathering and groups must therefore rely on social reciprocity or stored resources, on land, as a support mechanism (Bjerck 2016; Layton 2005; Rousseau 2006; Sahlins 1972; Trivers 1971). Boats are therefore an extremely delayed-return adaptation within an otherwise immediate-return subsistence base. The two systems are not mutually exclusive, and it is clear that the Early Mesolithic of Norway falls within the flexible facet of an adaptive immediate-return strategy (Layton 2005:140). It is not until the Late Mesolithic that other aspects of a delayed-return system emerge – larger settlement sites suggesting long-term occupation, evidence for regional identity in material culture, and territoriality in the appearance of rock art. This has been attributed to the richness of the coastal environment, which facilitated a broad spectrum economy based on fishing, and where other seasonally available resources could also be intensively exploited (Åstveit 2009; Bergsvik 2001; Fuglestvedt 2014; Gundersen 2009; Nygaard 1987; 1990; Pettersen 1999).

It is clear from the evidence outlined above that the resources available to the Early Mesolithic colonists differed markedly between Ireland and Norway; their economic responses equally so. In Ireland, the *limited availability* of predicable resources – namely anadromous fish – necessitated the rapid establishment of a delayed-return economic system through an investment in fixed facilities, storage of foodstuffs and caches of raw materials. Conversely in Norway, it is the *abundance* of predictable terrestrial and marine resources which enabled an immediate-return system to endure for so long, before eventually leading to a delayed-return system. Economic stability facilitated long-term settlement, an investment in more substantial house structures, and pronounced regional identity. Outside social factors may have also influenced this (Nygaard 1990:234). In both regions different aspects of a delayed-return economy were adapted as necessary, dependent on environmental and social factors.

Expressions of regional variations and local adaptations within these regions is also evident in lithic technology. In the Later Mesolithic of both Norway and Ireland there is an increase in the use of local raw material, with less reliance on flint that could only be obtained from restricted coastal sources. This is intrinsically linked with changes in both technology and social mobility. Use of local raw material suggests more sedentary populations, operating within smaller social territories (Glørstad 2013:72). This is emphasised by the distribution of axes and adzes in Norway which exhibit distinct stylistic differences and are made from regionally specific raw materials (Gjerland 1990; Olsen & Alsaker 1984). In Ireland, the diversification of raw material utilisation is closely connected to changes in lithic technology, which allowed these non-flint raw materials to be exploited at the expense of costly large-scale networks that were required to directly access flint (Costa & Sternke 2009). This is explored further in Chapter Nine.

A further parallel that can be drawn is the presence of shell middens in each of these regions. Shell middens in Ireland, Scotland and Norway all share similar characteristics in terms of composition, however there are significant differences in the artefact assemblages (Bjerck 2007:25; Hardy 2013:131; Woodman 1989:19). In Norway, the lack of shell middens indicates that shellfish exploitation was a marginal contribution to Mesolithic economy, whereas in Ireland the scale of shellfish exploitation is more pronounced, but not to the degree of Scotland (Bjerck 2007:25; Bjerck & Zangrando 2013:87; Woodman 2015:279). Debates surrounding the intended use of shellfish for bait or consumption notwithstanding (Bjerck 2007:24); it is clear that "[s]imple environmental and economic factors are not enough to explain this difference" (Woodman 1989:19). The social function of shell middens is drawn upon more fully in Chapter Nine.

There is a close association between shell middens, caves and deposits of human remains in all three areas, which is also discussed in Chapter Nine. In Scotland the Oronsay middens and Oban caves contain Mesolithic and later burials within the midden deposits (Hardy 2013; Milner & Craig 2009). Irish middens, rockshelters and open-air sites have yielded disarticulated and fragmentary Mesolithic human remains in addition to a cremation (Meiklejohn & Woodman 2012). Similarly, disarticulated human remains of Mesolithic and later date have also been recovered from several rockshelters and caves in Norway, which also contained shell deposits (Bergsvik & Storvik 2012). The favourable preservation conditions within sheltered caves and alkaline soils of shell middens may bias the archaeological record against evidence for interment of human remains at open-air sites (Bergsvik & Storvik 2012; Bjerck 2007). However, it is likely that these were favoured locations for occupation and shelter, which were also incorporated within a diverse funerary tradition (Bergsvik & Storvik 2012:35-36; Hardy 2013).

One significant difference between these regions is the production of Late Mesolithic rock art in Norway, as well as other Scandinavia and Eastern Europe. Beyond these regions, ritual activity is perhaps manifest in more mundane or intangible ways, combined with daily living and only archaeologically visible though practices such as the disposal of the dead (Chatterton 2006; Woodman 2015:313-320).

The transition to the Late Mesolithic in these regions coincides with the earliest evidence for Mesolithic occupation in the Western Isles. In sum, the permutations between the Early and Late Mesolithic in Ireland and Norway are similar in many regards: maritime adaptation to facilitate colonisation; a subsistence strategy reliant on fishing and marine resources; increasing regionalisation in lithic technology reflecting the development of social territories; the use of caves and midden sites to dispose of the dead. These parallels are present irrespective of the continental outside influences and wider range of resources exploited by Norwegian Mesolithic communities, and the fact that in Ireland these developments are very insular. Both regions are therefore extremely well suited in providing contextualisation and comparison with the Mesolithic evidence from Scotland the Western Isles, which is discussed in full in Chapters Eight and Nine.

Chapter 4 Lithic Recording Methodology

4.1. Introduction

This chapter outlines the recovery of the artefacts from the Mesolithic sites excavated in the Western Isles, and the methodology implemented in recording the lithic assemblages. The methodology has been developed from the detailed analysis of excavated lithic assemblages that were introduced in Chapter Two. It has been specifically tailored to answer the first of the three main research questions of this PhD: *what is the nature of the lithic technology of the Mesolithic in the context of the Western Isles of Scotland?*

This research question is underpinned by several smaller questions, which were formulated to guide the analysis by addressing specific issues previously identified in the study of Mesolithic assemblages in the region (Piper 2011).

QII. What raw materials are utilised, and where are they sourced from?
QIII. What reduction strategies are employed, and are these material specific?
QIV. Are microliths present at the midden sites and bevel ended tools at the open air sites?
QV. Is the assemblage an expedient or curated technology?

Each sub-question is derived from notable themes that have emerged during the study of the Mesolithic period in recent decades. In particular, the 'Obanian' debate discussed in Chapter Two has given rise to the assignation of a technological tradition that, despite refute, still heavily influences our understanding of the Mesolithic in western Scotland. This ensures the Western Isles assemblages can be contextualised within the broader Scottish Mesolithic and thus contribute to answering part of the third research question - *are the Western Isles sites representative of the Scottish Mesolithic?*

4.2. Recovery of the Lithic Assemblage

All artefacts exposed during the excavations were recorded in three-dimensions. However, as a 100% sampling strategy was implemented at each site, the majority of lithics were recovered during post-excavation processing of the samples. The residue from each sample was fractioned through 4mm, 2mm, and 1mm geological test sieves, with material <1mm discarded. Only >4mm and >2mm fractions were sorted for lithics, as there is no record of major excavations in Scotland and the north of England striving to recover lithic debris from anything less than 3mm (Hardy & Wickham-Jones 2009b; Waddington 2007; Wickham-Jones 1990a:28; 2004a). The >4mm fraction was sorted by eye and the >2mm fraction using a low-powered binocular microscope to ensure comprehensive recovery. Tweezers were used in both instances to recover all artefacts and ecofacts (Bishop *et al.* 2012a; Bishop *et al.* 2011a; Blake *et al.* 2012a; 2012b; Piper & Church 2014; 2015).

4.2.1. Cleaning and Concretion

Prior to analysis all lithics were cleaned in water with a soft-bristled toothbrush to remove dirt. Some of the lithics were heavily concreted with calcium carbonate that had dissolved in groundwater percolating through the overlying machair, and re-mineralised in the archaeological layers. In some instances this significantly obscured the lithics, preventing the attributes from being recorded (Figure 21). The affected stones were placed in a beaker containing white vinegar (acetic acid) and left in a fume cupboard overnight. The weak acid of the vinegar dissolved the calcium carbonate without damaging the lithics, which were subsequently cleaned following the standard procedure to remove any remaining concretion (calcium acetate; Figure 22). The process was repeated if necessary to remove large deposits. The chemical reaction for this process is:

$$CaCO_3 + 2CH_3COOH \rightarrow Ca(CH_3COO)_2 + CO_2 + H_2O$$

Figure 21. TNB9'13 L256 prior to treatment to remove the concreted deposits adhering to both the ventral (left) and dorsal (right) surfaces

Figure 22. TNB9'13 L256 following treatment to remove the concreted deposits adhering to both the ventral (left) and dorsal (right) surfaces

4.3. Recording Methodology

The methodology for recording the technological and morphological attributes of lithics used in this thesis has been adapted from Piper (2011), which was designed to analyse the material from Northton, the first Mesolithic lithic assemblage in the Western Isles. This was based upon methodologies from recent excavations in the Inner Hebrides (Finlayson *et al.* 1996; 2000; Wickham-Jones 1990c), which were adapted with typological nomenclature deriving from Tixier *et al.* (1980) and Inizan *et al.* (1999). Modifications and recommendations made by Andrefsky (1998) and Ballin (2000) – especially regarding Scottish material and the presence of quartz – have been followed where stated. The recording methodology was constructed in order to facilitate close contextualisation with the Mesolithic of the Inner Hebrides and Scotland.

4.3.1. Debates Surrounding Quartz Analysis

There has been a significant and on-going debate surrounding the study of quartz in archaeological assemblages. Scandinavian scholars have argued that this raw material should be analysed separately to flint, whereas others maintain the two raw materials can be studied within the same typology (cf. Ballin 2008; Broadbent 1979; Callahan 1987; Driscoll 2010; Lindgren 1998; Welinder 1977). In simplified terms, the debate concerns two inter-related aspects: flaking properties or fracture mechanics of the raw material itself, and the nature and definition of a ‘tool’. Consequently, the development of quartz analysis has been criticised as hampered by a ‘flintcentric’ viewpoint. Equally damaging is the *a priori* assumption that quartz is not a ‘valid’ raw material – it was only used as an inferior substitute where better-quality raw materials (i.e. flint) were unavailable (Driscoll 2010:59, 76; Lindgren 1998; Saville & Ballin 2000:45). Ballin’s (2008) recent publication on *Quartz Technology in Scottish Prehistory* is of central relevance to this debate, and indeed this thesis, due to the fact it is the only coherent study of quartz in this region. The brief discussion below concerning both aspects of the ‘quartz debate’ therefore centres on his conclusions.

In terms of the raw material, quartz is not homogenous. It varies widely in composition due to the different environments under which it forms, and different types and textures can occur within the same vein. As such, the fracture mechanics of quartz are dependent on its crystalline structure (Jones forthcoming in Ballin 2008; Collina-Girard 1997). Flint, which is a variety of cryptocrystalline silica, fractures conchoidally – as do very fine-grained macrocrystalline quartzes such as rock crystal. Conversely, coarser grained macrocrystalline quartzes, such as quartzite, fracture following “a preferential breaking direction” (de Lombera Hermida 2009:7), producing “cubic fragments in an uncontrollable fashion” (Ballin 2008:44-46). Consequently, the reduction of quartz is seen as less controllable, producing irregularly shaped flakes that are “difficult or even impossible to predict” (Welinder 1977:29). Reduction of quartz is frequently conducted through a bipolar knapping strategy to afford more control over the material (Ballin 2008:3; Wickham-Jones 2004a:25). Accordingly, it has been argued that different reduction strategies may have been used to produce the same recognisable formal artefact type in flint and quartz, which may (or may not) have been used for the same purpose (Knutsson 1988:12).

As a result, calls have been made for a separate typology, whereby quartz assemblages are analysed in isolation, and based upon experimental assemblages (Broadbent 1979; Callahan 1987; Driscoll 2010; Lindgren 1998; Welinder 1977). Ballin strongly disagrees with this, stating “its logical consequence is that assemblages in flint/flint-like silica and quartz *cannot be compared directly*” (Ballin 2008:40, emphasis added). Such an approach would hinder the analysis of mixed raw-material assemblages, like those from the Western Isles. Furthermore, both experimental and archaeological examples have proven that bipolar reduction is a more controlled and precise method than previously assumed. This technique ensures successful, utilisable flakes can be produced in the most efficient and economical manner – especially where there is an abundance of raw material (Callahan 1987:12-13, 63; Flenniken 1981:113). This is supported by linear regression analysis conducted on the quartz flake assemblage from Northton, where a statistically significant relationship between increasing flake dimensions was observed, indicating regular flaking (Piper 2011:165). Furthermore, finer grained quartzes may fracture conchoidally, producing partial Hertzian cones, albeit not as prominent as in flint. This would blur any distinction between a flint-typology and a quartz-specific typology. As such, the same methodology should be employed irrespective of the raw material.

Traditionally observed characteristics in flint, such as ripples, are not produced therefore determining the direction of force is difficult to observe (de Lombera Hermida 2009:7). Instead, several diagnostic features, as described by de Lombera Hermida (2009) were used to determine whether quartz had been worked or had naturally fractured. Knapping is indicated by the presence of: radial fissures; proximal fissures; striking platform fissures; steps; splintering; edge battering and scales (de Lombera Hermida 2009:8-9; Figure 23).

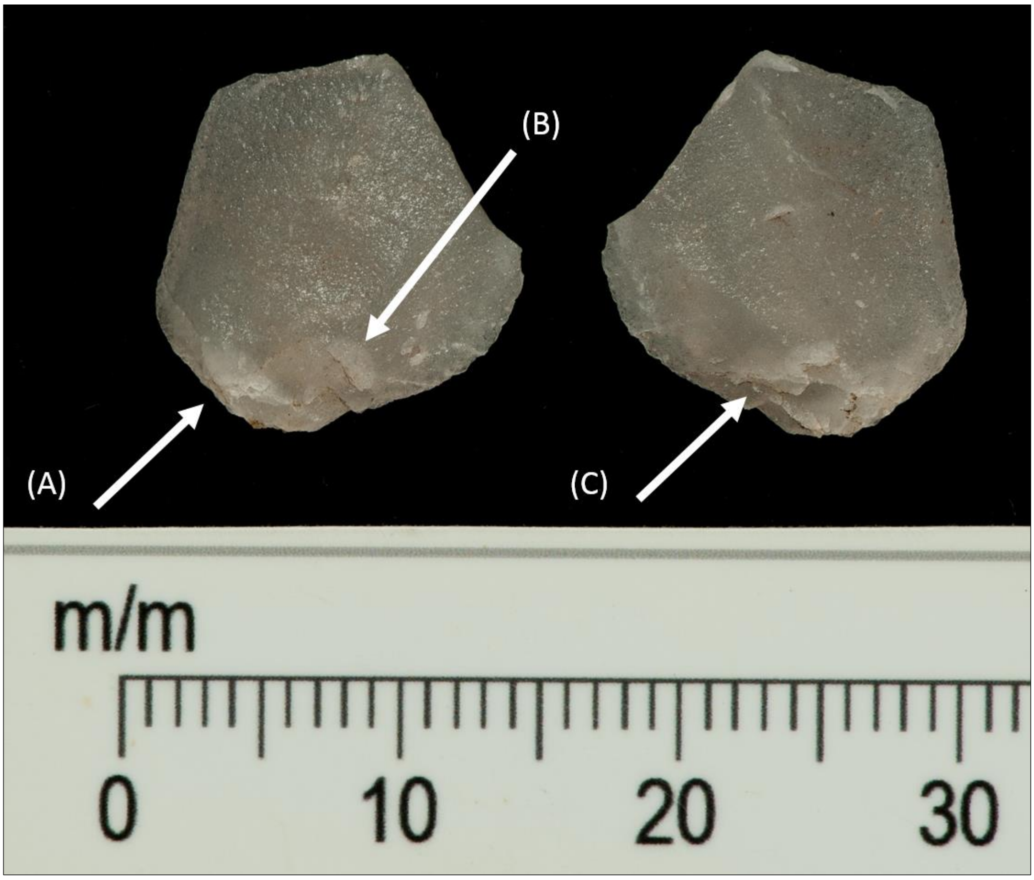


Figure 23. Identifying features of a struck quartz flake - (A) edge battering and striking platform fissures, (B) scales, (C) steps and splintering

With regard to the second issue, a ‘tool’ is defined as:

> “…any artefact *that has indubitably been used*, irrespective of its surmised function. This includes pieces made on knapped blanks (*e.g.* endscraper on blade) or on natural blanks (*e.g.* scraper on slab); unretouched pieces whose function can be demonstrated by microwear analysis (*e.g.* flakes used for cutting meat); natural "objects" modified by macro- or microscopic traces of wear or hafting; retouched or unretouched pieces bearing traces of intentional gloss; tools used for making stone tools (*e.g.* hammer, pecker, punch, etc.).” (Inizan *et al.* 1999:157, emphasis added).

The recognition of intentional modification on quartz artefacts is constrained by the inherent flaking properties of quartz, whereby the retouch may be (rightly or wrongly) identified on an uneven surface (Cornelissen 2003:11-13; Lindgren 1998:100). Additionally, the issue has been raised in Scandinavian research that any classification of quartz flakes as formal tools is incorrectly based on “ideographic” similarity to tools in flint assemblages (Knutsson 1988; Lindgren 1998).

Ballin (2008:40) proposes a simple solution to these issues: quartz artefacts cannot be classified as tools unless there is clear evidence for secondary retouch. The absence of modification would therefore classify it as ‘debris’ (as defined by Inizan *et al.* 1999). This basic assumption is concerning, given the vast corpus of use-wear and residue analyses conducted on both archaeological and ethnographically derived assemblages that indicate non-retouched artefacts were used as tools (Beyries & Rots 2008; Dumont 1988; Finlayson & Mithen 2000; Hardy 2004; Hardy & Shiel 2007; Högberg *et al.* 2009; Rots & Williamson 2004). This would have significant ramifications for the presence of a largely unretouched and expediently produced flake-based industry, for example.

In light of the above debate it is necessary to clarify my own theoretical standpoint, which agrees with Ballin (2008; Saville & Ballin 2000) in almost every respect. Quartz is a *legitimate* raw material, which was exploited throughout prehistory *alongside* other raw materials. The different flaking properties of this raw material *required* different knapping strategies, producing different end products that were likely used for different functions. Accordingly, quartz *can* be analysed within a flint typology providing fracture mechanics are taken into account (Ballin 2008:91; Knutsson 1988). Without such it would be impossible to compare the mixed raw material assemblages so characteristic of Mesolithic Scotland, and a separate typology would then be required for each raw material present (Ballin 2008:40, pers. comm.). I do not, however, agree with Ballin on the classification of quartz tools. Use-wear studies have clearly demonstrated that un-modified quartz artefacts were utilised and would therefore qualify as tools under the definition quoted above (Knutsson 1998:96-70; Sussman 1988).

The high fragmentation rate of quartz during knapping, due to its macrocrystalline formation, is widely accepted as problematic in the analysis of lithic assemblages containing this raw material (Callahan *et al.* 1992; Driscoll 2011; Tallavaara *et al.* 2010). As such, it is argued that because of its fragmentation rate, mixed raw material assemblages containing quartz are likely to be dominated by this raw material (Driscoll 2010:743). The principle of fracture analysis was designed in the 1980’s to 1990’s by archaeologists in Sweden and America using modern, experimentally produced quartz assemblages with which to compare the archaeological material (e.g. Knutsson 1988; Knutsson 1998; Lindgren 1998). In accordance with this, experimental quartz assemblages have often been created by archaeologists when analysing archaeological quartz assemblages, in order to ascertain a baseline for fragment distribution (see Tallavaara *et al.* 2010 for a discussion of this).

One of the most interesting outcomes of two independent studies, conducted at similar times, on the effect of recognising characteristic debitage from experimentally produced assemblages was that quartz fragmentation does not solely depend upon the raw material characteristics. A correct reconstruction of the assemblage could only be made by the analyst with extensive or complete prior knowledge regarding the skill of the individual knapper; the reduction method; the reduction sequence, and the hammer material, all of which affected the fragmentation of the quartz (Amick & Mauldin 1997; Driscoll 2010; 2011; Tallavaara *et al.* 2010). Driscoll (2011) and Tallavaara *et al*. (2010) acknowledge that this information is not available when analysing an archaeological assemblage, and the issue of fragmentation is further exacerbated by post-depositional processes such as trampling (Nielsen 1991). It is clear that the debate surrounding quartz fragmentation and experimental comparative analysis has become self-perpetuating, with more issues arising than clear answers. Driscoll (2011:743) counteracts this to some extent by stating that the issue of quartz fragmentation makes analysis of assemblages difficult for archaeologists, but may have not been at all important to the original prehistoric communities who worked with this material. Furthermore, unlike an experimental assemblage, no archaeological assemblage will be complete (irrespective of taphonomic and recovery bias), simply due to the agency of the people who created it in the first place. Pieces, including fragments, would have been selected for use and removed from the operational schema, thus from the archaeological record (Inizan *et al.* 1999:16). Given the conflicting evidence cited above over the efficacy of using an experimental assemblage as a baseline in quartz analysis, one was not produced for the purpose of comparing the Western Isles quartz assemblages.

One final point is the issue relating to the traditional association of bipolar reduction with quartz assemblages, usually due to the perceived irregular flaking properties of this raw material (Driscoll 2010:81; Saville & Ballin 2000:48; Wickham-Jones 2004a:25). This method of reduction is traditionally associated with working less amenable raw materials (i.e. quartz); small nodules of raw materials and exhausted platform cores (defined as <50mm in maximum dimension; Barham 1987:46). As such, this strategy is inextricably linked with connotations of 'last-resort' technology – an uncontrollable method of reduction and "a common indicator of impoverished lithic resources" (Nelis 2006b:71-72 cf. Ballin 1999a:18; Barham 1987; Knight 1991:57). This is despite the fact bipolar reduction has been shown to produce more complete flakes from quartz than platform reduction (Callahan *et al.* 1992; Driscoll 2011; Tallavaara *et al.* 2010).

Whilst acknowledging that bipolar-reduced quartz flakes are often difficult to identify, and can often be mistaken for those produced by platform reduction, it appears that the connection between quartz and bipolar reduction is misrepresented (Ballin 1999a:18-19; Driscoll 2010:81; 2011:739; Knight 1991:64-65; Knutsson 1988). This is due to a combination of factors – the neglect of detailed quartz analysis and research until the 1980's, and the fact bipolar technology was not fully integrated in-to mainstream lithic nomenclature until the same time (Driscoll 2010:75). Up to then, bipolar cores were variously described as chisels, wedges, fabricators, opposed-platform cores or *outils éscaillèes* (Ballin 1999a; Broadbent 1979; Knight 1991). A case in point is the Mesolithic assemblage from Lussa River, Jura which was excavated in the 1960's by John Mercer. The description of the cores from the site, for example, is as follows:

> "(1) *Cores (2 made into chisels, one into a scraper).* Poor and unstandardised work; several are just battered lumps lacking recognisable platforms and scarred from all angles; 5 others (no. 10, one platform) use natural platforms (a few corresponding flakes were noted e.g. nos 162, 240, 245). Quartz not included (no. 4 is exceptional for its flint-like treatment)." (Mercer 1971:11).

The original excavation report was published in 1971, prior to the recognition of bipolar cores as waste products rather than tools. It is interesting therefore, to note Mercer's description of the flint cores as "battered lumps lacking recognisable platforms" (1971:11), which would be in accordance with bipolar reduction as described by Helskog *et al*. "[t]he ends lack platforms. Both the transverse section and the longitudinal section are approximately pointed oval. Both ends are crushed" (1976:21 in Ballin 1999b). Furthermore, a large proportion of the Lussa River assemblage are described as 'chisels' (177 flint, 157 quartz), the illustrations of which clearly depict some bipolar cores (Mercer 1971:19). The formation of chisel-like edges on cores is described as characteristic of bipolar reduction (Barham 1987:78). Re-analysis of the quartz component of the Lussa River assemblage demonstrated that bipolar reduction of pebble quartz overwhelmingly dominated the assemblage, a technique which was particularly evident from the cores (Ballin 2002; 2008:9-10). Unfortunately the flint assemblage has not been re-considered, thus a comparison between reduction techniques and raw materials at the site cannot be drawn. Due to the lack of understanding of bipolar technology by Mercer it is clear that the bipolar reduction of flint in this assemblage is entirely unrepresented, which adds to the perceived misconception described above.

4.3.2. Generic Attributes

The following generic attributes were recorded for each lithic assemblage:

Catalogue Number

Where artefacts were recovered during excavation, the prefix of 'SF' (**S**mall **F**ind) was retained as this relates to the spatial data contained within the excavation records. All lithics recovered during post-excavation processing were prefixed with 'L' and a number starting from 1.

Context Number

This details the stratigraphic unit the artefact was recovered from and again relates to spatial information detailed within the excavation records.

Raw Material

The raw material of the artefact. The three main raw materials identified at Northton were quartz, flint and baked mudstone. Quartz and flint dominate in all other assemblages.

Raw Material Variety

This section refines the raw material category by referring to the specific type of raw material, which can be used to understand provenance and suitability of knapping (Driscoll 2010:56). This was solely applied to quartz, which comprises a wide variety of sub-types. Ballin (2008:46) developed a classification system for the most common types of quartz found in Scottish archaeological assemblages based on the geological attributes of colour and grain size (Table 1), and is used in this analysis.

↓ Increasing grain size	Quartz Type	Description
	Rock Crystal	Colourless and transparent, homogenous with fine flaking properties
	Milky Quartz	Massive (not grainy) and translucent, variable flaking properties dependent on quality and impurities. The most frequently utilised quartz in Scottish prehistoric assemblages
	Very fine-grained 'Greasy' Quartz	Microscopic grain size, translucent with a 'greasy' lustre. And a slightly rough surface texture. Good flaking properties
	Fine-grained Quartz	Grains are visible, "in the size order of fractions of a millimetre" and it is relatively compact", usually white. Good flaking properties
	Coarse-grained Quartz	Grains are visible, up to 1mm in size (occasionally greater) and loose-textured. Comparably poor flaking properties
	Quartzite	Metamorphosed sandstone

Table 1. Classification of quartz types (after Ballin 2008). The categories are not absolute and can grade into one another

Reduction Stage/Tool Type

This section provided a description of each piece categorising it by basic "debitage product" (i.e. primary or secondary technology – see below), or artefact type (after Andrefsky 1998; Ballin 2000; Inizan *et al.* 1999).

Primary Technology

Coarse stone tools

These range from tools used in initiating the knapping sequence, such as hammerstones and anvils to finished products such as choppers and Bevel Ended Tools (if present). A simple recording protocol was implemented for coarse stone tools which included maximum dimensions and a basic description.

Core

The lithic material remaining following the removal of flakes and blades until it is exhausted and discarded. The specific attributes recorded for cores are described in Section 4.3.3.1.

Flakes

Pieces removed from a core during the reduction sequence. Flakes may be used as blanks to form tools (which may or may not be retouched), a core for further flake removals (a *flake core*), or may simply be a by-product of the knapping strategy (waste products). The stage of the reduction process represented by the flake was determined according to the “triple cortex” approach (Andrefsky 1998:111), and used in conjunction with the dorsal scar count. Analysis of the correlation between these two attributes has indicated that combining both cortex percentage and dorsal scar counts is effective in determining early stages of core reduction (Mauldin & Amick 1989; Odell 1989:183). This study is adapted from Finlayson *et al.* (2000:62) where *primary flake removals* are characterised by the dorsal face completely covered in cortex, with no dorsal scars. *Secondary flake removals* are identified by the presence of both cortex and flake scars on the dorsal face. *Tertiary flake removals* only exhibit dorsal flake scars with no cortex present.

It is acknowledged that there are issues surrounding this approach. Secondary, and particularly tertiary, removals may have not necessarily been removed after a flake which exhibits a greater quantity of cortex (Andrefsky 1998:112). The percentage of cortex is therefore only indicative of the earliest stages of core reduction, and the ratio of cortical to non-cortical flakes may differ between reduction strategies (Mauldin & Amick 1989:71). Nonetheless, this method is the most commonly used. The attributes recorded for flakes are outlined in Section 4.3.3.2.

Blade

Defined as a flake where the length is twice that of the width, with roughly parallel sides and arrises. Blades are deliberately produced by a specific knapping strategy. In Scotland, microblades are defined as <8mm in width and macroblades >8mm in width (Ballin 2000). Attributes recorded for blades were the same as for flakes.

Chunk

This term has been frequently used in Scottish Mesolithic lithic analysis to denote pieces that do not exhibit platform or ventral surfaces, and are often the result of knapping error/shatter (Finlayson *et al.* 2000:62; Wickham-Jones 1990b:58). This is incorporated into Ballin’s (2000:10-11) wider sub-group of ‘indeterminate pieces’, with a maximum dimension >10mm and may not necessarily be ‘chunky’ in appearance. The only attributes recorded for chunks were dimensions, cortex, and breakage.

Small fraction

This term is defined by Finlayson *et al.* (2000:64-67) as debris <10mm maximum dimension. Similarly, Ballin defines lithic material up to and including 10mm as ‘chips’, which are indicative of *in situ* knapping, and discarded as refuse (2000:10). Finlayson *et al.* (2000:67) recorded a restricted number of attributes for this category including primary blank type (flake or chunk), cortex, and breakage, which was applied here in addition to the dimensions.

Fine fraction

Fine fraction debris is defined as material <4mm, which was recovered from the Northton assemblage and quantified by raw material (Piper 2011). The results of this study indicated that the same range of debris as the small fraction was present at a microscopic level. Therefore fine fraction debris was not considered any further.

Secondary Technology

This section primarily comprises microliths and retouched pieces, which are pieces with intentional secondary removals that have been conducted to produce a modified flake or blank. Nomenclature for retouched pieces follows McCartan (1990); pieces associated with the production of microliths, such as truncations, are also included in this section (Finlayson *et al.* 2000:64).

4.3.3. Specific Attributes

The attributes recorded in this section are specific to the reduction stage or tool type and provide valuable information relating to stone tool manufacture. All measurements were taken using digital callipers to the nearest 0.1mm.

4.3.3.1. Recorded Attributes for Cores

Dimensions

Only two dimensions were measured for cores: maximum length and weight. This is due to the range of morphological variability in cores, and the fact it is difficult to define a consistent point from which width or thickness could be measured. As such, the length was determined by the maximum linear dimension of the core which can be multiplied by the weight to provide “a uniform measure of size” (Andrefsky 1998:138-139). The weight was recorded using a digital balance to an accuracy of 0.01g.

Flake Removal Sequence

- Bidirectional – where flake removals originate from both the proximal and distal ends of the core, and are indicative of bipolar reduction.
- Multi-directional – where flake removals run in several directions, indicating frequent turning of the core and the use of multiple platforms.
- Unidirectional – where flakes are removed from a single direction. The removals are often parallel to one another and originate from a single striking platform.

Flake Removal Count

The number of flakes removed from the core was recorded as a numerical value, and is based on a description of the number of stages visible. This refers to the fact that each stage of reduction of the core is representative of deliberate choices made by the knapper (Finlayson *et al.* 1996:256).

Cortex

The cortex is the natural surface, or 'outer skin', of a raw material that has been weathered, either through chemical or mechanical processes. Usually this is removed during the initial stages of knapping (Andrefsky 1998:103). Noting the condition of cortex is useful in determining the source of the material (Inizan *et al.* 1999:91). Cortex on flint often occurs as a distinct chalky covering, which is rolled and smooth on beach pebbles (Andrefsky 1998:103). The cortex on quartz is more difficult to distinguish. Ballin (2004:6; 2008:57) describes the cortication of quartz as "frosted" in appearance, occasionally with some of the parent rock adhering to the surface. Cortex on cores signifies the extent to which the core has been worked and was simply recorded as present (P) or absent (A), with a short description of the cortex type also given.

Platform Preparation

- Unprepared – where there has been no preparation of the platform, i.e. it is cortical. Bipolar platforms are also unprepared.
- Simple preparation – where a single flake removal has been used to create the platform.
- Complex preparation – where multiple flake removals have been used to create a platform, i.e. by faceting.
- Lost – when the platform has been removed by later flake removals.

4.3.3.2. Recorded Attributes for Flakes, Blades, Retouched Pieces, Small Fraction and Chunks

Dimensions

The dimensions recorded were length, width, and thickness. Length is defined as the maximum distance between the proximal and distal end of the flake or retouched piece, at 90° to the platform (Andrefsky 1998). For chunks, the length was simply determined by the maximum dimension

(Finlayson *et al.* 2000:62). Width was measured at 90° to the length, at the maximum distance between the lateral edges. Thickness was in turn the maximum measurement taken at 90° to both length and thickness (Andrefsky 1998:97-98).

Cortex

For flakes the presence of cortex on the dorsal face was recorded by percentage. The degree of cortication, in combination with the dorsal scar count, signifies whether the flake is a primary, secondary or tertiary removal, as discussed above. The cortex percentage falls into four categories:

- 100% - primary removal
- ≥50% - secondary removal
- <50% - secondary removal
- 0% - tertiary removal

This follows the ranking proposed by Andrefsky (1998:104). Where values fall close to 50% and were difficult to determine by eye, a dot-grid drawn on permatrace paper was superimposed over the artefact. If the greater proportion of dots covered the cortex area rather than the dorsal scars, the piece was categorised as ≥50%, and *vice versa* (Andrefsky 1998:104). Where ≥50% cortex was present, a short description of the cortex type (e.g. rounded and smooth, flat and frosted) was also provided for the flakes.

Platform Type

The striking platform of flakes can be used to determine a variety of reduction processes (Andrefsky 1998:88). These are identified through various platform morphologies, listed below, that have been adapted from Andrefsky (1998) and Finlayson *et al*. (2000).

- Absent – there is no platform present.
- Broken/Crushed – the platform has been damaged or collapsed during the knapping process. This is often indicative of bipolar reduction (Finlayson *et al.* 2000:66).
- Cortical – the platform is covered with cortex.
- Facetted – a number of flakes have been removed from the platform. The number of facets is not recorded due to the difficulties in consistently recording their number (Andrefsky 1998:92).
- Plain – there has been no alteration or damage to the platform, usually smooth and flat, and made by a single flake removal.
- Prepared – additional flakes have been removed from around the platform prior to striking in order to prepare the platform area, sometimes by reducing its size and thus increasing control of the flake removal. Platform preparation may also involve abrasion of the surface to remove surplus material.

Platform Dimensions

The dimensions of a flake striking platform have been directly correlated with the reduction stage (Magne & Pokotylo 1981). These were only recorded if the platform was present and complete, i.e. it encompasses both lateral edges and the dorsal and ventral surfaces (Andrefsky 1998:89; Odell 1989:185). The platform width was determined as the maximum distance between the lateral edges. The platform depth was recorded as the maximum distance between the ventral and dorsal sides of the flake, at 90° to the width (Andrefsky 1998:92). There may also be a relationship between platform dimensions, and thus flake size, and raw material availability (Dibble 1997:157).

Dorsal Flake Scar Count

The presence of flake 'scars' on the dorsal face of a flake was recorded numerically. This information, when used in association with cortex percentage can be extrapolated to suggest the reduction stage of the objective piece, as discussed above. It is acknowledged that the number of dorsal flake scars can vary depending on the method and stage of reduction, flake size and raw material (Andrefsky 1998:106; Mauldin & Amick 1989:73; Odell 1989:178). This is especially pertinent regarding tertiary flakes, which may derive from any stage of the reduction process once the initial raw material nodule has been decorticated. In light of this the attribute was still recorded, but subsequent interpretation was of little merit. This attribute was not recorded where the dorsal surface exhibited 100% cortex.

Dorsal Flake Scar Pattern

The pattern of scars on the dorsal side of the flake suggests the manner in which previous flakes have been removed (Finlayson *et al.* 2000:66). Four categories recorded were for this:

- Bidirectional – where dorsal scars originate from both the proximal and distal ends of the blank. Indicative of bipolar reduction.
- Multi-directional – where dorsal scars run in several directions, indicating frequent turning of the core.
- Unidirectional – where the dorsal scars originate from a single side or end, this may be the lateral edges, distal or proximal ends.
- Indeterminate – this category was added retrospectively. In some instances it was impossible to identify the direction of multiple removals where the piece was broken or shattered. This was especially applicable to quartz flakes.

Breakage

The degree and type of breakage was previously recorded (Piper 2011), however there was little information that could be gleaned by recording different breakage patterns, beyond the overall greater propensity for quartz to exhibit parallel and perpendicular snaps (Piper 2011:167). The latter are often associated with bipolar knapping (Finlay *et al.* 2000:563). However, interpreting the significance of breakage patterns is difficult due to the numerous ways in which an artefact may have been broken. Breakage may have occurred accidentally or deliberately during manufacture or use, or through post-depositional trampling (Cotterell & Kamminga 1987:691; Wickham-Jones 2009b:244). Consequently, breakage is simply recorded as present (P) or absent (A), and does not assume the nature of the cause of the break (Inizan *et al.* 1999:131).

Retouch

The recording methodology for secondary retouch used directly follows Ballin (2000; Table 2), but excludes percussion angle.

Notes

This section recorded any additional information such as common features with other pieces.

4.3.4. A Note on Natural Fragments

Two of the sites from Lewis contained a large amount of ‘background quartz’ – quartz fragments that were present in extremely high quantities in the lower archaeological layers. This quartz was primarily of a milky-rock crystal variety with very frequent micaceous inclusions and is evidently a component of the natural background geology of the region. It is almost certain that none of these pieces had been worked do to the poor quality of the quartz, however this cannot be guaranteed. Therefore, the ‘background quartz’ was weighed and archived in case further analysis is required.

Description	Attribute	Definition
Type	Edge	Restricted to the outer sixth of the maximum width, along the edge of an artefact
	Invasive	Extends to within four-sixths of the width of the artefact and is only considered completely invasive if >90% of either face of the artefact is retouched
Extent of retouch	Un-retouched	The edge of the artefact is not retouched
	Sporadic	Regular retouch along < 8mm of the edge
	Continuous	Regular retouch along > 8mm of the edge
Orientation of retouch	Normal	Extends into the dorsal face; initiated from the ventral side
	Inverse	Extends into the ventral face; initiated from the dorsal side
	Alternating	Alternates between normal and inverse along the same lateral edge
	Propeller	Normal retouch on one lateral edge, inverse on the other
Fineness of retouch (length of each removal)	Very fine	>0.5mm to ≤1mm
	Fine	>1mm to ≤30mm
	Coarse	>3mm to ≤5mm
	Very coarse	>5mm
Morphology of retouch	Scaled	Resemble fish scales where the removals are short and widest at the distal end, often with hinged terminations
	Stepped	As scaled, but with stepped terminations
	Parallel	Individual removals are elongated and separated by parallel arrises
	Sub-parallel	Individual removals are elongated and separated by approximately parallel arrises
Angle of retouch	Very acute	0° to 15°
	Acute	16° to 45°
	Abrupt	46° to 75°
	Very abrupt	76° to 90°
	Obtuse	>90°
Course (delineation) of retouch	Straight	Follows a straight line
	Convex or concave	Curving
	Notched	A deliberate removal from the lateral edge which may be made up from a single, or multiple removals and creates “a small concave feature”
	Denticulated	A denticulation comprises more than two notches
	Shouldered	Found at either the proximal or distal end of an artefact where the retouch is concave-convex
	Nosed	As shouldered but where the retouch is concave-convex-concave

Table 2. List of recorded retouch attributes (after Ballin 2008)

4.4. Conclusion

This chapter has outlined the methodology used to record the lithic assemblages from the Western Isles sites, and is specifically designed to answer the first research question of this thesis: *what is the nature of the lithic technology of the Mesolithic in the context of the Western Isles of Scotland?* The recorded attributes are outlined and explained accordingly. This methodology was based upon those used in previous excavations of Mesolithic sites in the Inner Hebrides and the Scottish mainland to ensure the results are comparable. However, given the significant quantities of quartz recovered from each of the Western Isles sites, in contrast to the flint-dominated assemblages of comparable sites, these methodologies could not be strictly adhered to.

The only synthetic review of quartz technology in Scotland has been published by Ballin (2008), therefore the outcomes of his study were of central importance to outlining the overall debate surrounding quartz analysis, and also the remit of this thesis. I concur with the majority of Ballin's findings – the most significant of which is that quartz *can* be analysed within the same typology as flint, providing the differences in fracture mechanics are accounted for. Ballin's simplistic classification of 'tool', however, is not consistent with the definition outlined by Inizan *et al.* (1999). I also agree with the view that the disregard of un-retouched pieces as tools would present a biased picture of the archaeological record, and contradicts over three decades of lithic and use-wear research (Driscoll 2010:79-80).

The results of the assemblages analysed, and their implications for answering the research questions reiterated in the introductory section, are presented in the subsequent two chapters. The raw data are presented in Appendix Three through to Appendix Ten.

Chapter 5 Mesolithic ‘Open Air’ Sites on Harris

5.1. Introduction

This chapter introduces two Mesolithic sites on the Toe Head peninsula, South Harris – Northton and Tràigh an Teampuill**.** The nature of discovery, and subsequent excavation of the sites is outlined to provide background and context for the lithic assemblages. The results of the lithic analysis, which were analysed following the methodology in the previous chapter, are then presented**.** The full catalogue of recorded attributes can be found in Appendix Three.

Toe Head is a prominent headland situated in the south-west of South Harris. It is dominated by the hill of Ceapabhal, through which runs an exposed pegmatite dyke; the surrounding landscape comprises a system of sand flats and saltmarsh, beaches, dunes and machair which is a designated SSSI (Scottish National Heritage 2011). The two sites of Northton and Tràigh an Teampuill are situated c.250m apart on the south-western Atlantic facing stretch of the peninsula (Figure 24). Both are ‘open air’ sites with exceptional organic preservation and date to the late Mesolithic (c.7000-5400 cal. BC). As discussed in Chapter Two, this is extremely rare in the Mesolithic archaeological record of Scotland. Only three other ‘open air’ sites at Rubha Port an t-Seilich and Storakaig on Islay, and Fiskary Bay on Coll contain comparable faunal assemblages, and have only recently been identified (Mithen & Wicks 2009; 2010; 2011a; 2011b; 2011c; 2012; 2013; Mithen *et al.* 2007d). Previously, Mesolithic faunal remains in western Scotland have only been recovered from a small number of shell midden sites on the small island of Oronsay, An Corran on Skye, and Sand and the ‘Obanian’ cave sites on the western mainland (Bonsall 1996; Hardy & Wickham-Jones 2009b; Mellars 1987; Saville *et al.* 2012b). This makes Northton and Tràigh an Teampuill among the first non-shell midden Mesolithic sites to contain organic remains other than charcoal.

The phrase ‘open air’ refers to the fact these sites are not found in caves. Such sites can thus be both shell midden and non-shell midden sites. It would be misleading to refer to non-shell midden sites as 'settlement’, ‘activity’, ‘habitation’ or ‘occupation’ sites, since it implies that the evidence for human presence at shell midden sites does not warrant such interpretation, or that these activities were not conducted there.

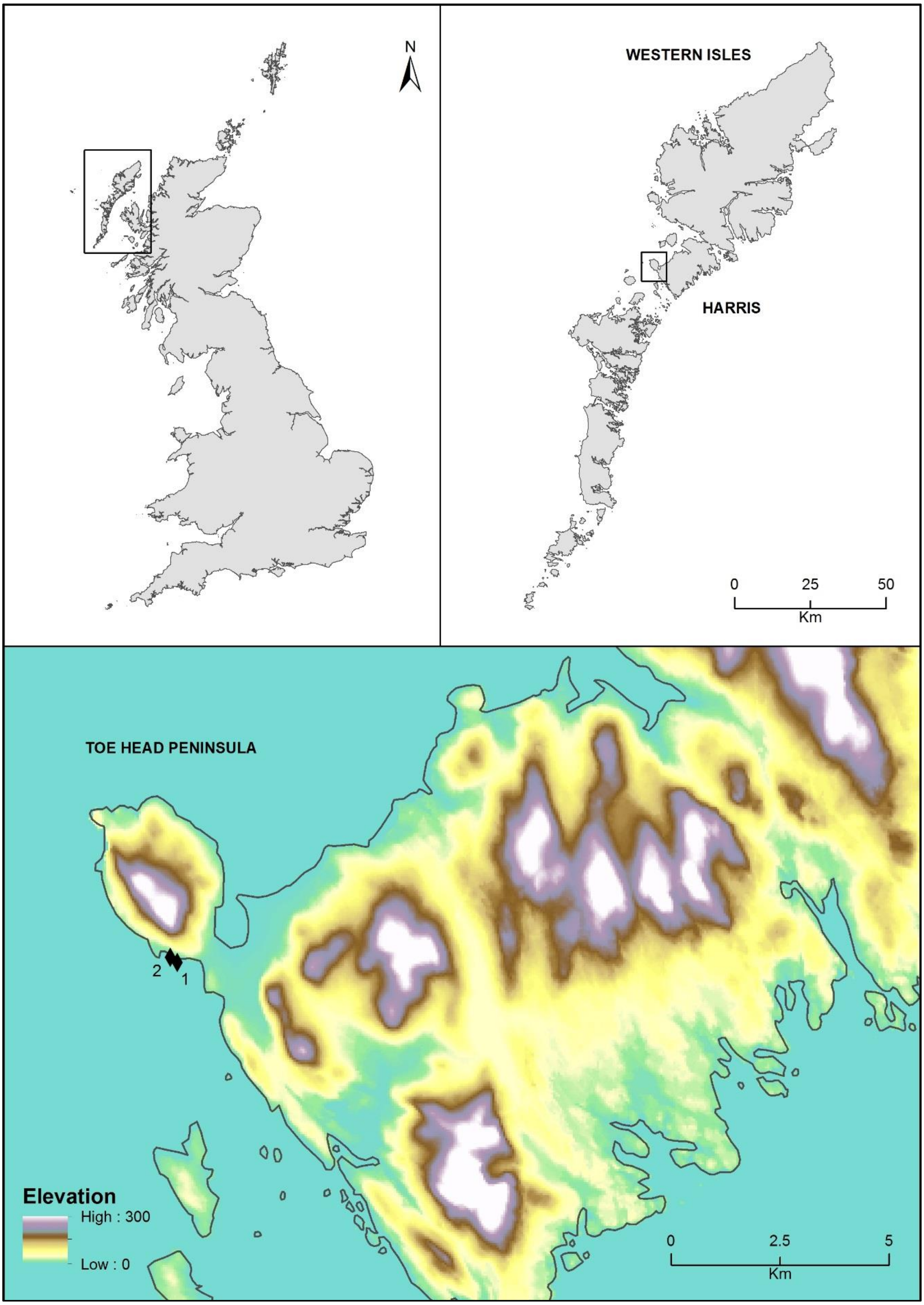


Figure 24. Location of the two sites on Harris. 1 - Northton, 2 - Tràigh an Teampuill. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

5.2. Northton

5.2.1. Discovery and Excavation

5.2.1.1. Excavation 1963-1966

Northton (NGR NF975 612) was initially identified in 1963 by Professor James McEwan when 'kitchen midden' deposits containing a variety of marine molluscs, mammal bones, and pottery were observed eroding from machair on the headland (Murphy *et al.* 2001:5). McEwan conducted a small rescue excavation at the site in the subsequent year, as significant damage was being caused to the deposits by grazing animals and rabbit trappers. He identified Neolithic, Beaker, and Iron Age occupation levels, and recommended that further research should be conducted by professional archaeologists (Murphy *et al.* 2001:5).

In 1965 and 1966 investigations were continued by a team under the direction of Professor Derek Simpson. These confirmed the findings of McEwan. However, the full importance of the site was not recognised as, due to a lack of funding, post-excavation analysis and full publication could not be completed for the excavations beyond interim statements (Murphy & Simpson 2000; Simpson 1965; 1966; 1971; 1976; Simpson *et al.* 2006:15-17; Thomas 1970). The site was scheduled under the Ancient Monuments and Archaeological Areas Act of 1979 in 1992 (Historic Scotland 1992).

5.2.1.2. Excavation 2001

In 2000, a grant was awarded by Historic Scotland to conduct another season of excavation at Northton, and to publish in full the findings from Simpson's excavations (Gregory *et al.* 2005:945; Simpson *et al.* 2006:17). The aims of this investigation were to recover data that could be integrated into the results of the 1960's investigations and assess the damage being caused by coastal erosion through topographic survey, coring, and excavation of exposed deposits (Murphy *et al.* 2001:2).

The assessment successfully identified "sections of archaeological significance" threatened by coastal erosion. These areas were targeted for excavation and are identified as the 'Small Section' and the 'Large Section' (Murphy *et al.* 2001:9). In the 'Large Section' total sampling was conducted, with bulk and routine soil samples taken to ensure maximum recovery of archaeological material (Jones 1991; Murphy *et al.* 2001:16). In this section two phases of potential Mesolithic activity were noted, in addition to the later prehistoric phases initially identified by McEwan (Simpson *et al.* 2006:18).

Phase I represented the earliest evidence of occupation at Northton. Deposits situated immediately above the natural boulder clay, and initially interpreted as early to mid-Holocene palaeosols contained burnt and unburned fish, small mammal and bird bones, charred hazel nutshell and charcoal (Church 2006a:36; Hamilton-Dyer 2006:33). Routine soil testing also indicated enhanced phosphate and magnetic susceptibility levels. Although no artefacts were present in this phase the evidence strongly suggested anthropogenic activity was present in these deposits (Gregory *et al.* 2005:946-948; Murphy *et al.* 2001:15-18). Two hazel nutshells yielded radiocarbon dates of 7051-6657 cal. BC (2σ) for the earliest occupation levels of the site (Church pers. comm.).

Phase II contained extensive occupation evidence in the form of two stone features and associated organic deposits. These deposits comprised a faunal assemblage much like that of Phase I, but with a greater number of taxa represented, in addition to marine molluscs. A lithic assemblage of worked quartz, flint and coarse stone tools was also recovered (Gregory *et al.* 2005:945). The hazel nutshells submitted for dating indicated the occupation of Phase II dated to 6559-6103 cal. BC (Church pers. comm.). A degraded barley grain and sheep phalanx was also found in this phase, and represent domesticated species that are not consistent with the Mesolithic dates. The routine soil tests suggested that the deposits of Phase II were heavily eroded and bioturbated, which may have resulted in later material becoming incorporated into the lower layers (Church pers. comm.; Gregory *et al.* 2005:946).

The 2001 excavation at Northton, Harris identified the first unequivocal evidence for a Mesolithic presence in the Western Isles, and the most western extent of hunter-gatherer occupation in Europe (Bishop *et al.* 2011b). This supports the long-held claim that palaeoenvironmental disturbances observed in the palynological record on Lewis and South Uist were likely to be caused by anthropogenic activity (Gregory *et al.* 2005; Gregory & Simpson 2006).

5.2.1.3. Excavation 2010

Dr Mike Church, a member of the 2001 investigation team returned with a team from Durham University in 2010 to conduct an excavation of the Mesolithic deposits. Aggressive coastal erosion – the very reason the site was discovered in the 1960's – continued to threaten the site, therefore assessing the state of erosion was the primary objective (Bishop *et al.* 2011a). The Mesolithic deposits had eroded by c.1m since 2001; the overlying later prehistoric deposits were almost entirely destroyed, most likely due to a violent winter storm in 2006 (Bishop *et al.* 2011a:4; 2011b).

Following the methods implemented in 2001, total sampling of the site was continued to ensure maximum recovery of archaeobotanical and zooarchaeological remains. A 2m X 5m trench was situated parallel to the location of the since-eroded 'Large section' of the 2001 excavation, along the exposed section of Mesolithic deposits (Figure 26). The total area of the trench was excavated to reveal the Mesolithic deposits. However, due to time constraints only an area 1m X 5m contiguous to the eroding edge could be excavated in its entirety down to the glacial till (Bishop *et al.* 2011a:3; Figure 26). In order to establish the depth and extent of the basal midden deposit, a 1.1m X 0.1m extension was made from the south-east edge of the trench, again along the eroding edge (Bishop *et al.* 2011a).

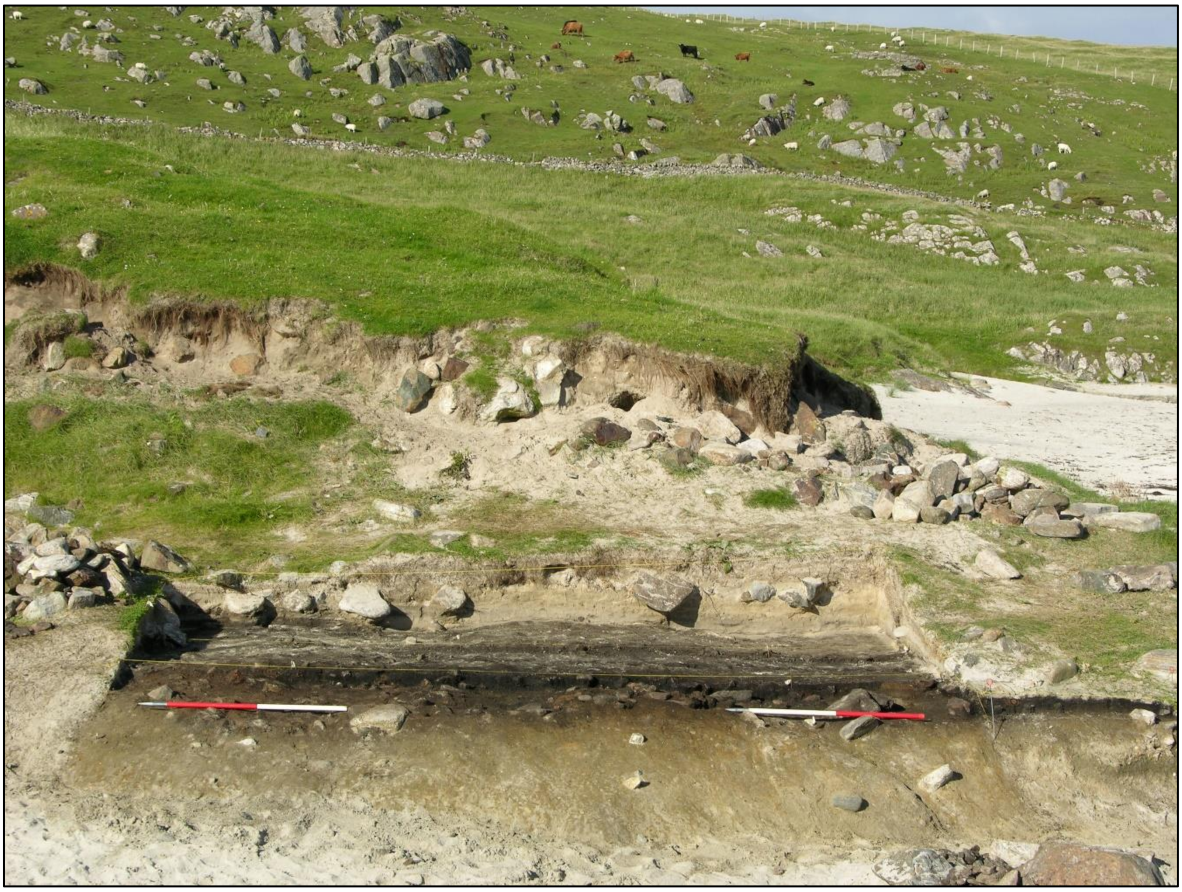


Figure 25. The Mesolithic deposits under excavation at Northton during 2010 with the later prehistoric settlement eroding above. Photo courtesy of Mike Church

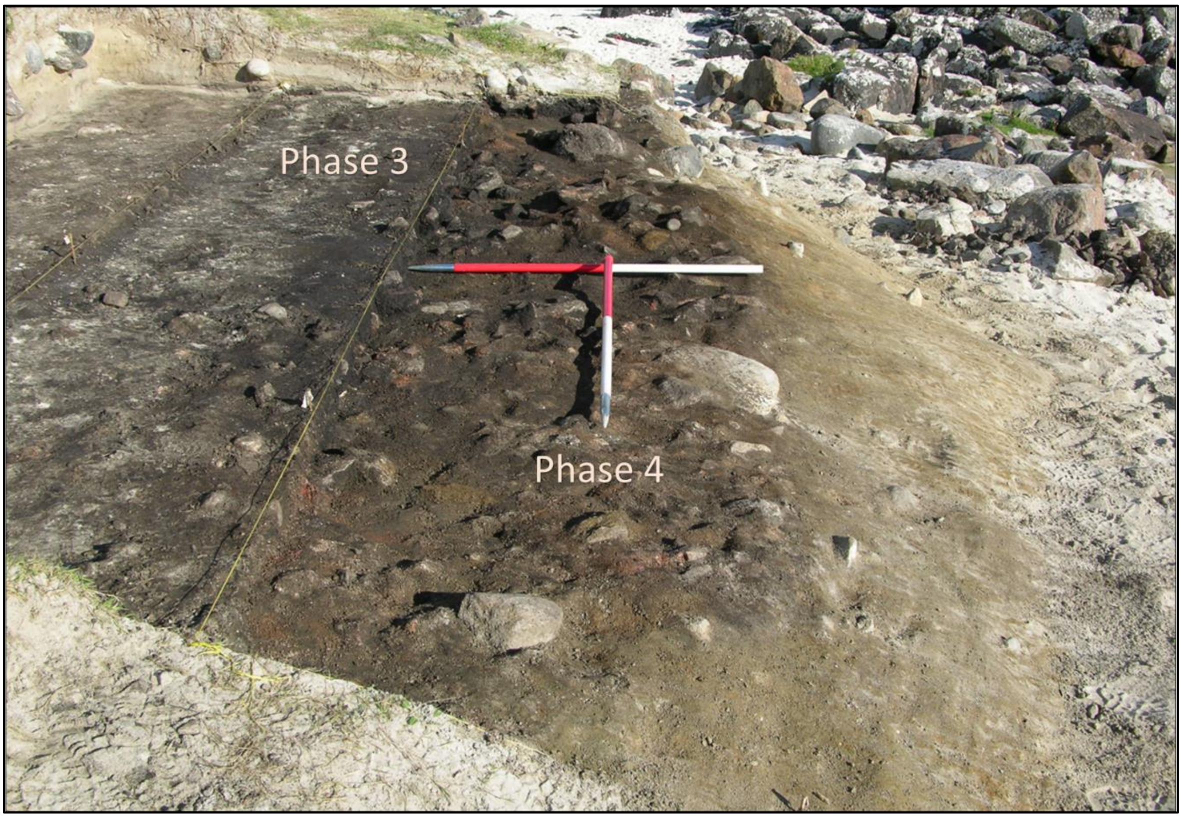


Figure 26. The trench at Northton during excavation in 2010 with the Phase 3 and Phase 4 deposits revealed. Photo courtesy of Mike Church

The phasing of the 2010 excavation at Northton is summarised in Table 3. Phase 3 was originally interpreted as comprising two phases: Phase 3a was thought to indicate terminal Mesolithic to Early Neolithic occupation at the site, whereas Phase 3b represented an intermediate phase of Mesolithic occupation (6559-6103 cal. BC; Bishop *et al.* 2011a:4-5). Following the submission of four hazel nutshells from Phase 3a for radiocarbon dating in 2010, this phasing has since been revised. The results span 6421-6117 cal. BC, making it contemporaneous with the dates from 3b and thus part of the same phase of later Mesolithic occupation at the site. It is subsequently referred to as Phase 3 (Bishop *et al.* 2012a:10-11).

Original Phasing	**Composition and Interpretation**	**Subsequent Phasing**
1	Turf overlying eroded modern and re-deposited material, mixed with disturbed and bioturbated windblown sand deposits	**1**
2		**2**
3a	Later Mesolithic occupation phase (6421-6117 cal. BC)	**3**
3b	Undisturbed *in situ* archaeological deposits from an intermediate phase of Mesolithic occupation (6559-6103 cal. BC)	
4	Undisturbed *in situ* archaeological deposits of most substantial evidence Mesolithic activity and the earliest dated phase of occupation at Northton (7051-6657 cal. BC)	**4**
5	Natural glacial till	**5**

Table 3. Revised Northton phasing (after Bishop *et al.*10-11; Bishop *et al.* 2011a:3-4)

The main occupation phases from Northton represent a palimpsest of bioturbated occupation deposits. In addition to knapping debris from quartz, flint, and baked mudstone, fuel remnants and burnt food waste from hearths were recovered. This included charcoal, hazel nutshell, seeds, tubers, burnt fish, small mammal and bird bone, shell fish and crustacean (Bishop 2013; Bishop *et al.* 2011a:5; 2011b; Blake 2011; Gregory *et al.* 2005:945; Piper 2011).

5.2.1.4. Excavation 2011

In 2011 an environmental sampling programme was conducted at Northton to assess the spatial extent of the Mesolithic deposits around the headland, in addition to sampling for pollen and land snails for palaeoenvironmental analysis. This was conducted by taking bulk samples at 3m intervals, where possible, along the eroding coastal edge to the north-east and north-west of the trench excavated in 2010 (Bishop *et al.* 2012a:9). The sampling indicated that the upper Mesolithic deposits were absent in the sections over 18m to the north-west of the 2010 trench, and over 25m to the north-east. Consequently it has been suggested that these upper Mesolithic layers were restricted to an area extending c.45-50m along the coast. This was supported by the borehole survey in 2001, which revealed the same deposits extending a minimum of 40m into the headland interior (Bishop *et al.* 2012a:12; 2012b). The lower Mesolithic deposits were identified in all of the sections excavated (with a single exception), and the borehole survey of 2001, therefore it appears that the earlier Holocene soil horizon extends over a much greater area of the peninsula (Bishop *et al.* 2012a:13). In total over 1000 litres of soil were excavated from Northton during 2010 and 2011.

A relic peat section had been noted during fieldwork in 2010, but due to time constraints was not sampled during the field season. A column sample was excavated from the section in 2011 to provide a palaeoenvironmental context for the archaeological remains. This has been analysed for pollen that could indicate the scale of human impact on the environment (Bishop *et al.* 2012a:8; Bishop *et al.*). An additional column sample was excavated from pre-machair deposits close to the 2010 trench for land snail analysis and to further contextualise the environment around the site (Bishop *et al.* 2012a:8).

The absence of any archaeological features, and minimal recovery of artefacts in the excavated sections around the main site, suggests that Northton and Tràigh an Teampuill (discussed below) are representative of distinct areas of Mesolithic occupation that occurred at different times over the course of almost 1700 years. It is highly probable there are other sites of similar nature in the area (Bishop *et al.* 2012a:13).

5.2.2. Northton Lithic Assemblage Results

The results presented in this section first comprise a summary of the lithics recovered during the excavations in 1965-66 and 2001. These are followed by a detailed analysis of the assemblage excavated in 2010. The results from the excavation in 2011 are discussed in isolation, since the deposits were located away from the main trench excavated in 2010; as such, the stratigraphic continuity cannot be guaranteed.

5.2.2.1. Results from 1965-66 and 2001

Eiméar Nelis of Queen’s University Belfast conducted an analysis of the chipped stone artefacts recovered from both the 1965-66 and 2001 excavations (Nelis 2006b:23). The original excavations in 1965-66 yielded an assemblage of 13 artefacts, excavated from the basal horizon below the Neolithic deposits. Nelis suggested that the stratigraphic position of this basal horizon corresponded closely with the basal horizon from Phase I of the ‘Large Section’ excavated during 2001, and thus likely to be of Mesolithic date (Nelis 2006b:23). The assemblage is detailed in Table 4. It comprised knapping waste from the production of flakes and blades, and only a single formal tool – “a barely modified piercer” – was recovered. Flint dominated this small assemblage, with only four pieces of quartz present – a flake, a piece of microdebitage, and two indeterminate shattered pieces (Nelis 2006b:23).

	Material				
	Flint		**Quartz**		
Technology	**No.**	**Max. length (mm)**	**No.**	**Max. length (mm)**	**Total**
Complete flakes & blades	5		1		6
Flake - platform	*1*	17	*1*	10	*2*
Flake - bipolar	*1*	<25			*1*
Blade - bipolar	*2*	<25			*2*
Flake - microdebitage	*1*	<5			*1*
Shattered flakes & blades	3		1		4
Flake - indeterminate	*3*	<9			3
Microdebitage			*1*	<5	*1*
Angular shatter			2		2
Angular shatter			*2*	<25	*2*
Possibly modified/utilised	1				1
Piercer-on-flake shatter	*1*	<25			*1*
Total	9		4		13

Table 4. Nothton excavation 1965-66: Lithic assemblage from basal horizon (after Nelis 2006b:24)

An assemblage of 45 lithics were recovered from the Phase II deposits of the 2001 'Large Section' excavation, detailed in Table 5 (Nelis 2006b:24). The assemblage was overwhelmingly dominated by quartz, which included vein quartz, fine quartz, and orthoquartzite. A single flake of hornfels and only two pieces of flint microdebitage were present in the assemblage, which contrasts to the raw material composition of the lower deposits recovered in 1965-66. The typology comprised a large quantity of indeterminate shattered pieces, with a small number of flakes and blades reduced through both platform and bipolar technology, in addition to a single platform core. The high quantity of waste, and absence of formal tools, was attributed to the poor knapping quality of quartz (Nelis 2006b:25). Two coarse stone tools were also recovered during the 2001 excavation. One is a water-worn granite cobble, likely a manuport and with no apparent signs of use-wear; the other is a fractured gneiss pebble. Both are locally derived raw materials; it is suggested that the former may have been used for cracking hazel nutshells or in hide processing, and that the latter was probably a hammerstone used in lithic knapping (Gregory 2006).

Given the lack of diagnostic Mesolithic artefacts from the 1965-66 and 2001 excavations, Nelis (2006b:25) discusses the material in very little detail. The absence of characteristic microliths is noted, along with a simple statement that "the assemblage is mostly comprised of flake and blade debitage, which indicate the application of platform and bipolar techniques…such characteristics are not distinct indicators of Mesolithic activity". As such, lithic material from these early investigations did not fit with the current understanding of a 'classic' Mesolithic assemblage. Instead, it seemed that Northton constituted an assemblage more characteristic of the undiagnostic, or amicrolithic, ‘Obanian’ sites on Oronsay. The overall interpretation of the undiagnostic material from Northton is that it may be “representative of a Mesolithic chipped stone assemblage in, at least, this area of the Western Isles”, and consequently “…suggest that the seemingly undiagnostic lithic scatters of the region represent the very evidence that has eluded the recognition of Mesolithic activity in this region for so long” (Gregory & Simpson 2006:79). This suggestion is discussed further in Chapter Nine.

The range of quartz types present in the 1965-66 and 2001 assemblages from Northton vary between ‘vein quartz’ and ‘orthoquartzite’ (Table 5). This is likely to be a factor in Nelis’ description of the quartz at the site as “poor quality”, although there is no qualifying statement as to why (2006b:24-25). The Northton report was published prior to the publication by Ballin (2008) on quartz use in Scottish prehistory, therefore the categorisation of the quartz varieties do not follow those provided by Ballin and which have been used in this thesis. As such, close comparisons between the quartz assemblage recorded by Nelis and the material recovered between 2010 and 2011 cannot be made.

	Material												
Technology	Vein Quartz		Quartz		Fine Quartz		Ortho-quartzite		Flint		Hornfels		
	No.	Max length (mm)	No.	Max length (mm)	No.	Max length (mm)	No.	Max length (mm)	No.	Max length (mm)	No.	Max length (mm)	
Unworked/Angular shatter	21		6		1		3						31
Angular chunks	*13*	*75*	*2*	*24*			*3*	*50*					*18*
Micro-shatter	*8*	*5*	*4*	*4*	*1*	*4*							*13*
Cores	1												1
Single platform	*1*	*45*											*1*
Complete flakes & blades			1		1				2		1		5
Flake – platform			*1*	*74*	*1*	*13*							*2*
Flake – bipolar											*1*	*19*	*1*
Microdebitage									*2*	11			*2*
Shattered flakes & blades	1		5		2								8
Flake shatter	*1*	*9*	*5*	*5*	*2*	*24*							*8*
Total	23		12		4		3		2		1		45

Table 5. Northton excavation 2001: Lithic assemblage from Phase II deposits (after Nelis 2006b:24)

5.2.2.2. Northton 2010 Excavation Lithic Assemblage Results

A pilot study was conducted on a sample of lithics recovered from the Mesolithic deposits excavated at Northton in 2010 for my MA dissertation (Piper 2011). Since the pilot study the excavated samples from the site have been fully processed, which has expanded the size of the assemblage. The phasing of the site has been also been revised (Bishop *et al.* 2012a:10-11). Consequently, the entire assemblage has required a complete and total re-assessment.

This section describes the results of the complete lithic assemblage from the Mesolithic deposits at Northton. A general overview of the assemblage and raw materials is presented, followed by analyses of the lithic composition from each Mesolithic phase. A bag of unstratified material of mixed date, including lithics, pottery and animal bone was recovered from the beach at Northton during a site visit by the Historic Scotland warden in 2009. Due to the absence of stratigraphic information this material was not included in the main analysis but is catalogued in Appendix Three.

It should be noted there is some concern over the identification of baked mudstone and mylonite in assemblages from the Western Isles. The Laxfordian shear zone runs very close to Tràigh an Teampuill, and banded mylonite has formed adjacent to this (Phillips 2006a). Torben Ballin (2014) states there is disagreement between geologists over the definition of meta-sediments from the Southern Hebrides and Western Isles, which have been variously described as mylonite, baked mudstone or hornfels. In an archaeological context these are often indistinguishable in appearance, due to weathering and post-depositional processes which render them "powdery and 'blurry' on the outside". Therefore, unless thin-sectioned these raw materials are almost impossible to differentiate (Ballin pers. comm.). Ballin believes that the mylonite from the Western Isles is "stripy" – which would fit with the "finely banded" description of Phillips (2006a) – whereas baked mudstone from Staffin, Skye is "monochrome" (Ballin pers. comm.). This fits the description of indurated (hardened) baked mudstone blade fragment analysed by Phillips from the Neolithic layers at Northton, which is described as:

> "a fine-to very fine-grained, indurated, hard baked mudstone which possess a dull/matt lustre. The weathered surface of the sample is a light olive-grey (Munsell colour code 5 Y 5/2)…The rock is essentially massive, but a weak sedimentary lamination or banding has been recognised under the microscope. The most distinctive feature of the sample is the mould of a *c*. 1 cm in diameter iron concretion or nodule on one of its surfaces…" (Phillips 2006b).

A late Beaker period flake from the site was thin-sectioned in 2001. This was deemed to be 'Harris mylonite' based on the hand specimen. Following thin-section analysis the 'Harris mylonite' was actually found to be an indurated, laminated baked mudstone rather than a true mylonite, and likely sourced from the Shiant Isles or Staffin, Skye (Phillips 2006b).

A raw material which closely fits the description of baked mudstone described by Phillips was identified in the Phase 3 deposits at Northton in 2010. Therefore, two pieces of the raw material suspected of being baked mudstone were selected for further assessment using thin-section analysis. The detail of this analysis is presented in Appendix Thirteen and based on the results, it is clear that the raw material within the Northton assemblage is not mylonite, and more closely resembles baked mudstone. Given the difficulty in distinguishing between certain raw materials, it may be that the hornfels piece identified in 2001 is the same raw material as this, although without re-analysis or thin-section of this piece, this remains purely speculative.

5.2.2.2.1. General Character of the Assemblage

There are a total of 785 pieces of lithic material from the Mesolithic phases of Northton. Of these, four were identified as natural fragments and not modified through human action (SF35, SF70a, SF80 and SF90). These are therefore excluded from the subsequent analysis, which comprises 781 lithics, recovered as small finds during the excavation and from the >4mm sieved fraction of the bulk samples. Nine flakes and a scraper were archived for future residue analysis; these are therefore only included within the results for basic raw material and size data.

Overall, flakes and small fraction flakes (<10mm) dominate the assemblage (Figure 27). Flake cores, core rejuvenation flakes, blades and retouched pieces are present in small numbers. The remainder of the assemblage comprises a quantity of cores, indeterminate chunks, several coarse stone tools, manuports, and a hammerstone (Table 6).

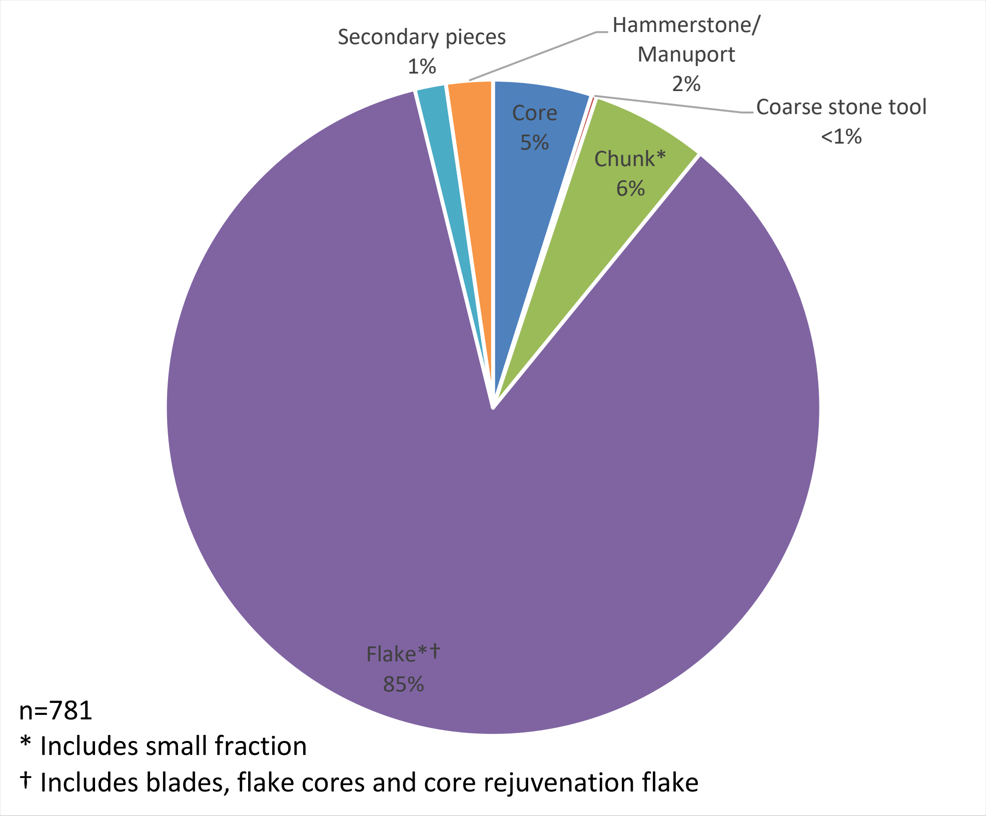


Figure 27. Northton 2010 assemblage composition

Technology	**Raw Material**				
	Quartz	**Flint**	**Baked mudstone**	**Other**	**Total**
Core	32	3	2	1	38
Coarse stone tool				2	2
Chunk	12	3	2	2	19
Small Fraction Chunk	16	6	4		26
Flake	260	44	35	5	344
Blade	2		1		3
Core rejuvenation flake	2	2			4
Flake Core	3		1		4
Small Fraction Flake	207	65	37	2	311
Secondary pieces	2	10			12
Hammerstone				1	1
Manuport	4			13	17
Total	540	133	82	26	781

Table 6. Northton 2010 assemblage composition

5.2.2.2.2. Raw Material

In terms of the flaked lithics, the assemblage at Northton is dominated by quartz (Figure 28 and Table 6). Flint and baked mudstone are present in much smaller quantities, and there are small numbers of other raw materials such as carbonate, chalcedony, feldspar, and pegmatite. Small cobbles of gneiss and metabasalt, probably transported from the beach, and several igneous rocks of an unknown type were also present.

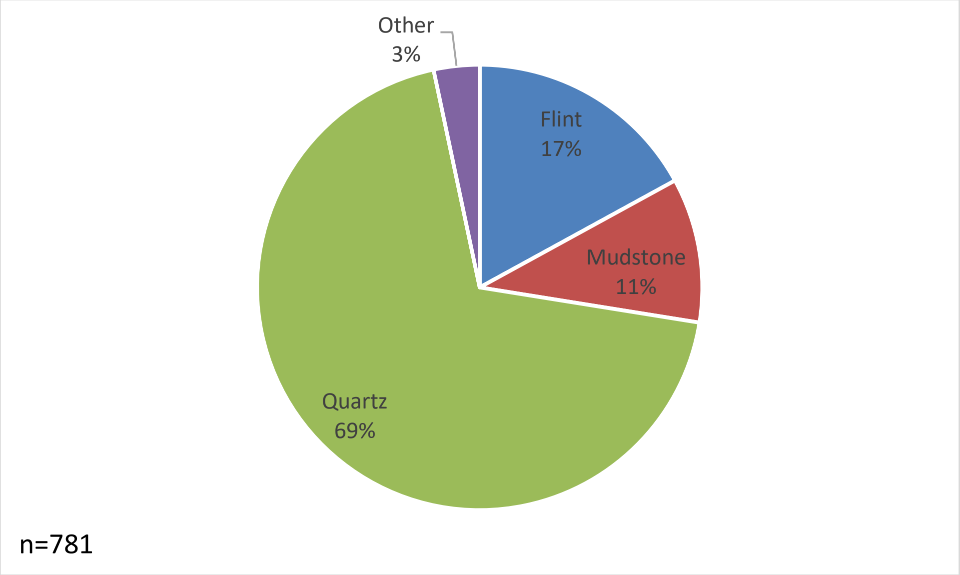


Figure 28. Northton 2010 raw material composition

Milky quartz is the most frequently represented variety of quartz at Northton (Figure 29). There are also a very high number of pieces made from mixed quartz, where one variety grades to another. Most often the mixed varieties are comprised of greasy to fine grained, milky to fine grained, or milky to rock crystal. Feldspar is also found mixed with some of the quartz pieces. The other quartz varieties are only present in small quantities, with fine grained and greasy the most common of these. There are very few pieces of rock crystal, coarse grained quartz or quartzite. The quartz variety was not recorded for the eight quartz pieces archived for residue/microwear analysis.

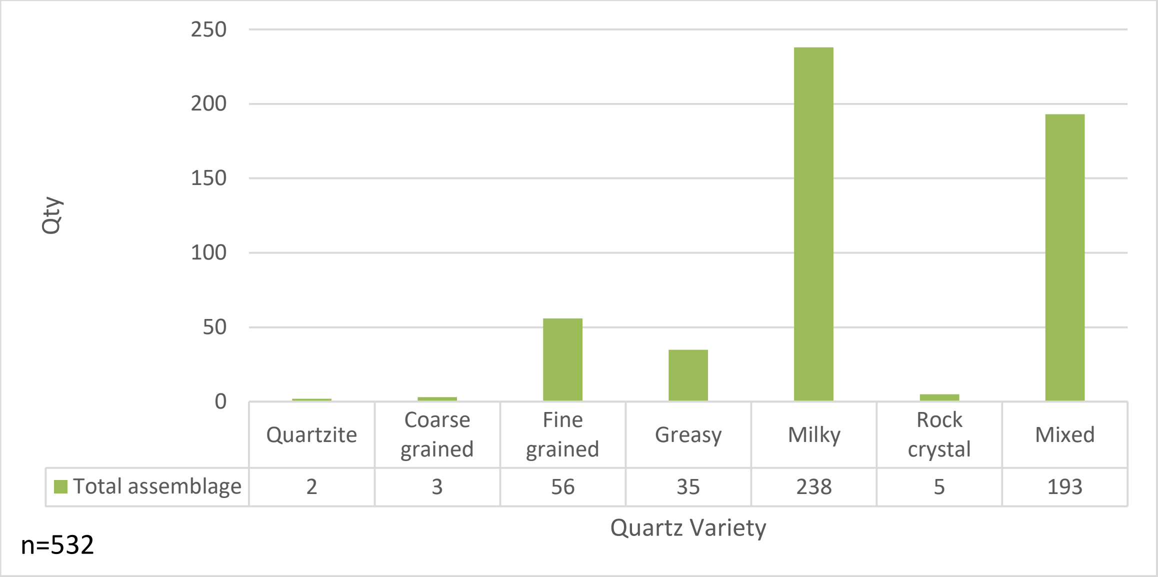
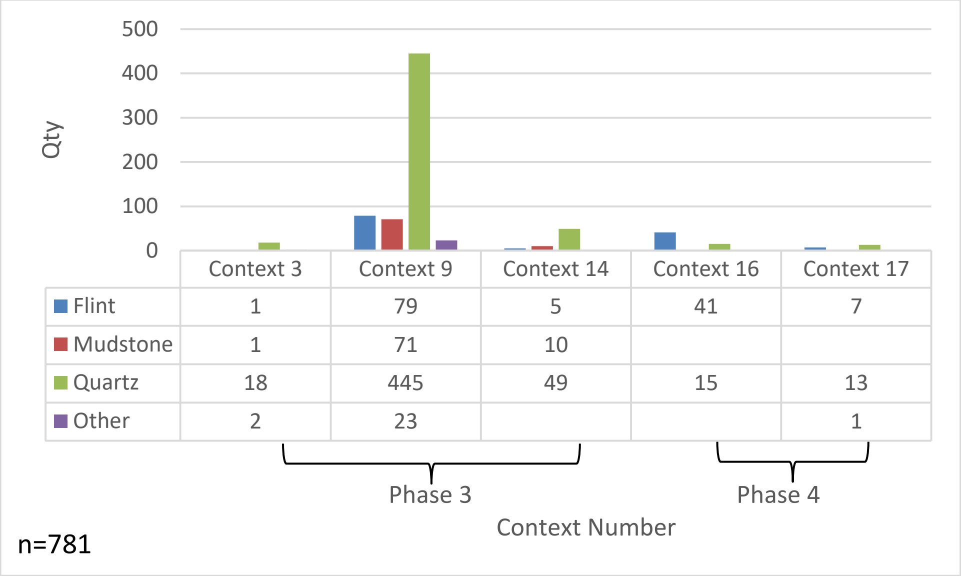


Figure 29. Northton 2010 quartz varieties

The flint assemblage from Northton has a fresh appearance, which suggests it has not suffered from excessive post-depositional movement. All of the flint pieces have a creamy-white patina and ten pieces retain the same pink cortex, suggesting they derive from the same nodule. Six pieces have been burnt; these are grey in colour and display crazing on the surface.

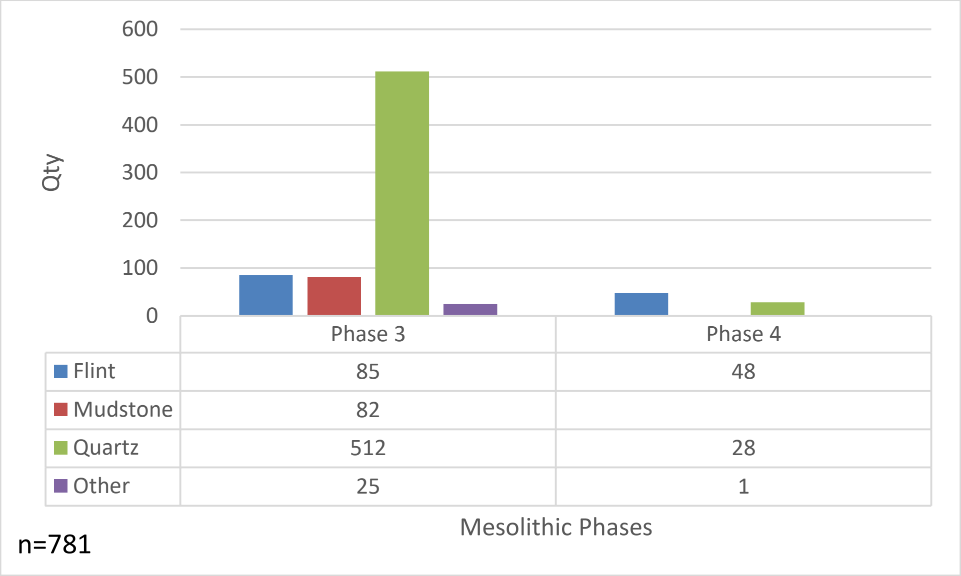
There are five contexts which provided material of Mesolithic date (Figure 30). Three of these are dated to the later Mesolithic phase of occupation, Phase 3 (C003, C009 and C014), and two are from the earlier phase, Phase 4 (C016 and C017). C009 is the largest excavated context and provides the most material. It is dominated by quartz but also contains a quantity of flint and baked mudstone. The largest proportion of 'other' raw materials also comes from this context. Quartz is the most frequently recovered raw material in all the other contexts, with the exception of C016. This is the only context that produced more flint than quartz. Flint is also present in small quantities in C003, C014, and C017. Baked mudstone is found only in the Phase 3 contexts.

Overall, Phase 3 is dominated by quartz and contains a wider variety of raw materials than Phase 4. These include baked mudstone, carbonate, chalcedony, feldspar, gneiss, metabasalt, and pegmatite (Figure 31). In contrast, flint is the most common raw material in Phase 4. There is no baked mudstone from this phase and only a single flake of unknown raw material was identified alongside the small quantity of quartz.



	Context 3	Context 9	Context 14	Context 16	Context 17
🟦 Flint	1	79	5	41	7
🟥 Mudstone	1	71	10		
🟩 Quartz	18	445	49	15	13
🟪 Other	2	23			1

Figure 30. Northton 2010 raw material by context, with phases indicated



	Phase 3	Phase 4
🟦 Flint	85	48
🟥 Mudstone	82	
🟩 Quartz	512	28
🟪 Other	25	1

Figure 31. Northton 2010 raw material by phase

The analysis below focusses on the primary and secondary technology from the large fraction (>10mm) of the Northton 2010 assemblage. *In situ* knapping is evidenced by the presence of small fraction flakes, beyond this there is little that can be deduced from such small pieces, which may also be from natural collision. This information is also true for chunks and small fraction chunks. Results of the small fraction flake, chunk, and small fraction chunk analysis is detailed in Appendix Eleven.

5.2.2.2.3. Primary Technology: Coarse Stone Tools

5.2.2.2.3.1. Anvil

A gneiss anvil (SF22) was recovered from Phase 3 (C009; Figure 32). It measures 112.5mm at its maximum dimension and weighs 746.5g. One side is rounded, and the opposing side displays seven multidirectional removals from unprepared platforms. One of the removals forms a shallow depression in the centre of the cobble that could have been used to hold material in order to facilitate bipolar reduction.

Figure 32. Overhead view of the anvil (SF22) from C009, Northton

5.2.2.2.3.2. Chopper

A chopper (SF91) of gneiss was also recovered from Phase 3 (C009). The maximum dimension of this piece is 94.5mm and it weighs 342.9g. A total of six unidirectional removals have been made from an unprepared platform along one face, creating a cutting edge. Fractures are present on the unworked face, and likely to have been caused by two of the flake removals.

5.2.2.2.3.3. Hammerstones and Manuports

A single feldspar hammerstone (L517) was identified in Phase 3 (C003). It measures 44.4mm X 57.3mm X 27.6mm in dimension, is semi-circular in shape, and has broken in two places. The rounded end of the piece displays some pitting which may be percussion damage (Figure 33).

Figure 33. Broken hammerstone L517

Seventeen manuports were recovered from Phase 3 contexts. Two came from C003 – one rounded cobble of milky quartz, and one piece of gneiss which appears to have a natural fracture on one side. On the opposite side the surface is very smooth with some post-depositional concretion and has the appearance of being worn. The other manuports were recovered from C009 and comprise: ten rounded to sub-rounded cobbles of gneiss; three rounded to sub-angular cobbles of quartz-feldspar; a single rounded cobble of metabasalt, and a smooth, rounded cobble of an indeterminate igneous rock which has broken in half. The largest measured dimension (length) for almost all of the manuports falls between 40-80mm. Only two gneiss cobbles from C009 are substantially bigger, in excess of 127mm (SF24) and 157mm (SF23) respectively (Appendix Three: Table 49).

5.2.2.2.4. Primary Technology: Cores

33 cores were recovered from the Phase 3 contexts at Northton, and five cores from Phase 4.

5.2.2.2.4.1. Raw Material

Most of the cores from Phase 3 are made from quartz, with two baked mudstone cores, a single flint core, and one chalcedony core also present (Figure 34). Flint and quartz are the only raw materials present in the Phase 4 core assemblage, represented by two and three cores respectively.

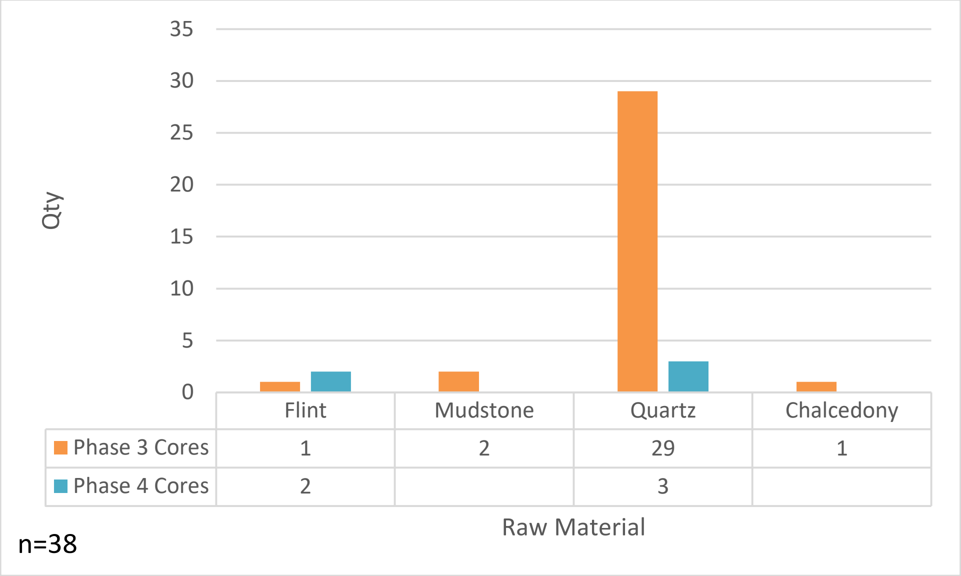


Figure 34. Northton 2010 core raw materials

Milky quartz is the most common quartz variety in use at Northton to produce cores (Figure 35). It is the only variety used during Phase 4, and is represented by the highest number of cores in Phase 3. A single core from Phase 3 is made from fine grained quartz and equal numbers of cores in this phase are made from quartzite and greasy quartz. Five cores are of mixed quartz varieties, which include greasy to fine grained quartz, milky to fine grained quartz, and milky quartz to rock crystal.

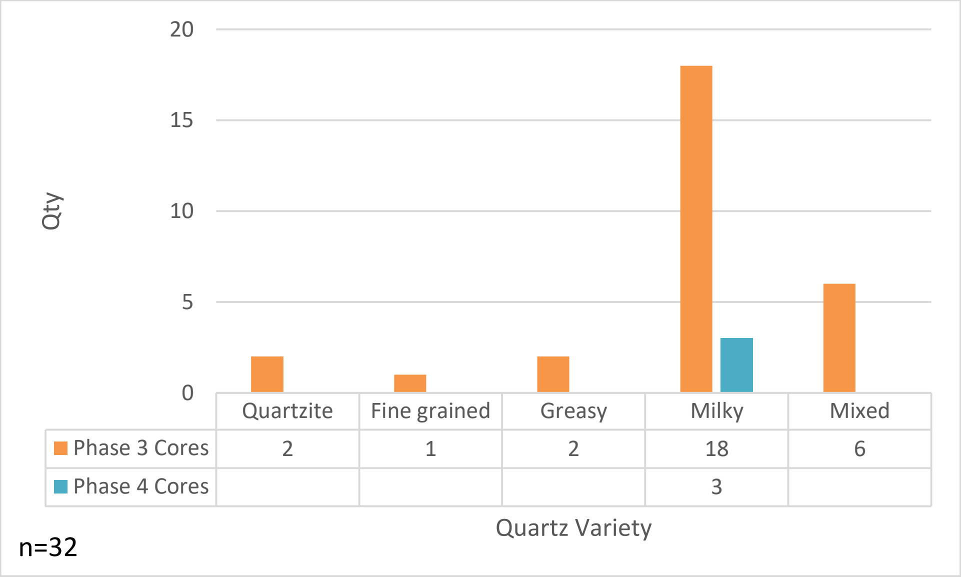


Figure 35. Northton 2010 core quartz varieties

5.2.2.2.4.2. Core Dimensions

The majority of the cores from both phases at Northton fall between 10-60mm in their maximum dimension, with only three quartz cores from Phase 3 exceeding this size (Figure 36). The chalcedony, flint, and baked mudstone cores from Phase 3 fall at the smaller and lighter end of the spectrum, as do the flint cores from Phase 4. The quartz cores from Phase 3 display a high variation in size and weight, as evident on the graph and indicated by the large standard deviation (Table 7). The quartz cores from Phase 4 are on average larger than those from Phase 3, but lighter.

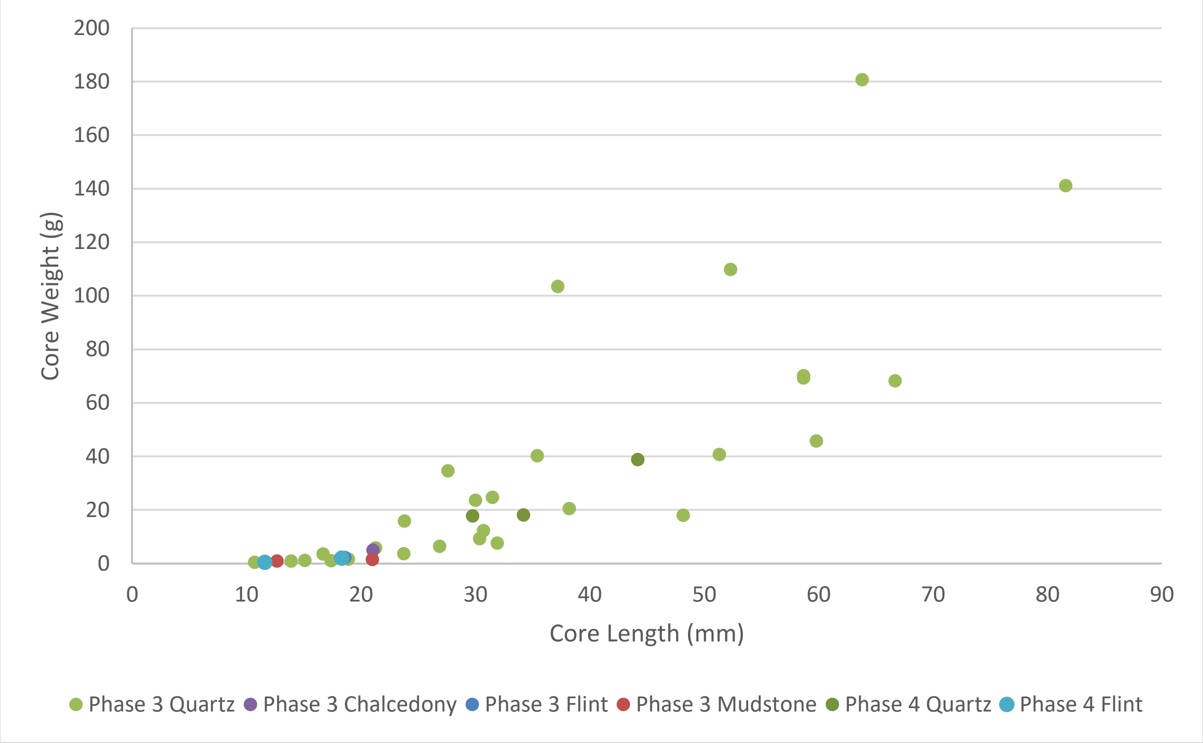


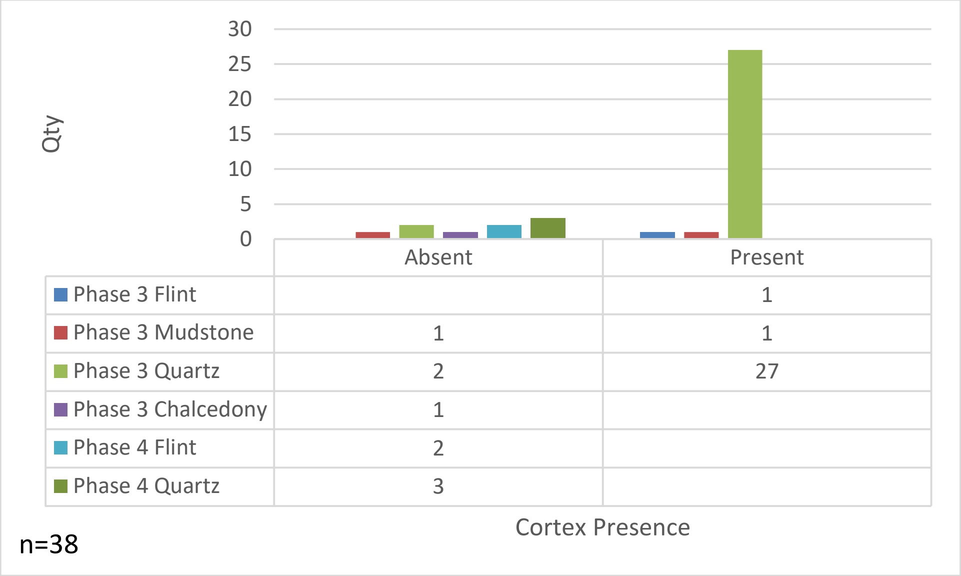
Figure 36. Northton 2010 core dimensions

	Length (mm)	**Weight (g)**
Phase 3 Quartz		
Mean	35.66	36.59
SD	18.91351	46.30178
Phase 4 Quartz		
Mean	36.05	24.92
SD	7.396251	12.05318

Table 7. Northton 2010 core dimension summary statistics

5.2.2.2.4.3. Cortex

Almost all of the quartz cores from Phase 3 retain a proportion of cortex, as do the flint core and one of the baked mudstone cores from this phase. None of the cores from Phase 4, or the chalcedony core from Phase 3 retain any cortex (Figure 37). The other baked mudstone core from Phase 3 displays a small amount of weathered cortex. Twice the number of quartz cores display rounded cortex indicative of a water rolled pebble source than those where the cortex is flat, suggesting a block or plate removed from a vein.



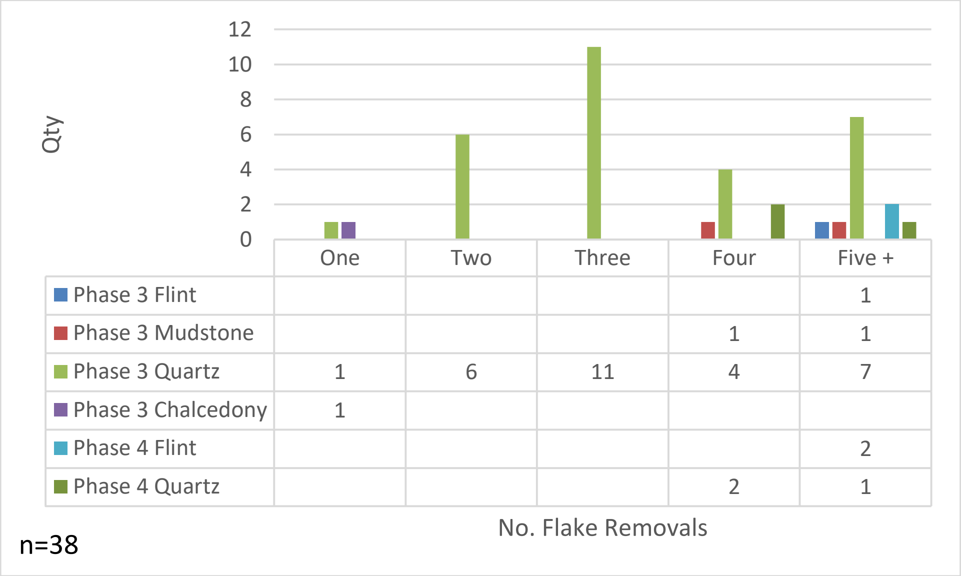
	Absent	Present
🟦 Phase 3 Flint		1
🟥 Phase 3 Mudstone	1	1
🟩 Phase 3 Quartz	2	27
🟪 Phase 3 Chalcedony	1	
🟦 Phase 4 Flint	2	
🟩 Phase 4 Quartz	3	

Figure 37. Northton 2010 core cortex presence

5.2.2.2.4.4. Flake Removals – Count and Sequence

In Phase 3 the flint and baked mudstone cores are characterised by four or more flake removals. Only two cores from this phase have a single flake removal – the chalcedony core and one quartz core. The most frequent number of flake removals from quartz cores in Phase 3 is three (Figure 38).

In Phase 4 all of the flint core display five or more flake removals. There are either four or five flake removals from the quartz cores in this phase.

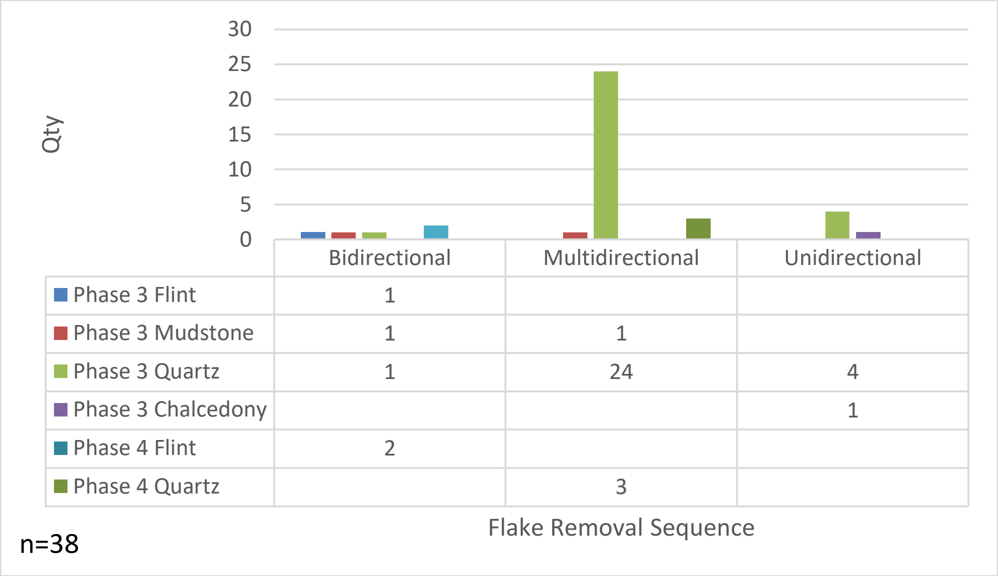


	One	Two	Three	Four	Five +
🟦 Phase 3 Flint					1
🟥 Phase 3 Mudstone				1	1
🟩 Phase 3 Quartz	1	6	11	4	7
🟪 Phase 3 Chalcedony	1				
🟦 Phase 4 Flint					2
🟩 Phase 4 Quartz				2	1

Figure 38. Northton 2010 number of flake removals from cores

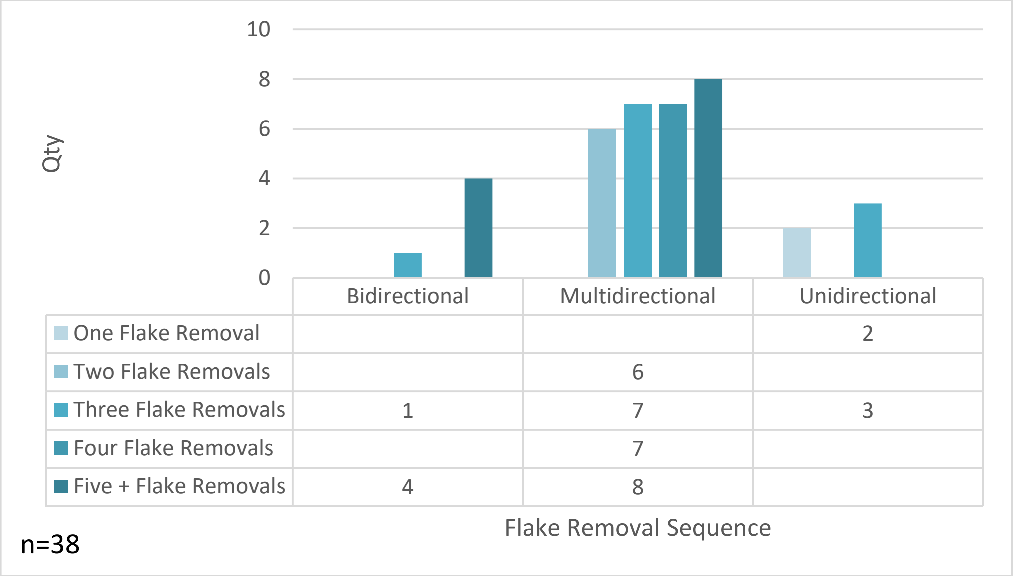
Regarding the direction of flake removals in Phase 3, the single removal from the chalcedony core in is obviously unidirectional (Figure 39). There are four quartz cores from this phase that also display unidirectional removals, and these mainly come from cores with three flake removals (Figure 39 and Figure 40).

Bidirectional removals, which indicate a bipolar reduction technique, are observed on all of the flint cores from both phases, in addition one of the baked mudstone cores from Phase 3. However, this technique is not observed on the Phase 3 quartz core with a bidirectional flake removal pattern. Instead, the three flakes have simply been removed from opposing platforms. A multidirectional flake removal pattern is observed on all the quartz cores from Phase 4, and the majority of quartz cores from Phase 3.



	Bidirectional	Multidirectional	Unidirectional
🟦 Phase 3 Flint	1		
🟥 Phase 3 Mudstone	1	1	
🟩 Phase 3 Quartz	1	24	4
🟪 Phase 3 Chalcedony			1
🟦 Phase 4 Flint	2		
🟩 Phase 4 Quartz		3	

Figure 39. Northton 2010 sequence of flake removals from cores

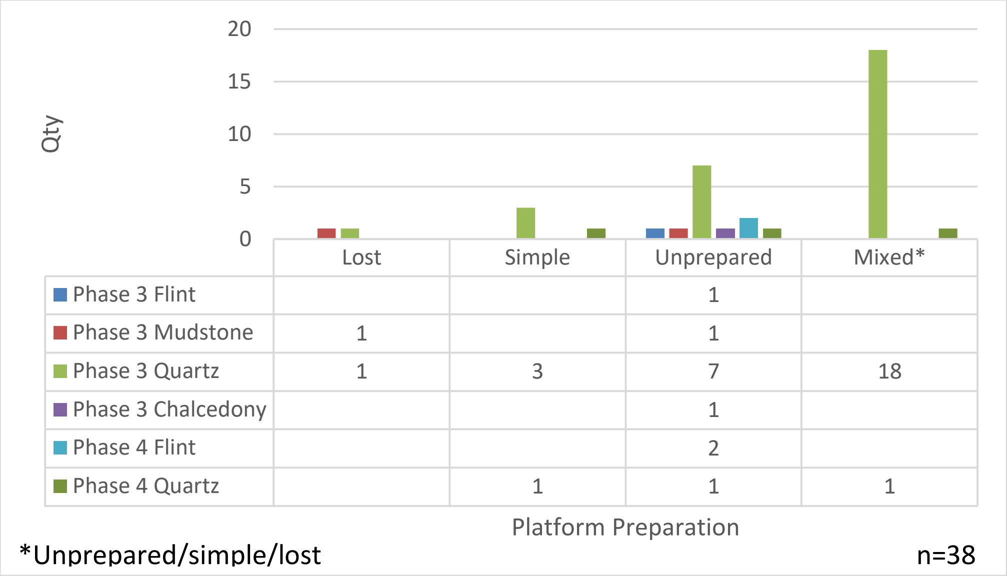


	Bidirectional	Multidirectional	Unidirectional
🟦 One Flake Removal			2
🟦 Two Flake Removals		6	
🟦 Three Flake Removals	1	7	3
🟦 Four Flake Removals		7	
🟦 Five + Flake Removals	4	8	

Figure 40. Northton 2010 sequence of flake removals from cores in relation to the number of flakes removed

5.2.2.2.4.5. Core Platform Preparation

Evidence of mixed platform preparation, where more than one type of platform preparation is evident or has been lost, is most commonly recorded for quartz cores in Phase 3 and one in Phase 4 (Figure 41). All of the flint cores and the chalcedony core have unprepared platforms, as does one of the baked mudstone cores. The platform preparation has been lost on the other baked mudstone core. More quartz cores display unprepared platforms than simple platforms.



	Lost	Simple	Unprepared	Mixed*
🟦 Phase 3 Flint			1	
🟥 Phase 3 Mudstone	1		1	
🟩 Phase 3 Quartz	1	3	7	18
🟪 Phase 3 Chalcedony			1	
🟦 Phase 4 Flint			2	
🟩 Phase 4 Quartz		1	1	1

Figure 41. Northton 2010 core platform preparation

5.2.2.2.5. Primary Technology: Flakes

The total flake (>10mm) assemblage from Northton comprises 344 pieces. There are 320 flakes in Phase 3 (C009; C014), and 24 flakes in Phase 4 (C016; C017). The results of the flake analysis are presented by phase, followed by a comparison between the two phases. Descriptions of the core rejuvenation flake, flake cores, refitting pieces and blades are described subsequently. The data presented here only includes material >10mm in maximum length following the suggestion that small fraction flakes (<10mm) and 'chunks' simply represent *in situ* knapping debris (Ballin 2000:10; Finlayson *et al.* 2000:67). The results of this data is presented in Appendix Eleven.

5.2.2.2.5.1. Raw Material

The overall flake assemblage is dominated by quartz, (75%; Figure 42). Flint flakes are marginally more common than baked mudstone flakes, and small quantities of carbonite, gneiss, pegmatite, and igneous raw materials make up the remainder of the assemblage.

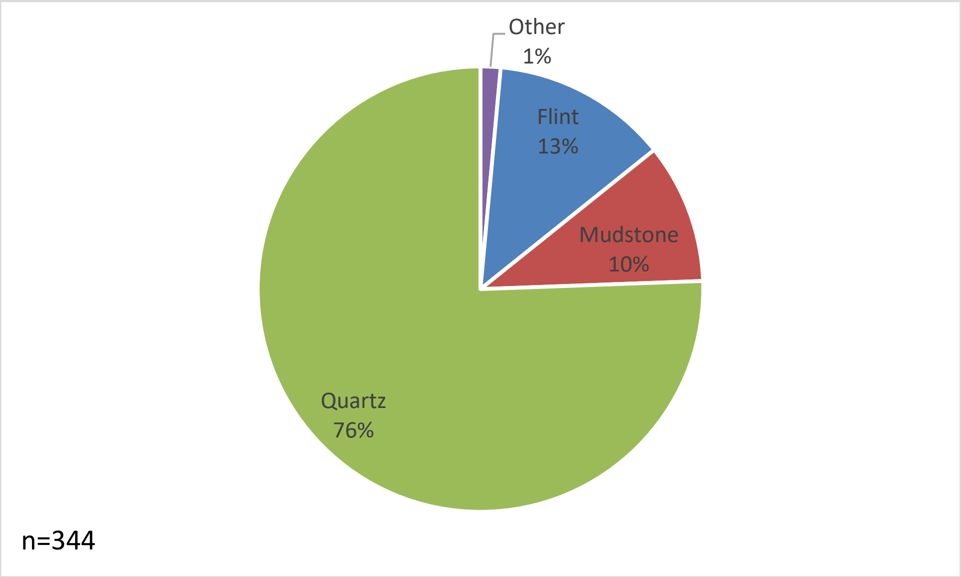


Figure 42. Northton 2010 total flake assemblage raw material composition

In Phase 3 the flake assemblage is dominated by quartz (Figure 43). A wide range of quartz varieties are present in the flake assemblage, with milky quartz the commonest (Figure 44). Mixed quartz varieties are the second most frequently represented, usually grading from very fine grained to fine grained quartz or rock crystal. Three pieces of fine grained quartz-feldspar appear to have been burnt (L206-208). Smaller numbers of fine grained and greasy quartz are also present, with very low frequencies of quartz varieties from the coarsest and finest ends of the spectrum. Baked mudstone is more commonly occurring than flint. Carbonate, gneiss, pegmatite, and an unknown igneous raw material are present in the remainder of the assemblage.

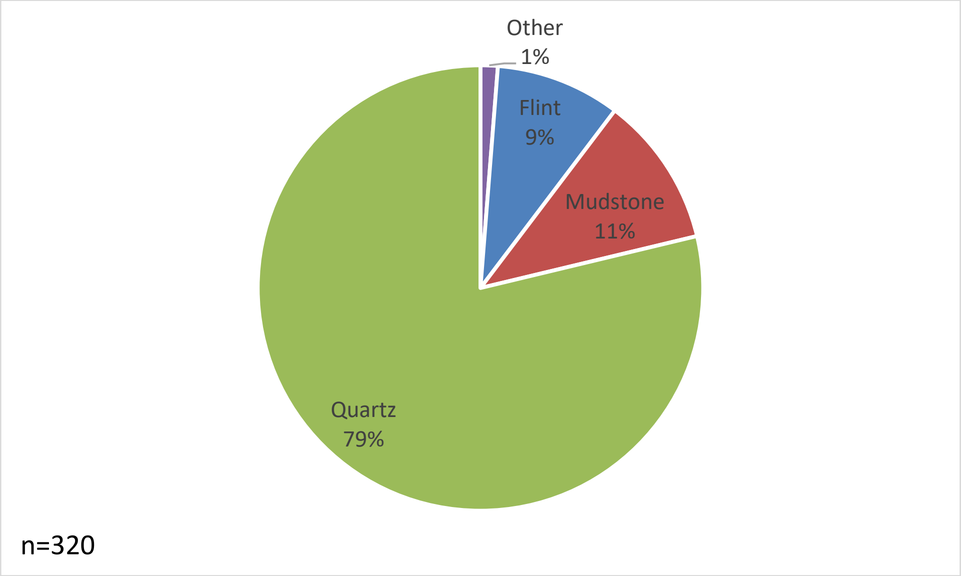
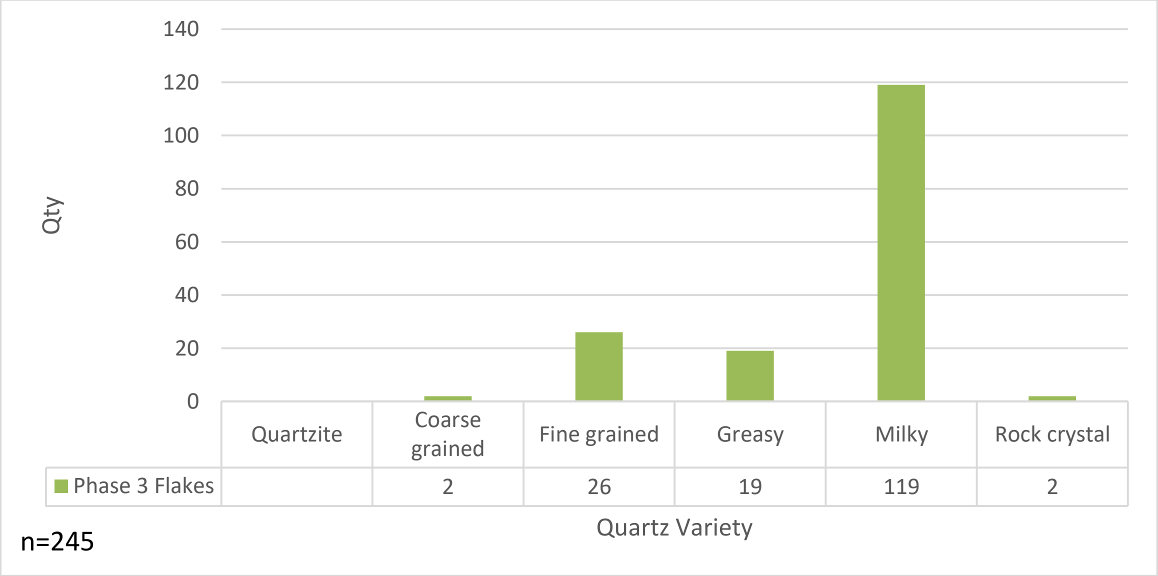


Figure 43. Northton 2010 Phase 3 flake raw material composition



	Quartzite	Coarse grained	Fine grained	Greasy	Milky	Rock crystal
🟩 Phase 3 Flakes		2	26	19	119	2

Figure 44. Northton 2010 Phase 3 flake quartz varieties

Flint is the dominant raw material in the Phase 4 flake assemblage, with quartz comprising a third of the raw material present (Figure 45). There are fewer quartz varieties present in Phase 4, of which milky is the most common. There are single flakes of coarse grained, fine grained and milky-greasy quartz (Figure 46). A single flake of unknown raw material is also present.

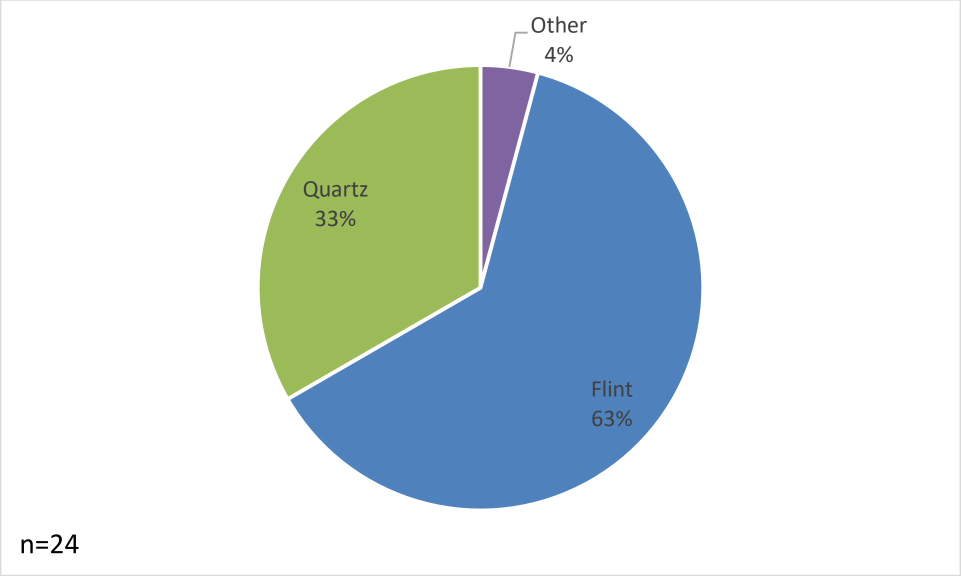


Figure 45. Northton 2010 Phase 4 flake raw material composition

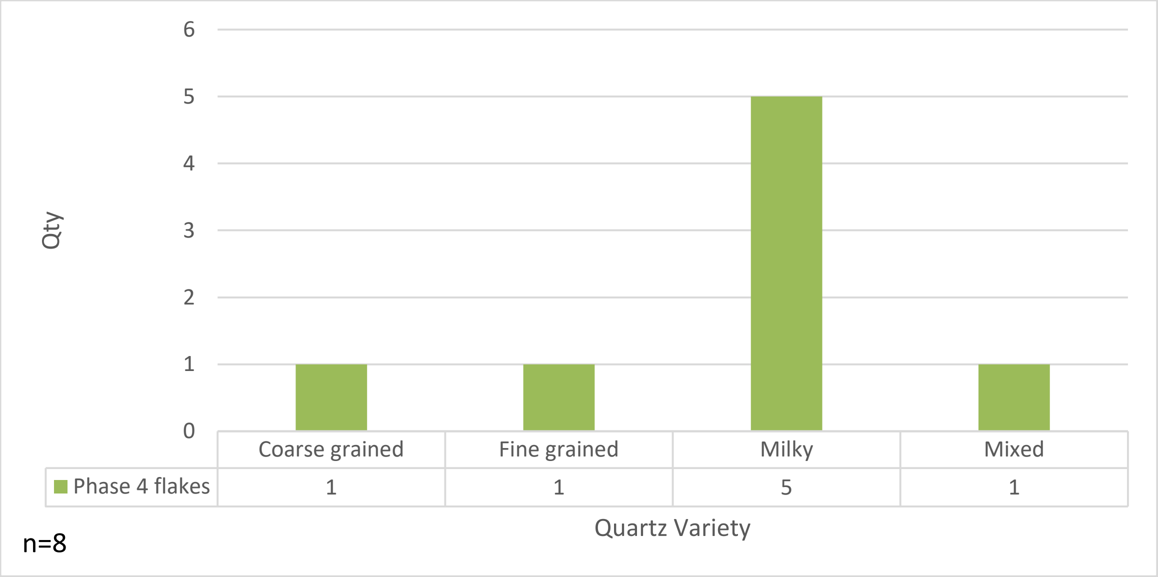


Figure 46. Northton 2010 Phase 4 flake quartz varieties

5.2.2.2.5.2. Flake Dimensions

The quartz flake assemblage from Northton is very large; therefore graphical presentation of the quartz flake dimensions is given separately to the rest of the raw materials for the sake of clarity. A graph of all of the raw materials together is then presented for comparison.

The summary statistics for Phases 3 and 4 of Northton are displayed in Table 8. In Phase 3 the quartz flakes are larger on average than baked mudstone flakes in all dimensions, which are in turn larger on average than flint flakes. In Phase 4, the quartz flakes are much larger on average than those made from flint.

Raw Material		**Length (mm)**		**Width (mm)**		**Thickness (mm)**	
		Phase 3	**Phase 4**	**Phase 3**	**Phase 4**	**Phase 3**	**Phase 4**
Flint	**Min**	10.10	10.04	3.50	4.60	0.90	1.54
	Max	33.20	16.80	27.20	11.36	9.70	5.04
	Mean	14.88	11.95	10.59	8.38	3.46	2.99
	SD	5.051701	1.724697	5.40194	2.367481	1.777198	1.293678
Baked mudstone	**Min**	10.30		5.00		1.30	
	Max	27.10		36.20		9.20	
	Mean	15.97		13.96		4.19	
	SD	5.28592		6.380265		1.938833	
Quartz	**Min**	10.00	10.00	4.50	10.30	1.50	2.00
	Max	58.40	37.10	63.90	32.97	26.30	12.70
	Mean	16.93	17.76	15.09	18.57	5.80	7.14
	SD	7.884406	8.982901	9.411335	8.590425	4.014479	3.184249

Table 8. Northton 2010 flake dimension summary statistics for Phase 3 and 4 primary raw materials

A MANOVA statistical test was conducted on the flake dimensions of flint and quartz from both phases (Field 2013). Using Wilks's lambda, there was no significant difference between the flint flake dimensions of Phase 3 and Phase 4:

$$\Lambda = .898, F(3,40) = 1.509, p = .227$$

Using the same test, no significant difference was found between the quartz flake dimensions of Phase 3 and Phase 4:

$$\Lambda = .933, F\ (3, 256) = .643, p = .588$$

To test the robustness of the MANOVA results, a Mann-Whitney U test was also conducted for each raw material, on the ranked values of each dimension between phases (Table 9).

Raw Material	**Dimensions (mm)**	**Mean Rank Phase 3**	**Mean Rank Phase 4**	***U***	***z***	***p***	***r***
Flint	**Length**	25.43	16.83	132.5	-2.105	**.035**	-.317
	Width	24.14	19.33	170	-1.176	.239	n/a
	Thickness	23.59	20.40	186	-.780	.435	n/a
Quartz	**Length**	130.24	138.75	1,074.0	.315	.753	n/a
	Width	129.21	171.19	1,333.5	1.554	.120	n/a
	Thickness	129.22	170.75	1,333	1.538	.124	n/a

Table 9. Northton 2010 Mann Whitney U test results for flint and quartz between phases. Flint Phase 3 n = 28, Phase 4 n = 15; Quartz Phase 3 n = 252, Phase 4 n = 8

For flint, there was a significant difference between the length of Phase 3 flakes and the length of Phase 4 flakes. The *r* value indicates a medium effect size, i.e. the difference is of medium strength. However, there was no significant difference between the widths or thickness of flint flakes between the two phases. Overall, this supports to MANOVA and indicates there is no change in size of the flint flakes between the phases (Field 2013).

For quartz, there was no significant difference between the two Phases in any of the dimensions, which again supports the MANOVA and shows that the size of the quartz flakes does not differ between the phases.

A MANOVA test between the raw materials was also conducted using Wilks's lambda. This shows that there is a significant difference between the dimensions of flint and the dimensions of quartz flakes from Northton.

$\Lambda = .937$, $F\,(3, 300) = 6.718$, $p = \mathbf{<.000}$

Dimensions (mm)	**Mean Rank Flint**	**Mean Rank Quartz**	***U***	***z***	***p***	***r***
Length	123.18	157.46	7,010.0	2.329	**.017**	.133
Width	100.14	161.36	8,024.0	4.273	**<.000**	.245
Thickness	92.26	162.69	8,370.0	4.916	**<.000**	.281

Table 10. Northton 2010 Mann Whitney U test results between raw materials. Flint n = 43; quartz n = 260

This is supported by the Mann-Whitney U test, whereby all dimensions display a statistically significant difference between the raw materials (Table 10; Field 2013). For length, the effect size is small, and for width and thickness the effect size is small-medium. On the basis of this test, in addition to the summary data above, it can be confidently interpreted that quartz flakes are larger than flint flakes.

5.2.2.2.5.3. Flake Dimensions in Phase 3

In Phase 3 the flint flakes are shorter than the baked mudstone flakes (Table 8), although the densest concentration for both these raw materials falls between 10mm-15mm in length (Figure 47). Flint flakes do not generally exceed 22mm in length although there is one flint flake which is a clear outlier. Baked mudstone flakes are frequently up to 5mm longer than the flint flakes. The carbonate, gneiss and pegmatite flakes fall within the group of larger baked mudstone flakes. Only the unknown igneous raw material flake falls at the lower end of the scale. The flint and baked mudstone flakes rarely exceed 20mm in width, with the carbonate, gneiss and igneous raw material flakes consistently falling under this figure – the pegmatite flake is one of the largest flakes present in the assemblage.

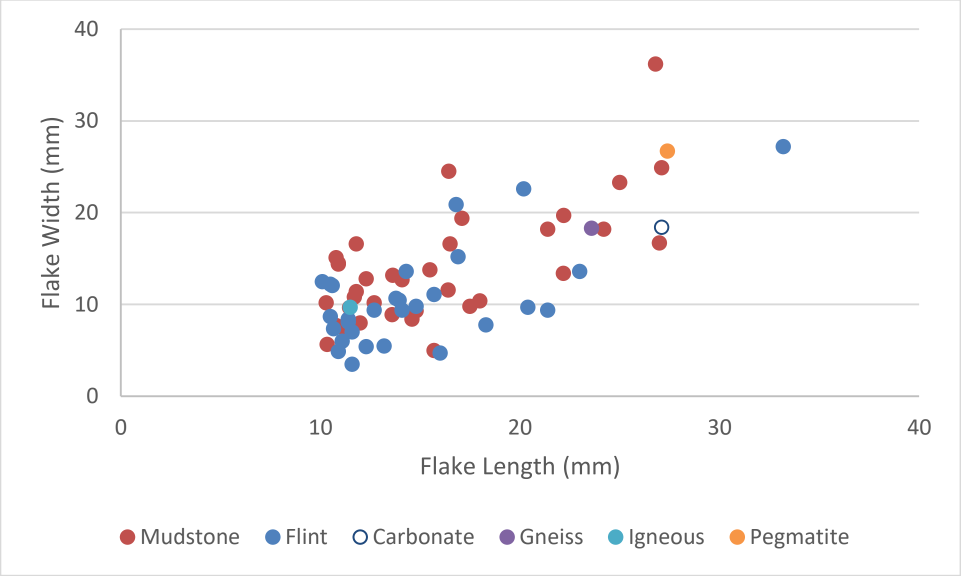


Figure 47. Northton 2010 Phase 3 flake dimensions length:width, quartz excluded

The quartz flakes from Phase 3 range widely in terms of length, although the tightest grouping falls between 10mm-20mm in length, similar to the other raw materials from this phase (Figure 48). There are also a large number of flakes grouped between 20mm-30mm in length, with a moderate number of quartz flakes that considerably exceed the length of the other raw materials. For example, the longest quartz flake is almost 60mm, over twice the length of the longest baked mudstone flake and almost three times that of the longest flint flake (Figure 49). The quartz flakes also display a high variation in width (Table 8); however, in line with the width of the other raw materials, the densest cluster again falls under 20mm. There is a clear, positive correlation between the length and width dimensions of quartz flakes.

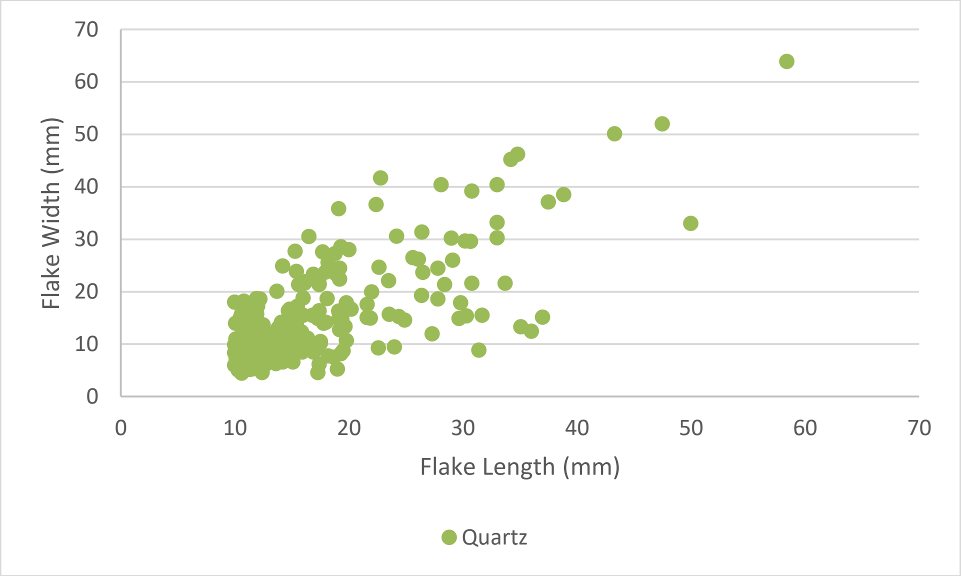


Figure 48. Northton 2010 Phase 3 quartz flake dimensions length:width

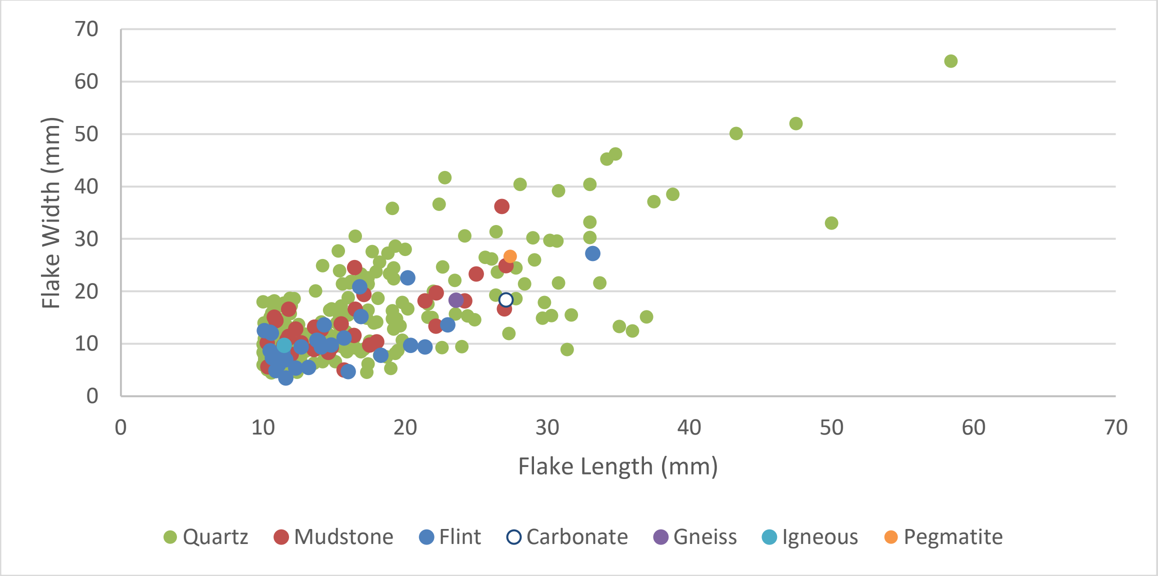


Figure 49. Northton 2010 Phase 3 flake dimension length:width, quartz included

The majority of the flint flakes from Phase 3 fall under 6mm in thickness, however there is one outlier which is closer to 10mm (Table 8 and Figure 50). The largest cluster of flakes from this phase is between 1mm-6mm in thickness. This is comprised of the majority of the flint and baked mudstone flakes, in addition to the igneous raw material flake. As described above, the longer baked mudstone, flint and flakes of the other raw materials are clearly separated from this group by their increased length, and frequently by an increase in thickness.

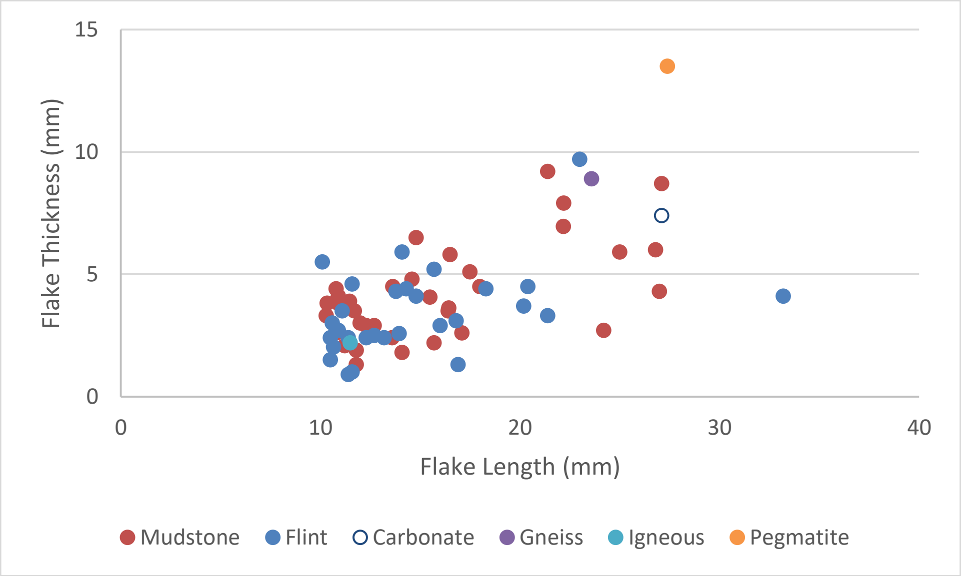


Figure 50. Northton 2010 Phase 3 flake dimensions length:thickness, quartz excluded

The quartz flakes in Phase 3 range substantially in thickness, as well as length, indicated by the high standard deviation from the mean (Table 8 and Figure 51). There is a very compact grouping of quartz flakes up to 6mm in thickness, which corresponds to that of the flint flakes (Figure 51 and Figure 52). Most quartz flakes fall under 15mm in thickness, although a small minority exceed this measurement. This contrasts to the thickest of the baked mudstone, carbonate, igneous, and gneiss flakes which do not exceed 10mm in thickness, in correlation with their length. The pegmatite flake sits clearly apart from the rest of the flake assemblage in terms of thickness.

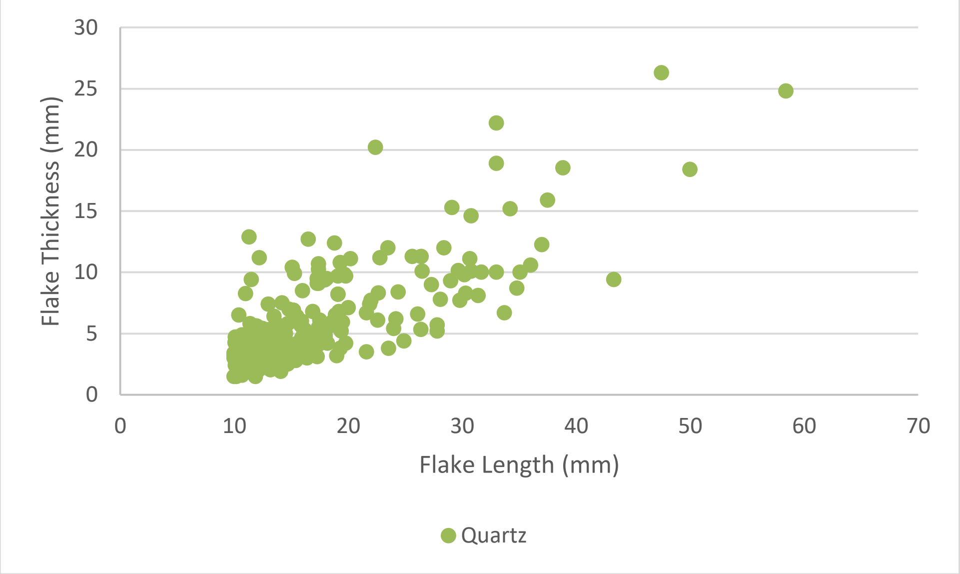


Figure 51. Northton 2010 Phase 3 quartz flake dimensions length:thickness

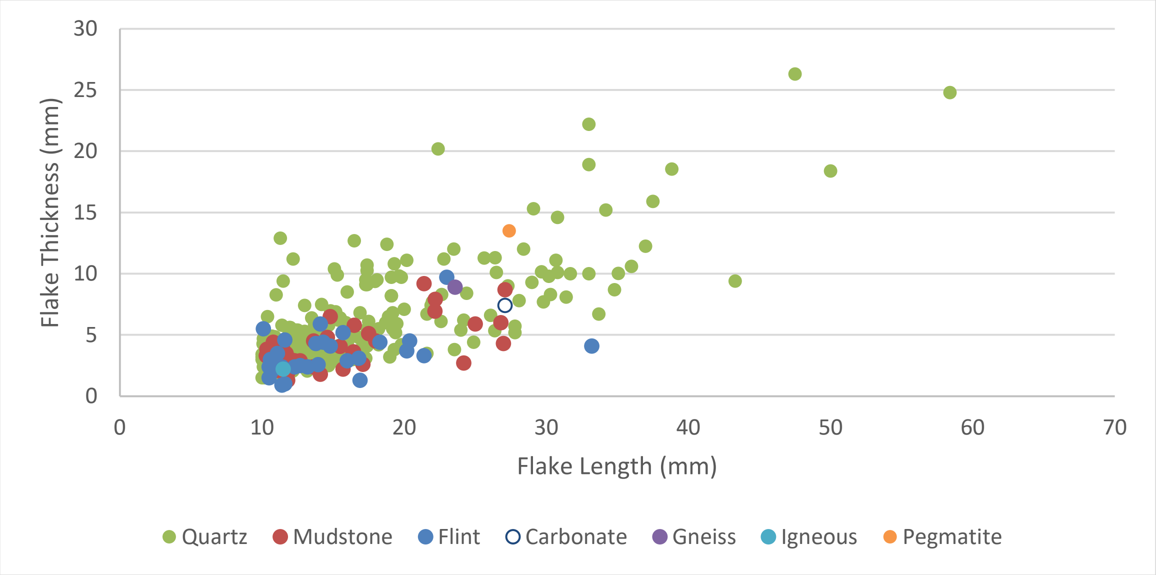


Figure 52. Northton 2010 Phase 3 flake dimensions length:thickness, quartz included

The close grouping of flint, baked mudstone, and igneous flakes less than 15mm in width and 6mm in thickness from Phase 3 is also demonstrated in Figure 53. Furthermore, this graph shows that the correlation between width and thickness for carbonate, gneiss and pegmatite flakes is much stronger than for flint and baked mudstone flakes.

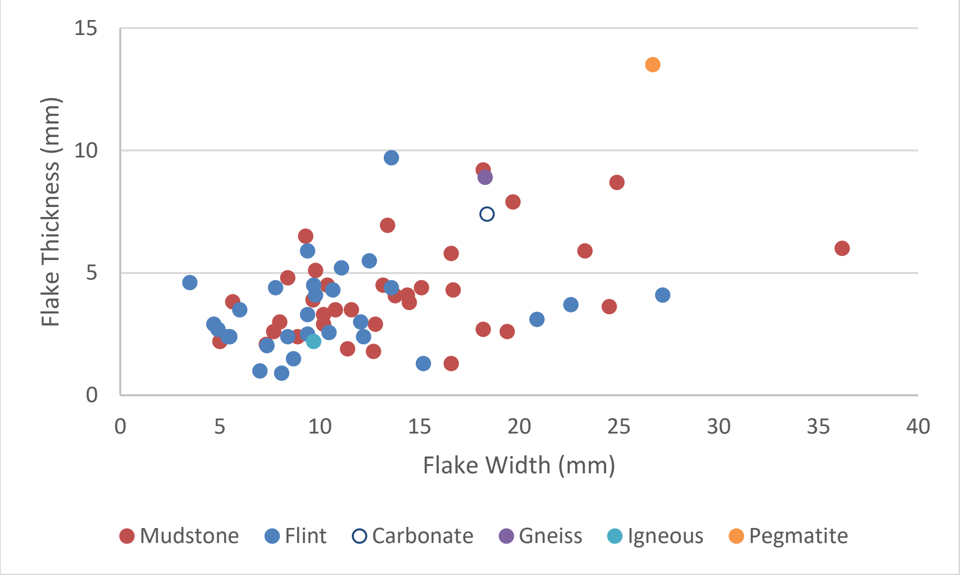


Figure 53. Northton 2010 Phase 3 flake dimensions width:thickness, quartz excluded

The large group of points in Figure 54 show that the majority of quartz flakes from Phase 3 up to 30.5mm in width are no more than 15.5mm in thickness. Beyond this, the correlation between width and thickness becomes very weak, with the exception of the two largest, outlying points. The overall greater diversity in the size of quartz flakes when compared to the other raw materials is again emphasised in Figure 55, and supports the results of the statistical analysis between the raw materials.

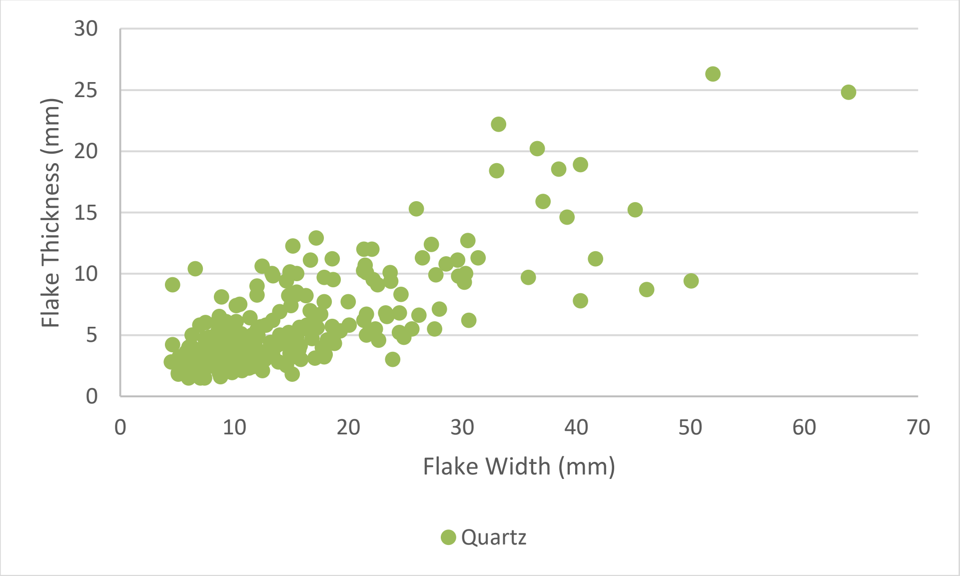


Figure 54. Northton 2010 quartz flake dimensions width:thickness

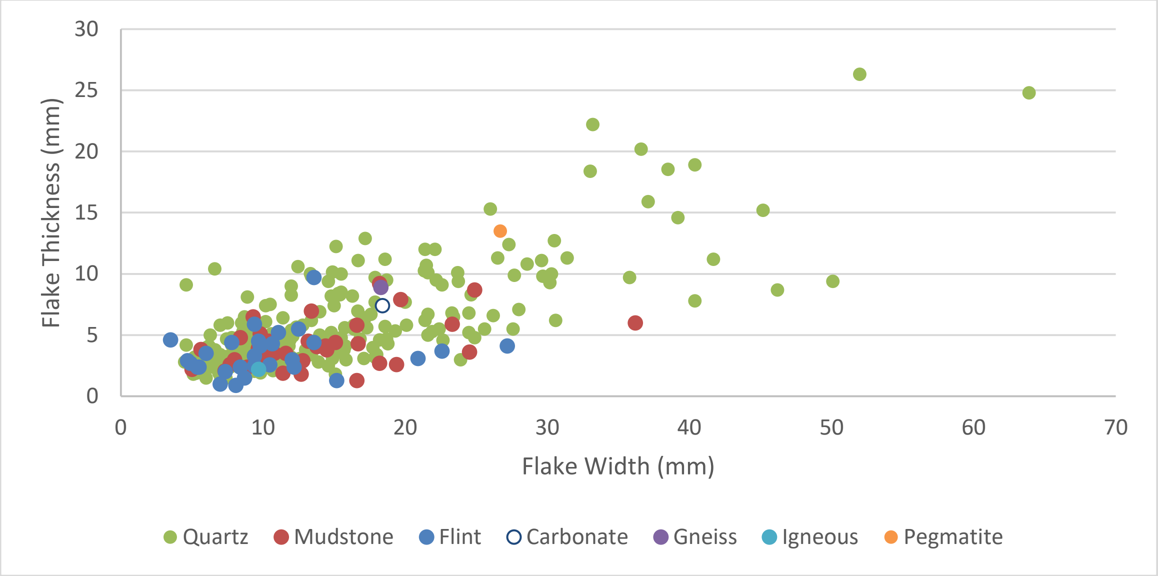


Figure 55. Northton 2010 Phase 3 flake dimensions width:thickness, quartz included

5.2.2.2.5.4. Flake Dimensions in Phase 4

The flint flakes from Phase 4 are small and very tightly group in terms of length and width (Figure 56). The largest flint flake is less than 17mm long, with the widest less than 13mm in width (Table 8). The quartz flakes from this phase are on average wider than the flint flakes, although the majority are of a similar length to the flint flakes. There are also some substantially longer and wider quartz flakes. The unknown raw material flake sits outside this main grouping.

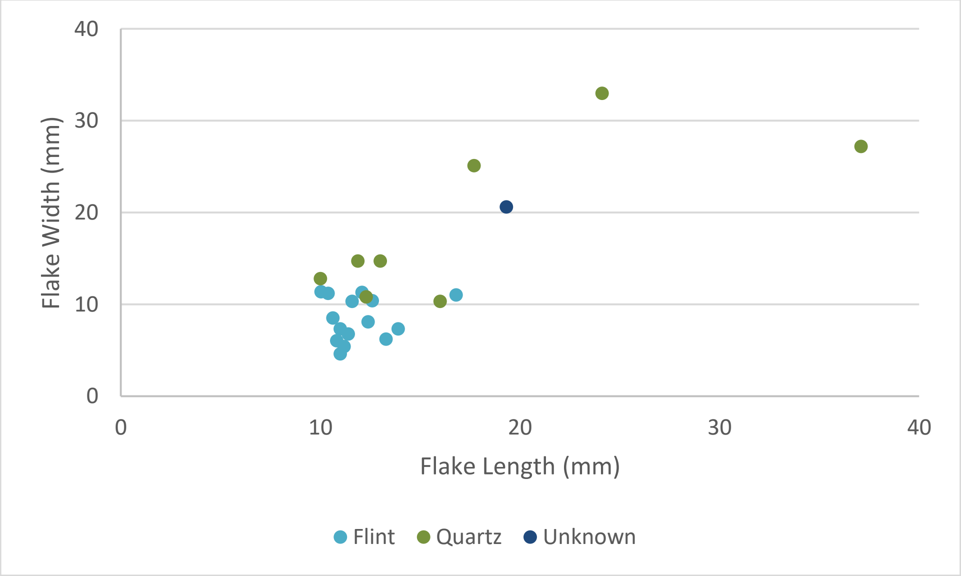


Figure 56. Northton 2010 Phase 4 flake dimensions length:width

The flint flakes are clearly thinner than the quartz flakes in Phase 4, despite the fact the majority of the quartz flakes are of a similar length (Table 8 and Figure 57). The unknown raw material flake is also thinner than most of the quartz flakes.

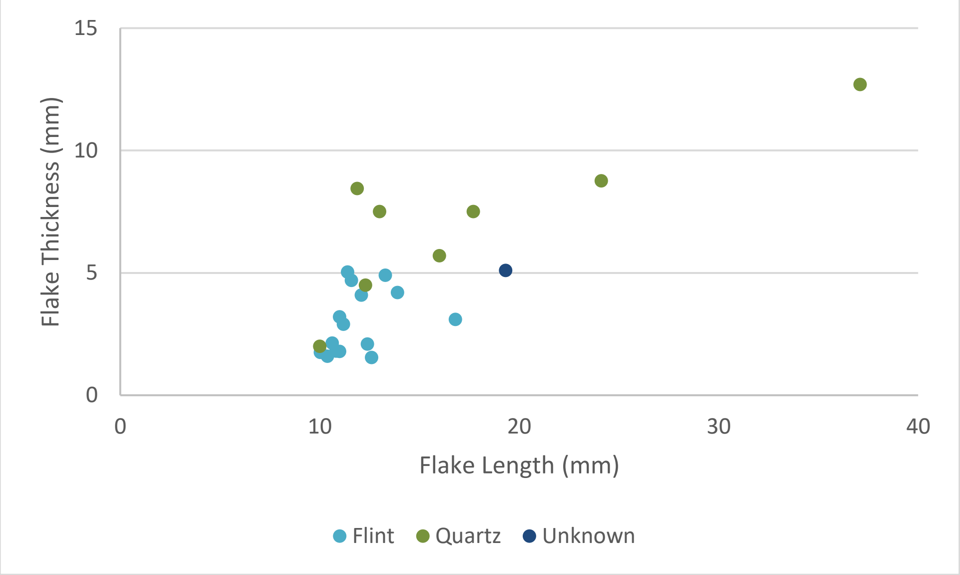


Figure 57. Northton 2010 Phase 4 flake dimensions length:thickness

There is a very clear distinction between the width and thickness of the flint and quartz flakes from Phase 4 in Figure 58. There is no clear correlation between these dimensions in the flint assemblage and these all group at the smallest end of the spectrum. The narrowest quartz flakes marginally overlap with the widest of the flint flakes which increase in width and thickness, showing a positive correlation. Overall, the again confirms the results of the statistical analysis between the raw materials.

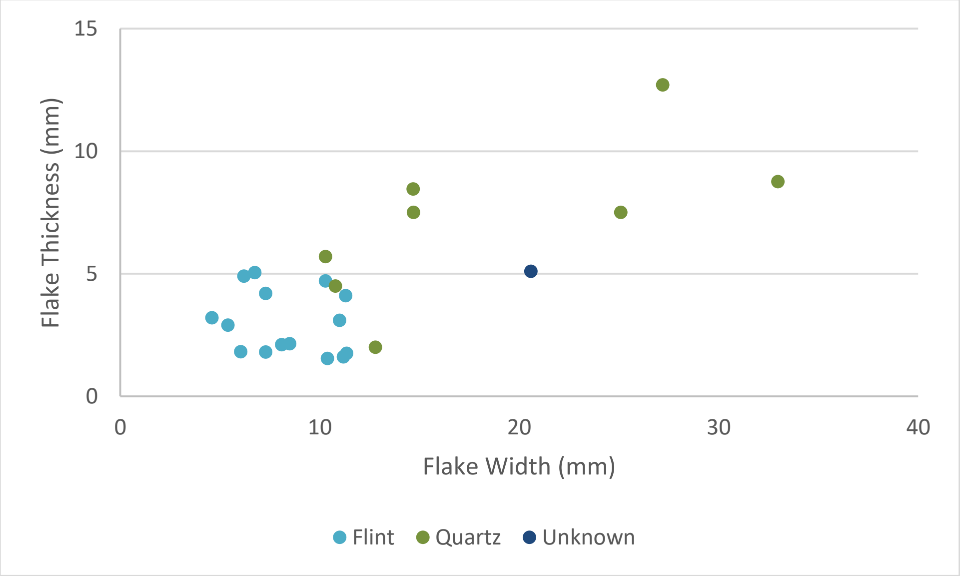


Figure 58. Northton 2010 Phase 4 flake dimensions width:thickness

5.2.2.2.5.5. Flint Flake Dimensions from Phases 3 and 4 Compared

Figure 59 shows the flint flakes from Phase 3 to have a wider variation in length and width to those in Phase 4, which is also evident from the larger standard deviation from the mean, however this is only statistically significant in terms of length (Table 8). Almost all of the Phase 4 flint flakes are grouped between 10mm-15mm in length, whereas the Phase 3 flakes are up to 8mm longer. The majority of the Phase 3 flint flakes fall within the same width range as those from Phase 4. Although there are two which exceed this substantially, this has no statistically significant effect.

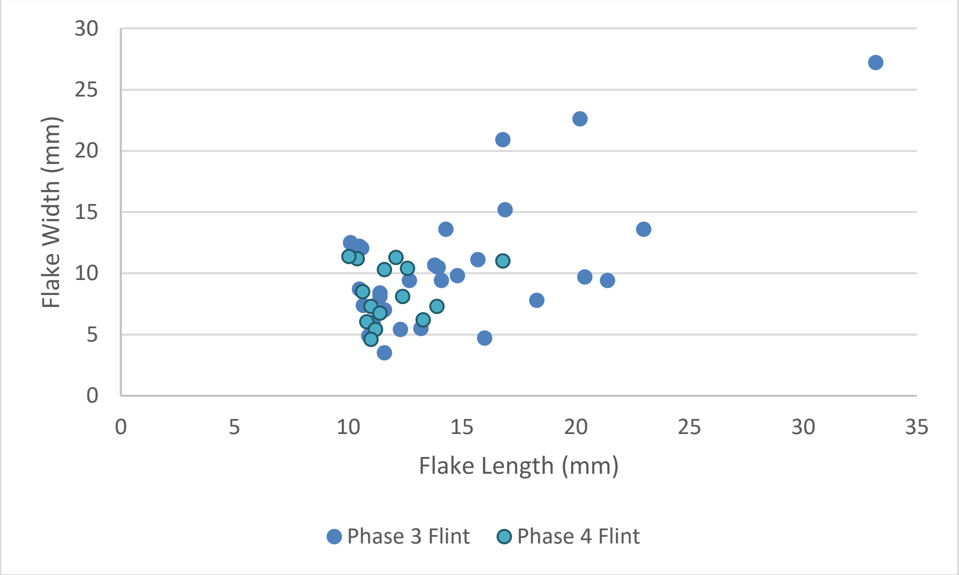


Figure 59. Northton 2010 comparison between Phase 3 and Phase 4 flint flake dimensions length:width

There is no observable or statistical difference between the thicknesses of the flint flakes from each phase, which generally fall between 1mm-6mm (Figure 60). The mean length and thickness of the flint flakes from both phases is very close and there is only a small standard deviation, despite the clear outliers from Phase 3 (Table 8). There appears to be no correlation between the increasing flake length of the Phase 3 flakes and their thickness.

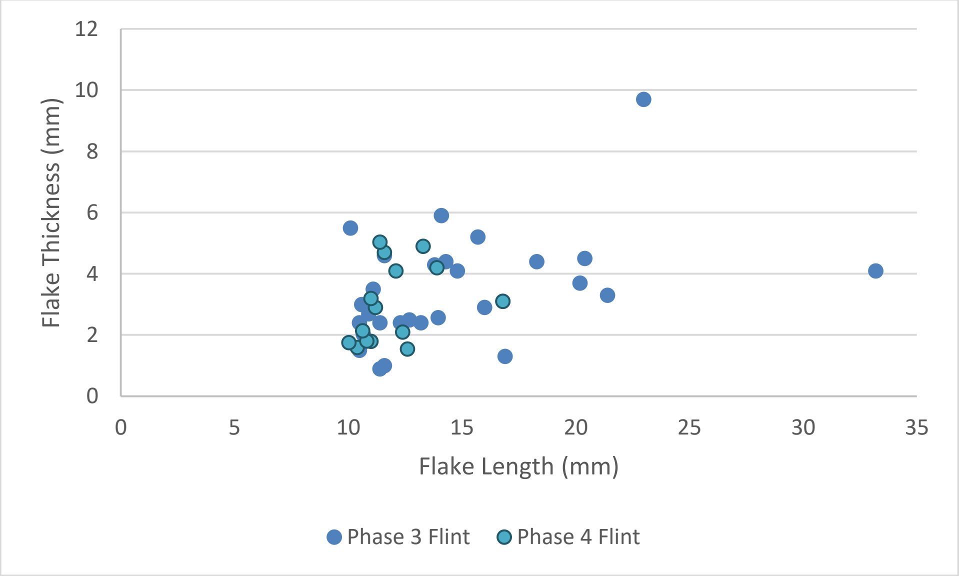


Figure 60. Northton 2010 comparison between Phase 3 and Phase 4 flint flake dimensions length:thickness

Similarly, there is no correlation or statistical difference between the width and thickness of the flint flakes from these phases (Figure 61). There are three clear outliers from Phase 3 to the main group of points that are wider, and one which is thicker.

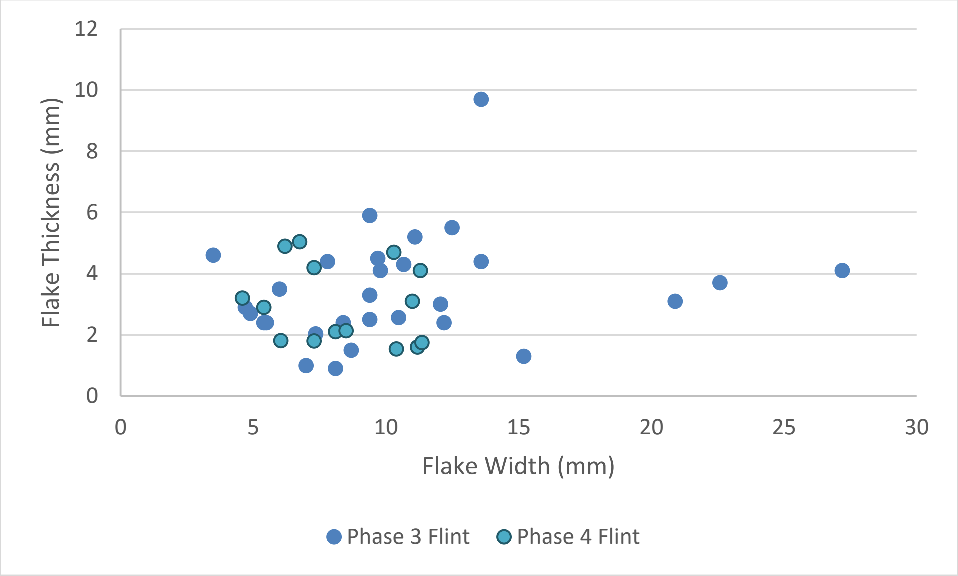


Figure 61. Northton 2010 comparison between Phase 3 and Phase 4 flint flake dimensions width:thickness

5.2.2.2.5.6. Quartz Flake Dimensions from Phases 3 and 4 Compared

It is difficult to observe any patterns between the quartz flakes from Phases 3 and 4 due to the overwhelming number of flakes from Phase 3 which dominate Figure 62, Figure 63 and Figure 64. On the whole it appears that the quartz flakes in both phases follow the same positive correlations between length, width and thickness. The majority of the flakes from Phase 4 fall within the main cluster of points from Phase 3 between 10mm-20mm in both length and width, and up to 10mm in thickness. As described above, there is no statistically significant difference between the dimensions of quartz flakes in either phase.

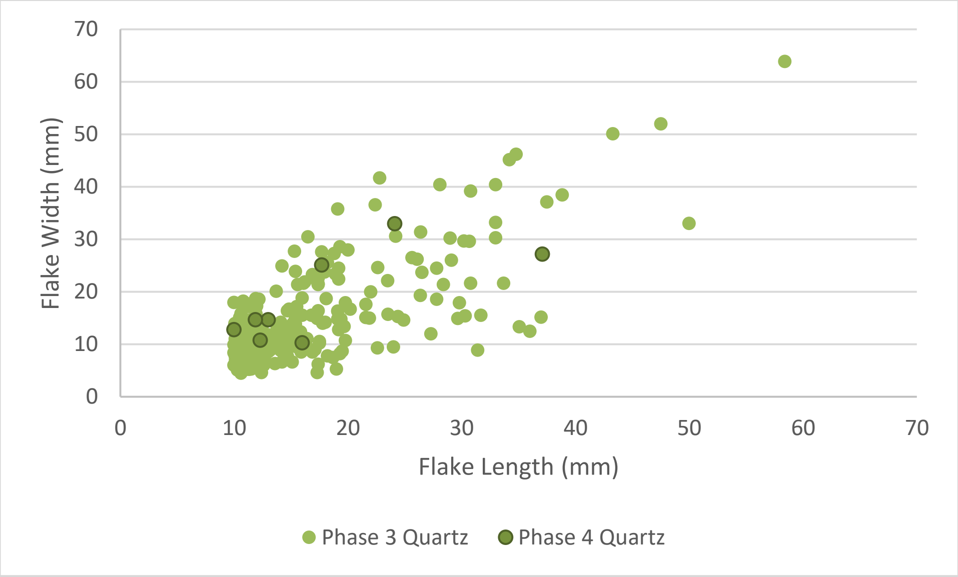


Figure 62. Northton 2010 comparison between Phase 3 and Phase 4 quartz flake dimensions length:width

The Phase 3 quartz flakes are on average larger across all three dimensions than the quartz flakes from Phase 4. This is evident in the larger maximum dimensions for length and thickness of Phase 3 quartz flakes (Figure 63). Although this causes a larger standard deviation from the mean than observed in the Phase 4 quartz assemblage, it has no statistically significant effect (Table 8).

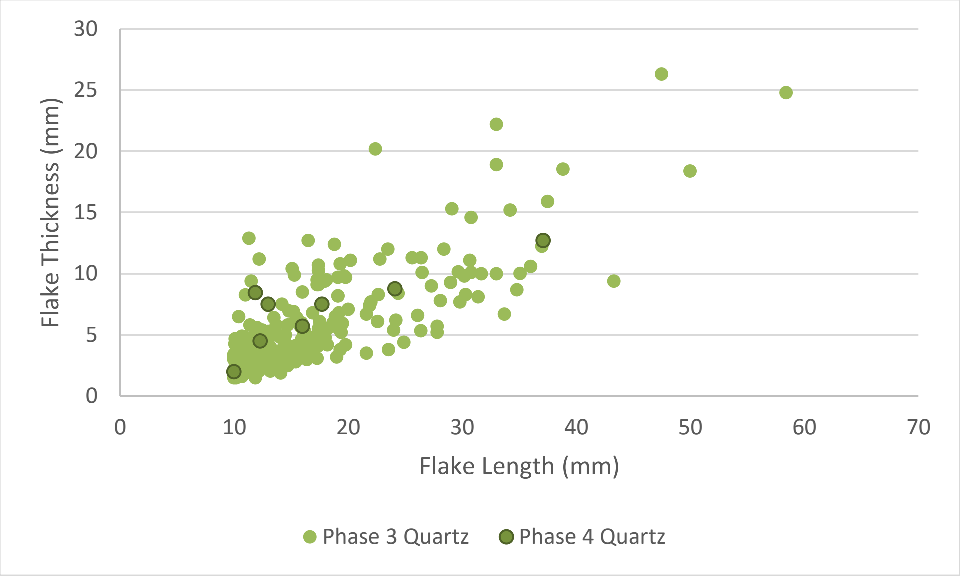


Figure 63. Northton 2010 comparison between Phase 3 and Phase 4 quartz flake dimensions length:thickness

The Phase 3 quartz flakes also exhibit a wider range in terms of their maximum and minimum width measurements, which are respectively larger and smaller than the Phase 4 quartz flakes. Again, this is not statistically significant (Table 8 and Figure 64).

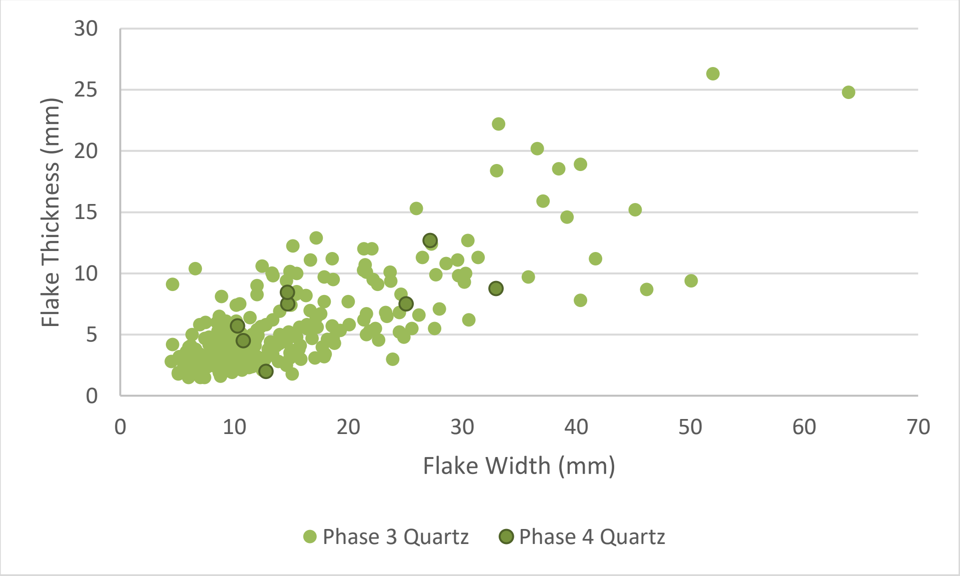


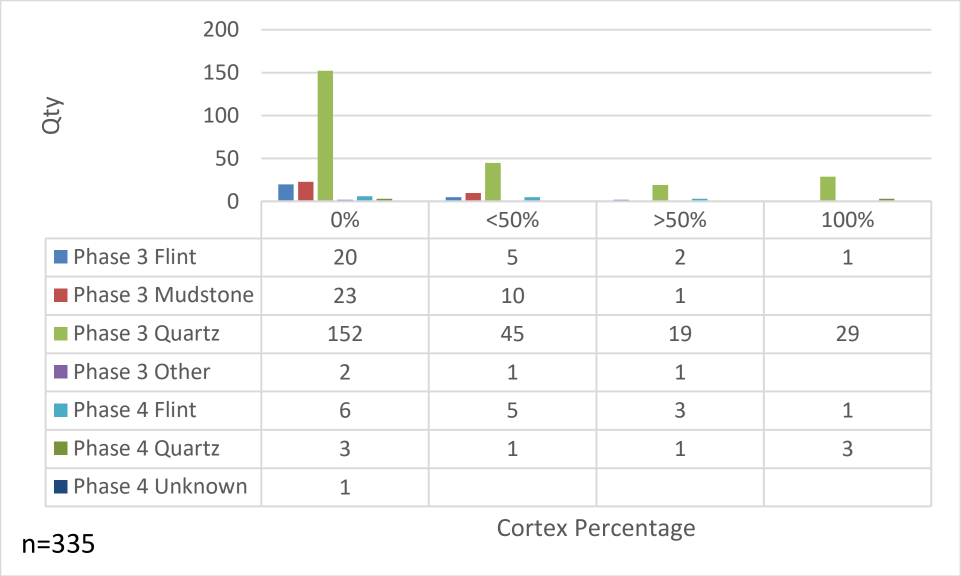
Figure 64. Northton 2010 comparison between Phase 3 and Phase 4 quartz flake dimensions width:thickness

5.2.2.2.5.7. Cortex

In Phase 3, tertiary flakes (which have 0% cortex) are the most common in all of the primary raw material categories. For the 'other' raw materials, it is the carbonate flake and the unknown raw material flake which do not display any cortex. Only a single flint flake retains 100% cortex in this phase, in addition to a proportion of the quartz flakes. There is no evidence for primary flakes of baked mudstone, and only a single flake retains >50% cortex in this raw material. The gneiss flake from Phase 3 displays <50% cortex, and pegmatite flake retains >50% cortex (Figure 65). The remainder of the flake assemblage are secondary flakes.

Secondary and tertiary flakes are equally represented in Phase 4. Tertiary flakes include the unknown raw material flake, three of the quartz flakes, and over a third of the flint flakes. A single flint flake retains 100% cortex, as do three of the quartz flakes. As in Phase 3, the remainder are secondary flakes.

The flint in both phases appears to have derived from water rolled pebbles as the cortex is rounded and smooth. The 'cortex' on the baked mudstone flakes is dark and weathered, with a degree of probable iron staining present. The cortex on the quartz flakes from Phase 4 is more frequently frosted and flat, suggesting these pieces may have been removed from a larger block or plate sourced from a vein. Only a single quartz flake from this phase displays cortex which is smooth and rounded, suggesting a water rolled pebble as the source. In contrast, the cortex on the quartz flakes from Phase 3 suggests that beach pebbles were more frequently exploited as the source of the raw material. Substantially fewer display evidence for direct extraction from a vein. In some instances this is very clear as the cortex comprises mica or other raw materials, on others it is more difficult to determine as weathering may have also rounded exposed outcrops.

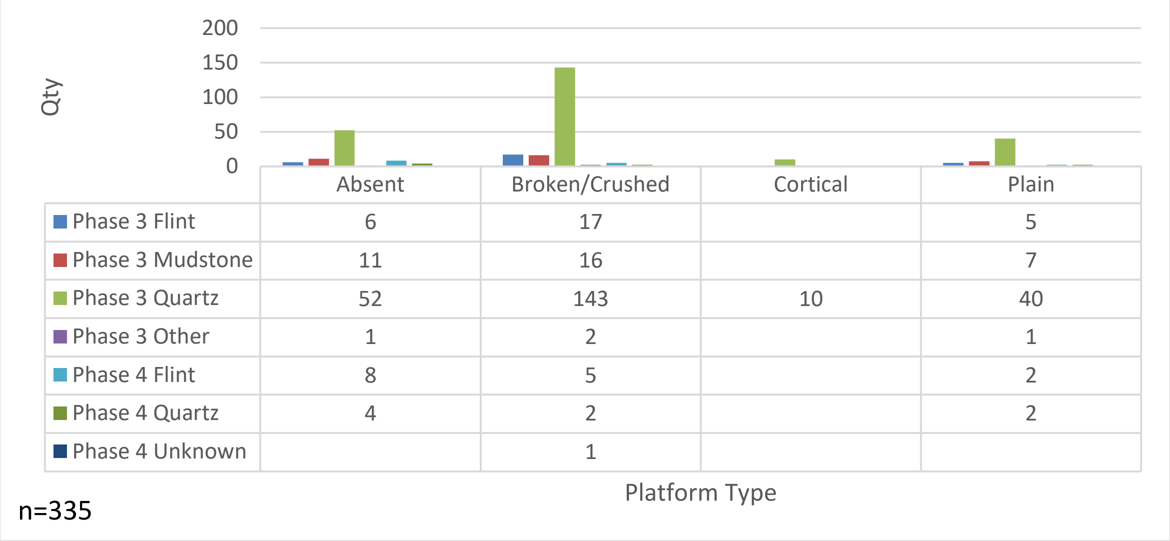


	0%	<50%	>50%	100%
🟦 Phase 3 Flint	20	5	2	1
🟥 Phase 3 Mudstone	23	10	1	
🟩 Phase 3 Quartz	152	45	19	29
🟪 Phase 3 Other	2	1	1	
🟦 Phase 4 Flint	6	5	3	1
🟩 Phase 4 Quartz	3	1	1	3
🟦 Phase 4 Unknown	1			

Figure 65. Northton 2010 flake cortex percentage

5.2.2.2.5.8. Striking Platform – Type and Dimensions

Absent or broken/crushed striking platforms are the most commonly recorded for all of the raw materials in both phases (Figure 66). In Phase 3 breakage/crushing is more frequent than the total absence of the striking platform in any of the raw materials, whereas this pattern is reversed in Phase 4. Plain striking platforms are common in quartz flakes from Phase 3, but less so in Phase 4. A small number of plain striking platforms are also recorded on flint from both phases. The baked mudstone flakes and the pegmatite flake from Phase 3 also have plain striking platforms. The only flakes to display complete cortical striking platforms are quartz flakes from Phase 3.



	Absent	Broken/Crushed	Cortical	Plain
Phase 3 Flint	6	17		5
Phase 3 Mudstone	11	16		7
Phase 3 Quartz	52	143	10	40
Phase 3 Other	1	2		1
Phase 4 Flint	8	5		2
Phase 4 Quartz	4	2		2
Phase 4 Unknown		1		

Figure 66. Northton 2010 flake striking platform type

There is a clear linear trend between the increasing size of the plain platform dimensions in both flint and baked mudstone (Figure 67). The majority of the baked mudstone plain platforms are of a similar size, clustered between 5mm-7mm in width and 1.5mm-3mm in depth, although there are two significantly larger platforms in this raw material. The flint plain platforms from both phases are fairly evenly distributed along the range of widths and none exceed 4.5mm in depth. The platform on the pegmatite flake is by far the largest, which reflects the large size of the flake, discussed in Section 5.2.2.2.5.3. For clarity, the quartz platform dimensions are presented separately to the rest of the raw materials, before being combined for comparison (Figure 69).

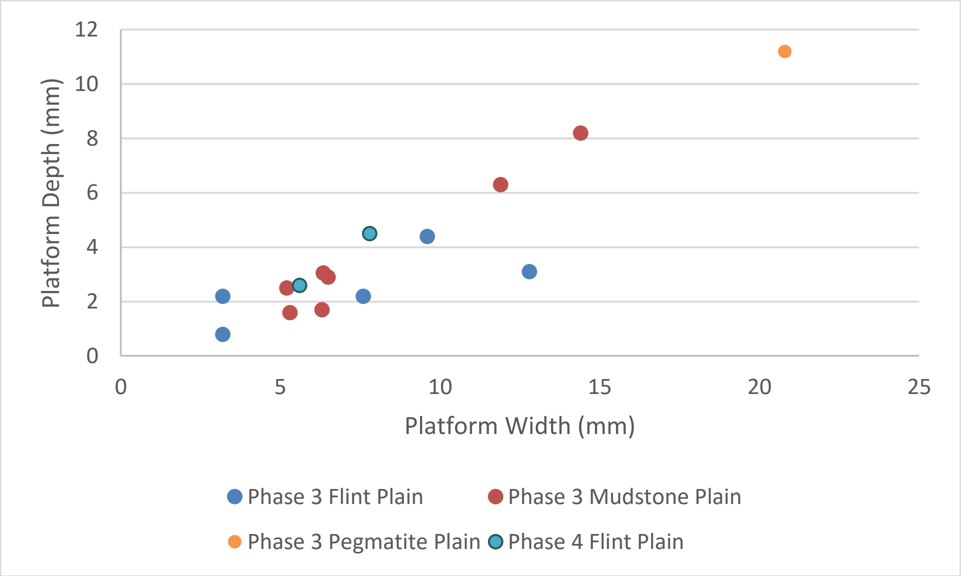


Figure 67. Northton 2010 plain striking platform dimensions for flint and baked mudstone

Figure 68 shows the platform dimensions for the quartz flakes, which are either plain or cortical platforms. The majority of plain platforms from Phase 3 fall between 3mm-15mm in width, whereas most of the cortical platforms from this phase are much larger, ranging from 14mm-50mm in width. Generally, the plain platforms from both phases are less than 10mm in depth, although the Phase

3 flakes vary more widely in their platform depth than those from Phase 4; the majority from Phase 3 are densely clustered below 5mm in depth and there are a number which exceed 10mm. The cortical platforms are more frequently found between 5mm-10mm in depth.

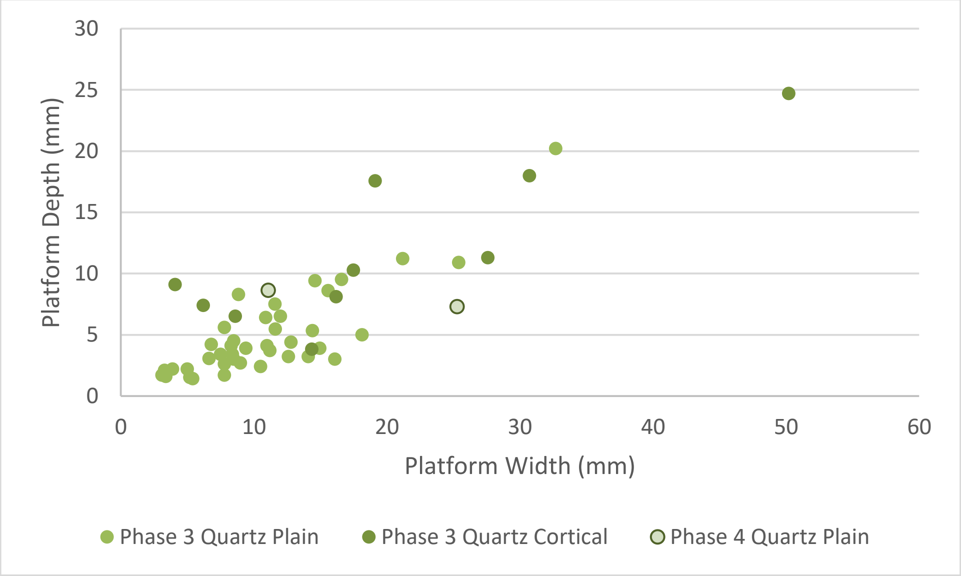


Figure 68. Northton 2010 plain and cortical striking platform dimensions for quartz

The majority of the other raw materials with plain platforms fall within the densest cluster of those recorded in the quartz assemblage (Figure 69). Only two of the mudstone platforms are comparable with the larger quartz plain platforms.

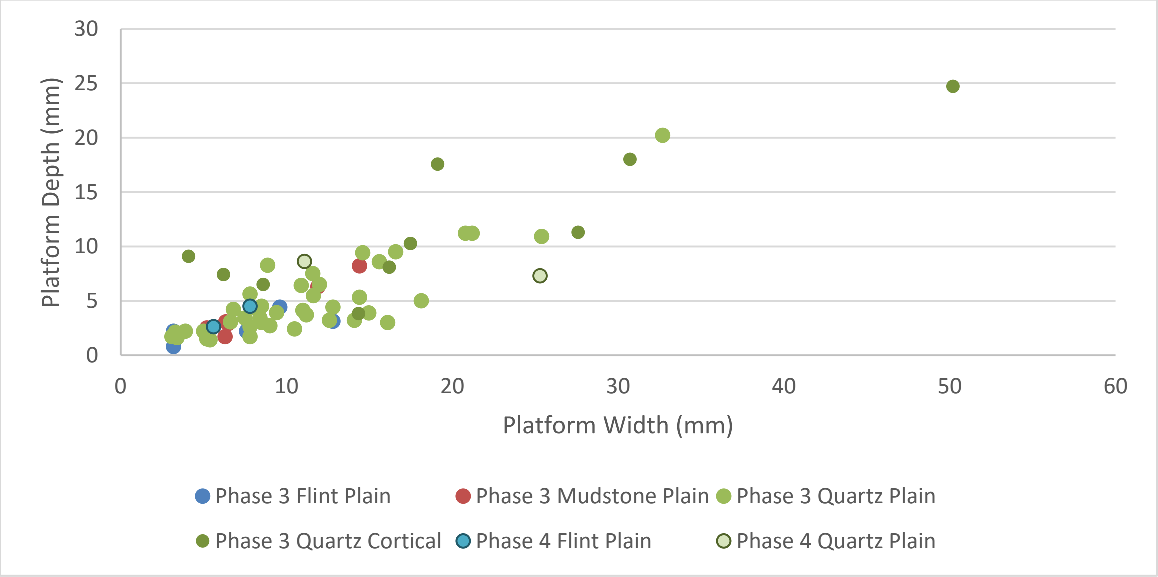
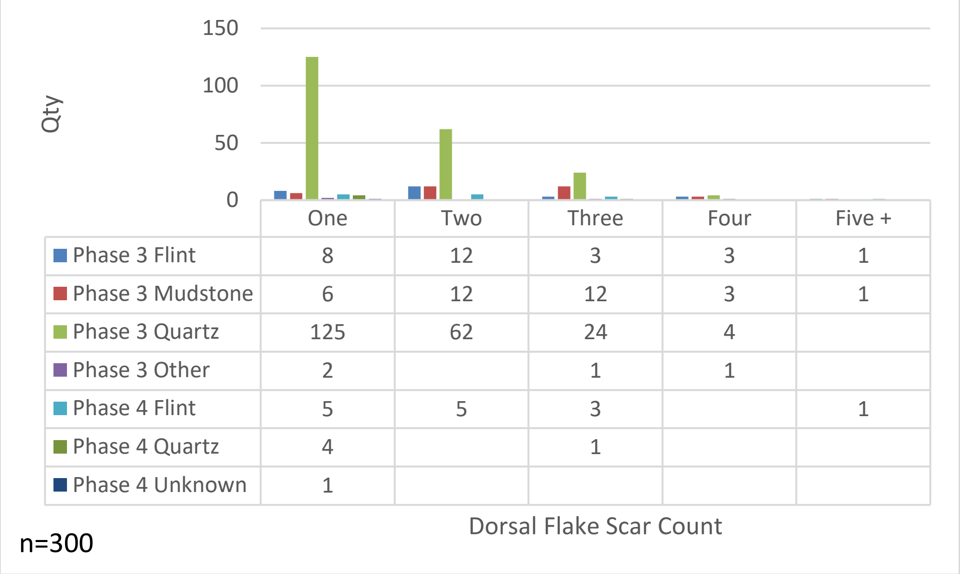


Figure 69. Northton 2010 striking platform dimensions for all raw materials

5.2.2.2.5.9. Dorsal Flake Scars – Count and Pattern

In Phase 3, single dorsal flake scars are the most commonly recorded number on quartz flakes, and none of the quartz flakes have more than four dorsal flake scars (Figure 70). The flint flakes predominantly display one or two flake scars, however three or more are not uncommon. The most frequently occurring number of dorsal flakes scars recorded on the baked mudstone flakes from this phase is two or three, although a single baked mudstone flake has six dorsal flake scars. The pegmatite and igneous flakes from Phase 3 have single dorsal flake scars, whereas the carbonate flake has three dorsal flake scars and the gneiss flake has four.

In Phase 4, all of the quartz flakes have one dorsal flake scar, with a single exception. The unknown raw material flake has one dorsal removal also. A single flint flake from Phase 4 has five dorsal flake scars, however the most commonly occurring number is one or two removals, as in Phase 3.

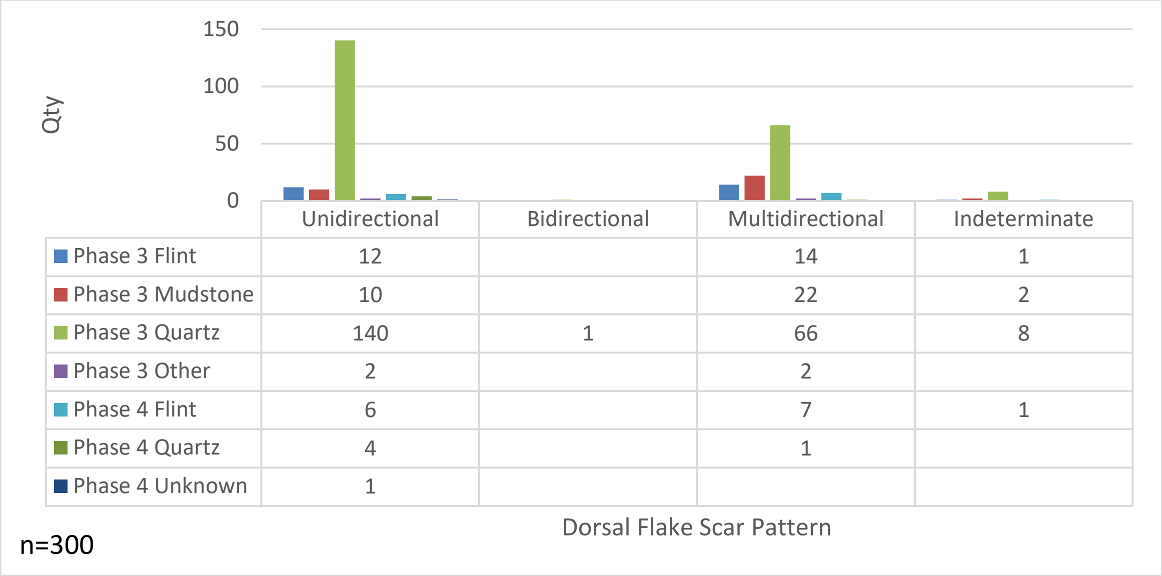


	One	Two	Three	Four	Five +
Phase 3 Flint	8	12	3	3	1
Phase 3 Mudstone	6	12	12	3	1
Phase 3 Quartz	125	62	24	4	
Phase 3 Other	2		1	1	
Phase 4 Flint	5	5	3		1
Phase 4 Quartz	4		1		
Phase 4 Unknown	1				

Figure 70. Northton 2010 dorsal flake scar count

Only a single quartz flake from Phase 3 exhibits bidirectional dorsal flake scars, which is indicative of a bipolar reduction technique (Figure 71). Unidirectional removals are the most commonly recorded in this raw material from this phase, although multidirectional removals are also well represented. Multidirectional removals are only marginally more common than unidirectional removals on flint in Phase 3, with the same pattern occurring in mudstone flakes, albeit significantly more pronounced. There are only a few instances where the dorsal flake scar pattern could not be determined in the raw materials from Phase 3.

In Phase 4, the majority of quartz flakes display a unidirectional dorsal flake scar pattern, as does the unknown raw material. As in Phase 3, a marginally higher number of flint flakes exhibit multidirectional dorsal flake scar patterns than those with unidirectional ones.

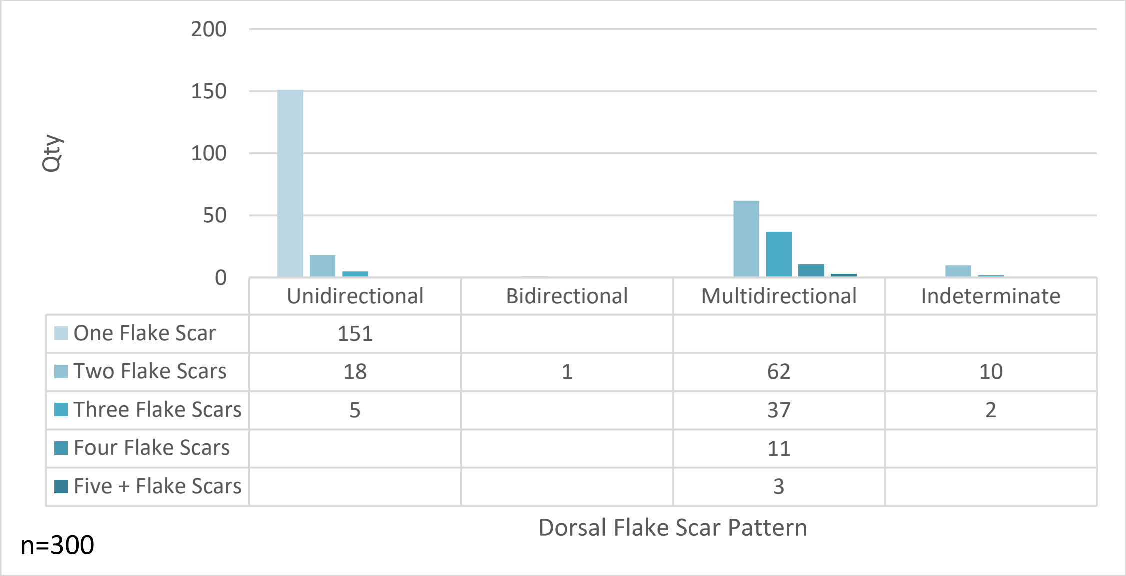


	Unidirectional	Bidirectional	Multidirectional	Indeterminate
Phase 3 Flint	12		14	1
Phase 3 Mudstone	10		22	2
Phase 3 Quartz	140	1	66	8
Phase 3 Other	2		2	
Phase 4 Flint	6		7	1
Phase 4 Quartz	4		1	
Phase 4 Unknown	1			

Dorsal Flake Scar Pattern

Figure 71. Northton 2010 dorsal flake scar pattern

The small number of indeterminate dorsal flake scar patterns is confined to flakes with two or three dorsal flake scars and is likely due to the nature of the raw material, which is predominantly quartz (Figure 71 and Figure 72). Flakes with single dorsal flake scars only display unidirectional removals as would be expected. Additionally, a unidirectional flake scar pattern is also present on flakes which exhibit two or three dorsal flake scars, although a multidirectional pattern is far more common for this number of flake removals. Flakes with four or more dorsal flake scars show that these have been removed exclusively following a multidirectional pattern.



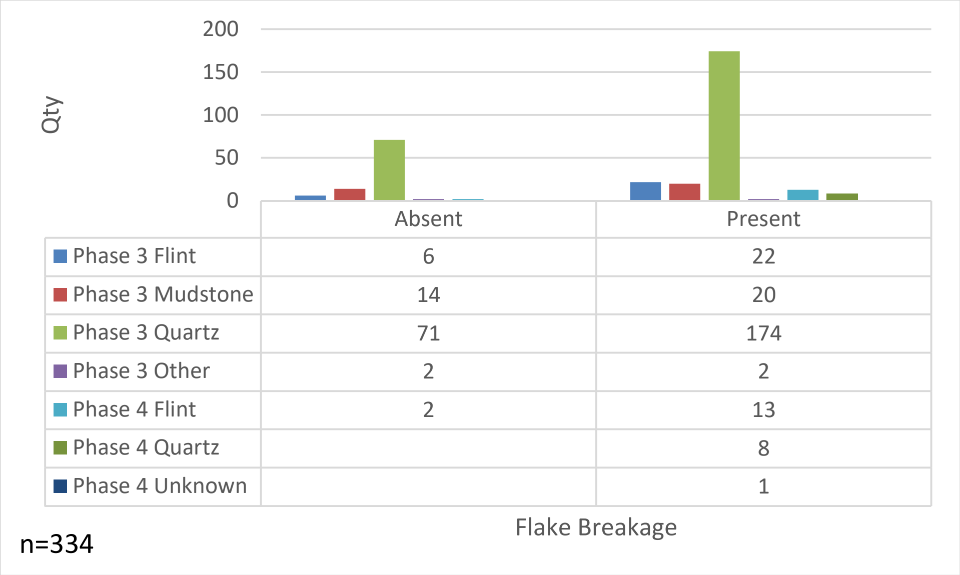
	Unidirectional	Bidirectional	Multidirectional	Indeterminate
One Flake Scar	151			
Two Flake Scars	18	1	62	10
Three Flake Scars	5		37	2
Four Flake Scars			11	
Five + Flake Scars			3	

Dorsal Flake Scar Pattern

Figure 72. Northton 2010 dorsal flake scar count in relation to flake scar pattern

5.2.2.2.5.10. Flake Breakage

With the exception of the Phase 3 carbonate and gneiss flakes, flake breakage is most commonly recorded as present across all of the raw materials, and in both phases (Figure 73).



	Absent	Present
Phase 3 Flint	6	22
Phase 3 Mudstone	14	20
Phase 3 Quartz	71	174
Phase 3 Other	2	2
Phase 4 Flint	2	13
Phase 4 Quartz		8
Phase 4 Unknown		1

Figure 73. Northton 2010 flake breakage

5.2.2.2.5.11. Flake Cores

There are four flake cores in the assemblage at Northton which were all recovered from Phase 3. The dimensions are presented in Table 11.

The baked mudstone flake core (SF25) does not exhibit any cortex and the plain platform measures 5.7mm X 5.8mm. There are three multidirectional dorsal flake scars present on the piece, which is complete. A further flake removal (SF26) has been taken from the ventral face, which refits and is described below. Overall, this piece is slightly larger than the mean dimensions of the baked mudstone flakes from Phase 3 (Table 8 and Table 11).

The three quartz flake cores (SF95m, SF95r and L501) are mixed varieties which grade between greasy and fine grained quartz.

SF95m does not display any cortex and the platform is broken. There are three multidirectional dorsal flake scars present; two of these were formed during the initial knapping sequence, prior to the removal of the flake from the core. The third flake removal has been initiated from the broken left lateral edge, which was used as a platform to remove the third flake on the dorsal side. The thickness measurement for this piece conforms to the mean of the quartz flakes for this phase, however the length and width dimensions are much larger than the mean (Table 8 and Table 11).

SF95r retains <50% cortex along the right lateral edge, which is smooth and rounded, suggesting the source is a water-rolled pebble. There are two multidirectional flake removals from the piece – one has been initiated from the cortical edge which removed the original platform of the piece, and formed a platform for the second removal on the dorsal side. There is breakage on the left lateral edge. The width of SF95r is slightly less than the mean for the quartz flakes from Phase 3, however the length and thickness are both larger than the average (Table 8 and Table 11).

Despite the slight breakage at one end of the platform of L501, it remains very large, which allowed it to be used as a platform for a further removal from the ventral face of the piece. There is only one dorsal flake scar present, yet it is a tertiary flake, and there is breakage to both lateral sides. The length of L501 fits with the mean of the quartz flakes from Phase 3, however the width and thickness are much larger (Table 8 and Table 11).

Context No.	Catalogue No.	Raw Material	Length (mm)	Width (mm)	Thickness (mm)
009	SF25	Baked mudstone	16.10	15.00	5.70
009	SF95m	Quartz	31.09	11.08	5.84
009	SF95r	Quartz	22.92	14.61	8.78
009	L501	Quartz	17.50	24.40	9.20

Table 11. Northton 2010 flake core dimensions

5.2.2.2.5.12. Core Rejuvenation Flakes

Four core rejuvenation flakes were found at Northton. Two are fine grained quartz and from Phase 3, two are flint and from Phase 4. The dimensions for the core rejuvenation flakes are presented in Table 12.

L481 and L482 are the fine grained quartz core rejuvenation flakes recovered from Phase 3. Both have broken platforms but no other observable breakage. L481 does not display any cortex and has four multidirectional dorsal flake scars. L482 retains <50% cortex and has three multidirectional dorsal flake scars. The length and thickness of both these pieces is much larger than the mean for the quartz flakes from Phase 3, however the width is much narrower than the average (Table 8 and Table 12).

L611 and L612 are the flint core rejuvenation flakes found in Phase 4. L611 has a broken platform, but no other breakage present. There is no cortex present on this piece and four multidirectional dorsal flake scars were recorded. L611 is exactly average in length, when compared to the mean lengths of the flint flakes from Phase 4, whereas the width is much narrower and the thickness much greater (Table 8 and Table 12).

L612 retains <50% cortex and there are three multidirectional dorsal flake scars. One of these previous flake removals was used as the platform for the other two flake removals. There is fine, scaled, normally orientated, and sporadic secondary working on the edge of this piece which has been initiated from an acute angle, and used to prepare the edge of the platform along a convex course (Figure 74). The cortex on this piece is smooth and rounded, thus the raw material likely derived from a water-rolled beach pebble. This piece is very short in comparison to the average length of the flint flakes in this phase, however the width and thickness measurements of L612 exceed the maximum dimensions recorded for any of the Phase 4 flint flakes (Table 8 and Table 12).

Figure 74. L612 core rejuvenation flake with retouch/platform preparation

Context No.	Catalogue No.	Raw Material	Length (mm)	Width (mm)	Thickness (mm)
009	L481	Quartz	31.00	12.00	10.60
009	L482	Quartz	33.10	9.30	9.60
016	L611	Flint	11.94	3.01	7.73
016	L612	Flint	3.88	15.29	7.26

Table 12. Northton 2010 core rejuvenation flake dimensions

5.2.2.2.5.13. Refits

In both phases two sets of refitting pieces were identified. In Phase 3 baked mudstone flakes SF25 and SF26 were found to refit. The former is a flake core (described in Section 5.2.2.2.5.11) and the refitting piece SF26 is the flake spall which was removed from the ventral face of SF25. SF26 measures 24.20mm X 18.20mm X 2.70mm and does not exhibit any cortex. The platform is absent and there are three multidirectional dorsal flake scars present, with no additional breakage.

Also from Phase 3 are milky quartz flakes L177 and L178. L177 has a plain platform that exhibits a small amount of knapping shatter and has therefore been recorded as broken. The piece measures 15.40mm X 23.90mm X 3.00mm. A single unidirectional flake removal (L178) has been made from the dorsal side on the same platform, which refits. L178 measures 10.50mm X 15.10mm X1.80mm and there is no cortex present on the piece. A single unidirectional dorsal flake scar is present and there is breakage to the flake in addition to the absent striking platform.

In Phase 4 a flint chunk (L157) and a flint flake (L158) refit together. L157 measures 11.70mm X 10.10mm X 4.30mm and displays >50% cortex, with substantial breakage. L158 has clearly spalled off from L157 upon striking, which has broken the platform. The piece measures 11.20mm X 5.40mm X 2.90mm and there is <50% cortex present. There is a single, unidirectional flake scar which is the relic surface of L157.

L153 and L167 were also recovered from Phase 4, albeit from separate contexts. Both pieces retain >50% cortex and there are two multidirectional dorsal flake scars on both pieces. L167 is the proximal end of what was a much larger flake and the platform is absent. L153 is the distal end of this original, larger, flake which has broken with a perpendicular snap across centre. The cortex present on these pieces is a pale pink colour and likely derived from the same unit as L147-L155.

5.2.2.2.5.14. Blades

There are three blades in the Northton assemblage, all of which come from Phase 3. The baked mudstone blade (SF78) retains <50% cortex on the dorsal side along with two, multidirectional, dorsal flake scars. The platform has broken on this piece and the end has snapped off. From the dimensions (Table 13), this piece does not appear to be a true blade; however when taking into account the breakage the piece fits with the definition. When compared to the maximum length of the baked mudstone flakes, the blade is very long but of average width and thickness (Table 8 and Table 13).

There are two quartz blades from Northton. Both of these exceed the average length of the quartz flakes from this phase, but are narrower and thinner than the mean (Table 8 and Table 13). The blade made from milky quartz (SF103i) is also broken at the end therefore, like the baked mudstone blade, the dimensions do not suggest it is a true blade but would be so if it were complete. There is no cortex present on this piece and the plain platform is complete, measuring 7.8mm X 2.7mm. There are two unidirectional flake scars visible on the dorsal face of the blade.

The fine grained quartz piece (L637) is also a broken blade – the platform is absent and a parallel snap runs the length of the blade. There is no cortex present on this piece and there are two unidirectional dorsal flake scars evident. The dimensions for this blade are presented in Table 13.

Context No.	Catalogue No.	Raw Material	Blade Length (mm)	Blade Width (mm)	Blade Thickness (mm)
009	SF78	Baked mudstone	20.60	14.00	3.40
009	SF103i	Quartz	20.10	11.70	2.80
009	L637	Quartz	20.01	7.59	3.81

Table 13. Northton 2010 blade dimensions

5.2.2.2.6. Secondary Technology

Several pieces in the Northton assemblage display secondary working. Each piece is described individually below.

5.2.2.2.6.1. Burins

Three burins were recovered from Phase 3. Two are flint and one is milky quartz that grades to rock crystal. The dimensions for the burins are presented in Table 14.

SF79 is a flint burin on the proximal end of a blade, which retains <50% cortex and has a plain platform measuring 10.10mm X 2.20mm. The burin spall has been removed by a single, abrupt removal initiated from the distal end towards the right lateral edge. This was the final flake removal in a sequence of four multidirectional flake removals (Figure 75). The full extent of the removal is not evident due to a parallel snap at the distal end of the piece. This piece exceeds the maximum length of the largest flint flake recorded in Phase 3, and the width and thickness measurements far exceed the average for flint in this phase (Table 8 and Table 14).

Figure 75. SF79 flint burin

L113 also has four multidirectional dorsal flake scars. This flint burin does not display any cortex and there is no evidence for further breakage on the piece beyond the broken platform. The burin spall on this piece has also been removed from the distal end towards the right lateral edge. In contrast to SF79, this piece falls marginally below the mean figures in all dimensions (Table 8 and Table 14).

Figure 76. L113 flint burin

The burin spall removed from L467 was initiated from the proximal end towards the left lateral edge (Figure 77). This quartz burin does not exhibit any cortex, and the platform on the piece has been broken by the burin spall removal. There are only two multidirectional dorsal flake scars on the piece and no evidence of breakage. The dimensions for this burin all fall below the average size for quartz flakes in Phase 3 (Table 8 and Table 14).

Figure 77. L467 quartz burin

Context No.	Catalogue No.	Raw Material	Length (mm)	Width (mm)	Thickness (mm)
009	SF79	Flint	21.80	14.80	5.50
009	L113	Flint	14.00	8.00	2.40
009	L467	Quartz	11.80	8.40	4.20

Table 14. Northton 2010 burin dimensions

5.2.2.2.6.2. Microliths

Five flint microliths were recovered from Phase 3 and three flint microliths were recovered from Phase 4. From Phase 3 are: a double backed blade (SF65); a scalene triangle/crescent (L79); a fine point (L90); and two truncations – a microburin (SF97), and a possible *lamelles a cran* (L65). From Phase 4 two crescents (L162; L613), an obliquely blunted blade (L609), and an indeterminate backed piece (L159 – described in section 5.2.2.2.6.4) were recovered. Each piece is described individually.

The double backed blade (SF65; Figure 78) does not retain any cortex, and exhibits three unidirectional dorsal flake scars. Two of these flake scars form a central arris creating a crested blade; however the crest has been partially removed by a third flake removal along the centre of the blade. This flake scar terminates in a step fracture midway along the piece. There is continuous, fine edge retouch, which runs straight along both sides of the piece, removing the platform. The retouch has normal orientation with sub-parallel removals struck from an acute angle. SF65 measures 16.20mm X 13.30mm X 8.20mm.

Figure 78. SF65 double backed blade

L79 (Figure 79) grades between a scalene triangle and a crescent in form (Finlayson et al 1996:258). There is continuous fine to very fine, propeller retouch along both lateral edges, creating a backed and obliquely blunted point. The removals are sub-parallel and very abrupt, grading from straight to convex – hence the slight crescent form; on the left side a perpendicular snap forms the long edge of the scalene triangle. There is no cortex or platform present on the piece, and a single unidirectional dorsal flake scar was recorded. The piece measures 14.00mm X 4.90mm X 1.90mm.

Figure 79. L79 crescent-scalene triangle microlith

L90 is a fine point (Figure 80), which measures 14.70mm X 5.60mm X 1.70mm. A single, unidirectional dorsal flake scar was recorded, and there is no cortex present. The platform is absent due to a parallel snap. Backing along a perpendicular snap on the right lateral side, at the extreme distal end, has caused the edges of the blade to converge to a fine point, creating the piece. The backing is formed by sub-parallel removals of continuous, fine to very fine invasive edge retouch, initiated at an acute angle with normal orientation. At the proximal end the retouch becomes more acute and invasive, and the very tip of the point has been broken.

Figure 80. L90 fine point microlith

The microburin (SF97) measures 16.20mm X 21.90mm X 4.10mm. There is <50% cortex present on the piece and there are three multidirectional dorsal flake scars. The second flake removal appears to have been a failed attempt at creating a notch on the left lateral side. The third flake removal – an invasive, scaled, very coarse removal initiated normally at an acute angle was successful in creating a notch at the mesial right lateral edge (Figure 81, arrowed). The breakage recorded on this piece is the accompanying microburin snap.

Figure 81. SF97 microburin

Due to the breakage present on L65, this piece cannot be confidently identified as a *lamelles à cran* truncation (Figure 82). However, a best estimate of this type of truncation has been made on the basis of continuous, normal edge retouch which runs along a straight to concave course, and forms a notch on the right lateral side of the proximal end. The very abrupt angle of the removals has created sub-parallel removals, which vary from fine to very coarse. The platform is absent and there is no cortex present on this piece. The retouch has obscured three of the four dorsal flake scars; therefore the dorsal flake scar pattern could not be determined. It measures 16.20mm X 13.3mm X 8.2mm.

Figure 82. L65 possible *lamelles à cran* truncation

The two crescent microliths recovered from Phase 4 are L162 and L613. There is <50% cortex present on the dorsal face of L162, in addition to two multidirectional flake scars. The platform is absent due to the presence of microlithic edge retouch along a perpendicular snap. The retouch follows a convex course, creating the crescent shape of the microlith (Figure 83). The parallel removals are continuous in their extent, ranging from fine to coarse and initiated from a very abrupt angle with normal orientation. L162 measures 13.6mm X 6.4mm X 3.9mm.

Figure 83. L162 crescent microlith

L613 is much smaller than the piece described above, with dimensions of 8.64mm X 3.15mm X 1.27mm. This piece is complete and there are two unidirectional dorsal flake scars present, with no cortex recorded. The absence of the platform is due to the presence of microlithic edge retouch which extends from the proximal end along the entire left lateral edge (Figure 84). This retouch is continuous and slightly convex in its course, with normal orientation. The removals are fine, scaled, and initiated from a very abrupt angle. This piece is interpreted as a very small crescent microlith.

Figure 84. L613 crescent microlith

L609 is a very small retouched piece measuring only 8.16mm X 4.11mm X 0.81mm (Figure 85). There is no cortex present on the piece and the platform is absent. A single unidirectional dorsal flake scar was recorded, and there is breakage on all edges of the piece. At the proximal end the oblique snap has been blunted by edge retouch. The retouch extends along the full width of the piece but, due to the size of the piece, is recorded as sporadic according to the methodology. The course of the retouch is straight and it has normal orientation with very fine scaled removals initiated from an abrupt angle. The oblique blunting of the breakage on this piece, and the fact the length is twice that of its width suggests this is a very small obliquely blunted blade.

Figure 85. L609 obliquely blunted microlith

5.2.2.2.6.3. Scraper

A single quartz scraper (SF103a) was recovered from Northton in Phase 3. The dimensions of the piece are 42.60mm X 23.20mm X 12.10mm and there is 100% dorsal cortex coverage. Initial observations indicate that up to five secondary removals have been made in order to create the scraper edge along the right lateral side. The piece has been archived for future analysis of potential microwear and residue, therefore no further analysis was undertaken.

5.2.2.2.6.4. Miscellaneous Pieces

There is secondary working on a single flint piece from Phase 4. However, due to its size (11.40mm X 6.75mm X 5.04mm), and the nature of the retouch its function cannot be determined. L159 displays a straight course of continuous, alternating retouch along its cortical edge (Figure 86, arrowed). These removals have been initiated from a very abrupt angle and range from fine to coarse, with a scaled to stepped morphology. There are two unidirectional flake scars present on the dorsal face and the platform is absent. The retouch may have been an attempt to remove the cortex present at the proximal end of this piece.

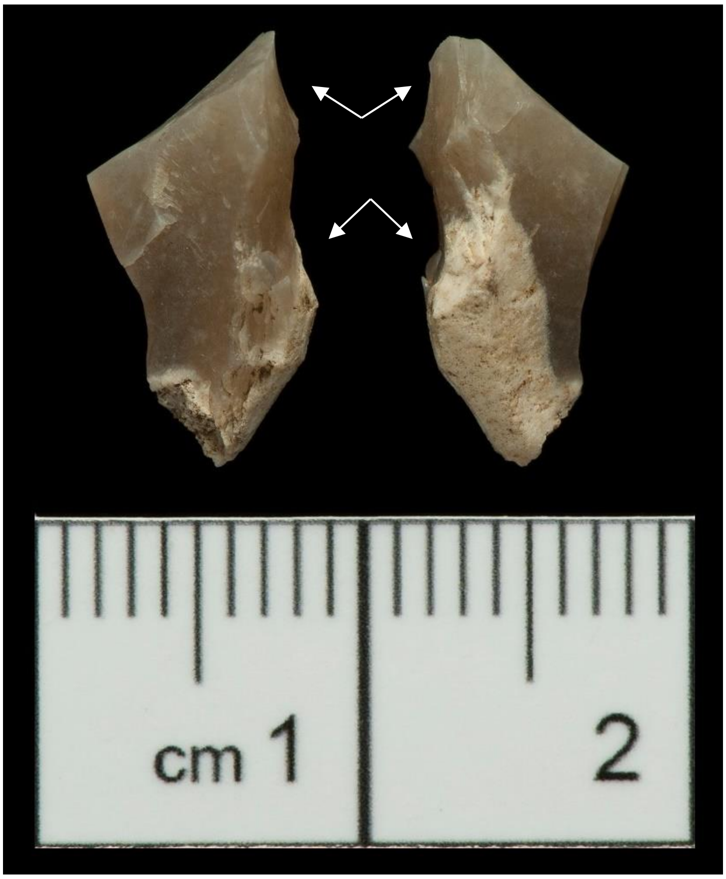


Figure 86. L159 miscellaneous retouched piece

The retouch present on the core rejuvenation flake L612 is described above in Section 5.2.2.2.6.4.

5.2.2.3. Northton 2011 Excavation Lithic Assemblage Results

During the fieldwork season of 2011, seventeen sections were excavated at 3m intervals around the eroding coastal edge of the Toe Head peninsula, close to the area targeted for excavation in 2010. Section numbers 1-5 were situated to the north-east of the 2010 trench and sections 6-17 were located to the north-west (Bishop *et al.* 2012a). The Mesolithic contexts interpreted as the earlier and later anthropogenic ground surface horizons, which were identified in 2010 (C009, C016 and C017), were present in all of the sections to the north-east of the 2010 trench. To the north-west, C009 (Phase 3) was only present in sections 7-10 and C016/C017 was identified in sections 6-15. C009 was absent from section 15, which lay between sections 7 and 8, appearing to have eroded away. C018 was instead identified below the machair deposits and above the glacial till in this section. C018 comprised a dark brown sandy-silt of similar composition to C017, although darker in colour. It is interpreted as comparable to C016/C017 and likely to be part of the Phase 4 lower Mesolithic horizon (Bishop *et al.* 2012a).

5.2.2.3.1. General Character of the Assemblage

A total of 29 artefacts were recovered from six of the excavated sections during the 2011 excavation at Northton. The majority of the material was recovered following post-excavation processing of the bulk samples, however SF103, SF104 and SF105 were recorded *in situ*, eroding from C009

(Phase 3), immediately next to the 2010 trench. One flint flake (SF102) was unstratified and is not included in this analysis. All of the worked lithic material derived from the Mesolithic horizons, with the exception of the unstratified flake. Sixteen pieces were identified in what is believed to be the continuation of C009 (Phase 3), which was identified during the 2010 excavation. Twelve pieces derived from contexts equivalent to Phase 4 of the 2010 excavation (C016/017 and C018).

The lithic assemblage from the >4mm sieved residue fraction is dominated by flakes and small fraction flakes (Figure 87 and Table 15). A single manuport was also recovered in addition to two cores, one of which is a broken core fragment.

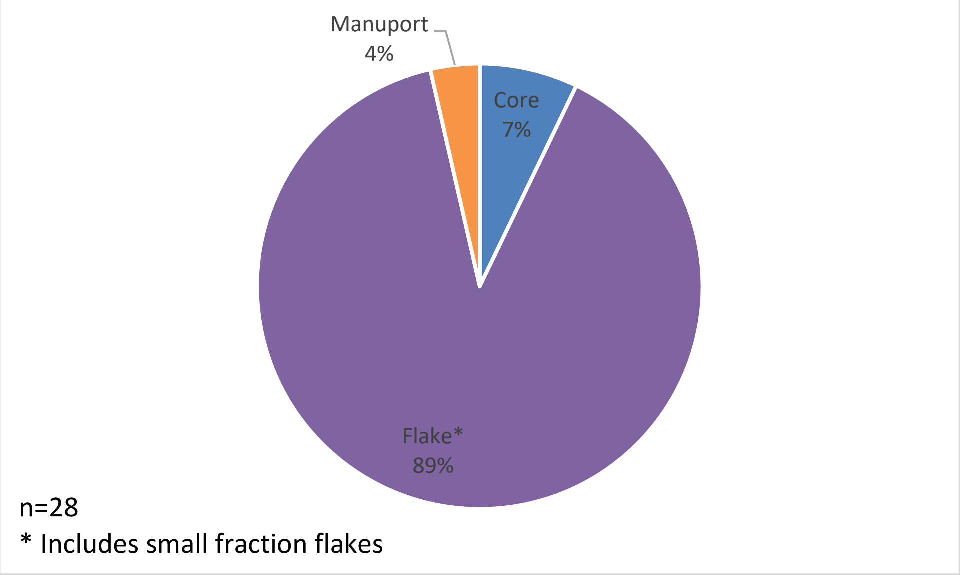


Figure 87. Northton 2011 assemblage composition

Technology	**Raw Material**			
	Quartz	**Flint**	**Other**	**Total**
Core	2			2
Flake	13	1	2	16
Small Fraction Flake	7	2		9
Manuport	1			1
Total	23	3	2	28

Table 15. Northton 2011 assemblage composition

5.2.2.3.2. Raw Material

Quartz is the most frequently occurring raw material in the Northton 2011 assemblage (Figure 88). Single flakes of feldspar and an unknown raw material represent a total of 7% of the assemblage. A slightly higher quantity of flint makes up the remainder.

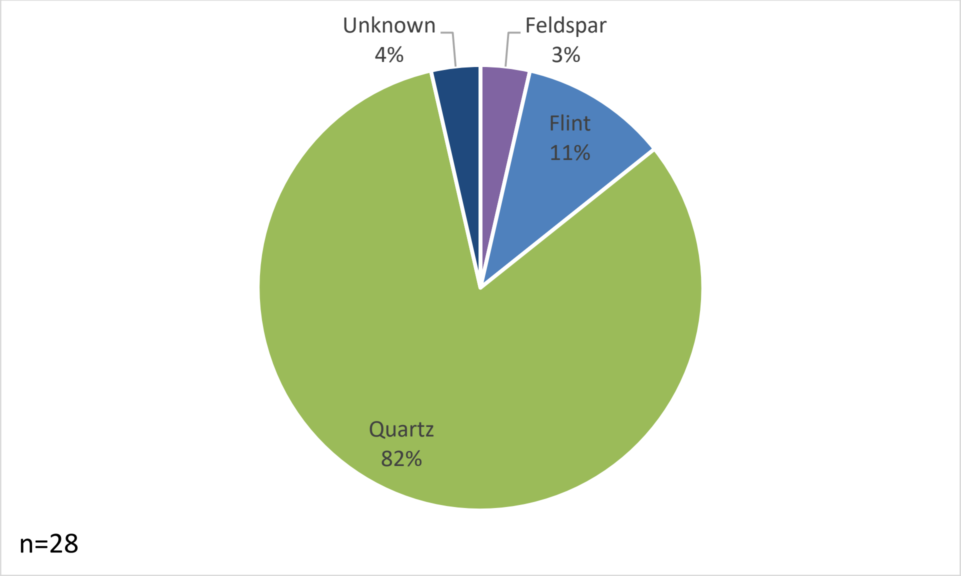


Figure 88. Northton 2011 raw material composition

The whole range of quartz varieties are represented in this small assemblage (Figure 89). The finer-grained varieties are more frequently present, with milky quartz the most common, and small quantities of fine grained quartz, rock crystal and greasy quartz. Single pieces of quartzite and coarse grained quartz were also identified. The mixed quartz varieties predominantly range between milky to fine grained.

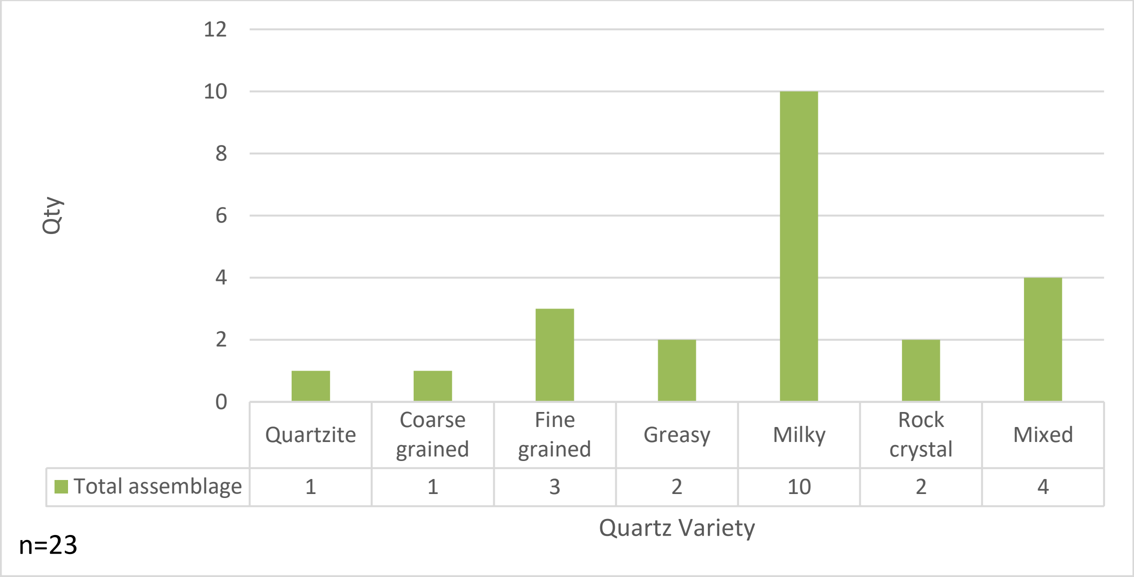


Figure 89. Northton 2011 quartz varieties

The lithics found in C009 (Phase 3) were only identified in sections 1-4, to the north-east of the 2010 trench, and number a total of 16 pieces. These are predominantly quartz with single flakes of flint and an unknown raw material (Figure 90). Only two lithics were recovered from C016/C017 (Phase 4). Both are flint, and these derived from section 12, to the north-west of the 2010 trench. The remaining ten lithics were recovered within section 15, from C018 (Phase 4), also to the north-west of the 2010 trench. The majority of these are quartz, with a single flake of feldspar also present.

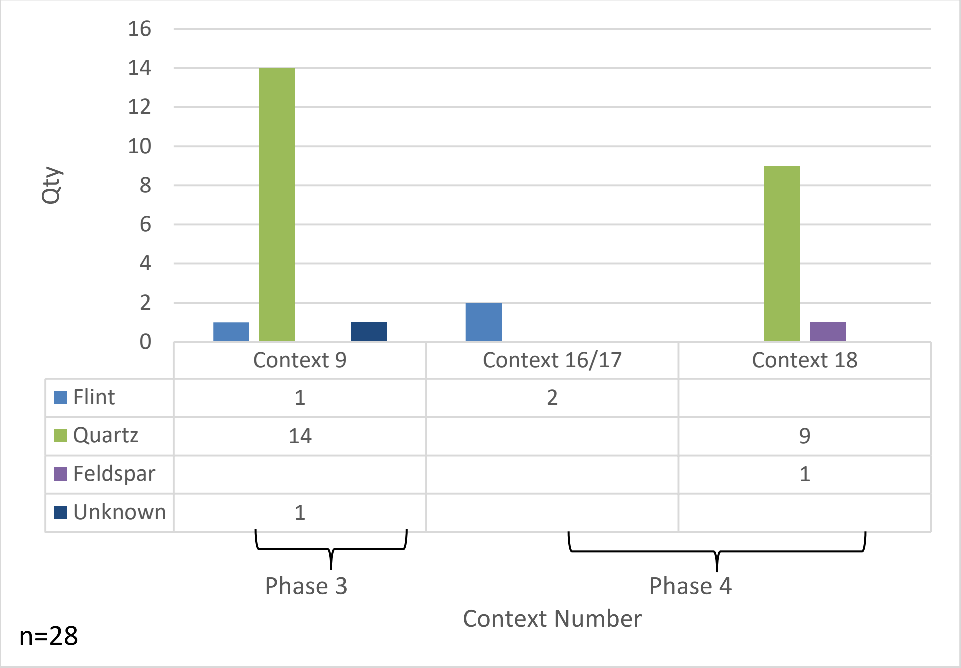


Figure 90. Northton 2011 raw material by context, with phases indicated

On the whole, the assemblage is in a fresh condition with little evidence of post-depositional movement. SF107 stands out as different from the rest of the assemblage as it appears to be rolled and abraded. Both of the flint pieces are light grey in colour. L650 does not appear to be patinated, whereas L663 is completely patinated and exhibits some iron pan staining. The unknown raw material piece is also very fresh in appearance.

The analysis presented below is on the primary technology from Northton 2011. The small fraction flake assemblage is detailed in Appendix Eleven.

5.2.2.3.3. Primary Technology: Coarse Stone

5.2.2.3.3.1. Manuports

A single greasy quartz manuport (L659) was recovered from C009 in section 3. The piece is a sub-rounded, water worn pebble which does not display any visible evidence for working and measures 49.71mm X 32.50mm X 22.56mm.

5.2.2.3.4. Primary Technology: Cores

Two quartz cores were recovered from the 2011 excavation at Northton, both from C009. SF105 was recovered eroding from the later Mesolithic horizon close to the 2010 trench. It is made from greasy quartz and the dimensions are presented in Table 16. The cortex on the core is smooth and rounded, suggesting the original source of the material was a beach pebble. There are six multidirectional flake scars on the piece, which were removed from unprepared platforms. Some platform preparation has also been lost due to subsequent flake removals.

L660 is very small piece of fine grained quartz and better described as a core fragment. The cortex on the piece is also smooth and rounded, again indicating a beach pebble source. A single, unidirectional flake removal has been initiated from an unprepared platform. The piece has clearly broken during knapping.

Catalogue No.	Quartz Variety	Length (mm)	Weight (g)
SF105	Greasy	29.40	8.98
L660	Fine grained	9.15	0.24

Table 16. Northton 2011 core dimensions

5.2.2.3.5. Primary Technology: Flakes

There are a total of 16 flakes (>10mm) from Northton 2011. Eight flakes each were recovered from Phase 3 (C009) and Phase 4 contexts (C016/017; C018).

5.2.2.3.5.1. Raw Material

Quartz dominates the flake assemblage from Northton 2011, with only single pieces of flint, feldspar and an unknown raw material represented (Figure 91). The unknown raw material flake was found in C009 (Figure 92). There is a slightly higher percentage of quartz in the Phase 3 assemblage which reflects the trend identified in 2010.

Flint and feldspar are present in the Phase 4 deposits, with a proportionally lower number of quartz flakes in comparison to Phase 3. Again this is consistent with the findings from 2010.

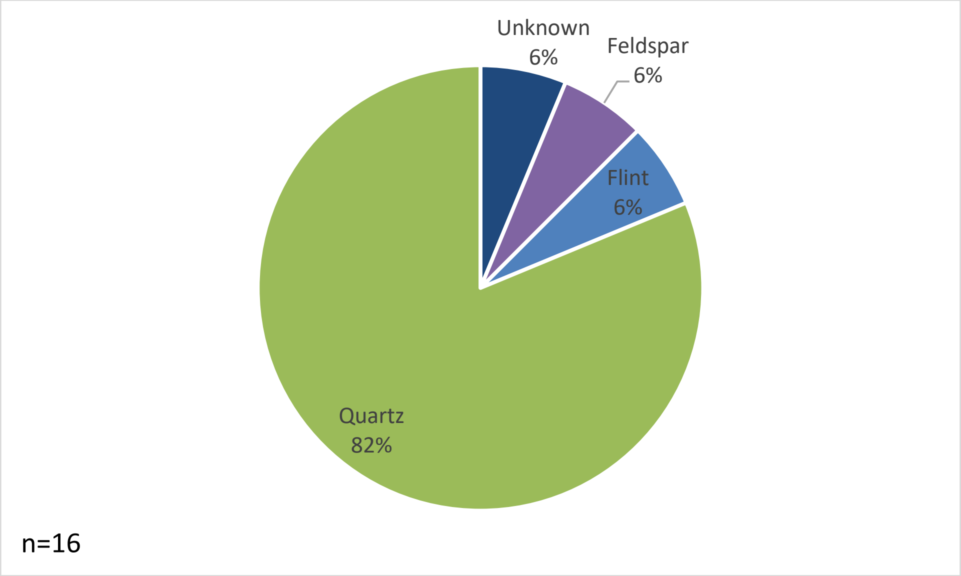
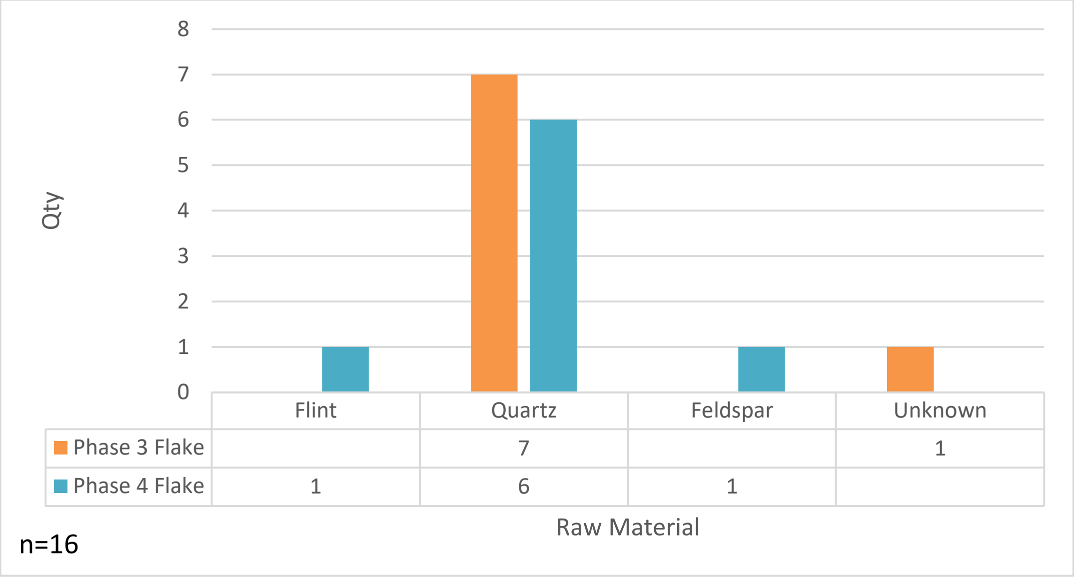


Figure 91. Northton 2011 total flake assemblage raw material composition

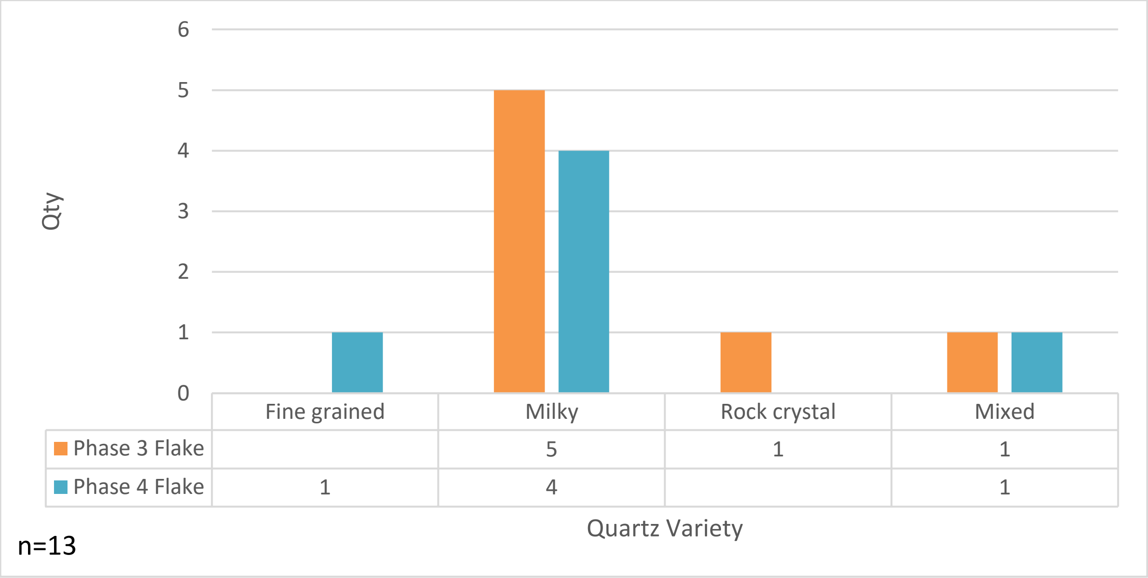


	Flint	Quartz	Feldspar	Unknown
🟧 Phase 3 Flake		7		1
🟦 Phase 4 Flake	1	6	1	

Figure 92. Northton 2011 Phase 3 and Phase 4 flake raw material composition

There is a wide range of quartz varieties present in the Northton 2011 assemblage, with milky quartz dominating the flake assemblage in both phases (Figure 93). In Phase 3 rock crystal and mixed milky to rock crystal flakes are also present.

In Phase 4 the remainder of the flake assemblage is split equally between fine grained and mixed (milky to fine grained) quartz varieties.



	Fine grained	Milky	Rock crystal	Mixed
🟧 Phase 3 Flake		5	1	1
🟦 Phase 4 Flake	1	4		1

Figure 93. Northton 2011 Phase 3 and Phase 4 flake quartz varieties

5.2.2.3.5.2. Flake Dimensions

The summary statistics for the quartz flakes are presented in Table 17. These could not be conducted for the other raw materials as there are less than three in each phase. The Phase 4 flakes have a wider range in length than those in Phase 3, although the mean value is very similar, and is reflected in the higher standard deviation value for Phase 4.

In contrast to the length, the Phase 4 flakes display less variation in the minimum and maximum dimensions for both width and thickness than those from Phase 3. Phase 3 has greater mean and standard deviation values for both of these dimensions than Phase 4.

Raw Material		**Length (mm)**		**Width (mm)**		**Thickness (mm)**	
		Phase 3	**Phase 4**	**Phase 3**	**Phase 4**	**Phase 3**	**Phase 4**
Quartz Flake	**Min**	11.14	11.09	6.41	6.60	1.64	2.30
	Max	25.51	30.18	19.04	15.22	9.97	5.90
	Mean	15.71	15.54	12.40	9.21	5.59	4.42
	SD	4.750448	7.325852	4.947657	3.183763	3.251896	1.44352

Table 17. Northton 2011 quartz flake dimension summary statistics for Phase 3 and 4

The majority of the quartz flakes from both phases, in addition to the feldspar and flint flakes from Phase 4, cluster very closely together in terms of length and width. It is clear from Figure 94 that the greater mean length of the Phase 4 quartz flakes is caused by a single outlier, which exceeds 30mm in length. The unknown raw material flake from Phase 3 is also clearly an outlier, over double the width of the rest of the flake assemblage and over 10mm longer. The longest quartz flakes from both phases are also the widest.

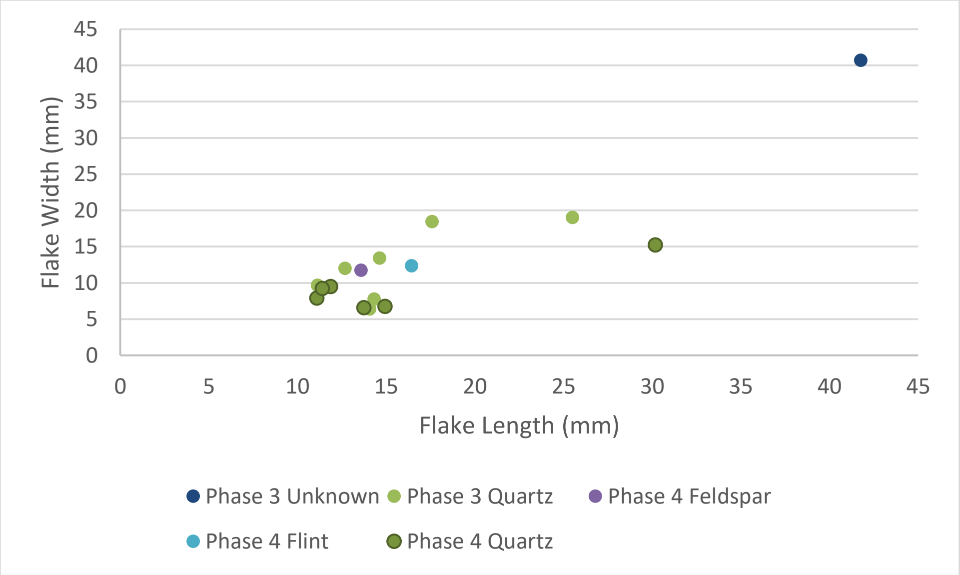


Figure 94. Northton 2011 flake dimensions length:width

The Phase 3 unknown raw material flake is also an outlier in terms of thickness (Figure 95). Although the Phase 3 and 4 quartz flakes are closely clustered in terms of length, the thickness varies widely (1.5-10mm). This is also the case for the feldspar and flint flakes from Phase 4. There is no correlation between the length and thickness of the Phase 4 quartz flakes, however there is a strong positive trend observed between these dimensions in the quartz flakes from Phase 3.

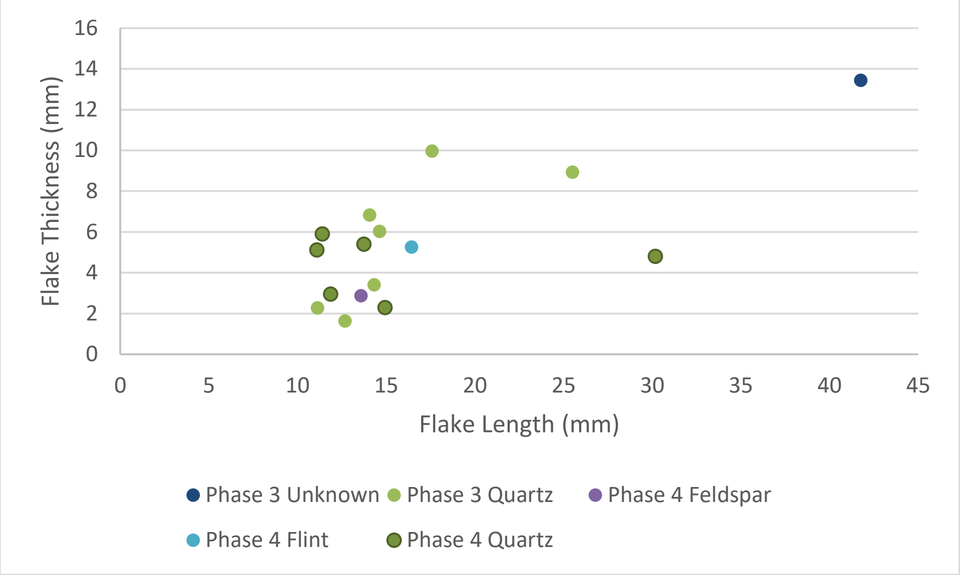


Figure 95. Northton 2011 flake dimensions length:thickness

The two longest and widest quartz flakes from Phase 3 are also the thickest (Figure 95 and Figure 96). The Phase 3 unknown raw material flake clearly stands apart from the rest of the assemblage which is loosely clustered between c.6.5-15.5mm in width and c1.5-7mm in length. The flint flake from Phase 4 is on the whole larger than the majority of the quartz flakes from this phase. The opposite is observed in Phase 3, where the quartz flakes are much larger than the flint flake.

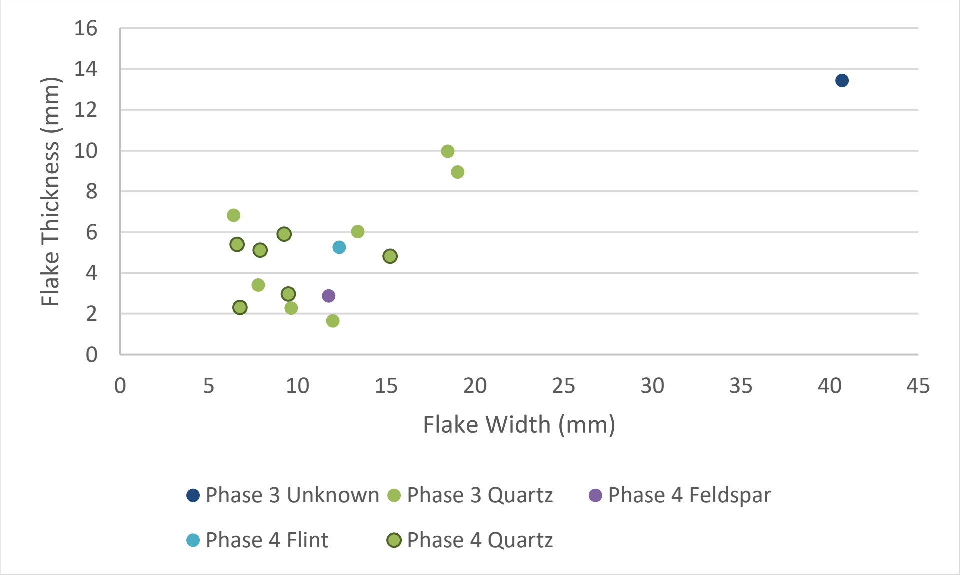
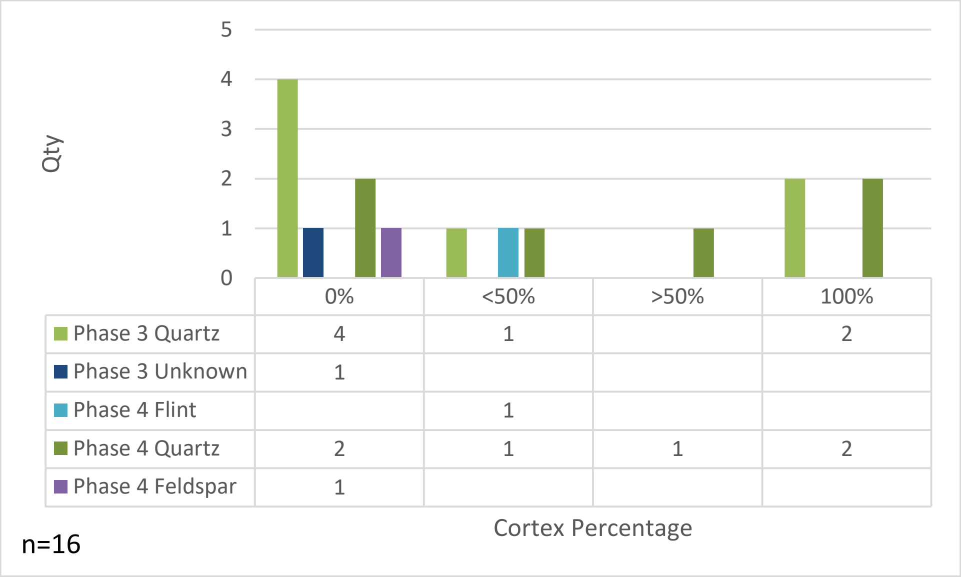


Figure 96. Northton 2011 flake dimensions width:thickness

5.2.2.3.5.3. Cortex

The unknown raw material flake from Phase 3 does not retain any cortex, nor do the majority of the quartz flakes from this phase (Figure 97). Only two of the quartz flakes have 100% cortex present. The cortex on one of these pieces is smooth and rounded, suggesting a beach pebble source whereas the other is flat and frosted, indicating it came from a block or plate. This type of cortex is also observed on the quartz flake from Phase 3 with <50% cortex present.

The flint flake from Phase 4 retains <50% cortex, which is smooth and rounded, again suggesting a beach pebble source. Both of the quartz pieces with 100% cortex, and the quartz flake displaying >50% cortex, were also sourced from beach pebbles as the cortex is smooth and rounded. The cortex on the quartz flake from Phase 4 with <50% cortex is flat and frosted, indicating it was removed as a block or plate from a vein. Only two quartz pieces from this phase are tertiary flakes.

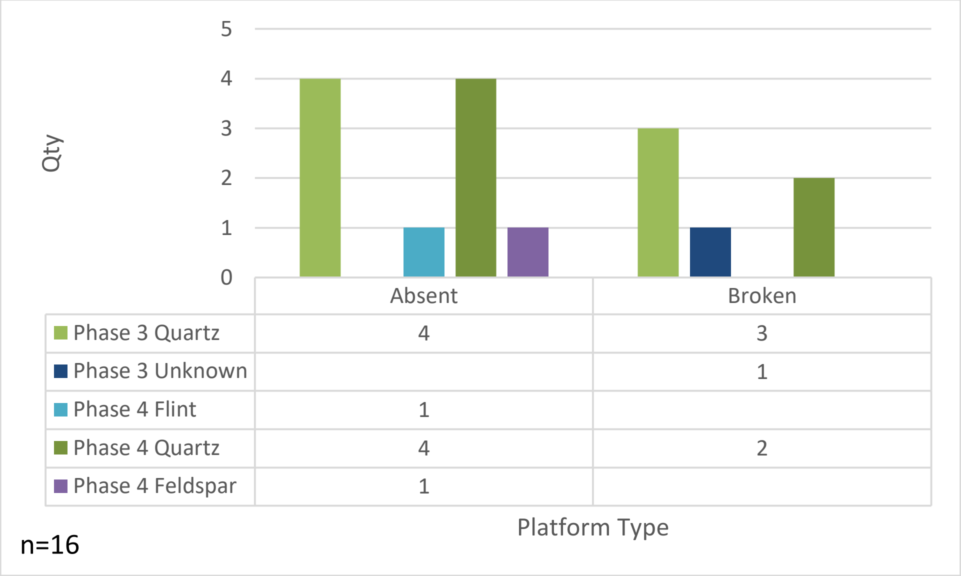


	0%	<50%	>50%	100%
🟩 Phase 3 Quartz	4	1		2
🟦 Phase 3 Unknown	1			
🟦 Phase 4 Flint		1		
🟩 Phase 4 Quartz	2	1	1	2
🟪 Phase 4 Feldspar	1			

Figure 97. Northton 2011 flake cortex percentage

5.2.2.3.5.4. Striking Platform Type

There are only two types of striking platform recorded on the flake assemblage from Northton 2011: absent or broken (Figure 98). In Phase 3 the striking platform is absent in the majority of the quartz flakes. For the unknown raw material flake and the remainder of the quartz flakes the platform is broken. In Phase 4 the feldspar, flint and majority of the quartz flakes also have absent striking platforms. Only two quartz flakes have platforms which are broken.



	Absent	Broken
🟩 Phase 3 Quartz	4	3
🟦 Phase 3 Unknown		1
🟦 Phase 4 Flint	1	
🟩 Phase 4 Quartz	4	2
🟪 Phase 4 Feldspar	1	

Figure 98. Northton 2011 flake striking platform type

5.2.2.3.5.5. Dorsal Flake Scars – Count and Pattern

Of the six flakes from Phase 3 that have dorsal flake scars present (one unknown raw material and five quartz); five have single, unidirectional flake scars. A single mixed quartz flake has two dorsal flake scars; however the removal sequence is indeterminate due to the nature of the raw material. There are six flakes in Phase 4 with dorsal flake scars and all of these are single, unidirectional removals.

5.2.2.3.5.6. Flake Breakage

All of the flakes in Phase 3 are broken, and only a fine grained flake from Phase 4 is complete.

5.2.2.4. Assemblage Summary

A total of 810 artefacts were analysed from the 2010 and 2011 excavations at Northton. The assemblage, which derives from two distinctly dated phases, represents elements of the entire lithic reduction sequence from hammerstones; an anvil and primary working flakes, to blades and finished tools such as microliths and a scraper. The volume of small fraction debitage (Appendix Eleven) indicates that knapping occurred *in situ*. Only a small number of formal tools were recovered, which suggests that finished artefacts may have been transported away from the site following initial production. The lithic assemblage is comprised of three primary raw materials, which will be summarised in turn.

Quartz is the most prolific raw material at Northton; however there is a clear difference in exploitation between the two phases of occupation. Quartz only makes up 42% of the raw material present in the earlier Phase 4 deposits, whereas in the later Phase 3 occupation at the site quartz is present in much greater quantities (73% of raw materials present). This also coincides with the higher proportion of quartz which comprises 93% of the assemblage in the equivalent Phase II deposits excavated in 2001.

There are two distinct sources of quartz present in the assemblage: beach pebbles and quarried blocks or plates. A breakdown of the cortex-type is not presented for the earlier excavations, however when comparing between the phases from 2010, there appears to be a greater use of vein quartz in the earlier, Phase 4 deposits, and a preference for beach pebbles in the later Phase 3 deposits. However, this pattern is purely speculative given the small number of pieces in Phase 4 with enough cortex to analyse. The quartz at Northton appears to have been transported a short distance from these sources to the site, and reduced using a combination of bipolar and freehand, or platform-on-anvil, techniques. This is evident from the frequently mixed assortment of platform types and multidirectional removals present on the cores. Bipolar reduction may have been used to split large beach pebbles, that could have then been reduced using platform technology (Ballin 2008:70). The high number of broken platforms on the quartz flakes may be linked to both the use of bipolar reduction and the brittleness of the raw material – the latter is evident in the high number of indeterminate pieces and small fraction debitage present. Where the platforms are intact, quartz flakes display deep striking areas. This helps to prevent platform collapse by striking further back from the platform edge (Ballin 2008:70). Two core rejuvenation flakes were recovered from Phase 3 in fine grained quartz, which has better flaking properties than the most frequently found milky quartz and may suggest an attempt to conserve this higher quality quartz variety.

The quartz assemblage overall appears to have been less intensively worked than the flint or baked mudstone present at the site. Of main raw materials present, quartz cores have the lowest average number of flake removals (3.6), and there are an average of 1.3 dorsal flake scars present on the flakes, which are most frequently unidirectional. The flakes and cores are also much larger than the other raw materials. Statistically, there is no difference between the dimensions of the quartz flakes in either phase. The local, readily available and abundant source of this raw material is therefore reflected by the more profligate use at the site.

Flint is the dominant raw material in Phase 4, the earliest phase at Northton, and makes up 56% of the worked material. Its dominance in the early occupation of Northton is corroborated by the corresponding assemblage to this phase from the basal deposits excavated in 1965-66, where flint represents 69% of the material. In Phase 3, flint is present but has significantly diminished in frequency to only 12% of the assemblage.

Flint was intensively exploited throughout the occupation of the site. The small cores have the highest average number of flake removals of all the raw materials (8), and have only been discarded once completely exhausted. The presence of two core rejuvenation flakes from Phase 4 also indicates attempts to obtain the maximum use from the raw material. The flakes are small, with an average of two dorsal flake scars per flake. Overall, the statistical analysis did not show any significant difference between the flint flake dimensions. Multi- and bidirectional removals on the cores and flakes denote the use of bipolar reduction, as does the presence of unprepared platforms on the cores, and the broken or crushed striking platforms on the flakes. The cortex present on the flint from Northton reveals the source of the material as small beach pebbles, which are not locally available, but have been brought to the site to be reduced. Ten pieces, including, two refitting flakes all have the same pink cortex, providing an insight into the reduction of a single pebble. The intensive reduction of flint at Northton most likely results from the fact the raw material was hard to obtain. Only a small number of flint microliths were found at the site, and when considered alongside the lack of blades present, it suggests that microlith production was not the primary objective of the inhabitants at Northton, or that the raw material available precluded the production of such artefacts.

The third most common raw material utilised at Northton is baked mudstone, which was only recovered in the Phase 3 deposits, and is marginally less common than flint. This raw material can only be sourced on Skye or the Shiant Isles. Given the minimal evidence for primary working of this raw material on the site, it appears this raw material was imported as pre-prepared blanks. As with the flint assemblage, the baked mudstone has been intensively reduced. The cores and flakes are small with an average of 4.5 flake removals per core, and 2.4 dorsal scars per flake. Bipolar reduction is evident on one core, which is completely exhausted, and the dominance of multidirectional dorsal flake scars suggests continual reorientation of the core to access the most appropriate striking platform, few of which are intact. Baked mudstone is a high quality raw material and has suffered the least amount of breakage within the assemblage as a whole. A single blade suggests baked mudstone may have been intended for microlith manufacture at Northton, however in the absence of such evidence this is purely speculative. The presence of a flake core suggests that reduction of this rare raw material was extended as far as possible, in tandem with the flint assemblage**.** Another potentially imported raw material is a single flake of carbonate rock. It is possible that this flake may be limestone or dolomite, which is variant of limestone that has undergone chemical change. The nearest source of limestone/dolomite runs along the Moine Thrust fault from Durness in north-west Scotland to the south-east coast of Skye, and outcrops in many of the sea lochs along the western coast (Highley *et al.* 2006).

Finally, within the Northton assemblage there are also a small number of locally derived raw materials, including gneiss, pegmatite, and other meta-igneous rocks. The water-worn nature of each indicates they have been eroded from their various parent rocks and incorporated into the beach deposits below, from where they have been transported to the site. These raw materials are primarily found within the coarse stone tool assemblage, similar to those which were recovered in 2001 (Gregory 2006). A single core of chalcedony was recovered from Phase 3. This piece is very unusual in several respects. It is very rounded and worn, even where a flake has been removed, which contrasts markedly with the fresh condition of the assemblage as a whole, even in the earlier phase. Its colouring is orange-brown banding which is also very different to any other raw material in the assemblage or observed in the background geology of the site. It is small and there appears to be no clear evidence for any further use.

Overall the lithic assemblage at Northton represents a collection of knapping waste that includes debitage, exhausted cores, and broken and discarded tools; some of which have been burnt. Knapping strategies were modified to suit the characteristics of each raw material, with the rarest and highest quality most heavily reduced. The exploitation of locally available quartz increases as the use of flint diminishes, and baked mudstone is imported during the later phase of occupation. Possible reasons for this, and a comparison with the neighbouring site of Tràigh an Teampuill (discussed in the following section), will be presented fully in Chapter Eight.

5.3. Tràigh an Teampuill, Harris

5.3.1. Discovery and Excavation

5.3.1.1. Excavation 2011

Tràigh an Teampuill (NGR NF9734 9132) was identified during a small-scale coastal erosion survey in September 2011 (Blake *et al.* 2012b; Church *et al.* 2012a). The survey targeted areas of accessible coastline within the vicinity of the Mesolithic site at Northton. It aimed to identify potential new sites that could date to the Mesolithic based on two criteria: the geomorphic and stratigraphic position of the deposit, and the archaeological composition of the deposit.

At Northton, the early to mid-Holocene soils that contained the evidence for Mesolithic activity overlay sterile glacial till. Furthermore, the deposits were sealed by machair, which is believed to have formed after the Mesolithic (Blake *et al.* 2012b:5; Simpson *et al.* 2006:14). The organic deposits identified at Tràigh an Teampuill were comparably positioned: situated above the glacial till and bedrock, but underneath eight metres of machair. This initially indicated the site may have been of Mesolithic date. The nature of the artefacts and ecofacts eroding from the deposits also suggested hunter-gatherer activity, comprising a similar faunal, floral and artefact assemblage to that of Northton. Most crucially, domesticated plant or animal species and pottery, which are indicative of the Neolithic appeared absent, which suggested a Mesolithic date for the deposits was likely (Ashmore 2004b:92; Blake *et al.* 2012b:6; Church *et al.* 2012a).

The eroding face of the cliff was cleaned back to expose the archaeological deposits along a vertical section c.3.5m X c.1.2m (Figure 99), and a total sampling strategy implemented in line with the methodology used at Northton (Blake *et al.* 2012b:8; Jones 1991). A total of 41 litres of bulk samples were recovered for laboratory analysis in Durham (Blake *et al.* 2012b:7). In section, the site appeared to comprise buried ground surfaces that were subsequently overlain by shell and ash-rich midden deposits. It therefore appeared to be a type of site similar to Northton (Blake *et al.* 2012b:10).

Two carbonised hazel nutshells recovered from an old ground surface deposit, and two others from a discrete area of shell midden, were submitted for radiocarbon dating. The results indicate the site was occupied between 5715-5368 cal. BC, confirming Tràigh an Teampuill as the second Mesolithic site identified on Harris. The dates of occupation for this site lie between that of Northton, just around the peninsula, and the Tràigh na Beirigh sites on Lewis (Blake *et al.* 2012b:10).

Figure 99. Tràigh an Teampuill before excavation in 2011. Photo courtesy of Mike Church

5.3.1.2. Excavation 2012

In 2012 a second season of excavation was carried out at Tràigh an Teampuill, with the aim of conducting larger-scale sampling of the exposed Mesolithic deposits before the site was completely destroyed (Blake *et al.* 2012b:10; Piper & Church 2015). Substantial erosion had occurred at the site since the previous year; however the majority of the archaeological deposits remained intact under the protective reinstatement that was constructed following the investigation in 2011. Due to the erosion, it was possible to extend the section by c.1.5m to the west, exposing a total of c.5m of deposits (Figure 100). Total sampling continued to be employed in keeping with the previous field seasons and over 135 litres of bulk samples were taken. Additionally, spot and column samples were also excavated for routine soil tests, as well as Kubiena tin samples for thin-section analysis (Piper & Church 2015).

Figure 100. Tràigh an Teampuill following excavation in 2012. Photo courtesy of Mike Church

The 2012 excavation was able to substantiate the initial interpretation of the site made in 2011, and allowed a clearer understanding of the stratigraphic matrix. Tràigh an Teampuill indeed comprised a buried ground surface, which was most likely part of the early to Mid-Holocene landscape first identified through coring and excavation on the adjacent headland at Northton (Bishop *et al.* 2012a; Bishop *et al.* 2011a; 2012b; Blake *et al.* 2012b; Church *et al.* 2012a; Gregory *et al.* 2005; Piper & Church 2015; Simpson *et al.* 2006). The ash-spread and shell-rich deposits were the fill of a scoop which cut into the buried ground surface (Piper & Church 2015). The artefact and ecofact assemblages were similar in nature to those of Northton, containing fish and animal bones, charred hazelnut shells and charcoal, marine molluscs, and a quartz-dominated lithic assemblage. A red deer antler tine pressure flaker may indicate the presence of much larger, but as yet unrepresented terrestrial mammalian fauna on the islands, or may simply be an imported raw material (Blake *et al.* 2012b:9; Kitchener *et al.* 2004; McCormick & Buckland 1997). The tips from two broken worked bone points also revealed rare evidence of the organic component of the Mesolithic toolkit (Piper & Church 2015).

Figure 101. Close-up view of the scoop feature at Tràigh an Teampuill. Photo courtesy of Mike Church

5.3.2. Tràigh an Teampuill Lithic Assemblage Results

This section describes the results of the lithic analysis from Tràigh an Teampuill, with a summary interpretation provided before the chapter conclusion. Unlike Northton, Tràigh an Teampuill cannot be discussed in terms of phases of site occupation until a more secure chronological sequence has been established through further radiocarbon dating. The assemblage from both the 2011 and 2012 seasons of excavation are therefore presented as a whole.

A single piece of material suspected of being baked mudstone was included in the thin-section analysis alongside the pieces selected from Northton. As with Northton, the piece does not resemble mylonite, but is closer to baked mudstone in composition. The detail of this analysis is presented in Appendix Thirteen.

5.3.2.1. General Character of the Assemblage

The total lithic assemblage from Tràigh an Teampuill comprises 88 pieces. A small number of the total assemblage (13 pieces, 15%) could not be included in the subsequent analysis as these lithics were recovered from cleaning contexts (C001, C010, C012). Although it is certain these derived from the Mesolithic deposits their exact location within the site could not be determined, therefore they are categorised as unstratified. The details of the unstratified assemblage, which included a range of debitage types in flint and quartz is listed in Appendix Four. Only the stratified material, which totals 75 pieces and is also detailed in Appendix Four, is discussed in the following sections.

The assemblage is dominated by flakes, including a flake core and small fraction flakes (<10mm; Figure 102). The remainder of the assemblage comprises indeterminate chunks, a small number of cores, two hammerstones, and two blades (Table 18).

The assemblage derived from eight contexts at the site. These comprised a sandy-silt interface layer (C009) between the overlying machair, and underlying old ground surface which contained organic remains from anthropogenic discard (C004, C005, C011). Cut into the old ground surface of C005 was a shallow scoop (C013) which was filled by a primary fill of wood-ash and calcined bone material (C006). A secondary fill of a shell-rich deposit was also identified (C007), which had formed alongside another old ground surface with evidence for anthropogenic activity outside the scoop (C008). Below the main ground surface horizon (C004; C005; C011) lay an earlier relic ground surface of early- to mid-Holocene soil, which also contained evidence of anthropogenic activity (C003). This overlay an almost sterile clay-silt deposit which graded into the underlying glacial till (C002).

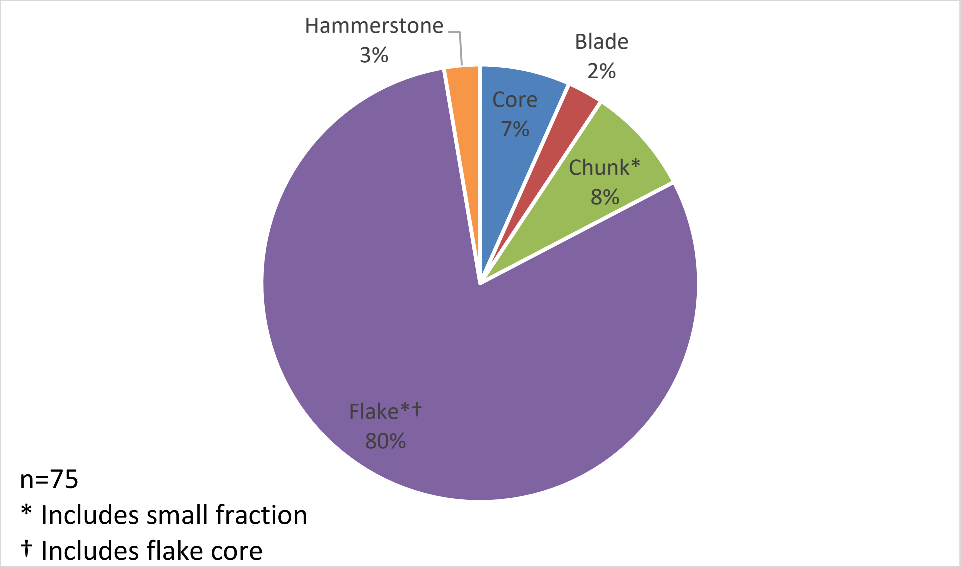


Figure 102. Tràigh an Teampuill assemblage composition

Technology	**Raw Material**				
	Quartz	**Flint**	**Baked mudstone**	**Other**	**Total**
Core	5				5
Blade		1		1	2
Chunk	1	1			2
Small fraction chunk	3	1			4
Flake	17	15	1	1	34
Flake core	1				1
Small fraction flake	10	15			25
Hammerstone				2	2
Total	37	33	1	4	75

Table 18. Tràigh an Teampuill assemblage composition

5.3.2.2. Raw Material

A number of raw materials are present at Tràigh an Teampuill. Half of the assemblage is quartz, with flint the second most common raw material at 44% (Figure 103 and Table 18). The remains of the assemblage is comprised of a single secondary flake of baked mudstone, two pieces of metabasalt, and two gneiss pebbles.

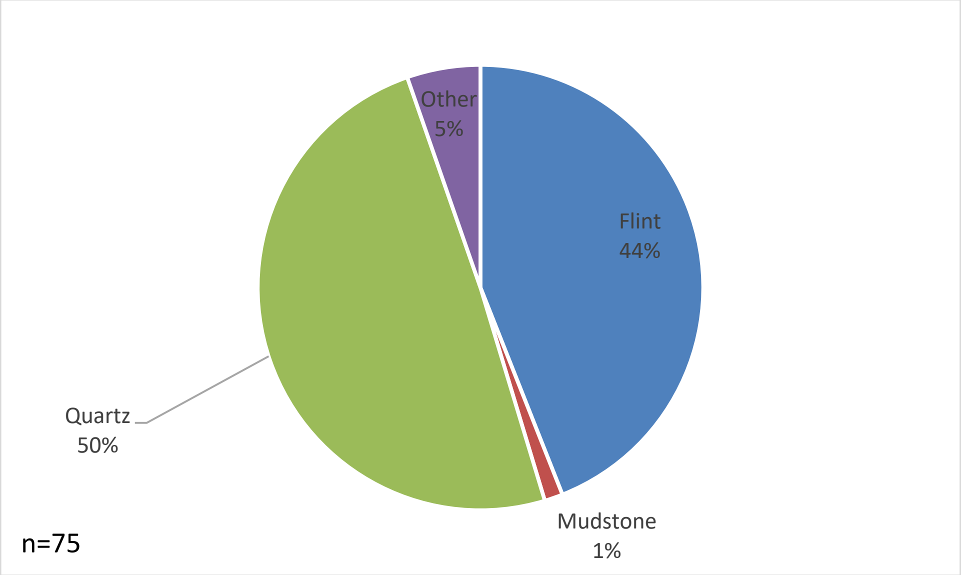
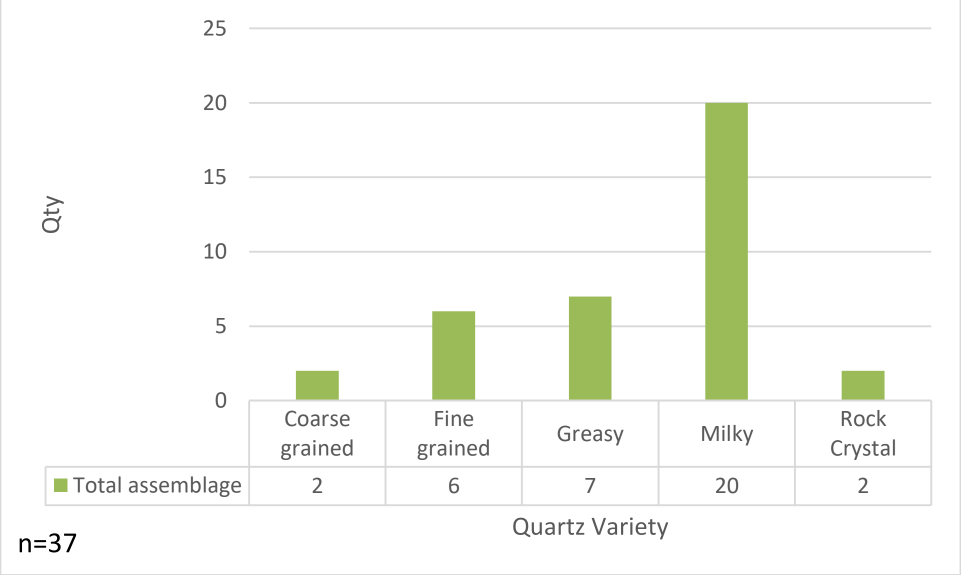


Figure 103. Tràigh an Teampuill raw material composition

Over half of the quartz assemblage is milky quartz (Figure 104). Greasy, or very fine grained, quartz is the second most common variety, followed closely by fine grained quartz. Coarse grained quartz and rock crystal are represented by two pieces each.



	Coarse grained	Fine grained	Greasy	Milky	Rock Crystal
🟩 Total assemblage	2	6	7	20	2

Figure 104. Tràigh an Teampuill quartz varieties

The flint component of the assemblage is fresh in appearance, indicating little post-depositional movement; however the majority of the pieces are stained and/or heavily patinated. Three pieces of flint have a similar pink colour, suggesting they may have derived from the same nodule and three other flint lithics are burnt.

Quartz is present in all of the contexts at Tràigh an Teampuill, and is the only raw material represented in the basal clay-silt deposit (C002), and the secondary fill of the scoop (C007; Figure 105). C003, the early-to mid-Holocene relic ground surface has the greatest concentration of lithics, followed by the main ground surface horizon (C004 and C005). C003 is dominated by quartz, whereas in the latter contexts flint is proportionally greater in quantity. One of the gneiss manuports was recovered form C004, and the other was situated in C008, the late ground surface which formed alongside the scoop deposits. Like C003, this context has a higher number of quartz pieces present. Two pieces of metabasalt were recovered from C003 and a single flake of baked mudstone from C005.

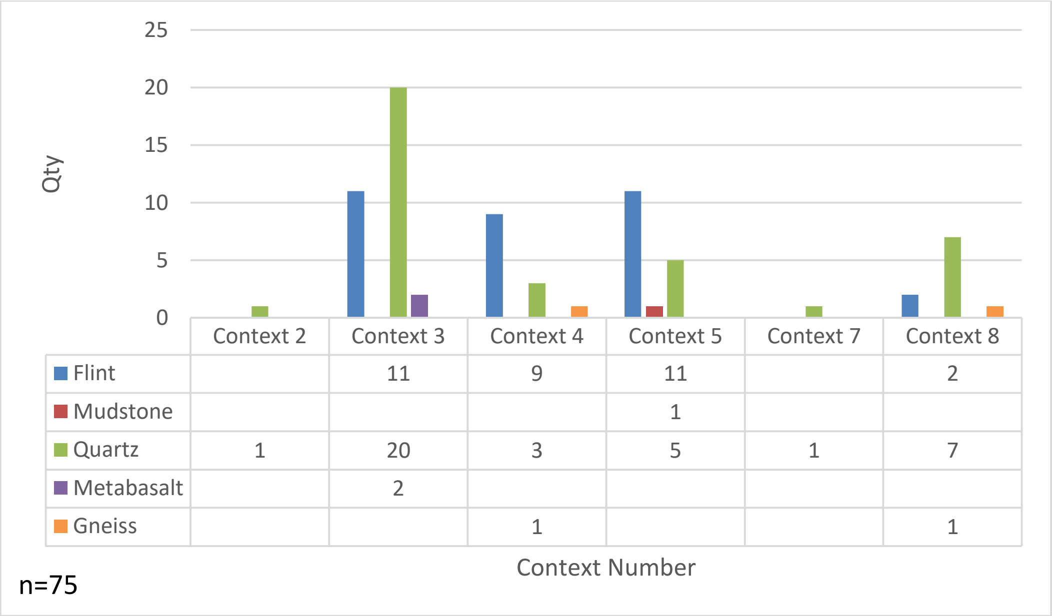


Figure 105. Tràigh an Teampuill raw material by context

The subsequent analysis is for the primary technology (>10mm) recovered from Tràigh an Teampuill. The small fraction flake, chunk and small fraction chunk assemblage analysis are presented in Appendix Eleven.

5.3.2.3. Primary Technology: Coarse Stone Tools

5.3.2.3.1. Hammerstones

As described above, two gneiss pebbles were found at Tràigh an Teampuill, one in C004, the main gorund surface horizon and the other in C008, the ground suface which formed alongside the scoop. The dimensions are presented in Table 19. It is likely that both have been used as hammerstones.

Catalogue No.	Context No.	Length (mm)	Width (mm)	Thickness (mm)
L35	008	97.58	68.99	39.83
L40	004	52.38	61.04	27.98

Table 19. Tràigh an Teampuill hammerstone dimensions

L35 is a smooth, sub-rounded pebble with a large number of peck-marks and depressions along two of the edges. This has caused cracks to radiate out from the depressions and there is active disintegration of the outer surface. One of these edges displays crushing and white discolouration, most likely a result of striking quartz.

L40 is also a smooth, sub-rounded pebble with peck-marks along the shortest edge. It is notable that the piece fits comfortably in either hand.

5.3.2.4. Primary Technology: Cores

Five cores were present in the Tràigh an Teampuill assemblage. Four cores derive from C003, the early to mid-Holoecene ground surface and the other was recovered from C008, the ground surface which formed alongside the scoop deposits.

5.3.2.4.1. Raw Material

All cores are quartz – three are milky quartz, one fine grained and the other coarse grained (Figure 106).

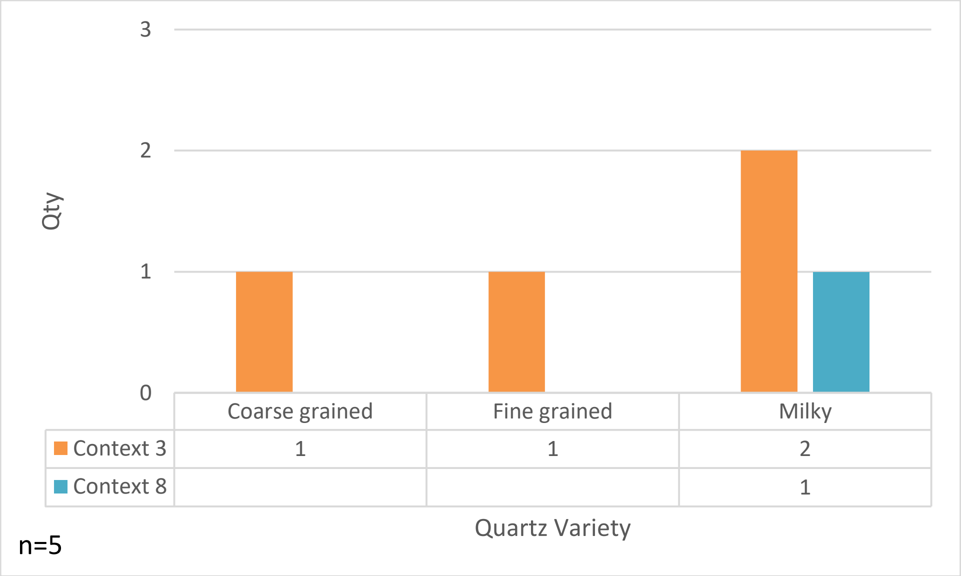


Figure 106. Tràigh an Teampuill core quartz varieties

5.3.2.4.2. Core Dimensions

There are two very large and heavy cores from C003 and two which are much smaller and lighter (Figure 107). The single core from C008 is very small in comparison.

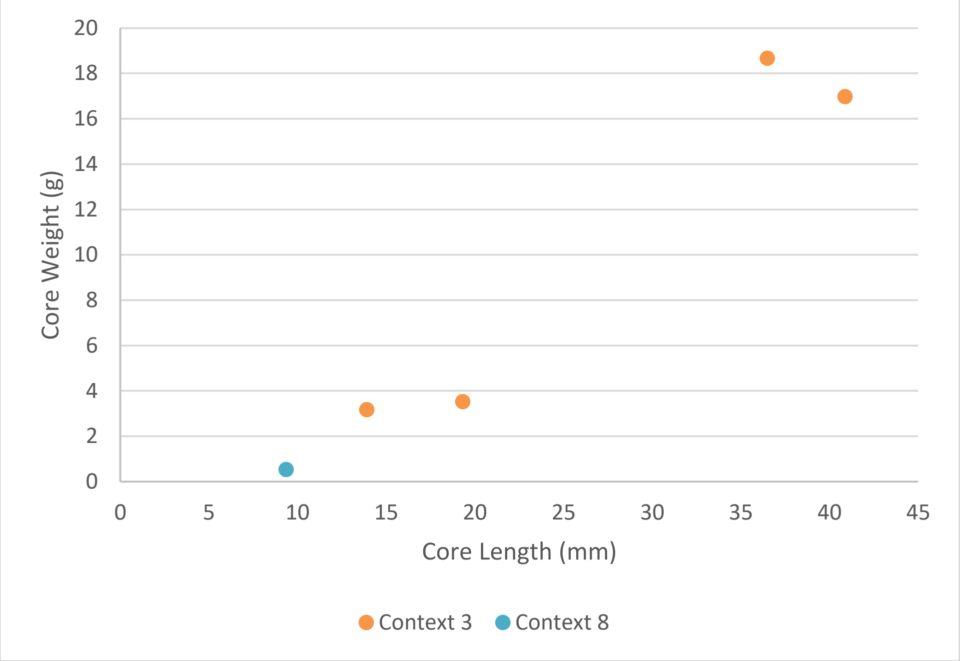


Figure 107. Tràigh an Teampuill core dimensions

5.3.2.4.3. Cortex

Only a single core does not have cortex, this is a small core from C003 (Figure 108). All the others retain some degree of cortex, therefore the presence of cortex does not correlate with the size of the original piece. The cortex present indicates that both rounded beach pebbles and vein quartz were equally exploited.

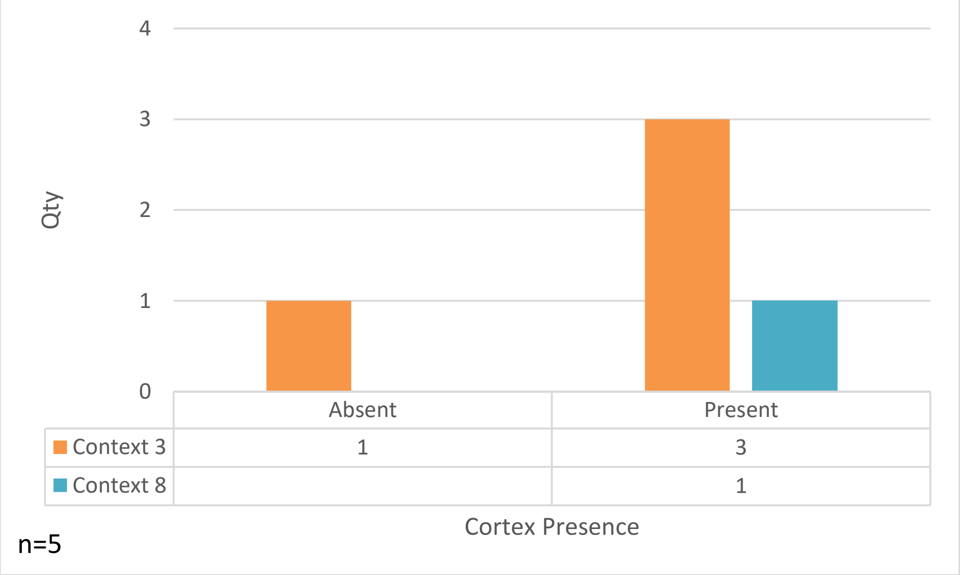


Figure 108. Tràigh an Teampuill core cortex presence

5.3.2.4.4. Flake Removals – Count and Sequence

Two of the cores derived from C003 have two flake removals, as does the one from C008. The remaining two cores from C003 have three and four flake removals respectively, which demonstrates evidence for minimal core reduction, and is consistent with the high proportion of cortex (Figure 109).

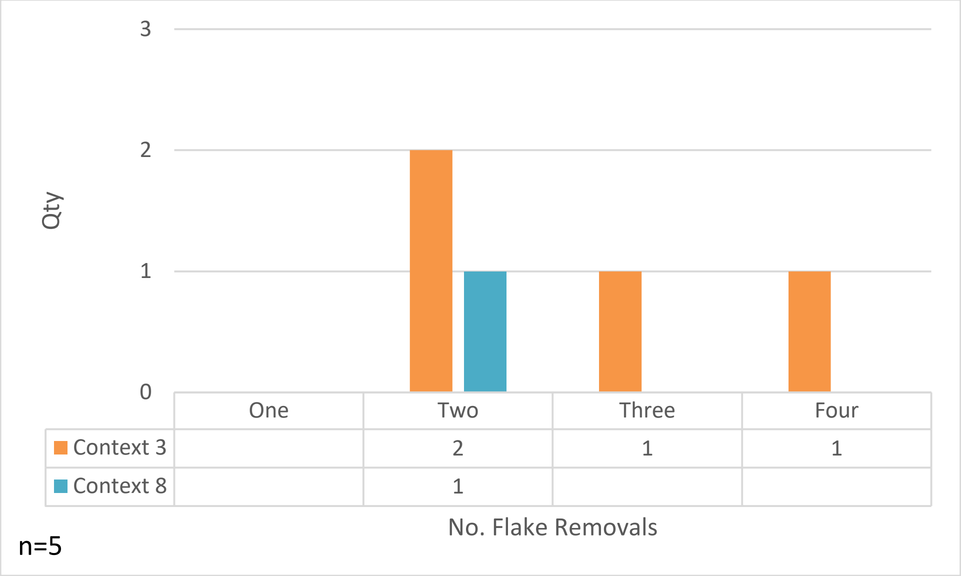


Figure 109. Tràigh an Teampuill number of flake removals from cores

The two cores from C003 which have two flakes removed from them exhibit unidirectional flake removals (Figure 110 and Figure 111). The single core from C008 that also has two flakes removed displays a multidirectional pattern, as the scar from the first flake removal was used as a platform for the second. The flake removal sequence on the two cores from C003 that have three and four flake removals indicates they had been initiated from multiple directions. There is no correlation between the size or weight of the cores and the number of flakes removed from them (Appendix Four).

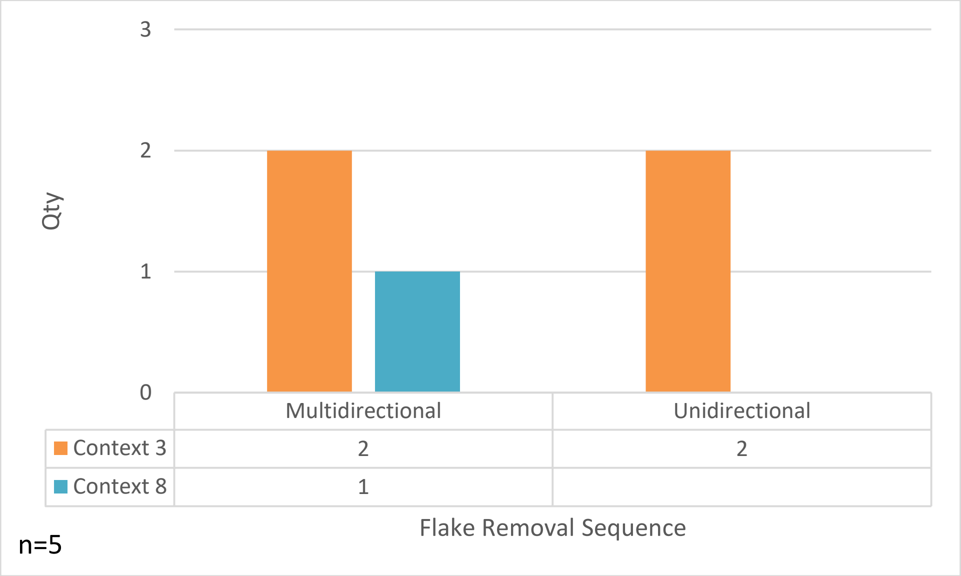


Figure 110. Tràigh an Teampuill sequence of flake removals from cores

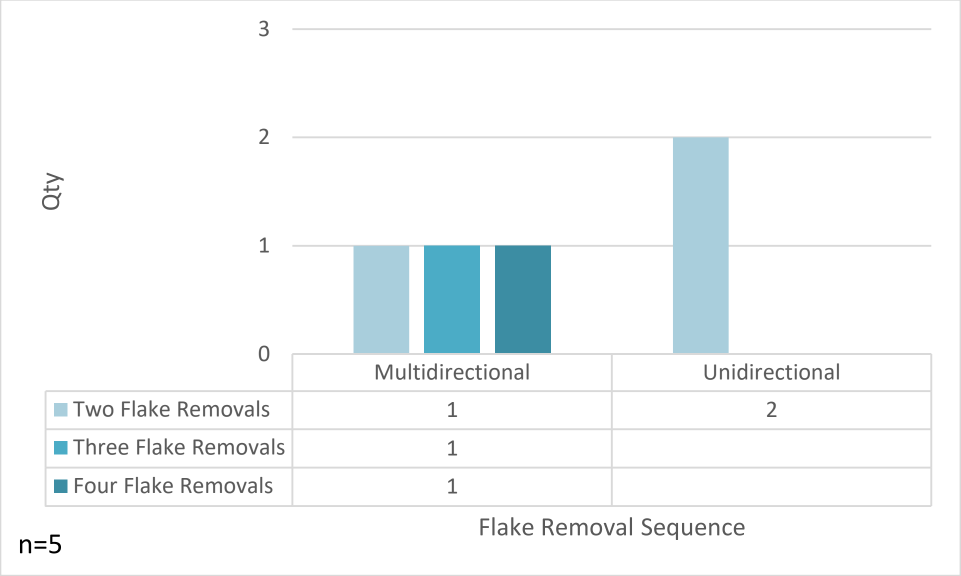


Figure 111. Tràigh an Teampuill sequence of flake removals from cores in relation to the number of flakes removed

5.3.2.4.5. Core Platform Preparation

Half of the cores from C003 display simple platform preparation, and both of these exhibit two, unidirectional flake removals (Figure 112). The core from C008 also displays simple platform preparation. The two cores from C003 which exhibit three and four flake removals have mixed platform preparation. On core L72, two flakes have been removed from a cortical, unprepared surface. One of these removals destroyed the plaform of a flake removal from a previous stage. For SF5 the flake removals were detached from a combination of unprepared and simple platforms.

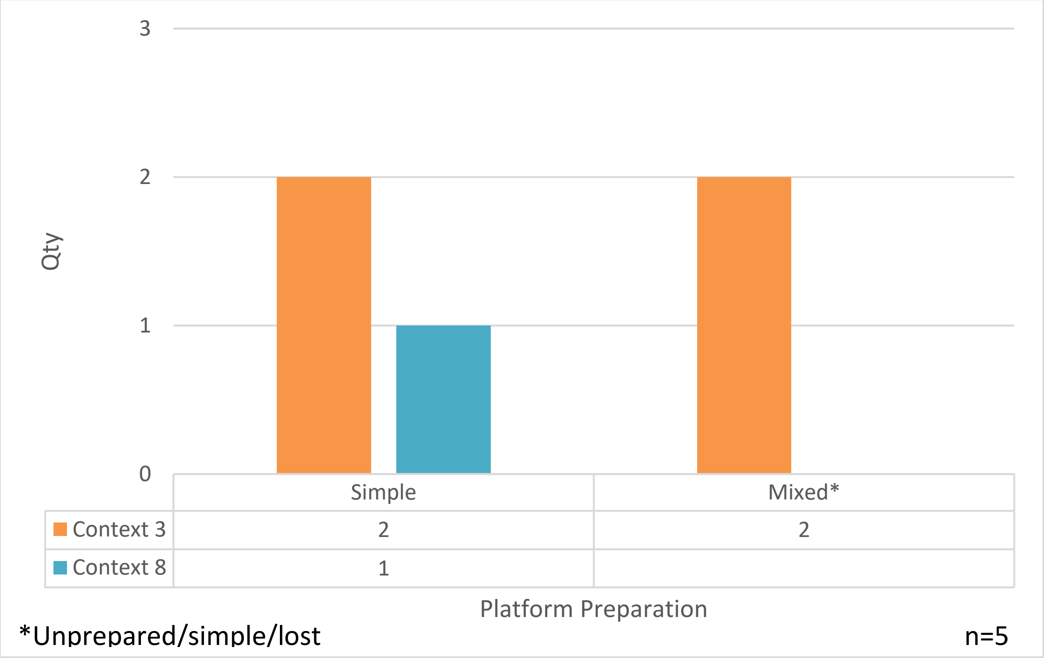


Figure 112. Tràigh an Teampuill platform preparation of cores

5.3.2.5. Primary Technology: Flakes

A total of 34 flakes (>10mm) were recovered from Tràigh an Teampuill in addition to a single flake core. The analysis of the flakes is presented below, with subsequent sections providing descriptions of the flake core, refitting pieces, and blades. The data presented here only includes flakes >10mm in maximum length. The small fraction flakes (<10mm) and chunks, which are representative of *in situ* knapping debris (Ballin 2000:10; Finlayson *et al.* 2000:67), are presented in Appendix Eleven.

The majority of the flakes were recovered from C004, C005, and C003. A single flake of quartz was recovered from the primary fill of the scoop (C007), with four flakes identified in C008.

5.3.2.5.1. Raw Material

The flake assemblage is dominated by quartz, with flint the second most common raw material utilised (Figure 113). Baked mudstone and metabasalt are represented by single flakes (3% each).

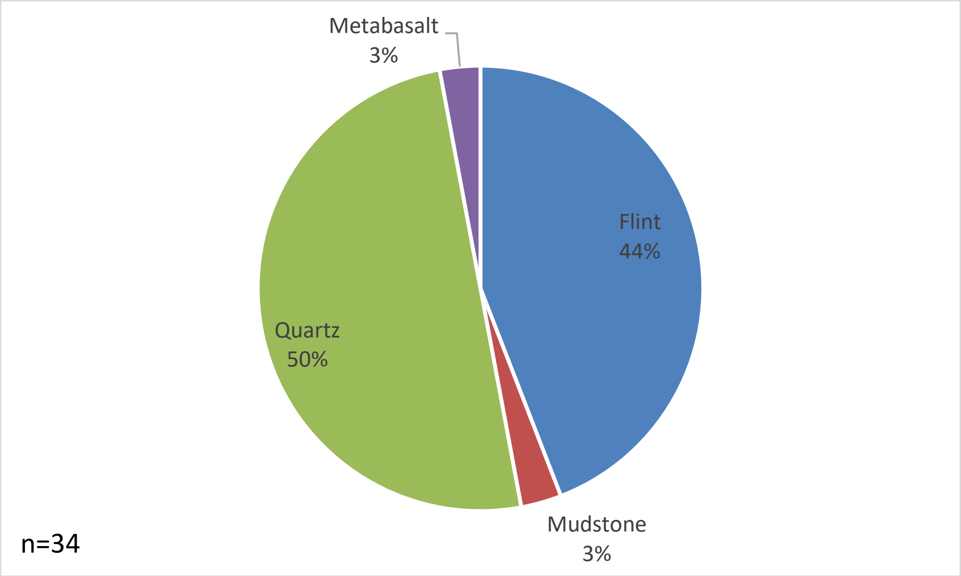


Figure 113. Tràigh an Teampuill flake raw material composition

Milky quartz dominates the flake assemblage, followed by the greasy (very fine grained) variety (Figure 114). Three flakes are of the fine grained variety and a single flake of coarse grained quartz was recovered. One flake grades from milky quartz to rock crystal.

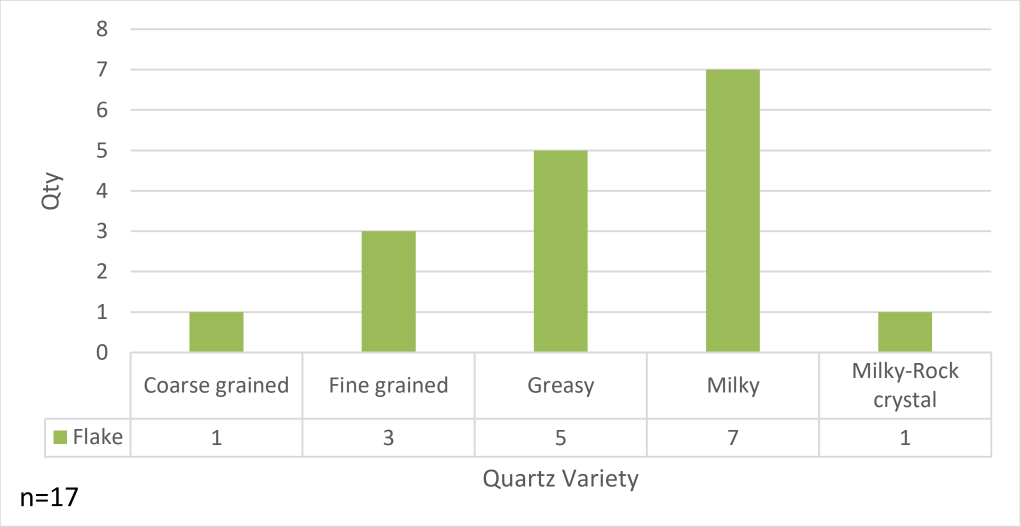


Figure 114. Tràigh an Teampuill flake quartz varieties

5.3.2.5.2. Flake Dimensions

The summary statistics for the main raw materials present in the flake assemblage at Tràigh an Teampuill are displayed in Table 20. The maximum and minimum length for flakes in both flint and quartz are similar, although the quartz flakes are marginally longer on average than the flint flakes, and with a slightly smaller standard deviation. In terms of width, the quartz flakes are larger than the flint flakes in both their maximum and minimum measurements, which is reflected in the overall greater average width in the former raw material. The standard deviation from the mean is the same in both raw materials. The flint flakes range more widely in thickness than the quartz flakes, therefore the standard deviation for flint flakes is slightly higher than that for quartz; however, flint flakes are thinner on average.

Raw Material		**Length (mm)**	**Width (mm)**	**Thickness (mm)**
Flint	**Min**	10.48	4.69	1.14
	Max	21.96	14.00	8.68
	Mean	13.56667	9.512	3.196667
	SD	3.472142	2.862524	1.81798
Quartz	**Min**	10.03	7.33	2.00
	Max	21.79	16.38	7.15
	Mean	13.95824	12.36882	4.115294
	SD	3.239892	2.821467	1.240273

Table 20. Tràigh an Teampuill flake dimensions summary statistics for primary raw materials

A MANOVA test was conducted to determine whether there was a statistically significant difference between the dimensions of the two main raw materials. Using Wilks's lambda, there is a significant difference between the dimensions of flint and the dimensions of quartz flakes from Tràigh an Teampuill:

$$\Lambda = .759, F\,(3, 28) = 2.965, p = \mathbf{.049}$$

A Mann-Whitney U test to test the robustness of the MANOVA (Table 21). There is no significant difference between the lengths of the flakes; however there is a significant difference between the width and thickness of these raw materials. The *r* value indicates this is a large affect size and thus overall the Mann Whitney test supports the MANOVA (Field 2013). Overall, the data show that the quartz flakes are larger than the flint flakes in this assemblage.

Dimensions (mm)	**Mean Rank Flint**	**Mean Rank Quartz**	***U***	***z***	***p***	***r***
Length	15.33	17.33	110.000	-0.661	0.526	n/a
Width	11.33	21.06	50.000	-2.927	**0.003**	-0.51743
Thickness	11.87	20.59	58.000	-2.625	**0.008**	-0.46404

Table 21. Tràigh an Teampuill Mann Whitney U test results between raw materials. Flint n = 15; quartz n= 17

All of the raw materials fall within a loose grouping between 10-20mm in length, and 5-15mm in width (Figure 115). Both the flint and quartz flakes are fairly evenly distributed along this range of lengths, with the flint flakes generally narrower than the quartz flakes. Two quartz flakes and one flint flake are much larger than the majority of the assemblage. The mudstone flake is one of the smallest pieces recorded, and although the metabasalt flake is long, it is also quite thin.

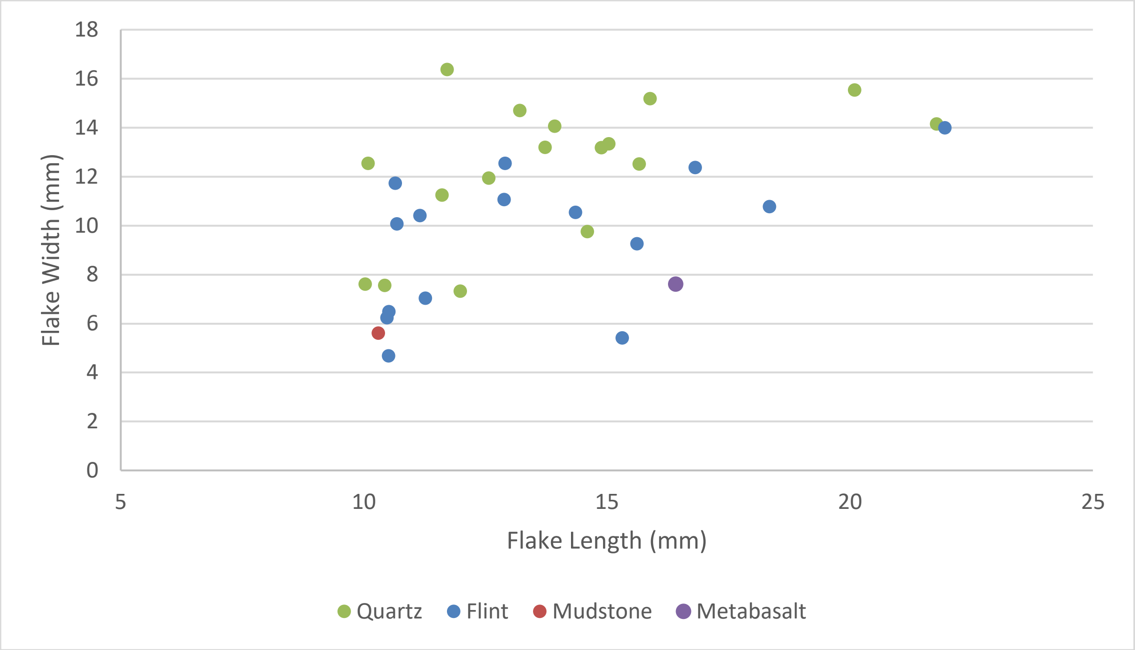


Figure 115. Tràigh an Teampuill flake dimensions length:width

There appears to be a very weak correlation between the length and thickness of both the flint and quartz flakes in this assemblage (Figure 116). Flint flakes rarely exceed 4mm in thickness, irrespective of their length, however there is one significant outlier that is very thick. Quartz flakes that are of a comparable length to the flint flakes are clearly thicker than those of flint. The mudstone flake is very short and thin, whilst the metabasalt flake is much longer and thicker.

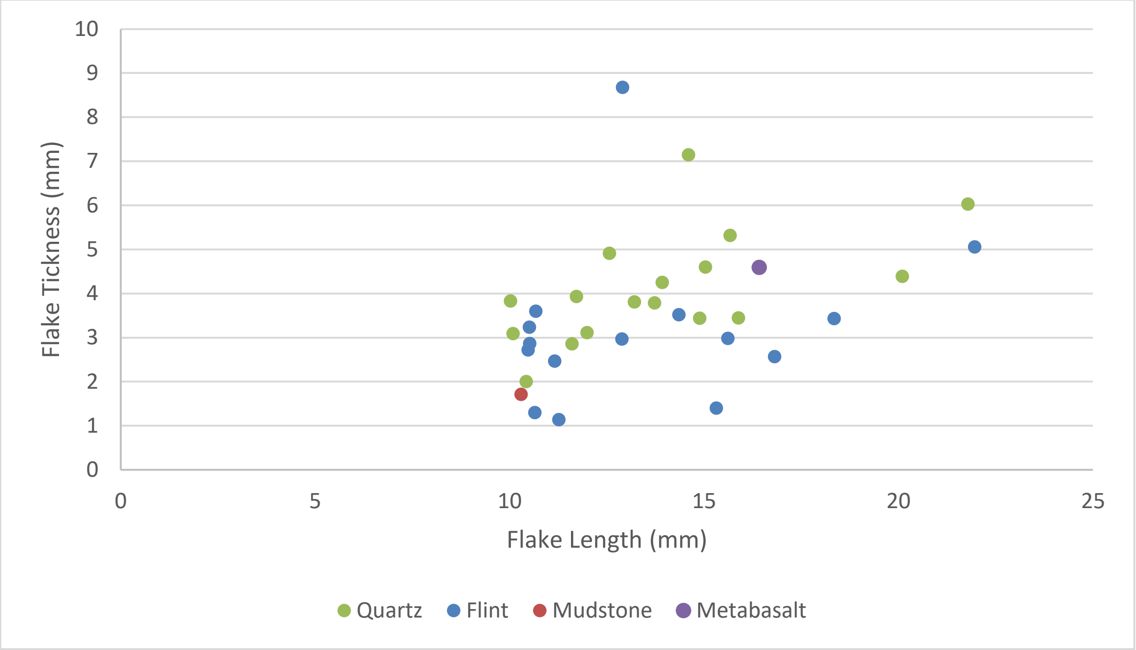


Figure 116. Tràigh an Teampuill flake dimensions length:thickness

The difference between the widths of the flint and quartz flakes is very pronounced in Figure 117. It is clear that, although the range in width of flint flakes is varied, this has little effect on the thickness overall. The quartz flakes also follow a similar pattern, albeit generally wider and thicker than the flint flakes. There is a strong correlation between the width and thickness of the other two raw materials.

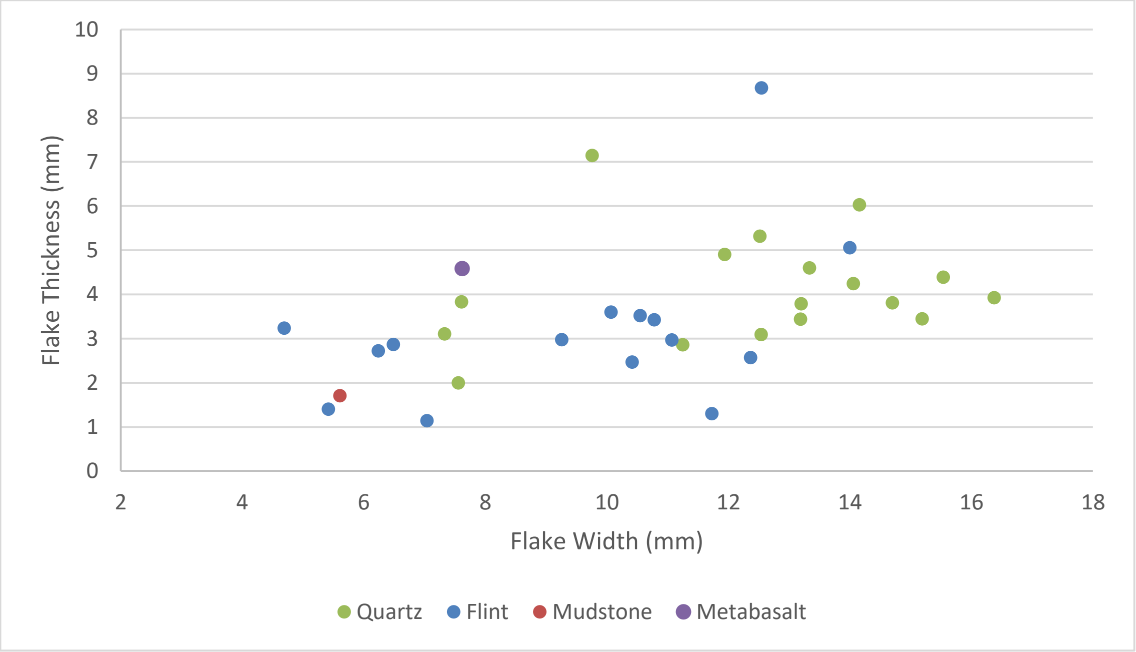
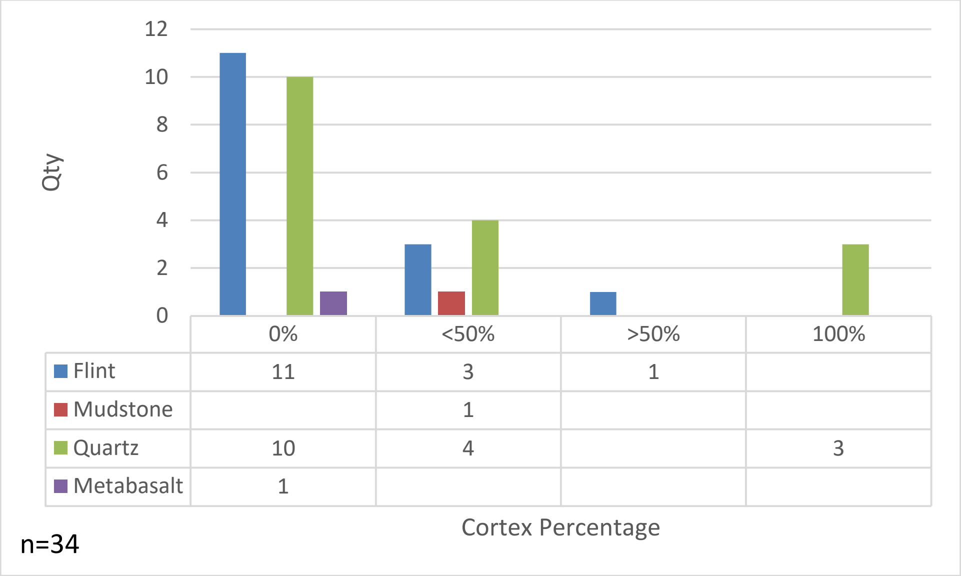


Figure 117. Tràigh an Teampuill flake dimensions width:thickness

5.3.2.5.3. Cortex

The majority of both flint and quartz flakes have no cortex present (Figure 118). Marginally fewer quartz flakes exhibit <50% cortex, and three quartz flakes have complete cortical coverage on the dorsal face. The baked mudstone flake shows <50% cortex, as do a small number of flint flakes. Only a single flint flake exhibits >50% cortex.

Where present, the cortex on the flint flakes was smooth, hard and rounded indicating the source material derives from beach pebbles. The cortex present on the quartz indicates that the source material is most frequently rounded beach pebbles; however a vein source was also exploited, as denoted by the flat and frosted appearance of the cortex on a small number of pieces. The metabasalt flake does not have any cortex present.



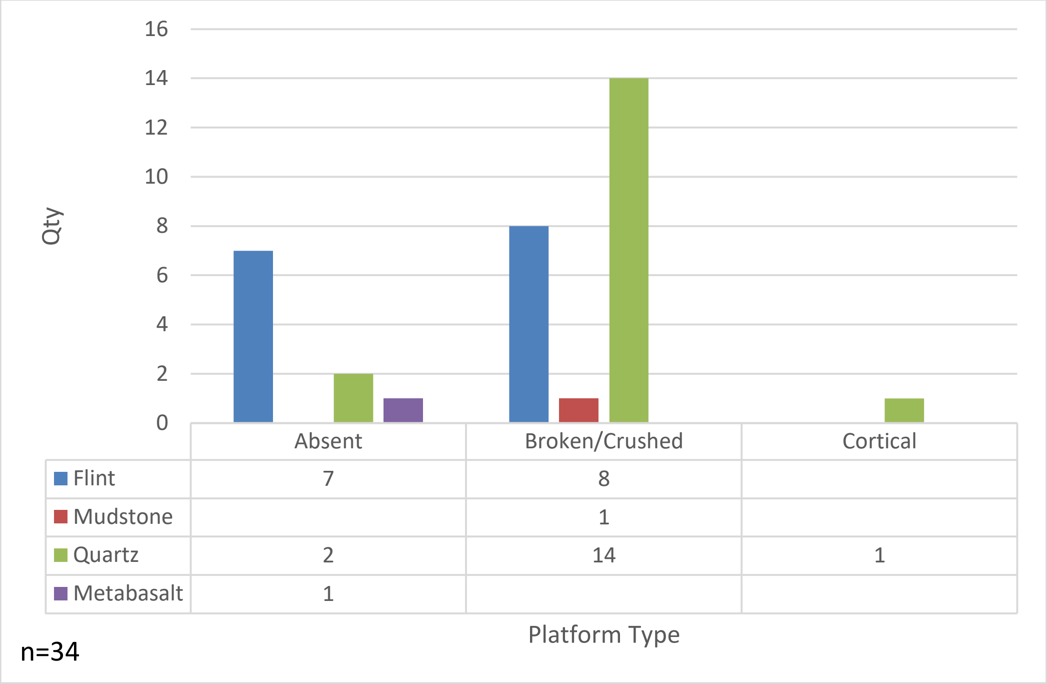
	0%	<50%	>50%	100%
🟦 Flint	11	3	1	
🟥 Mudstone		1		
🟩 Quartz	10	4		3
🟪 Metabasalt	1			

Figure 118. Tràigh an Teampuill flake cortex percentage

5.3.2.5.4. Striking Platform – Type and Dimensions

The most common flake platform type recorded from Tràigh an Teampuill is a broken or crushed platform (Figure 119). For quartz flakes, broken or crushed platforms are significantly more common in comparison to the other platform types: two are absent and another two are cortical. Flint flakes are almost equally represented by absent and broken/crushed platforms. The latter category also accounts for the platform type of the baked mudstone flake. For the metabasalt flake the platform is absent.

The platform dimensions for the single quartz flake with a cortical platform measured 3.90mm X 1.47mm.

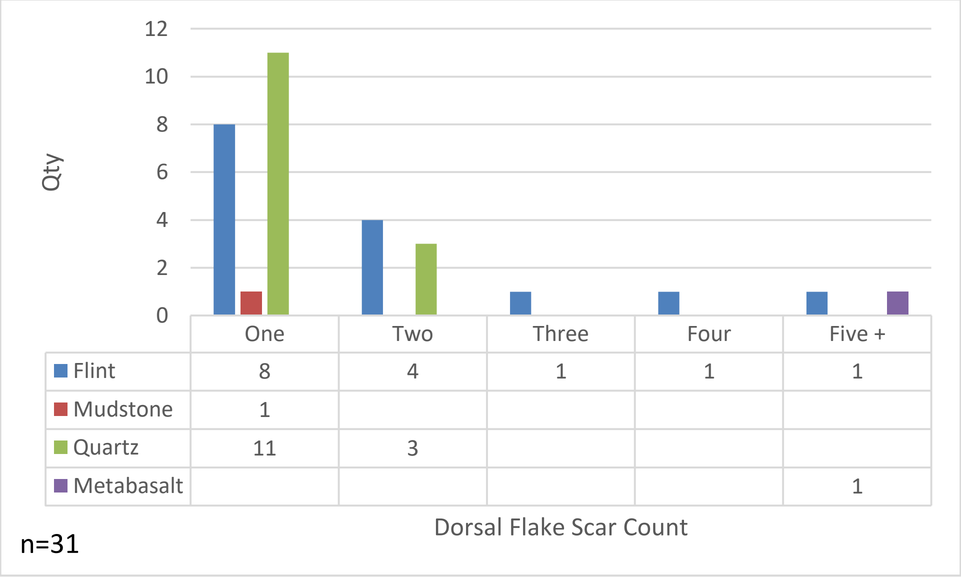


	Absent	Broken/Crushed	Cortical
🟦 Flint	7	8	
🟥 Mudstone		1	
🟩 Quartz	2	14	1
🟪 Metabasalt	1		

Figure 119. Tràigh an Teampuill flake platform type

5.3.2.5.5. Dorsal Flake Scars – Count and Pattern

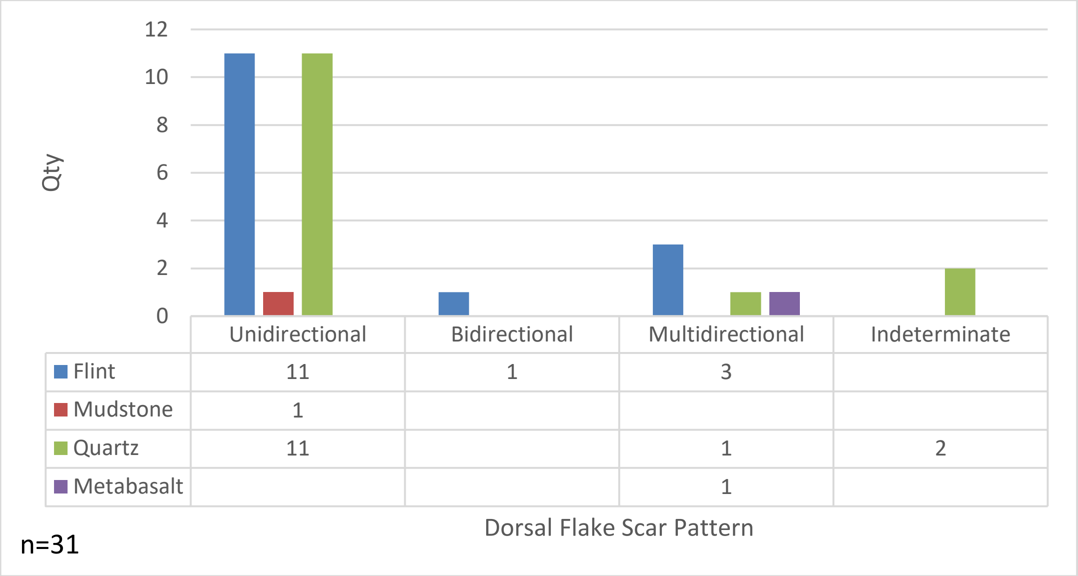
The majority of quartz flakes only have a single dorsal flake scar evident (Figure 120). The maximum number of flake scars recorded on this raw material is two, which is present on three flakes. Most flint flakes also exhibit a single dorsal flake scar, whilst two flake scars are the second most common number recorded on this raw material. On three flint flakes, between three and six dorsal flake scars were recorded. The baked mudstone flake only has one dorsal flake scar. The flake of metabasalt has seven dorsal flake scars. This may be retouch, however this is very difficult to identify for certain due to the nature of the raw material.



	One	Two	Three	Four	Five +
🟦 Flint	8	4	1	1	1
🟥 Mudstone	1				
🟩 Quartz	11	3			
🟪 Metabasalt					1

Figure 120. Tràigh an Teampuill dorsal flake scar count

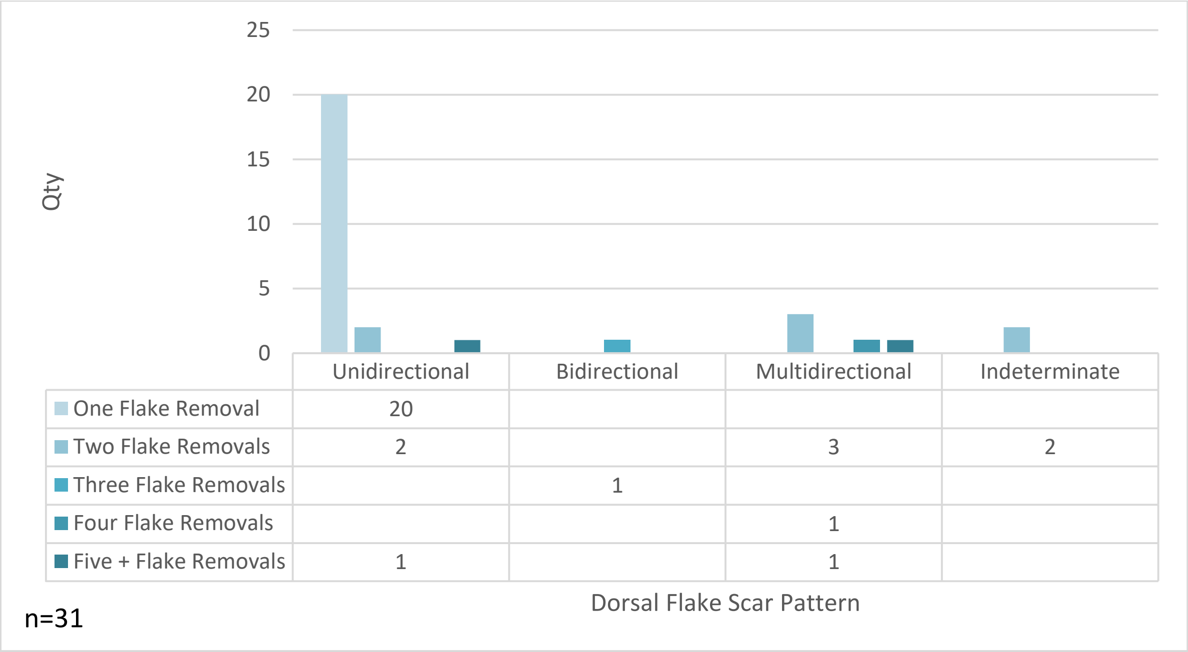
An equal number of quartz and flint flakes exhibit unidirectional flake scars, which is the most common for these raw materials (Figure 121). The baked mudstone flake also displays a unidirectional flake scar. Three flint flakes have multidirectional removals, as does the flake of metabasalt. A single flint flake shows bidirectional removals, suggesting bipolar reduction. The remaining quartz flakes are equally represented by multidirectional and indeterminate dorsal flake scars.



	Unidirectional	Bidirectional	Multidirectional	Indeterminate
Flint	11	1	3	
Mudstone	1			
Quartz	11		1	2
Metabasalt			1	

Figure 121. Tràigh an Teampuill dorsal flake scar pattern

As would be expected all of the single dorsal flakes had been removed from a single direction (Figure 122). Two flakes with two dorsal flake removals also show they had been removed from one direction, as does SF2, with six dorsal flake scars. The single flake with three dorsal flake scars shows that they have been removed from opposing directions (bidirectional). The dorsal flake scar pattern could not be determined for the two quartz flakes with two dorsal flake scars. The remainder of the flakes with two or more flake scars show evidence for their removal from multiple directions.



	Unidirectional	Bidirectional	Multidirectional	Indeterminate
One Flake Removal	20			
Two Flake Removals	2		3	2
Three Flake Removals		1		
Four Flake Removals			1	
Five + Flake Removals	1		1	

Figure 122. Tràigh an Teampuill dorsal flake scar pattern in relation to the number of dorsal flake scars counted

5.3.2.5.6. Flake Breakage

The vast majority of quartz and flint flakes exhibit breakage, as do the baked mudstone and metabasalt flakes (Figure 123). Only a small number of flint and quartz flakes are complete.

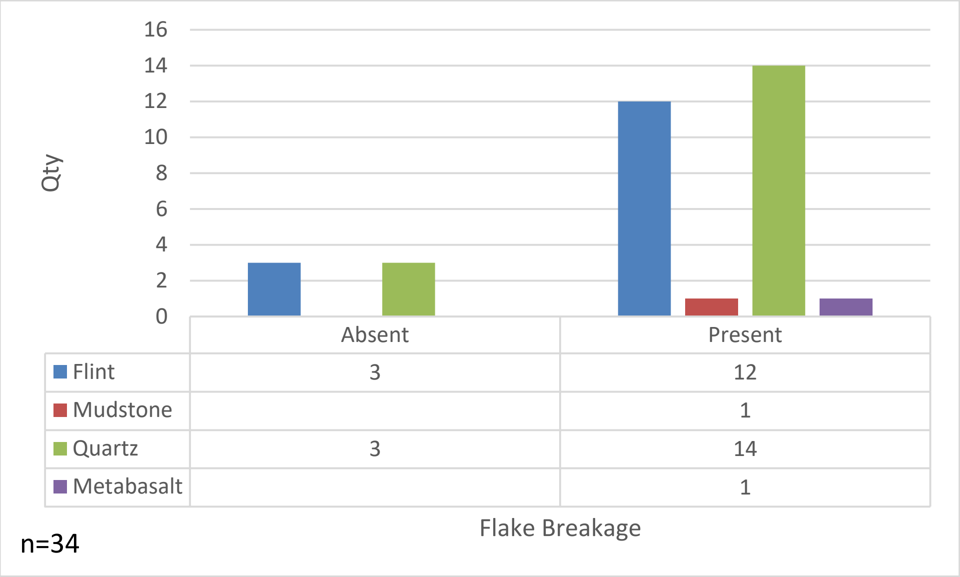


Figure 123. Tràigh an Teampuill flake breakage

5.3.2.5.7. Flake Core

The flake core was recovered from C004 and is made from milky quartz. It measures 12.57mm X 11.94mm X 4.91mm and retains <50% cortex. The platform of the flake core is covered by some of this cortex, which measures 7.12mm X 3.88mm. There is a single, unidirectional dorsal flake scar which has been initiated from the same platform and the flake core is complete.

5.3.2.5.8. Refits

Two flint pieces, SF2 and L6, refit together. The break, a perpendicular snap which originates from a shattered bulb of percussion at the proximal ends of the pieces, is most probably knapping shatter. The break happened in antiquity as L6 is more heavily patinated than SF2.

5.3.2.5.9. Blades

There are two blades in the Tràigh an Teampuill lithic assemblage, L11 and L14. L11 is made from metabasalt and was recovered from C003, the underlying early to mid-Holocene ground surface horizon, where a flake of the same raw material was also obtained. There is <50% of the cortex present and the platform is absent. A single, unidirectional, flake had been removed from the dorsal face and there is no breakage beyond the absence of the platform.

L14 was recovered from C004, the main ground surface deposit, and is made from pink flint. This is the same pink flint as two other pieces in the assemblage – L13, a chunk which was recovered from the same context and L53, a flake recovered from C003. There is no cortex present on the blade and the platform has been crushed. There are two unidirectional dorsal flake scars on the piece and despite the damage to the platform it is complete. The dimensions of the two blades are presented in Table 22.

Context No.	Catalogue No.	Raw Material	Blade Length (mm)	Blade Width (mm)	Blade Thickness (mm)
003	L11	Metabasalt	17.61	8.84	3.02
004	L14	Flint	11.40	5.36	1.72

Table 22. Tràigh an Teampuill blade dimensions

5.3.2.6. Assemblage Summary

The assemblage from Tràigh an Teampuill is small, totalling only 75 pieces. It derives from a mixture of *in situ* deposits, such as the scoop fill, as well as bioturbated relic ground surfaces. The effect of mixing of these ground surfaces on preservation conditions at the site is reflected in the differential staining and patination on two flint pieces SF2 and L6. These pieces, which derive from an old ground surface (C005) refit together to form a larger flake that had broken in antiquity. Furthermore, three flint pieces at the site are of the same pink coloured flint, but were recovered from two different contexts, which also indicates post-depositional movement. It is clear from the flake and blade debitage present that knapping of flint and quartz was conducted at the site, using gneiss cobble hammerstones sourced from the beach nearby.

The dominant raw material in the Tràigh an Teampuill assemblage is quartz, which is comparable to the later phase of the neighbouring site at Northton. Quartz was primarily sourced as pebbles from a nearby beach, with some exploitation of the local vein source also in evidence. The reduction of quartz at Tràigh an Teampuill also follows a similar pattern to Northton. The majority of the cores are large, discarded well before they were exhaused, and with an average of only 2.6 flake removals from simple platforms. The large size of the raw quartz facilitated the use of platform technology as the primary method of reduction for this material, producing flakes which are much smaller on average than those from Northton, and with an average of only one dorsal flake scar. The diminishing size of the quartz flakes on the Toe Head Peninsula is difficult to interpret. There is clearly an abundance of material in the area that could be exploited, therefore it does not reflect a strategy to conserve diminishing supplies. The broken and crushed platforms on the quartz flakes are a common feature, suggesting this is related to the brittleness of the raw material when considered alongside the high rate of flake breakage, and number of indeterminate pieces. It is likely that the reduction in size of the flakes reflects the poor quality of the quartz available.

A little under half of the assemblage at Tràigh an Teampuill is made of small beach pebble flint. In contrast to Northton and the quartz assemblages, there is no evidence of primary reduction at the site. This may be due to the small size of the assemblage, or indicate that the first stages of cortex removal were carried out elsewhere, with pre-prepared cores being imported to the site for further working. Although this is possible, the small size of the pebbles that have been utilised suggests that such reduction methods (usually implemented to reduce transport costs) would not have been necessary. The treatment of flint at Tràigh an Teampuill is similar to Northton with evidence for intensive reduction: flakes are much smaller in size than quartz, they display evidence for bipolar reduction, and where platform reduction was employed, more frequent turning of the core (although there are no flint cores present). The average number of dorsal flake scars per flint flake is two, which is also equivalent to Northton, and is most likely constrained by the small size of the original raw material. Some of the flint pieces are burnt, which is also seen at Northton, and suggests that knapping debris may have been present on the ground where a fire was built, or that knapping of flint occurred close to a fire with some pieces falling in during the reduction process. The clear evidence for human modification of these pieces precludes their use as 'pot-boilers'.

Of the small number of other flaked raw materials in the assemblage, the metabasalt is most likely local given the underlying bedrock in the area. A single small flake of baked mudstone was recovered from the old ground surface, which closely resembles the pieces recovered from Northton which were sourced from the Shiant Isles or northern Skye (Appendix Thirteen). The size of the piece prevents any further interpretation, however.

Overall, the assemblage from Tràigh an Teampuill is very small. It is likely the assemblage is only partly representative of the lithic knapping activities at the site. As such, it is difficult to establish any clear trends. From the evidence available it appears that the flint and quartz at the site were reduced in the same manner as at the earlier site of Northton, further along the headland. Flint, which does not appear to be readily available was intensively reduced using bipolar technology to maximise the number of flakes obtained from small pebbles. A less conservative approach was applied to quartz, which was local and abundant. The presence of an antler tine pressure flaker indicates that retouch of artefacts may have been carried out at the site, however this is not represented in the assemblage analysed. A single piece of baked mudstone may suggest that contacts with the occupants of the source area of baked mudstone, either Skye or the Shiant Isles, endured during the 400 year hiatus between end of occupation at Northton and first evidence for Mesolithic activities along the coast at Tràigh an Teampuill.

5.4. Conclusions

This chapter has presented the lithic data from the two Mesolithic open air sites on Harris, Northton and Tràigh an Teampuill. The data will be used in conjunction with the results from shell midden sites that are presented in the next chapter to explore the relationships between the assemblages of these two types of sites. The wider implications of these results will then be synthesised with other comparable Mesolithic sites in Scotland and the Atlantic façade, which will be discussed in Chapters Eight and Nine.

Chapter 6 Mesolithic ‘Open Air’ Midden Sites on Lewis

6.1. Introduction

The preceding chapter introduced and presented the results of the lithic analysis from the Mesolithic sites situated on Harris. Similarly, this chapter will outline the discovery, excavation, and results of the lithic analysis from six Mesolithic shell midden sites in Lewis. Five sites were identified along the Cnip headland of the Bhaltos Peninsula, Lewis and the sixth is situated on the small island of Pabaigh Mòr. As discussed previously, this background information provides context for each of the lithic assemblages, before the results of the analyses are presented. Each section is concluded with a summary interpretation.

The Bhaltos Peninsula is found on the western coast of Lewis. The modern environment is characterised by machair dunes along the coast, and rocky, moor-covered hills in the interior. Several significant structures of later prehistoric date are known from the peninsula, and a comprehensive archaeological survey was conducted between 1989 and 1996 (Armit 1994; Burgess & Church 1997). The Mesolithic sites, which all date to the terminal Mesolithic (c.4600-4000 cal. BC), are clustered along the Cnip headland, at the westernmost point of Tràigh na Beirigh beach (Figure 124 and Figure 125).

Pabaigh Mòr is a small island which lies less than 1km off the north-east coast of the Bhaltos Peninsula; its geography echoes that of the Cnip headland. The shell midden of Pabaigh Mòr South, which is of similar date to those at Tràigh na Beirigh, is situated at Briomanish on the southern point of the island (Church & Rowley-Conwy 2014).

It is notable that, in contrast to the sites on Harris, these sites are all shell middens. As discussed in Chapter Two, numerous shell middens are known in the Inner Hebrides and the along the Oban coastline (Bonsall 1996; Hardy & Wickham-Jones 2009b; Mellars 1987; Saville *et al.* 2012b). These sites therefore provide the opportunity to compare shell midden composition and function between the Inner and Outer Hebrides.

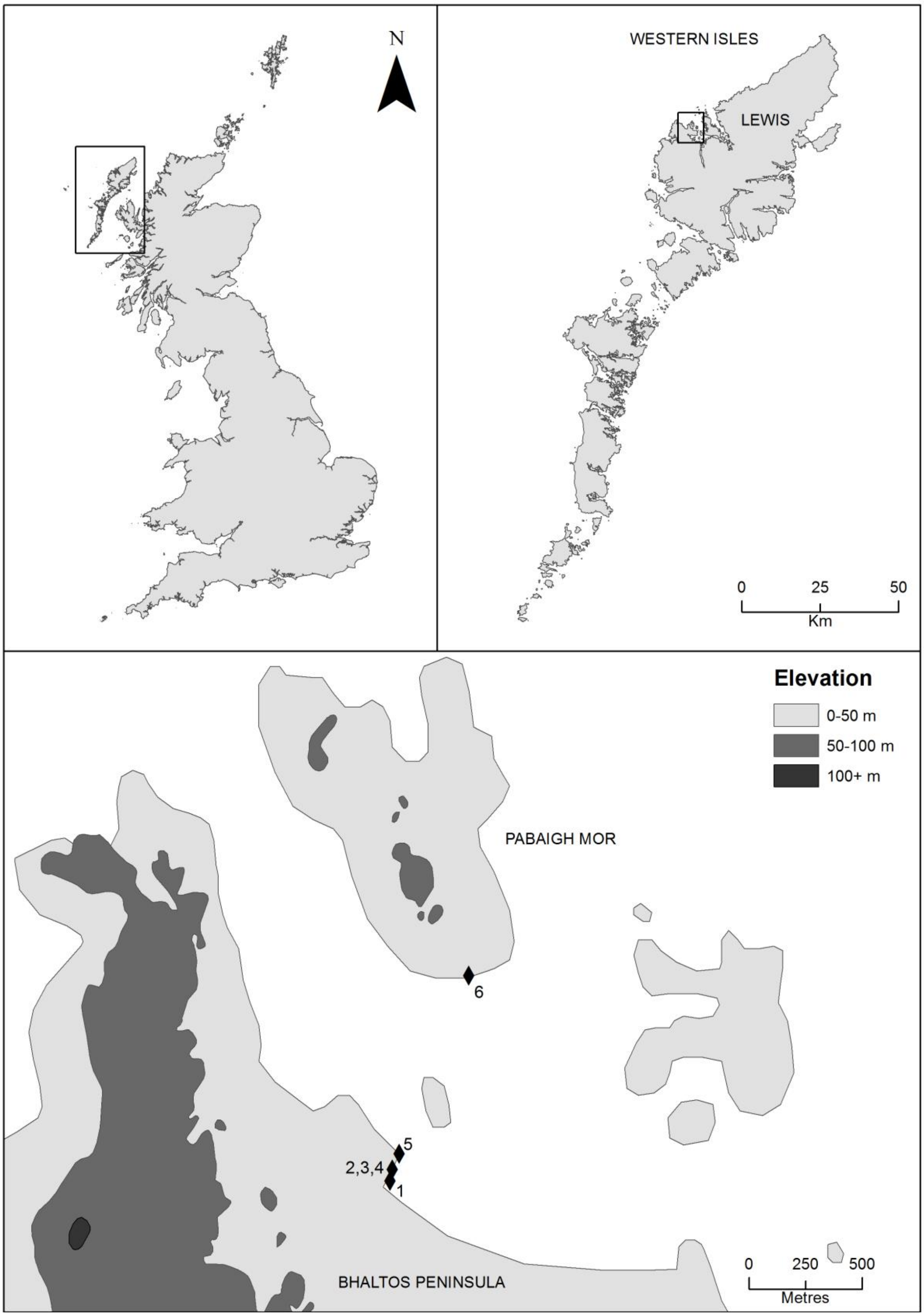


Figure 124. Location of Mesolithic sites in Lewis. 1 - Tràigh na Beirigh 1, 2 - Tràigh na Beirigh 2, 3 - Tràigh na Beirigh 3, 4 - Tràigh na Beirigh 4, 5 - Tràigh na Beirigh 9, 6 - Pabaigh Mòr South. Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service.

Figure 125. The Cnip headland from the sea. Tràigh na Beirigh 1, Tràigh na Beirigh 2, Tràigh na Beirigh 3 & 4 and Tràigh na Beirigh 9 are arrowed from left to right. Photo courtesy of Peter Rowley-Conwy

6.2. Tràigh na Beirigh 1

6.2.1. Discovery and Excavation

6.2.1.1. Excavation 2010

As a consequence of coastal erosion, a shell midden was revealed at on a small rocky promontory, identified on the OS maps as Gridig, at the western edge of Tràigh na Beirigh beach during the 1990's (NGR NB1002 3628; Armit 1994:90). The aceramic midden was recorded again as part of a coastal erosion survey around the coastline of Lewis in 1996 (Burgess & Church 1997:117), but its date was unknown.

As part of the season of fieldwork investigating the first known Mesolithic site in the Western Isles, at Northton in 2010, a two-litre sample was taken from an eroding section of the main body of this shell midden. The site was deemed likely to be Mesolithic in date, as the basal deposits of the midden graded into an apparent early to mid-Holocene soil, much like that at Northton, Harris (Blake *et al.* 2012a:4-5; Church *et al.* 2012b:194). The ecofacts recovered from the sample were also very similar in composition to those of Northton – containing fish bones, crustacean, and a hare bone, in addition to charred hazel nutshells and a piece of charcoal. The absence of pottery and domesticated species of plants and animals also supported the likelihood of a Mesolithic date (Blake 2011; Blake *et al.* 2012a:4-5; Church *et al.* 2012b:194). Hazel nutshells from the sample were radiocarbon dated to c.4400-c.4000 cal. BC – the very terminal Mesolithic (Ashmore 2004b:92; Blake *et al.* 2012a:5; Church *et al.* 2012b:195). There was no lithic material recovered from this excavation.

6.2.1.2. Excavation 2011

The team from Durham University returned in 2011 with the aim of conducting a full coastal erosion assessment. The extent of the midden deposits were to be defined, and sampled for artefacts and ecofacts (Blake *et al.* 2012a:5). The eroding edges of the deposits were excavated back by c.0.1m along five exposed sections (Figure 126). Two small test pits were excavated behind the eroding edge of the midden in order to establish the extent of the deposits in plan (Blake *et al.* 2012a:6). Again a 100% sampling strategy was employed for all excavated areas, recovering over 50 litres of bulk samples (Blake *et al.* 2012a:6; Church *et al.* 2012b:195; Jones 1991). An assemblage of ecofacts was recovered which were similar in composition to those identified in 2010, but in much a greater quantity. Worked flint and quartz was also recovered (Church *et al.* 2012b:195).

Almost the entirety of the shell midden has eroded due to its exposed location. The shell midden deposits were absent in both test-pits, indicating only a very small proportion of the midden survived and it was anticipated that the site would be completely destroyed within a few years (Blake *et al.* 2012a:8).

Figure 126. The eroding faces of the midden at Tràigh na Beirigh 1, prior to excavation in 2011. Photo courtesy of Mike Church

6.2.1.3. Excavation 2012

In 2012 the team returned to excavate the midden in its entirety, before it was completely destroyed (Church *et al.* 2012b:195). Two small open area trenches were excavated; the first c.1.8m X 1.5m was situated at the northern extent of the remaining shell midden, where the midden deposits graded out into a rock outcrop, thereby defining the extent of the shell midden in that area (Figure 127). A small round feature, filled with a deposit of burnt shell, was identified in the basal inorganic sandy silt layer of the trench (Piper & Church 2014).

The second trench, c.2m X 1.1m contained the greatest concentration of the midden deposits (Figure 128). Several negative features were identified in the buried ground surface and underlying basal layer of the trench, which may represent stake holes. A perforated oyster shell was recovered from the base of the midden deposits. The edges had been modified to make it circular in shape, and a circular hole made in the centre (Jones 2012; Piper & Church 2014). It is likely to be a decorative object as there is little apparent functional use for it. Several perforated oyster shells have been recovered from the shell middens on Oronsay and offer an interesting parallel (Hardy 2010:133), which will be discussed further in Chapter Eight.

A 100% sampling strategy was employed, in line with that adopted for the excavation of Northton and Tràigh an Teampuill (Bishop *et al.* 2011a; Church *et al.* 2012b; Jones 1991; Piper & Church 2015).

Additionally, several samples were removed using Kubiena tins for further palaeoenvironmental and micromorphological analysis. The bulk samples total over 500 litres of excavated material. Initial processing of the bulk samples has supplemented the assemblages of artefacts and ecofacts that were recovered from the 2011 and 2010 investigations in even greater quantity.

Figure 127. Trench 1 under excavation at Tràigh na Beirigh 1, revealing the northern edge of the midden deposits. Photo courtesy of Mike Church

Thus far, the Mesolithic activity at Tràigh na Beirigh 1 has been interpreted as evidence for numerous short-term occupations, during a slow accumulation of substantive shell deposits. These comprise the remnants of hearth material, food waste and lithic knapping debris. Occasionally, single episodes of discard were observed within the deposits, in the form of 'tip lines' of shells. The shell midden overlies a buried ground surface, which also contains artefacts and ecofacts that may have been deposited during earlier occupation of the site (Blake *et al.* 2012a:10; Church *et al.* 2012b:195; Church pers. comm.).

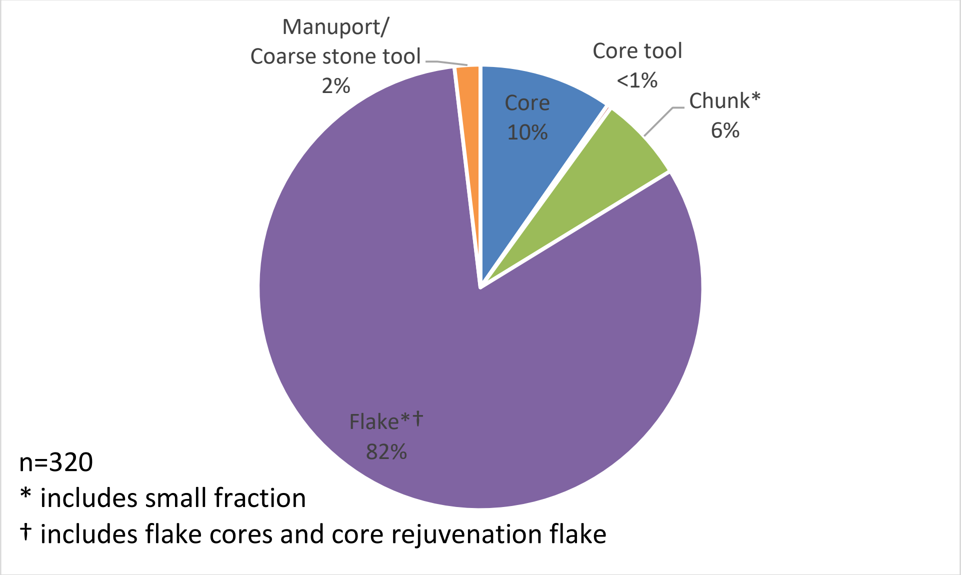
Figure 128. Trench 2 under excavation at Tràigh na Beirigh 1 with the top of the shell midden exposed. Photo courtesy of Mike Church

6.2.2. Tràigh na Beirigh 1 Lithic Assemblage Results

6.2.2.1. General Character of the Assemblage

The lithic assemblage from the *in situ* and >4mm sieved fraction of Tràigh na Beirigh 1 totals 334 artefacts. The highest proportion of the assemblage was recovered from the main body of the shell midden (C008), with artefacts also present in most of the contexts recorded. A single piece (L236) was identified as a marine mollusc fragment, not flint as originally thought, and thus not recorded. A very small proportion of the assemblage (n=14, 4%) derived from cleaning contexts (C002, C018, C019) and are not included in the subsequent analysis. Although it is certain these lithics were recovered from the Mesolithic contexts, their precise provenance is not known. As such these lithics are categorised as unstratified, and listed in Appendix Five. One cleaning context (C020) has still been included in the analysis as this was excavated mid-way through the excavation of the main body of the shell midden (C008); therefore the stratigraphic integrity of this context is definite. The analysis that follows is only based upon the stratified material, with the inclusion of lithics from C020, and totals 320 pieces.

Flakes dominate the assemblage and comprise 82% of the total artefacts recovered (Figure 129 and Table 23). The flake category represented in Figure 129 also includes flake cores, a core rejuvenation flake and small fraction flakes (<10mm). Cores make up 10% of the assemblage, and a single, barely modified borer is the only formal tool that has been identified from the site. Indeterminate chunks, including small fraction chunks, several manuports, and a modified piece of gneiss make up the remainder of the assemblage.



n=320
* includes small fraction
† includes flake cores and core rejuvenation flake

Figure 129. Tràigh na Beirigh 1 assemblage composition

Technology	**Raw Material**			
	Quartz	**Flint**	**Other**	**Total**
Core	29	2		**31**
Core tool	1			**1**
Chunk	9			**9**
Small Fraction Chunk	11			**11**
Flake	102	6	3	**111**
Core rejuvenation flake	1			**1**
Flake Core	7			**7**
Small Fraction Flake	139	3	1	**143**
Manuport	2		3	**5**
Coarse stone tool			1	**1**
Total	**301**	**11**	**8**	**320**

Table 23. Tràigh na Beirigh 1 assemblage composition

Figure 130 shows the proportion of artefacts contained within the different stratigraphic units, and Figure 131 the distribution by individual context. Over half of the artefacts were recovered from contexts in the main body of the shell midden (Figure 130; C008, C009, C011, C020). Just less than a quarter of the assemblage was found in the upper interface layers between the overlying turf and the shell midden below (C004, C005, C006), and an almost equal amount were recovered from the relic ground surface and soil/sand layers below the shell midden (C014, C015, C016, C017, C022, C032). Six artefacts were found in the fill of two small, discrete features (C026, C028). Worked quartz was found in all of the stratigraphic units, and is supplemented by small quantities of flint and other raw materials thoughout the archaeological sequence.

This site cannot be discussed in terms of phases of occupation, owing to a lack of radiocarbon dates from the different deposits that make up the site. As a result, a defiitive interpretation cannot be made over the duration of the site formation.

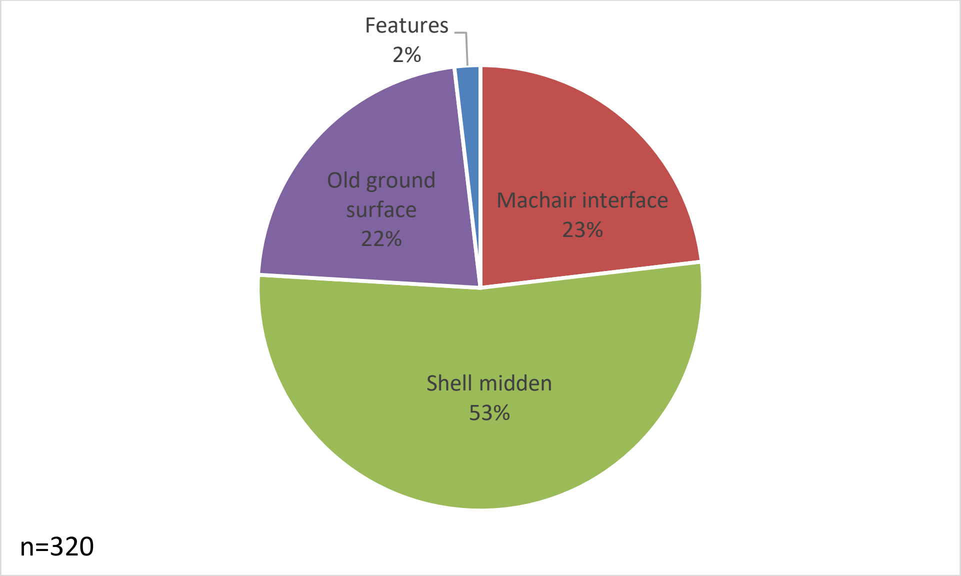
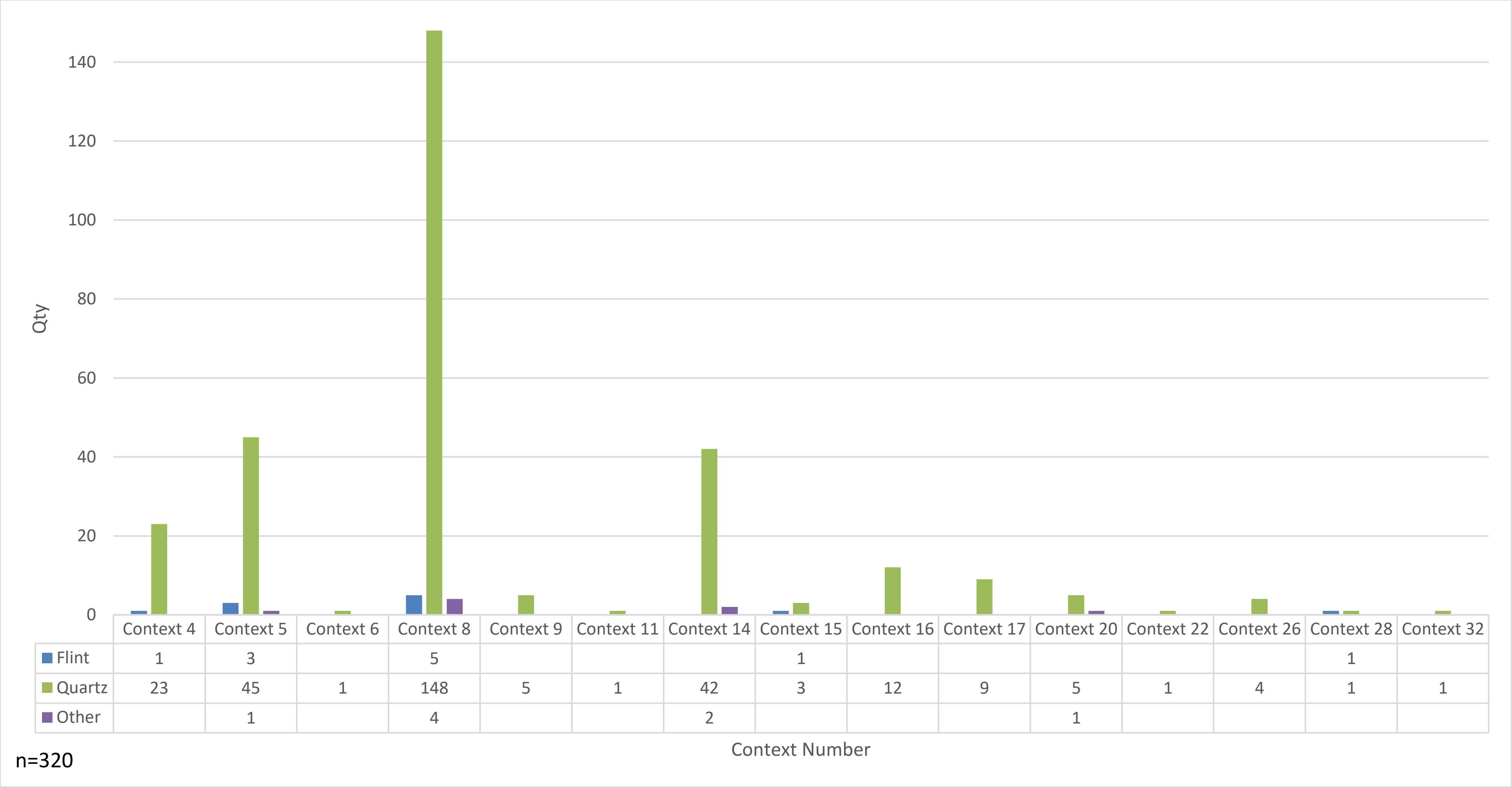


Figure 130. Tràigh na Beirigh 1 assemblage by stratigraphic sequence



	Context 4	Context 5	Context 6	Context 8	Context 9	Context 11	Context 14	Context 15	Context 16	Context 17	Context 20	Context 22	Context 26	Context 28	Context 32
🟦 Flint	1	3		5				1						1	
🟩 Quartz	23	45	1	148	5	1	42	3	12	9	5	1	4	1	1
🟪 Other		1		4			2				1				

Figure 131. Tràigh na Beirigh 1 raw material by context

6.2.2.2. Raw Material

Quartz overwhelmingly dominates the lithic assemblage from Tràigh na Beirigh 1, with 94% of the artefacts made from this raw material (Figure 132). A small proportion of flint and other raw materials such as feldspar, diorite, gneiss, and granite were also recovered.

The whole assemblage is in fresh condition, suggesting limited post-depositional disturbance. All of the flint pieces are completely patinated, ranging in colour from white, grey, and creamy yellow. None of the pieces are stained or heavily scratched, however two flint flakes are burnt.

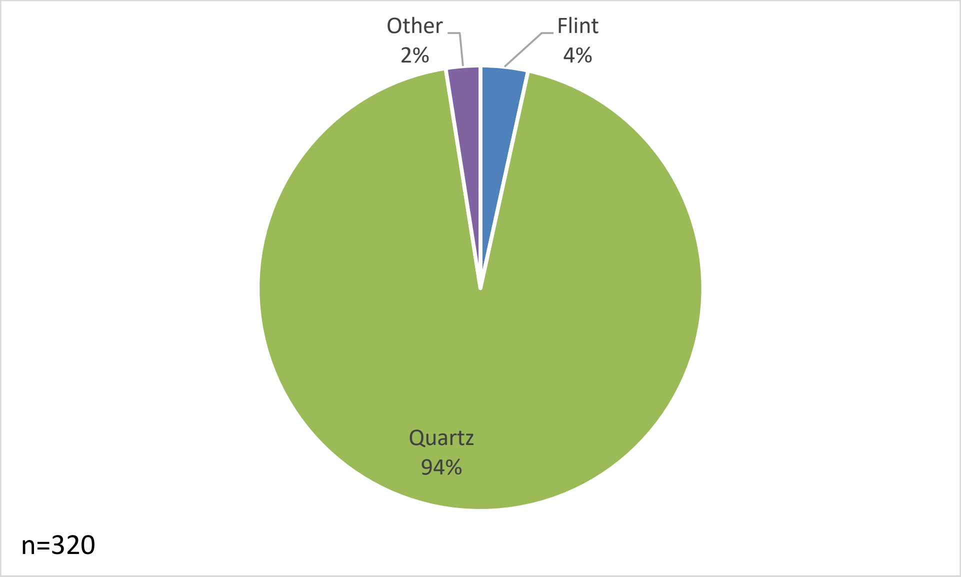


Figure 132. Tràigh na Beirigh 1 raw material composition

Greasy (very fine grained) quartz is the most frequently represented variety at Tràigh na Beirigh 1, with milky quartz the second most often used (Figure 133). Mixed quartz varieties predominantly comprise milky or greasy quartz with feldspar inclusions, or grade into coarse grained types such as quartzite. Milky quartz mixed with rock crystal also frequently occurs in this category. Quartzite and rock crystal, are only present in the assemblage in very low numbers.

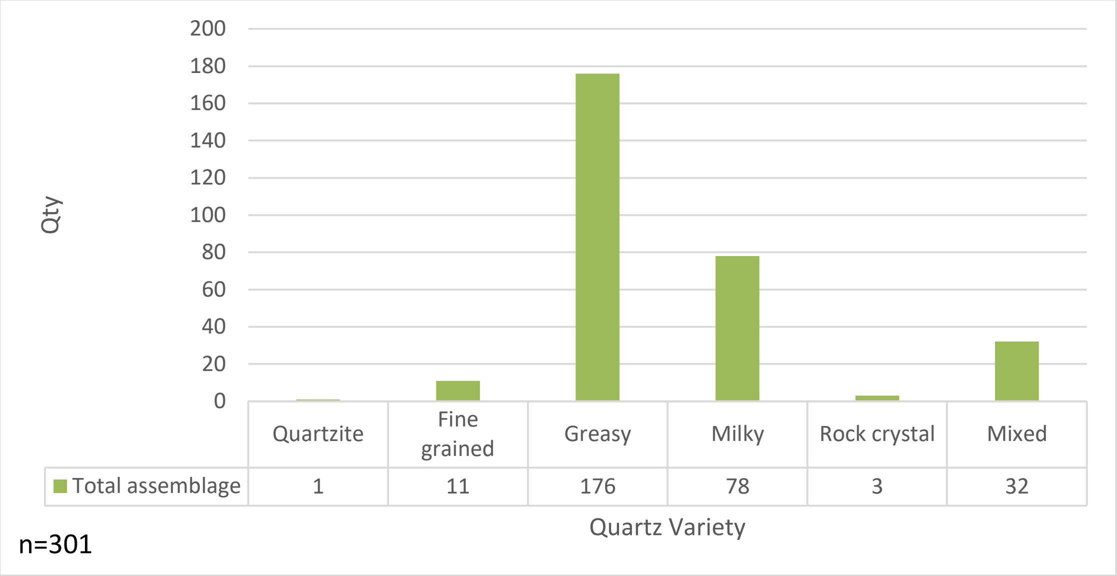


Figure 133. Tràigh na Beirigh 1 quartz varieties

The primary technology from Tràigh na Beirigh 1 is presented below. Details of the small fraction flake, chunk, and small fraction chunk assemblages can be found in Appendix Twelve.

6.2.2.3. Primary Technology: Coarse Stone Tools

6.2.2.3.1. Manuports

Five manuports were recovered from Tràigh na Beirigh 1, which included pieces of gneiss (SF2, SF9), and quartz (L181) from the shell midden contexts (C008, C009). A single piece of diorite (SF3) was recovered from the old ground surface deposits (C014), and a small quartz pebble (L309) was found in the fill of a discrete feature (C026). The dimensions of these pieces are presented in Table 24.

There is no evidence of working on either of the quartz pieces. L181 is a large, angular block with a micaceous, granitic 'cortex' on one face which suggests it was obtained from a nearby vein. In contrast, L309 is a smooth, sub-rounded pebble that is likely to have been acquired from the beach.

SF2, SF3 and SF9 are of locally derived metamorphic rock. SF2 and SF9 are sub-rounded, broken, and actively degrading; SF3 is well worn and smooth. There is no evidence of working on these pieces; however it is notable that they are all quite flat and differ from the background material of the site.

Catalogue No.	Context No.	Raw Material	Length (mm)	Width (mm)	Thickness (mm)
SF2	008	Gneiss	96.63	76.47	60.31
SF3	014	Diorite	99.07	73.56	30.84
SF9	008	Gneiss	148.77	115.02	38.00
L181	009	Quartz	135.15	90.19	54.39
L309	026	Quartz	43.14	33.7	31.32

Table 24. Tràigh na Beirigh 1 manuport dimensions

6.2.2.3.2. Miscellaneous

L58 is a piece of gneiss recovered from the fill of a shallow scooped feature (C022). Its maximum dimension is 72.61mm and it weighs 65.95g. There are up to three concave notches in the piece that are indicative of unidirectional flake removals, and which have created a larger concave feature in the piece. The piece has subsequently fractured, and its exact function cannot be determined.

6.2.2.4. Primary Technology: Cores

A total of 31 cores were recovered from Tràigh na Beirigh 1 (Table 23). These primarily derived from the main body of the shell midden (C008), with a high number also present in the interface context above (C005). One came from the fill of a discrete feature (C028) and a small number from the old ground surface and soil/sand layers below the shell midden (C014, C016, C017).

6.2.2.4.1. Raw Material

Over 90% of the core assemblage is quartz, and there are only two flint cores (Figure 134).

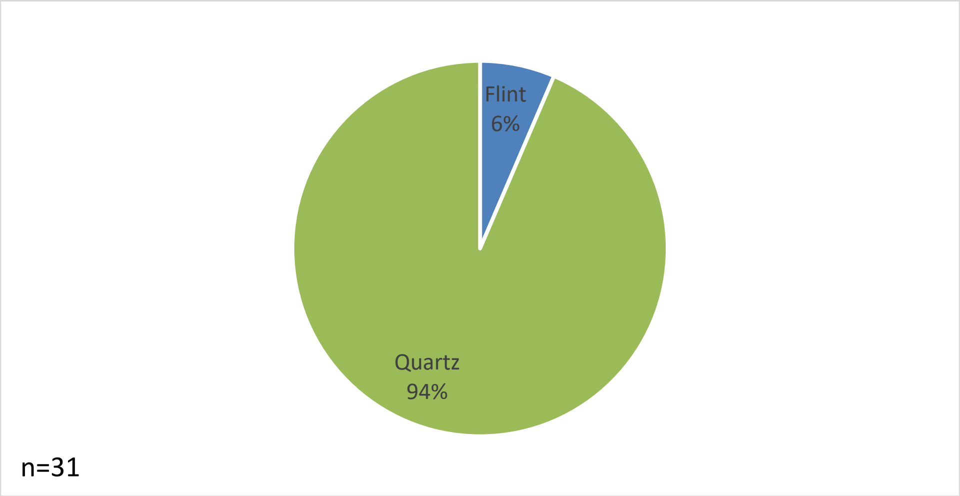


Figure 134. Tràigh na Beirigh 1 core raw material

The majority of quartz cores are made from greasy quartz, including a dark variant, with several also of milky quartz (Figure 135). The mixed quartz varieties most often range from milky to greasy, although there are two which are mixed greasy quartz and feldspar.

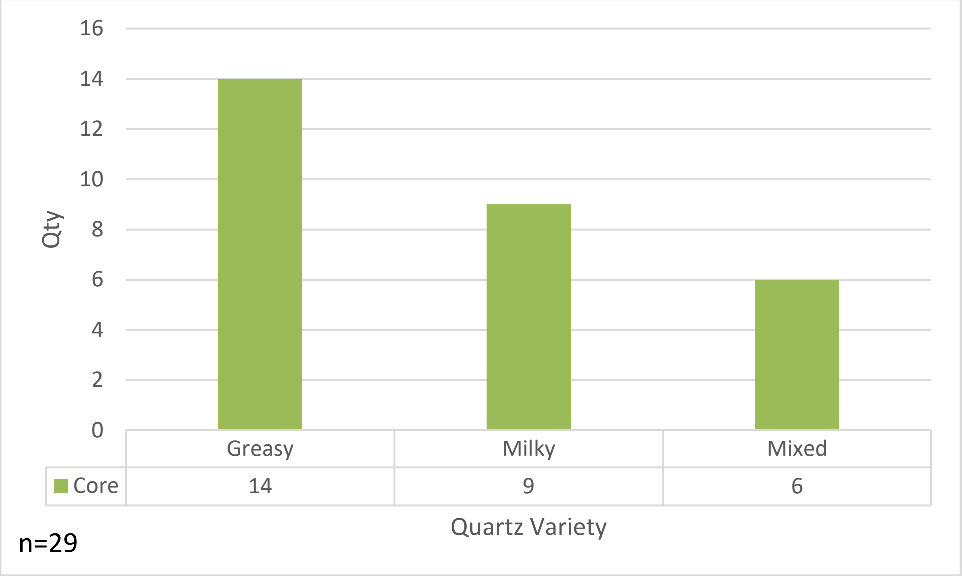


Figure 135. Tràigh na Beirigh 1 core quartz varieties

6.2.2.4.2. Core Dimensions

The flint and quartz cores from Tràigh na Beirigh 1 are small, generally between 10-40mm in length. The weight usually correlates with size, depending on the specific gravity of the raw material (Figure 136). Two of the quartz cores are exceptionally large and heavy.

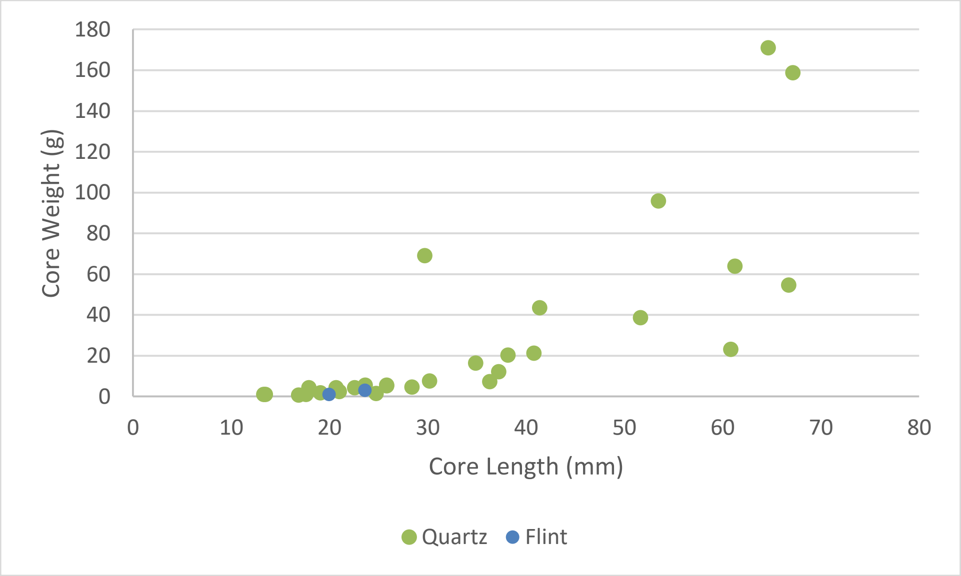


Figure 136. Tràigh na Beirigh 1 core dimensions

6.2.2.4.3. Cortex

Neither of the flint cores at Tràigh na Beirigh 1 have cortex present on them, nor do three of the quartz cores; therefore the source of these materials cannot be determined (Figure 137). The cortex present on the remainder of the quartz cores is most frequently flat and frosted in appearance, with other raw materials such as feldspar mixed into the cortex. This indicates the quartz was sourced directly from a local outcrop. A few cores display cortex that suggests they are water-rolled pebbles collected from the beach.

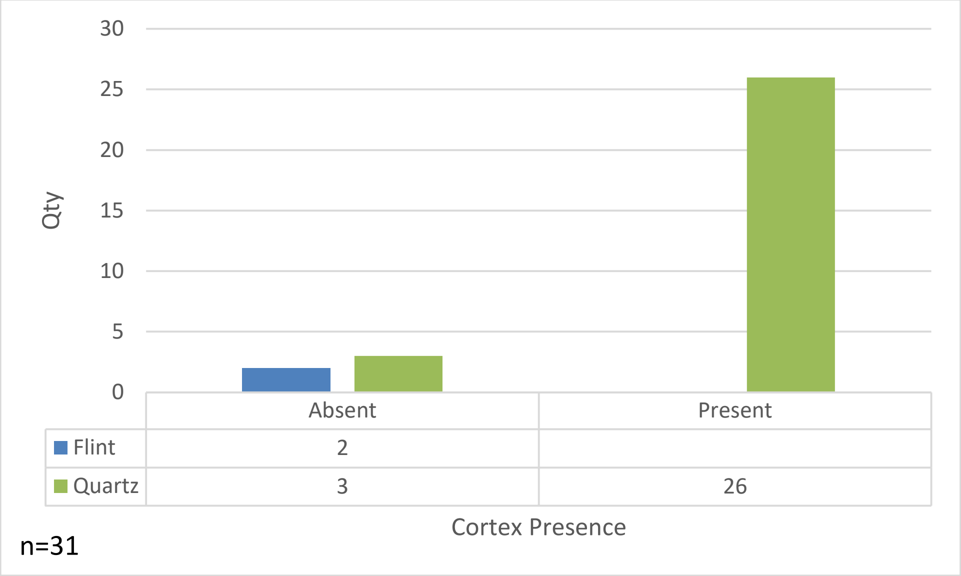


Figure 137. Tràigh na Beirigh 1 core cortex presence

6.2.2.4.4. Flake Removals – Count and Pattern

The number of flake removals on the quartz cores ranges between one and seven (Figure 138). Quartz cores with four removals are marginally more frequently represented than cores with one or three flake removals. There are five quartz cores which have five or more removals – one has five, three have seven and one has six. One of the flint cores has eight removals and the other has six.

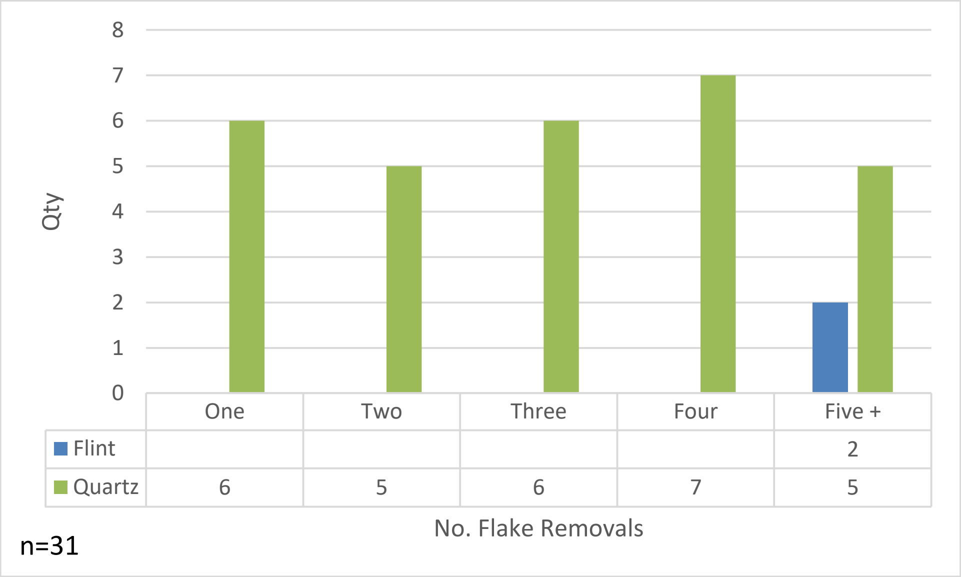


Figure 138. Tràigh na Beirigh 1 number of flake removals for core

The flint core with six removals is a bipolar core, represented by bidirectional removals (Figure 138 and Figure 139). On the other flint core the flake removals have been made from multiple directions. Multidirectional flake removals are almost exclusively found on the quartz cores with two or more flake removals; there is only one quartz core with two flake removals that have been removed from a single direction. A unidirectional flake removal sequence is almost exclusively found on all cores with a single dorsal flake scar, as would be expected, and accounts for the flake scar pattern of a single core with two removals (Figure 140).

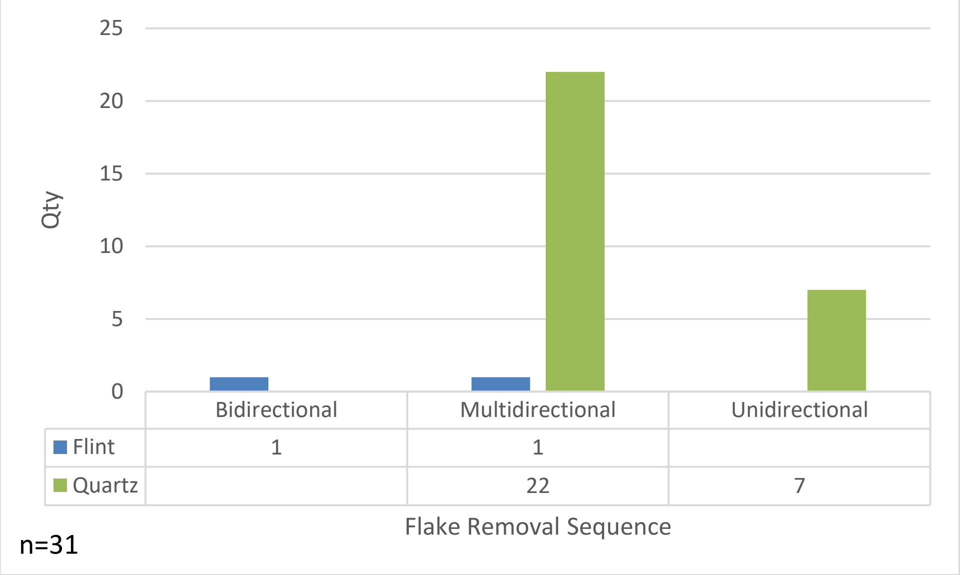


Figure 139. Tràigh na Beirigh 1 sequence of flake removals from core

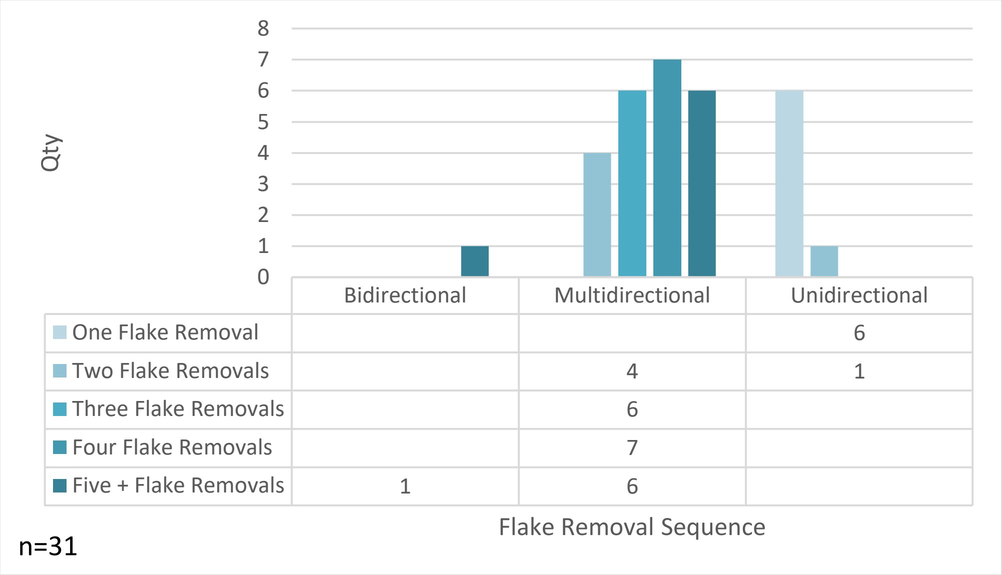
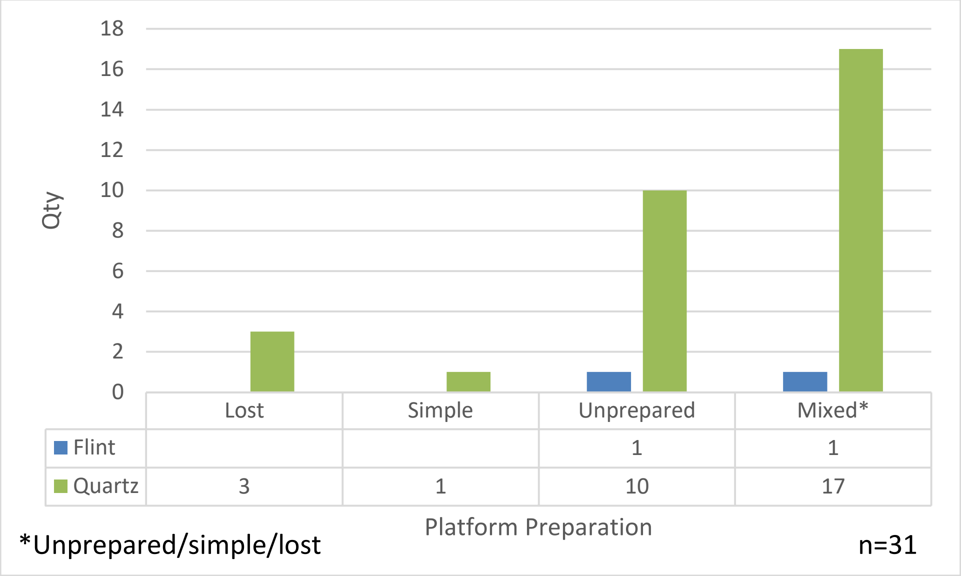


Figure 140. Tràigh na Beirigh 1 sequence of flake removals from cores in relation to the number of flakes removed

6.2.2.4.5. Core Platform Preparation

There is no evidence for platform preparation on the bipolar flint core. The other flint core displays a mixture of simple platform preparation, and platforms that have been lost due to subsequent flake removals (Figure 141). Only a single quartz core displays solely simple platform preparation, although a further 11 exhibit simple preparation in combination with other types. On three cores evidence for platform preparation has been completely lost. Unprepared platforms are present on the majority of the quartz cores, either alone, or in combination with other forms of preparation.



	Lost	Simple	Unprepared	Mixed*
🟦 Flint			1	1
🟩 Quartz	3	1	10	17

Figure 141. Tràigh na Beirigh 1 core platform type

6.2.2.4.6. Core Tool

The core tool (SF14) was recovered from the fill of a shallow, scoop shaped negative feature (C022). It is made from greasy quartz and is 40.72mm at its maximum dimension, weighing 13.58g. There are six multidirectional removals from the core, and there are a range of platform preparation stages from unprepared to simple, and lost. The cortex present is flat and frosted, suggesting the piece derived from a vein source. Of the flake removals, two are very abrupt and have been initiated from one edge, opposite a break, to create a pointed end. These removals appear to be very late in the knapping sequence and are too small to have provided adequate flakes for working; therefore the intention behind their removal appears to be to shape the point. Based on the modification of a single edge to create a pointed end, it is likely this piece is a borer (McCartan 1990).

6.2.2.5. Primary Technology: Flakes

The flake assemblage from Tràigh na Beirigh 1 totals 111 pieces. The flake analysis presented below only comprises material >10mm in length. As mentioned in Chapter Five, the small fraction flakes (<10mm), chunks, and small fraction chunks simply represent *in situ* knapping debris (Ballin 2000:10; Finlayson *et al.* 2000:67); therefore, this data is presented in Appendix Twelve. A description of the seven flake cores and core rejuvenation flake, which were also recovered from the site, is given in a separate section after the initial flake analysis.

The majority of the flake assemblage was recovered from the main body of the shell midden (C008; C009; C020). A high proportion was also found in the old ground surface deposits, and soil/sand layers underlying the shell midden (C014; C015; C016; C017; C022; C032). A small number of flakes were identified in the interface deposits between the turf and the shell midden (C005, C014). The remainder of the assemblage comprises a single flake that was recovered from a discrete layer of razor clams (*Ensis* sp.) below the main body of the shell midden (C011), and two flakes from the fill of a negative feature (C026) cut into the underlying ground surface.

6.2.2.5.1. Raw Material

The flake assemblage from Tràigh na Beirigh 1 is dominated by quartz flakes (92%; Figure 142). Flint only comprises 5% of the assemblage, and the remainder of the flakes are made on feldspar or granite.

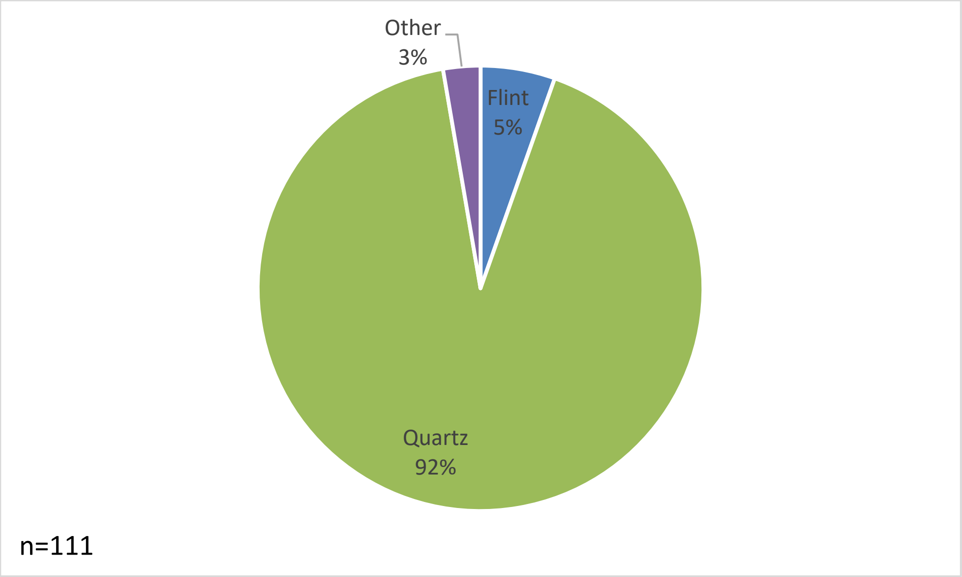
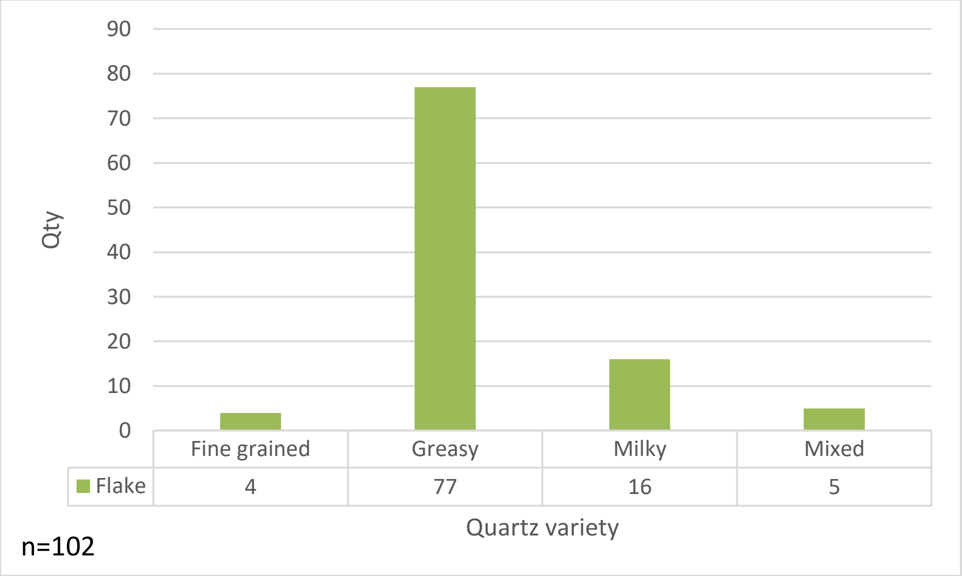


Figure 142. Tràigh na Beirigh 1 flake raw material composition

Greasy quartz, including a dark variety, is most frequently found in the flake assemblage from this site, with smaller quantities of milky quartz represented (Figure 143). There are very few fine grained pieces, and the mixed quartz varieties range between milky and greasy quartz with feldspar inclusions; milky quartz which grades into coarser grained quartz varieties such as quartzite is also present.



	Fine grained	Greasy	Milky	Mixed
🟩 Flake	4	77	16	5

Figure 143. Tràigh na Beirigh 1 flake quartz varieties

6.2.2.5.2. Flake Dimensions

The summary statistics for the flint and quartz flakes from Tràigh na Beirigh 1 are presented in Table 25. On average, the flint flakes are longer than the quartz flakes; however, the quartz flakes have a greater range in terms of length, with a higher standard deviation. Despite this, both raw materials have an almost equal widths and thicknesses on average, albeit the flint marginally bigger. There is a very small range of thickness in the flint flakes, which is reflected in the low standard deviation. This contrasts with the larger range in thickness of flakes made from quartz.

Raw Material		Length (mm)	Width (mm)	Thickness (mm)
Flint	**Min**	16.34	7.12	4.71
	Max	26.99	22.40	7.59
	Mean	21.55	14.73	5.82
	SD	5.086883	5.086828	1.084535
Quartz	**Min**	10.06	5.00	1.10
	Max	42.89	38.13	27.29
	Mean	16.49	14.60	5.30
	SD	6.835002	6.773683	3.449084

Table 25. Tràigh na Beirigh 1 flake dimension summary statistics for primary raw materials

Overall, there is a positive linear trend between the increasing length and width of the quartz flakes (Figure 144). The densest cluster of points falls between 10mm-15mm in length and 5mm-16mm in width. Outside of this cluster the points become more dispersed and all of the flakes, with a single exception, fall below less than 30mm in length and 35mm in width. The flint flakes from two groups in terms of length – one at c.17mm and another at c.26mm, but there is little difference between the widths. The granite flake falls in the dense cluster of quartz flakes, whereas the two feldspar flakes are slightly longer and wider.

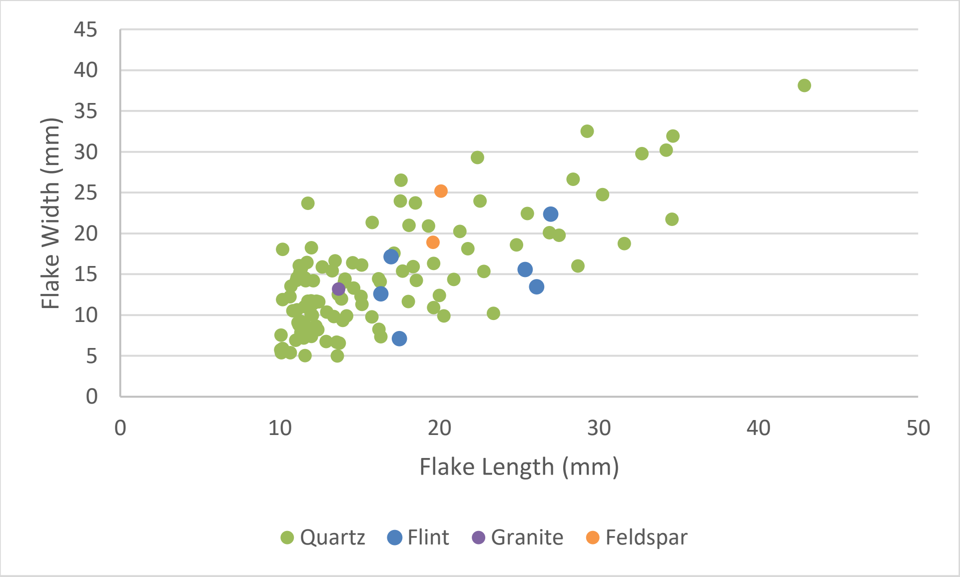


Figure 144. Tràigh na Beirigh 1 flake dimensions length:width

A linear trend between increasing flake length and thickness is also observed in the flake assemblage from Tràigh na Beirigh 1 – the longer flakes are generally thicker. As described above, the clear dense grouping of quartz flakes, and two groups of flint flakes are evident in Figure 145. The narrow range of the thickness of flint flakes is visible, with none exceeding 8mm in thickness. A very small proportion of the quartz flakes are thicker than 10mm. One of these is a significant outlier with a thickness of 27.29mm, although it is quite short. The granite and feldspar flakes all fall within a similar range of thickness as those of flint and quartz.

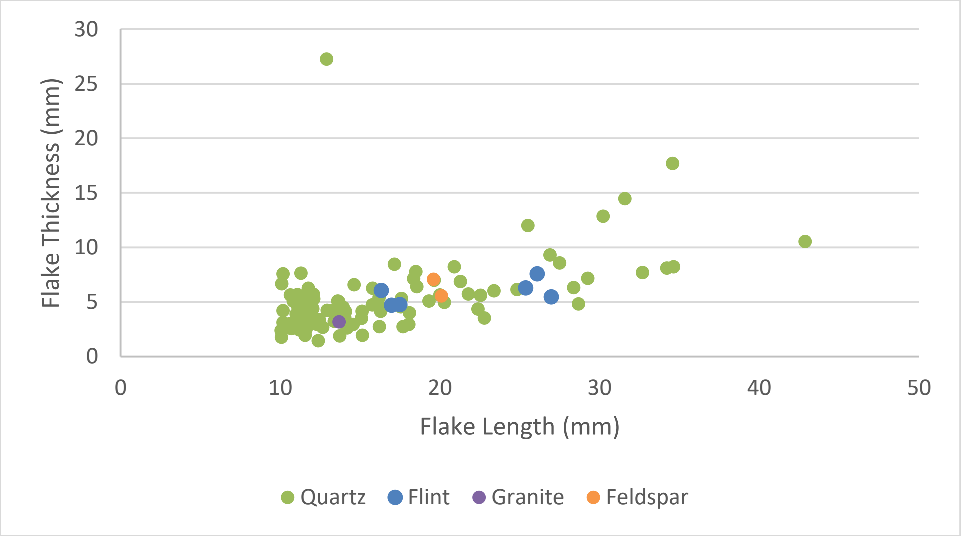


Figure 145. Tràigh na Beirigh 1 flake dimensions length:thickness

The extremely thick quartz flake falls at the narrower end of the range in terms of width (Figure 146). Overall, there is a weak positive correlation between the increasing width and thickness of quartz flakes; however there are a number of thicker flakes of mid-range width that do not fit this trend. There is little variation in the thickness of the flint flakes, regardless of width, which is also the case for the feldspar and granite flakes.

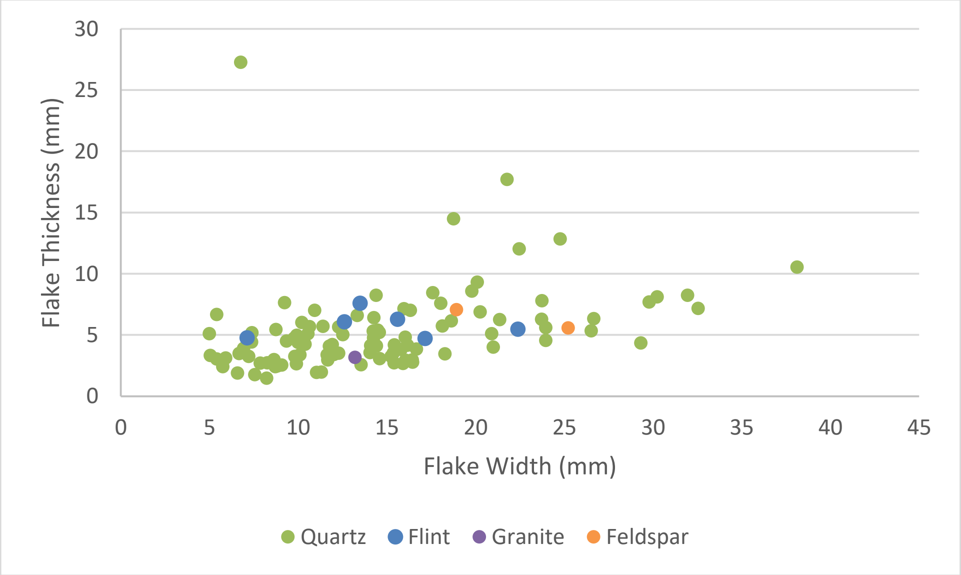
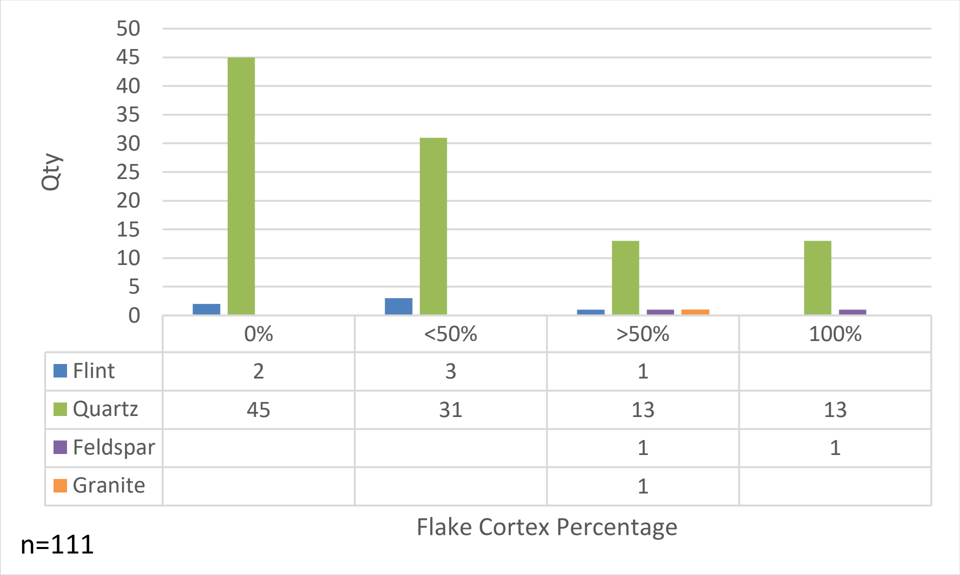


Figure 146. Tràigh na Beirigh 1 flake dimensions width:thickness

6.2.2.5.3. Cortex

There are no flint flakes at Tràigh na Beirigh 1 which have 100% cortex present, and only a single flake retains >50% of the cortex (Figure 147). The remainder of the flint flakes have <50% or none at all. Where cortex is present on flint flakes it is smooth, rounded and water worn, indicating it was sourced from beach pebbles. One of the feldspar flakes has 100% cortex present which is also smooth and rounded, suggesting the likely source of the material is again a beach pebble. The other feldspar flake and granite flake both retain >50% of the original outer surface, which is smooth and weathered, suggesting an outcrop source for both pieces.

The majority of the quartz flakes from the assemblage are completely decorticated, and a high number retain <50%. Considerably fewer quartz flakes have >50% or 100% dorsal cortex. The cortex present on the quartz flakes is most frequently smooth, rounded and water worn which also suggests the source is beach pebbles. There are also a small number of flakes with flat, frosted cortex that is frequently combined with weathered feldspar. This is indicative of ‘parent’ material, where a block or plate of quartz has been detached from an outcrop.

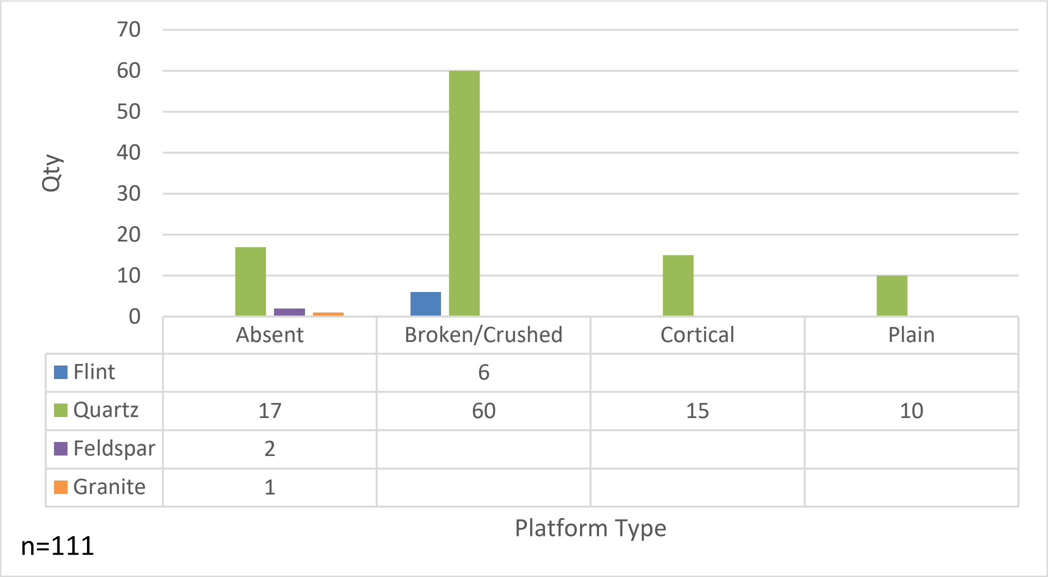


	0%	<50%	>50%	100%
🟦 Flint	2	3	1	
🟩 Quartz	45	31	13	13
🟪 Feldspar			1	1
🟧 Granite			1	

Figure 147. Tràigh na Beirigh 1 flake cortex percentage

6.2.2.5.4. Striking Platform – Type and Dimensions

The platforms of all of the flint flakes are either broken or crushed, which is also the most frequently recorded platform type category recorded for quartz flakes (Figure 148). The striking platform is absent from the feldspar and granite flakes. Where the striking platform on the quartz flakes is present and complete, these platforms are either cortical or plain. Cortical platforms occur more frequently than those created by a previous flake removal.



	Absent	Broken/Crushed	Cortical	Plain
🟦 Flint		6		
🟩 Quartz	17	60	15	10
🟪 Feldspar	2			
🟧 Granite	1			

Figure 148. Tràigh na Beirigh 1 flake platform type

The majority of both platform types fall between 5mm-17mm in width and 1mm-9mm in depth (Figure 149). Two plain platforms exceed 20mm in width, one of which is unusually deep, and two cortical platforms are more than 25mm wide. There is a single flake with a cortical platform that is a significant outlier at 25.31mm in depth.

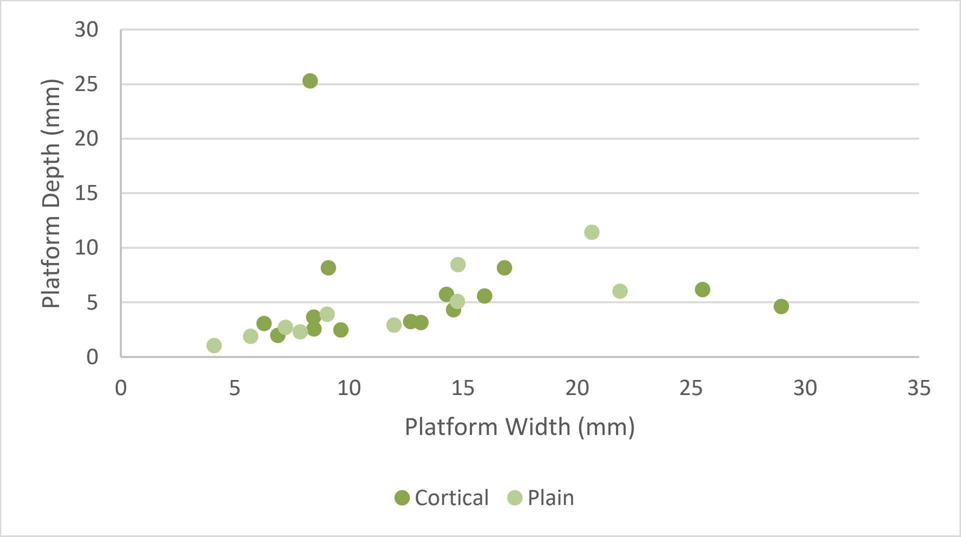
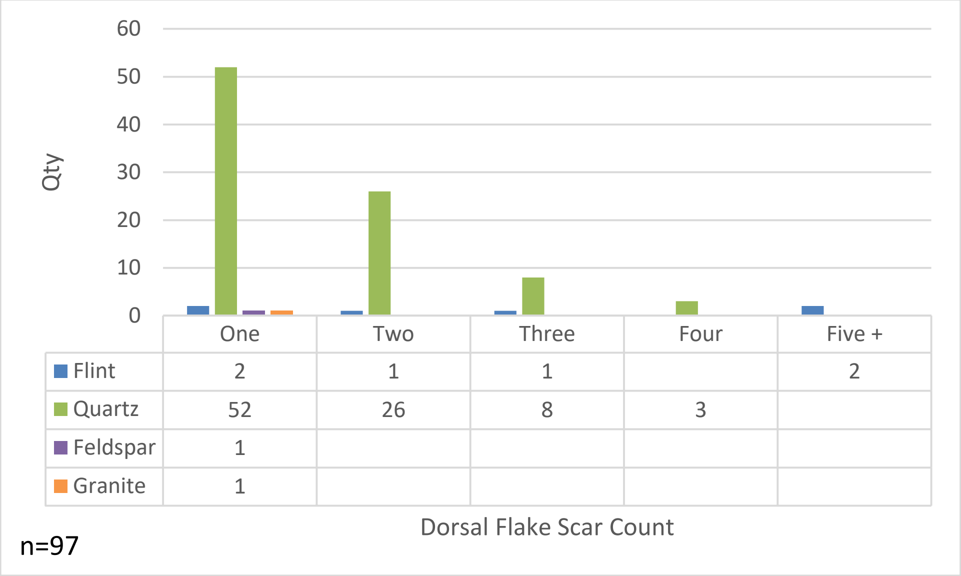


Figure 149. Tràigh na Beirigh 1 quartz flake platform dimensions

6.2.2.5.5. Dorsal Flake Scars – Count and Pattern

The maximum number of dorsal flake scars present on quartz flakes is four, although this is not common and the majority of quartz flakes only display a single dorsal flake scar (Figure 150). Of the other raw materials that have dorsal flake scars, the feldspar flake and the granite flake have single removals each. Flint flakes generally exhibit several dorsal flake scars, which range in number between two and eight.

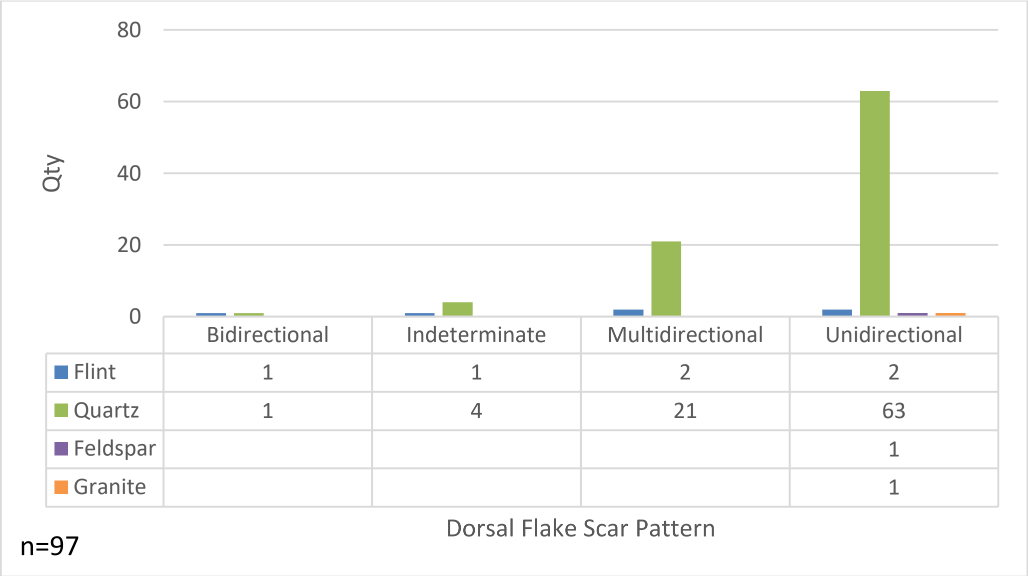


	One	Two	Three	Four	Five +
🟦 Flint	2	1	1		2
🟩 Quartz	52	26	8	3	
🟪 Feldspar	1				
🟧 Granite	1				

Figure 150. Tràigh na Beirigh 1 dorsal flake scar count

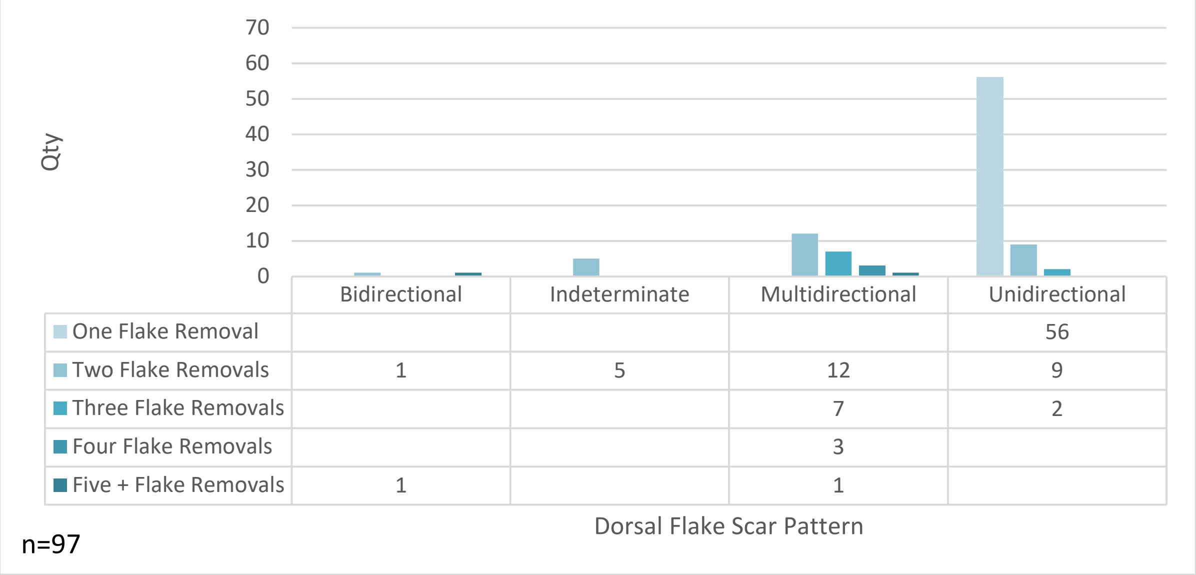
A unidirectional dorsal flake scar pattern is most frequently observed on the quartz, feldspar and granite flakes (Figure 151). Equal numbers of flint flakes display multidirectional and unidirectional flake removals. On one flint and one quartz flake a bidirectional pattern was observed. This indicates a bipolar reduction technique has been employed to reduce the flint flake, and is evidenced by a high number of dorsal flake scars (Figure 152); however for the quartz flake it simply demonstrates that the knapping sequence had alternated from one end to another.

For a small number of flakes the knapping pattern could not be identified, and in all cases this was where only two dorsal flake scars were present (Figure 152). A multidirectional flake scar pattern is evident in the majority of flakes with two or more flake scars; however in a small number of flakes two or three dorsal scars indicate a unidirectional pattern.



	Bidirectional	Indeterminate	Multidirectional	Unidirectional
🟦 Flint	1	1	2	2
🟩 Quartz	1	4	21	63
🟪 Feldspar				1
🟧 Granite				1

Figure 151. Tràigh na Beirigh 1 dorsal flake scar pattern

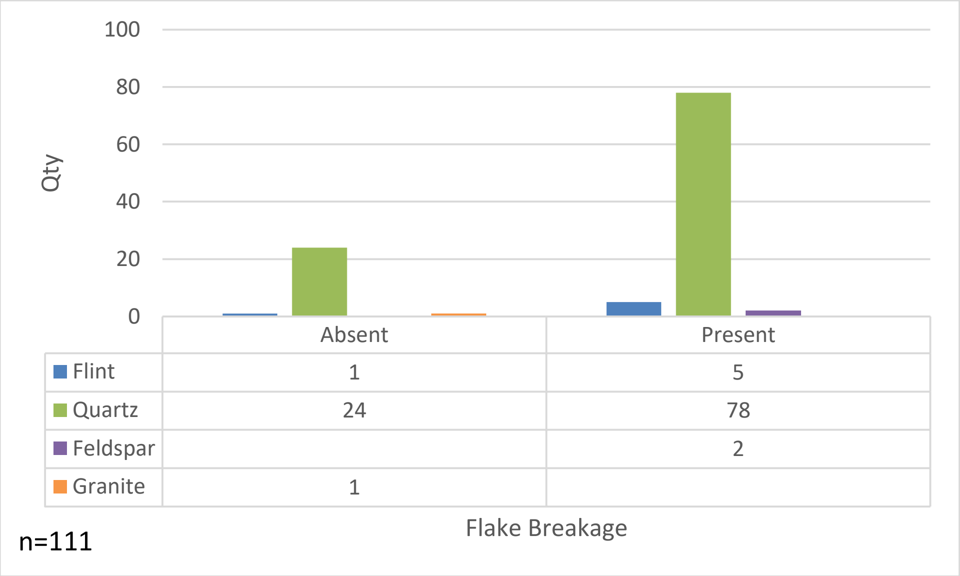


	Bidirectional	Indeterminate	Multidirectional	Unidirectional
One Flake Removal				56
Two Flake Removals	1	5	12	9
Three Flake Removals			7	2
Four Flake Removals			3	
Five + Flake Removals	1		1	

Figure 152. Tràigh na Beirigh 1 dorsal flake scar pattern in relation to the number of dorsal flake scars counted

6.2.2.5.6. Flake Breakage

Only a small proportion of flakes in the assemblage do not exhibit any evidence of breakage beyond knapping shatter. The majority of flakes in each raw material are broken to some extent (Figure 153).



	Absent	Present
Flint	1	5
Quartz	24	78
Feldspar		2
Granite	1	

Figure 153. Tràigh na Beirigh 1 flake breakage

6.2.2.5.7. Flake Core

Seven quartz flake cores were recovered from Tràigh na Beirigh 1. L33 was recovered from an interface context between the turf and the top of the shell midden (C005). SF8, L94, L160, and L226 were all recovered from the main body of the shell midden (C008, C009), whilst L273 was found in the underlying old ground surface (C014). SF19 was recovered from the fill of a discrete feature below the shell midden (C028). The dimensions of these pieces are presented in Table 26, and each piece is described below.

Catalogue No.	Context No.	Length (mm)	Width (mm)	Thickness (mm)
SF8	008	22.16	21.65	5.49
SF19	028	15.73	21.12	6.59
L33	005	18.93	14.62	4.07
L94	009	17.94	13.93	4.54
L160	008	10.39	11.74	3.60
L226	008	5.37	15.13	2.20
L273	014	15.29	11.66	4.08

Table 26. Tràigh na Beirigh 1 flake core dimensions

SF8 is made from greasy quartz and does not have any cortex present. The original platform is absent due to breakage and a single, unidirectional dorsal flake scar is present. The break was used as the platform to remove a further flake on the dorsal face of the original flake.

SF19 is also a greasy quartz flake core, and there is <50% cortex on the piece, which is flat and frosted suggesting a vein source. The cortex covers the striking platform which measures 18.13mm X 4.90mm. A single, unidirectional flake scar is present on the dorsal face. A further flake removal has been initiated from a break on the right lateral side of the piece, which formed the platform for its removal.

L33 is a greasy quartz flake core with complete dorsal cortex coverage, which also extends on to the ventral face. Two very small flake removals have been made into the ventral face from a break along the left lateral edge. There is no evidence for the original striking platform.

L94 is quartzite with a broken platform, no cortex present, and a single unidirectional dorsal flake scar. A break on the right lateral edge has been used as a platform to remove a further flake.

L160 is a milky quartz flake core. A single, unidirectional dorsal flake scar has left >50% cortex on the piece. This cortex is smooth, rounded, and water-worn suggesting it was obtained from the beach. A further flake removal on the ventral face has been initiated from the right lateral at the proximal end, removing the platform of the original flake.

L226 is very similar to SF19. The greasy quartz flake also has <50% cortex present which covers the striking platform. The platform measures 13.65mm X 2.20mm. In contrast to the other flake cores, this piece displays four dorsal flake scars that have been removed from multiple directions. There are two bulbs of percussion present on the ventral face, which has subsequently been destroyed by a later flake removal.

L273 is made from milky quartz and the original striking platform has been crushed. There is no cortex present on the piece and a single, unidirectional flake scar is present on the dorsal face. The removal of a further flake on the same face was initiated from a break on the right lateral edge, which acted as a fresh platform.

6.2.2.5.8. Core Rejuvenation Flake

A single quartz core rejuvenation flake was recovered from the main body of the shell midden (C008) at Tràigh na Beirigh 1. L162 is made from greasy quartz and measures 18.95mm X 12.76mm X 14.62mm. There is <50% cortex present on the piece and the striking platform is broken. There are two multidirectional flake scars evident in addition to further breakage.

6.2.2.5.9. Natural Quartz Fragments

The site of Tràigh na Beirigh 1 lies on an outcrop of Lewisian gneiss, with a vein of quartz running through the centre of the site. The samples from the site, principally from the basal sand and old ground surface contexts, therefore contained a quantity of natural quartz fragments. Quartz was observed actively becoming detached from the bedrock during the excavation of these basal contexts, and thus became incorporated into the samples. These fragments were clearly identifiable as they are frosted and weathered on both faces, with angular breaks along natural fracture planes. Other natural fragments were found within the samples from other contexts, however these principally comprised small, sub-angular pieces of rock crystal with micaceous inclusions. The natural quartz fragments from each context were weighed and archived; the weights are presented in Appendix Five.

6.2.2.6. Assemblage Summary

A total of 320 pieces make up the lithic assemblage from Tràigh na Beirigh 1, which is largely derived from the shell midden deposits. Flint and quartz debris in the underlying ground surface indicates that the site was used prior to the build-up of midden deposits; without further radiocarbon dates the relationship between this occupation and use of the midden is not clear. The presence of artefacts in the upper interface layers is likely to be a consequence of the upper section of the midden being eroded, and possibly later activity at the site.

Quartz is the dominant raw material throughout the occupation of Tràigh na Beirigh 1. It is evident from the manuports, and the cortex of the cores at the site, that both a vein and beach pebbles were exploited as the sources of this raw material. There are a higher number of vein quartz cores than pebble cores, which indicates the former source was more frequently exploited. The presence of a small number of granite and feldspar flakes at the site, which appear to be decorticating flakes from the primary reduction of quarried quartz, supports this. There is evidence for quarrying of the quartz vein outcrops around Gridig, the small promontory on which Tràigh na Beirigh 1 is situated, in the presence of small, circular impact marks that denote attempts to remove a piece. Other outcrops of quartz, also with visible evidence for quarrying have been identified on the west side of the Bhaltos peninsula near Cliobh (McHardy 2010).

The quartz is predominantly of a very fine grained (greasy) variety, as such the material is of very high quality, which contrasts to Northton and Tràigh an Teampuill. The cores display an average of 3.2 flake removals, and this remains largely constant throughout the occupation of the site. There is, however, a noticeable difference between the average number of flake removals on purely greasy quartz (3.7) and purely milky quartz (2.7). On quartz cores where these two varieties grade into one another, there is an average of 3.5 flake removals, suggesting that the better quality raw material was more intensively reduced. This is reflected in the greater number of greasy quartz flakes present in the assemblage and this quartz variety is primarily used for the flake cores and core rejuvenation flake. The large size of many of the cores indicate they were discarded long before they were exhausted, as often observed when a raw material is locally abundant. The flake cores do not appear to have been intentionally produced in terms of strategic economising of the raw material, however. In almost every instance breakage on the original flake has been used opportunistically as a platform to initiate a further removal.

Quartz was primarily reduced using platform technology, and is evident in several aspects of the assemblage. The high number of unprepared platforms on the cores display flat, frosted cortex that denotes the edge of a block or plate, which functions as a ‘ready made’ platform (Ballin 2008:69-70). Furthermore, plain platforms are present on a number of flakes, which demonstrates they have been removed from cores with simple platform preparation. Flakes displaying cortical platforms are almost exclusively pebble quartz. The large size of many of these pieces could relate to the application of bipolar technique for initial ‘quartering’ of the pebbles (Ballin 2008:70-71). The high frequency of multidirectional flake removals on the cores, but dominance of single, unidirectional dorsal flake scars in the flake assemblage attests to the frequent turning of the core to remove a single flake.

Flint is found in small quantities throughout the occupation deposits at Tràigh na Beirigh 1, where it is clearly very heavily reduced. The cores average seven removals, and the flakes display an average of 3.3 dorsal flake scars. There is little evidence for the primary reduction of flint at this site. The two cores in the flint assemblage do not display any cortex, and the only flake to retain >50% cortex suggests that the source of the material was a beach pebble. The primary reduction of these pebbles may have therefore taken place elsewhere. Both bipolar and platform technology was used to knap the flint. Where the latter was performed, the core was rotated frequently, and flakes removed from multiple directions. The small number of flint flakes present in the assemblage at Tràigh na Beirigh 1 is not in accordance with the high number of flake removals represented by the flakes and cores, therefore it appears that the majority of the flint flakes have been removed from the site. There are no known flint sources nearby, and the closest recorded is in South Uist. This material may have therefore been imported to the site, hence the reason for its intensive reduction.

The manuports of gneiss and diorite, which are locally derived, may have been used in processing activities at Tràigh na Beirigh 1. Their flat shape is not conducive to use as hammerstones, although they may have been used in platform-on-anvil reduction, to support the splitting of quartz and flint pebbles. The notched gneiss piece has clearly been intentionally modified but its function is unknown.

Overall, the assemblage at Tràigh na Beirigh 1 represents a collection of knapping waste from the reduction of flint and quartz. The final stages of the *chaîne opératoire*, such as the modification of flakes for tools, is largely absent. Only the barely-modified core borer represents clear evidence of tool production at the site, and there is no evidence for microlith technology. Comparisons with the other shell midden sites on Lewis will be made within the subsequent assemblage summaries, to establish whether the assemblage is representative of this site-type in the Western Isles. A more detailed appraisal of Mesolithic shell middens is discussed in Chapter Eight, in order to contextualise these assemblages more fully.

6.3. Tràigh na Beirigh 2

6.3.1. Discovery and Excavation

6.3.1.1. Excavation 2012

A shell midden at Tràigh na Beirigh 2 (NGR NB 1002 3642) was discovered in September 2012 following a small-scale coastal erosion survey. This was conducted along the headland between Tràigh na Beirigh beach and Cnip campsite jetty to the north, as part of the excavation of the Mesolithic shell midden at Tràigh na Beirigh 1. The survey was conducted with the same aims and criteria that were so successful in identifying the third Mesolithic site in the Western Isles at Tràigh an Teampuill, described in Chapter Five. This survey was previously conducted in 2011, however nothing was observed. The exposure of the shell midden is therefore most likely a consequence of extreme coastal erosion and machair deflation in the area, caused by the very dry summer and aggressive autumn storms of 2012, which has been a long-standing issue (Armit 1994). The site was observed eroding from under the machair dune, with the basal deposits of the midden grading into a probable early to mid-Holocene soil, as observed at Tràigh na Beirigh 1, which made it likely to be Mesolithic in date (Bishop *et al.* 2014a). It is situated to the north of the Gridig promontory, where Tràigh na Beirigh 1 is located.

A 1.3m section of the eroding deposits was cleaned for investigation, although the deposits were sporadically visible in the eroding section for a significant distance along the headland. Below the machair dune lies a probable buried ground surface (Figure 154). This overlies a stone layer, which seals a shell-rich midden deposit. The midden in turn overlies another probable buried land surface. The lower deposits are heavily concreted as a result of groundwater outflow in this area (Bishop *et al.* 2014a).

In accordance with the sampling strategy outlined for the Western Isles (Church 2002b; Jones 1991), the deposits were 100% sampled, and 51.5 litres of bulk samples were taken. Initial processing of the samples indicated the deposits contained a similar repertoire of wild animal and plant species to those found in Northton, Tràigh an Teampuill and Tràigh na Beirigh 1, most notably fish and hare bones, shellfish, crustacean, charred hazel nutshells, and charcoal. Struck quartz was also present. There was no evidence of domesticated plant or animal species; however, the upper deposits contained very small fragments of heavily abraded pottery, which may be residual (Bishop *et al.* 2014a). Four hazel nutshell fragments recovered from the main body of the shell midden produced statistically consistent dates of 4542-4465 cal. BC, which is c.200 years earlier than the occupation at Tràigh na Beirigh 1.

Figure 154. Mesolithic deposits revealed underlying the machair at Tràigh na Beirigh 2 following excavation in 2013. Photo courtesy of Mike Church

6.3.1.2. Excavation 2013

Further excavation of Tràigh na Beirigh 2 in 2013 exposed a more substantial stretch of shell midden deposits along the headland than the previous season, and a little under 400 litres of bulk samples were removed from site overall. The samples contained large quantities of the artefacts and ecofacts that have become characteristic of the Mesolithic shell midden deposits in Lewis. The site most likely forms part of a relic Mesolithic landscape that is preserved under the machair across the east of the peninsula, which incorporated the Tràigh na Beirigh site 1 on Gridig in addition to Tràigh na Beirigh Sites 3, 4 and 9, discussed subsequently (Burgess & Church 1997).

6.3.2. Tràigh na Beirigh 2 Lithic Assemblage Results

6.3.2.1. General Character of the Assemblage

The total lithic assemblage from the >4mm fraction of Tràigh na Beirigh 2 is 351 artefacts. Nine lithics were not included in the final analysis however, as these were recovered from cleaning contexts (C001, C007, C022). They are listed in Appendix Six alongside the raw data for the whole assemblage. Although it is highly likely these derived from the Mesolithic deposits, this cannot be guaranteed, therefore the total number of artefacts presented in the subsequent analysis is 342. The main body of the shell midden (C005 and C011) contained the highest proportion of lithics, and artefacts were recovered in small quantities from almost all of the recorded contexts. A small quantity of pottery fragments were found C003, however it is likely these are intrusive.

The assemblage is dominated by flakes, which represent 83% of the total quantity (Figure 155 and Table 27). Flake cores, core rejuvenation flakes, and small fraction (<10mm) flakes are included within the flake category represented in Figure 155. 12% of the assemblage is made up of cores; indeterminate chunks, including small fraction chunks are present in small quantities, and several manuports were recovered (Figure 155 and Table 27). No formal tools were identified from the site.

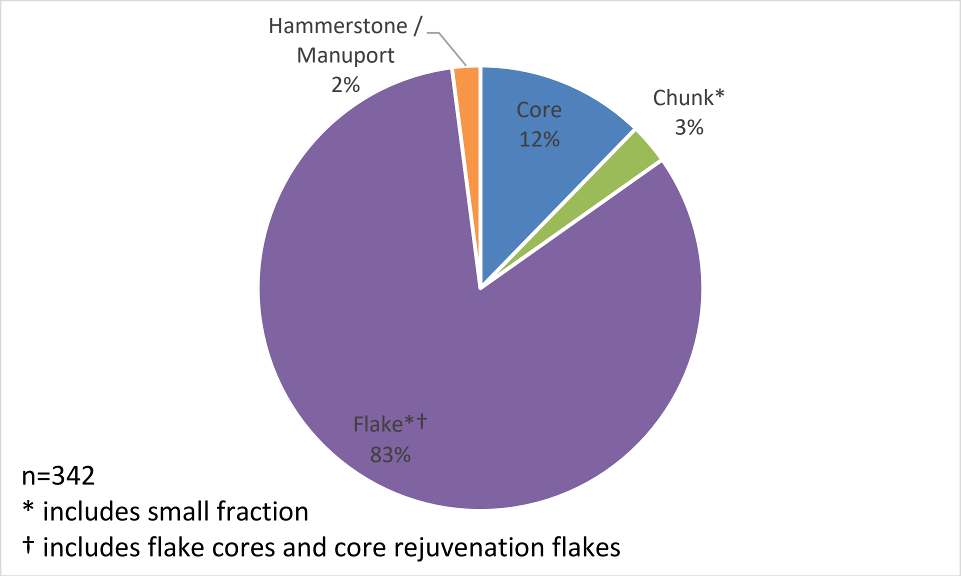


Figure 155. Tràigh na Beirigh 2 assemblage composition

Technology	**Raw Material**			
	Quartz	**Flint**	**Other**	**Total**
Core	41		1	**42**
Chunk	4			**4**
Small Fraction Chunk	6			**6**
Flake	111	7		**118**
Core rejuvenation flake	2			**2**
Flake Core	1			**1**
Small Fraction Flake	160	2		**162**
Hammerstone/Manuport	6		1	**7**
Total	**331**	**9**	**2**	**342**

Table 27. Tràigh na Beirigh 2 assemblage composition

Almost three quarters of the lithic assemblage from Tràigh na Beirigh 2 was recovered from contexts interpreted as shell midden deposits (C005, C011; Figure 156 and Figure 157). The shell midden predominantly contained quartz, in addition to most of the flint and other raw materials found in the assemblage (the latter primarily from C011; Figure 157). The upper interface layers of mixed machair and shell overlying the midden deposits (C003, C004, C009, C010 and C012), contained around one-sixth of the total assemblage, the majority of which derived from C003. These are almost exclusively quartz, with only two pieces of flint identified. There were two old ground surface horizons, an upper (C006, C016, C017), and lower (C019, C020, C021), underlying the midden. The lithics recovered from both of these old ground surface layers comprise a little over 10% of the lithic assemblage and are also predominantly quartz. A single piece of flint was recovered from C016 in the upper ground surface and a gneiss manuport from C021 in the lower horizon.

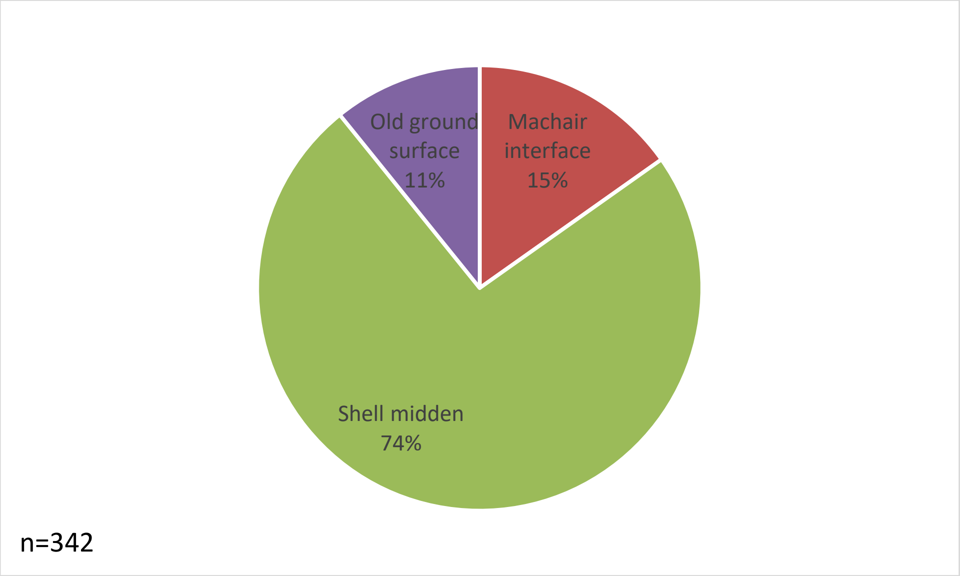
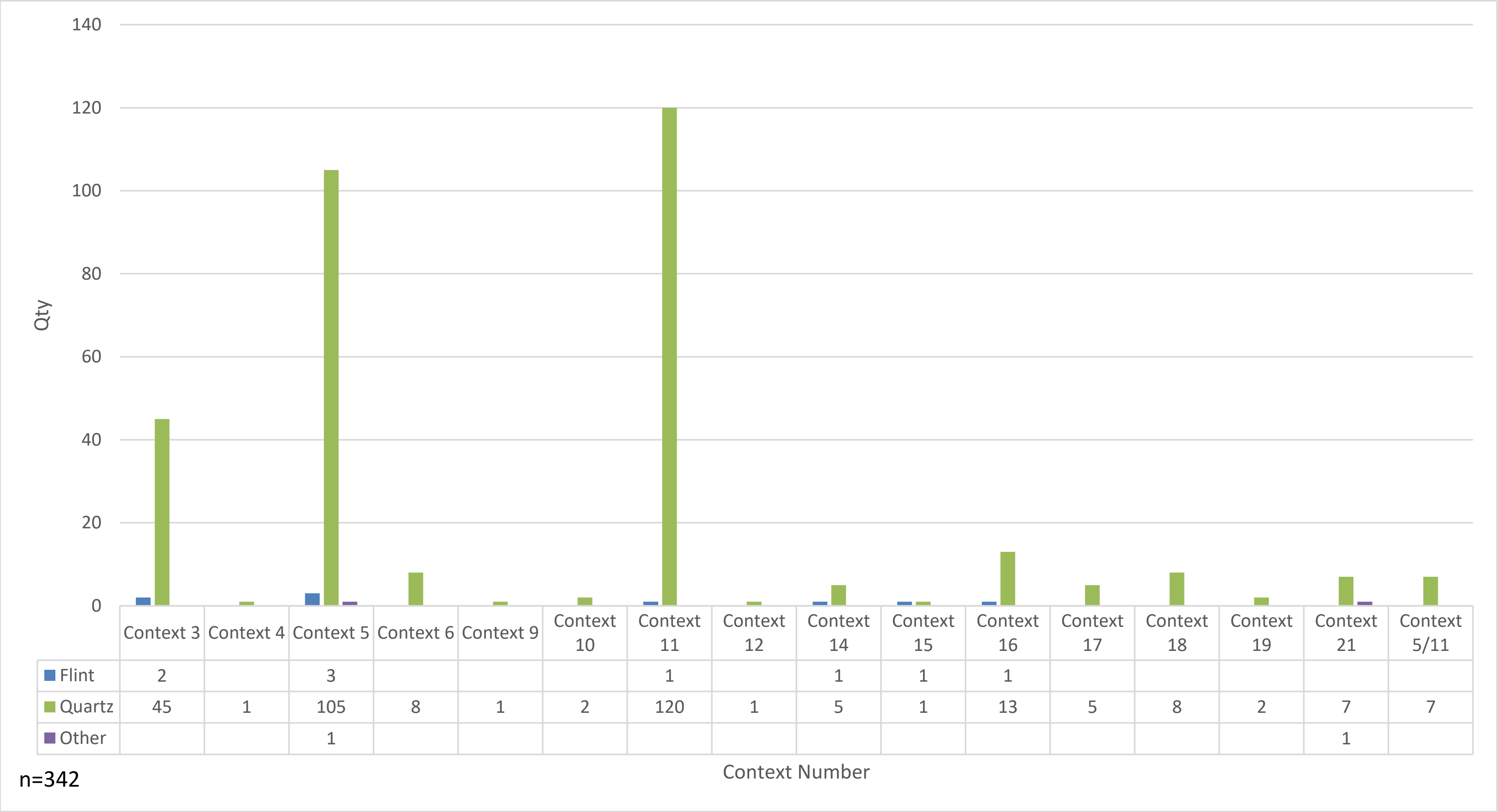


Figure 156. Tràigh na Beirigh 2 assemblage by stratigraphic sequence



	Context 3	Context 4	Context 5	Context 6	Context 9	Context 10	Context 11	Context 12	Context 14	Context 15	Context 16	Context 17	Context 18	Context 19	Context 21	Context 5/11
🟦 Flint	2		3				1		1	1	1					
🟩 Quartz	45	1	105	8	1	2	120	1	5	1	13	5	8	2	7	7
🟪 Other			1												1	

Figure 157. Tràigh na Beirigh 2 raw material by context

6.3.2.2. Raw Material

Quartz dominates the lithic assemblage at Tràigh na Beirigh 2 with 97% of the artefacts made from this raw material, including a metamorphosed variety (Figure 158). Only a small amount of flint was recovered from the site (2%), in addition to single pieces of gneiss and feldspar.

The assemblage is in fresh condition, and there is little evidence for post-depositional disturbance beyond the conflation of the upper interface contexts. All of the flint is completely patinated, which predominantly ranges in colour from white to grey, although the patina on one flint flake is creamy yellow. There is no staining or scratching on the assemblage.

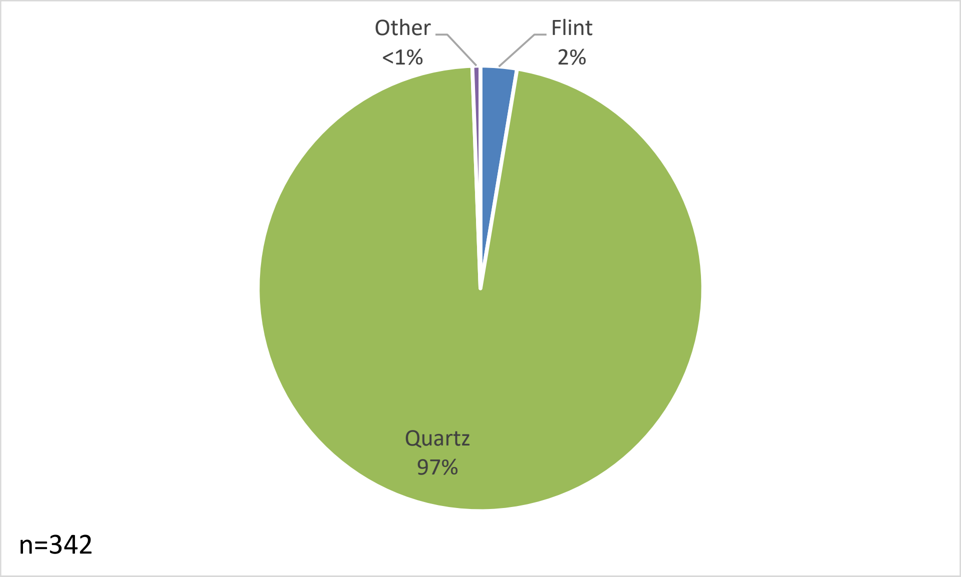


Figure 158. Tràigh na Beirigh 2 raw material composition

The most common quartz variety recorded at Tràigh na Beirigh 2 is greasy quartz, which includes a dark variant (Figure 159). A small proportion of fine grained quartz is also present, in addition to three pieces of quartzite. Milky quartz is more common than the mixed quartz varieties in the assemblage. The mixed varieties are most often milky or greasy types, which grades to fine grained types or feldspar.

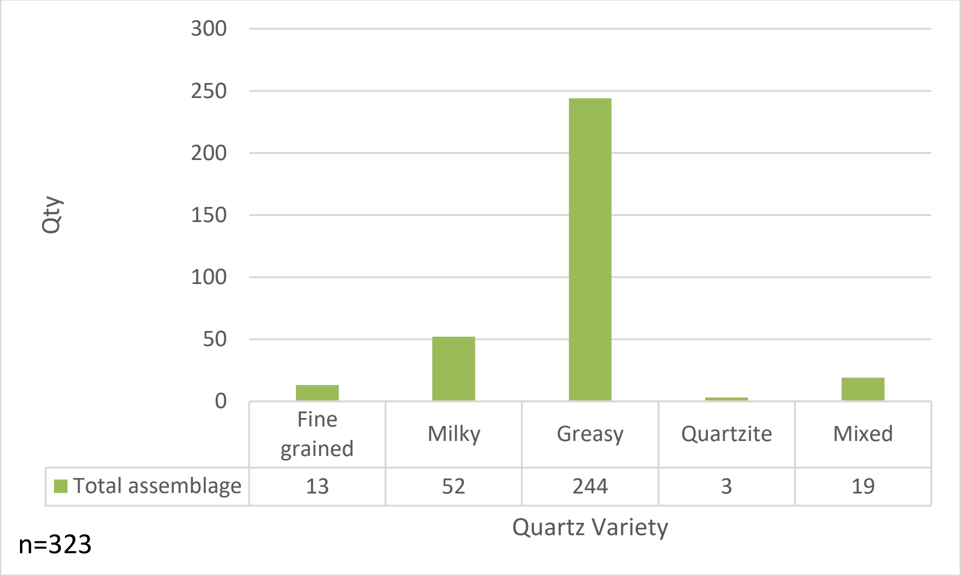


Figure 159. Tràigh na Beirigh 2 quartz varieties

The primary technology from the site is detailed in the following sections. Results of the small fraction flakes, chunks, and small fraction chunk analysis are presented in Appendix Twelve.

6.3.2.3. Primary Technology: Coarse Stone Tools

6.3.2.3.1. Hammerstones and Manuports

A single hammerstone (L320) was identified in the shell midden (C011) at Tràigh na Beirigh 2. The piece is of sub-rounded, water worn, metamorphosed quartz-feldspar, which is pitted and has fractured along one face. The pitting and fracture is indicative of damage caused by percussion.

Six manuports with no obvious function were also recovered from the site, the majority of these derived from the same shell midden context as the hammerstone described above (C011). L316 and L319 are sub-rounded to sub-angular, water-worn stones of quartzite, whereas L317, L318 and L320 are metamorphosed quartz-feldspar pieces, which are also sub-rounded to sub-angular and water-worn. There are no signs of working present on the pieces; although small chips and a crack are present around the edge of L318, which is likely post-depositional degradation of the rock.

A sub-angular, flattish piece of gneiss (L145) was recovered from the lower old ground surface (C021). This piece is chipped along one edge but does not appear to be the type of percussion damage associated with a hammerstone.

The final manuport recovered from Tràigh na Beirigh 2 is a rounded, water-worn pebble of metamorphosed quartz-feldspar from the shell midden (L240; C005). The pebble has broken laterally, which may have been the result of the pebble being 'tested' for knapping quality. The dimensions of the hammerstone and manuports are presented in Table 28. Tràigh na Beirigh 2 manuport dimensions

Catalogue No.	Context No.	Raw Material	Length (mm)	Width (mm)	Thickness (mm)
L145	021	Gneiss	101.78	56.89	19.41
L240	005	Quartz-feldspar (metamorphosed)	58.58	47.91	24.75
L316	011	Quartzite	91.19	55.88	25.40
L317	011	Quartz-feldspar (metamorphosed)	68.63	36.23	24.04
L318	011	Quartz-feldspar (metamorphosed)	69.79	44.12	21.05
L319	011	Quartzite	43.12	42.55	22.94
L320	011	Quartz-feldspar (metamorphosed)	50.75	33.86	19.67

Table 28. Tràigh na Beirigh 2 manuport dimensions

6.3.2.4. Primary Technology: Cores

There are 42 cores present in the assemblage at Tràigh na Beirigh 2 which comprise 12% of the total assemblage (Figure 155). The largest proportion of cores (30) was recovered from the shell midden deposits (C005, C011), with seven cores found in the upper interface layers (C003, C004) and five in the underlying old ground surface deposits (C006, C016, C019, C021).

6.3.2.4.1. Raw Material

The cores from Tràigh na Beirigh 2 are almost exclusively quartz (Figure 160). Only a single core of feldspar was recovered from the site.

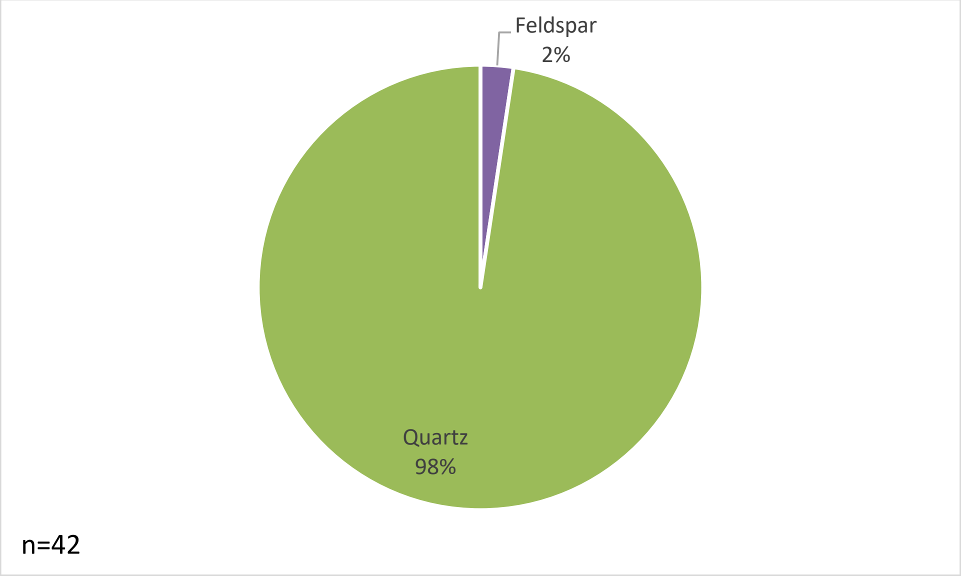


Figure 160. Tràigh na Beirigh 2 core raw material

Greasy quartz, including some dark greasy quartz, is the dominant variety in the core assemblage with a small number of cores made from milky quartz (Figure 161). The mixed quartz core grades between greasy and fine grained quartz and there is a single core of quartzite.

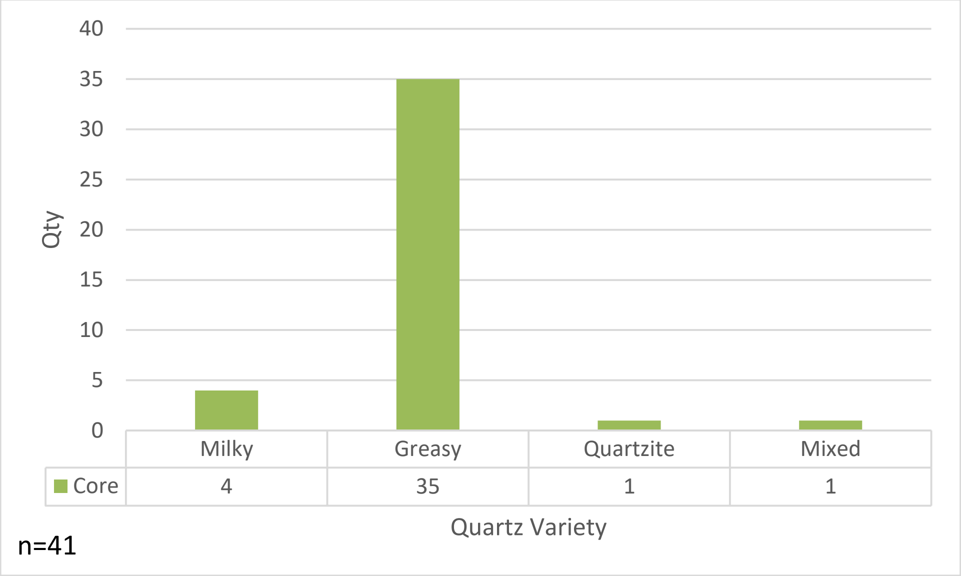


Figure 161. Tràigh na Beirigh 2 core quartz varieties

6.3.2.4.2. Core Dimensions

The majority of quartz cores are less than 40mm in length and 50g in weight (Figure 162). The three largest cores, which are over double the length of the majority, are also the heaviest by a significant margin. The feldspar core is one of the largest cores, but is much lighter than quartz cores of a similar length.

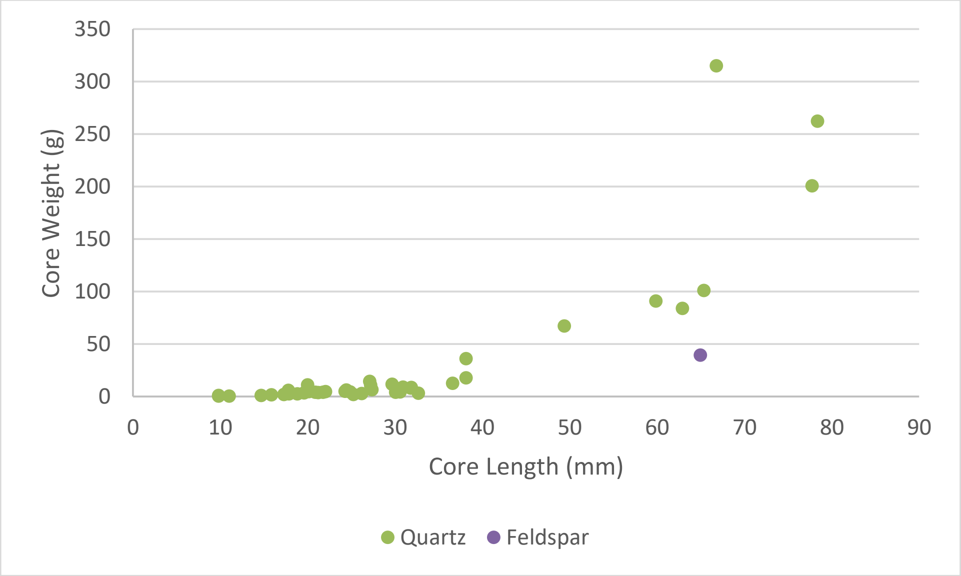


Figure 162. Tràigh na Beirigh 2 core dimensions

6.3.2.4.3. Cortex

The ‘cortex’ present on L237 is evident as the weathered outer surface of the feldspar (Figure 163). Cortex is present on all but three of the quartz cores. On the majority of cores this is smooth and rounded, indicating the original piece was a water-worn beach pebble. Some pieces display flat and frosted cortex which suggests it has derived from a block or a plate. A small number of cores display circular percussion marks on the cortical surface, or on flake scars, which is evidence of failed attempts to remove flakes.

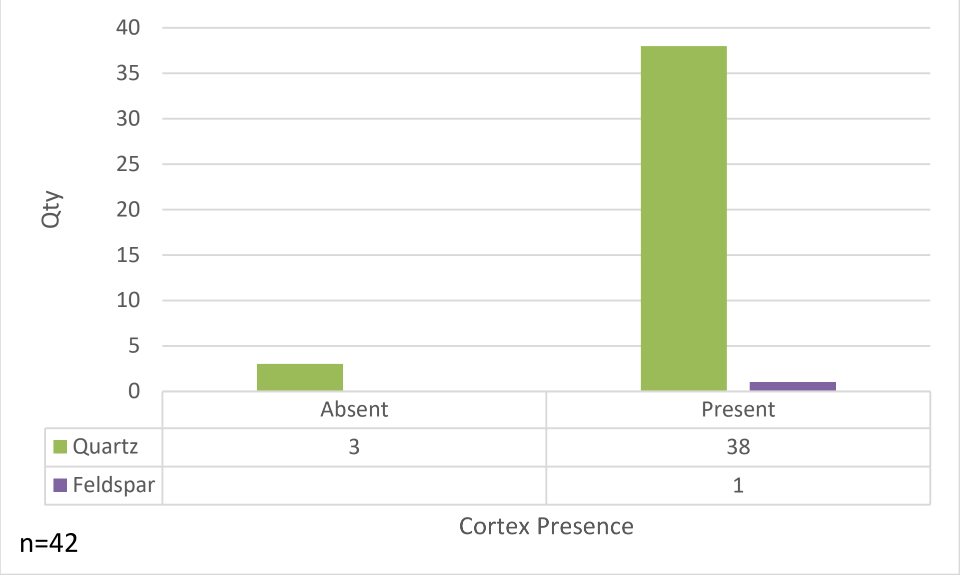


Figure 163. Tràigh na Beirigh 2 core cortex presence

6.3.2.4.4. Flake Removals – Count and Pattern

Only a single quartz core has one flake removal scar (Figure 164). The feldspar core has two flake removals and this number of removals is present on seven of the quartz cores. Marginally more quartz cores display four flake removals than three. The largest number of quartz cores have five or more flake scars – most have five or six, although one core has ten flake removals recorded.

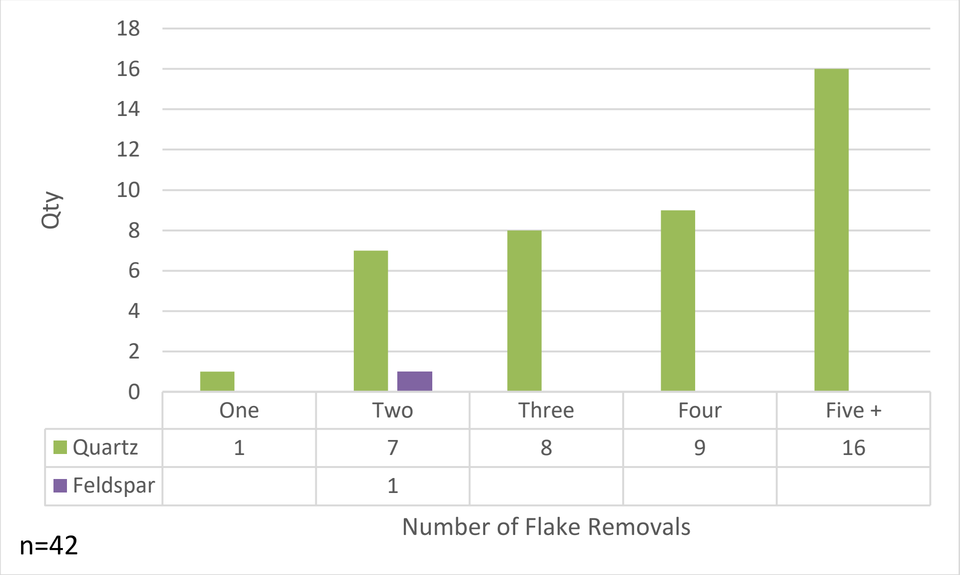


Figure 164. Tràigh na Beirigh 2 core flake removal count

The two flake scars on the feldspar core have been removed from one direction (Figure 165 and Figure 166). Most of the quartz cores have a multidirectional flake removal pattern. This pattern is exclusively present in cores with five or more flake removals. The unidirectional pattern is only found on a small number of quartz cores with between one and four flake removals.

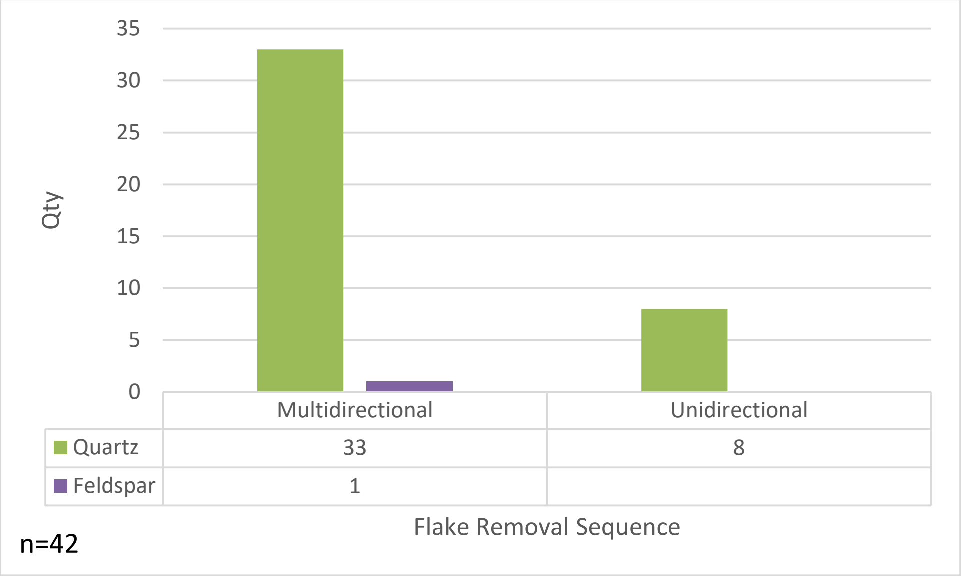


Figure 165. Tràigh na Beirigh 2 core flake removal sequence

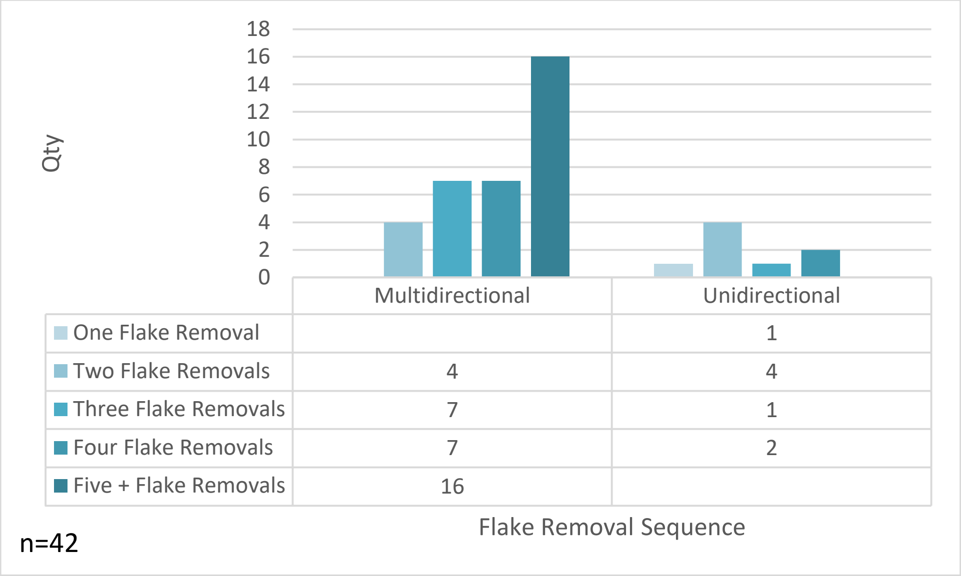
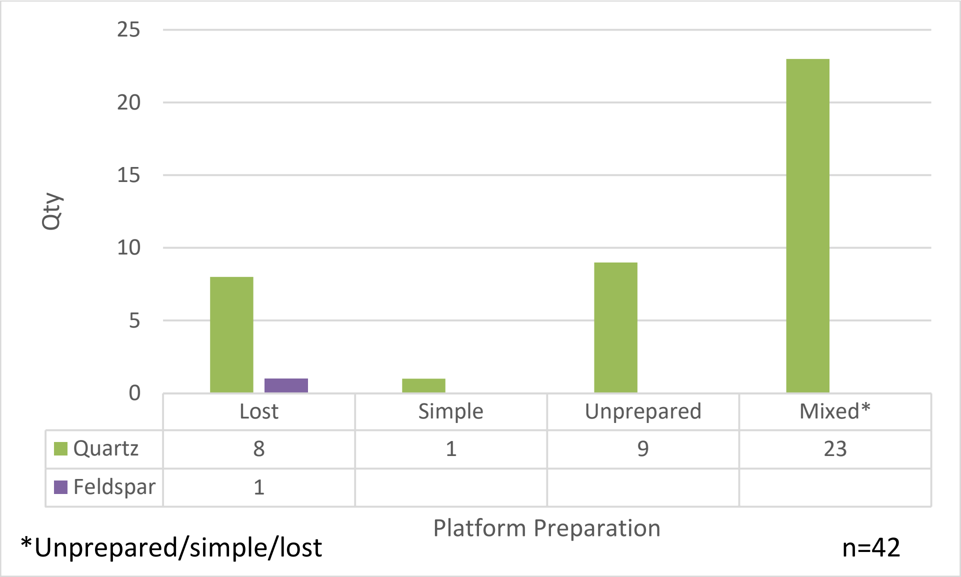


Figure 166. Tràigh na Beirigh 2 sequence of flake removals from cores in relation to the number of flakes removed

6.3.2.4.5. Core Platform Preparation

There is only one quartz core that exclusively displays simple platform preparation (Figure 167). The platform on the feldspar core has been lost, which is also recorded on eight of the quartz cores. A slightly higher number of quartz cores display solely unprepared platforms. The majority of the quartz cores fall into the 'mixed' category. In all cases evidence for the type of platform preparation has been lost, however the cores also retain unprepared platforms or evidence for simple platform preparation.



	Lost	Simple	Unprepared	Mixed*
🟩 Quartz	8	1	9	23
🟪 Feldspar	1			

Figure 167. Tràigh na Beirigh 2 core platform preparation

6.3.2.5. Primary Technology: Flakes

The flake assemblage (>10mm) from Tràigh na Beirigh 2 totals 118 pieces, which are described below. Separate descriptions detailing the flake core and two core rejuvenation flakes are given at the end of the section.

The majority of the flake assemblage derived from the shell midden deposits (C005; C011; C014; C015; C018). A high proportion was also recovered from the overlying interface deposits of mixed machair and shell, predominantly in C003. A small quantity of flakes were found in the upper old ground surface horizon (C006; C016; C017), and only a single context from the lower ground surface (C021) yielded pieces of this typology.

6.3.2.5.1. Raw Material

The flake assemblage from Tràigh na Beirigh 2 is dominated by quartz (94%; Figure 168). Only seven flakes in the assemblage are flint.

The most common quartz variety found in the flake assemblage is greasy quartz (Figure 169). Milky quartz accounts for a small proportion of the assemblage, and a small number of fine grained and mixed varieties are also present. The mixed varieties are generally milky or greasy quartz with some coarse grained varieties, which grade into fine grained quartz or feldspar.

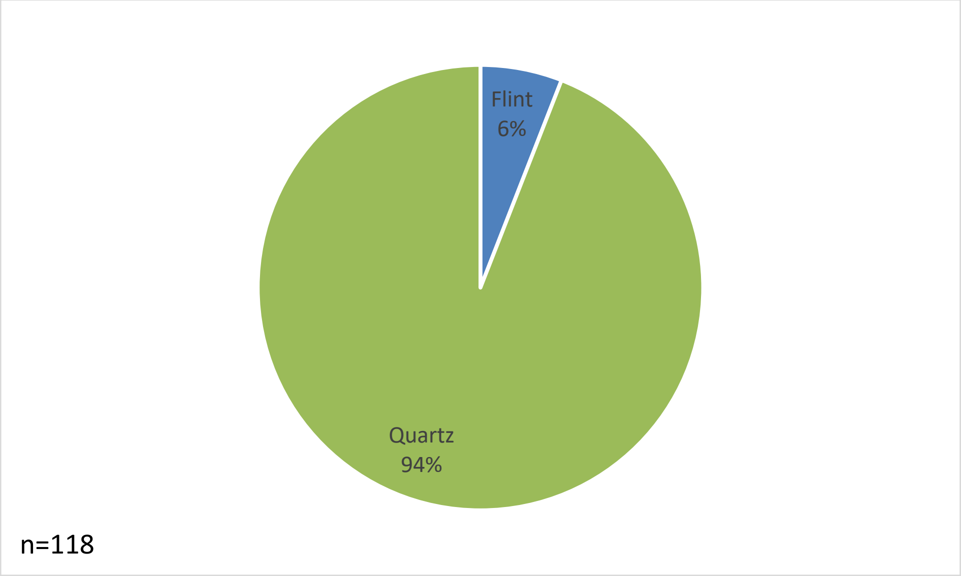


Figure 168. Tràigh na Beirigh 2 flake raw material

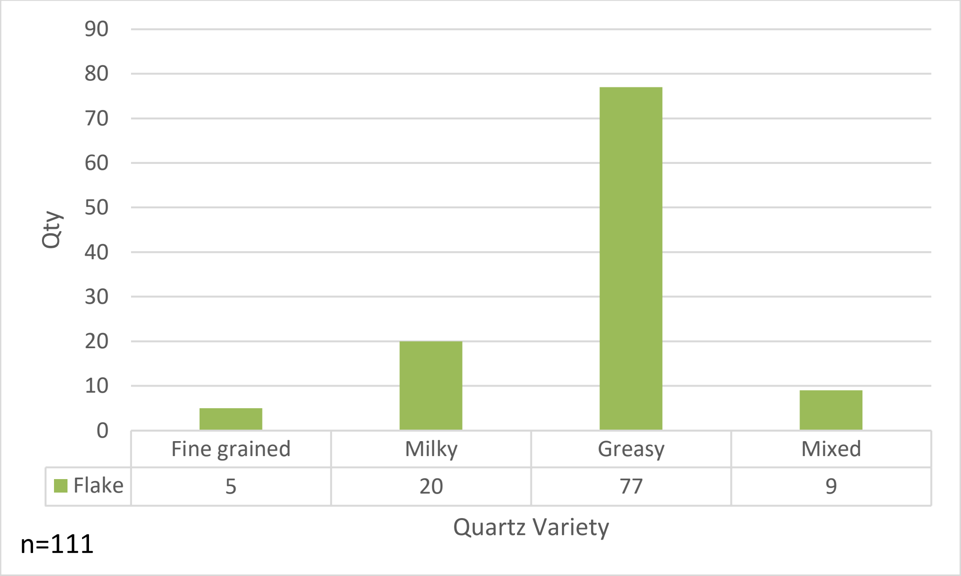


Figure 169. Tràigh na Beirigh 2 flake quartz varieties

6.3.2.5.2. Flake Dimensions

Table 29 displays the summary statistics for the flake assemblage at Tràigh na Beirigh 2. The quartz flakes range more widely than the flint flakes in each dimemsion recorded, and as such have a greater standard deviation from the mean. The quartz flakes have significantly higher maximum values than the flint flakes, and are therefore larger on average in all dimensions.

Raw Material		Length (mm)	Width (mm)	Thickness (mm)
Flint	**Min**	10.30	7.22	1.90
	Max	23.44	17.93	6.24
	Mean	13.43	12.08	3.37
	SD	4.71391	4.327869	1.500549
Quartz	**Min**	10.00	3.18	1.65
	Max	42.84	42.4	23.04
	Mean	17.06	14.20	5.22
	SD	6.584664	7.397428	3.312754

Table 29. Tràigh na Beirigh 2 flake dimension summary statistics for primary raw materials

The largest quartz flake exceeds 40mm in both length and width, which separates it distinctly from the rest of the quartz assemblage (Figure 170). The densest cluster of quartz flakes falls between 10-15mm in length and 3-20mm in width. Almost all of the flint flakes also fall within this cluster. The flint flake which falls outside this group is much longer than the other flakes in this raw material, but not much wider. The outlying flint flake lies within the more dispersed group of quartz flakes. There is a positive correlation between the increase in length and width for both raw materials present.

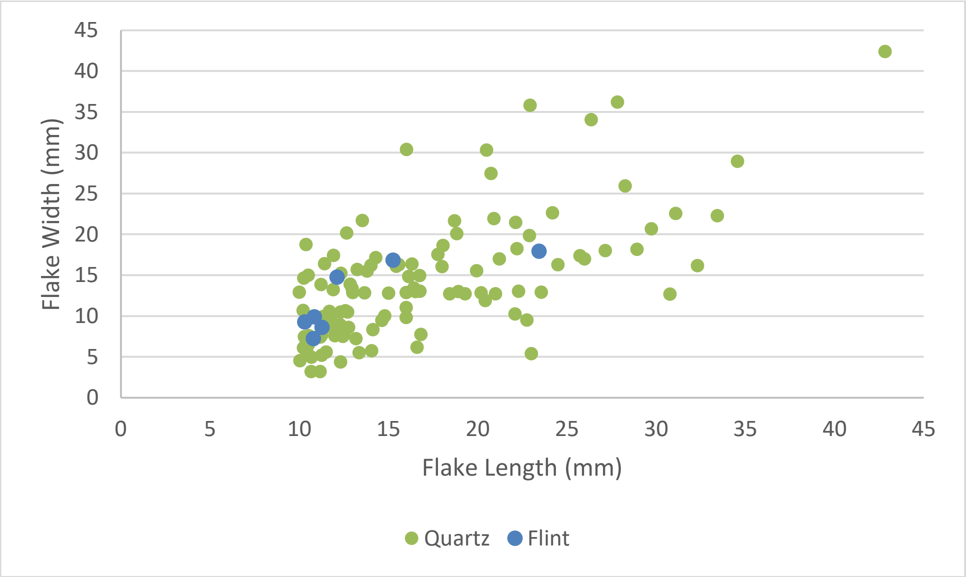


Figure 170. Tràigh na Beirigh 2 flake dimensions length:width

There is no clear relationship between the length and thickness of the flint flakes; however the quartz flakes display a clear positive correlation between these dimensions (Figure 171). The range between the minimum and maximum measurements for thickness of the quartz flakes is very wide, with a difference of over 20mm, which contrasts to the flint flakes which are separated by less than 5mm (Table 29). The dense cluster of quartz and flint flakes discussed above with regard to length, is again observed in Figure 171. The longest flint flake which, falls outside this main group, is no thicker than the shorter flakes in this raw material. The majority of the quartz flakes are less than

15mm in thickness and only two exceed this measurement, one of which is the longest and widest outlier mentioned above.

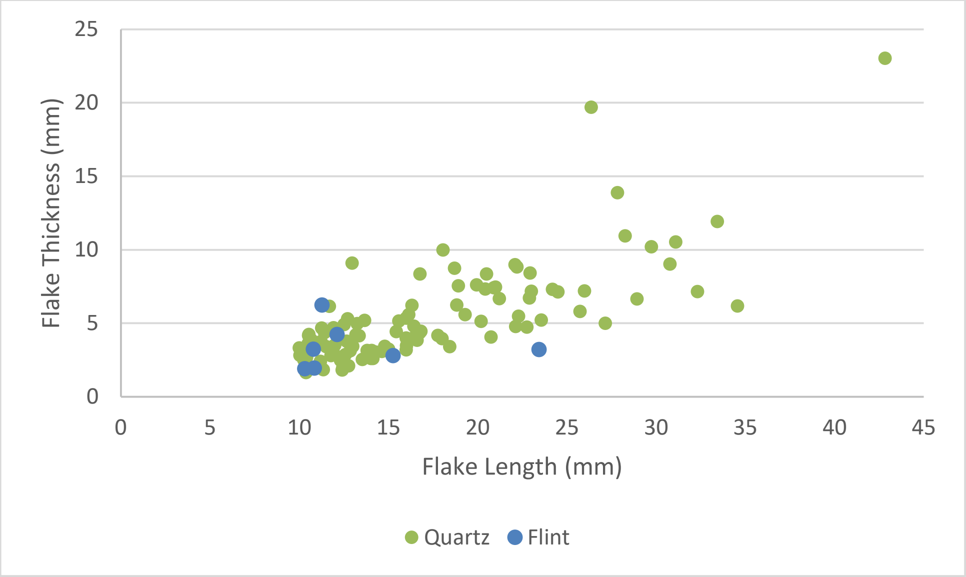


Figure 171. Tràigh na Beirigh 2 flake dimensions length:thickness

All of the flint flakes are less than 20mm in width and 10mm in thickness, as are the majority of the quartz flakes (Figure 172). There is no relationship between increases in these dimensions for the flint flakes, although a positive trend can be seen for the quartz flakes. Of the four widest quartz flakes, three of these are also the thickest.

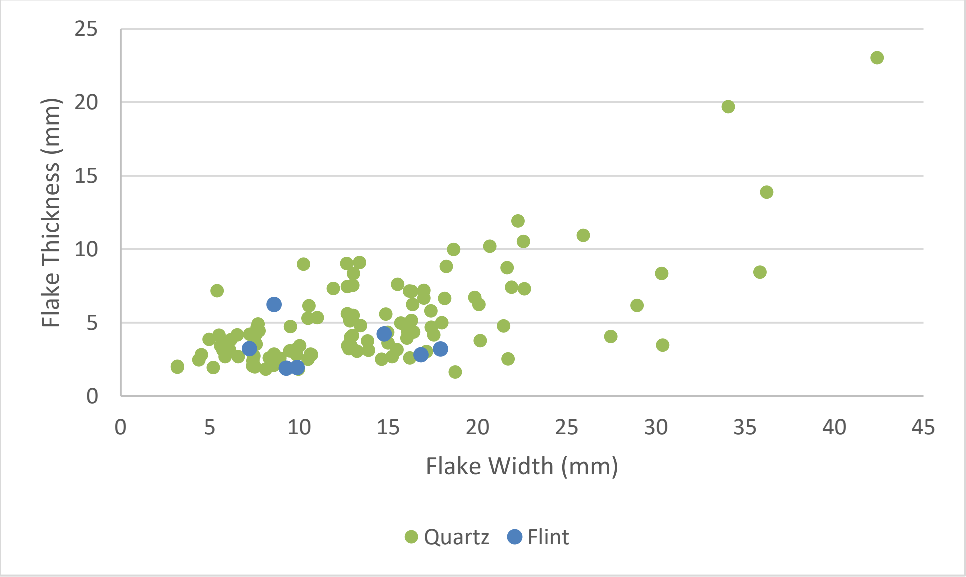


Figure 172. Tràigh na Beirigh 2 flake dimensions width:thickness

6.3.2.5.3. Cortex

At Tràigh na Beirigh 2 there are slightly more flint flakes which retain cortex than those that do not (Figure 173). The greatest proportion of quartz flakes in the assemblage are decorticated. Of the quartz flakes which retain cortex, this is most frequently <50%, and a higher number of primary flakes are present than secondary flakes that have >50% cortex. As in the core assemblage, the majority of the cortex is smooth and rounded, indicating the source of the material was water-worn cobbles from the beach. On a very small number of flakes the quartz is mixed with feldspar, which forms part of the cortex. This is weathered in appearance; therefore these pieces, in addition to those with flat and frosted cortex, indicate that an outcrop was also exploited for raw material. The cortex present on the flint flakes indicates this raw material was obtained from beach pebbles.

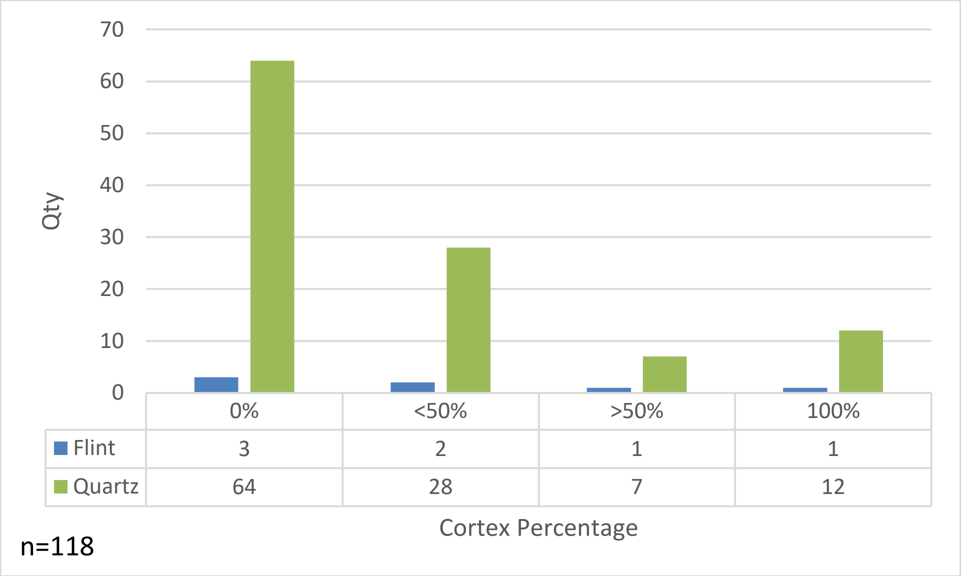


Figure 173. Tràigh na Beirigh 2 flake cortex percentage

6.3.2.5.4. Striking Platform – Type and Dimensions

The striking platform is absent from almost all of the flint flakes at Tràigh na Beirigh 2, the only exception is one flake where the platform is broken (Figure 174). Broken or crushed platforms are most commonly recorded on quartz flakes at the site, with absent striking platforms also frequently observed. Only ten quartz flakes have complete striking platforms. Three of these are plain, caused by the removal of a flake to prepare the platform prior to knapping, and seven of these are cortical.

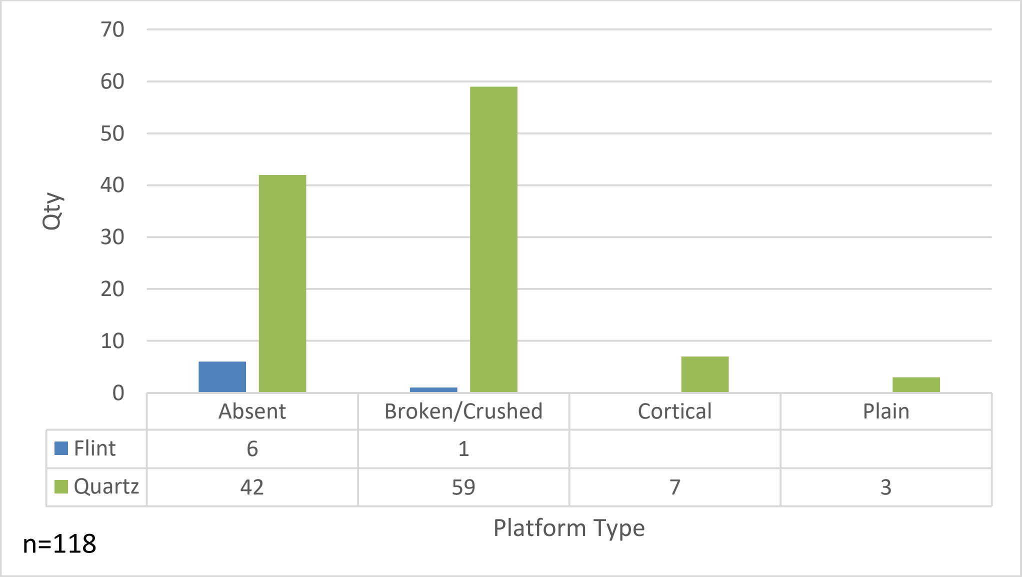


Figure 174. Tràigh na Beirigh 2 flake platform type

The dimensions of the cortical platforms varies widely (Figure 175). The widest cortical platform (39.38mm) is also the deepest (23.04mm) by a significant margin, as most of the cortical platforms to not exceed 12mm in depth. The width of the plain platforms is similar to the smallest of the cortical platforms, but less deep.

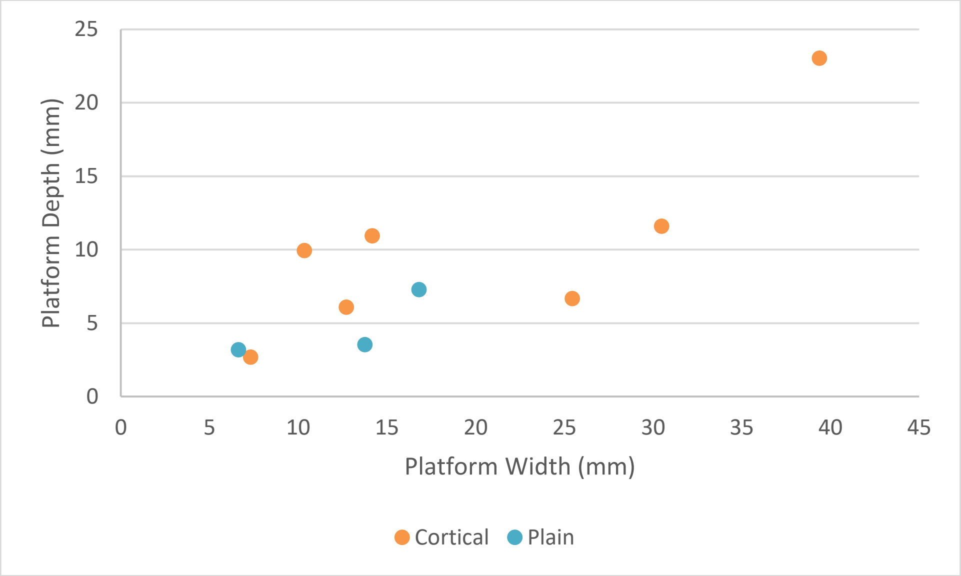
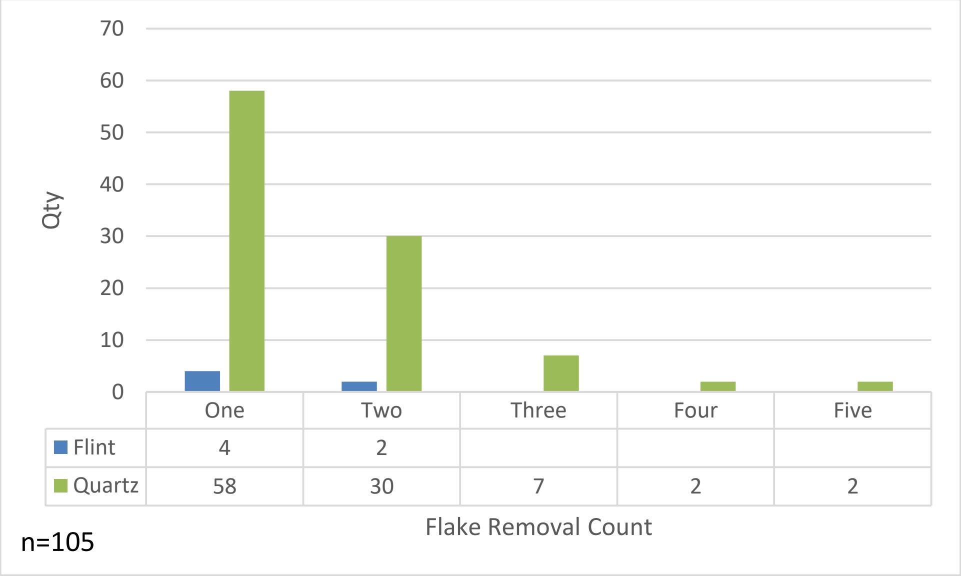


Figure 175. Tràigh na Beirigh 2 flake platform dimensions

6.3.2.5.5. Dorsal Flake Scars – Count and Pattern

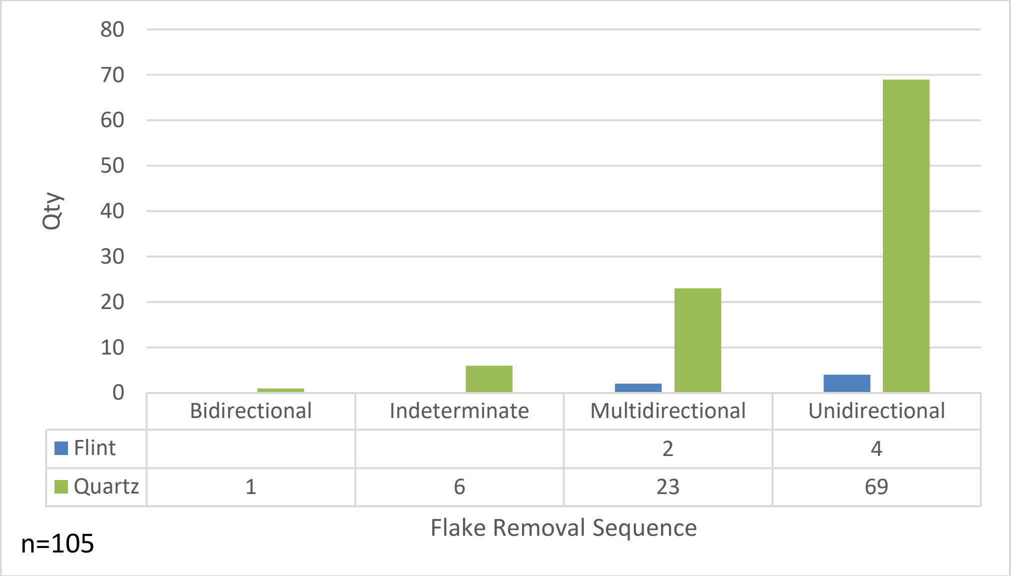
Single dorsal flake scars are most frequently recorded on flint and quartz flakes from Tràigh na Beirigh 2 (Figure 176). None of the flint flakes have more than two dorsal flake scars, which is the second most common number recorded on quartz flakes. Seven quartz flakes have three dorsal flake scars and the remaining quartz flakes display either four or five removals.



	One	Two	Three	Four	Five
Flint	4	2			
Quartz	58	30	7	2	2

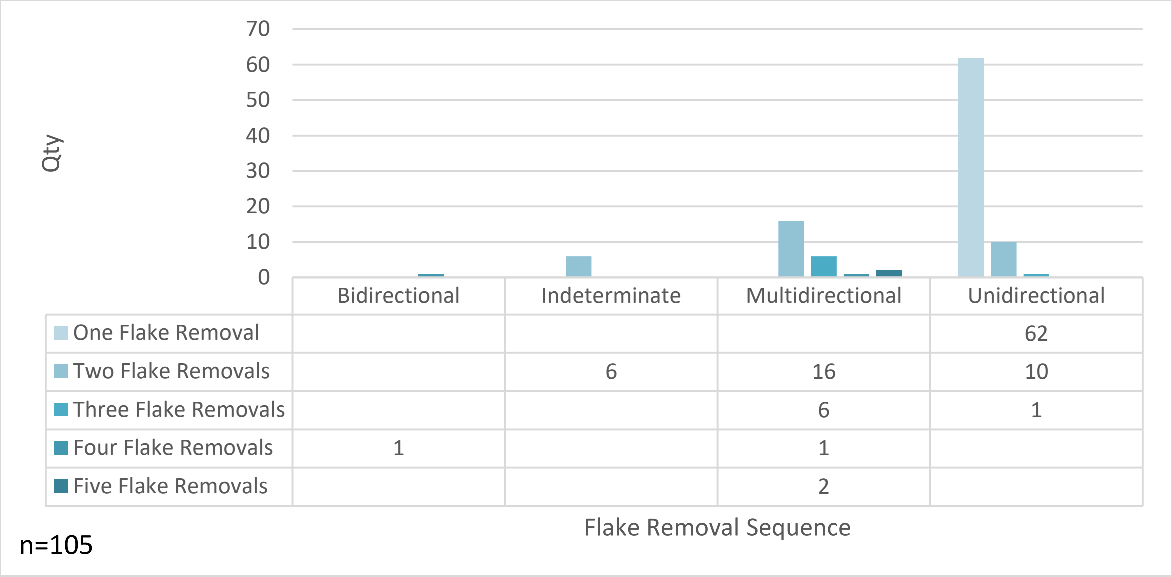
Figure 176. Tràigh na Beirigh 2 dorsal flake scar count

A unidirectional dorsal flake scar pattern is recorded on the majority of quartz and flint flakes in the assemblage; this is due to the high number of single removals, although a unidirectional pattern is observed on flakes with up to three dorsal flake scars (Figure 177 and Figure 178). Multidirectional flake removal patterns are found on flint or quartz flakes with two or more dorsal scars. Flakes with two dorsal flake scars also fall exclusively within the indeterminate category, where a pattern could not be discerned. A single quartz flake with four removals exhibited a bidirectional pattern, where the flakes were removed from directly opposing directions, rather than through bipolar reduction.



	Bidirectional	Indeterminate	Multidirectional	Unidirectional
Flint			2	4
Quartz	1	6	23	69

Figure 177. **Tràigh na Beirigh 2 flake removal sequence**

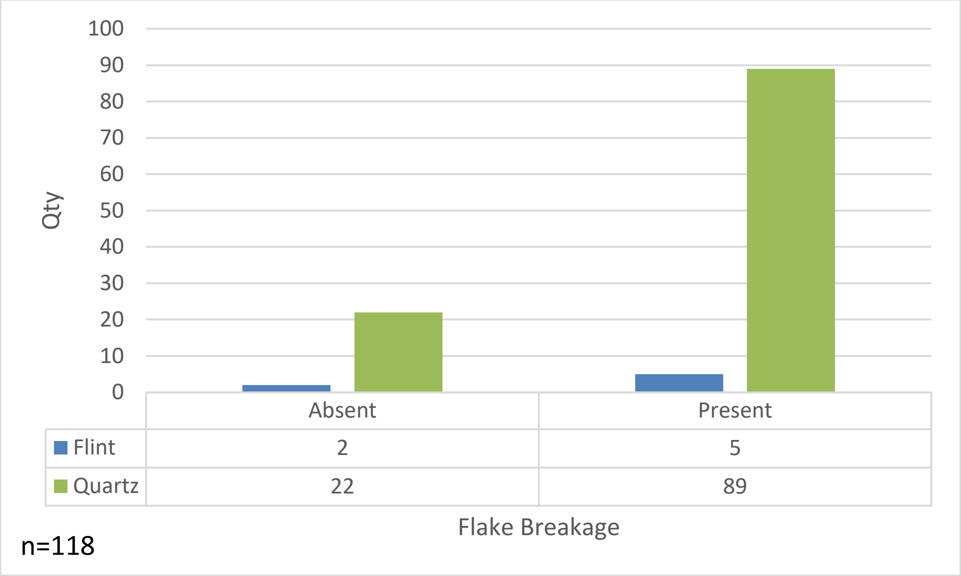


	Bidirectional	Indeterminate	Multidirectional	Unidirectional
One Flake Removal				62
Two Flake Removals		6	16	10
Three Flake Removals			6	1
Four Flake Removals	1		1	
Five Flake Removals			2	

Figure 178. Tràigh na Beirigh 2 dorsal flake scar pattern in relation to the number of flakes removed

6.3.2.5.6. Flake Breakage

Only 20% of the quartz flake assemblage is complete, as are only two of the seven flint flakes (Figure 179). The remainder of the flint and quartz flakes are broken.



	Absent	Present
🟦 Flint	2	5
🟩 Quartz	22	89

Figure 179. Tràigh na Beirigh 2 flake breakage

6.3.2.5.7. Flake Core

A greasy quartz flake core was recovered from the shell midden deposits at Tràigh na Beirigh 2 (C005). L179 measures 22.96mm X 23.75mm X 7.84mm and does not retain any cortex. The original striking platform is absent from the piece as the proximal end of the flake has been removed by a further flake removal on the dorsal face. This was initiated from the distal end of the original flake, and has destroyed the distal end of the ventral face with knapping shatter. There is a single unidirectional flake scar present on the dorsal side.

6.3.2.5.8. Core Rejuvenation Flake

Both core rejuvenation flakes from Tràigh na Beirigh 2 were found in the main body of the shell midden (C011). L251 is made from greasy quartz and measures 19.03mm X 7.31mm X 17.63mm. There is no cortex present on the piece and the striking platform for the rejuvenation is plain, measuring 2.28mm X 3.79mm. The core rejuvenation flake is complete and there is evidence for three multidirectional flake removals from the piece, one of which has been initiated from the rejuvenated platform.

L263 is a milky quartz core rejuvenation flake, measuring 10.92mm X 9.21mm X 10.84mm. There is no cortex present, and the plain striking platform measures 5.53mm X 8.38mm. There are four multidirectional flake scars present on this piece, which is complete.

6.3.2.5.9. Refits

A quartz flake and small fraction flake from C003, an interface context, refit together. The original flake has snapped across the width, although whether this happened pre- or post-deposition cannot be determined. L167 is the proximal end of the flake and L168 is the distal end of the flake.

6.3.3. Assemblage Summary

Tràigh na Beirigh 2 is slightly older in date than Tràigh na Beirigh 1, described above, with a slightly larger lithic assemblage that totals 342 pieces. The assemblage primarily derives from the main shell midden deposits, with only small quantities found in the underlying old ground surface, and the overlying interface deposits with the machair. There are no formal tools present at the site and the assemblage is comprised of flake debitage from the reduction of quartz, and a very small quantity of flint using a gneiss hammerstone.

Quartz comprises 94% of the total lithic assemblage at Tràigh na Beirigh 2. The fine grained (greasy) variety is primarily used, which is also the most dominant quartz type at Tràigh na Beirigh 1. In contrast to Tràigh na Beirigh 1, a higher number of cores with water-worn cortex at this site suggests that pebble quartz was more frequently exploited than the local vein sources. Furthermore, the quartz is more heavily exploited at this site, with an average of 4.2 multidirectional flake removals per core – this is one extra removal per core on average than at Tràigh na Beirigh 1. The milky quartz, although less frequent, is worked more intensively than the greasy quartz, and again this is at odds with the more intensive reduction of greasy quartz at the later site. At neither site does the intensity of reduction pertain to the source or size of the raw material – there are a wide range of core sizes at both sites, most of which have been discarded without being exhausted. The profligate use of this raw material is further reflected in the low average number of dorsal flake scars on the quartz flakes. The dominance of single, unidirectional dorsal scars on the flakes indicates that each turn of the core relates to a single episode of knapping, whereby a very small number of flakes were removed before the core was turned again.

Quartz was primarily reduced using platform technology at Tràigh na Beirigh 2. In both pebble and vein quartz cores there is very little evidence of platform preparation, with flakes frequently struck from plain or unprepared platforms. No preparation is necessary for vein quartz, as the flat face of the natural break provides a clean platform from which to detach a flake (Ballin 2004:11). The cortical platforms preserved in the flake assemblage are from rounded beach pebbles, which are not conducive to platform reduction. These may have been initially reduced by quartering using bipolar technology. One of the quartz-feldspar manuports is split laterally and appears to have been 'tested' using this method.

A very small proportion (3%) of the assemblage is comprised of flint flakes and small fraction flakes. There is little that can be determined from this assemblage, other than the fact that small beach flint pebbles were occasionally exploited. The flint appears to have been partly reduced at the site, possibly using bipolar technology. The presence of flint throughout the deposits may either be due to taphonomic factors, or the fact this raw material was used in a limited capacity throughout the occupation of the site. Further radiocarbon dating is required to understand the relationship between the shell midden and the surrounding deposits. As described above, there are no known sources of flint in the vicinity, and the high quality of the locally available quartz may have meant there was little need for flint to be sourced from elsewhere.

The small number of quartz-feldspar cobbles, which could easily have been obtained from a nearby beach, may have served as a supply of unused cobbles for flaking, or as hammerstones. The chipped edge along the flat gneiss piece may have been caused during use as an anvil to support the splitting of quartz and flint pebbles.

Overall, the lithic assemblage at Tràigh na Beirigh 2 is very similar to that found at the slightly later site of Tràigh na Beirigh 1, in terms of the raw materials exploited and the reduction strategies employed. There is a notable absence of formal tools from this site, which is comparable with Tràigh na Beirigh 1, where the full *chaîne opératoire* is not completely represented. This will be discussed further in Chapter Eight.

6.4. Tràigh na Beirigh 3 and Tràigh na Beirigh 4

6.4.1. Discovery and Excavation

6.4.1.1. Excavation 2013

Following a coastal erosion assessment around the headland close to the site of Tràigh na Beirigh 2, further areas of the Holocene ground surface were observed eroding from under the machair at various points around the headland, to the north of Tràigh na Beirigh 1 and Tràigh na Beirigh 2 (Figure 125). Each of these sections were sampled; however, only site numbers 3, 4 and 9 contained artefact material. The single lithic recovered from 10 litres of sampled deposits at Tràigh na Beirigh 3 (Figure 180) is presented below, followed by the assemblage from Tràigh na Beirigh 4. It should be noted that the deposits from Tràigh na Beirigh 3 and Tràigh na Beirigh 4 are as yet undated. The excavation and lithic assemblage from Tràigh na Beirigh 9 is outlined separately in Section 6.5.

Figure 180. Tràigh na Beirigh 3 under excavation in 2013, revealing the buried ground surface. Photo courtesy of Mike Church

6.4.2. Tràigh na Beirigh 3 Lithic Assemblage Results

A single greasy (very fine grained) quartz flake was recovered from C001, an early to mid-Holocene ground surface at Tràigh na Beirigh 3. It is broken, and measures 10.30mm X 7.80mm X 2.02mm; there is no cortex present. A single, unidirectional flake has been removed from the dorsal face, and the platform is absent. This data is detailed in Appendix Seven.

The assemblage summary, which follows the presentation of the assemblage from Tràigh na Beirigh 4, includes this piece.

6.4.3. Tràigh na Beirigh 4 Lithic Assemblage Results

As described above, Tràigh na Beirigh 4 was identified as part of small-scale sampling of the eroding coastal edge of the Cnip headland, alongside Tràigh na Beirigh 3 and Tràigh na Beirigh 9. The site is situated to the north of Tràigh na Beirigh 3, and eight litres of deposits were removed for sampling (Figure 181). The results of the lithic analysis from the site are presented below, and the raw data is detailed in Appendix Eight.

Figure 181. Tràigh na Beirigh 4 following excavation in 2013 with the buried ground surface visible in section. Photo courtesy of Mike Church

6.4.3.1. General Character of the Assemblage

The total assemblage from Tràigh na Beirigh 4 comprises 21 pieces from the *in situ* and >4mm sieved fraction. These all derive from a single context (C001), which is an old ground surface of early to mid-Holocene soil. The assemblage is dominated by flakes >10mm in length, and small fraction flakes (<10mm in length). Cores and chunks, including small fraction chunks, are equally represented (Figure 182 and Table 30).

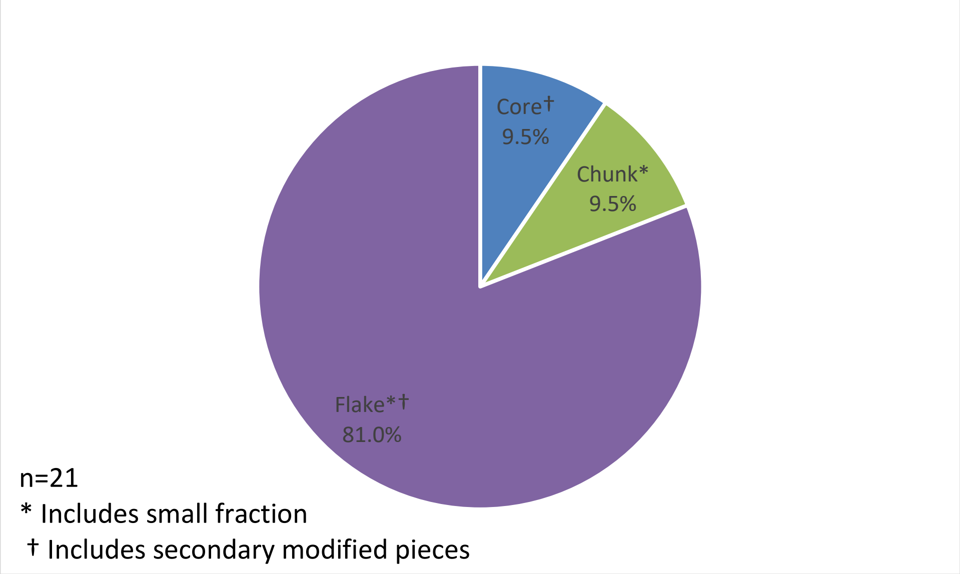


Figure 182. Tràigh na Beirigh 4 overall assemblage

Technology	**Quartz**
Chunk	1
Small fraction chunk	1
Core	2
Flake	7
Small fraction flake	9
Secondary piece	1
Total	**21**

Table 30. Tràigh na Beirigh 4 overall assemblage

6.4.3.2. Raw Material

The whole assemblage from Tràigh na Beirigh 4 is quartz, with three different quartz varieties represented (Figure 183). The majority is made from greasy (very fine grained) quartz, whereas two are of the fine grained variety. A single piece grades between fine grained and greasy.

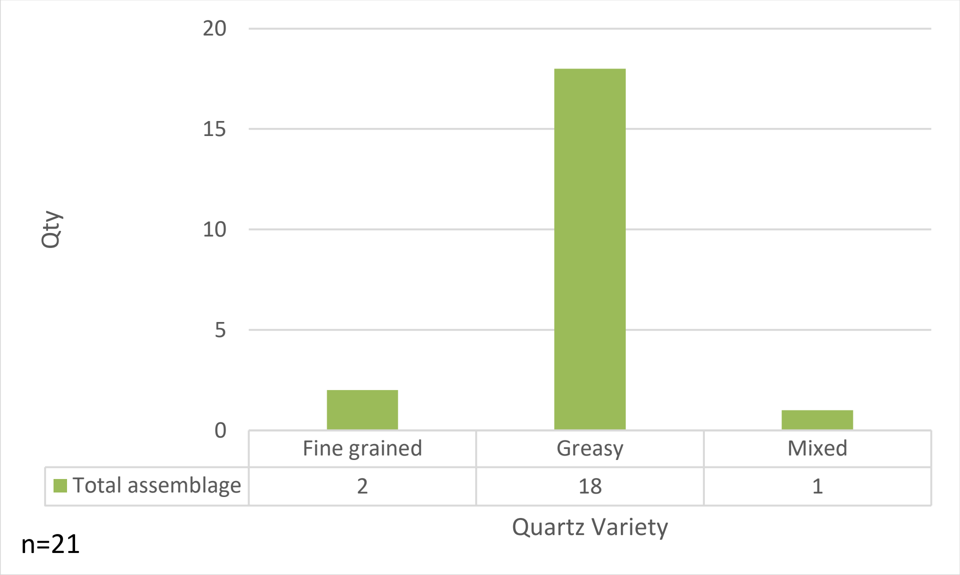


Figure 183. Tràigh na Beirigh 4 quartz varieties

Only the primary and secondary technology from the site is described in this chapter. The analysis of the small fraction flakes, chunks and small fraction chunks is outlined in Appendix Twelve.

6.4.3.3. Primary Technology: Cores

Two cores are present in the Tràigh na Beirigh 4 assemblage. Both are made from greasy quartz and neither display cortex.

SF2 is the larger and heavier of the two cores (Table 31). It exhibits eight bidirectional flake removals, indicative of bipolar reduction, and therefore has no platform preparation. One end has been retouched to form a scraper, which is discussed in Section 6.4.3.5.

L18 is smaller and lighter (Table 31). There are four multidirectional flake removals evident and the original knapping platform has been lost following the rejuvenation of the core at a later stage of working.

Catalogue No.	Length (mm)	Weight (g)
SF2	32.11	8.92
L18	23.68	3.22

Table 31. Tràigh na Beirigh 4 core dimensions

6.4.3.4. Primary Technology: Flakes

Seven flakes (>10mm) were recovered from the single context at Tràigh na Beirigh 4, and are described below. The small fraction flakes (<10mm) are presented in Appendix Twelve.

6.4.3.4.1. Raw Material

As observed in the assemblage overall, greasy quartz is the dominant quartz variety for the flakes. One quartz flake is of the fine grained variety and the other grades between fine grained and greasy.

6.4.3.4.2. Flake Dimensions

On the whole, the flakes fall between 10-20mm in length, with a single exception that is significantly larger than the majority of the assemblage (Figure 184). The width of flakes generally falls between 5-20mm, again excepting this outlier, which is also much thicker than the assemblage overall. It is clear that there is a strong positive correlation between all of the dimensions of the flakes at this site (Figure 184, Figure 185 and Figure 186).

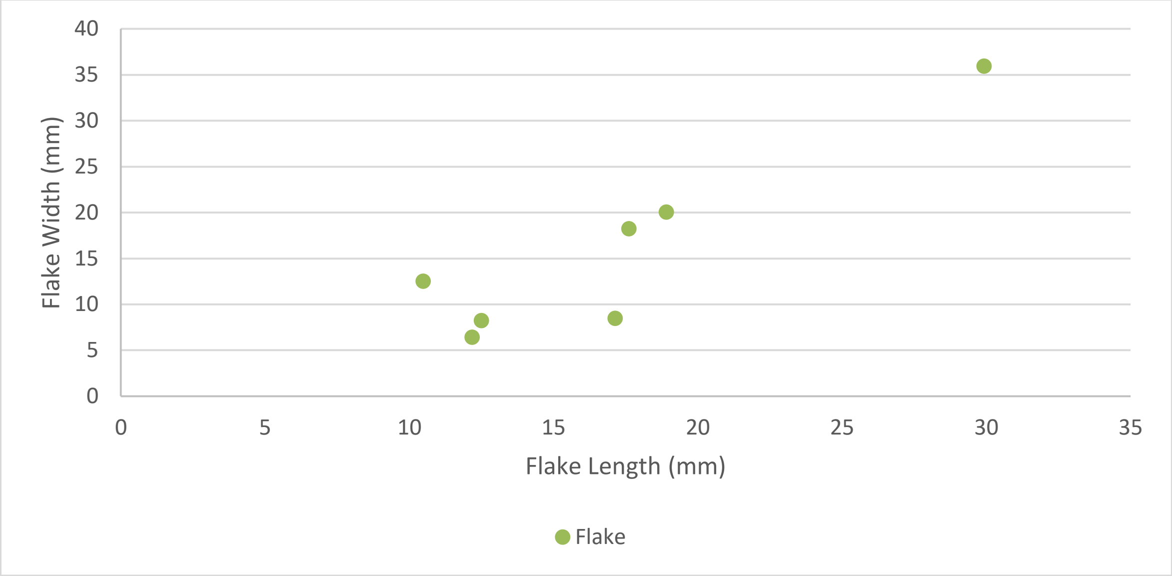


Figure 184. Tràigh na Beirigh 4 flake dimensions length:width

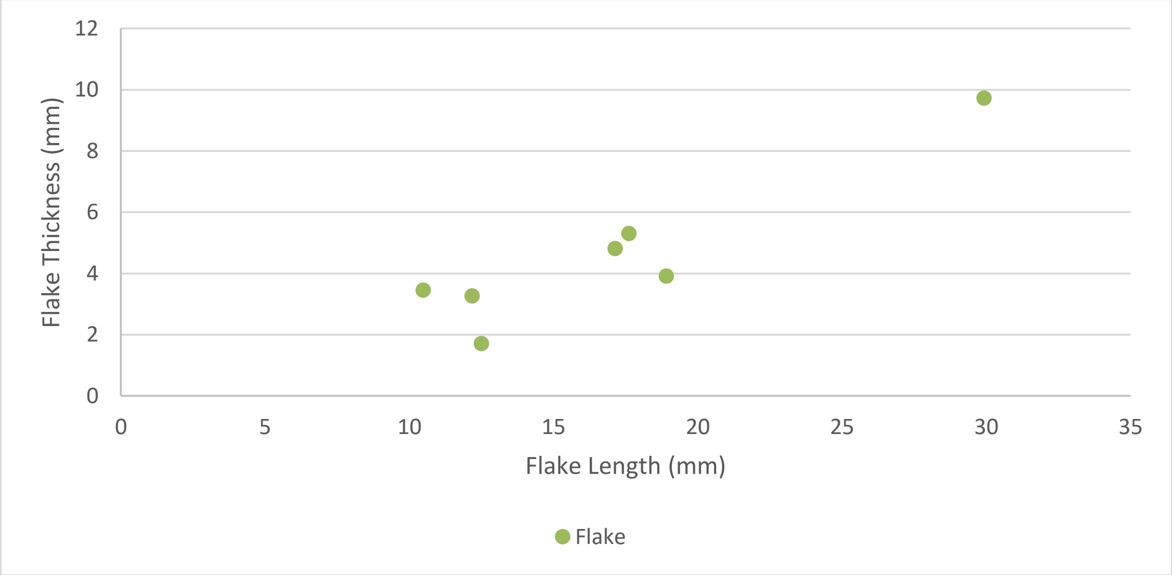


Figure 185. Tràigh na Beirigh 4 flake dimensions length:thickness

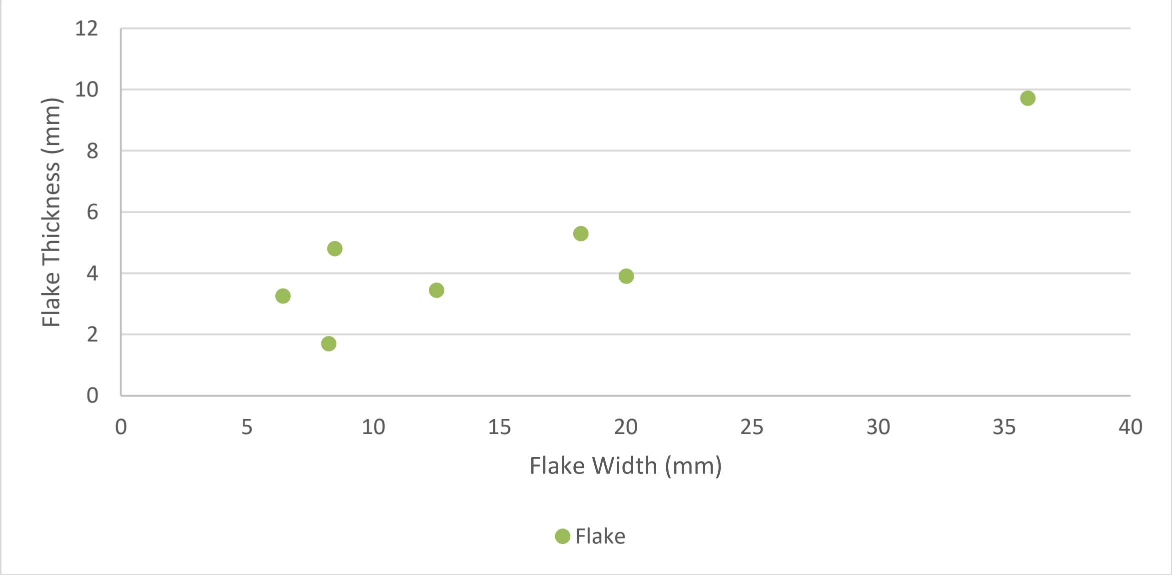


Figure 186. Tràigh na Beirigh 4 flake dimensions width:thickness

6.4.3.4.3. Cortex

Only a single flake has a complete coverage of cortex on the dorsal face (Figure 187). The remainder of the assemblage is equally split between the other categories, with two flakes each. The cortex present varies between smooth and rounded, which indicates that the material is likely derived from beach pebbles, and also frosted and flat suggesting a break along the fracture plane from a vein source.

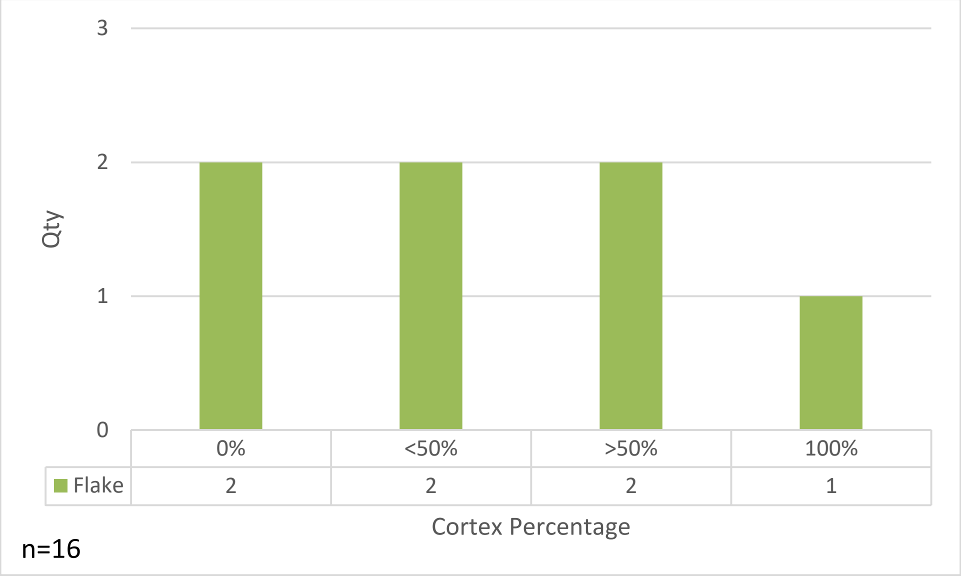


Figure 187. Tràigh na Beirigh 4 flake cortex percentage

6.4.3.4.4. Striking Platform – Type and Dimensions

The platform types of the seven flakes in the assemblage fall into three categories (Figure 188). On five flakes the platform is either absent or broken; on the remaining two flakes the platform is plain, which enabled the dimensions to be measured (Table 32).

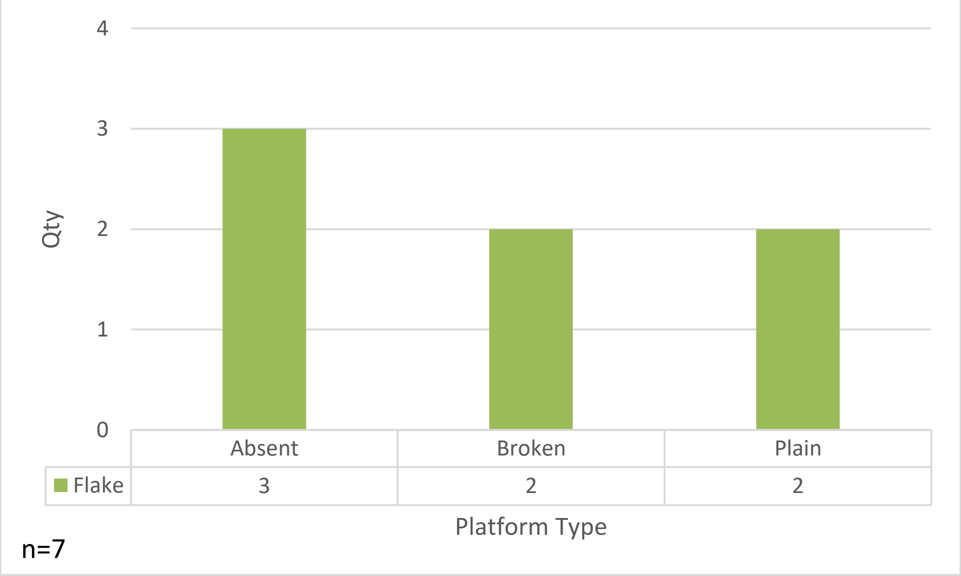


Figure 188. Tràigh na Beirigh 4 flake platform type

The platform on SF1 is narrower than that of L13 and has a greater depth (Table 32). This correlates with the dimensions of the flakes whereby L13 is wider than L1, but thinner.

Catalogue No.	Platform Width (mm)	Platform Depth (mm)
SF1	7.51	4.69
L13	8.25	3.34

Table 32. Tràigh na Beirigh 4 flake platform dimensions

6.4.3.4.5. Dorsal Flake Scars – Count and Pattern

The majority of flakes from this site have single dorsal flake scars (Figure 189). There are two dorsal flake removals from one flake, and the very large flake discussed above has five dorsal flake scars. The flake with 100% dorsal cortex obviously does not have any dorsal flake removals.

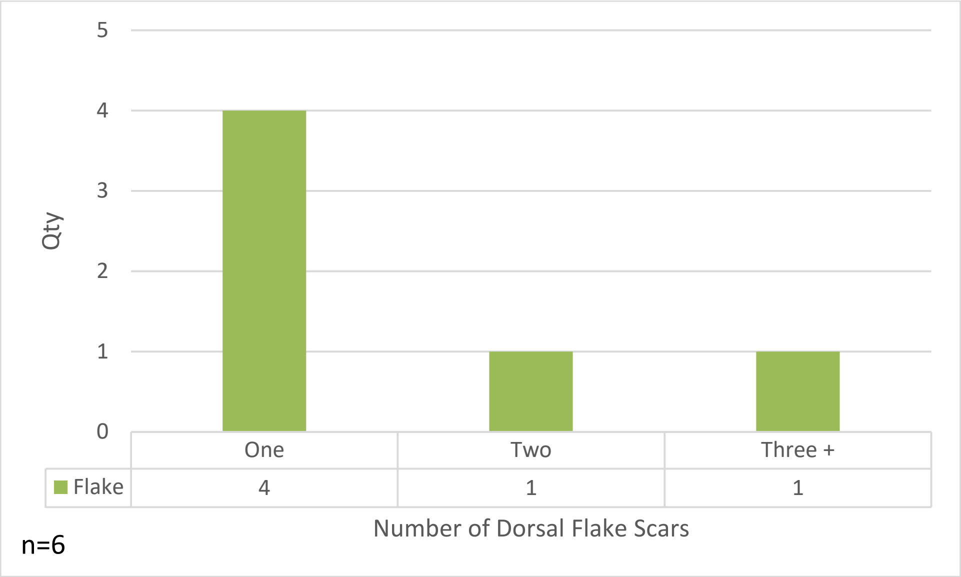
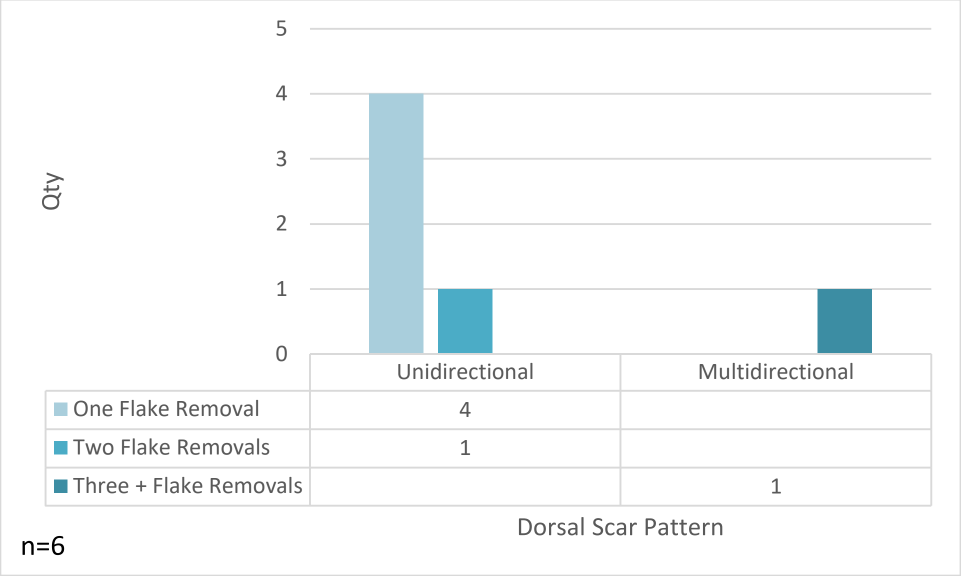


Figure 189. Tràigh na Beirigh 4 dorsal flake scar count

The only multidirectional dorsal flake removal pattern is recorded on the flake with five dorsal flake scars; the remainder of the assemblage displays a unidirectional removal pattern (Figure 190).



	Unidirectional	Multidirectional
One Flake Removal	4	
Two Flake Removals	1	
Three + Flake Removals		1

Figure 190. Tràigh na Beirigh 4 dorsal flake scar pattern in relation to the number of dorsal flake scars counted

6.4.3.4.6. Flake Breakage

All but one of the flakes in the Tràigh na Beirigh 4 assemblage is broken.

6.4.3.5. Secondary Technology: Scraper

One end of core SF2, described above in Section 6.4.3.3, was retouched to form a simple scraper (Figure 191, arrowed). This is clear from a convex area of fine, abrupt to very abrupt, sub-parallel, sporadic edge retouch and crushing at one end. The orientation of the retouch could not be identified due to the fact this was originally a core.

Figure 191. SF2 bipolar core retouched to form a simple scraper at one end

6.4.3.6. Secondary Technology: Notch

A notched piece, L17, was also recovered from Tràigh na Beirigh 4. It measures 15.77mm X 19.11mm X 4.95mm and does not retain any cortex. The striking platform is broken and there is a single, unidirectional dorsal flake scar present. The notch, which is situated on the right side of the piece, was created from a single invasive, very coarse, normal removal (Figure 192).

Figure 192. L17 notched piece

6.4.4. Assemblage Summary

The material recovered from the eroding cliff section at Tràigh na Beirigh 3 and Tràigh na Beirigh 4 cannot be categorically assigned to the Mesolithic period as the sites have not yet been dated. However, the general characteristics of these pieces fall within the same suite of undiagnostic artefacts recovered from the Mesolithic sites identified in the early to mid-Holocene ground surface either side of these areas, which extends along a c.200m stretch of the Cnip headland.

The single greasy quartz flake recovered from Tràigh na Beirigh 3 is considered alongside the very small assemblage of 21 quartz pieces from Tràigh na Beirigh 4, which is also almost exclusively greasy quartz.

The two greasy quartz cores from Tràigh na Beirigh 4 suggest that this raw material was used fairly conservatively. One core was reduced using bipolar technology, before being retouched further at one end to form a simple scraper. The other core has four multidirectional removals, two of which have been initiated from a plain platform created by a rejuvenation scar. There is no cortex present on the pieces and they have clearly been discarded following exhaustion.

The greasy quartz flake assemblage is small in both quantity and size, primarily representing the initial stages of platform reduction applied to material provenances from both primary and secondary sources. This contrasts to the two, large, fine grained quartz flakes that show evidence of more extensive reduction. There are five multidirectional dorsal scars on the larger piece, which still retains a small amount of smooth cortex, suggesting it derived from a very large cobble of good knapping quality. A single notched flake was the only other ‘tool’ recovered from the assemblage, besides the scraper.

This assemblage is very small, therefore there are few conclusions that can be drawn. Overall, it is clear that the presence of high-quality quartz facilitated the production of tools either on, or near, the site. The presence of retouched tools in such a small assemblage differs markedly to the relative lack of such in the larger assemblages at Tràigh na Beirigh 1 and Tràigh na Beirigh 2.

6.5. Tràigh na Beirigh 9

6.5.1. Discovery and Excavation

6.5.1.1. Excavation 2013

Tràigh na Beirigh 9 was discovered as part of the same coastal erosion survey described in Section 6.4 and 6.5. A small-scale excavation along a 1.1m stretch of eroding coastline identified an old ground surface, probably contiguous with the same deposit that had been noted around the headland at Tràigh na Beirigh sites 2, 3, and 4 to the south (Snape-Kennedy *et al.* 2014). The poorly preserved remains of a single human interment were identified overlying shell midden deposits (Figure 193). Owing to time constraints in the field, and the extremely fragmented state of the remains caused by crushing from the machair overburden, only the upper portion of the head, torso, and arms was excavated as part of bulk samples. Cutting the midden deposits, which date to c. 4300-4000 cal. BC, was a 'V'-shaped pit with a basal layer of placed cobbles (Figure 194). These overlay the old ground surface. The human remains have been dated to the Mesolithic-Neolithic transition, the significance of which will be discussed in Chapter Eight. A large assemblage of struck quartz was recovered from the site, in addition to burnt bone, ash, and shell (Snape-Kennedy *et al.* 2014). Over 50 litres of material was excavated from the site, which contained a similar suite of artefacts and environmental remains to those observed within the Mesolithic shell midden deposits of Tràigh na Beirigh 1 and Tràigh na Beirigh 2.

Figure 193. Human remains revealed during the excavation of Tràigh na Beirigh 9 in 2013. Photo courtesy of Mike Church

Figure 194. The 'V'-shaped cut through Mesolithic shell midden deposits at Tràigh na Beirigh 9. A layer of cobbles is visible at the base of the cut. Photo courtesy of Mike Church

6.5.2. Tràigh na Beirigh 9 Lithic Assemblage Results

6.5.2.1. General Character of the Assemblage

A total of 324 lithics were recovered from the *in situ* deposits and >4mm sieved fraction of Tràigh na Beirigh 9. The majority of these derive from C005 and C006 – the former an old ground surface and midden deposit around the human skeletal remains, and the latter a mixed shell midden and old ground surface deposit. Small quantities of lithics were also found in: C004, an interface deposit between the midden and overlying machair; C007, the lower pit fill below the skeleton; C009, a midden deposit which had been cut by pit (C008); and C011, the basal soil horizon. Three small finds are missing, therefore they could not be recorded as part of the analysis, and one artefact (L87) was determined not to be humanly modified. Only the results from the remaining 320 artefacts are thus included in the subsequent analysis. The raw data is detailed in Appendix Nine.

Overall, the assemblage is dominated by flakes, which include flake cores, a core rejuvenation flake and small fraction (<10mm) flakes. Chunks, including small fraction chunks are also represented. The smaller constituents of the assemblage are cores, hammerstones and manuports, and a number of subsequently modified pieces such as burins, a notch, and an oblique point (Figure 195 and Table 33).

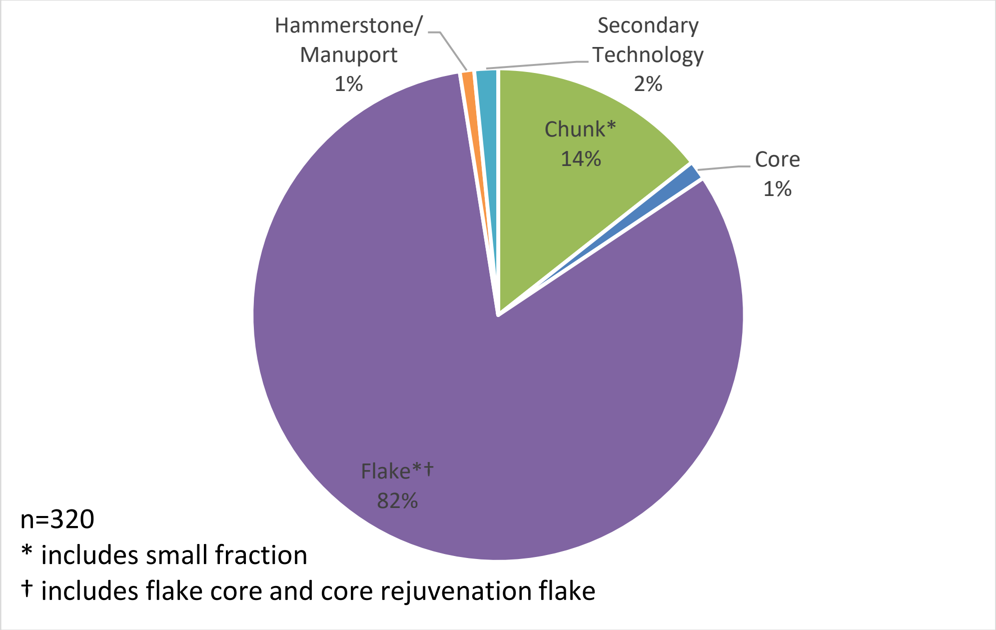


Figure 195. Tràigh na Beirigh 9 assemblage composition

Technology	Raw Material			
	Quartz	Flint	Other	Total
Core	4			**4**
Chunk	23			**23**
Small fraction chunk	23			**23**
Flake	90	1	7	**98**
Core rejuvenation flake	1			**1**
Flake core	3			**3**
Small fraction flake	159		1	**160**
Secondary piece	5			**5**
Hammerstone/Manuport	1		2	**3**
Total	**308**	**1**	**11**	**320**

Table 33. Tràigh na Beirigh 9 assemblage composition

6.5.2.2. Raw Material

The dominant raw material at Tràigh na Beirigh 9 is quartz, representing over 95% of the assemblage. A small number flakes made from carbonate, feldspar, basalt, flint, and granite make up the remainder of the raw materials present, an addition to a hammerstone of vesicular volcanic rock (flowstone), and a manuport of a small sandstone pebble (Figure 196).

The assemblage is in a fresh condition, suggesting little post-depositional movement of the material. The flint piece is completely covered in a grey-white patina. There is no scratching or staining on the piece.

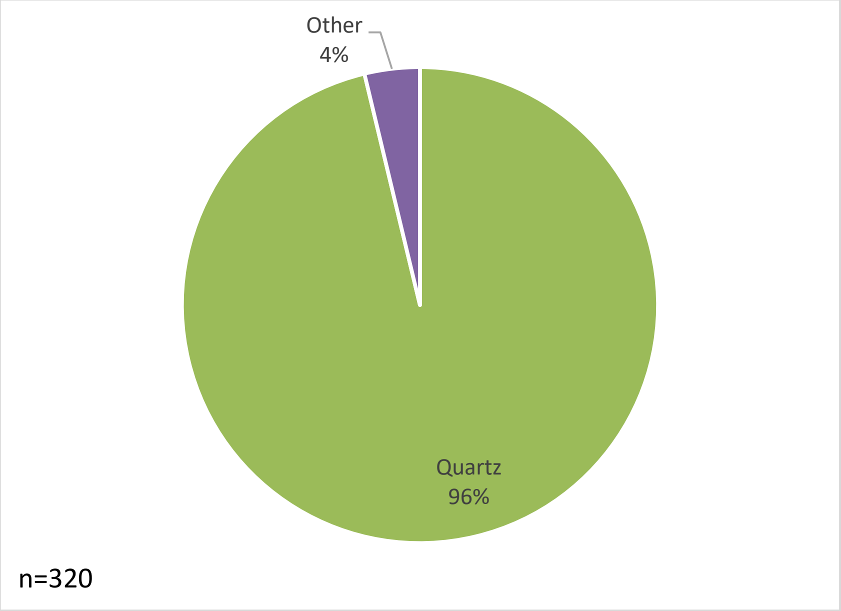
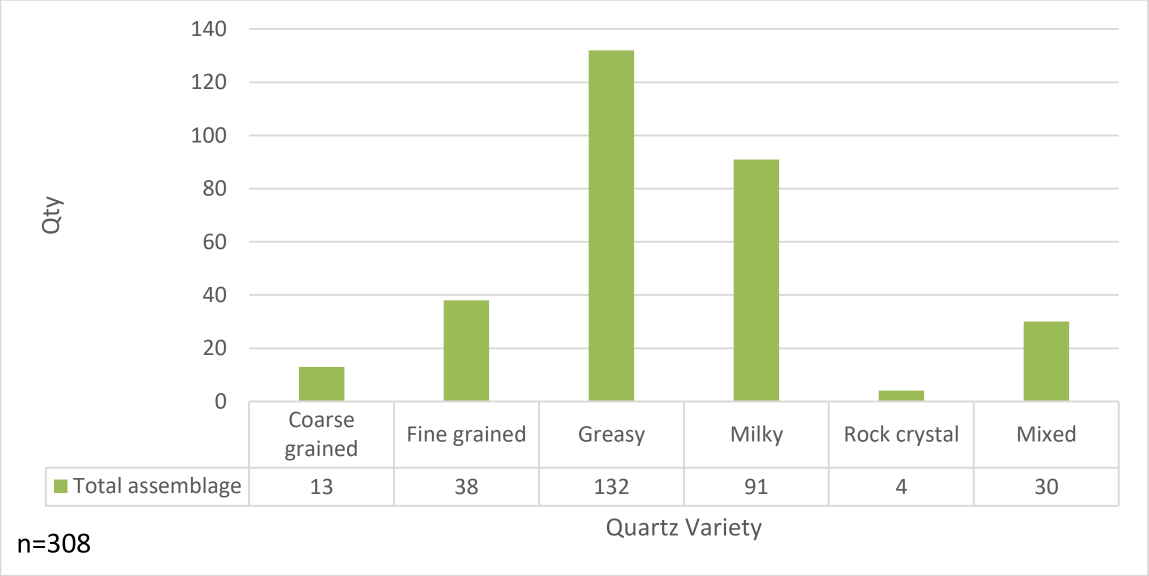


Figure 196. Tràigh na Beirigh 9 raw material composition

The quartz constituent of the assemblage is primarily made from greasy (very fine grained) quartz, although milky quartz also contributes a significant proportion of the assemblage. This is followed by fine grained quartz, and a number of pieces which are 'mixed'. The 'mixed' category predominantly contains quartz varieties grading from milky through to fine, or very fine grained and rock crystal. Two flakes of greasy quartz also contained feldspar. Very few pieces are made from coarse grained quartz and the presence of rock crystal in the assemblage is rare (Figure 197).



	Coarse grained	Fine grained	Greasy	Milky	Rock crystal	Mixed
🟩 Total assemblage	13	38	132	91	4	30

Figure 197. Tràigh na Beirigh 9 quartz varieties

Quartz is represented in all contexts at Tràigh na Beirigh 9, and is the sole constituent of C004 and C011 (Figure 198). C006 contains the most lithics in a wide variety of other raw materials, including feldspar and limestone. C005 contains marginally fewer lithics comprised of quartz, a single flake of flint, granite, sandstone, and carbonate. A piece of vascular volcanic rock (flowstone) was found in C007 and a single piece of basalt in C009.

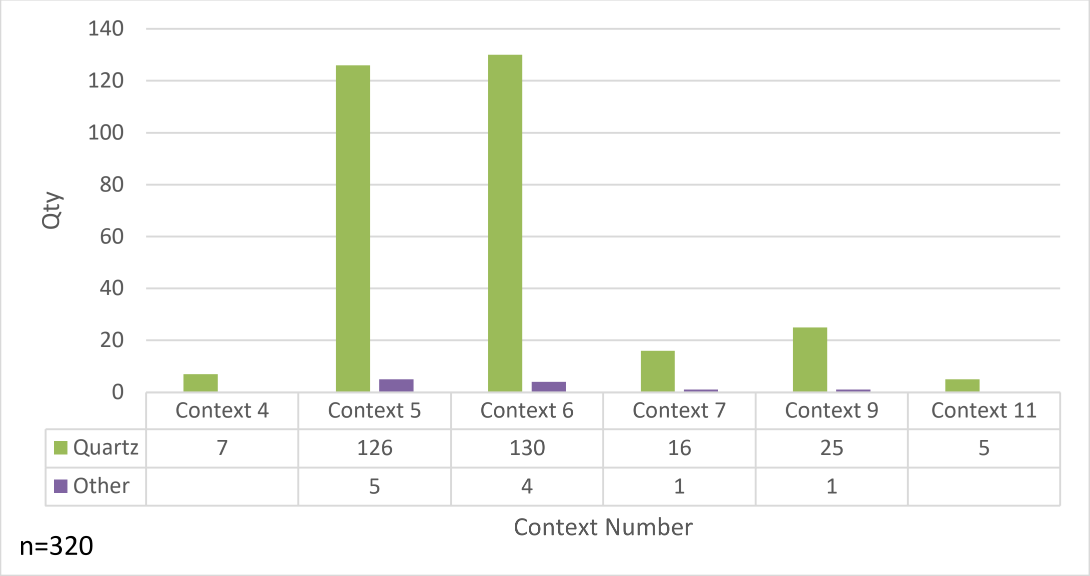


Figure 198. Tràigh na Beirigh 9 raw material by context

The primary and secondary technology from Tràigh na Beirigh 9 is presented in the following sections. The chunk, small fraction flake, and small fraction chunk assemblages are detailed in Appendix Twelve.

6.5.2.3. Primary Technology: Coarse Stone Tools

6.5.2.3.1. Hammerstone and Manuports

The three manuports recovered from Tràigh na Beirigh 9 included a small, rounded, broken sandstone pebble (L54) from the upper pit fill containing the skeleton C005, a sub-angular milky quartz pebble (SF31), and a rounded piece of vesicular volcanic rock (flowstone; L255), which is likely to be a hammerstone from the lower pit fill deposits (C007). The dimensions for each of these pieces are presented in Table 34.

The sandstone pebble is notable as the material is not at all consistent with the background material from the site. Sandstone is not found close to the site but is available on east coast of Lewis around Stornoway, amidst a background of highly conglomerated sandstones, undifferentiated Lewisian gneiss, and unassigned fault zone rocks. The breakage of this piece may have been the reason for its discard.

The piece of flowstone is interpreted as a hammerstone owing to a high degree of pitting along one face, which may have been percussion damage. However, the possibility of pitting as a result of exposure and weathering cannot be overlooked. This piece is unusual, but given the igneous base of the bedrock it is potentially locally available.

The quartz pebble likely derived from beach deposits close to the site.

Catalogue No.	Context No.	Raw Material	Length (mm)	Width (mm)	Thickness (mm)
SF31	007	Quartz	77.12	50.29	32.60
L54	005	Sandstone	15.46	14.17	8.45
L255	007	Flowstone	56.82	32.93	24.34

Table 34. Tràigh na Beirigh 9 manuport/hammerstone dimensions

6.5.2.4. Primary Technology: Cores

Four quartz cores were recovered from Tràigh na Beirigh 9 (Table 33).

6.5.2.4.1. Raw Material

Two cores of greasy quartz were recovered from the mixed shell midden/old ground surface that contained the skeleton (C005), and a single core of this variety was also found in C006, the underlying deposit of a similar composition. A single core of milky quartz was identified in the upper interface deposit (C004; Figure 199).

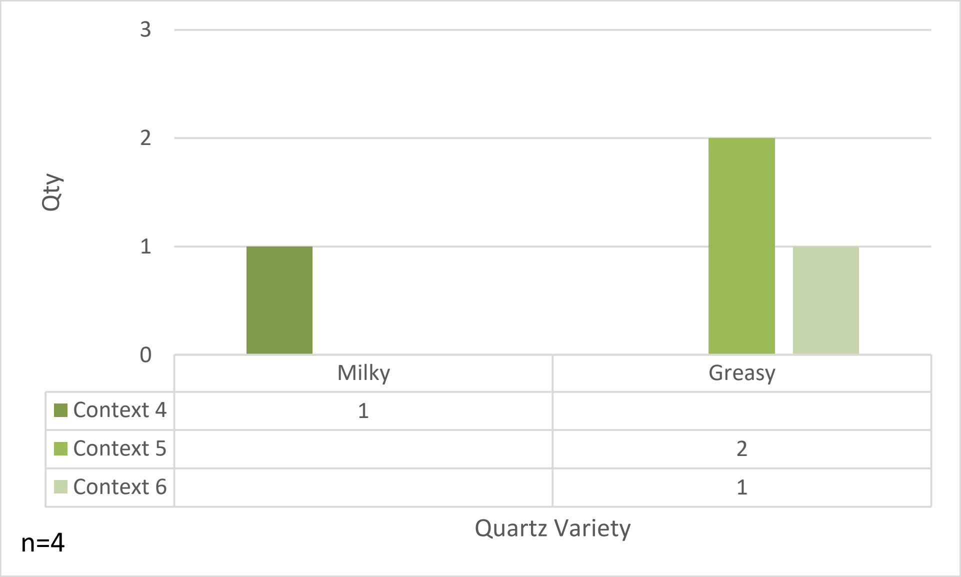


Figure 199. Tràigh na Beirigh 9 core quartz varieties

6.5.2.4.2. Core Dimensions

The core from the mixed shell midden/old ground surface (C006) is the largest and heaviest in the assemblage (Figure 200). The two cores from the upper pit fill containing the skeleton (C005) differ in their dimensions – one is fairly large and of a moderate weight in comparison to the whole assemblage, whereas the other is much smaller and lighter. The latter is similar to the dimensions of the core from the upper interface deposit (C004).

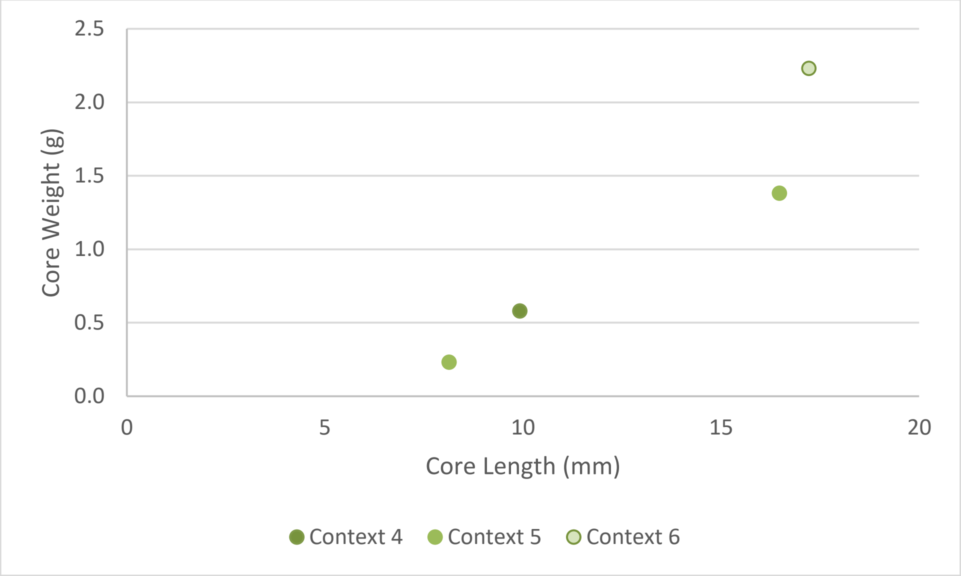
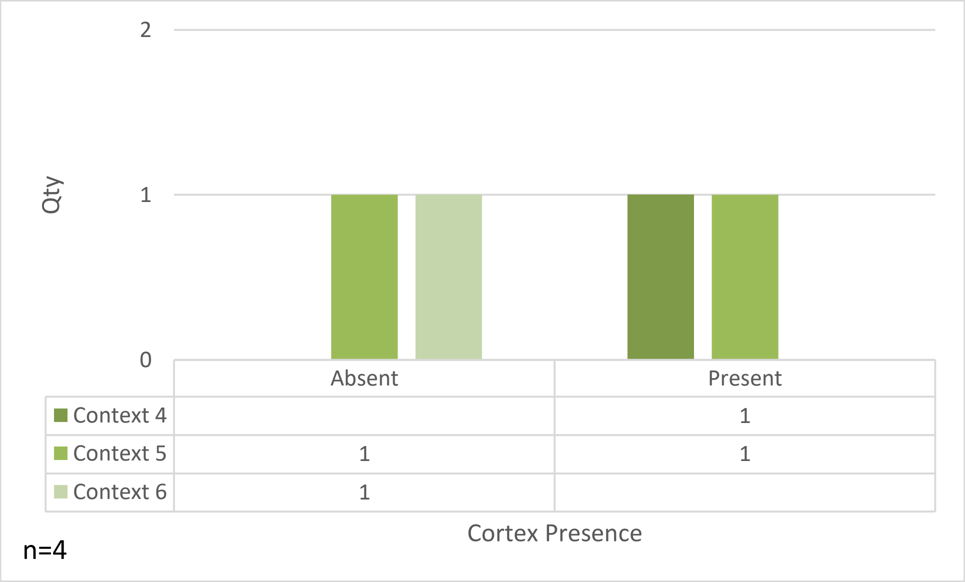


Figure 200. Tràigh na Beirigh 9 core dimensions

6.5.2.4.3. Cortex

The presence of cortex is equally represented between the cores. The single core from C004 has cortex present, which would be expected given that only one flake has been removed from it. The larger core from C005 also has cortex present, whereas the smaller one does not. There is no cortex present on the large core from C006 (Figure 201). The cortex on one of the cores is flat and weathered, which may have been sourced from a vein or outcrop. The flat cortex on the other piece appears to be a break along a natural fracture plane, which also suggests it may have been detached from a vein source.



	Absent	Present
Context 4		1
Context 5	1	1
Context 6	1	

Figure 201. Tràigh na Beirigh 9 core cortex presence

6.5.2.4.4. Flake Removals – Count and Pattern

As mentioned above, the core from C004 has a single, unidirectional flake removal. The two cores from C005 have four and five removals respectively, and the core from C006 has six flake removals

(Figure 202). On the cores that exhibit multiple flake scars, the flakes have been removed from several different directions (Figure 203).

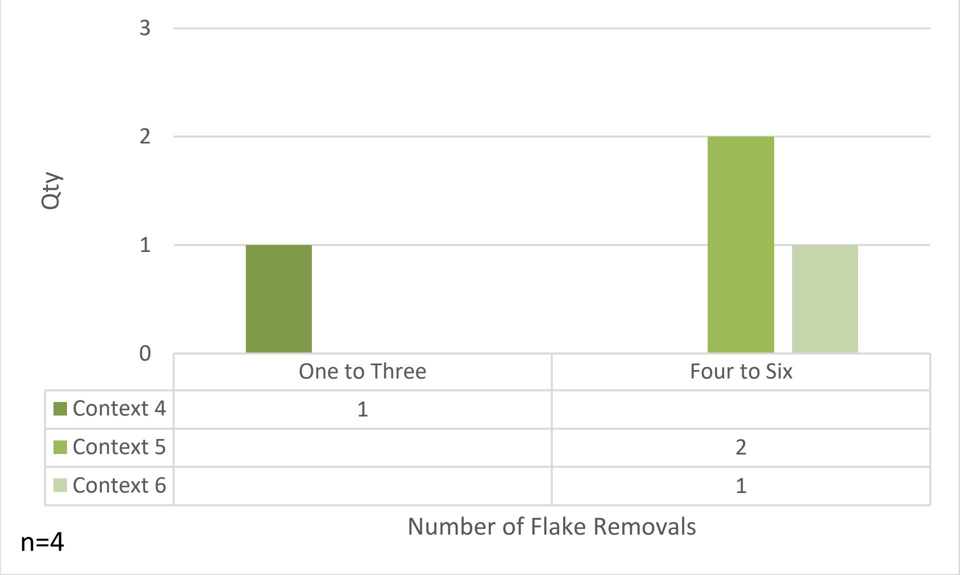


Figure 202. Tràigh na Beirigh 9 number of flake removals from core

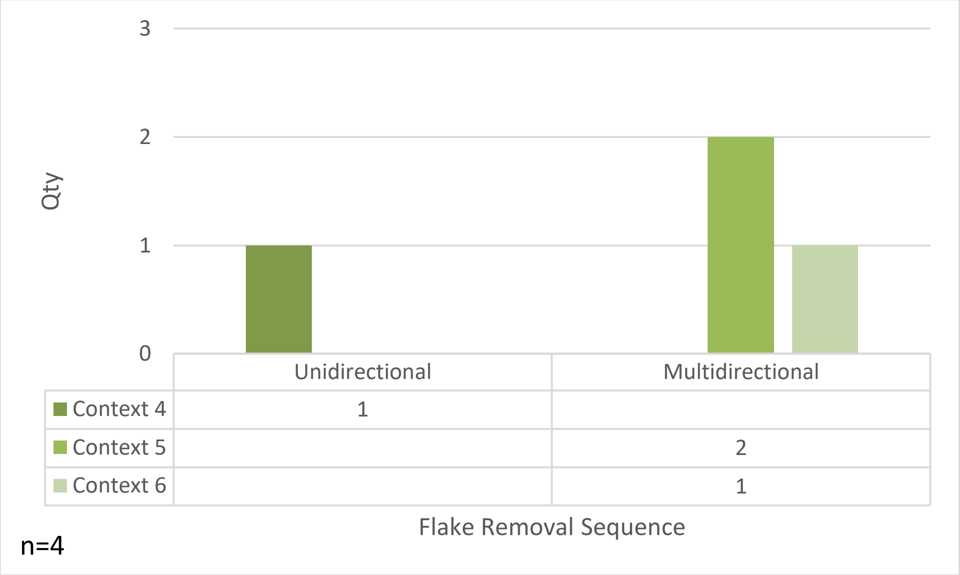


Figure 203. Tràigh na Beirigh 9 sequence of flake removals from core

6.5.2.4.5. Core Platform Preparation

The single removal from the core found in C004 displays no evidence for platform preparation. Where the platforms are visible on the large core from C005, and the core from C006, no platform preparation can be seen. However, in some instances this had been lost due to a later flake removal. The smaller core from C005 displays simple platform preparation, although some of this evidence was also lost through subsequent flake removals (Figure 204).

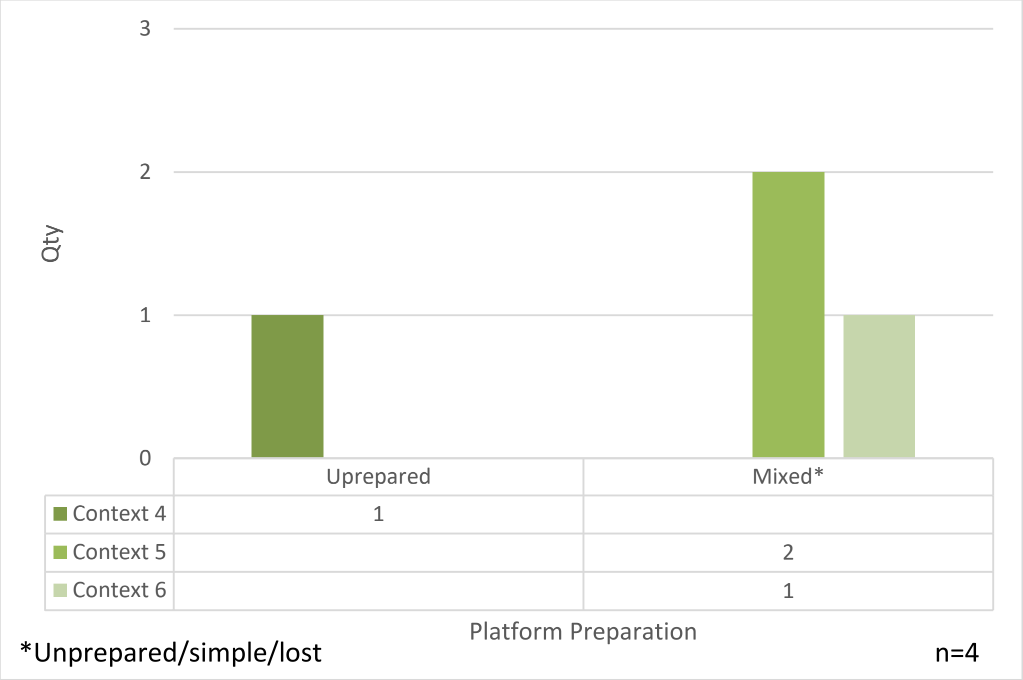


Figure 204. Tràigh na Beirigh 9 core platform type

6.5.2.5. Primary Technology: Flakes

A total of 98 flakes were recovered from Tràigh na Beirigh 9, in addition to three flake cores and a core rejuvenation flake (Table 33). The results of the flake analysis are presented below, with a separate presentation of the flake cores, and core rejuvenation flake results at the end of this section. As with the previous sites, the data presented here only includes flakes which are >10mm in maximum length. To reiterate, this follows the suggestion that small fraction flakes (<10mm) simply represent *in situ* knapping debris (Ballin 2000:10; Finlayson *et al.* 2000:67). This data, along with the indeterminate chunks and small fraction chunks, is presented in Appendix Twelve.

The flakes (>10mm) were recovered from throughout the archaeological sequence, including the overlying interface deposits (C004), mixed shell midden/old ground surface (C006), both the primary and secondary pit fill (C007; C005), and the lower soil horizons (C009; C011).

6.5.2.5.1. Raw Material

The raw material of the flake assemblage from Tràigh na Beirigh 9 is completely dominated by quartz (Figure 205). Only 8% of the flakes are made from other raw materials, which include single flakes of flint and basalt, and two flakes each of carbonate, granite, and feldspar (Figure 206).

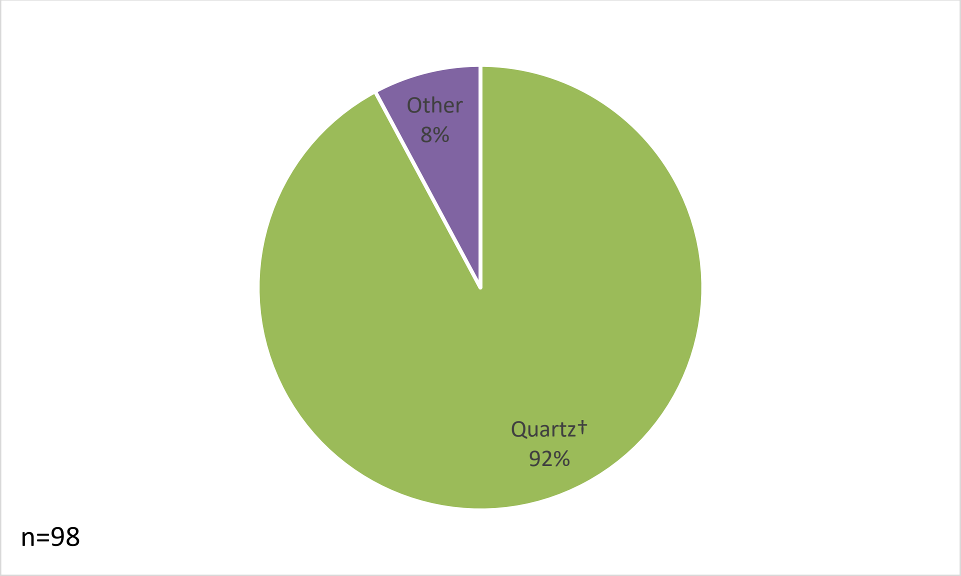


Figure 205. Tràigh na Beirigh 9 flake raw material composition

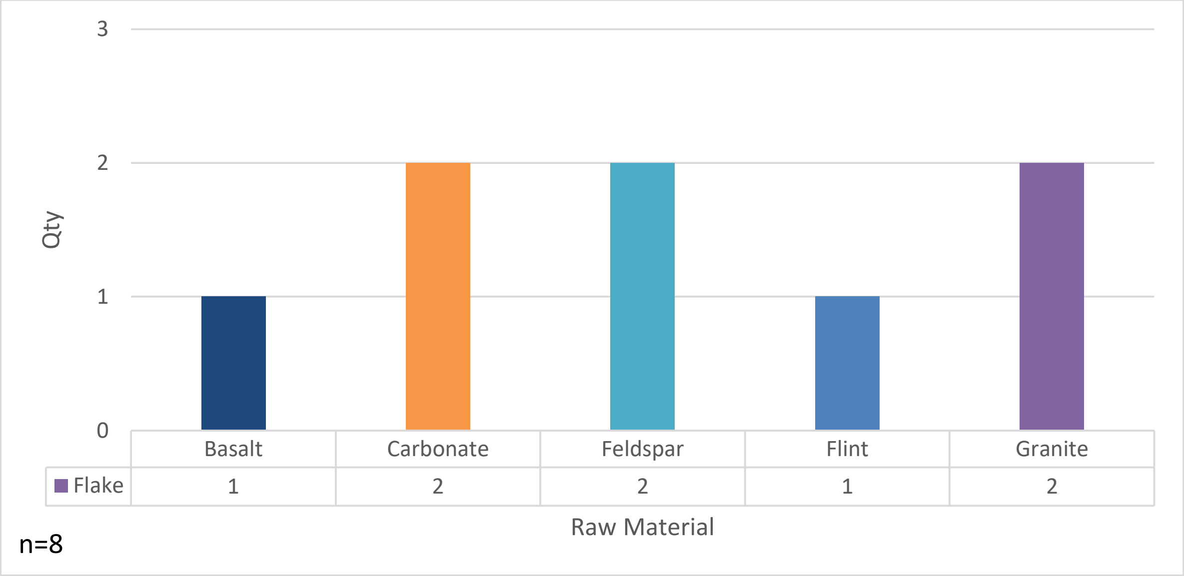


Figure 206. Tràigh na Beirigh 9 flake 'Other' raw material composition

The quartz flake assemblage is predominantly of the greasy variety, in addition to a large percentage of milky quartz (Figure 207). Mixed quartz varieties are more frequently represented than the fine grained variety, and only single flakes of rock crystal and coarse grained quartz were recovered.

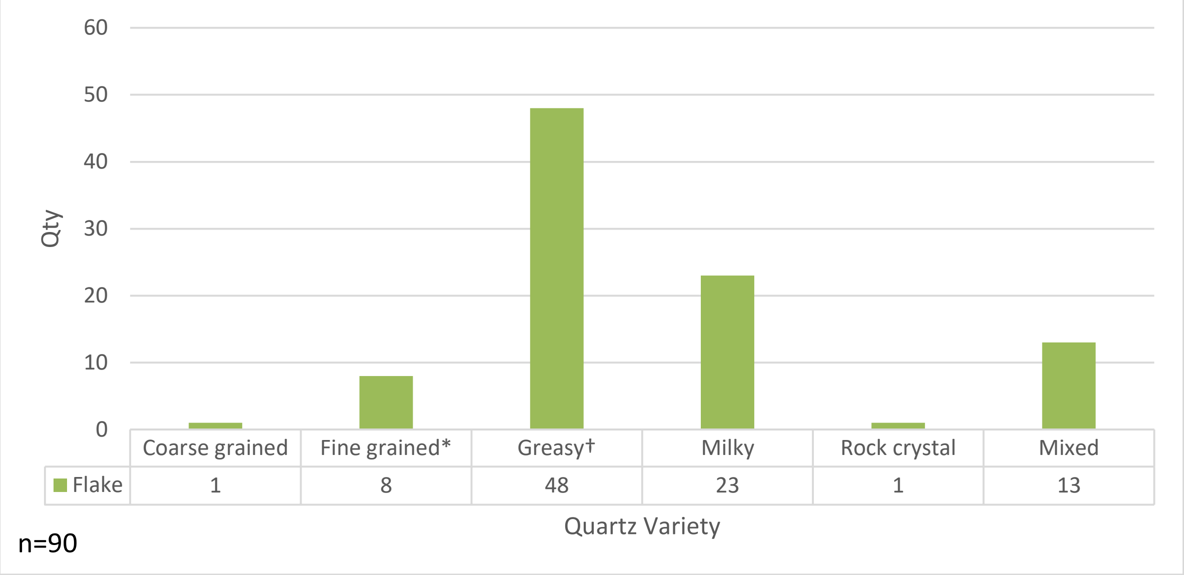


Figure 207. Tràigh na Beirigh 9 flake quartz varieties

Granite and feldspar are constituents of the background geology of the site. Although there is no visible 'cortex' on these pieces, they may have been removed as flakes during the initial reduction of vein quartz, which was extracted close to contact zones with the parent rock.

It is clear that flint was not a significant raw material in the lithic assemblages of the other sites along the headland, nor is it well represented at Tràigh na Beirigh 9. To reiterate, the nearest known source is in South Uist; however, drift deposits of beach flint also occur along the exposed west coast of the Inner Hebrides and mainland Scotland.

Two flakes in the assemblage were identified as carbonate rocks, it is possible that these flakes may in fact be limestone or dolomite, similar to those at Northton. The nearest source of limestone/dolomite is along the western coast of mainland Scotland (Highley *et al.* 2006).

6.5.2.5.2. Flake Dimensions

The summary statistics for the quartz flakes from Tràigh na Beirigh 9 are presented in Table 35. There is a wide range between the minimum and maximum values for each recorded dimension, and the mean values are toward the lower end of the range, suggesting the maximum dimensions are anomalous. It is likely these high maximum values are responsible for the high standard deviation figure.

Raw Material		**Length (mm)**	**Width (mm)**	**Thickness (mm)**
Quartz	**Min**	10.00	3.03	0.96
	Max	42.53	28.79	16.00
	Mean	15.05	12.85	4.71
	SD	5.308103	6.447574	2.894855

Table 35. Tràigh na Beirigh 9 quartz flake dimension summary statistics

The flake dimensions for both quartz and the 'other' raw materials broadly follow a positive correlation between the length and width (Figure 208 and Figure 209). Only a single quartz flake exceeds 30mm in length, and the majority of the flakes are less than 25mm in length. All of the flakes fall below 30mm in width.

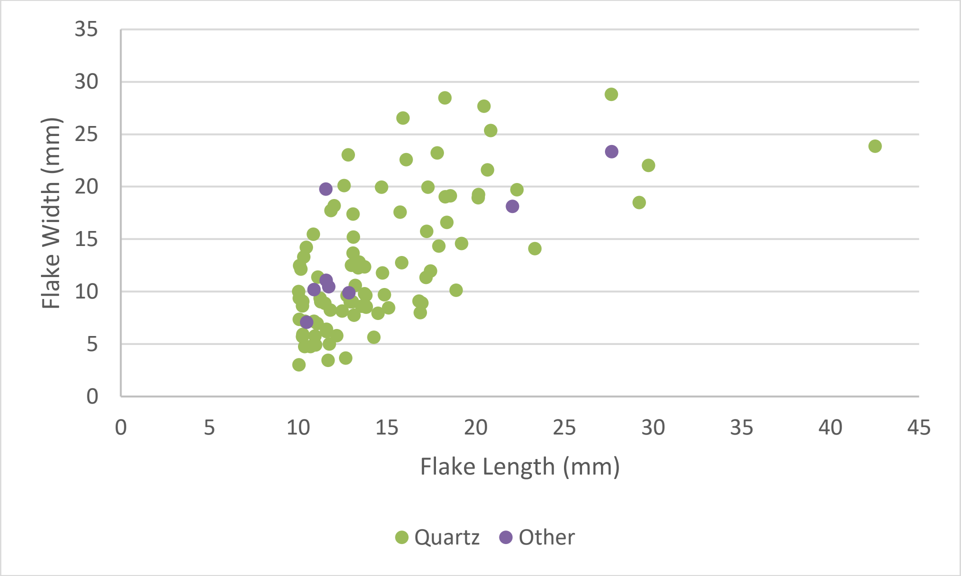


Figure 208. Tràigh na Beirigh 9 flake dimensions length:width

The two feldspar flakes, the smaller flake of carbonate and the flint flake are all of a very similar size, with the basalt flake slightly smaller (Figure 209). These all fall within the densest cluster of quartz flakes. The remaining 'other' raw materials are larger, with a granite flake and the other carbonate flake exceeding 20mm in length.

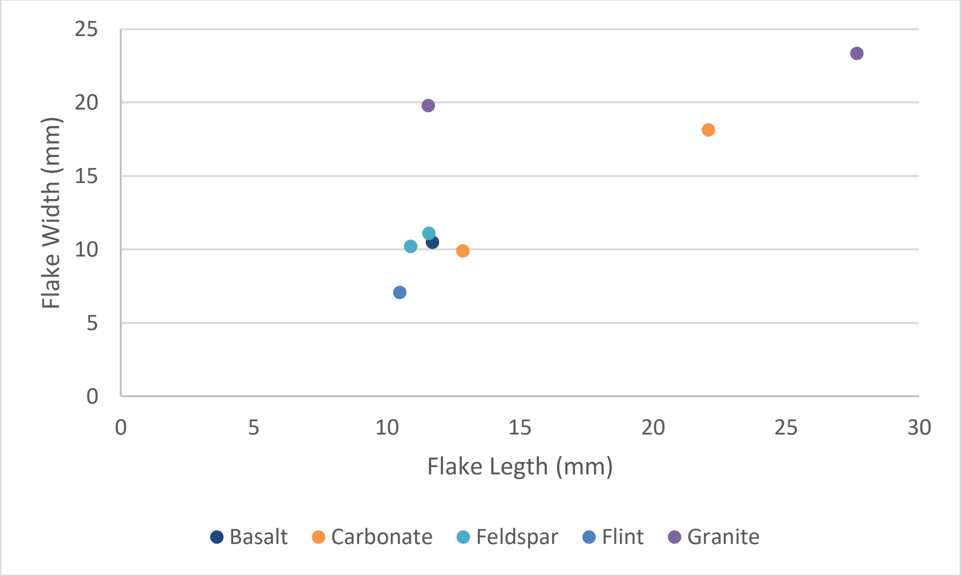


Figure 209. Tràigh na Beirigh 9 detail of 'Other' raw material flake dimensions length:width

A similar positive trend is also observed between the increasing length and thickness of the quartz flakes (Figure 210). There is a large grouping of flakes less than 8mm in thickness, with small clusters set apart from this main group. A collection of four flakes are separate in terms of greater thickness and a group of three are both longer and thicker. These outliers may be a result of flake breakage affecting the dimensions.

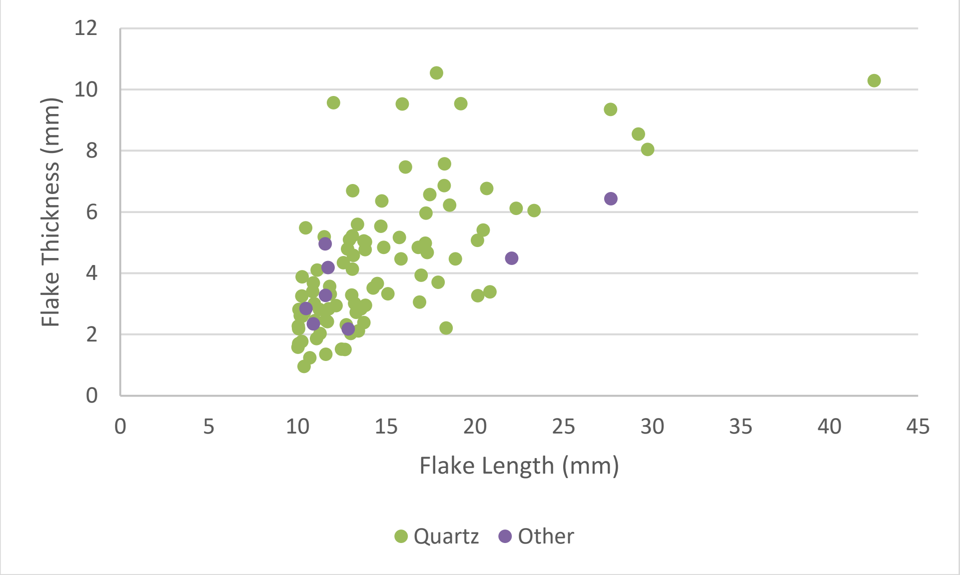


Figure 210. Tràigh na Beirigh 9 flake dimensions length:thickness

In terms of the ‘other’ raw materials, there is an observable difference between the flake thickness and the raw material, despite a similarity in length for the majority of the pieces (Figure 211). The granite flakes are the thickest, despite the difference in length between these pieces. The carbonate, flint, and pegmatite flakes at the thinner end of the scale. Although one of the carbonate flakes is longer than the majority of the ‘other’ raw materials, it is not thicker. The basalt flake is thick considering it is similar in length to the flint and feldspar flakes.

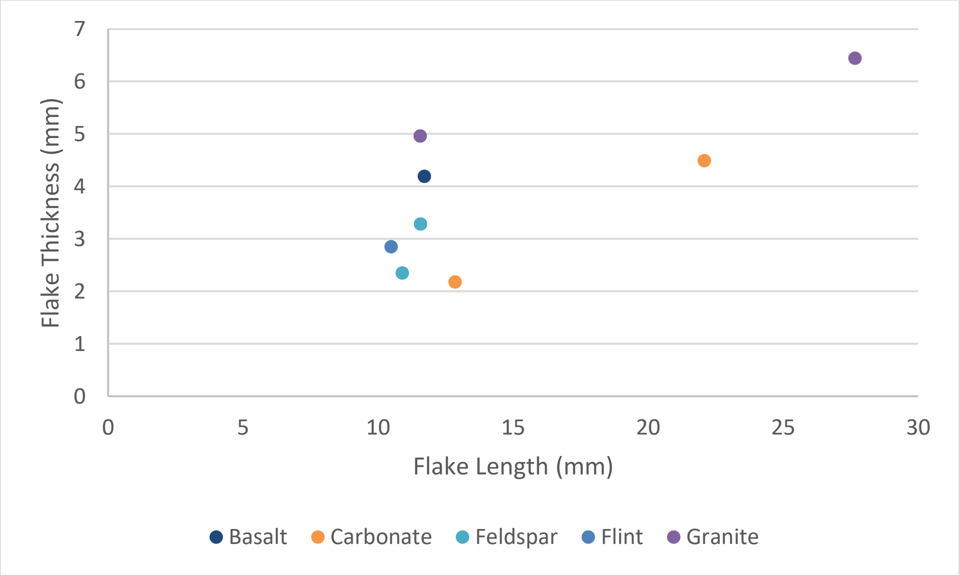


Figure 211. Tràigh na Beirigh 9 detail of 'Other' raw material flake dimensions length:thickness

Again, a positive correlation is observed between the width and thickness of the quartz flakes (Figure 212). The correlation between flake width and thickness is stronger for the ‘other’ raw materials than observed in the quartz flake assemblage (Figure 213). The tightest grouping of quartz flakes is between c.3-15mm in width, and 1-6.5mm in thickness. Beyond these values the points become widely dispersed.

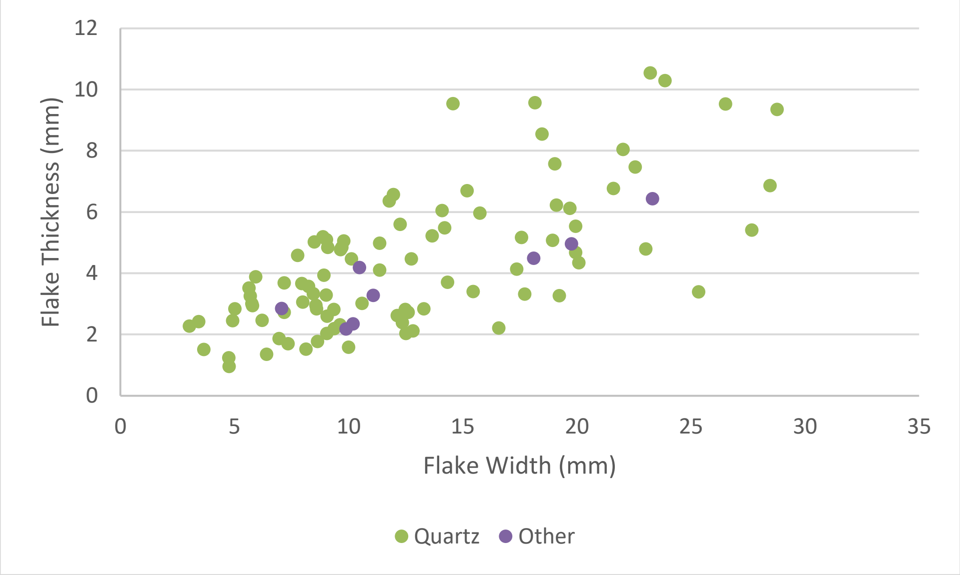


Figure 212. Tràigh na Beirigh 9 flake dimensions width:thickness

The granite and large carbonate flakes fall outside of the main clustering of quartz flakes described above, in terms of width and thickness (Figure 213). Both of the feldspar, the smaller carbonate, flint and basalt flakes fall within the main group.

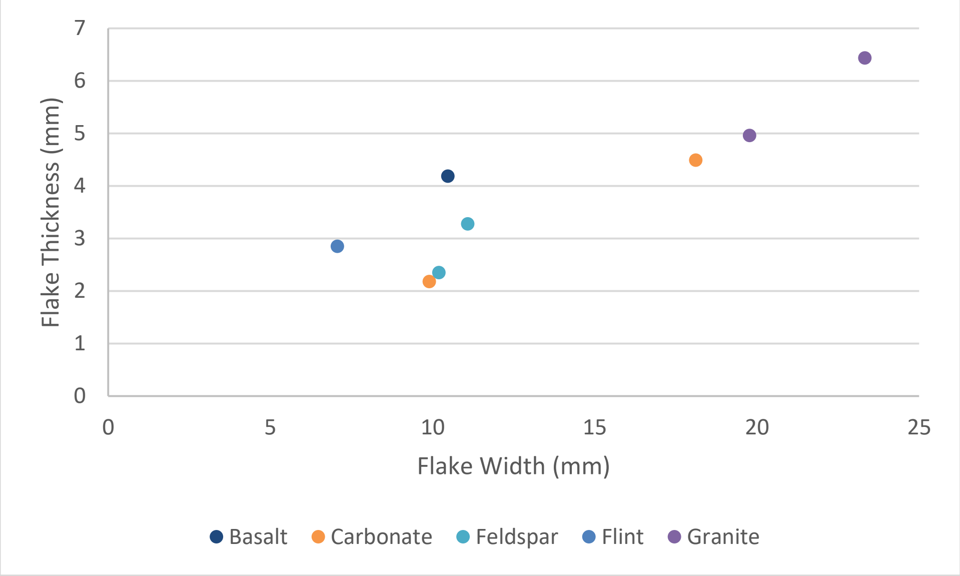


Figure 213. Tràigh na Beirigh 9 detail of 'Other' raw material flake dimensions width:thickness

6.5.2.5.3. Cortex

The highest proportion of quartz flakes retain no cortex, suggesting they are tertiary flakes, which is echoed by the 'other' raw materials (Figure 214). The only 'other' raw materials to retain any cortex are the flint flake (L48; <50% cortex), and a granite flake (L126) which is completely corticated; this is denoted by a smooth and weathered surface. Equal numbers of quartz flakes are secondary pieces, and only nine quartz flakes exhibit 100% cortex. The cortex present on the quartz flakes indicates that, for the majority, this is flat and often mixed with other material. This suggests the quartz derived from a vein, and was removed as blocks or plates. Comparatively few quartz flakes displayed cortex that was smooth and rounded, indicating the source as a beach pebble.

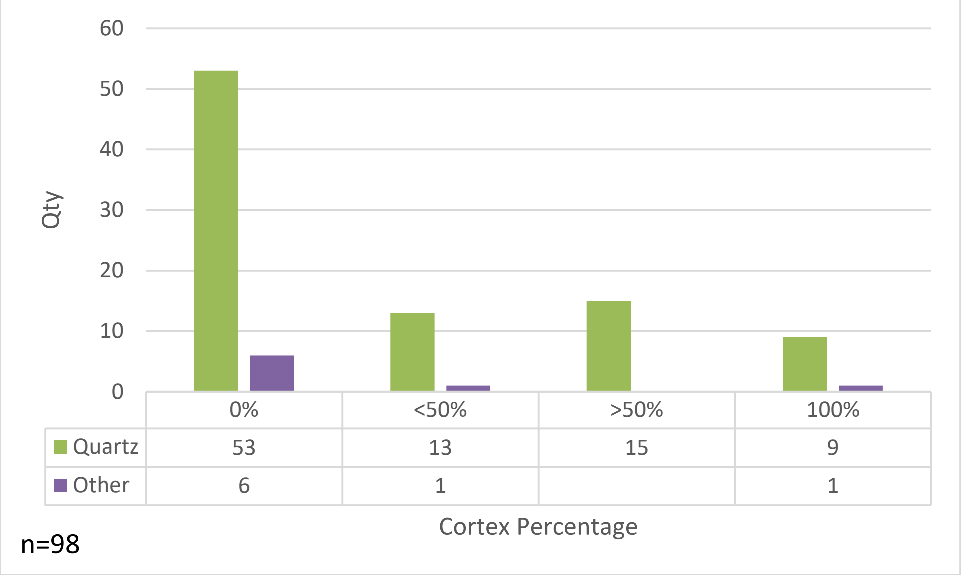


Figure 214. Tràigh na Beirigh 9 flake cortex percentage

6.5.2.5.4. Striking Platform – Type and Dimensions

The platform type could not be determined for the vast majority of both the quartz flakes and the 'other' raw material flakes, as the platforms are either absent, or damaged through breakage or crushing (Figure 215). Three quartz flakes retain cortex on the platform, and two are facetted with a number of prior removals. Six quartz flakes and a feldspar flake display a plain platform. The measured platform dimensions overall indicate a general positive trend (Figure 216); however, there appears to be no observable relationship between the platform dimensions and the type of platform recorded.

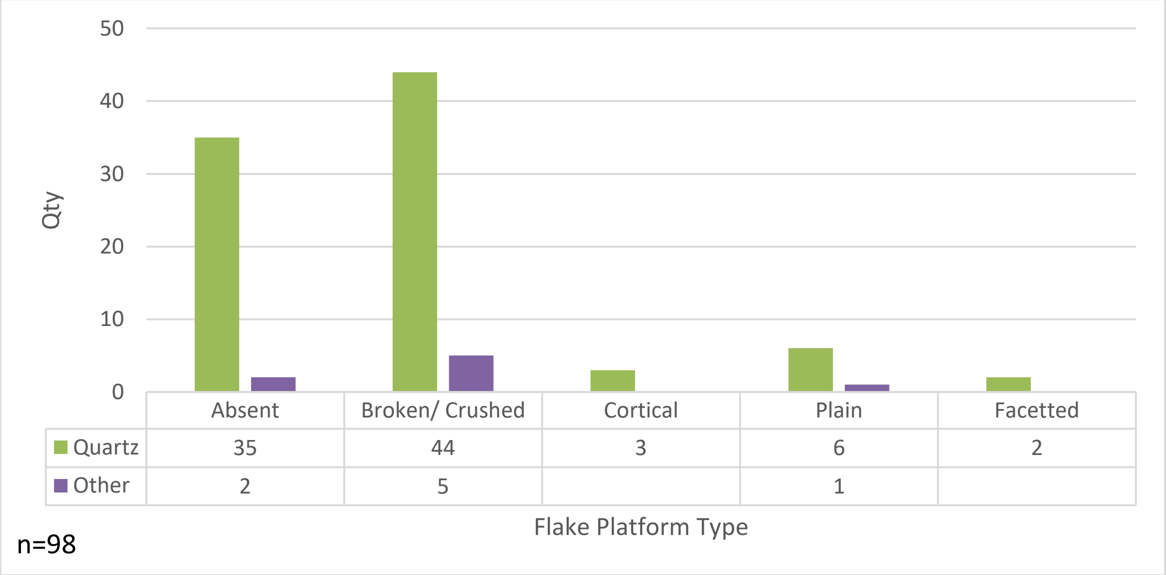


Figure 215. Tràigh na Beirigh 9 flake platform type

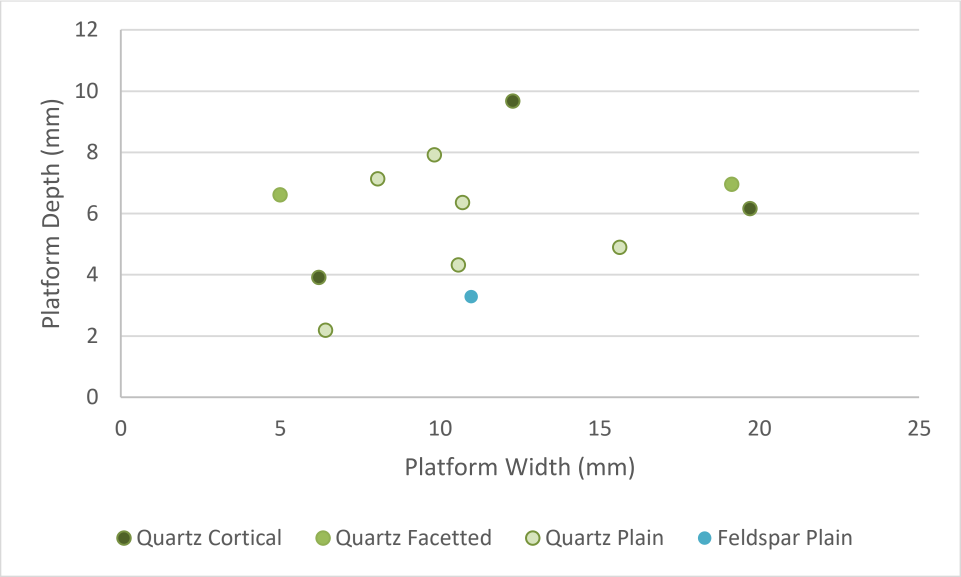
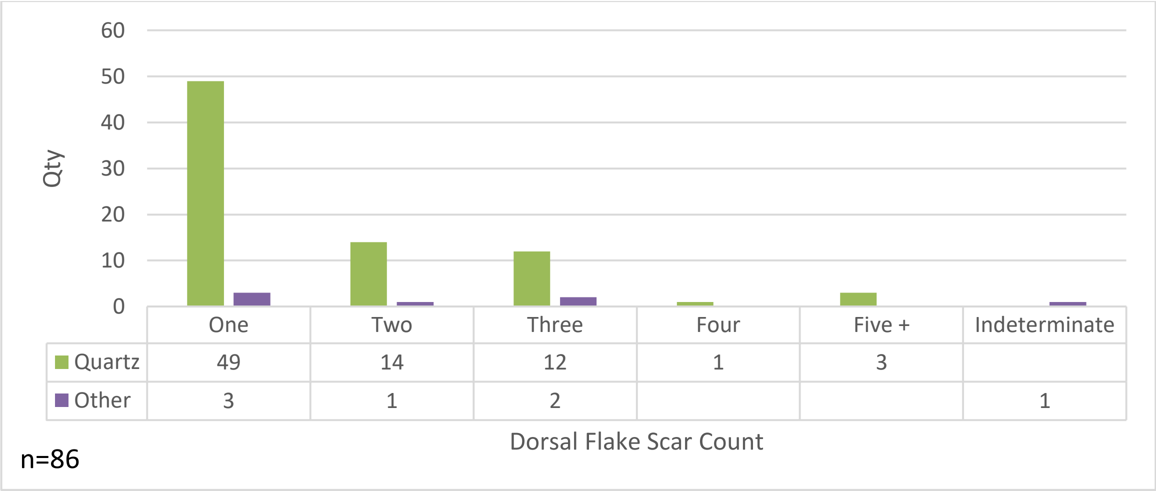


Figure 216. Tràigh na Beirigh 9 flake platform dimensions

6.5.2.5.5. Dorsal Flake Scars – Count and Pattern

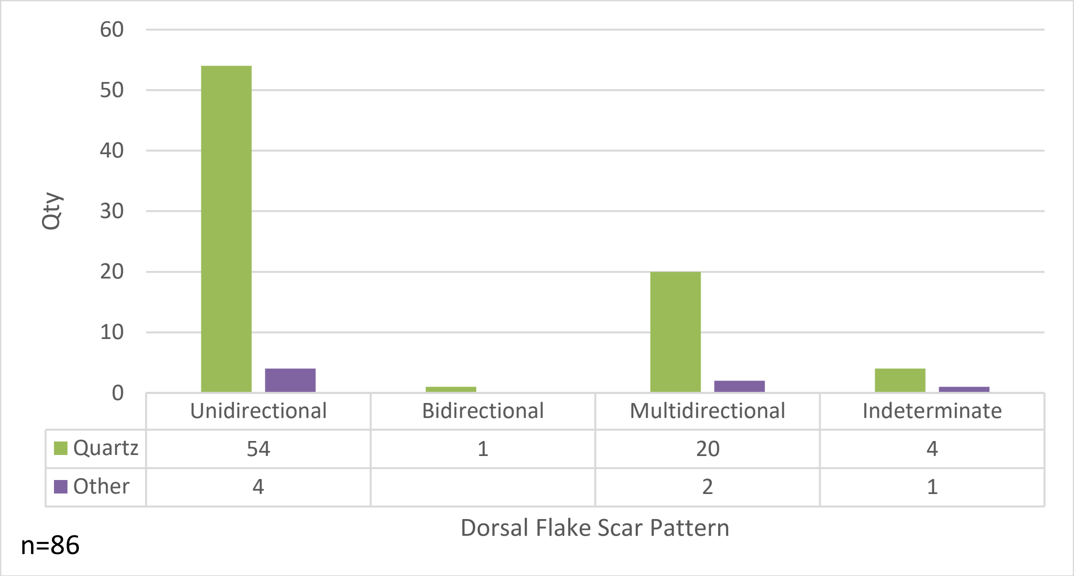
The highest proportion of quartz flakes by far display a single dorsal flake scar, followed by two and three flake scars respectively (Figure 217). Only four quartz flakes have four or more flake scars, the highest of which is SF10 with eight dorsal flake scars. The facetted platform of this flake is likely to be a consequence of this. The feldspar and limestone flakes only have one flake removal, with the basalt flake displaying two. The carbonate and flint flakes have three dorsal flake removals evident. In two instances (SF1a and SF8, both C005), breakage on the flakes had been used as a platform from which to detach a further flake, prior to their removal from the core. The dorsal scars on a single granite piece (L53) cannot be determined due to the nature of the raw material.



	One	Two	Three	Four	Five +	Indeterminate
🟩 Quartz	49	14	12	1	3	
🟪 Other	3	1	2			1

Figure 217. Tràigh na Beirigh 9 dorsal flake scar count

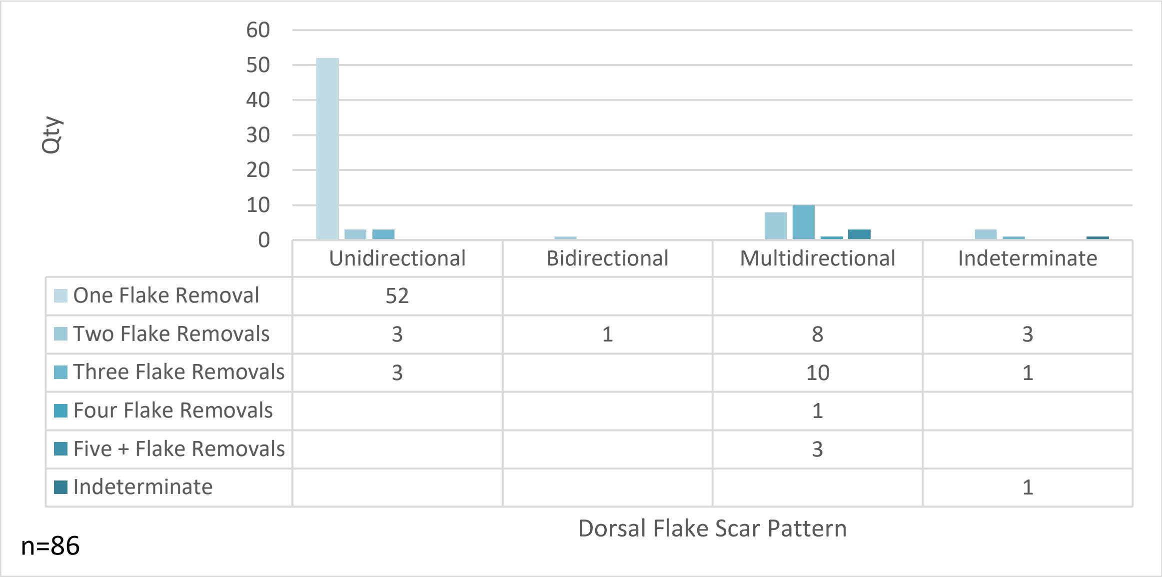
A unidirectional flake scar pattern is the most commonly observed in both quartz and the 'other' raw material flakes (Figure 218). Multidirectional dorsal flake scar patterns are also well represented in both raw materials. A single quartz flake (SF3) displays bidirectional dorsal flake scars; however, this is not evidence of a bipolar reduction strategy – the two flakes have simply been removed from opposing directions. The dorsal flake scar pattern on the remaining quartz and granite flakes could not be determined due to the nature of the raw material, or the size of the flake.



	Unidirectional	Bidirectional	Multidirectional	Indeterminate
🟩 Quartz	54	1	20	4
🟪 Other	4		2	1

Figure 218. Tràigh na Beirigh 9 dorsal flake scar pattern

The unidirectional dorsal flake scar pattern is most commonly observed on flakes displaying a single flake scar as would be expected, and also observed on flakes with up to three flake scars (Figure 219). More commonly, flakes with two or more flake scars exhibit a multidirectional pattern. Flakes with two dorsal removals are the most common pieces where the dorsal flake scar pattern cannot be determined, although this is also the case for a flake with three dorsal flake scars.



	Unidirectional	Bidirectional	Multidirectional	Indeterminate
One Flake Removal	52			
Two Flake Removals	3	1	8	3
Three Flake Removals	3		10	1
Four Flake Removals			1	
Five + Flake Removals			3	
Indeterminate				1

Figure 219. Tràigh na Beirigh 9 dorsal flake scar pattern in relation to the number of dorsal flake scars counted

6.5.2.5.6. Flake Breakage

Breakage of both quartz and ‘other’ raw material flakes overwhelmingly dominates the assemblage at Tràigh na Beirigh 9 (Figure 220). In very few instances are quartz flakes complete, in addition to only one feldspar flake and the basalt flake.

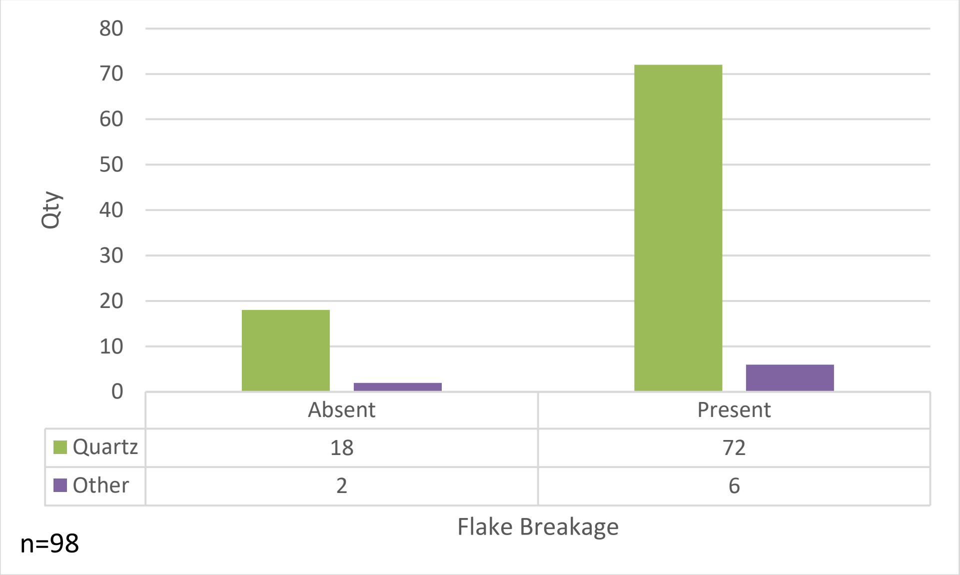


Figure 220. Tràigh na Beirigh 9 flake breakage

6.5.2.5.7. Flake Cores

Three flake cores were recovered from Tràigh na Beirigh 9 (SF8; SF34; L128). The former derives from C005, the secondary pit fill containing the skeleton, and the latter two from the underlying mixed shell midden/old ground surface (C006). All are made from very fine grained (greasy) quartz flakes. The dimensions are presented in Table 36.

SF8 is of the dark greasy quartz variety. This flake core retains <50% cortex, and has broken, causing the loss of the original platform. This breakage occurred perpendicular to the platform, creating a new platform for a further flake removal, subsequent to the previously existing dorsal flake scar.

SF34 has three multidirectional dorsal scars; the platform is plain, measuring 15.63mm X 4.89m, and it is broken. A further removal was initiated from the same platform.

There is crushing on the arris of L128 between the two multidirectional dorsal flake scars, denoting attempts to remove a further flake perpendicular to the dorsal face. This caused the flake to break, leading to the removal of the proximal end of this piece and the loss of the original striking platform.

Context No.	Catalogue No.	Length (mm)	Width (mm)	Thickness (mm)
005	SF8	23.35	14.1	6.05
006	SF34	14.71	19.96	5.54
006	L128	18.30	19.05	7.58

Table 36. Tràigh na Beirigh 9 flake core dimensions

6.5.2.5.8. Core Rejuvenation Flake

The core rejuvenation flake (SF23) was recovered from the secondary pit fill containing the skeleton (C005). It is made from fine grained quartz and measures 23.14mm X 10.54mm X 11.70mm. There is no cortex present on the piece, and the plain platform measures 9.82mm X 7.91mm. There are five multidirectional dorsal flake scars evident on the piece, which is complete.

6.5.2.5.9. Refits

Two very fine grained quartz flakes from C006 (L167 and L169) refit together. A long, thin flake had snapped laterally in the medial section, therefore L167 forms the proximal end of the piece and L169 the distal end.

6.5.2.6. Secondary Technology

The assemblage from Tràigh na Beirigh 9 contains five lithics that display evidence of further working. All of these are quartz and most were recovered from the secondary pit fill containing the skeleton (C005), with the exception of the notched piece which came from the underlying mixed shell midden/old ground surface deposit (C006).

6.5.2.6.1. Burins

There are three burins present at Tràigh na Beirigh 9, their dimensions are presented in Table 37. L8 is made from fine grained quartz and is the only burin with an undamaged platform, although there is subsequent breakage of the piece. The platform is plain and measures 7.88mm X 2.36mm (Figure 221). There is no cortex present, and there are two, multidirectional dorsal flake scars present. The burin spall has been removed from the distal end to the right lateral edge.

SF25 is a burin made from milky quartz and there is no cortex present. Although the platform has been broken, there is no other recorded breakage to this piece. SF25 displays a single, unidirectional dorsal flake scar, and the burin spall was removed obliquely from the proximal end to the right lateral edge, with the facet perpendicular to the lower face.

L89 is also made from milky quartz with no cortex present. The platform has been crushed and there three multidirectional dorsal flake scars present. The burin spall was removed from the distal end to the left lateral edge.

Catalogue No.	Length (mm)	Width (mm)	Thickness (mm)
L8	16.41	13.83	3.41
L89	10.53	11.34	3.04
SF25	14.05	15.78	5.11

Table 37. Tràigh na Beirigh 9 burin dimensions

Figure 221. L8 quartz burin

6.5.2.6.2. Notch

SF36 is a notched piece of dark greasy quartz recovered from C006. The flake measures 17.79mm X 11.68mm X 3.50mm and exhibits <50% cortex. The platform is absent in addition to further breakage of the piece, and there is a single unidirectional flake scar on the dorsal face. The notch was initiated from ventral side, removing the right lateral edge, and has caused the flake to shatter.

Figure 222. SF36 notched piece

6.5.2.6.3. Oblique Point

A greasy quartz oblique point (SF14) was recovered from C005. The piece measures 22.37mm X 8.99mm X 3.18mm, there is <50% cortex present and the striking platform is absent. There are two ventral surfaces on the piece, indicating it has been removed from a flake core, and the only breakage to the piece has been caused by the microburin blow which created the point. There is unusual microlithic retouch backing the piece, which is sporadic and situated along the edge of an arris, having been initiated from a cortical ridge (Figure 223, arrowed). It comprises fine, scaled removals following a straight course and at an abrupt angle. This may have functioned as keying for hafting.

Figure 223. SF14 oblique point microlith. The microlithic retouch is obscured due to the nature of the material

6.5.3. Assemblage Summary

The lithic assemblage at Tràigh na Beirigh 9 comprises 324 pieces in total, 95% of which is quartz. As seen at the other sites along the headland, this is primarily very fine grained (greasy) quartz, however there is a higher proportion of milky quartz in this assemblage than at the others. This may account for the higher quantity of indeterminate pieces recovered, especially in the small fraction component of the assemblage, due to the tendency for milky quartz to fracture less regularly than other varieties (Ballin 2008:44). A full *chaîne opératoire* is present, including a hammerstone and primary to tertiary flakes, as well as a small number of retouched pieces.

The number of cores at Tràigh na Beirigh 9 is very low, which contrasts with the similarly-sized assemblages of Tràigh na Beirigh 1 and Tràigh na Beirigh 2. At both Tràigh na Beirigh 9 and Tràigh na Beirigh 1, which are later in date than Tràigh na Beirigh 2, there appears to be more intensive reduction of higher quality greasy quartz – although the small quartz core assemblage from this site makes such an observation difficult to verify. A further comparison between the two later sites (Tràigh na Beirigh 9 and Tràigh na Beirigh 1) is that there is greater exploitation of vein quartz than pebble quartz, which is evident from both cores and flakes. It is possible that the continued occupation of the region had an impact on the source of beach pebbles, with over-exploitation leading to reduced availability. Irrespective of this, the quartz variety and source has no bearing on the size of the cores, regardless of the level of reduction. This is a comparable feature of the quartz assemblages across all three sites. If pebble quartz was less available during the latest Mesolithic, the supply was still abundant enough when combined with the nearby vein sources not to require any change in the reduction strategy in order to conserve the material available.

Quartz continued to be reduced using platform technology, as evidenced by the unprepared and simple platform preparation on the cores, and the plain and facetted platforms preserved on a small number of flakes. The preparation of platforms using faceting is unique to this site. The single, unidirectional dorsal flake scars on the majority of flakes, and the multidirectional flake removal sequence on the cores suggests that the cores were continually turned during the course of reduction, with very few flakes removed per episode.

As at Tràigh na Beirigh 1, the flake cores do not appear to have been intentionally produced, and this typology is simply opportunistic use of breakage on the original flake to initiate a further removal. There are a greater number of formally retouched tools at Tràigh na Beirigh 9 than at the other sites which have large assemblages in the area. The production of burins in quartz is unusual, due to its fracture mechanics; however, given the characteristics of greasy quartz which “flakes as well as coarser flint varieties”, the manufacture of retouched tools in this higher-quality material is not unknown in the Mesolithic of Scotland (Ballin 2008:72-73).

Tràigh na Beirigh 9 follows a similar trend to the earlier sites along the headland, primarily utilising locally available quartz to produce occasional retouched implements, with debitage and discarded manufacturing tools incorporated into the midden and old ground surface deposits. The few flakes of other raw materials present at Tràigh na Beirigh 9 include indigenous rock types, and some unusual pieces that are not local to the Western Isles. Of these non-quartz flakes, flint and carbonate have been worked the most intensively. The general lack of flint in the area is mitigated by the high quality of the greasy quartz that is most frequently exploited. The potential import of other raw materials from within, and beyond, the Western Isles raises interesting questions regarding the movement of people, which will be discussed in Chapter Eight.

6.6. Pabaigh Mòr South

6.6.1. Discovery and Excavation

6.6.1.1. Excavation 2013

Coastal erosion revealed eroding shell midden deposits from a stratigraphically significant position on the south coast of the small island of Pabaigh Mòr, which lies 1km to the north-east of the Bhaltos peninsula (Figure 224 and Figure 225). A small quantity of bulk samples excavated for analysis demonstrated the midden comprised similar material to those on the Cnip headland, and were therefore characteristic of a Late Mesolithic midden. The artefact and ecofact assemblage included charred hazel nutshells and charcoal, bunt and unburnt mammal and fish bones, marine molluscs, crustacean and a quantity of worked flint and quartz (Bishop *et al.* 2014a; Blake *et al.* 2012a; Church *et al.* 2012b; Church & Rowley-Conwy 2014). Radiocarbon dates from the hazel nutshell indicates the main body of the shell midden dates to c.4500 cal. BC.

Figure 224. Location of Pabaigh Mòr South arrowed. Photo courtesy of Peter Rowley-Conwy

Figure 225. Pabaigh Mòr South shell midden prior to sampling. Photo courtesy of Peter Rowley-Conwy

6.6.2. Pabaigh Mòr South Results

6.6.2.1. General Character of the Assemblage

The lithic assemblage from Pabaigh Mòr South comprises a total of thirteen lithics recovered from the >4mm sieved fraction. These derived from two contexts: C001, an interface layer between the overlying machair and the underlying shell midden, and C002, the main body of the shell midden. The overall assemblage is dominated by flakes, which include a flake core, and small fraction flakes (<10mm; Figure 226). The remainder of the assemblage is represented by two chunks, a core, and a tested piece of quartz (Table 38). There are no retouched pieces from the assemblage.

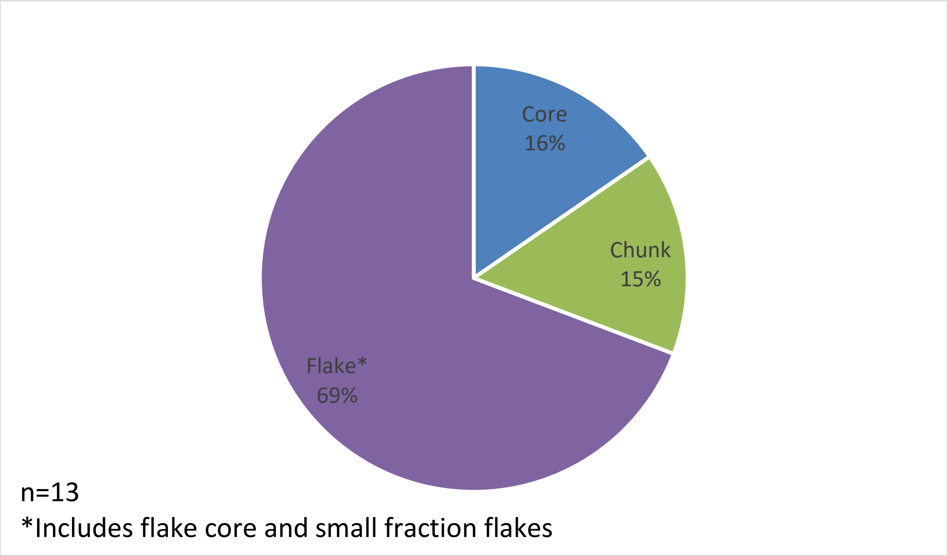


Figure 226. Pabaigh Mòr South assemblage composition

Technology	**Raw Material**		
	Quartz	**Flint**	**Total**
Core		1	1
Chunk	2		2
Flake	4		4
Flake Core	1		1
Small Fraction Flake	4		4
Test Piece	1		1
Total	12	1	13

Table 38. Pabaigh Mòr South assemblage composition

The raw data for this assemblage is presented in Appendix Ten.

6.6.2.2. Raw Material

The assemblage is almost exclusively quartz. Flint is represented by a single core which is in mint condition, showing no evidence for post-depositional rolling or abrasion (Figure 227 and Table 38).

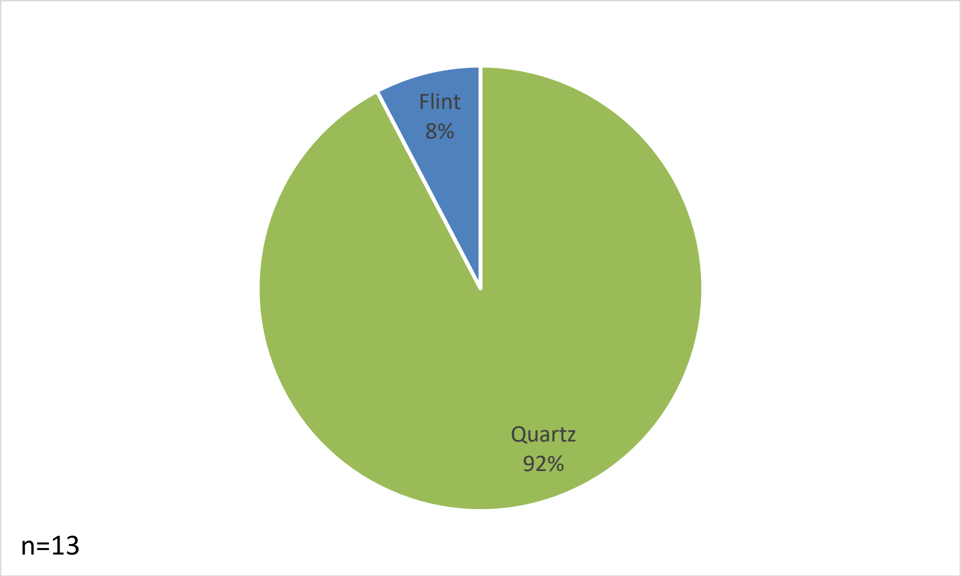


Figure 227. Pabaigh Mòr South raw material composition

The most common quartz variety is greasy (very fine grained) quartz, and milky quartz is the second most common variety (Figure 228). The tested quartz piece grades between fine grained and very fine grained quartz.

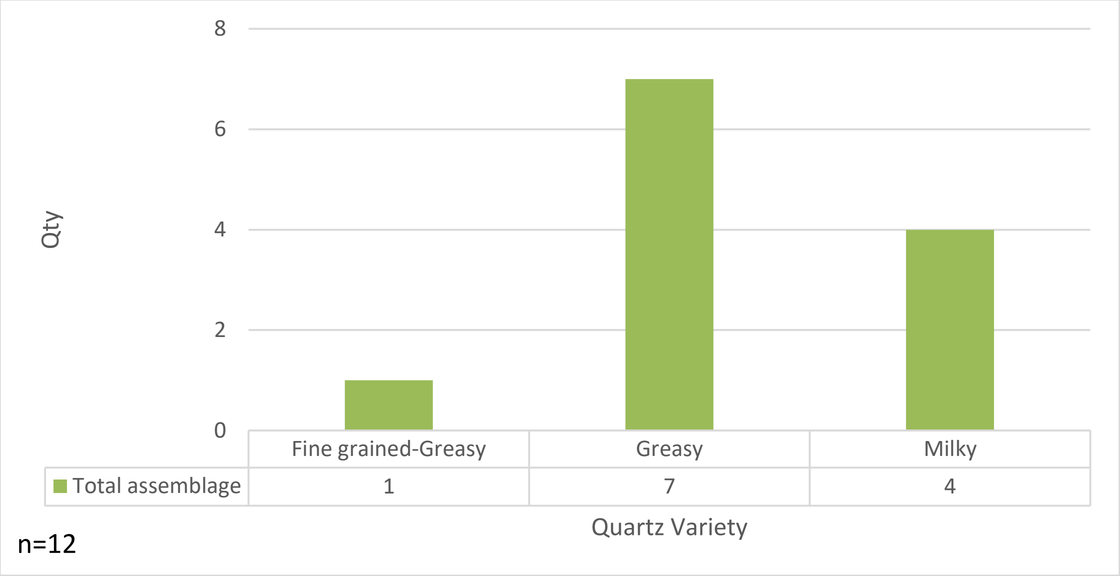


Figure 228. Pabaigh Mòr South quartz varieties

A total of two quartz pieces were recovered from the interface layer (C001). The majority of the quartz assemblage and the single piece of flint derive from the main body of the shell midden (C002; Figure 229).

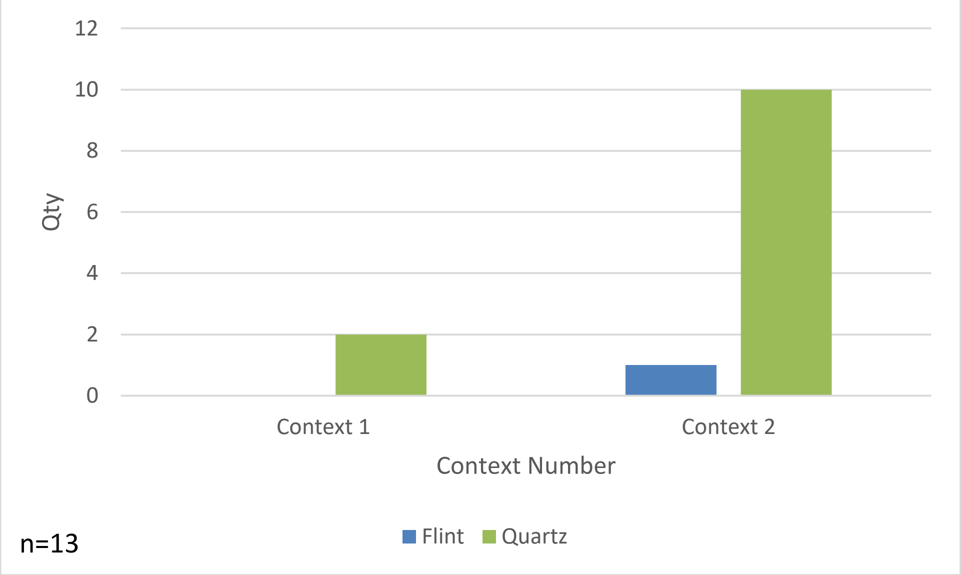


Figure 229. Pabaigh Mòr South raw material by context

The primary technology from the site is presented below with results of the small fraction flake, chunk, and small fraction chunk assemblage detailed in Appendix Twelve.

6.6.2.3. Primary Technology: Test Piece

L13 was recovered from the main body of the shell midden (C002). It is a piece of fine grained to greasy quartz, and it appears to have been discarded following testing of the raw material block/plate. The plate measures 110.4mm in length and weighs 127.09g. There is no cortex observable on the piece; however both faces are flat with slight evidence for weathering. There are five unidirectional removals along the length of the plate, all struck from unprepared platforms. A further removal on a lateral edge, running perpendicular to the rest of the flake removals is the scar created from the blow used to detach the piece from its source (Figure 230, with three of the removals arrowed).

Figure 230. L13 tested quartz block with three of the removals arrowed

6.6.2.4. Primary Technology: Core

A single white, completely patinated, flint core was recovered from the shell midden (C002). It measures 13.97mm in length and weighs 1.78g. Nine multidirectional flake removals were recorded from lost or unprepared platforms. The cortex present on the piece is smooth, hard, and slightly rounded, suggesting it may have been a beach pebble.

6.6.2.5. Primary Technology: Flakes

Four flakes (>10mm) were recovered from Pabaigh Mòr South and are described below. The flake core is detailed in the subsequent section. Data on the small fraction flakes (<10mm) and indeterminate chunks are presented in Appendix Twelve.

6.6.2.5.1. Raw Material

All of the flakes are quartz. The flakes from the interface layer (C001) are greasy (very fine grained) quartz, as is one of the flakes from the shell midden (C002). The other flake from C002 is milky quartz.

6.6.2.5.2. Flake Dimensions

The flakes range widely in their dimensions. The length varies between 10mm and 20mm, and in width from 4.8mm to 18mm. There is no correlation between these dimensions (Figure 231). However, there is a strong positive correlation between the length and thickness, and the width and thickness of the flakes (Figure 232 and Figure 233).

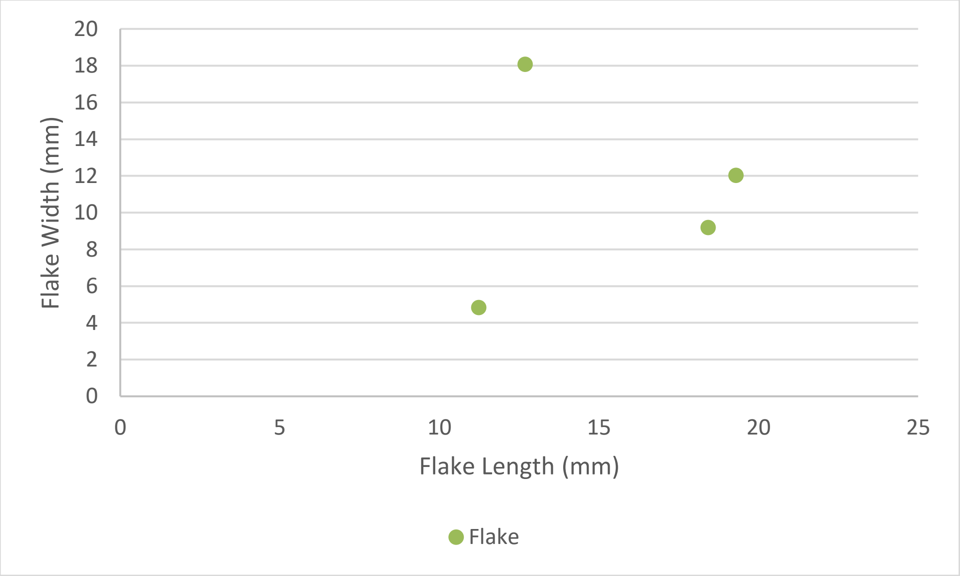


Figure 231. Pabaigh Mòr South flake dimensions length:width

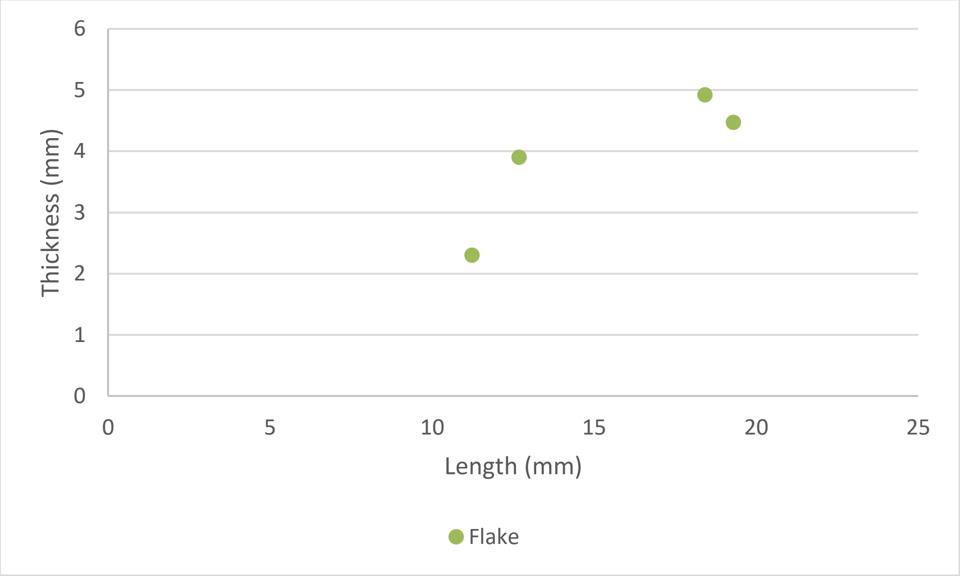


Figure 232. Pabaigh Mòr South flake dimensions length:thickness

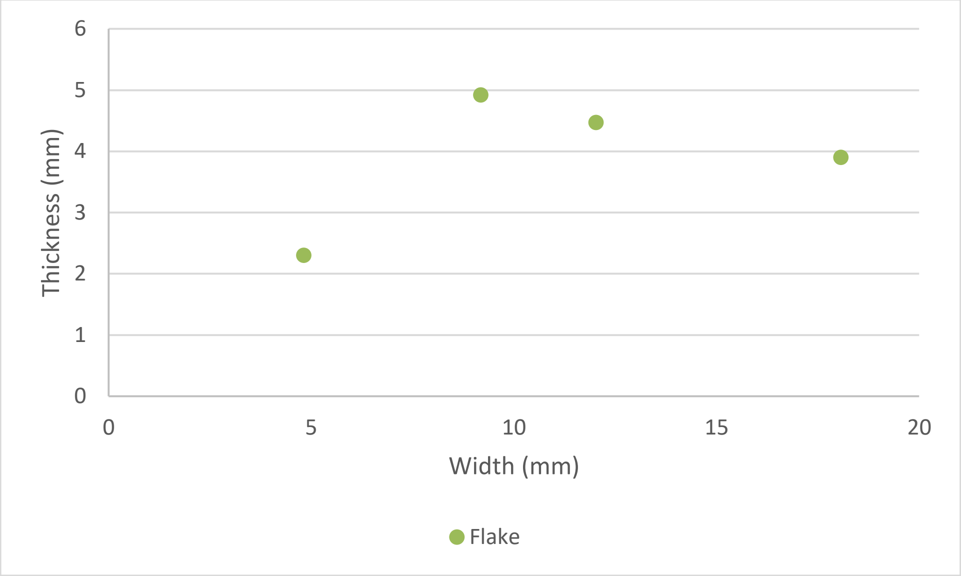


Figure 233. Pabaigh Mòr South flake dimensions width:thickness

6.6.2.5.3. Cortex

One flake does not display cortex, and another retains <50%. Two flakes have 100% dorsal coverage of cortex (Figure 234). The cortex on two of the pieces is flat and frosted, suggesting they have been removed from a block or plate of raw material, probably from a vein. The cortex on the other is flat and smooth, which may indicate the source was a water worn beach pebble.

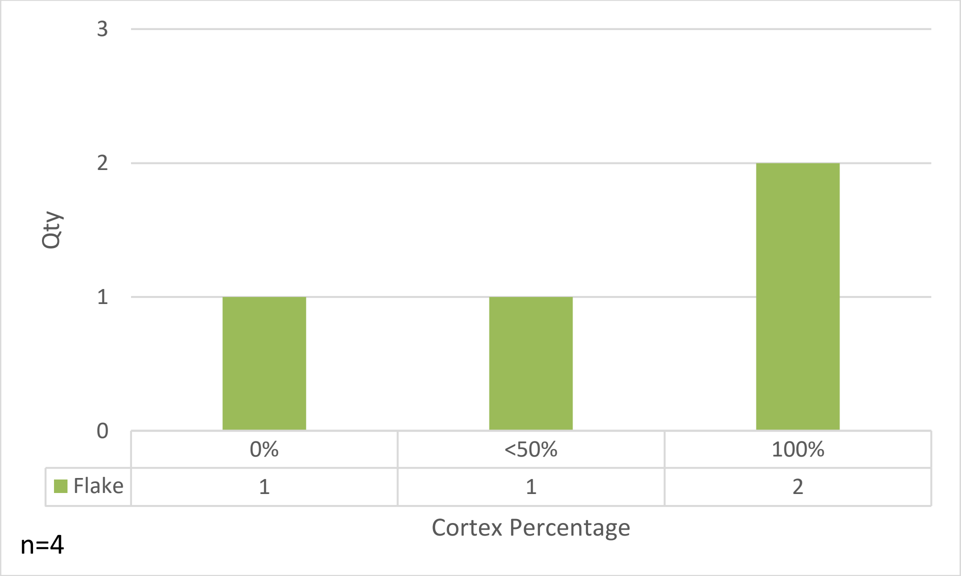


Figure 234. Pabaigh Mòr South flake cortex percentage

6.6.2.5.4. Platform – Type and Dimensions

Two of the quartz flakes have broken platforms and the platform is absent on another. A single flake has a plain platform which measures 8.11mm X 1.97mm.

6.6.2.5.5. Dorsal Flake Scars – Count and Patterns

Of the two flakes with dorsal scars present, both exhibit single unidirectional flake removals.

6.6.2.5.6. Flake Breakage

The entire flake assemblage from this site is broken to some extent.

6.6.2.5.7. Flake Core

The flake core, which was recovered from the shell midden context (C002), does not have any cortex present. It measures 3.73mm X 25.76mm X 5.74mm and has a broken striking platform. There is a single, unidirectional dorsal flake scar and the piece is broken along the left lateral edge due to a knapping error. This resulted in an accidentally rejuvenated platform that was used for a further flake removal on the dorsal side.

6.6.3. Assemblage Summary

The thirteen-piece lithic assemblage from Pabaigh Mòr South is a very small sample and is therefore not likely to be representative of the assemblage as a whole. It reflects the grab-sampling strategy employed upon discovery of the site, and is thus a very small proportion of the lithic material that is likely to be contained within the remaining midden and interface deposits.

The mint condition of the single flint core recovered from Pabaigh Mòr South suggests that is has experienced very little post-depositional movement, and the patina may therefore relate to the alkaline nature of the burial conditions (Rottländer 1975). The small size and high number of flake removals from this core, taken from several different directions, indicates that it was worked until it was exhausted, then discarded. The cortex on the flint core suggests it derived from a secondary water-borne context, such as a pebble on a beach. To reiterate, there are no known sources of flint nearby. The flake removals are multidirectional and do not indicate a bipolar reduction strategy. As such, the original flint pebble may have been large enough to reduce through platform technique.

The remainder of the assemblage comprises quartz flakes, indeterminate pieces and a tested quartz plate. The presence of small fraction debitage and indeterminate pieces is indicative of knapping on the site, or close by, with the waste material deposited in the midden. The flakes vary in size, with the larger pieces retaining complete or partial cortex, marking them as primary and secondary flakes from early in the reduction process. The smaller flake, which does not have any cortex present, only bears a single flake scar and may have been removed later in the *chaîne opératoire*. From the cortex present on three of the flakes, the quartz was procured from both primary and secondary sources, and is likely to have been reduced using a combination of platform and bipolar technology.

It appears that the exploitation of flint and quartz at Pabaigh Mòr South follows the same process as the sites on the Cnip headland across the water, namely conservative reduction of rare flint pebbles and profligate treatment of ubiquitous, high quality quartz. Only further investigation of the site can affirm this.

6.7. Conclusions

This chapter has presented the lithic data from six Mesolithic shell midden in Lewis: Tràigh na Beirigh 1, 2, 3, 4 and 9, in addition to Pabaigh Mòr South. The data and initial conclusions drawn from each of the assemblages in this chapter will be combined with the results from the open air sites from Harris, which were presented in the previous chapter, in order to understand the similarities and differences between the assemblages from these two different site-types. The interpretation of these results is discussed and contextualised within the Mesolithic of Scotland and the broader Atlantic façade in Chapters Eight and Nine.

Chapter 7 Searching for the Inland Mesolithic of the Western Isles: A Survey of Gleann Mor Barabhais

7.1. Introduction

This chapter presents the findings of an additional project that was conducted in 2013, alongside the main focus of this thesis. The study of the Mesolithic in this region has been hampered by a number of issues, most pertinent of which are problems of archaeological visibility in the Western Isles, and investigation away from the coastal zone.

A Mesolithic presence in the Western Isles has been successfully confirmed, as detailed in the preceding four chapters. Furthermore, a number of investigations in the interior of mainland western Scotland, and the islands of the Inner Hebrides, have yielded positive indicators of inland Mesolithic occupation. During 2013 a survey was conducted in an attempt to assess the likelihood of identifying the Mesolithic in the interior of the Isle of Lewis.

A specific set of research questions were generated for this investigation, and the methodology was drawn from inland investigations in both Britain and Norway. The identification of Mesolithic sites in the interior has, however, been has been cautioned as “more likely to be a matter of chance than of careful research” (Armit 1996:34).

7.2. Investigating the Interior in Scotland and Norway

7.2.1. Location

The overall distribution of Mesolithic sites in Scotland and the surrounding islands is coastally biased. This imbalance reflects a combination of settlement choice by Mesolithic people, coupled with greater visibility and ease of access for research by archaeologists, of which the latter contributes most significantly (Wickham-Jones 1990c). A number of factors, which were discussed in Chapter Two, have hindered archaeological investigation of the Scottish interior region. These can be summarised as: peat formation, ‘greening’ of the landscape (Edwards & Mithen 1995) and topography, especially in the highland region, which limits access described above. Instances where Mesolithic sites have been identified inland are frequently accidental, such as in forestry ploughing and drainage up-cast (Affleck *et al.* 1985; Edwards *et al.* 1983; Wickham-Jones & Firth 2000:123; Woodman 1989:6) or through farming and amateur surface collection (Mithen 2000f:9; Ward 2010). Furthermore, these ‘sites’ are predominantly un-stratified artefact scatters or isolated finds. Alternatively, sites are located as a result of targeted investigation for research (Affleck 1984a; 1984b; 1984c; 1984d; 1985a; 1985b; Edwards *et al.* 1983) or prior to infrastructure development (Bain 1995; Cachart 1989; Centre for Field Archaeology 1991; Duncan 1997; Mackenzie 1995; 1996; 2002; Mitchell 2002; Mitchell & Neighbour 2003).

Despite the issues affecting discovery, inland Mesolithic sites have been identified in south-west Scotland through investigation of major river and loch systems such as the Tweed, Ken and Doon. These rivers were likely to have functioned as inter-connecting route-ways through the interior during the Mesolithic (Edwards *et al.* 1983; Ward 2010:3). Recently, significant Mesolithic sites have been recorded in the Biggar Gap floodplain where the Biggar Water connects the Tweed in the east and the Clyde in the west (Ward 2010:4). Furthermore, the evidence suggests that upland regions were also exploited, as evidenced by the Daer reservoir sites situated at 300m a.s.l (Saville 2000:94; Ward 1995; 1997). This is corroborated by the identification of over a dozen Mesolithic upland/inland sites situated on plateaus close to river systems in Yorkshire, which “appear to confirm the association of Mesolithic sites in the uplands (and dales) with wetland habitats” (Donahue & Lovis 2003:312).

In Norway, similar academic and environmental issues prevail, such as bog formation and an overarching bias in research towards the coast (Bang-Andersen 2003b:15; Boaz 1998a:63). However, this has been mitigated by major engineering and hydro-electrical schemes, conducted since the 1920’s, which have altered the water levels of inland lakes and required investigation along substantial river systems such as the Dokkfløy, Glomma and Rena, resulting in the discovery of numerous inland Mesolithic sites (Bang-Andersen 2003b:15; Boaz 1998b:131; 1998a; Persson 2009). In northern Scandinavia, Mesolithic sites are identified through the presence of fire-cracked stones and quartz lithic debris eroding from the banks of lakes and rivers as general practice (Welinder 1977:13). From this work, it is clear that inland Mesolithic sites in Norway and northern Scandinavia appear to be similarly situated to those in Britain, with close connections to lakes and riverine locations, often occupying “well-drained gravel ridges” (Bang-Andersen 1989:340-344; 2003b; Fretheim 2009:379; Persson 2009). However, even inland, research bias may also present an obscured picture of Mesolithic settlement (Bang-Andersen 1989). Relatively few Mesolithic sites are known, or have been excavated, from the low lying forested interior of Norway for instance, although there are some known from the high mountains (Boaz 1998a:32, 37-8). Consequently, some archaeologists have called for survey work to be conducted away from the rivers to rectify this (Fretheim 2009:383). To this end, it is significant that investigations in Scotland have begun to identify sites in ‘dry’ areas i.e. away from watercourses (Ward 2010). On the whole, this evidence suggests that inland evidence for Mesolithic activity in the Western Isles is very likely.

7.2.2. Methods

The methods used to investigate inland areas vary depending on local conditions. As on the coast, erosion has been responsible for the identification of numerous sites in western Scotland. The natural fluvial process of a flowing river may produce transects through the mid- to late-Holocene peat development, potentially exposing the relic ground surface below (Wickham-Jones & Firth

2000:123; Figure 235). Where sites have been identified by lakes or rivers, such as by Loch Doon, lithics and charcoal were observed in the freshly eroding sections of loch edges or river banks (Affleck 1984c; 1984d; Ansell 1968c; 1969b). Unsystematic investigation by the Scotland's First Settlers and Southern Hebrides Mesolithic projects focussed on inspection of other erosion events, such as natural scars, peat cuttings, footpaths, road drains, and mole hills (Hardy 2009a; Mithen 2000a:57). The identification of an artefact scatter excavated at Kati's Bay, Skye was made when lithics were uncovered in a sheep 'scrape' - a deliberate hollow made by sheep for shelter (Kozikowski *et al.* 1999).

Figure 235. Eroding peat hags along the banks of Gleann Mor Barabhais. Photo courtesy of Peter Rowley-Conwy

Locations for shovel pits, test pits, and trial trenches are most often governed by prior investigation, such as systematic field-walking or walk-over surveys, which identify 'hot spots' of activity like lithic scatters. Test-pitting is then often conducted to assess the viability, preservation, or extent of a site once it has been located (Hardy 2009a; Mithen 2000a:58-59). Unfortunately in the Western Isles only 0.14% of the total agricultural area is dedicated to arable farming, where ploughing could facilitate field-walking as a method of investigation. Only a slightly greater area (0.19%) is forested, where drainage ditches and up-cast could be observed (Scottish Government Environment and Forestry Directorate & RESAS 2013). In the absence of viable ploughed land in Norway 'blind' test-pit surveys have been extensively used (Bang-Andersen 1989; Woodman 1989). However, this method is both time consuming and labour intensive, requiring a detailed sampling strategy and the transportation of heavy equipment, with limited success of identifying a site (Mithen 2000a:57-58).

7.3. Research Questions

Understanding spatial relationships is one of the most integral aspects of archaeology (Clarke 1977). It is clear from the archaeological evidence presented above that the perceived distribution of Mesolithic occupation along the coast is a misnomer; therefore a predictive model can be used to evaluate the potential for occupation evidence in other, less obvious, locations (Woodman 1997:41-43). This has the benefit of providing a "guide to fieldwork, thus making it a more cost and time effective procedure" (Woodman 1997:41), especially regarding the significant challenges to archaeological investigation of the interior that are presented by the environment of the Western Isles.

For this survey it was predicted that riverine contexts would provide the greatest potential for investigation. This was based on several factors: first was the burgeoning evidence in Scotland, and significant finds in Norway for Mesolithic occupation along rivers. Second was that the types of deposits most likely to produce evidence for Mesolithic activity in the interior were expected to be located under thick peat and overlying glacial till, as in evidence at the coastal sites of Northton, Tràigh an Teampuill, and Tràigh na Beirigh 2, which were sealed beneath metres of machair and observed eroding from the cliff-edge. As such, the most viable of the limited methods available to investigate this landscape was to inspect eroding areas caused by fluvial activity.

There were four research questions that the inland survey aimed to explore.

QI. Is there a Mesolithic presence in the interior of the Western Isles?

The successful identification of Mesolithic sites in the interior would supplement the burgeoning proof for hunter-gatherer habitation of these islands, where previously evidence for human occupation was limited to palaeoenvironmental conjecture. If no sites were found, this would raise further questions of whether archaeologists are looking in the right place (see Q.2), or if Mesolithic occupation was restricted to the coast.

QII. Do these sites occur in riverine locales, where predicted?

Today, the River Barvas provides seasonal gluts of salmon and sea trout in late summer-early autumn (Fish Hebrides 2014; Groome 1884-1884:133). Rivers not only provide access to essential fresh water and a ready supply of edible aquatic resources, but also facilitate transport links (Bonsall *et al.* 2009:71; Edwards *et al.* 1983; Warren 2005b:63).

QIII. What is the age, character, and formation processes of these site(s)?

The highly acidic nature of the peaty soils in the region are not conducive to bone preservation (Fairnell & Barrett 2007:469); therefore, lithics and carbonised plant material are frequently the only surviving Mesolithic evidence recovered from inland sites in Scotland and Norway. The presence of lithics undeniably attests to human presence; whereas carbonised plant material may result from anthropogenic activities, or a natural event (cf. Edwards 1996; Tipping 1996). The recovery of carbonised plant material would provide means to date the sites. The dating evidence from the six coastal Mesolithic sites presented in Chapters Five and Six span the late to terminal Mesolithic, therefore the recovery of dating evidence would further refine the chronology for Mesolithic occupation in the Western Isles.

7.4. Methodology

7.4.1. Preliminary Investigation

A desk-based assessment was conducted using Ordnance Survey Landranger 1:50,000 Maps and Google Earth to identify a river system that would offer the most prospective location for Mesolithic sites. The criterion for this was that the river must be geographically constrained within a valley; ensuring marginal alteration to the watercourse over the last 7000 years. Gleann Mor Barabhais was selected as the most ideal locale. This is the longest river in Lewis, penetrating c. 10km into the island's interior (Figure 236). Furthermore, historical and modern fishing accounts attest to the abundance of salmon in this river, which would have no doubt attracted Mesolithic hunter-gatherer-fishers (Fish Hebrides 2014; Macrae 1836; Martin 1703).

The locations and details of all previously recorded archaeological sites in the vicinity of the river were obtained from the Royal Commission on the Ancient and Historical Monuments of Scotland's online database CANMORE. These were plotted in ArcGIS ArcMap 10.0 on to Ordnance Survey MasterMap 1:1000 raster data of the area, obtained from the University of Edinburgh's online mapping and geospatial data resource 'Digimap', and converted to ESRI format by ESRI Productivity Suite 2.1 MapManager software. The survey area was arbitrarily restricted to a 10m radius of the river banks; a 10m buffer zone was created and applied to the inland water polygons that represented the surveyed river. Any previously recorded sites that fell outside the buffer zone were subsequently omitted from the survey.

7.4.2. Walkover Survey

As the nature of the topography prevented traditional methods of preliminary archaeological survey such as field-walking (and therefore surface collection of material), a walk-over survey was conducted which would identify and record visible archaeological features along both banks of the river. Observations were made of eroding sections and banks for diagnostic attributes that may indicate Mesolithic activity. Any material of this type was expected to be contained in deposits situated below peat and above glacial till. The presence of carbonised plant macrofossils, namely wood charcoal and charred hazel nutshell, would provide the dating evidence required to confirm these sites as Mesolithic. Furthermore, there is currently no record of large terrestrial game for the post-glacial of the Islands (Fairnell & Barrett 2007). Preservation conditions permitting, interior sites may provide valuable insight into native terrestrial species and their exploitation.

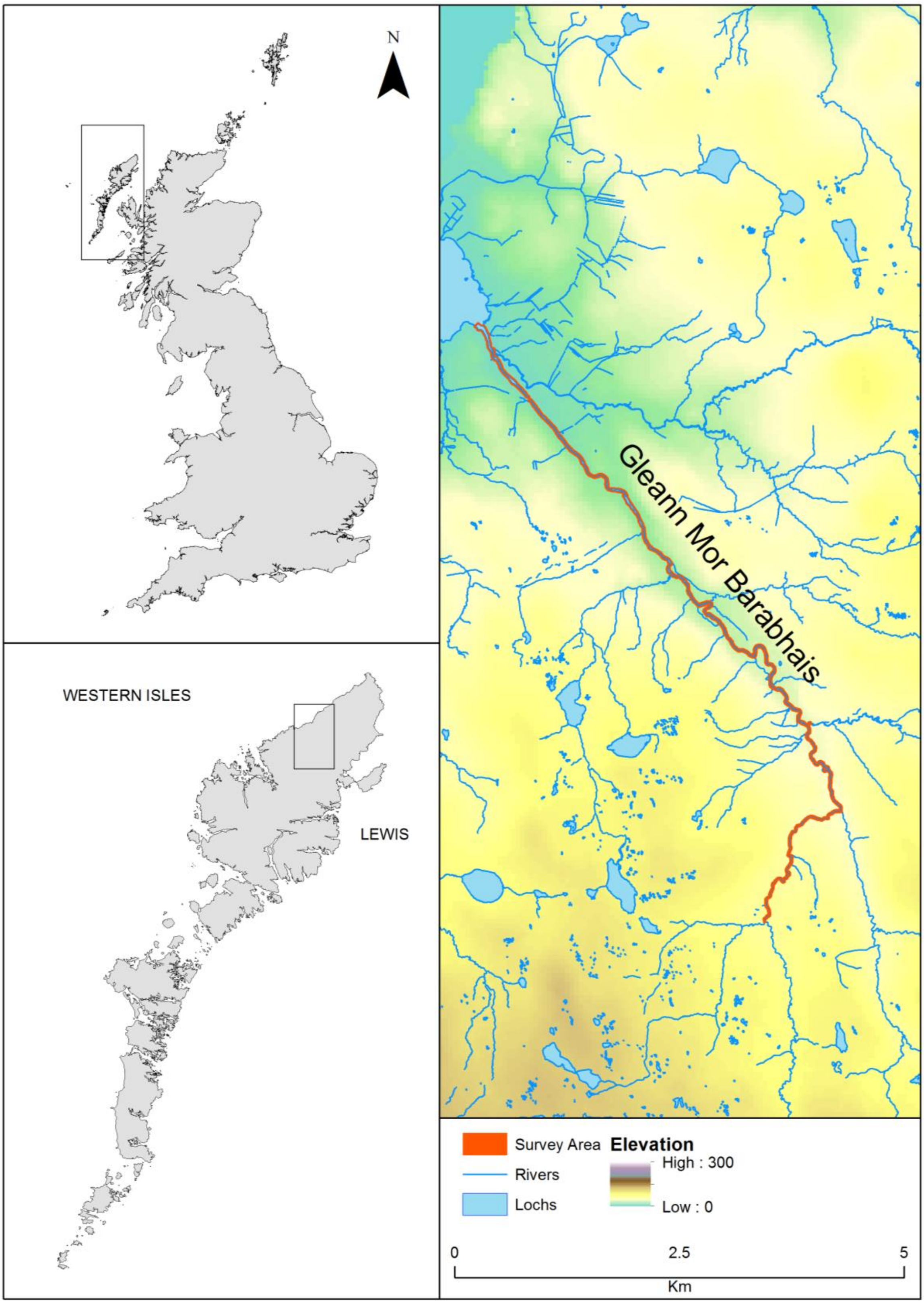


Figure 236. Gleann Mor Barabhais survey area. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

7.4.3. Monument Recording, Excavation and Sampling

The overall aim of the survey was to identify potential Mesolithic sites, however it was decided that a full archaeological survey should be conducted; therefore, all archaeological remains, regardless of age were recorded. The catalogue of all recorded sites is provided in Appendix Fourteen.

A field survey record sheet obtained from the Orkney Research Centre for Archaeology was used as a template to record the sites, detailing the information listed in Table 39. A sketch plan of each site was also drawn in addition to this information.

Attribute	**Information required**
Site Code	DLS'13. This was derived from **D**urham **L**ewis **S**urvey 20**13**
Site Name	The name of the river being surveyed – Gleann Mor Barabhais
Site Number	The number attributed to the site being recorded
Northings and Eastings	The six or eight-figure National Grid Reference (NGR) beginning NB. For speed and portability in rough terrain a navigation-grade (handheld) Garmin GPS was used following English Heritage guidelines (Ainsworth & Thomason 2003); consequently all GPS points were recorded to c.10m accuracy, additionally an Ordnance Survey Explorer 1:25,000 map of the area was used in case of GPS failure
Type	The site type being recorded i.e. cairn, shieling etc.
Previously noted?	This identified whether or not the site has been previously recorded - if so, details of the Sites and Monuments Record (SMR), National Monuments Record (NMR) and Scheduled Ancient Monument (SAM) numbers were also given
Photograph number	The numbers of any photographs taken which could be cross-referenced with the photograph register; not all sites, for example lazy beds, were photographed
Erosion	The state and possible cause of any erosion affecting the site
Estimated date	Estimated age of the site
Description/Interpretation	Written description of the site, including dimensions and any other sites in the vicinity the site being recorded may be associated with

Table 39. List of attributes recorded for each site

When a site indicating significant potential of Mesolithic activity was identified, the above information was recorded and further recording techniques implemented. The section was cleaned, photographed and recorded using standard single-context recording. An illustration of the section identifying the different stratigraphical units was drawn at 1:10 (Figure 237). Two soil micromorphology samples (S.1 and S.2) were taken from the eroding section to provide detailed site-formation information (Macphail *et al.* 1990), and a single bulk sample of c.3.5 litres (S.3) was also excavated to ensure the maximum recovery of environmental remains (Jones 1991). The soil micromorphology samples were wrapped in cling-film and placed in sealed bags to be transported to the environmental laboratory at Durham University. The samples were kept in cold storage (4°C) until required for sampling.

7.4.4. Laboratory Methods

7.4.4.1. Bulk Sample Processing

The bulk sample was sub-sampled for routine soil tests (loss on ignition, magnetic susceptibility and soil pH) by Elise McLellan as part of her MSc guided study, prior to floatation by hand to recover artefacts and ecofacts (Kenward *et al*. 1980). The flot was caught by 1mm and 0.5mm mesh sieves and a 1mm mesh sieve retained the residue. Both flots and residue were slowly oven-dried before being fractioned through geological test sieves at 4mm, 2mm and 1mm mesh sizes for sorting using a low-powered stereo microscope at X15-80 magnification.

7.4.4.2. Palaeoenvironmental Analysis

Charcoal was only extracted from the >4mm fraction due to difficulties in identifying fragments below this size (Pearsall 2000). The identification of wood species was conducted by examining the transverse, radial and tangential sections at up to X600 magnification. The remaining archaeobotanical remains were recovered from all fractions. The identification of plant macrofossils was aided by modern reference material held in the Department of Archaeology, Durham University. Nomenclature follows Stace (1997).

7.4.4.3. Sedimentary Analysis

Sedimentary analysis was undertaken on a 5ml sub-sample of the bulk sample and at 1cm increments for each of the soil-micromorphology samples.

7.4.4.3.1. Basic Soil Description

Basic descriptions of the physical characteristics of each sample were recorded for the sub-sample of the bulk sample and the two soil-micromorphology samples. This comprised texture, following DEFRA guidelines (2006), and colour which was estimated using a Munsell colour chart.

7.4.4.3.2. Magnetic Susceptibility

Mineral magnetic analysis was conducted on $4cm^3$ sub-samples. Samples were dried and ground with a pestle and mortar before being passed through a 2mm mesh sieve to remove stones and large particles. The <2mm fraction was placed in $1cm^3$ vials in a Bartington MS2G Single Frequency Sensor. The volume specific magnetic susceptibility (κ) was calculated following Dearing (1994). For Sample 1, magnetic susceptibility and loss-on-ignition could not be conducted between 9-9.4cm as the layer is heavy in stone inclusions and not enough material could be recovered for the analysis.

7.4.4.3.3. Loss-on-Ignition

Sequential loss-on-ignition was conducted following (Heiri *et al.* 2001). 1cm³ sub-samples were dried in ceramic crucibles in a Carbolite AAF Furnace for 16 hours at 105°C. Upon removal for cooling, lids were placed over the crucibles inside a dessicator to ensure atmospheric moisture was not re-absorbed into the dried samples, thus affecting the mass (Heiri *et al.* 2001). This was repeated after the samples were replaced in the furnace and burnt at 550°C for four hours. The organic content of each sub-sample is calculated through the percentage difference of the dry-weight before and after firing (Heiri *et al.* 2001).

7.5. Survey Results

The investigation was conducted, intermittently due to inclement weather, over ten days during September 2013. Both banks of Gleann Mor Barabhais, and a substantial tributary of the river along Gleann Airigh na Gile, were surveyed during this time. Due to the weather, there was clear evidence for recent high river levels in the area; therefore there were numerous fresh erosion scars from bank collapse that could be inspected.

A total of thirty features were recorded during the survey, seven of which had been previously identified and were present in the NMR. Three sites detailed in the NMR that fell within the survey area were not located during the investigation. Twenty-nine of the sites most likely date between the Medieval and modern periods. These include a high number of lazy beds, structures, and earthworks – often in association with one another. Two shielings, and walls built to stabilise the river banks, were also recorded. The full details of these sites are presented in Appendix Fourteen.

7.5.1. Excavation Results

Of the thirty recorded sites, only a single feature (DLS'13 #30; NB 3746 4648) displayed evidence for potential early anthropogenic activity of the type the survey was designed to locate. At an eroding section of the river bank, further worn away by a sheep scrape, a c.6cm layer of dark brown/black silty-clay with charcoal flecks was identified overlying a thin layer of grey clay and well-sorted gravel. This was in turn overlain by series of alluvial laminations under the turf. The layer was visible for c.5m along the eroding edge. A 0.95m stretch of the section was targeted for bulk-sampling for evidence of archaeological material (S.3). The layer is present between 3-7cm in S.1, and 4-9cm in S.2 (Figure 237, Figure 238 and Figure 239).

7.5.2. Palaeoenvironmental Analysis

Eleven pieces of small deciduous round-wood charcoal were recovered from the 4mm residue fraction of DLS'13 #30. The charcoal was very poorly preserved, with post-depositional iron-oxide mineral deposits largely obscuring diagnostic features. Despite this, the fragments were positively identified as *Calluna vulgaris* based on the diffuse pore arrangement, and the fact the largest of these pores appeared in the upper third of a single growth year (Hather 2000; Schweingruber 1990; Lorne Elliott pers. comm.). Additionally, the sample contained the charred remains of typical heathland species including a single seed of *Arctostaphylos* cf. *uva-ursi* (Bearberry), culm nodes and a culm base of *Poaceae* spp., two rhizomes, and an abundance of sclerotia (resting bodies) of *Cenococcum geophilum* (Table 40). This ectomycorrhizal soil fungus is known to be closely associated with the roots of tree species including *Betula* and *Pinus* (Hudson 1986). This therefore implies the presence of such tree species in the vicinity of the burning activity.

Charred plant macrofossils		**Qty**
Charcoal		
Calluna vulgaris		11
Charred plant material		
Poaceae undiff.	culm node	3
Poaceae undiff.	culm base	1
Poaceae undiff.	rhizome	2
Arctostaphylos spp.	seed	1
Cenococcum geophilum	sclerotia	>120

Table 40. Abundance of charred plant macrofossils recovered from Sample 3

The band of silty clay loam sampled for potential archaeological evidence has a high, diamagnetic organic content (56-65%), with magnetic susceptibility ranging between extremely low and positive, to slightly negative. This contrasts to the overlying alluvium which is very low in organic content (10-30%), and has slightly elevated levels of magnetic susceptibility. In the underlying thin band of grey clay the percentage of organic content is equal to that of the overlying alluvium, and the level of magnetic susceptibility peaks, although is still low. There is virtually no organic content (<10%) present in the basal gravel layer, and the magnetic susceptibility is very low (Figure 240). Magnetic susceptibility and loss-on-ignition could not be conducted between 9-9.4cm in S.1 as the layer is heavy in stone inclusions and not enough material could be recovered for analysis. Overall, the lack of magnetic enhancement of this material indicates burning did not occur *in situ* (Dearing 1994).

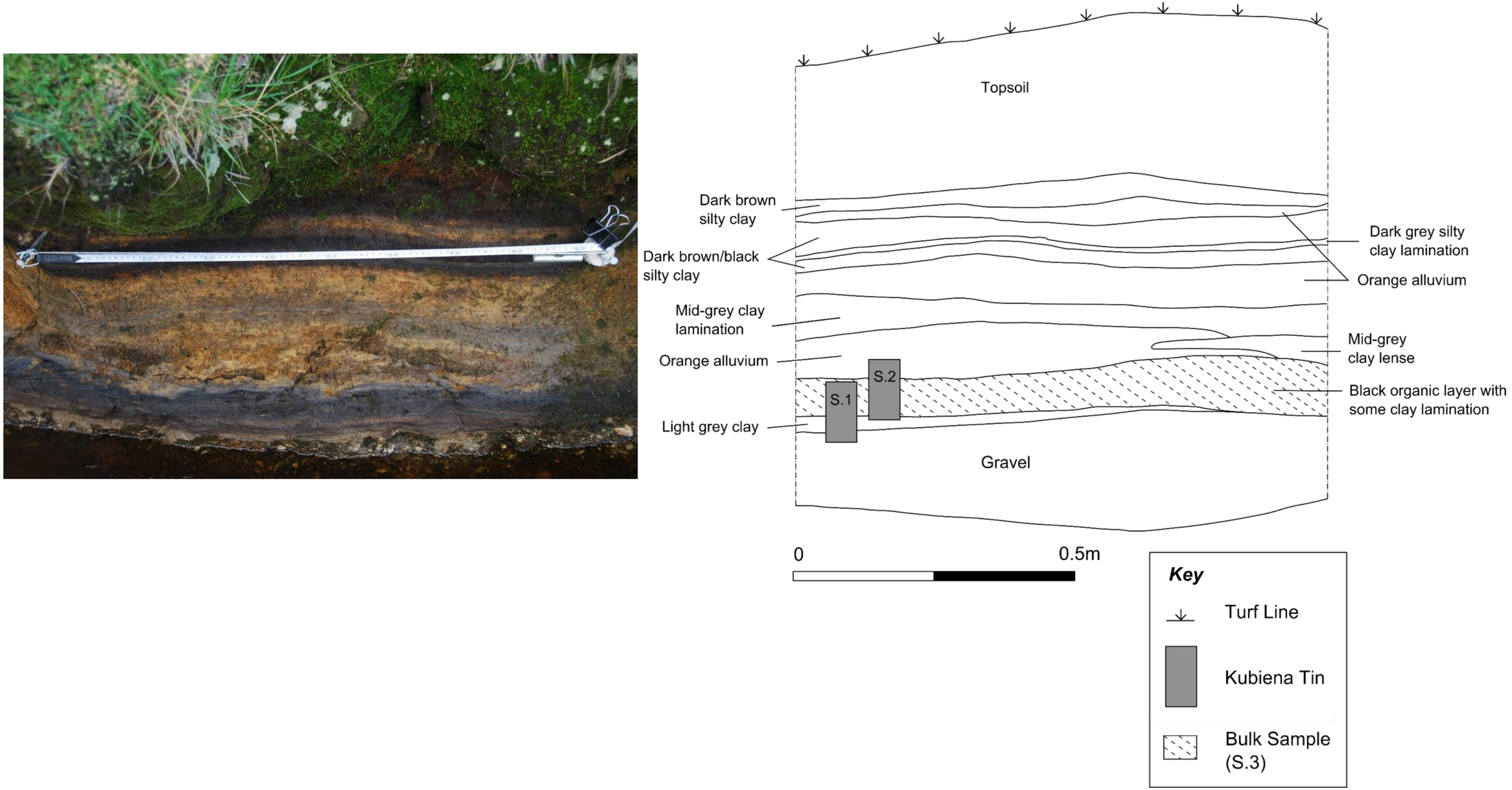


Figure 237. Left - Section of DLS’13 #30, cleaned before sampling, facing south-west; Right – DLS'13 #30 section 1:10

Sample Depth (cm)	Soil Colour and Texture
0-3.4	Black (2.5Y 2.5/1) silty clay loam. Transition is sharp in to underlying layer at 3.4cm.
3.4-3.6	Thin lense of very dark brown (7.5YR 2.5/3) silty clay loam. Transition with underlying layer is distinct between 3.5-3.6cm.
3.6-5.5	Very dark grey (2.5Y 3/1) silty clay loam which grades into the underlying layer between 5.5-5.6cm.
5.6-7.2	Dark greyish brown (2.5Y 4/2) silty clay loam which grades in to the underlying layer between 6.8-7.2cm.
7.2-8.8	Yellowish brown (10YR 5/8) sandy loam with frequent very small (<1cm) angular gravel inclusions.
8.8-9.4	As above, small quantity of yellowish brown (10YR 5/8) sandy loam with predominantly small (<3cm) angular gravel inclusions.

Figure 238. DLS'1 #30 Sample 1 basic soil description

Sample Depth (cm)	Soil Colour and Texture
0-2.6	Mottled very dark grey (10YR 3/1) and dark yellowish brown (10YR 4/6) sandy clay loam which grades in to the underlying layer between 2-2.6cm
2.6-3.5	Black (10YR 2/1) silty clay loam which grades in to the layer below between 3.5-3.7cm.
3.7-6.0	Black (2.5Y 2.5/1) silty clay loam. Transition is sharp to the underlying layer at 6.0cm.
6.0-6.4	Thin lense of very dark brown (7.5YR 2.5/3) silty clay loam. Sharp transition with underlying layer at 6.4cm.
6.4-8.3	Very dark grey (2.5Y 3/1) silty clay loam which grades in to the underlying layer between 7.8-8.3cm.
8.3-9.0	Dark greyish brown (2.5Y 4/2) silty clay loam.

Figure 239. DLS'1 #30 Sample 2 basic soil description

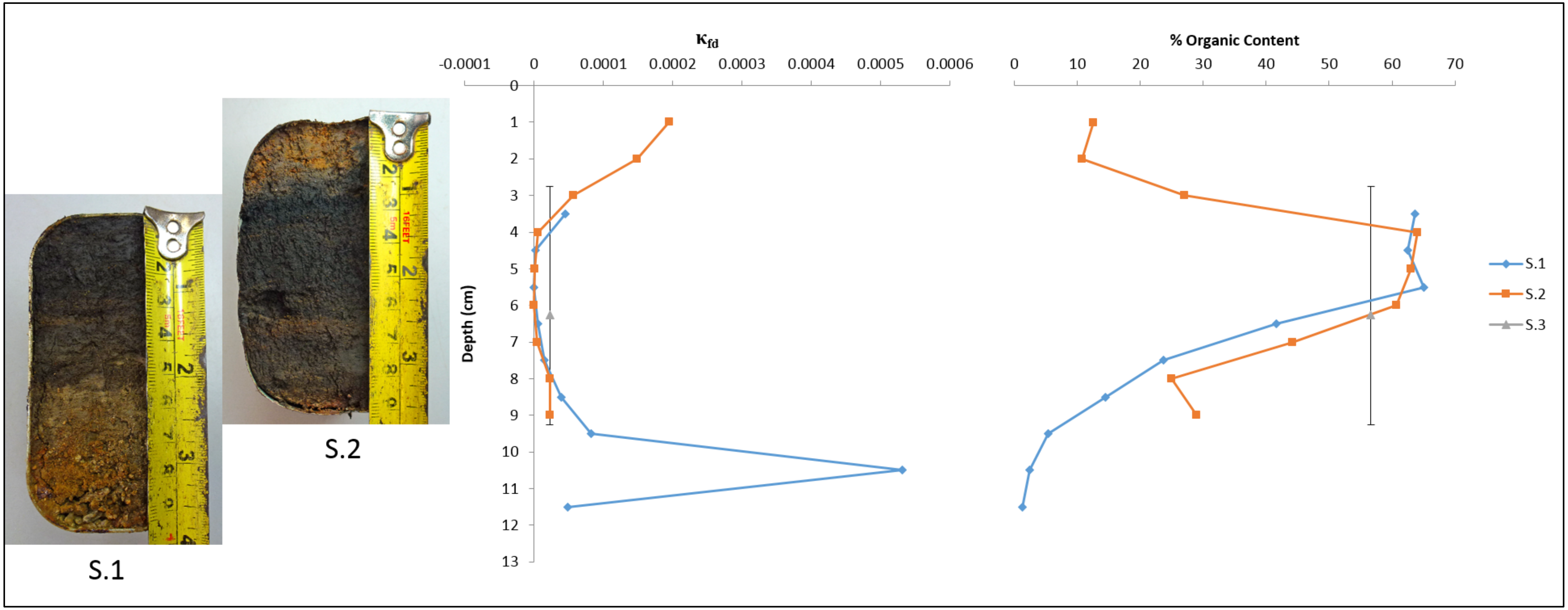


Figure 240. DLS'13 #30 loss-on-ignition and magnetic susceptibility results

7.5.3. Radiocarbon Dating

A single fragment of deciduous round-wood charcoal was submitted for single-entity AMS radiocarbon dating at the Scottish Universities Environmental Research Centre (SUERC). Calibration of the date was conducted using OxCal 4.2 (Bronk Ramsey 2014), with atmospheric data derived from Reimer *et al*. (2013). This piece was dated, at 95.4% probability, to 4460-4355 cal. BC (5583±27 B.P., SUERC-55370, Figure 241), placing it at the end of the Late Mesolithic in Britain (Piper *et al.* 2015).

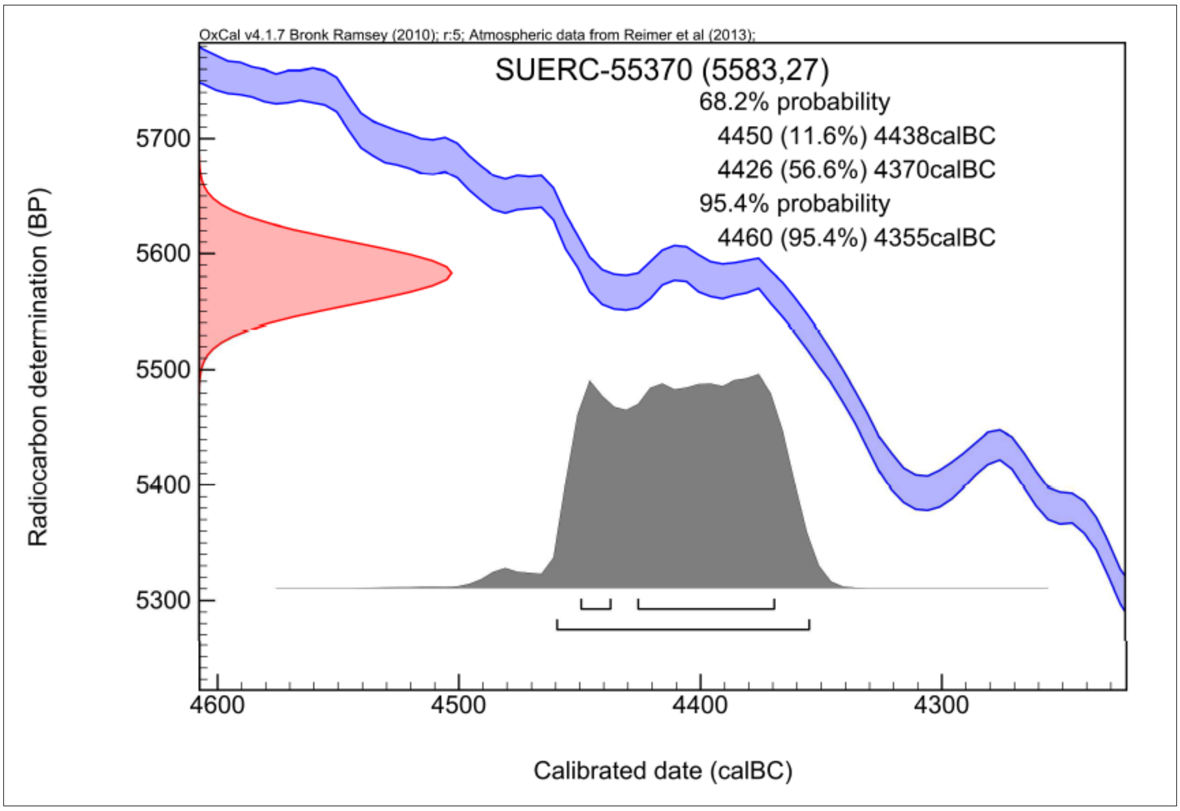


Figure 241. Calibration plot of radiocarbon dated charcoal from DLS'13 #30

7.6. Discussion

Research Question 1: Is there evidence for Mesolithic dated burning in the interior of the Western Isles?

The charred palaeoenvironmental material recovered from DLS’13 #30 dates to the Late Mesolithic of Britain. The carbonised heather and other plant macrofossils were recovered from floodplain deposits c.5km inland from the present coastline. During this time the sea level would have been as much as 5m lower than today (Jordan *et al.* 2010:131; Ritchie 1979; 1985:174-175)**.** The wider catchment from which the material is likely to have originated extends a minimum of 7km further up-river, and may be as much as 10km wide. This places the source of the material firmly within the interior of the Isle of Lewis.

Research Question 2: Do these sites occur in riverine locales, where predicted?

The survey targeted a major river, which was deemed unlikely to have significantly altered course over time. As previous investigations in Britain and Norway have proven, evidence for Mesolithic occupation is closely associated with watercourses and easily accessible to researchers (Bang-Andersen 2003b; Boaz 1998b; Donahue & Lovis 2003; Edwards *et al.* 1983; Persson 2009; Ward 2010). Inspection of the eroding banks of Gleann Mor Barabhais and the successful identification of Mesolithic-age palaeoenvironmental remains in section has demonstrated that locating sites using this methodology and predicted location of a riverine context is attainable.

Research Question 3: What is the age, character, and formation processes of these site(s)?

Age: The charcoal from DLS'13 #30 is Late Mesolithic date (4460-4355 cal. BC). This falls within the current range for known Mesolithic occupation along the coast of Lewis, between c.4600-4000 cal. BC, along the Cnip headland of the Bhaltos peninsula at the sites of Tràigh na Beirigh 1, 2 and 9.

Character and Site Formation: The effects of burning events on aggregate stability, principally causing an increased susceptibility of soils to water runoff and erosion, are well documented (i.e. Fox *et al.* 2007; Kutiel *et al.* 1995; Mataix-Solera *et al.* 2011; Yoder 1936). Archaeologically, the effects of such burning events in the Mesolithic have been intensively studied in the Pennines and North York Moors of Northern England. The degradation of soil through repeated Mesolithic burning activities has been attributed as a primary causal factor of the 6000 B.P *Ulmus* decline in these regions (Simmons 1975 ; Simmons *et al.* 1975; Simmons & Innes 1987; Sturludottir & Turner 1985).

Sedimentary analysis of the samples taken from DLS'13 #30 indicates that the site comprises a series of silty-clay alluvial laminations. The laminated nature of the stratigraphy and low magnetic susceptibility, described above, suggests that this small quantity of carbonised plant remains were not burnt *in situ*, but re-deposited. In light of this, and the above archaeobotanical evidence, it can be reasonably inferred that:

- a fire event occurred within the interior of Lewis, a landscape which comprised areas of heathland;
- the fire event occurred upstream of DLS'13 #30, within in a potential catchment area of the Barvas river that extends over 36.5km^2 (Figure 242);
- the resultant aggregate instability caused by this fire event led to soil erosion and runoff during a period of rainfall or flooding, which contained both sediment and charred plant macrofossils;
- the material carried by the runoff was redeposited during one or more low-energy hydrological events as the downstream floodplain accreted.

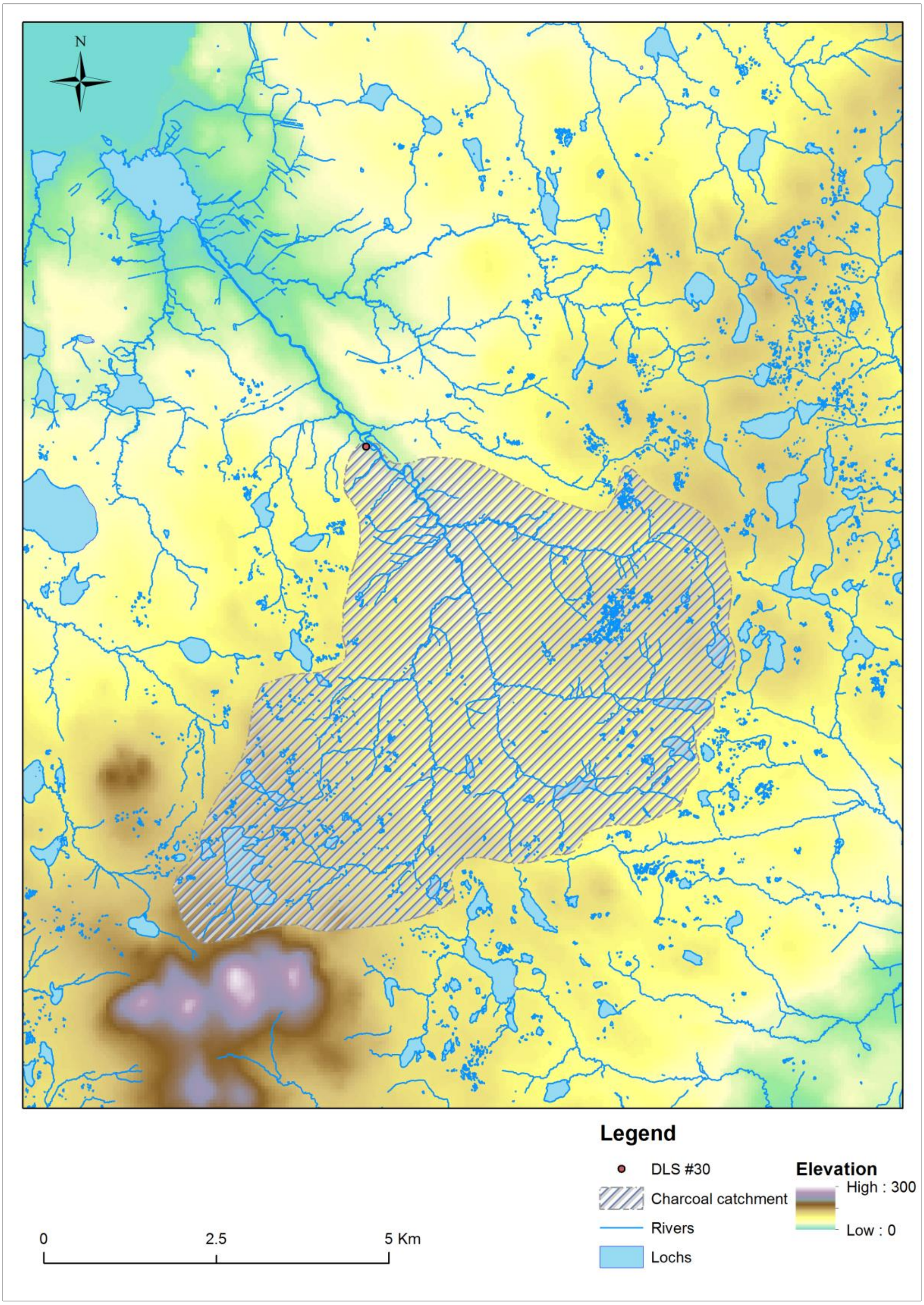


Figure 242. Topographic map detailing likely catchment for the source of charred archaeobotanical remains recovered from DLS'13 #30. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

The palaeoenvironmental evidence from DLS’13 #30 provides a very small snapshot of an open scrub/heathland area of landscape in inland Lewis. This is a significant contribution to understanding the palaeoenvironmental make-up of the Western Isles, which is traditionally described as open scrub birch-hazel woodland (Bohncke 1988; Tipping 1996). *Calluna* is tolerant of a wide-range of moisture and may grow in wet to dry conditions, from heathland mor humus or peat bog, to the open birch woodlands so well represented in the pollen diagrams from Lewis (Edwards 1996; Simmons 1996:108). The presence of *Cenococcum* within the assemblage attests to the presence, or former presence, of *Betulaceae* (birch) in the vicinity of the burning activity. The inferred presence of birch, in addition to the heathland shrub taxa of *Calluna* and *Arctostaphylos* suggests that the upstream catchment of Gleann Mor Barabhais comprised an open scrubland and heathland-carr environment, potentially with early bog formation (Stace 1997).

Evidence for the Mesolithic flora of the Lewisian landscape is present in pollen diagrams from Callanish-3, Loch Builaval Beag, and Loch na Beinne Bige, situated c.20 kilometres away from Gleann Mor Barabhais as the crow flies (Bohncke 1988; Fossitt 1996; Lomax 1997). These indicate that heathland only contributed to a very small proportion of total land pollen in the area at this time, although local expansions in *Calluna* heathland are recorded at Loch Builaval Beag and Callanish-3 between c.8400-7900 B.P. (Edwards 1996; Tipping 1996). It is likely, therefore, that the landscape comprised areas of heathland openings within a still-wooded environment (Fyfe 2007). At the site of Aird Calanais, East Loch Roag, charred plant macrofossils were recovered from an old ground surface below a Neolithic hearth feature (O'Brien *et al.* 2009). Charred hazel nutshell from the deposit was radiocarbon dated to 6685-5690 B.P., which is only slightly earlier than the dates from DLS'13 #30. Other palaeoenvironmental indicators included charcoal of *Betula* spp. and Salicaceae undiff. (willow/poplar), again indicating an open scrubland environment, similar to that at DLS'13 #30 (O'Brien *et al.* 2009). Although no interpretation could be made as to whether the burnt material derived from human or natural agency, the presence of a single undiagnostic piece of quartz may lend credence to an anthropogenic source. In contrast to Lewis, palaeoenvironmental evidence from Loch a'Phuinnd, South Uist indicates that there is evidence for a more widespread and well-established *Calluna* heathland on the southern islands during the Mesolithic period (Fossitt 1996).

Two popular models are frequently cited with regard to the presence of open areas in the Mesolithic landscape. The 'wood pasture' model proposes a patch-work of woodland and pasture "maintained by large herbivore grazing regimes" (Fyfe 2007; Vera 2000). The second 'high-forest' model, proposed by Peterken (1996), favours a closed-canopy landscape with some open areas. Bradshaw *et al*. (2003) argue that in both models "dense populations" of large ungulates are necessary in maintaining these areas of openness. There is currently no evidence for the presence of large terrestrial mammals in the Mesolithic of the Western Isles, however. In which case, the creation and/or maintenance of open areas within this landscape are likely to result from an alternative source: fire (Bradshaw *et al.* 2003).

There is an abundance of evidence for Mesolithic-age fire incidence connected with disturbance phases in local vegetation cover throughout Britain, particularly in the Pennine region (e.g. Albert & Innes 2015; Blackford *et al.* 2006; Caseldine 1999; Caseldine & Hatton 1993; Innes & Blackford 2003; 2009; Innes *et al.* 2013; Innes *et al.* 2010; 2011; Innes & Simmons 2000; Ryan & Blackford 2010; Zvelebil 1994). Largely, these studies have focussed on the effects of deforestation through human agency as deliberate land-management strategies, designed to increase yields from nut species (particularly *Corylus*); additionally, these practices would promote open areas of newly regenerating woodland which would increase browsing opportunities, and thus the predictability and productivity of large terrestrial herbivores (e.g. Clarke 1976; Dimbleby 1962; Edwards 1990; Innes & Blackford 2003; Jacobi *et al.* 1976; Simmons 2001:46; Simmons & Innes 1987; Zvelebil 1994). Furthermore, Mesolithic-age human impact on the environment has also been recorded within the islands of the Inner Hebrides, such as Kinloch, Rum (Hirons & Edwards 1990); Loch a'Bhogaidh, Islay (Edwards & Berridge 1994); and Auchareoch, Arran (Affleck *et al.* 1988), which is supported by archaeological evidence.

In this instance, Mesolithic fire ecology models from mainland Britain cannot be applied to the Western Isles. The issues are twofold:

- these models centre on the *creation* of clearings within predominantly woodland habitats, whereby the pollen peaks indicating the presence of recolonization species such as *Calluna* are a by-product (intentional or otherwise) of repeated burning;
- such models focus on the attraction of 'big game' species.

To reiterate, the palaeoenvironmental evidence from DLS'13 #30 presents burning of an *already open* area of landscape and there is currently *no evidence for large ungulates* in the Western Isles. Furthermore, these models are largely derived from palaeoenvironmental cores whereby data is extrapolated from peaks in micro-charcoal – "low-level background rain of carbonised particles" from off-site burning (Innes & Simmons 2000). The data from DLS'13 #30 is on a *macro* scale.

To expand on the first issue, there are only a few studies which discuss Mesolithic fire incidence in open areas such as heathland. Analysis of a number of cores taken from intertidal peats along the west coast of South Uist have indicated burning episodes associated with *Calluna* heathland during the Late Mesolithic (Ballantyne & Ward 2009; Bennett *et al.* 1990; Edwards 1996:34; Edwards *et al.* 1995; Mulder 1999; Simmons 1996:158). Evidence for any perceptible human impact on the landscape involving fire has only been inferred from North Locheynort, Loch an t-Sil, Rineval, and

Borve on Benbecula (Brayshay & Edwards 1996; Edwards 1990; Edwards *et al.* 1995; Whittington & Edwards 1997). The expansion of heathland communities has largely been attributed to "progressive soil deterioration" (Mulder 1999:276-278). Although there is, as yet, no physical evidence for a Mesolithic presence on South Uist at this time, fire ecology by way of heathland management during the Mesolithic is documented in England (Caseldine & Hatton 1993; Simmons 2001); Wales (Fyfe 2007; Smith & Cloutman 1988), and Norway (Hjelle *et al.* 2010; Prøsch-Danielsen & Simonsen 2000), which is supported by the archaeological record. Furthermore, it is notable that *Calluna* is "readily inflammable in many stages of its growth and under most likely weather conditions" (Simmons 1996:122). The implication here is that it requires a deliberate source of ignition and dry, dead plant matter such as deciduous grasses or sedges to create the necessary heat with which to burn the heather (Simmons 1996). Experimental, simulated burning of heathland has indicated that controlled burning can improve the regeneration of *Calluna* (Whittaker & Gimingham 1962). Moreover, continued burning of moorland would be necessary to some extent to prevent the regeneration of woodland and maintain clearings (Mighall *et al.* 2008:625).

The second issue is also pertinent to the application of such models in Ireland. The evidence for Mesolithic age disturbance of local woodland, including fire incidence on the Mizen Peninsula, Co. Cork, would traditionally be interpreted through fire ecology models as a deliberate management strategy to attract large game species (Mighall *et al.* 2008). However large ungulates, other than wild boar, are entirely absent from Ireland during the Mesolithic. This has prompted questions over why such practices would therefore be necessary (Woodman *et al.* 1997). Consequently, the analogous situation of the Western Isles leads to the question of whether the evidence from DLS'13 #30 represents anthropogenic disturbance of the environment at all.

Accordingly, a hypothesis for a natural cause must also be investigated. In contrast to Simmons (1996), Peterken (1996) and Brown (1997) have argued that heathland species, including heather and gorse, are *more* susceptible to natural fires such as those caused by lightning strike. Climatic instability and high natural fire frequency during very dry periods of the early Holocene is often postulated as an explanation for elevated charcoal levels in palaeoenvironmental records of north-west Europe (Brown 1997:136; Fossitt 1990; Huntley 1993; Tipping 1996). Furthermore, light surface fires of ground-level vegetation are a frequent part of natural fire dynamics (Moore 2000). It should be noted that the dating evidence from the charred material from DLS'13 #30 accords with increasing precipitation towards the *end* of a "regionally significant and broadly synchronous" period of drier climate between 8000-5000 B.P. (Tipping 1996:50-51).

Supporting evidence for significant human impact on the environment in the Mesolithic of Lewis is also highly circumstantial. Low levels of charcoal and woodland decline at Loch Builaval Beag were interpreted as indicative of natural, climatic change (Fossitt 1996:188), similarly the evidence from Loch na Beinne Bige does not attest to significant anthropogenic disturbance of the environment, only the possiblity of small, local fires (Lomax 1997:240, 265). Only the medium levels of charcoal abundance at Callanish-3 have been interpreted as anthropogenic in origin (Bohncke 1988). Light surface fires are also the most frequently created fires by humans, therefore distinguishing between an anthropogenic or natural cause is highly problematic without very fine-resolution sampling (Moore 1996; 2000). Moreover, Tipping (1996:45) has cautioned against drawing close comparisons between broad datasets due to discrepancies in data presentation and recording methodologies between studies.

One final interpretation is that the charred plant macrofossils represent the remains of localised burning of peat or turf (Hall 2003), rather than a 'catastrophic' and large-scale fire for the purposes of managing woodland resources (Moore 1996). The burning of peat/turf for fuel is well documented in the Western and Northern Isles, as well as other islands of the north Atlantic, from the Iron Age to modern times (Bishop *et al.* 2013; Church 2002a; Church *et al.* 2005; Church *et al.* 2007; Dickson 1998; 1999; Smith 1999), and the Bronze Age in England (Branigan *et al.* 2002). There is little evidence for the burning of turf in the Mesolithic however. It has been suggested that incorporation of charred tubers of lesser celandine (*Rununculus ficaria*) within the Mesolithic deposits at Staosnaig, Colonsay may have been due to the burning of turf, rather than collected for human consumption (cf. Hall 2003; Mithen *et al.* 2000a). Turves may have also have been used in a domestic hearth or a fire for the purposes of smoking or drying foodstuffs at the Mesolithic site of Northton, Isle of Harris (Bishop 2013). In sum, although comparable evidence for the deliberate burning of peat/turf as fuel at DLS'13 #30 is weak, it is nonetheless plausible.

Gleann Mor Barabhais has clearly meandered, with evidence for flood events visible in the eroding sections of the banks. The active river systems on Lewis have almost certainly changed, especially given the extent of sea level rise since the Mesolithic period, which will have altered the water table and, consequently, drainage patterns (Woodman 1997:370). Furthermore, it cannot be readily assumed that the heavily managed modern rivers were comparable during the Mesolithic (Warren 2005b:56). Overcoming this issue would require extensive digital modelling of underlying geology or relic river systems based on local geomorphology (Woodman 1997:370), or a programme of coring to detect sedimentation of relic beds (Wren *et al.* 2008).

The geomorphological processes and environmental changes that have occurred on Lewis since the mid-Holocene have greatly altered the landscape. In addition to the natural barriers that have hampered this investigation, theoretical hurdles must also be overcome. The predictive model explored in this chapter is based on the long-standing view that Mesolithic mobility encompassed regular movements between coastal and inland regions, whether residential moves of the whole group (Clark 1972), logistic forays by specialist task-groups (Binford 1980), or a more complex mobility pattern combining both models, such as has been proposed for the Mesolithic occupation of the Pennines (Donahue & Lovis 2006). These ethnographically-derived models and their application to the archaeological record have been criticised as creating a coast:inland dichotomy that has pervaded, unimpeded, over interpretations of Mesolithic sites in Britain (Preston 2013; Spikins 2000). Even so, models such as Spikins' Social Territories Model (1996) and the Pennine Nexus Hypothesis (Preston 2013), formulated as alternatives, are restrictive in their application as both are tied to river networks. The data therefore becomes part of a hermeneutic cycle: sites are found by rivers, therefore models are created based on this data; surveys are conducted based on said model, which in turn result in further data that reinforce the model. Warren (2005b:64-65) has criticised the neglect by archaeologists of over-land routes as likely means of movement through the landscape, stating the Holocene woodland has been characterised as "dark and impenetrable: overgrown, foreboding places…". This is despite evidence from the Tweed valleys in south-east Scotland which indicate Mesolithic settlements were situated away from the coast and rivers (Warren 2005b:141). Further work investigating the interior of the Western Isles must therefore heed such admonitions, whilst it must be understood that in the absence of any other suitable method of investigation, successful implementation of the river-survey methodology will only continue to support this bias.

7.7. Conclusion

The charred palaeoenvironmental remains from DLS'13 #30 represent evidence for burning of *Calluna* heathland, which is situated within the catchment of Glean Mor Barabhais in the interior of Lewis during the Late Mesolithic. It is likely that the effects of this burning caused a degree of aggregate instability which in turn caused the charred material to be eroded from its original location, and incorporated within flood deposits further downstream.

There are three different hypotheses which could explain the presence of the charred palaeobotanical material at DLS'13 #30:

- the material represents deliberate land management strategies by Mesolithic people in order to clear woodland/maintain heathland with the purpose of manipulating both floral and faunal resources by way of fire ecology;
- the material represents a natural event, such as fire by lightning strike;
- the material represents small-scale burning of turf in an anthropogenic setting, such as a domestic hearth or for the purposes of food processing.

The results of palaeoenvironmental analyses from across Scotland and the Hebridean Islands indicate there are notable relationships between Mesolithic-age vegetation disturbance and charcoal presence during the period of known Mesolithic occupation of the islands. This is further corroborated by palaeoenvironmental and archaeological evidence from England, Wales, Ireland and Norway. On the whole, these patterns are interpreted as deliberate land management strategies by hunter-gatherers.

However, based on the evidence alone, it is not possible to ascertain whether the charred plant remains from DLS'3 #30 derive from anthropogenic interference such as domestic hearth material, rather than active vegetation clearance (Edwards 1990:77; Simmons 1996:158), or a landscape fire resulting from deliberate land-management strategies such as fire ecology (Edwards 1990; 1996; Jacobi *et al.* 1976; Tallis & Switsur 1990). It is possible that the fire in the landscape is simply a natural occurrence (Tipping 1996).

What is certain is that the methodology employed in the survey along the river, which was based upon successful investigations of eroding river banks in Britain and Norway in order to identify Mesolithic sites, was a success. Although the sampling did not yield definitive evidence for Mesolithic occupation, it is hoped that future investigation of the interior will reveal Mesolithic remains, despite the present difficulties of investigation.

Chapter 8 The Mesolithic Occupation of the Western Isles

8.1. Introduction

This chapter draws together the whole of the available archaeological evidence from the Mesolithic occupation of the Western Isles. First, the wider evidence of settlement and subsistence activities conducted at each of the sites is outlined. A summary of the results of the technological and typological analysis of the Western Isles lithic assemblages, presented in Chapters Five and Six, is then integrated. This provides a holistic overview of the nature of Mesolithic occupation in the Western Isles that can be compared with the evidence for the Mesolithic in western Scotland, discussed in Chapter Two. In doing so, detailed comparisons can be drawn between each region to determine the nature of hunter-gatherer subsistence and the occupation on the two main islands over the period of c.2700 years. The aim of this section is to collate the information required to answer the second research question of this thesis: *how do the lithic assemblages fit into the occupation of the Western Isles sites?*

The methodology used in the lithic analysis, and outlined in Chapter Four, was designed to answer the first research question of this thesis: *what is the nature of the lithic technology of the Mesolithic in the context of the Western Isles of Scotland?* The second section of this chapter returns to address the four sub-questions of research question one, in order to further discuss the themes that pertain to lithic *chaîne opératoire*. These themes comprise: raw material acquisition, reduction strategy, technology and type-facies. By aligning the methodology used in the lithic analysis with those used in Scottish Mesolithic studies, and by drawing upon the evidence that was observed during such, it is possible to compare between these and other assemblages to ascertain whether Mesolithic lithic production in the Western Isles is representative of the Scottish Mesolithic overall. This will be discussed further in Chapter Nine alongside the wider implications for group settlement and subsistence patterns in the Mesolithic of the north-east Atlantic façade.

It should be reiterated here the caveat that the small size of the assemblages present in the Western Isles only provides a very limited sample of material through which to contextualise Mesolithic settlement, activities, technology and lithic traditions.

8.2. Mesolithic Occupation in the Western Isles: The Wider Evidence

The first, unequivocal evidence for the Mesolithic in the Western Isles of Scotland has only been established within the last decade. The evidence from Aird Calanais and DLS'13 #30, discussed in Chapters Two and Seven respectively, suggests there are other areas of buried early to mid-Holocene landscapes that may contain new Mesolithic sites. The excellent organic preservation at the Mesolithic sites from the Western Isles provides a rare insight into the exploitation of particular terrestrial and marine resources by Mesolithic people inhabiting the area, and thus their subsistence practices (Kitchener *et al.* 2004:80). The evidence observed to date indicates that the major economic focus of the communities living on these islands was on fishing, hunting small terrestrial game, and processing plant material. Sites with organic preservation are unfortunately rare in Scotland and it is most often scatters of lithics that betray the ephemeral presence of Mesolithic people in the landscape (Saville 2003:342). The lack of organic preservation at Mesolithic sites in Scotland makes it difficult to understand whether the activities at these sites are representative of Mesolithic open air sites in Scotland as a whole. The plant and animal remains recovered from the Western Isles are integral to understanding the little-known post-glacial palaeoenvironmental record of the islands. Additionally, these inform us of the species Mesolithic inhabitants may have exploited as part of the subsistence strategies that extreme maritime coastal adaptation required (Bishop *et al.* 2011b).

This section therefore considers each site as a whole. The topographic location of each site is described alongside the various the faunal and floral assemblages, which inform subsistence activities that may have been carried out at each of the sites. In turn, this influences understanding of how the lithic assemblages correlate with particular activities, such as the procurement and processing of specific resources. It is the availability of these resources which directly influences hunter-gatherer settlement patterns, as such different economic strategies are adapted as a result (Binford 1979; 1980; Woodburn 1980). It is clear from Figure 243 that understanding the subsistence strategies of these Mesolithic communities is intrinsically linked with interpreting lithic function. It is not enough to simply analyse tools and debitage as products of the knapping process in isolation - the decisions involved behind their production must also be addressed in addition to their role in the subsistence economy.

The islands of Harris and Lewis present two very different types of sites. The earlier open-air sites, within relic ground surface deposits at Northton and Tràigh an Teampuill on Harris, contrast in appearance to the later shell midden sites around the Cnip headland at Tràigh na Beirigh and Pabaigh Mòr, Lewis. Despite the differences in site composition, it is clear that the Toe Head peninsula of Harris and the Bhaltos Peninsula of Lewis were prime locations for hunter-gatherer activity during the Mesolithic for very different reasons, and that the exploitation of marine resources is a trait shared at both locations. Where appropriate, comparisons with these sites are drawn between the evidence from Ireland and larger Scottish islands, as well as Norway. These parallels will be drawn upon again more fully in Chapter Nine.

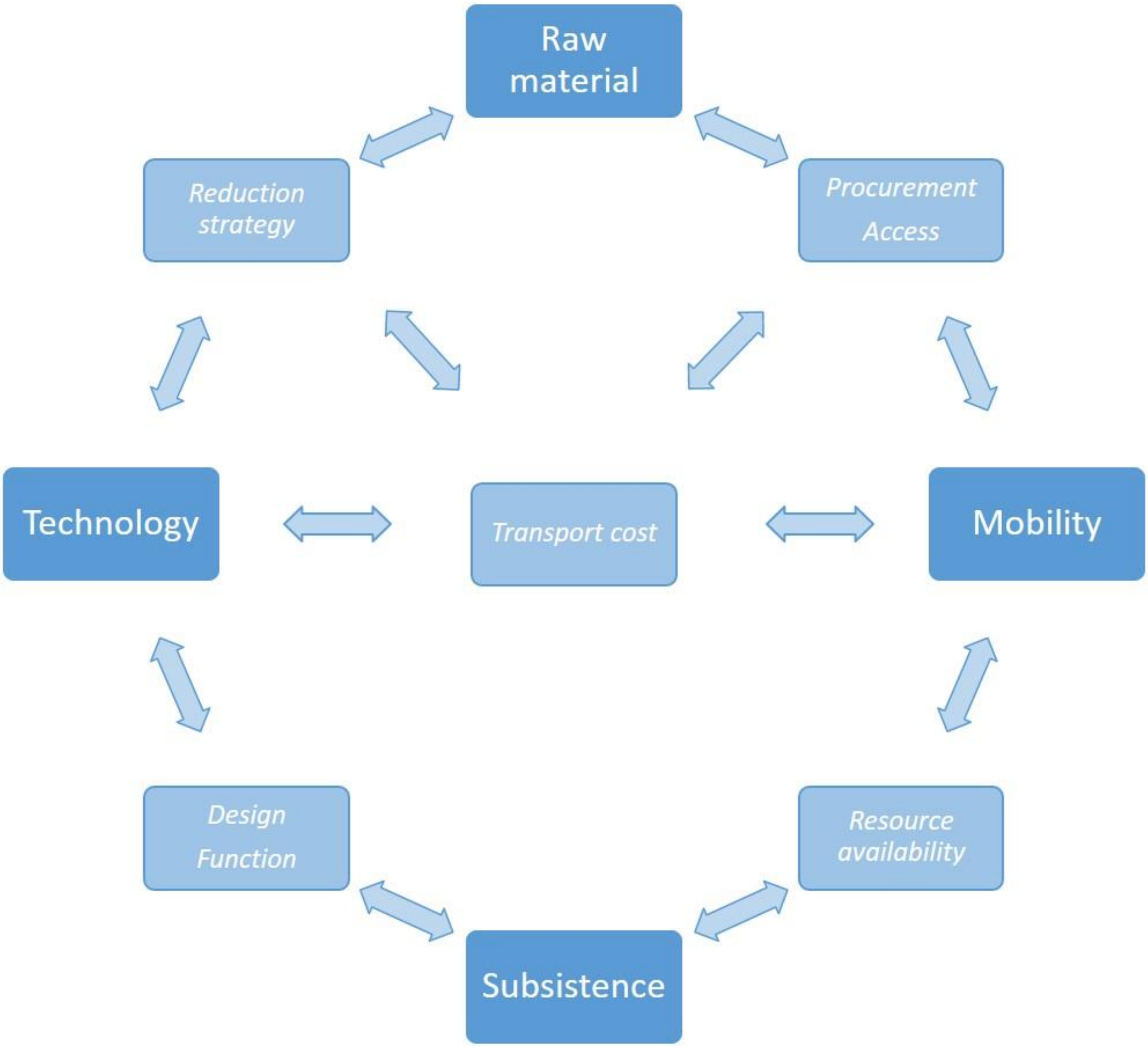


Figure 243. Inter-related aspects of settlement and subsistence within hunter-gatherer groups

8.2.1. The Late Mesolithic on Harris

8.2.1.1. Northton

During the Mesolithic, Northton would have been situated atop a rocky platform, several hundred metres from the existing shoreline (Figure 244). The archaeobotanical evidence from the site indicates that the immediate environment was a mixture of open grassland and woodland, as machair had not yet developed in the area (Bishop 2013:221; Church 2006a; 2006b; Ritchie 1979). The spread of Mesolithic occupation deposits at Northton are broadly interpreted as "a palimpsest of disturbed and bioturbated hearth deposits containing fuel remnants and food waste" (Bishop *et al.* 2011a:1; 2011b; 2012b). During processing of the environmental samples, it was noted that the faunal assemblage from Northton is burnt and highly fragmented. The charred and calcined nature of these remains has prevented their decay in the usually acid soils of Scotland. An initial study of the faunal and floral remains from Phase 3 at Northton has provided an indication of the types of activities conducted at the site and the subsistence strategies employed there. A chart indicating the most likely seasons of occupation at the site is presented in Table 41.

Figure 244. Northton (arrowed right) would have been situated away from the immediate shore and likely to have been close to woodland. Whilst the machair beaches would not have been present, the rocky tidal embayment would have served as an ideal harbour. The hill of Ceapabhal can be seen rising to the left on the picture. A similar environment would have existed during the occupation of Tràigh an Teampuill (arrowed left). Author's own photo

Preliminary identification of large faunal species from the site points towards a clear exploitation of marine species. These include seabird species such as guillemot (*Uria aalge*), and the now-extinct Great Auk (*Alca impennis*; Rowley-Conwy pers. comm.). Great auk were a large, pelagic bird that spent the majority of the year at sea. They were also flightless, and reported to only have been present on shore during a few weeks from April-June for breeding, which would have made them vulnerable to predators (Fisher & Lockley 1954). Their presence in the faunal assemblage at Northton therefore indicates occupation of the site during spring. Similar seabird species have been recovered from Mesolithic shell midden sites in Brittany, where they display definitive evidence for human consumption in the form of cut-marks and burning (Dupont *et al.* 2009:102). Alcids such as the guillemot nest on steep cliffs, where they are likely to have been caught using nets or lines (Dupont *et al.* 2009:102). Hunting seabirds, using home-made poles and snares, was an integral part of life for the islanders of St. Kilda, until the island was abandoned in 1930; the *guga* (Gallic for gannet) hunt on the island of Sula Sgeir, 40 miles north of the Butt of Lewis, is a Hebridean tradition that endures to this day (Beatty 1992).

The presence of cetacean species – potentially porpoise (Phocoenidae) or orca (*Orcinus orca*) – has been inferred through analysis of unidentified bone fragments from the site using ZooMS (Charlton 2016). Otter (*Lutra lutra*) and seal (Phocidae spp.) bones have also been identified (Rowley-Conwy pers. comm.). The only terrestrial fauna recovered from the site were bones of hare (*Lepus* spp.); evidence for large terrestrial game is conspicuous in its absence. Otter and hare are well-known fur-bearing species and there is extensive evidence for their exploitation during the Mesolithic, it is also likely their flesh was consumed (Grigson & Mellars 1987:285). Particular evidence for skinning otters for their pelts has been found at Tybrind Vig and other sites in Denmark, as well as in the Netherlands (Louwe Kooijmans 2003; Richter 2005; Trolle-Lassen 1987), whereas hare remains from Moynagh Lough, Ireland were processed for meat (McCormick 2004; Warren 2015b). Seals would have provided a wide range of raw materials, including food, blubber for oil, and skin for boats, tents, containers, and clothing amongst other uses. The disproportionate number of particular elements at Cnoc Coig, Oronsay were interpreted as evidence for the multitudinous uses of seal (Grigson & Mellars 1987:271).

The major fish taxa exploited at Northton were wrasse (Labridae) and cod families (Gadidae), the latter of which included species of Atlantic cod (*Gadus morhua*), saithe/pollack (*Pollachius* spp.), pout (*Trisopterus* spp.), and whiting (*Merlangius* spp.) amongst others (Blake 2011:55, 80). Accepting the possibility of taphonomic bias against larger fish, analysis of the size of gadid family fish indicated that the majority were estimated at <300mm in length. This falls within a specified size category of 'tiny-small', which is representative of first, second, and potentially some third year fish (Blake 2011:15, 54). Young gadids, up to three years of age, naturally migrate from deep ocean water after spawning to shoal inshore between late spring and mid-winter (Wilkinson 1981:34). Based on the dominance of small-medium sized gadids from the Phase 3 occupation of Northton, it is proposed that the fish assemblage indicates repeated visits to the site during summer and autumn. This is supported by the presence of herring (Clupeidae), juvenile plaice (Pleuronectidae), and European eel (*Anguilla anguilla*), which can also be caught inshore during these seasons (Blake 2011:154-157). Visits during the spring are also likely given the presence of smaller fish and other species such as Great Auk, whereas winter occupation could be indicated by seal (Table 41).

The diversity of species present in this catch has been taken to suggest that the fishing methods employed at Northton were largely unselective (Blake 2011:160). Whilst line-fishing could have been used to procure these species, it is more likely that a tidally regulated stationary trap or net was used, such as those identified in Halsskov, Denmark and the Liffey estuary, Ireland (McQuade & O'Donnell 2007; McQuade & O'Donnell 2009; Pedersen 1995). This would facilitate the catch of a range of species inhabiting the inshore area, as well as the different year groups of fish such as saithe and pollack (Enghoff 1995). The coastal geomorphology of sheltered, tidal embayment close to the site at Northton would also be conducive to this (Blake 2011:161, 163).

Exploitation of the inshore zone at Northton is further corroborated by the species of shellfish and crustacean present in the environmental assemblage. Species favouring both rocky shore and sandy substrate habitats are represented. The former include limpet (*Patella* spp.), periwinkle (*Littorina* spp.); dog whelk (*Nucella lapillus*); common mussel (*Mytilus edulis*) and green shore crab (*Carcinus maenas*). The latter habitat is indicated through the presence of razor clam (*Ensis* spp.) and common cockle (*Cerastoderma edule*; Blake 2011:70-72, 94-95). These resources would have been available year-round and most easily accessible at low-tide. The variety and abundance of marine mollusc and crustacean remains from Northton has been taken to suggest the Mesolithic inhabitants procured these extensively, on a generalised and intensive scale (Blake 2011:182-184, 194-197).

Skeletal element representation of the two most commonly exploited fish taxa, Gadidae and Labridae, is indicative of the presence of the whole fish at the site. From the high ratio of burnt bones present at Northton, it is interpreted that these fish were immediately processed at the site, whole, through cooking methods that would expose the bones to high temperatures for an extended period of time such as on open fires. The burnt and fragmented nature of the crustacean remains, as well as of many of the mollusc shells, suggests that a similar method is likely to have been used to process these taxa on site for human consumption (Blake 2011:169, 172, 190-193, 196). Such cooking methods are likely to account for the high quantity of carbonised plant material from Northton, including fragments of pine (*Pinus* spp.) and hazel (*Corylus avellana*) charcoal (Bishop *et al.* 2015). This charred material has been interpreted as representative of hearth material, in addition to food waste, which included not only the faunal remains, but numerous quantities of hazel nutshell, seeds, and edible roots from species such as lesser celandine (*Rununculus ficaria*), and bitter-vetch (*Lathyrus linifolius*) (Bishop *et al.* 2012a; Bishop *et al.* 2011a; Bishop *et al.* 2014b). The charred hazel nutshells are estimated to have derived from >500 whole nuts, and are interpreted as evidence of extensive hazel nut exploitation at the site with subsequent roasting of the haul (Bishop 2013:201, 219). The well-preserved nature of the tubers at Northton has been taken to suggest the material was accidentally charred during, or after, intentional drying for storage (Bishop *et al.* 2014b:41). This was proposed for the large quantity of charred hazel nutshell and lesser celandine at Staosnaig, Colonsay (Mithen *et al.* 2001; Mithen *et al.* 2000a). Although no distinctive hearth features were identified, the presence of fire-cracked rocks and a small number of burnt flint flakes attests to the processing of foodstuffs at Northton. This interpretation is corroborated by an abundance of heat fractured stone ‘pot boilers’ at the site, which are similar to those produced experimentally, and have been recovered from the Mesolithic site at Sand in the Inner Hebrides (Clarke 2009a; Wickham-Jones 1986). The abundance of charred grass material at Northton has also been taken to suggest steaming or roasting activities using peat or turf (Bishop 2013:218). Overall, the charred plant macrofossils suggest that Northton was situated in a wooded, scrubland environment with areas of open, disturbed ground. Within this environment edible plants were likely to have been gathered through the summer and autumn before being processed at the site, which supports the seasonality evidence from the fish remains. However, it should also be noted that once cooked and dried, hazel nuts and tubers can be stored for long periods of time and may have been deposited during a visit to the site by Mesolithic people during any season

(Bishop 2013:215-222). Irrespective of this, there is definitive evidence in the form of charred plant material, calcined bone, and fire-cracked rocks from Northton that attest to deliberate burning at the site, probably involving the processing of foodstuffs.

To re-iterate the main findings of the lithic analysis from Northton presented in Chapter Five: the earliest occupation of Northton (Phase 4) was dominated by the use of flint, which had either been imported to the site along with the first occupants, or was locally available in an extremely small quantity. This was supplemented by the use of locally available quartz. During the later phase of occupation (Phase 3), quartz is the most prolifically used raw material. Flint is only represented in small quantities, alongside a nominal amount of baked mudstone, which has been imported from across The Minch in a pre-prepared state.

Overall, the results of the lithic analysis from the recent investigations at Northton largely support Nelis' original interpretation of the assemblage as "representative of a Mesolithic chipped stone assemblage in, at least, this area of the Western Isles". The implication therein is that the largely undiagnostic material from the Western Isles is characteristic of an independent, potentially insular industry akin to the trajectory of lithic industry development in Ireland, which will be discussed in more detail below. The suggestion that the Western Isles Mesolithic assemblage is entirely undiagnostic can no longer be supported in light of the presence of microliths, albeit few in number.

Finally, it should be noted that the most enigmatic find from the Mesolithic deposits at the site is that of a distal fragment of a human second middle phalanx. An in-depth discussion of this pertaining to Mesolithic burial practices is presented in the following chapter.

8.2.1.2. Tràigh an Teampuill

Tràigh an Teampuill is located in a very similar geographical position to Northton, occupying a rocky outcrop which may easily have overlooked the encroaching sea (Figure 244). As yet, there has been little analysis conducted on the organic remains from Tràigh an Teampuill. A quantity of charred hazelnut shells were recovered throughout the deposits in addition to a discrete deposit of periwinkle shells which filled a clay-ash lined scoop that cut into the old ground surface. The hazel nutshells are poorly preserved and suggested to have derived from occasional discard onto domestic hearths. As at Northton, their presence may suggest the site was occupied during the autumn, but it is also possible that the hazelnuts had been stored (Bishop 2013:220). Well-preserved bones of small mammals and birds have been observed within the faunal assemblage in addition to thousands of fish bones, which indicate the site may have been visited at various times of the year (Table 41). Thus far, there is no categorical evidence for large terrestrial mammals in the Western Isles during the Mesolithic, beyond undiagnostic bone fragments. Results from ZooMS analysis of these fragments indicates the Mesolithic inhabitants of the site exploited marine mammals, including seal (*Phoca* spp.) and various species of *Cetacea* such as grey whale (*Eschrichtius robustus*); porpoise (Phocoenidae)/orca (*Orcinus orca*); humpback whale (*Megaptera novaeangliae*)/grey whale, and Risso's dolphin (*Grampus griseus)*/pilot whale (*Globicephala* spp.). There were also results which indicated large terrestrial mammals such as deer (Cervidae spp.) or elk (*Alces alces*; Charlton 2016).

At its greatest extent, the British Ice Sheet of the Last Glacial Maximum (LGM hereafter) extended to the west of the Western Isles, covering the islands in ice. Deglaciation in the region occurred at least c.13,000 cal. BC, when the Minch exhibits evidence for open sea conditions, separating the Western Isles from the mainland (Bradwell *et al.* 2008:212-213). Based on this, and the highly restricted number of native species which survived the LGM further south in Ireland, it would appear all but impossible for the Western Isles to have functioned as long-term glacial or interglacial refugia where large terrestrial mammals such as red deer/elk could have survived the Loch Lomond re-advance; during which time some islands of the Inner Hebrides were re-glaciated and the Outer Hebrides would have experienced a semi-frozen, tundra landscape (Edwards & Whittington 1994; Lowe & Walker 1986; Montgomery *et al.* 2014). As such, any presence of red deer/elk in the Western Isles is likely to be a human introduction. It is unknown if this was with live animals to create a niche by importing a breeding population, much as wild boar were introduced to Ireland (Montgomery *et al.* 2014; Rowley-Conwy & Layton 2011). The occupation of the site is c.400 years later than at Northton. If Mesolithic people had begun to transport these animals across it would be likely that by the time of occupation at Tràigh an Teampuill a viable population could have been established. Alternatively, it may be that haunches of meat were imported, as there is currently no secure evidence for the presence of red deer in the Western Isles until the Neolithic (Stanton *et al.* 2016). The possibility of imported commodities will be discussed further in the following chapter.

The red deer antler tine present at Tràigh an Teampuill could also have been an imported product. Although no microliths were recovered from the small lithic assemblage, this closely resembles a pressure flaker, which would have been an intrinsic part of the microlithic tool kit, although is not the only method of producing microliths (Finlay 2006). On the continent, antler pressure flakers have been variously recovered from Mesolithic contexts in Russia (Skakun *et al.* 2011; Zhilin & Matiskainen 2002); Serbia (Vitezović 2011); Denmark (Andersen 1989), and Sweden (Hallgren 2011). In Scotland, antler tines have been recovered from An Corran (Saville *et al.* 2012b), Cnoc Coig (Grigson & Mellars 1987), Sand (Hardy 2009c), Risga (Foxon 1991), and MacArthur's Cave, Oban (Elliott 2012). The function of these tines as punches or pressure flakers has not been considered in a recent synthesis of antler-working practices during the Mesolithic of Britain, which contrasts to the continental sites mentioned above (Elliott 2012), and has previously been largely rejected (Foxon 1991); instead the notion that these artefacts functioned as 'bevel-ended tools' persists, despite experimental evidence to the contrary (Hardy *et al.* 2009; Tolan-Smith 2008:149). Given there is currently no evidence for populations of deer living on these islands during the Mesolithic, the antler must have been brought to the site as a raw material commodity from the Inner Hebrides or elsewhere, where red deer were present. This may have been linked with the import of other raw materials such as flint, baked mudstone and limestone which are discussed in more detail in the following chapter.

A small number of broken worked bone points have also been recovered from the site. These may have functioned as piercers or needles, potentially for the production and repair of clothes or fish nets. Larger specimens of bone points have been recovered from An Corran (Saville *et al.* 2012a); Oronsay (Bishop 1914; Lacaille 1954:226; Mellars 1987); the Oban caves (Anderson 1895; Clark 1956); Sand (Hardy 2009c), and Risga (Foxon 1991). It is notable that the sites in which bone and antler points are found in Scotland are all shell midden sites, which contributed to the long-standing assumption that bone and antler artefacts were associated with the 'Obanian' industry (Saville *et al.* 2012a). A more plausible interpretation is that this results from the more alkaline conditions of shell middens which facilitate a greater degree of organic preservation than open-air sites. The assemblage from Tràigh an Teampuill therefore provides rare evidence of the organic component of the Mesolithic took kit from non-shell midden sites, which is largely absent from the archaeological record in Scotland.

The lithic assemblage from Tràigh an Teampuill, as described in Chapter Five, follows a very similar pattern of raw material exploitation to Northton. The assemblage is comprised entirely of flake and blade debitage, dominated by locally available vein and pebble quartz, which was reduced on an *ad hoc* basis using platform technology. The flint assemblage is only partial: there is no evidence for primary reduction of flint at the site nor are there any cores. The flakes and blades that are present however, have been treated in the same manner as at Northton – intensively reduced, using a combination of both bipolar and platform technology, which reflects the small size of the original raw material. Only a single flake of baked mudstone was recovered in addition to a small number of other, more local, raw materials.

8.2.2. The Terminal Mesolithic on Lewis

8.2.2.1. Tràigh na Beirigh 1

The location of Tràigh na Beirigh 1, atop the rocky promontory of Gridig, would have occupied a prominent position along what would have been a cliff face during the Mesolithic, due to slightly lower sea-level and absence of machair (Figure 245). From here, both terrestrial and marine resources could easily have been exploited. Analysis of the faunal material from Tràigh na Beirigh 1 suggests that Mesolithic activities at the site almost exclusively involved fishing and shellfish collection. There is limited evidence for the exploitation of terrestrial resources, which appears to be restricted to hare (Rowley-Conwy pers. comm.) and charred faunal material. As at Tràigh an

Teampuill, the small quantity of poorly preserved hazel nutshells may result from the occasional disposal of material onto domestic hearths during the autumn, or consumption of stored nuts at another time of the year (Bishop 2013:220).

Figure 245. Tràigh na Beirigh 1 under excavation at low-tide (arrowed left). This site, Tràigh na Beirigh 2 (arrowed right), and the other areas of exposed midden at the machair-bedrock interface are situated at the edge of what would have been a cliff-face during the Mesolithic, when the sea level would have been a minimum of two metres lower and the machair formations above would not have existed. Photo courtesy of Mike Church

The fish remains recovered from the site are almost exclusively of the Gadidae family, primarily saithe and pollack. A very small proportion of other species such as sea scorpion (Cottidae) and dragonet (*Callionymus lyra*) are also present (Blake 2011:115). Analysis of both fish bones and otoliths by Blake (2011), and otoliths by Morley (2015), indicated that repeated episodes of fishing activity were likely at Tràigh na Beirigh 1, with the most intensive activity during the spring and winter seasons**.** In Morley's study, this was based on the distribution of otolith size, which shows two distinct groups of saithe present. The first group is indicative of a high number of small first year fish, which shoal inshore during late spring (April-June) shortly after spawning in deep offshore waters. The second, most prominent, group were of larger first year fish that have not yet migrated into deeper waters, the size of which suggests mid-winter fishing from November to late December (Morley 2015:29-30). The otoliths previously studied by Blake largely fall into the same range as those studied by Morley and the total fish length, estimated from both the bones and a small sample of otoliths, corroborates the suggestion that the saithe present were almost exclusively first year fish (Blake 2011:124-125).

The large standard deviation of otolith size within the sample was interpreted as evidence for an extended fishing season, suggesting "multiple fishing events at different times throughout the year", but with the most intensive exploitation during spring (Morley 2015:30). A significantly protracted fishing season similar to this is observed in the saithe otoliths from Caisteal nan Gillean I/II where the range of fish exploited includes both first and second year fish throughout mid-summer to mid-winter. This differs from the other shell middens on Oronsay where the evidence suggests fishing seasons were much shorter (Mellars *et al.* 1980:35-36). The *highly selective* catch – both in terms of species and homogenous size as determined by Blake – is suggested to imply the use of more discriminatory fishing methods than those used at Northton, for example hook and line or nets. Furthermore, a stationary trap, such as the like suggested for Northton would not be viable at Tràigh na Beirigh 1 due to wide, exposed shoreline (Blake 2011:164). Although a similar interpretation of the fishing methods employed at Tràigh na Beirigh 1 is given by Morley, the means by which she arrived at this conclusion are very different. Morley suggests that the range in the size of otoliths present is representative of the *natural population* range of fish procured over a long fishing season, which is indicative of unselective capture technology. Methods such as netting could have been conducted close to the shore; fish may also have been collected from natural traps, for instance inter-tidal rock pools that now lie buried beneath the machair beach (Morley 2015:35). It should be noted that the sample studied by Blake was very small and taken throughout the entire thickness of the midden deposits (Blake 2011:19, 159), whereas the data from Morley was obtained from a more stratigraphically secure unit (C008). Consequently, the data from these two studies requires further resolution.

Low levels of carbonisation of the otoliths were noted, indicating that the methods used in processing the fish meant the fish heads did not frequently come into direct contact with fire. Fish heads may have been removed prior to cooking over an open fire for example, or the whole fish may have been boiled (Morley 2015:35-36). During sorting of the environmental remains to collect the data for this thesis, few calcined fish bones were observed, which supports the latter interpretation. Smoking of the fish may also be a viable alternative suggestion, with a low number of carbonised otoliths potentially representative of a small number of waste fish that had dropped off the smoking rack and become incorporated into the embers below. This would be supported by the very small quantity of calcined fish bone (7%) reported by Blake (2011:112). Furthermore, the representation of the full suite of skeletal elements has been interpreted as "on-site consumption of whole, freshly caught gadids" (Blake 2011:158, 174).

Extensive exploitation of the inshore environment is indicated by the substantial shell midden deposits at Tràigh na Beirigh 1, where a similar range of marine molluscs and crustaceans to Northton were recovered. These again included species indicative of both rocky shore environs as well as sand flats, and which were available all year round (Blake 2011:182, 185, 193). An in-depth study of the marine mollusc assemblage concluded that there was a minimum taxa of 21 mollusc species largely indicative of exposed shorelines. Of these species limpet (*Patella* spp.) is the most prevalent, followed by razor clam (*Ensis* spp.), and dog whelk (*Nucella lapillus*; Evans 2015:41-42). The exposed nature of the shore at Tràigh na Beirigh 1 is further attested by the low number of periwinkle (*Littorina* spp.). Periwinkle are much more frequently represented at shell midden sites from the Inner Hebrides with sheltered shores, such as Ulva Cave, Sand and An Corran (Evans 2015:57, 72; Russell *et al.* 1995:280).

There is an unusually high representation of razor clam at the site, with a marked absence of juvenile taxa, which is not representative of a natural population. This has been interpreted as selective exploitation of larger individuals during the most extreme low tides, such as the spring and autumn equinoxes (Evans 2015:43, 69). This is further corroborated by the presence of a number of large specimens of other mollusc species such as banded carpet shell (*Polititapes rhomboids*) and common otter shell (*Lutraria lutraria*). These species inhabit the same environs as razor clams and were exclusive to the sub-assemblages where razor clams were present. It has been suggested that these molluscs may have been "'caught out' by the extremes and variability of low spring tides" (Evans 2015:57, 69-70). This also coincides with the season of occupation as indicated by the otolith data (Morley 2015:41). A summary chart of the proposed seasons of occupation at this site is presented in Table 41.

The exploitation of razor clams on the scale seen at Tràigh na Beirigh 1 is unique to this site and not reflected at other Scottish Mesolithic sites. This is despite the evidence for an overall greater exploitation of the low shore region at sites such as Sand and An Corran, than is observed at Tràigh na Beirigh 1 (Evans 2015:59, 68-69). This has been attributed to the difference in exposure of the shoreline; Sand and An Corran are more sheltered, hence a greater representation of low shore species, whereas the exposed nature of the shore at Tràigh na Beirigh 1 may "render the very lowest part of the shore an unacceptably hazardous location" (Evans 2015:69).

The dominance of limpets at Tràigh na Beirigh 1 is consistent with shell middens of Mesolithic age in the Inner Hebrides at Sand, An Corran, Ulva Cave, Carding Mill Bay, MacArthur Cave and Oronsay (Anderson 1895; Connock *et al.* 1992; Mellars 1987; Milner 2009; Russell *et al.* 1995:284; Saville *et al.* 2012b). More widely, this is consistent with Mesolithic middens found in Brittany and Cantabrian Spain (Bailey & Craighead 2003; Dupont *et al.* 2009; Gutiérrez-Zugasti 2011). This is divergent from the *Køkkenmøddinger* of Denmark however, which are dominated by oyster and appear vastly more complex in terms of structural evidence and year-round occupation (Gutiérrez-Zugasti *et al.* 2011:73; Rowley-Conwy 1999; 2004).

Limpet exploitation took place across the whole shore during the occupation of Tràigh na Beirigh 1, with the weather a key factor in determining their shoreline availability in this exposed location. This may explain the preponderance of smaller, more conical specimens, indicative of higher shore zones as inclement weather would restrict access to the lower shore. This is consistent with the comparatively flatter profile of low shore limpets from An Corran and Ulva Cave, and the selective procurement of razor clam discussed above (Blake 2011:186; Evans 2015). In contrast to razor clam exploitation, the procurement of limpets appears to be much more generalised and it has been suggested that they may have been used as fishing bait (Blake 2011:187, 190; Morley 2015:41-42). The possibility of seaweed collection, for use as food or fuel, is also inferred by the presence of small numbers of flat periwinkle (*Littorina fabalis*) and yellow periwinkle (*Littorina obtusata*; Bell 1981; Evans 2015:68). These were abundant at Ulva Cave, leading to a suggestion that seaweed collection may have been a particularly targeted resource (Russell *et al.* 1995; Saville & Wickham-Jones 2012:38), very small shells indicative of seaweed collection were also recovered at Sand, Carding Mill Bay, and An Corran (Milner 2009; Pickard & Bonsall 2012:68; Russell *et al.* 1995). At the latter site and at Staosnaig, Colonsay, charred seaweed has been identified (Bishop *et al.* 2014b; Holden & Miller 2012:71; Saville & Wickham-Jones 2012:98).

The lithic assemblage from Tràigh na Beirigh 1 was presented in Chapter Six, therefore only a brief re-cap of the main findings is provided. The lithic assemblage was largely derived from the shell midden deposits, however the presence of flint and quartz debris in the underlying ground surface suggests the site may have been in use prior to the build-up of the midden. High-quality greasy quartz dominates the lithic assemblage at Tràigh na Beirigh 1, which was derived from both a vein source and beach pebbles that could be obtained within the immediate vicinity of the site. Evidence for quarrying of the vein close to the site is discussed below in Section 8.3.1. Despite the quality of the raw material there no evidence for blade production and the only formal tool present in the assemblage is a barely-modified borer made from an exhausted core. The quartz assemblage on the whole reflects an expedient flake-based industry that was reduced on-site with informal tools produced on an *ad hoc* basis. A very small quantity of worked beach pebble flint was also recovered from Tràigh na Beirigh 1. The absence of significant aspects of the *chaîne opératoire* suggest that the primary reduction of flint was conducted elsewhere, and that flakes detached during further working of the core were removed from the site. A number of coarse stone manuports were also recovered from the site, which may have been used as anvils for the reduction of lithics, or in the processing of plant material.

8.2.2.2. Tràigh na Beirigh 2

Tràigh na Beirigh 2 also occupies a similar position to Tràigh na Beirigh 1, on the relic cliff-edge overlooking the wide embayment of Tràigh na Beirigh (Figure 245 and Figure 246). The faunal material from the site has not yet been fully analysed, but it is evident that during the occupation of the site, a large number of marine resources were exploited, in addition to terrestrial plants and small mammals. The location of the site would have been ideally situated for this. Otoliths from the main body of the shell midden (C005) at Tràigh na Beirigh 2 were also studied by Morley (2015:9). The results show a very different exploitation strategy to the one proposed for Tràigh na Beirigh 1. The fishing activities at this site are represented by more intensive exploitation of larger first year saithe during the winter months, with less evidence for second year fish present in the assemblage.

The range of fish sizes does, however, extend to smaller fish captured late in the summer and throughout autumn. Overall, the high standard deviation for the range of fish size supports an extended period of fishing practice at Tràigh na Beirigh 2, with the most intense period of activity in mid-winter (Morley 2015). The only midden on Oronsay to clearly display evidence for saithe fishing during this part of the year is at Priory Midden, where a high number of exclusively first year fish were intensively exploited; however, mid-winter fishing at Caisteal nan Gillean II is also implied (Mellars *et al.* 1980:34-36). The extended fishing season observed at this site and Tràigh na Beirigh 1, however, is similar to the evidence from Cnoc Coig, Oronsay where both first and second year fish were caught from mid-summer into autumn, potentially as late as December (Mellars *et al.* 1980:34).

The sudden drop-off in fish size at the largest end of the scale at Tràigh na Beirigh 2 is not representative of a natural population, and is taken to indicate more selective procurement or processing strategies (Morley 2015:32-33, 35-36). It was noted that the higher rate of carbonisation and fragmentation in the assemblage may be a contributing factor to the fall-off in size, and may therefore be taphonomic rather than cultural (Morley 2015:43). It is clear that the Cnip peninsula was ideally situated for exploitation of young saithe throughout spring and late summer to mid-winter, with repeated visits to both these sites indicated throughout these seasons (Table 41). Despite this, the preferred season of exploitation between Tràigh na Beirigh 1 and Tràigh na Beirigh 2 differs, with a greater intensity of exploitation during spring at Tràigh na Beirigh, and during winter at Tràigh na Beirigh 2. Given the close geographical location, but temporally separate nature of the two sites, Morley suggests this may be down to changing procurement and processing practices over time (Morley 2015:38).

The lithic assemblage from Tràigh na Beirigh 2 can be summarised in a similar manner to that of its slightly later, neighbouring site of Tràigh na Beirigh 1. The large very fine-grained (greasy) quartz assemblage was largely derived from beach pebbles, although some appears to have been quarried from a vein. This material was reduced using platform technology to expediently produce a high quantity of flakes that were not subsequently modified, despite the high quality of the raw material. Worked flint is found in extremely small quantities at the site. As at Tràigh na Beirigh 1, a small quantity of lithic debris was recovered from the old ground surface underlying the middens deposits, which suggests activity at the site prior to the build-up of the midden. The main body of the shell midden again contained the majority of the lithic assemblage.

8.2.2.3. Tràigh na Beirigh 9

The articulated remains of part of a single human individual were recovered from a pit cut into a Mesolithic-age shell midden at Tràigh na Beirigh 9. The base of the pit was lined with intentionally-placed cobbles, and the pit filled with re-deposited midden material (Snape-Kennedy *et al.* 2014).

The recovery of human remains dating from the Mesolithic in Scotland is rare, and a formal burial from this period in the region is unique (Saville & Wickham-Jones 2012:73; Wickham-Jones 2009d:482). The individual has been dated to 4040-3805 cal. BC[6], which spans the traditional transition period between the Mesolithic and Neolithic. Based on the $\delta^{13}C$ (-15.2 ‰) and $\delta^{15}N$ (15.5 ‰) stable isotopic values, it is believed that the diet of this individual was c.55% marine, which testifies to hunter-fisher-gatherer subsistence (Church pers. comm.; Richards & Hedges 1999; Schulting & Richards 2002). This has significant implications for understanding the Mesolithic-Neolithic transition in the region, and the continuity of Mesolithic hunter-gatherer subsistence practices in peripheral environments (Schulting & Richards 2002:147-148). In terms of funerary traditions, this burial is markedly different to the isolated find of the single finger bone fragment recovered from deposits c.2000 years earlier at Northton, yet both are consistent with Mesolithic burial practices across the Atlantic façade. A more in-depth discussion of this, alongside the burgeoning evidence for continuity across the Mesolithic-Neolithic transition is presented in the following chapter.

Initially, it was believed the individual may have been buried with a quantity of quartz debitage. However, detailed analysis of the lithic assemblages from the surrounding context (C005), and that of the underlying Mesolithic-age shell midden (C006), has demonstrated the two are identical (Appendix Twelve). Based on this, and the homogeneity of the deposits surrounding the individual with those of the midden below[7], it is interpreted that any such cut was filled with redeposited midden material once the individual had been interred. As at the other shell midden sites along the Cnip peninsula, very-fine grained quartz dominates the assemblage. In most other respects, the assemblage is slightly different from the other shell midden sites. The full *chaîne opératoire* relating to the reduction of quartz is evident, including the presence of a number of tools. Furthermore, there is significant evident for the movement of raw materials at this site. The sandstone manuport is likely to have been imported to the site from east Lewis and the presence of carbonate (dolomite or limestone) suggests contact with the west coast of Scotland where this material outcrops. This will be discussed in more detail in Chapter Nine, in connection with the movement of Mesolithic people around the Hebridean islands.

Post-excavation analysis of the environmental remains from Tràigh na Beirigh 9 has not yet been carried out; however, during preliminary sorting of the material small bones of mammals and fish – including otoliths, crustacean fragments, marine molluscs, and charred hazel nutshell were all noted. This environmental assemblage is closely comparable with that of the other Mesolithic shell

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[6] This date has not been fully corrected for the Marine Reservoir Effect as the ΔR for this region is unknown.

[7] There was no discernible 'grave cut' beyond the layer of cobbles below the individual. It should also be noted that the human remains and cobble layer were slightly off-set, suggesting a degree of slumping has occurred.

midden sites along the Cnip headland (Snape-Kennedy *et al.* 2014). In the absence of machair dunes, the cliff-top position of the site would have enabled observation of marine resources across the bay at Tràigh na Beirigh, in addition to capitalising on terrestrial resources (Figure 246). Based on this, a tentative indication of when the site may have been occupied is presented in Table 41.

Figure 246. View across the bay at Tràigh na Beirigh, with excavation of Tràigh na Beirigh 9 in progress (arrowed). The other sites lie just beyond the machair dune. Photo courtesy of Mike Church

8.2.2.4. Pabaigh Mòr South

Otolith analysis was also conducted on the small sample from C002 at Pabaigh Mòr South (Morley 2015:9). As at Tràigh na Beirigh 1, the results from this site showed that only first year fish were represented, and that there was a similarly intensive exploitation of very small saithe during the spring. The range of sizes of first year fish represents the natural population, and is indicative of similarly unselective fishing practices close to the shore that were suggested for Tràigh na Beirigh 1 above (Morley 2015:35). However, the size of these fish were smaller than at Tràigh na Beirigh 1, suggesting they were caught earlier in the year, soon after their arrival inshore between April and May. In contrast to both Tràigh na Beirigh 1 and Tràigh na Beirigh 2, the low standard deviation of the otolith measurements suggests that the fishing season at Pabaigh Mòr South was very short, possibly only relating to brief seasonal visits (Morley 2015:31). Similarly short episodes of fishing activity were observed at Cnoc Sligeach, albeit during mid-summer, between June-July (Mellars *et al.* 1980:34). The higher rate of carbonisation at this site attests to different processing strategies than at Tràigh na Beirigh 1. Given the very small size of the fish, it is likely they were simply cooked whole (Morley 2015:36).

Further analysis of the faunal assemblage has yet to be conducted; however, preliminary sorting of the environmental remains indicates a very similar midden composition to those on the Cnip headland – predominantly limpets, with razor clams and periwinkle/dogwhelk also present. Fragments of crustacean, seal, small mammal and fish bones, and charred hazel nutshell were also recovered (Rowley-Conwy pers. comm.; Church & Rowley-Conwy 2014). The fish remains are therefore the most reliable seasonal indicator for the occupation of the site, yet seasonal visits outside the winter months are hinted at in the wider environmental assemblage (Table 41). The site occupies a very similar position to those at on the Cnip headland. It is situated on a rocky platform, close to a sheltered embayment. This would have offered an ideal landing area for boats, and thus access to marine resources, as well as terrestrially-based species.

Figure 247. Pabaigh Mòr South (arrowed) is situated atop a rocky platform, next to a sheltered bay. Photo courtesy of Peter Rowley-Conwy

The lithic assemblage from the site is extremely small, owing to the small sample taken for analysis. As with the environmental assemblage, the lithic assemblage also appears to be closely comparable with those on the Cnip headland. The single, exhausted flint core indicates that this pebble-derived raw material was reduced intensively, as in the Tràigh na Beirigh assemblages. Similarly, the quartz assemblage is evidence of the exploitation of both primary vein and secondary beach pebble sources that were expediently reduced using platform technology to produce a flake-based industry.

This section has described the results to-date of the environmental evidence that has been recovered from the Western Isles Mesolithic sites. The importance of fishing at all of these sites is overwhelming and the contribution of terrestrial resources to the subsistence base is conspicuous in its scarcity. The following section begins to draw this evidence together with a detailed interpretation of the lithic assemblages, which forms a base for the exploration of a number of notable themes across the Mesolithic of the Atlantic façade, which will be discussed in Chapter Nine.

8.3. Interpreting the Western Isles Lithic Evidence within the Context of the Late Mesolithic of the Atlantic Seaboard

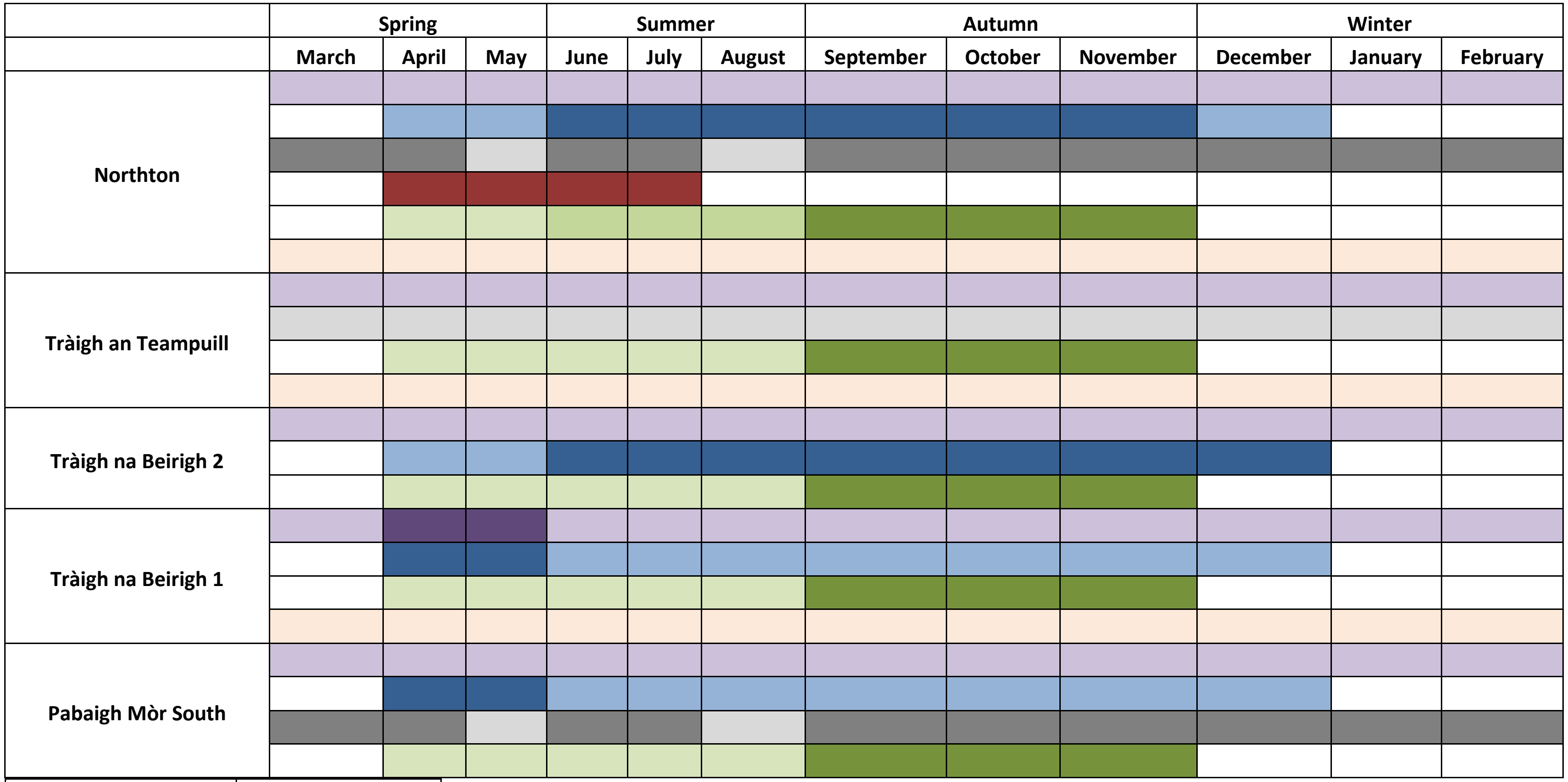
There are several themes that have emerged from the analysis of the Mesolithic lithic assemblages in the Western Isles that contribute to answering the first research question of this thesis: *what is the nature of the lithic technology of the Mesolithic in the context of the Western Isles of Scotland?* Each section – raw material acquisition**,** reduction strategy, technology, and tool use **–** will be discussed in turn and contextualised by drawing on evidence from Scotland, Norway, and Ireland. Throughout this section the evidence for subsistence activities at the sites described above will be integrated with the lithic technology evidence, and used to inform interpretations of the decisions that influenced the *chaîne opératoire*.

8.3.1. Raw Material Acquisition

The first trend is that overall, *the Later Mesolithic assemblages in the Western Isles are dominated by locally available raw materials*. This was supplemented by less readily available raw materials which were imported from elsewhere. The sources and practical methods of procurement for flint and quartz are discussed in the following section. The import of baked mudstone to Harris and limestone to Lewis will be discussed in Chapter Nine, alongside greater elaboration on the implications of raw material sourcing for mobility and social connections.

8.3.1.1. Quartz – Varieties, Sources and Procurement

Quartz is a ubiquitous raw material throughout Scotland, and is the most common component of the Western Isles Mesolithic assemblages. There are many different varieties of quartz, to recap, these are: rock crystal, milky quartz, 'greasy' (very fine grained) quartz, fine grained quartz, coarse grained quartz and quartzite, which were described in detail in Chapter Four (Ballin 2008). The boundaries between each type are not distinct, and varieties may grade between one another. Even within a single quartz vein or outcrop, the type of quartz can vary significantly (Jones forthcoming in Ballin 2008). Furthermore, the knapping quality between these varieties also varies. This provides a significant point of discussion regarding the similarities and differences between the Late Mesolithic sites on Harris, and the Terminal Mesolithic sites on Lewis.



	Spring			Summer			Autumn			Winter		
	March	April	May	June	July	August	September	October	November	December	January	February
Northton	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣
		🔵	🔵	🟦	🟦	🟦	🟦	🟦	🟦	🔵		
	⬛	⬛	⚪	⬛	⬛	⚪	⬛	⬛	⬛	⬛	⬛	⬛
		🟥	🟥	🟥	🟥							
		🟢	🟢	🟢	🟢	🟢	🟩	🟩	🟩			
	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠
Tràigh an Teampuill	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣
	⚪	⚪	⚪	⚪	⚪	⚪	⚪	⚪	⚪	⚪	⚪	⚪
		🟢	🟢	🟢	🟢	🟢	🟩	🟩	🟩			
	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠
Tràigh na Beirigh 2	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣
		🔵	🔵	🟦	🟦	🟦	🟦	🟦	🟦	🟦		
		🟢	🟢	🟢	🟢	🟢	🟩	🟩	🟩			
Tràigh na Beirigh 1	🟣	🟪	🟪	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣
		🟦	🟦	🔵	🔵	🔵	🔵	🔵	🔵	🔵		
		🟢	🟢	🟢	🟢	🟢	🟩	🟩	🟩			
	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠	🟠
Pabaigh Mòr South	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣	🟣
		🟦	🟦	🔵	🔵	🔵	🔵	🔵	🔵	🔵		
	⬛	⬛	⚪	⬛	⬛	⚪	⬛	⬛	⬛	⬛	⬛	⬛
		🟢	🟢	🟢	🟢	🟢	🟩	🟩	🟩			

	Availability	
	Likely	Definite
Shellfish	🟣	🟪
Fish	🔵	🟦
Marine mammals	⚪	⬛
Seabirds		🟥
Terrestrial plants	🟢	🟩
Terrestrial mammals	🟠	

Table 41. Seasonality indicators for Mesolithic occupation of the Western Isles sites, derived from the environmental remains analysed thus far. The key below refers to the potential seasons of availability of resources at the sites (likely), and if definitive seasonal evidence for these resources have been recovered from the archaeological record (definite).

Milky quartz is the most commonly occurring quartz type in Scottish quartz-bearing rock formations and has been exploited throughout Scottish prehistory (Ballin 2008:47). It is massive (not grainy), usually translucent and white in colour with a vitreous lustre. Depending upon the quality, milky quartz grades between appearing almost rock crystal-like to highly irregular, which affects the flaking properties of the material (Ballin 2008:44). Generally, milky quartz does not fracture conchoidally, as flint does, but through "intricate cracking…which…tends to produce cubic fragments in an uncontrollable fashion", and consequently a large amount of debitage or debris[8]. As evident in the preceding results chapters, despite the high fragmentation rate of this raw material, this does not preclude the majority of the assemblage from being identified as indeterminate pieces, also known as the 'gravel effect' (Callahan 1987). Milky quartz is the most frequently occurring variety of quartz at both sites on the Toe Head Peninsula of Harris. At Northton the quartz assemblage is made up of 65% milky quartz, with 54% of the quartz assemblage at Tràigh an Teampuill made from milky quartz. In both instances this is often mixed with other quartz varieties. The remainder of the quartz assemblages at these sites are predominantly of mixed saccharoidal (grainy) quartz varieties, with small contributions of coarse-grained quartz/quartzite and rock crystal.

Quartz that has been directly obtained from a vein is characterised by the presence of red, brown and yellow to orange coloured surfaces. This is interpreted as mineral deposits – possibly iron, which appear between the contact points of different quartz layers. Often the exposed outer surface of a quartz vein displays a 'frosted' appearance due to weathering. Other indications of a vein source is the inter-mixing of the parent rock type – such as gneiss or pegmatite – with the outer face of the quartz (Ballin 2004:8-9; 2008:56-57). The exploitation of this type of source is evident in both the quartz assemblages on the Toe Head Peninsula as indicated by the presence of weathered, mixed-material or frosted 'cortex'. The majority of the 2001 quartz assemblage from Northton was identified as either vein quartz or "derived from the granite pegmatite near to the site" (Nelis 2006b). Similarly, 40% of the quartz assemblage excavated from Northton in 2010 displayed evidence for the exploitation of a vein source. At Tràigh an Teampuill, just over a quarter of the quartz was derived from a vein source. Furthermore, exploitation of the quartz-granite-pegmatite vein that is situated close to the sites is evidenced by the high variation in the quality and variety of quartzes at both Northton and Tràigh an Teampuill.

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[8] According to Inizan *et al*. (1999), 'débitage' is "used to denote the intentional knapping of blocks of raw material, in order to obtain products that will either be subsequently shaped or retouched, or directly used without further modification. Refers also to the tangible results (débitage products) of this action". This contrasts to the definition of 'debris' as "shapeless fragments whose mode of fracture cannot be identified, and which cannot be assigned to any category of objects".

The shear zone where this granite-pegmatite protrudes is clearly visible from both sites, emerging from the south-east face of a nearby hill, Ceapabhal, and is highlighted by the sun on a clear day (Phillips 2006a; Figure 248, Figure 249 and Figure 250). Exploration of this shear zone during the field season in 2010 provided highly varied samples of pegmatite and quartzites, although no evidence to indicate quarrying of the granite-pegmatite vein was observed.

Figure 248. Outcrops of quartz running across the flank of Ceapabhal are clearly visible on a bright day. Photo courtesy of Peter Rowley-Conwy

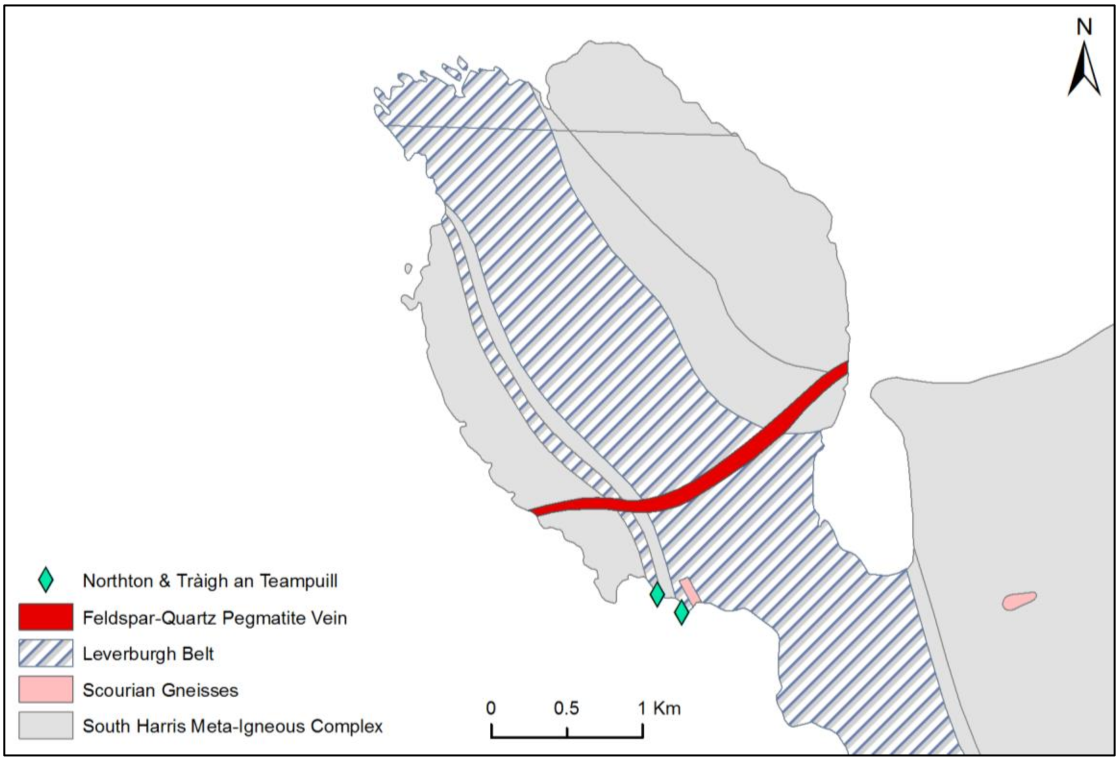

Figure 249. Simplified map of the bedrock geology of the Toe Head peninsula, highlighting the close proximity of the Mesolithic sites to the exposed vein. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

A greater proportion of the quartz assemblages at both Northton and Tràigh an Teampuill is characterised by a pebble quartz (60% and 73% respectively). Pebble quartz is simply vein quartz that has become “detached from its original matrix and subsequently abraded and rounded by a variety of water media” (Ballin 2008:46); in this instance the sea. The ‘cortex’ of pebble quartz is therefore smooth and rounded, which is easily identifiable on flakes and cores where cortex is retained. Given the prolific nature of quartz within the bedrock geology of Scotland and the Western Isles, it is probable that the supply of pebble quartz is continuously replenished by the tide. A brief survey of the pebbled beach to the west of the site at Northton recovered numerous small quartz pebbles, and is likely to have been the source of the material used at these sites (Figure 250).

On the Toe Head peninsula it is clear that overall, quartz was immediately abundant. The Mesolithic inhabitants could easily exploit both the pegmatite vein on Ceapabhal, above the sites, or retrieve pebbles from the beach below. The ease of procurement from these sources is reflected in the treatment of the raw material, which is discussed in detail in Section 8.3.2.

Figure 250. Pebbles recovered from the beach close to Northton and a piece of vein quartz from the exposure on Ceapabhal (centre back)

The Tràigh na Beirigh sites on Lewis are comprised of a different quartz variety. ‘Greasy’, or very fine grained quartz, is so called because of the slightly frosted lustre created by its microscopic granular structure (Ballin 2008). Greasy quartz is suggested to have better flaking properties than many other quartz types, almost akin to coarse varieties of flint or chert (Ballin 2008:44, 49, 56).

The high quality of the quartz present around the Bhaltos peninsula and Tràigh na Beirigh was noted by Lacaille during a survey of the region in 1935, commenting that:

> "The vein-quartz of Valtos, while inferior to flint for the manufacture of implements, is not of the poor quality so often met with in localities where other varieties predominate. At Valtos the quartz is virtually granular and its cleavage approaches that of some gritty cherts, fine quartzite, or schistose grit. The implements show that percussion does not always produce these features noticeable in flint intentionally struck. Nevertheless, a large proportion of vein-quartz flakes of the West bear, if not a perfect part of a cone, at least a prominence not unlike the soft swelling seen on flint flakes detached from the cores by the use of a percussion instrument such as a wooden bar." (Lacaille 1937:282).

The regular flaking properties of greasy quartz have also been recognised during the analysis of later prehistoric quartz assemblages on Lewis, such as Calanais and Dalmore. At these sites different quartz varieties dominate, but greasy quartz appears to have been used specifically to produce artefacts such as arrowheads (Ballin 2008). In the absence of any known site in the Western Isles where this variety of quartz dominates, and its presence in later prehistoric assemblages primarily as finished tools, Ballin has suggested that "this resource may have been saved for the production of more prestigious objects, such as arrowheads and other sophisticated forms". This is attributed to the very different visual and flaking properties between this variety and milky quartz or rock crystal. As such, it has been proposed that prehistoric people may have perceived these as separate raw materials in their own right, favouring greasy quartz for the production of specific tools (Ballin 2008:2, 48, 56; Saville & Ballin 2000:47). During Ballin's (2008) study of quartz use in Scottish prehistory the only known site where greasy quartz dominates the assemblage is the multi-period site of Shieldaig, on the mainland of Scotland at Wester Ross. Ballin therefore proposed that greasy quartz may have been sourced from Shieldaig, and imported to the Western Isles for use in arrowhead production at Dalmore and Calanais (2008:66, 89).

Focussing on the assemblages from the around the Cnip headland (Table 42), it is clear that greasy quartz dominates at all the sites, which is unprecedented in the Western Isles. This begins to challenge Ballin's suggestion that this quartz variety may have been imported, therefore it is important to address this. If true, this would have significant implications for the understanding of raw material procurement. To assess whether the greasy quartz at the Tràigh na Beirigh assemblages was imported, the whole *chaîne opératoire* is considered. The extraction, reduction and movement of finished tools has been extensively studied in the Mesolithic and Neolithic of Norway. As such, the Tràigh na Beirigh sites should theoretically fit within a spectrum of characteristic 'site types' relating to the reduction and movement of this raw material. These 'site types' are based on the distinct stages of reduction associated with the proximity of the site to the source, which have been modelled on the distribution of high quality raw materials with very specific sources such as greenstone, diabase, rhyolite, and slate. Where raw materials were transported or exchanged over long distances it would be expected that products of later operational stages would be present at the destination – blanks, cores or finished artefacts and associated debris from later modification or use. Raw nodules or unprepared blocks, debitage and debris relating to basic preparation and the primary stages of working – decorticating and 'roughing out' – would be greater at the source of the material. This would be in order to reduce the dead weight of redundant material before transport (Ballin 2008:64; Bergsvik 2006:156-164; Olsen & Alsaker 1984:81-83).

Site	Total Assemblage		Quartz assemblage		
	% Quartz	% Other	% Greasy	% Milky	% Other
Tràigh na Beirigh 1	**94%**	**6%**	**60%**	**34%**	**6%**
Tràigh na Beirigh 2	**97%**	**3%**	**78%**	**18%**	**4%**
Tràigh na Beirigh 3 & 4	**100%**	**0%**	**86%**	**14%**	**0%**
Tràigh na Beirigh 9	**96%**	**4%**	**48%**	**32%**	**20%**

Table 42. Quartz composition from the Tràigh na Beirigh assemblages

Furthermore, as evident from Table 43, the full range of the *chaîne opératoire* is present in the greasy quartz assemblages at all the Tràigh na Beirigh sites. This includes unworked or tested pieces, a vast quantity of debitage and debris from the reduction and rejuvenation of cores, and only a small number of finished artefacts. This is characteristic of both procurement and reduction of the raw material on-site by the occupants (Bergsvik 2006:156). If Shieldaig were the source of greasy quartz, it would suggest the direct procurement of this raw material by the inhabitants of Cnip, a distance of over 100km as the crow flies across The Minch, with raw blocks transported back to Lewis.

Directly procuring, or acquiring through trade/barter a raw material over such a distance would involve a substantial amount of time and effort. In instances where non-local, high quality raw materials are required for the production of specific tools, this time/effort is offset by "the organization of technology" (Andrefsky 1994; Torrence 1989b:3). The *chaîne opératoire* would therefore be expected to show conservative reduction, or specific use, of the raw material in order to compensate for the expense in acquiring it (Jeske 1989:36; Morrow & Jeffries 1989:30). Conservative reduction would be indicated by very small exhausted cores, worked using bipolar technology, which would maximise the quantity of flakes removed from the core, in addition to the preparatory reduction at the source to reduce transport costs discussed above (Barham 1987:49; Binford 1980:10, 16; Manninen & Knutsson 2014:95). These characteristics are not displayed in the greasy quartz assemblages at any of the sites. For example, the cores frequently have a high number of flake removals, but were often discarded long before they became exhausted. This uneconomical treatment of quartz is likely to reflect an abundance of material to hand, and is indicative of an embedded procurement strategy. Several quartz beach pebbles could have been picked up by a Mesolithic fisher returning to camp from their day collecting limpets and checking the fish trap, for example.

	Tràigh na Beirigh 1	**Tràigh na Beirigh 2**	**Tràigh na Beirigh 3 & 4**	**Tràigh na Beirigh 9**
Core	29	41	1	4
Chunk	9	4	1	23
Small fraction chunk	11	6	1	23
Flakes				
Primary	13	12	1	9
Secondary	44	35	4	28
Tertiary	45	64	3	53
Core rejuvenation flake	1	2		1
Flake Core	7	1		3
Small fraction flake	139	160	9	159
Secondary pieces	1		2	5
Manuport	2	6		1

Table 43. Quartz artefact composition of the Tràigh na Beirigh assemblages

It should be noted that with boat technology, the cost:benefit compromise in terms of embedded procurement is significantly reduced. Ames (2002) suggests that ‘field processing’, i.e. kill-site butchering of animals, or testing of raw materials at the source, is a primary concern of terrestrial hunter-gatherers. The load-bearing capacity of groups who largely move on foot is very low, as such transport costs of resources must be offset against their economic return. With aquatic hunter-gatherers, however, transport cost is negligible – “what is 15kg in a boat that can easily carry 2000kg?” (Ames 2002:35-37; Bjerck 2016). Furthermore, whilst a distance of 100km would take between 4-5 days to travel on foot, by boat in favourable conditions this could be travelled in two (Ames 2002). Boats significantly extend the geographical range of foraging groups, thus embedded procurement is feasible on a much greater scale (Rowley-Conwy & Piper in press). In light of this, the *chaîne opératoire* alone is insufficient evidence to determine whether Shieldaig is the only source of greasy quartz as Ballin proposes.

The cortex present on the greasy quartz at these sites indicates that the material was indeed primarily extracted from a vein source (discussed in Chapter Five); however, evidence for the use of locally available beach cobbles at all of the Tràigh na Beirigh sites is also in abundance. A quartz vein at the Gridig promontory, on which Tràigh na Beirigh 1 is situated, exhibits signs of being exploited, and could have been easily accessed from any of the sites. There are three main types of evidence for quarrying that may be visible on an exploited quartz vein. The first is ‘stepping’, caused by the removal of blocks or plates along the natural planes of weakness within the vein. The second are ‘circular impact scars’ which are incipient Hertzian cones either in the centre or near the edges of the block surface, created by attempts to break through a layer. The third are ‘denticulated edges’ created by the removal of a block or a plate, the success of these produces denticulated flake removal scars along a protruding edge. On the whole this strategy aims to remove blocks or plates for further reduction elsewhere. These diagnostic features are evident at the quartz quarry at Cnoc Dubh, near the town of Gearraidh na h-Aibhne, Lewis (Ballin 2004:8-11); this quarry lies 15km to the south-east of the Mesolithic sites on the Bhaltos peninsula, as the crow flies.

There are circular impact scars present on the Gridig vein which attests to quarrying of this raw material (Figure 251 and Figure 252). Further evidence for quarrying of a quartz vein is found on the tested quartz piece from Pabaigh Mòr South. This piece has clearly been detached as a ‘layer’, denoted by a set thickness defined by the plane of weakness within the vein, and has characteristically flat sides and a weathered appearance of the outer surfaces, as observed on the quarried vein at Cnoc Dubh (Ballin 2004). Some of the flake scars may have been created during the process of detaching the piece from the source, certainly the single flake scar perpendicular to the others on the lateral edge is evidence for this, creating the characteristic denticulated appearance. The flake scars present are very small and shallow, with large areas of the piece unworked (Figure 253). It may have been discarded following a few test blows to ascertain its flaking properties, or lost before it could be utilised.

Overall, it is concluded that the greasy quartz present in the Tràigh na Beirigh assemblages is derived from a very locally available source, rather than imported from the mainland. This is based on several observations, discussed above, which include: the dominance of greasy quartz in all of the Mesolithic assemblages on Lewis; the presence of an exploited greasy quartz vein close to the sites; the large quantity of primary manufacturing debitage and associated tools at these sites; the profligate treatment of this raw material, which does not fit with conservative reduction practices that would be expected if the material was hard to come by or expensive to obtain. This is irrespective of reduced transport costs by boat-using communities.

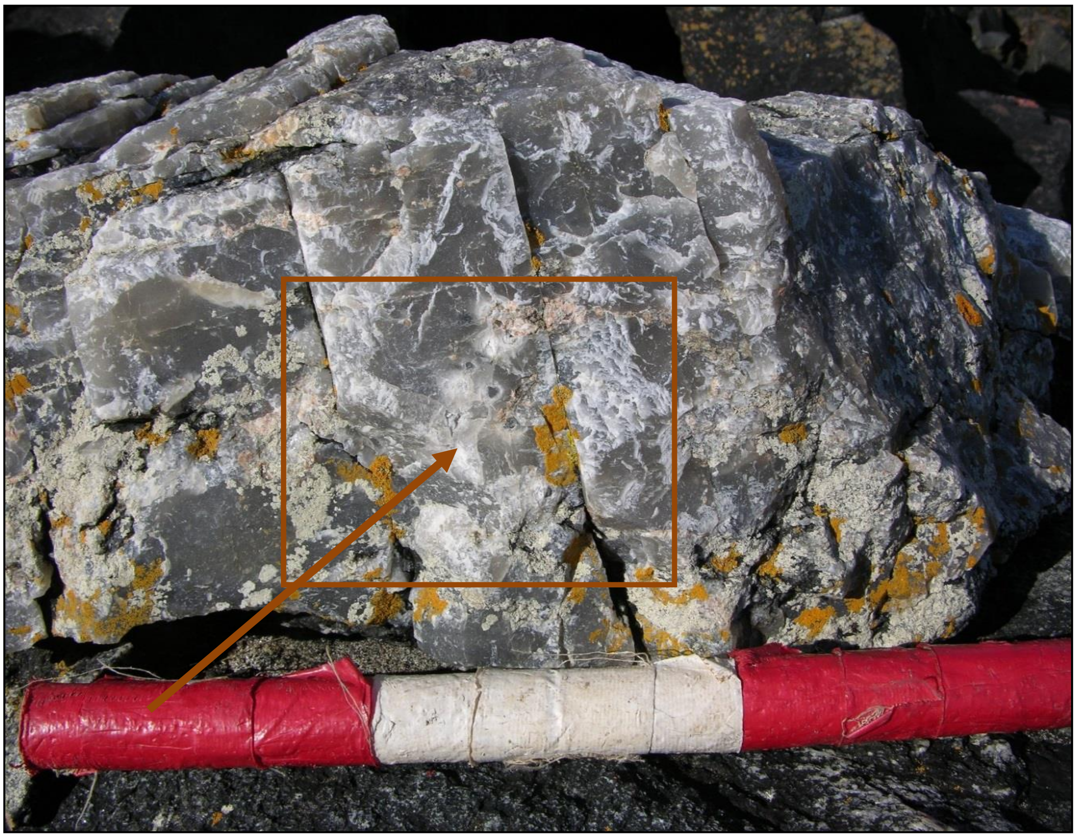

Figure 251. Circular impact scars created through the quarrying of the quartz vein, Gridig, Cnip. Photo courtesy of Peter Rowley-Conwy

Figure 252. Close-up of impact scars evident in Figure 251. Photo courtesy of Peter Rowley-Conwy

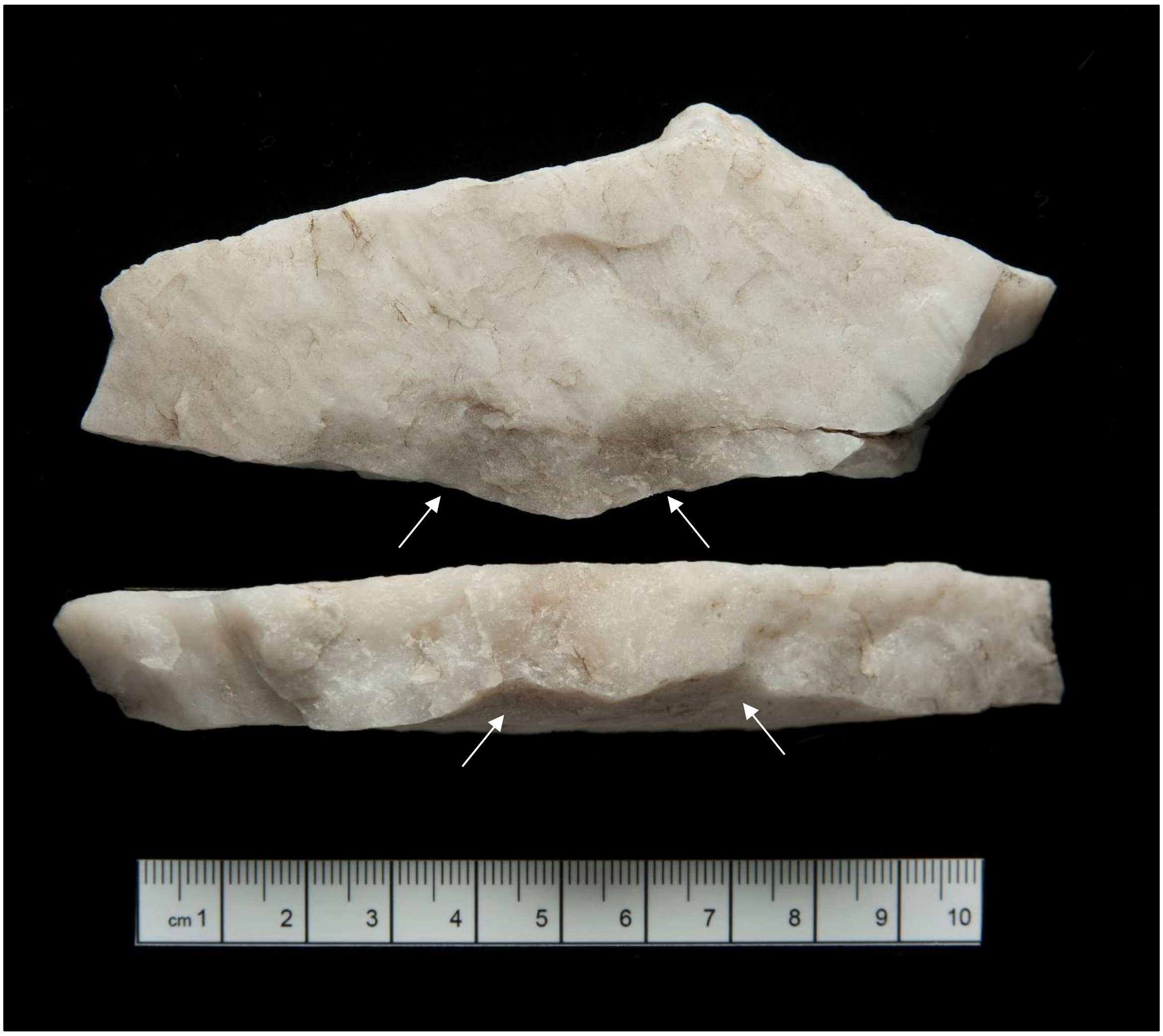

Figure 253. Tested quartz plate (L13) from Pabaigh Mòr South with removals arrowed

It is notable that the exploitation of beach pebble sources appears to change during the Mesolithic occupation of the Western Isles. On Harris, beach pebbles were used more frequently than the nearby vein. This may have been due to the low quality of the milky quartz from the vein, which included large quantities of mica and pegmatite. At the later sites on Lewis, the proportion of pebble quartz is highest at Tràigh na Beirigh 2, the oldest site on the Cnip peninsula. This is slightly reduced at Tràigh na Beirigh 1, and by the occupation at the youngest site of Tràigh na Beirigh 9 extraction of vein quartz has greatly increased (Table 44). The difference between exploitation of vein and pebble sources at these sites may be due to availability, or ease of access to the most appropriate material. It is also possible that over time, the supply of quartz pebbles may have 'dried up' on Lewis, as suggested for the drop-off in flint use on Harris above. This clearly indicates the choices made by the Mesolithic inhabitants for raw material that is both locally available and of reasonable quality, due to high use-rate of this raw material. Such requirements suggests direct or embedded procurement would have been the most suitable method of obtaining quartz, and is evident in later prehistoric quartz-using communities on Lewis (Ballin 2008:65).

Site	Quartz Source	
	Pebble	Vein
Tràigh na Beirigh 1	57%	43%
Tràigh na Beirigh 2	73%	27%
Tràigh na Beirigh 9	35%	65%

Table 44. Proportion of vein quartz and pebble quartz at the Tràigh na Beirigh sites, where likely provenance could be determined from the cortex of cores and flakes

8.3.1.2. Flint – Sources and Procurement

There are very few known sources of flint in the Western Isles. The smooth, water-rounded cortex present on the flint debitage recovered from both sites on Harris as well as at Pabaigh Mòr South, Tràigh na Beirigh 1, and Tràigh na Beirigh 2 on Lewis, indicates this material was derived from a secondary, water-borne source. The small size of the debitage present in the assemblages as a whole suggests that the supply of flint was limited and likely to have been obtained from "diminutive beach pebble[s]", as described by Nelis for the Northton assemblage (2006b:23-25). The nearest derived deposits bearing flint in the Western Isles are situated on South Uist, and further away on Barra; however, these are described as a single "boulder of chalk flint recorded in drift", and "rare but large" chalk flint boulders from drift deposits in the north-east of the island, which were recorded in 1925 (Wickham-Jones & Collins 1978:11-12; Figure 254). The lack of systematic survey for flint sources in Scotland, beyond the investigations conducted on Islay for the Southern Hebrides Mesolithic Project, hampers our understanding of the movement of this raw material (Marshall 2000b; 2000c). From this, and the long-outdated gazetteer by Wickham-Jones and Collins (1978), the known distribution of flint is predominantly along the exposed, western facing coasts of islands around the Inner Hebrides, where it has been washed ashore from eroding sub-marine outcrops and commonly recovered as rolled beach pebbles (Benn & Dawson 1987; Dawson & Dawson 2000; Marshall 2000b; 2000c; Ritchie 1981; Wickham-Jones 1986).

Table 45 summarises the proportion of flint found in each of the largest assemblages. It is notable that flint contributes to a greater proportion of the assemblages on Harris than those on Lewis. In Lewis, despite the local abundance of much higher quality quartz than on Harris, flint is clearly still a valued raw material as evidenced by the exhaustively worked cores.

Site	Total Assemblage		
	% Flint	% Quartz	% Other
Northton	17%	71%	12%
Tràigh an Teampuill	44%	49%	7%
Tràigh na Beirigh 1	3.5%	95%	1.5%
Tràigh na Beirigh 2	2.7%	97%	0.3%
Tràigh na Beirigh 9	0.3%	97%	2.7%

Table 45. Main raw material composition of the debitage from the largest sites from Harris and Lewis, excludes manuports or coarse stone tools. The Northton assemblage comprises raw material from all excavations.

There are a number of possible reasons that may explain the disparity in the quantity of flint between the Western Isles assemblages:

1. Time

Initially, this factor appeared to be the most relevant, especially when considering the change in raw material use during the Later Mesolithic. At Northton flint dominates in the earliest (Phase 4) deposits; however, the proportion of flint diminishes significantly in the later (Phase 3) deposits at the site when baked mudstone is present in the assemblage and quartz is more widely exploited. Furthermore, at Tràigh na Beirigh 9, the youngest site on Lewis (c.2000 years younger than the oldest occupation at Northton), flint is represented by only a single flake. If the flint could only be sourced from derived deposits, rather than drift, then without a continued replenishment at the source areas this raw material would quickly become over-exploited. The lack of flint in younger sites may therefore be linked to the effects of over-exploitation, or geographic availability, which diminished the supply of flint over time, as recorded for the same period in Southern England (Pitts & Jacobi 1979).

This interpretation is not straightforward, however. Tràigh an Teampuill is c.400 years younger in date than Northton, yet the flint and quartz are almost equally represented. Furthermore, the proportion of beach pebble flint at Tràigh an Teampuill is *higher* than the Phase 3 deposits at Northton. Although it is difficult to draw definitive conclusions about the nature of the lithic assemblage from Tràigh an Teampuill due to its small size, there are two plausible explanations. The first is that the higher quantity of flint at the younger site may have been the result of an increase in supply. The Storegga tsunami occurred c. 6000 cal. BC, between the dates of occupation at Northton and Tràigh an Teampuill (Smith *et al.* 2004). Flood deposits potentially relating to the Storegga tsunami have been recorded on the eastern side of the Toe Head peninsula (Jordan *et al.* 2010). As such, sediment disturbed by fluctuating water levels as a result of the tsunami, or a major storm event, may have contained erratic nodules of flint that replenished raw material supplies in the area. This frequently occurs on flint bearing beaches on Islay (Marshall 2000b; 2000c). It is also notable that there is little baked mudstone present at the site – the increase in flint supplies may therefore have precluded the necessity for this raw material to be imported in the quantities required at Northton. Alternatively, the flint, baked mudstone, and antler pressure flaker may have been imported by Mesolithic people travelling to Tràigh an Teampuill from the Inner Hebrides, as part of their mobile existence.

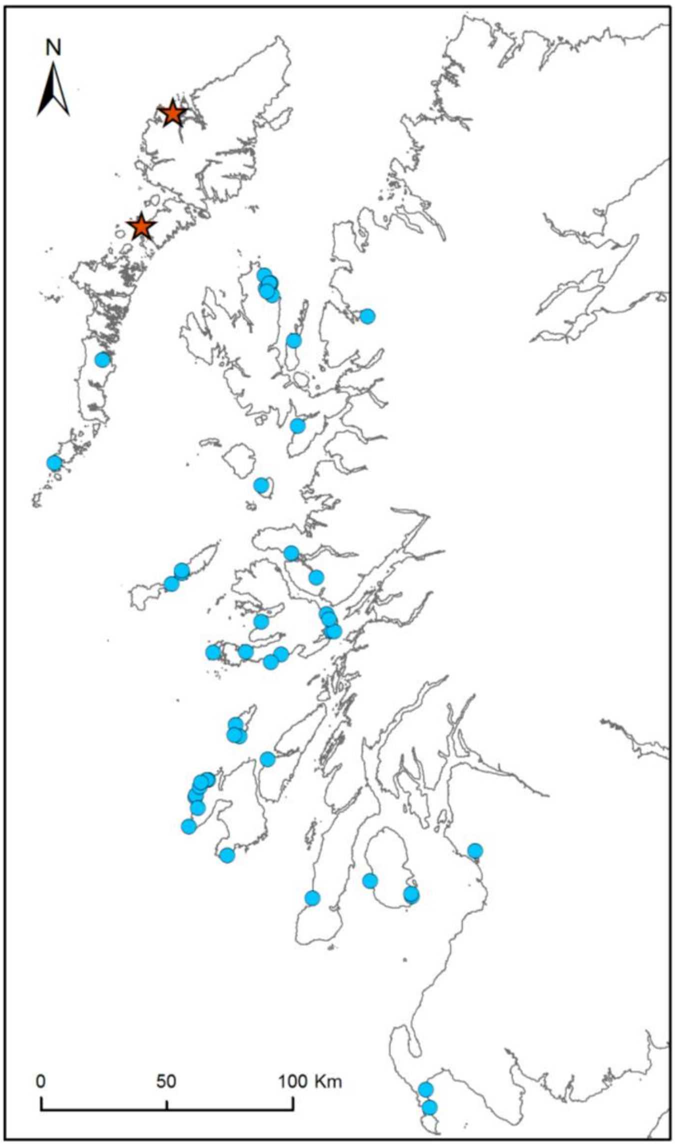

Figure 254. Known distribution of flint sources in western Scotland and the Hebrides, in relation to the Western Isles Mesolithic sites (starred). Ordnance Survey data © Crown Copyright/ database right 2014. An Ordnance Survey/EDINA supplied service.

2. Proximity to source

Another likely explanation is the proximity of these sites to the source of the raw material. The nearest known drift flint sources to Harris and Lewis are located on Skye, which lies across the Minch. The derived flint deposits from South Uist are slightly further afield (Figure 254).

Drop-off patterns, whereby the presence of a raw material diminishes in relation to the distance from the source, have been extensively studied for a variety of raw materials during the Mesolithic in Norway (Ballin 2009:54; Bergsvik 2006:20). Similarly, this pattern has been observed regarding the reduction of flint in the Inner Hebrides. During the Southern Hebrides Mesolithic Project a number of Mesolithic sites were excavated in Islay and Colonsay, with surveys of the surrounding beaches conducted to assess raw material procurement strategies (Marshall 2000b; 2000c). The site at Coulererach is situated less than a kilometre from the west coast of the Rhinns of Islay, and less than two kilometres from two of the surveyed beaches that yielded a large range of flint pebbles, suitable for replicating blade core technology (Marshall 2000b). The assemblage from Coulererach was exclusively made from flint, and comprised a high number of unmodified and tested flint pebbles. Primary flaking debitage dominated the assemblage – indicative of the initial stages of the knapping process. Cores were large, frequently reduced using platform technology and, although often discarded once exhausted, exhibited less intensive reduction in terms of working the final platform area. Overall, this assemblage was interpreted as indicative of flint procurement activities that included testing of raw material. The wasteful reduction process, and frequent discard of cores, reflects the high abundance of large flint pebbles given the site's close proximity to the beaches (Finlay *et al.* 2000; Mithen & Finlay 2000:220-227; Mithen & Finlayson 2000b). This contrasts with the assemblage recovered from Gleann Mor. This site is further inland, in the upland region of the Rhinns although still only an hour's walk from the flint-bearing beaches of the west coast (Mithen 2000d:607). The assemblage is significantly different from that at Coulererach. The unworked flint pebbles recovered were very small and there was a greater use of quartz at the site. The core reduction demonstrated use of both bipolar and platform techniques, with the majority of the sample analysed indicating that between 70-100% of the final platform surface had been worked. This indicates substantial and intensive core reduction associated with the more distant location of the site to the source of flint (Finlay *et al.* 2000:567-568; Mithen 2000f:607-608; Mithen & Finlayson 2000a:194-198). Mithen notes these cost-benefit decisions are also present in the Mesolithic assemblages on Jura, whereby the quantity of flint in each assemblage diminishes toward the north-east of the island, away from the flint-bearing beaches of Islay (Mithen 2000f:608).

In the Western Isles this drop-off pattern can also be observed. The sites on Harris are much nearer to the flint sources on South Uist or Skye than the sites on Lewis. All other things being equal, the higher proportion of flint on Harris is a result of closer proximity to the source. It follows that the lack of flint at the sites on Lewis is due to their greater distance from the source. This can be substantiated further by comparing the composition of flint debitage at the sites, although reduction strategies are discussed in greater detail in the following section. Whilst Northton and Tràigh an Teampuill do not display the same profligate reduction of flint as at Coulererach, there is clear evidence for primary working of the material. Moreover, flint comprises a low, but not insubstantial proportion of the raw material present. In contrast, the sites on Lewis compare more closely with Gleann Mor – flint bears an almost negligible presence in relation to quartz, and primary reduction of this raw material is all but absent.

3. Group mobility

The third factor, group mobility, is intrinsically linked with the distance to the source and has previously been discussed in Piper (2011). It was concluded that if flint was either embedded within seasonal visits, or directly procured, then both sources lie beyond the 'regional' catchment zone of 50km that was anticipated to have been covered within a groups' annual movement. As such, procurement of this resource via direct access, or embedded within other activities, would have significant implications for the degree of mobility around this region, for example the annual territory of these people was far greater than anticipated, allowing material from much further way to be obtained. An alternative suggestion is that flint was indirectly procured – traded, exchanged or bartered. If so, the drop-off may relate to connections between distant trading groups and the effects of maintaining these connections. By the implication of cost-benefit, material from further away would be more 'expensive' in terms of the effort expended in the maintenance of remote contacts (Whallon 2006). In both instances, economical treatment of the raw material would be expected (Manninen & Knutsson 2014; Orton 2008:1093). The networks existing between distant groups may also be subject to change over time, thus affecting exotic raw material supply (e.g. Costa & Sternke 2009; Whallon 2006). These interpretations should be treated with caution however, as they are based upon models of terrestrial hunger-gatherers. Ethnographic and experimental evidence for the use of boats in transporting both people and material goods has indicated that a daily foraging catchment may extend up to 30km – three times that of terrestrial hunter-gatherers (Ames 2002; Higgs & Vita-Finzi 1972; Jarman 1972). As an extreme example, annual territories for residential groups specifically within the Gulf of Georgia (incorporating Vancouver Island, mainland British Colombia, the extreme north of Washington state and the San Juan Islands) averaged 420km, whereas groups elsewhere along the Pacific Northwest Coast could move as little as 10km or as great as 100km in a year (Ames 2002; Mitchell 1971). It is evident therefore, that the annual territorial range of boat-using hunter-gatherers has the potential to be far greater than that of terrestrially-based groups. In turn, this increases the opportunity to access more distant raw materials via embedded or direct procurement. As evident in Figure 255, Northton is over 50km in a straight line from the nearest source. The sites on Lewis are over 100km away as the crow flies, thus flint is still expensive to obtain overall. This expense is reflected in the reduction of the flint, which is discussed in the following section.

It is difficult to extricate the three scenarios – time, distance and group mobility – from one another given the limited data available, indeed, the three may be intricately interwoven. It is possible however, to highlight the strongest influencing factor – distance to source – by briefly assessing a more complete dataset. There are a much greater number of Neolithic sites recorded throughout the Western Isles. The raw material evidence from Neolithic sites reflects a similar pattern to those studied in this thesis. At Allt Chrisal on Barra, the lithic assemblage is almost exclusively comprised of flint (Wickham-Jones 1995; Figure 255). The site is also situated extremely close to one of the known sources of beach flint at Vatersay. An Doirlinn is located further north, on South Uist and is equidistant between the source on Barra, and one known in the north of the island at Skiport. Flint also dominates the lithic assemblage, although to a lesser extent than at Allt Chrisal, which most likely reflects the greater distance of the site from the source (Pirie forthcoming). Bharpa Carinish, North Uist is a similar distance from the Skiport source as An Doirlinn, but to the north and over several water crossings. Whilst flint still dominates the assemblage, it is again of a smaller proportion than the site further south (Crone *et al.* 1993:375). At Geirisclett, situated almost at the furthest north-west point North Uist, flint is virtually absent (Dunwell *et al.* 2003:19). At the later Neolithic/Beaker-age phase from Northton, flint is certainly diminished in quantity, an observation also made regarding the assemblage at Callanish, Lewis (Ballin 2016b; Nelis 2006a). This follows a pattern of 'down the line' exchange (Renfrew 1977), whereby an inverse relationship exists between the quantity of the raw material and the distance from its source (Olsen & Alsaker 1984).

Nelis notes that within the Neolithic/Beaker assemblage at Northton the relative expense of acquiring raw materials is "reflected in the dimensions of the lithic material. Quartz material tends to be larger than other lithic material used, and is usually minimally worked, whereas flint and indurated mudstone tends to be small and exhaustively worked" (Nelis 2006b:71-72). This is expanded upon in the following section. Importing baked mudstone, which is discussed in the next chapter, and extensive reduction of the flint available confirms the suggestion that not only did the Neolithic occupants of Northton have "limited access to suitable raw materials" (Nelis 2006b:71-72). It is clear that this was also true during the Mesolithic.

The sporadic availability of flint in South Uist may have therefore been enough to supply Neolithic communities inhabiting the south, but the quantity was not such that it could be exported north (Garrow 2015; Pirie forthcoming). The greater proportion of flint at Northton and Callanish, in contrast to Geirisclett, may suggest an as-yet unknown source of flint on Harris and/or Lewis. Overall, a lower population density and/or higher mobility during the Mesolithic may have allowed a slightly wider range of raw material movement, however the net effect is the same. A more in-depth exploration of changing raw material use and distribution during the Mesolithic throughout Atlantic Europe is presented in the following chapter.

8.3.2. Reduction Strategies

The second notable theme to emerge from the Mesolithic assemblages is that when each raw material is considered, it is clear that *the reduction strategies employed are specific to the nature of the raw material being utilised*. A combination of both simple or unprepared, migrating platform reduction and bipolar technique were used where necessary. Not only does this reflect an adaptation to the fracture mechanics of the raw material involved, but is also indicative of the logistics in acquiring the material from its source, as briefly discussed in the section above.

The variations in fracture mechanics of different raw materials, specifically flint and quartz have been a source of extensive debate in the study of lithic technology, as discussed in Chapter Four. The application of different reduction strategies to specific raw materials is likely to have been necessary to account for the inherent flaking properties of the raw material. Alternatively, similar reduction sequences may have been used in order to produce specific tool types, regardless of the raw material. This would be expected in the application of blade technology to produce microliths for example, and is discussed in the subsequent section.

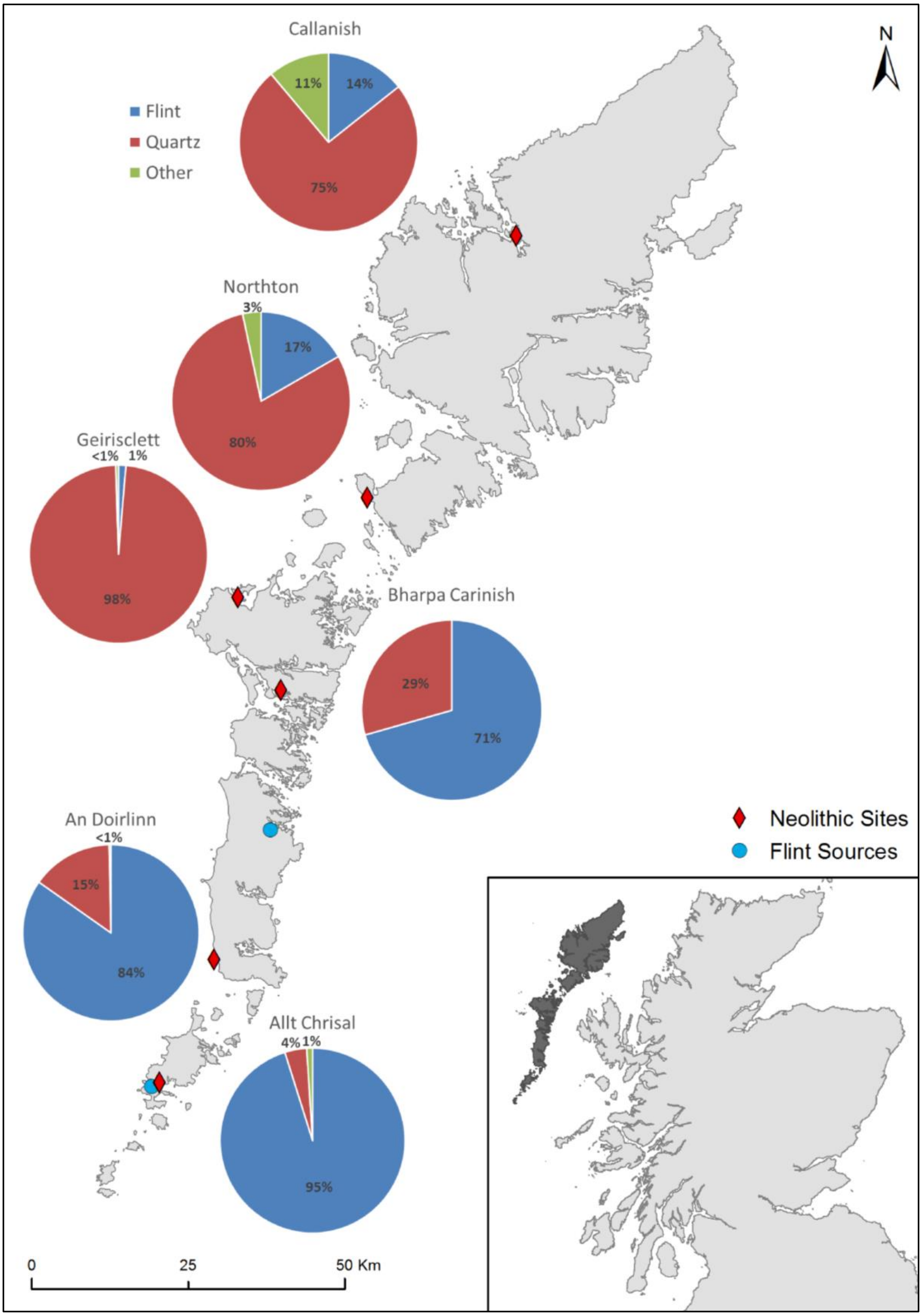

Figure 255. Proportion of flint within Neolithic assemblages in relation to known flint sources. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

8.3.2.1. Bipolar Reduction

Bipolar technology is commonly perceived as "the dominant approach" in Mesolithic assemblages throughout Norway, northern and middle Sweden, and is most strongly correlated with the use of non-flint raw materials (Ballin 1999a; 2008:71; Broadbent 1979; Lindgren 1995). This correlation is also observed in non-flint industries of Holocene South Africa (Barham 1987), Northern United States (Flenniken 1981; Goodyear 1993), and Australia (Hiscock 1996). Conversely, where flint is ubiquitous in primary deposits (i.e. Cretaceous chalk), such as in southern Sweden and south-east England, bipolar technology is lacking (Ballin 1999a:21).

Bipolar reduction is used in a number of ways, and it is clear that this technology is closely linked with the flaking properties of raw materials. For example, in Scandinavia where assemblages are comprised of coarser raw materials such as quartz, that is both large and locally ubiquitous, the bipolar reduction technique has been interpreted as a strategy to control flakeability and proven in experiments to prevent unpredictable flake shatter (Callahan *et al.* 1992; Lindgren 1995:96; Manninen & Knutsson 2014:93; Tallavaara *et al.* 2010; Vergès & Ollé 2011). In contrast, where bipolar reduction is applied to flint assemblages in Scandinavia, it is interpreted as evidence for the maximisation of a high quality, but scare, resource that is only available in small nodules, and used as a "coping mechanism" in response to the limited availability of the resource (Ballin 1999a; Manninen & Knutsson 2014:94; Thorsberg 1985). In instances where flint is of high quality, bipolar reduction allows the knapper to extend the life of the core further and eke out as much material as possible. This is often observed when bipolar reduction has subsequently been applied to an exhausted platform core, and/or the piece is too small to reduce further using platform technology, as at Kilmore, Scotland (Bonsall *et al.* 2009:75).

The bipolar treatment of flint described in Scandinavia fits well with what is observed in the Western Isles Mesolithic assemblages. Here, bipolar reduction was largely reserved for reducing small, rounded beach pebbles of flint that were not locally abundant. Pebbles cannot be reduced using platform technology. Often, their size precludes the removal of cortex to access the interior material, and the rounded exterior does not provide a suitable platform to execute a successful strike. As such, a bipolar technique is the only method of reduction (Ballin 2008:69; Barham 1987; Thorsberg 1985; Vergès & Ollé 2011).

The use of bipolar technique at Northton is evident not only in the worked lithic assemblage but also the coarse stone tool assemblage, where a gneiss anvil was identified in the Phase 3 deposits. It had been worked on one side to produce a depression that could be used to support cores during the reduction process (Figure 256). In the reduction process, anvils can be used in two different ways, either for bipolar reduction, or platform-on-anvil reduction (Ballin 2008:70-72; Callahan 1987:60; Driscoll 2011). Although the knapper has less control over the removal of flakes using this technique, it maximises the number of flakes that can be produced by a single hammer strike (Barham 1987:49). This is reflected in the high number of flake removals recorded on the flint cores at Northton, Tràigh an Teampuill and Pabaigh Mòr South. These flint cores are very small in size, which further indicates the material was worked to its maximum extent. The shortness of the flint flakes in all of the assemblages attests to the minimal size of the original source material.

Figure 256. The stone anvil from Northton

In terms of raw material acquisition, discussed above, there is evidence at Tràigh an Teampuill to suggest that flint may have been imported by the inhabitants of the sites from a distant source. In the flint assemblage from this site there is no evidence for primary working of flint. As such, flint may have been initially prepared at the source in order to reduce transport costs, then imported as flake blanks that could be modified as needed.

Overall, the use of flint within the Western Isles Mesolithic is minimal. The intensive reduction of flint through bipolar technology reflects the small size of the flint pebbles available to the Mesolithic inhabitants of the Western Isles, coupled with its limited local availability, or the expense of obtaining it from a distance. Bipolar reduction in the flint industry was therefore employed as an economising or curating strategy that attests to the 'costliness' of its presence at the sites, in the absence of any locally known sources.

As discussed in the section above, the quartz at the Mesolithic sites on Harris was more frequently procured from beach pebble sources than the nearby vein. Pebble quartz was often exploited on Lewis, but not to the same extent. During the course of analysis some flakes were found to be difficult to categorise, sometimes owing to the presence of two ventral faces and segment shape. It was subsequently recognised that these may be "split cobble cores", whereby bipolar technology was applied to initially quarter, or break open, the quartz beach pebbles in order to test the material and produce a workable edge (Flenniken 1981:37; Figure 257). The size of some of discarded pebble cores are large and could therefore have been subsequently reduced using simple platform reduction following the initial breaking of the pebble. The later stages of working the core would obscure the initial treatment (Ballin 2008:70-71). A similar operational schema was observed in the quartz assemblages at Lealt Bay and Lussa River, Jura, which were also derived from locally available beach pebbles. These displayed more extensive core preparation, and the use of bipolar reduction on exhausted platform cores, however (Ballin 2001; 2002).

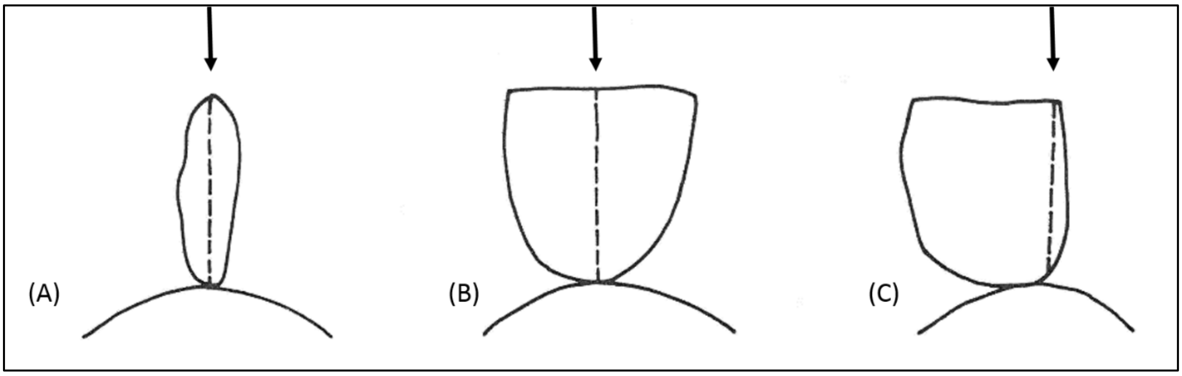

Figure 257. Schematic diagrams showing the varying applications of bipolar reduction - (A) splitting a small pebble, (B) splitting a core, (C) spalling fom the core edge inwards. Arrows show the direction of the hammer strike (after Callahan 1987:16)

It should be noted that 'split cobble cores' are not technically cores if the terminology of Inizan *et al* (1999) is followed. A core is defined as "a block of raw material *from* which flakes, blades, or bladelets have been struck, in order to produce blanks for tools" (Inizan *et al.* 1999:137, my emphasis). In contrast, a split cobble core is described as being used to open a cobble in order to determine the raw material quality, or the "first stage of cobble reduction" (Flenniken 1981:42). If suitable, the piece was further reduced, thus making it a true core. If rejected (and subsequently discarded) it falls within the first definition of a flake – a piece of material "removed from a core during its preparation", which is also known as a preparation flake, preliminary flake or first flake (Inizan *et al.* 1999:141-124). As such, the presence of split cobble cores at these sites was simply quantified as evidence for bipolar reduction, and to provide more certain evidence for the use of bipolar technology, which is largely lacking in these assemblages. Strictly, these pieces are flakes and were therefore categorised as such. A total of 40 quartz 'split cobble cores' were positively identified in the Western Isles assemblages, primarily from Northton, Tràigh na Beirigh 1 and Tràigh na Beirigh 2. This provides a greater degree of certainty about the use of bipolar technology for reducing quartz pebbles, in addition to the very low number of bipolar flakes and cores. Only a single quartz core from Tràigh na Beirigh 1 is clearly a true bipolar core, which has subsequently been modified into a borer. One quartz core from Phase 3 at Northton also showed a bi-directional flake removal sequence, however this was caused by the removal of separate flakes from opposing platforms, rather than bipolar reduction. Only a single quartz flake from the 2010 assemblage indicated bipolar reduction. On the whole, despite this further category of data, the evidence for bipolar reduction of quartz in the Western Isles remains minimal.

Overall, it appears that there were factors other than controlling flakeability, which influenced the reduction process of quartz at these sites. This further supports the suggestion made by Driscoll (discussed in Chapter Four) that the association of bipolar technology with quartz reduction has been over-emphasised, and that "it is clear that the use of a bipolar technique was certainly not a necessity but came down to traditions of working and choices by the knappers, rather than material constraints" (Driscoll 2010:81). In contrast to Norway, there is little evidence for bipolar reduction in Ireland (Driscoll *et al.* 2013:12), or on the Scottish mainland during this period (Finlay *et al.* 2002:108). Similarly, in the Western Isles the local ubiquity and quality of the quartz facilitated the use of a less economical knapping strategy – simple platform technology – with bipolar reduction only applied where necessary.

8.3.2.2. Simple and Unprepared Platform Reduction

Despite the traditional association between the fracture mechanics of quartz and bipolar reduction, it appears that bipolar technology was *not* frequently employed in the quartz assemblages from any of the Western Isles sites, discussed above. The primary means of working quartz in the Western Isles assemblages is freehand, using simple or unprepared migrating platform reduction that may have been aided by the use of an anvil (Figure 258). Simple/unprepared platform reduction is the most appropriate method of reduction for quarried vein quartz, as it is procured from blocks and plates which have flat edges, therefore "these constituted natural cores, with ready-made striking and anvil platforms" (Ballin 2008; Powell 1965). There are an abundance of exposed quartz veins in the Western Isles and, as discussed in the section above regarding quartz procurement, the vein at Tràigh na Beirigh 1 exhibits clear evidence for exploitation. On Lewis the availability of high quality 'greasy' quartz would certainly have been conducive to reduction using platform technology, as noted elsewhere in the Scottish Mesolithic (Ballin 2013:3).

The treatment of the greasy quartz at these sites is indicative of a raw material that was ubiquitous throughout the region. Comparison between the dimensions of quartz, flint, and other raw materials shows that the quartz flakes from the Western Isles assemblages are generally larger overall. Most significantly, the quartz flakes are thicker and with deeper striking platforms. Enlarging the striking platform is a conscious decision made by the knapper and has a direct effect on the thickness of the flake (Davis & Shea 1998; Dibble 1997). Increasing flake thickness makes the flake less brittle and therefore not as prone to breakage through platform collapse. However, by doing so, this removes a greater proportion of the core's working edge, and is thus a highly uneconomical strategy (Ballin 2008:70; Tallavaara *et al.* 2010:2447). The majority of the cores in all of the Western Isles Mesolithic assemblages exhibited multi-directional, irregular flake removals in no clear sequence, which indicates frequent turning of the core – also known as migrating-platform cores (White & Ashton 2003:599). The intention behind this knapping strategy is to remove medium-sized flakes in "an invasive fashion", i.e. increasing flake thickness by removing material from the body of the core (White & Ashton 2003:599). Again, this reflects an uneconomical strategy, which would create thicker quartz flakes. These cores were frequently discarded before they were exhausted, as attested by the large size of many of the abandoned cores.

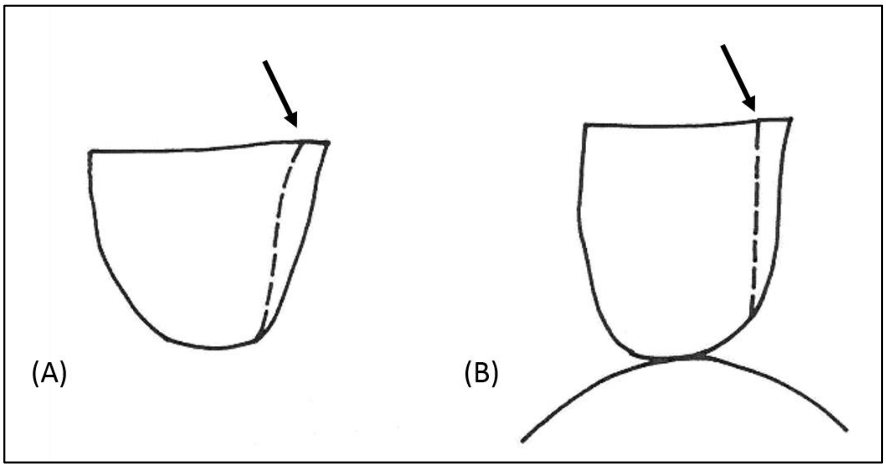

Figure 258. Schematic diagram of freehand platform (A) and platform-on-anvil reduction (B). Arrows show the direction of the hammer strike (after Callahan 1987:15)

The presence of a high quantity of debitage and quartz small fraction flakes at all of the Western Isles Mesolithic sites clearly attests to *in situ* knapping of quartz. It is notable that at Tràigh na Beirigh 9 there are a very low number of quartz cores present in comparison with the other the sites along the peninsula, which suggests they may have been removed from the site and further reduced elsewhere. Likewise, at Tràigh na Beirigh 1 the representation of the different stages of core reduction at the site is disproportionate to the number of cores. Despite being situated above the vein, the small number of primary flakes suggests that the initial reduction of quartz was conducted elsewhere, perhaps in another part of the site that has since been destroyed. It is highly likely that tertiary flakes detached during further working of the core were removed from the site for use at another location.

Overall, the profligate use of quartz is most likely to be associated with the ease of procurement. The local abundance of this raw material is evident in the un-economical reduction of the cores, primarily using platform technology, to expediently obtain irregular flakes. The two different knapping strategies that were employed to reduce the two different raw materials reflects three inter-related aspects: the flaking characteristics of the raw material based on its source; the impetus to conserve flint which had limited availability and was expensive to obtain; the technology and tools that were required for use. This latter point is discussed henceforth.

8.3.3. Technology and Tool Use

On the whole, there is *a notable absence of formally retouched tools in the Western Isles assemblages*. The use of bipolar and simple or unprepared platform reduction strategies has resulted in irregularly-shaped cores with migrating platforms, described in the section above. This demonstrates that there was no intention to produce blades, and thus specialised production of microlith technology so closely associated with this, in any raw material at these sites. There are a number of potential interlinked explanations for the lack of retouched tools, which will be discussed in turn. It is possible to draw inferences regarding the absence of specialised microlith production in the Western Isles from the transition between microlithic to macrolithic technology in Ireland. The presence of coarse stone tools at the site, and the use of other, organic, raw materials as tools is also discussed.

8.3.3.1. Microliths and Retouched Tools

Only a very small number of flint microliths were recovered from Northton. These comprised: two crescents; a scalene triangle/crescent; a fine point; a double backed blade; an obliquely blunted blade; a truncation, and a microburin. Two flint burins were also present, in addition to miscellaneous retouched pieces that included a retouched core rejuvenation flake and an indeterminate backed piece. Northton is therefore unique within the Western Isles Mesolithic. There are no flint tools present at any of the younger sites, and the small number of irregular flint flakes does not suggest that blade production for the manufacture of tools such as microliths was intended by the knappers.

There are a very small number of retouched quartz artefacts in the Western Isles Mesolithic assemblages. These account for a scraper at Northton; a modified core borer at Tràigh na Beirigh 1; a modified core scraper and notched flake at Tràigh na Beirigh 4; another notched flake, a small number of burins and an oblique point microlith at Tràigh na Beirigh 9. These pieces are all described in Chapters Five and Six. There are a number of possible factors why the number of retouched tools – especially microliths – is so low. This section will focus on the purely functional aspects, with consideration of social implications in the following chapter.

8.3.3.1.1. Raw Materials

First, raw material suitability and procurement strategy are significant factors that influence tool manufacture. Andrefsky (1994) identified a highly significant correlation between the *availability* of raw materials, the *quality* of raw materials, and the *influence* on tool manufacture. This follows the optimisation of stress factors proposed by Torrence (1989b). The primary stress factors that affect hunter-gatherers are time and energy. Tool production is therefore influenced by either access to, or availability of suitable raw materials, on the basis that "it is the energy involved in obtaining the stone that affects the subsequent production and consumption rather than the quantity of raw material itself" (Torrence 1989b:3). For example, in the Rochelle archaeological district, Wyoming, sites were situated within an area containing ubiquitous, but poor-quality porcellanite. This raw material was utilised for informal tool production, such as flakes and informal cores, which dominates the assemblage. Non-local raw material was imported to the site for the production of a small number of formal tools, such as scrapers and projectile points (Andrefsky 1994:28-29).

The assemblage from Northton falls within this pattern, whereby a locally abundant, but poor quality, raw material (milky quartz) is readily available close to the site. The flaking properties of milky quartz are generally not conducive to the production of formal tools, and the reduction strategy used at these sites implies expedient reduction of a ubiquitous resource (Ballin 2004; Driscoll 2011; Saville & Ballin 2000). Only a single scraper was recovered from the large quartz assemblage. In contrast, there were a higher number of flint tools identified at the site, despite the low overall presence of flint. The tools are therefore made from a higher quality, but non-local raw material that was imported to the site. It is probable that pre-prepared baked mudstone was also imported for tool manufacture in a similar way, however this cannot be substantiated by the present assemblage. This pattern also follows the 'rules' of predicting raw material value proposed by Morrow and Jeffries (1989).

The relationship between raw material procurement and tool manufacture observed on Lewis is very different from those on Harris. In contrast to the assemblages from Wyoming, Andrefsky (1994) noted that at Pinon Canyon, Colorado a large number of good-quality local raw material varieties were readily available. As such, there was "no preference [of raw material] for production of either formal or informal tools". This was despite the presence of a small number of very high quality non local raw materials (Andrefsky 1994:29). This pattern is consistent with the production of quartz tools on Lewis. As established above, the greasy quartz present in the assemblages of the Tràigh na Beirigh sites and Pabaigh Mòr South is certainly locally abundant, and of high quality. Therefore, this may account for both the small number of formal tools and largely informal, expediently produced, flake technology made from the same raw material. The refined flaking properties of greasy quartz for both tool manufacture and expedient flakes has been observed at Shieldaig, Wester Ross (Ballin 2008:72).

However, the above scenario does not take into account other risk factors such as the availability of food. Woodman (2015), following the risk models of Torrence (1989a), suggests that variability in raw material procurement in the Later Mesolithic of Ireland is not only tied to the quality of the material, but to the reliability of the resources that it was used to capture. In areas such as the Bann Valley, where resources may have been seasonally available, and only reliable for a short period of time, axes were imported from significant distances away. In contrast, food supplies were continually available throughout the year in the Strangford region, therefore the risk-level was low. Here, locally available and lesser-quality erratic flint was utilised in the form of small blade-like flakes and axes are not present (Woodman 2015:258-262). Further adaptations with regard to mitigating risk of resource availability in terms of tool use are discussed below.

The diversification of raw material use is an adaptive strategy which affects the entire *chaîne opératoire* – from procurement and reduction to the artefacts produced (Manninen & Knutsson 2014:94). A basic, generalised technology is therefore a functional response to a lack of available high-quality raw materials, and is posited as a significant factor in the transition from microlithic to macrolithic technology in Ireland. As discussed previously, the production of specialist tools such as microliths required a high quality material, for instance flint that was primarily sourced from the north-east of the island. Without the constraints of such a high-maintenance toolkit, this facilitated a greater degree of freedom in the use of more local and diverse ranges of raw materials. Employing a more generalised technology was better suited to the flaking characteristics of less fine-grained materials (Callahan 1987:58; Costa & Sternke 2009:799; Costa *et al.* 2005:26). Such changes to the technological schema can significantly impact on diagnostic or characteristic "traits", which may ultimately have led to "a loss of culturally acquired skills… [whereby] effects on technology… seem similar to those of demographic fluctuations" (Manninen & Knutsson 2014). The culture-historical suggestion that the change from microlithic to macrolithic technology in Ireland was due to population replacement of the 'Sandelians' by the 'Larnians' is no longer valid (Mitchell & Ryan 1997:118-119). The transition is ascribed to insular developments that began taking place as early as the first known occupation at Mount Sandel. As such, the use of microliths in Ireland may have lasted less than a thousand years (Costa *et al.* 2005:22; Mitchell 1976; Woodman 1978:203). Raw material diversification, and technological simplification to suit the flaking properties of quartz by the Mesolithic inhabitants of the Western Isles is in evidence at the earliest site at Northton. Like Mount Sandel, this suggests that adaptations were already occurring by the time Northton was occupied, and indicates that the inhabitants were already used to utilising this material, which is evident in the diverse knapping repertoire, and aware of its abundance.

Where microliths are present in the Western Isles assemblages (at Northton, and a single oblique point from Tràigh na Beirigh 9), they are traditional narrow-blade types that are found in Later Mesolithic assemblages on both open-air and shell midden sites around the Inner Hebrides and western mainland. The presence of scrapers and non-microlithic, miscellaneous retouched pieces also fits within this technological repertoire (Ballin 2001; McCullagh *et al.* 1989; Mercer 1968;

Pollard 2000; Wickham-Jones 2004a; 2009b). Large numbers of flint microliths feature in these assemblages however. The flint assemblages present in the Western Isles therefore differ significantly from those in the Inner Hebrides. As in the quartz assemblage, there are very few blades present, and the manufacturing debris does not indicate that blade production was the objective of the Mesolithic inhabitants. The closest comparable assemblage is a pilot study on a small sample of the lithic assemblage recovered from Cnoc Coig (Pirie *et al.* 2006). Beach pebble flint dominates, with quartz making up the remainder of the assemblage. There were a number of retouched tools recovered (≤10 in each raw material); significantly, however, this did not include microliths which contrasts markedly to the flint-dominated, microlithic, Mesolithic industries in the Inner Hebrides. The lithic industry was instead found to be flake-based, whereby tools were made and used on an *ad hoc* basis, and with an extremely low emphasis on blade production irrespective of the raw material present (Pirie *et al.* 2006:8). It is likely that the lithic assemblages from the middens of Caisteal nan Gillean I and Cnoc Sligeach are also a-microlithic, based on the brief description of the assemblages by Lacaille (1954:218, 227-228). The absence of microliths within the shell midden lithic assemblages of the Western Isles – with the exception of the oblique point from Tràigh na Beirigh 9 – is therefore consistent with the similarly dated terminal Mesolithic shell midden site of Cnoc Coig. This may be attributed to site function, discussed in the following section, or raw material suitability.

To test this further, the tool ratios between raw materials at microlith-bearing Mesolithic sites in the Inner Hebrides should be considered. Milky quartz dominates the quartz assemblages at Lealt Bay and Lussa River, Jura, which although mixed by marine transgression, contain a small number of diagnostic Late Mesolithic artefact types (Ballin 2001; 2002). Only a single quartz microlith was recovered from Lealt Bay, and only four from Lussa River. The debitage products indicate that there was clearly no intention by the occupants to produce blade technology in this raw material at either site, with simple flakes being the main product. This contrasts significantly with the flint assemblage from both sites. At Lealt Bay for example, over a thousand flint microliths were recovered. Whilst this may be due to the intended site activity or chronology of the site, characteristics of the raw material appear to be a significant factor (Ballin 2001; 2002).

8.3.3.2.1. Subsistence and Optimal Solutions

Jeske (1989) argues that the optimisation of stress factors is critical in environments where success rates of food procurement are low, and *vice versa*. For example, deer hunting has a low success rate, so projectile points used in this activity will be well made with “a high degree of energy [in]…manufacture and maintenance”, in order to ensure the tool has less chance of failing (Jeske 1989:35). Furthermore, increasing tool diversity and specialisation is directly correlated with increasing the stress factors, thus *reliable* tool systems are required (Bleed 1986; Myers 1989:87). In contrast, tasks that are guaranteed to succeed require less investment of time or energy.

Consequently more expedient and *maintainable* tools, made from lesser quality raw materials, will suffice (Bleed 1986; Jeske 1989; Myers 1989).

Based on this, it is possible that the diverse hunting/trapping/fishing subsistence activities at Northton were more stressful (energy/time) or risky (failure) than those on the Cnip headland, which appear to have functioned as specialist shell/fish processing sites[9]. For example, non-seasonal resources cannot be easily scheduled, which places a greater reliance on high-risk strategies such as encounter-hunting (Kuhn & Stiner 2001:106). The use of microliths in composite tools, such as projectiles, are seen as maintainable elements of a very complex and reliable tool system (Eerkens 1998; Finlayson 1990b:53; Myers 1989:96-87; Torrence 1983:13). Whilst there is evidence for some predictable seasonal resources at Northton – such as the pelagic, flightless Great Auk – many of the resources available on the Toe Head Peninsula may have been unpredictable, either in terms of availability, or that the success rate of these activities were low. This would have required the use of a reliable technological system, which was repaired and maintained at the site. Following the observations of Woodman (2015), regarding the use of particular raw materials for tools in Ireland, the requirement for a complex maintainable *and* reliable microlithic technology necessitates the import of high quality raw materials (flint). Further evidence of mitigating the risk of failure at Northton is demonstrated by the diverse fish catch present at the site, which suggests the use of untended trapping facilities. Such facilities are generally found "where search time is high due to the low density and high mobility of resources" (Torrence 1983:16) – this could also apply to snares that may have been used for catching the hares and otter also recovered from the site. The technology used to mitigate these perceived risks may be a result of the unfamiliarity of the early occupants of Northton with the resources that were available, and that the early colonists brought to the site the technology and raw materials with which they were most familiar. Over time, as the inhabitants become acquainted with their environment, the risk of unsuccessful food procurement diminished, thus lower quality, but locally available quartz becomes more frequently used.

It is possible that a shift away from microlithic technology was an adaptive response to the absence of large game, and toward a more specialised subsistence strategy focussing on fishing and trapping of the resources available on the island (McCartan 2003:337-338). For example, there is no evidence for hunting on the islands of Corsica and Sardinia, where the largest terrestrial mammal is the Sardinian pika (*Prolagus sardus*). The Mesolithic on these islands is therefore characterised by simple subsistence strategies of fishing and trapping pika, utilising local, poor-quality raw materials (primarily quartzite) for expedient tool production. No microliths are known from the

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[9] This interpretation may change once the full post-excavation analysis of all of the sites has been carried out.

island, which is in stark contrast to the lithic technology of the wider Mediterranean; however, in all other respects there is no apparent difference between the islanders and their mainland counterparts (Costa *et al.* 2003).

Thus far, a similar situation appears to be reflected in the Scottish islands. This is most pronounced when comparing the striking typological and faunal differences between the contemporary sites of the Toe Head peninsula in the Western Isles and those on the Inner Hebridean islands of Islay and Coll. The Storakaig and Rubha Port an t-Seilich assemblages are predominantly made from flint, supplemented by quartz, with a high quantity of microliths and microlith manufacturing debris. The assemblages fit within the characteristic Scottish Mesolithic narrow blade tradition that is so well evidenced on Islay through Mithen's previous work on the island. There is also definitive evidence for the exploitation of large terrestrial game as the major resource base on Islay (Mithen 2000c; Wicks *et al.* 2014:407-408). This contrasts markedly with the lithic assemblages from the sites on Harris. Prior to the investigation in 2010, the known Mesolithic lithic assemblage from Northton was entirely undiagnostic with regard to period-specific type facies. The assemblage from Tràigh an Teampuill remains so. These assemblages are instead dominated by the *ad hoc* reduction of quartz to produce an expedient flake-based technology. Furthermore, the evidence for any large terrestrial game from Northton and Tràigh an Teampuill is highly circumstantial, as discussed in Section 8.2.1.2.

This interpretation however, presupposes that microliths were primarily used in hunting/projectile technology, when there have been a number of studies that indicate a microliths were used in a wide range of functions, including plant processing (Dumont 1985; 1988; Eerkens 1998; Finlayson 1990a; Finlayson & Mithen 2000; Hardy 2004; Mithen & Finlayson 2000a). Given the lack of evidence for any discernible change in subsistence during the Mesolithic in Ireland, it is evident that the inhabitants were able to continue carrying out the same activities using informal, 'simple' technology made from local raw materials that were previously conducted using flint-dominated microlithic assemblages (Costa *et al.* 2005:23; Finlay 2003:88; Woodman & Anderson 1990:380).

The presence of microliths at Northton, and the implied production of microliths at Tràigh an Teampuill through the presence of the pressure flaker, harks back to the long-standing argument between microlithic open-air sites and the 'Obanian' shell middens. This difference has partly been attributed to site function, whereby shell middens were utilised as specialised fish- and shellfish-processing sites, and open-air sites were used for hunting (Bonsall *et al.* 2009:71). The relative absence of microliths within the shell midden assemblages on Lewis only supports this dichotomy to an extent. There is significant evidence for fishing on Harris, and only circumstantial evidence for large terrestrial game. Consequently, the presence of microliths at Northton does not fit with this debate. Fishing and small-mammal hunting appears to have been the mainstay of subsistence throughout the Mesolithic of the Western Isles. If the shift away from microlithic technology is real, rather than perceived, it attests to the continuity of the same fishing-based subsistence practices throughout the Mesolithic occupation of the island, but utilising less formal technology, as in Ireland.

The use of an informal, expedient lithic technology made from quartz at the Western Isles sites fits within the broader picture of quartz-dominated assemblages in the Mesolithic of northern Europe (Manninen & Knutsson 2014:86). This follows the pattern of low-quality, but highly abundant, raw material use anticipated by Andrefsky (1994) and Tallavaara (2010:2447). There is abundant use-wear evidence from ethnographic, experimental and archaeological sources that flakes, and even shatter from bipolar reduction, can be used in the majority of day-to-day activities without modification or retouch (Andrefsky 1994; Berman *et al.* 1999; Flenniken 1981; Hardy 2004:34; Sussman 1985; Wickham-Jones 2004a). Where quartz tools are present in the Mesolithic assemblages on Lewis they still comprise significantly less than 10% of each assemblage, which is consistent with the general low percentage of quartz tools throughout the Mesolithic and later prehistory (Ballin 2001; 2002; 2008:59-60). Overall the *ad hoc*, irregular quartz flakes that dominate the Western Isles Mesolithic are indicative of a general purpose tool-kit that could be used for a wide range of tasks, including fishing, trapping, manufacture of structures, and plant processing to name but a few (Torrence 1983:13). This may have been supplemented by coarse stone tools and organic artefacts, which are described below. The topic of subsistence will be returned to more fully in Chapter Nine.

8.3.3.3. Coarse Stone Tools

Finlay *et al*. (2002:111) state that "One class of artefact that unites the middens and the scatter sites is the coarse stone tool". The array of coarse stone tools recovered from the Western Isles assemblages therefore fits well into this aspect of the Mesolithic tool repertoire. Hammerstones and anvils made from locally available feldspar, basalt, and gneiss for use in lithic reduction are found at Kinloch, Bolsay Farm, Staosnaig, MacArthur Cave, and on Oronsay (Clarke 1990a; Lacaille 1954; Mithen *et al.* 2000a; Mithen *et al.* 2000d). An alternative suggestion is that these cobbles could have been used in processing animal skins, hides or plant material or shellfish as proposed for Ulva Cave (Gregory 2006; Russell *et al.* 1995:283). The absence of any distinctive use-wear on these pieces prohibits functional analysis, however (Clarke 2009b). An alternative use for the coarse stone anvil found at Northton could be for cracking open hazel nuts, as suggested for the anvils found at Staosnaig (Score & Mithen 2000). Throughout the occupation deposits of the larger Western Isles Mesolithic sites, a number of gneiss, quartz-feldspar and other coarse-stone cobbles were recovered, which may have functioned as hammerstones or for processing foodstuffs (Figure 259).

A coarse stone chopper was also recovered from Northton. Beyond a brief description of "boldly edge-flaked" pebble choppers from Cnoc Sligeach, Oronsay by Lacaille (1954:228), and a "chopper-like tool" (subsequently reclassified as a core in the absence of use-wear) made from a dolerite pebble at An Corran (Hardy *et al.* 2012:22), there appears to be no indication of the presence of this tool type in Scottish Mesolithic sites where detailed analysis of the coarse stone assemblage has been conducted (Clarke 1990a; 2004; 2009a; Mithen *et al.* 2000a:402-403; Mithen *et al.* 2000d:276). A large number of cobble chopper tools were recovered from Culverwell shell midden on the Isle of Portland, Dorset. Their proximity to hearth features led to the interpretation they were associated "with cooking or food preparation activities" (Palmer 1999:57). The association of the chopper with the bioturbated hearth deposits at Northton would correspond with this interpretation.

Figure 259. Broken hammerstone from Northton

The use of barely-modified coarse stone tools directly contrasts to Ireland and Norway where 'coarse stone', such as schist and basaltic rocks (primarily greenstone and diabase) were utilised to produce ground, pecked, or polished stone tools – a defining feature of the Mesolithic technology in these regions (Gjerland 1990; Olsen & Alsaker 1984; Ryan 1980; Woodman 2012). In these areas there is also deliberate caching of materials, which does not readily occur in the Scottish Mesolithic. The quartz cobbles present at Northton, Tràigh na Beirigh 1, Tràigh na Beirigh 2 and Tràigh na Beirigh 9 are spatially separate, and given the lack of evidence for post-depositional disturbance at the midden sites, it is unlikely that this is a result of taphonomic factors. These cobbles have been transported to the site to be worked, and for some reason were discarded or left unused, but not as caches.

Bevel-ended tools made from bone and stone have traditionally been recognised as one of the defining characteristics of the 'Obanian' shell midden sites (Lacaille 1954:200). The Obanian, as discussed in Chapter Two, is no longer recognised as the material remains of a separate culture; the presence of this particular suite of artefacts is interpreted as functionally related. This has, however, created "a stereotyped functional approach to artefacts", based upon the perceived use of individual sites (Finlayson 1995:261). The suggestion that bevel-ended tools may have functioned as hammers to procure limpets was made by Anderson (1898), reporting on the artefacts recovered from the Mesolithic shell middens at Druimvargie, Oban and on Oronsay. This was based upon the local knowledge of similarly-shaped stones historically used to detach limpets from rocks, and known in Gaelic as a 'limpet-hammer' (Anderson 1898:312). Furthermore, an experiment by Bishop (1914) using a similarly shaped piece of cement, made for a persuasive argument regarding the use of these tools "for gouging the mollusc of the limpet from the shell", thus naming them limpet-scoops (Bishop 1914:95). This misnomer has endured, in spite of repeated suggestions that the association with limpets "is both unlikely and unhelpful" (Finlayson 1995:262). Despite this, an experimental study on the use of elongated-pebble-tools (EPT's hereafter) by Barlow and Mithen concluded that the removal of limpets did create the distinctive use-wear (breakage and fracturing patterns) observed on EPT's found in the Mesolithic assemblages on Islay, when compared to other tasks of flint knapping and hide preparation (Barlow & Mithen 2000).

Limpets comprise 80% of the shell midden at Tràigh na Beirigh 1 (Evans 2015:44), and dominate the other shell middens under consideration in this thesis. It follows that, if Anderson and Bishop's interpretations are correct (bolstered by Barlow and Mithen), with all things being equal, bevel-ended tools would be a notable component within the artefact assemblages of the Lewis middens. None, however, have been found. This lends credence to the suggestion that they may have been used in other activities, such as the processing of hide (Finlayson 1995:263 contra. Barlow & Mithen 2000), or of plant remains (Mithen *et al.* 2000a:439-440; Score & Mithen 2000); however without further analysis the function of these pieces remains enigmatic (Clarke 2009b:13-14). An analogous example for the ethnographic use of bevel-edged coarse-stone tools is found in midden deposits of coastal south-east Queensland, Australia. These were used in the processing of plant foods, primarily the starchy root of the 'bungwall' fern (*Blechnum* spp.). Whilst these are technically flaked tools, the scraping-pounding use of stone created a polished, bevelled edge "so pronounced as to give the impression that the working edge has melted away" (McNiven 1992). These tools are similar in form to the bevel-ended tools recovered from Mesolithic middens in Scotland.

The absence of bevel ended tools within the Western Isles assemblages is comparable with the site of Sand on Skye. Here only a "narrow range of tool types" were recovered, which implied that the variety of activities requiring the use of coarse stone tools at the site was either limited, or highly specialised (Clarke 2009a). This contrasts with the much wider range of coarse stone tools, including bevel ended stones, in Mesolithic assemblages on Rum, Islay and Colonsay (Clarke 2009b; Mithen *et al.* 2000a; Mithen *et al.* 2000d). Following Torrence, the increase in tool diversity or complexity is inversely proportional to time stress (Torrence 1989b). The use of EPT's at certain sites may therefore have been an adaptive strategy to efficiently complete a particular time-constrained task. Alternatively, they may not have had any particular functional use. The following section discusses less tangible evidence for tool use within the Mesolithic.

8.3.3.4. Imperceptible Tools: Organic Artefacts

As discussed above, the general lack of microliths at shell midden sites in the region may be attributed to site function. As such, the use of organic materials as tools must also be considered in place of formal lithic technology. The presence of bone and antler harpoon-like tools at Risga, Oban, and Oronsay supports the suggestion that the activities conducted at these sites may have required the use of organic artefacts rather than microliths (Bonsall 1997:25; 2004; Pollard *et al.* 1996:176). In contrast to the 'Obanian' shell middens in the Inner Hebrides and western Scotland, and despite the excellent preservation conditions, there is no evidence for similar bone and antler tools present in the shell midden sites in the Western Isles. This suggests an absence of the resources required to make them, and corroborates further the suggestion that there was no large terrestrial game in the Western Isles during the Mesolithic, as the antler pressure flaker from Tràigh an Teampuill may have been imported.

Only the presence of two broken worked bone points at Tràigh an Teampuill, described in Section 8.2.1.2, attests to the use of organic materials within the Western Isles Mesolithic tool-kit. These may have been used in the construction of nets, baited lines, and snares that could have been used to catch the birds and small mammals that are present within the faunal assemblages. It is probable that such equipment was made from wood, plant or animal fibres and has since decayed (Bailey & Milner 2002:7; Dupont *et al.* 2009; Hardy 2008; Zhilin & Karhu 2002). Such mass capture technology is another method of averting the risk of failure (Hayden *et al.* 1981). By employing mass capture technology such as a stationary, tidally regulated fish trap, the inhabitants of the Toe Head peninsula were able to widen and diversify available species within the catch, therefore broadening the spectrum of resources that were exploited at the site (Blake 2011). This contrasts to the Cnip headland, where the resources are both abundant and predictable. The short, intensive bursts of activity at the sites targeted specific resources (young saithe) at specific times of the year, when marine molluscs could also be collected. As such, a high success rate was guaranteed and there was less need to invest time and energy in producing a reliable toolkit, when a maintainable one would suffice (Myers 1989:87). A maintainable, expedient strategy places less time/energy stress on the community as there is no requirement to procure non-local, high quality raw materials for tool manufacture, as discussed above. Although there is no direct evidence for the use of fishing traps/nets, or hooks and line, to capture the vast quantities of fish recovered from the Western Isles sites, this may be inferred from preserved fish traps and organic artefacts found within numerous Mesolithic contexts in Demark, Ireland, and France (Andersen 1985; Fischer 2004; McQuade & O'Donnell 2007; McQuade & O'Donnell 2009; Mordant & Mordant 1992; Mossop 2009; Pedersen 1995; 1997). The construction of 'complex' technology, in the form of fixed facilities such as stationary fish traps, takes a significant investment of time, resources and energy, especially where there is evidence for the use of coppiced wood (Bishop *et al.* 2015; Christensen 1997; McQuade & O'Donnell 2009; Rowley-Conwy 2001). This has a demonstrable effect on the organisation and mobility of the communities who use them, which is discussed further in Chapter Nine.

A deliberately modified oyster shell (*Ostrea edulis*) was identified at the base of the shell midden deposits at Tràigh na Beirigh 1. The shell is extremely thin, with a circular perforation though the centre and is worn around the edges in a roughly circular shape (Figure 260). Tool marks could not be detected during conservation of the artefact owing to the fragile nature of the shell (Jones 2012); however, the perforation may have been made using a tool similar to the quartz core-borer that was recovered from the same site. The use of shells as tools has frequently been overlooked, despite strong ethnographic evidence, and their presence in Holocene hunter-gatherer contexts elsewhere (Cuenca-Solana *et al.* in press; Cuenca-Solana *et al.* 2011; Hardy 2010; Szabó 2013). The evidence, which largely derives from the Pacific islands, Australia, the Caribbean and North America attests to a wide range of uses for both unmodified shells and shells that have been carefully shaped for specific purposes. These include: picks, adzes/axes, knives, vegetable peelers/scrapers, net sinkers, and fish hooks (Allen & Ussher 2013; Attenbrow 2010; Cuenca-Solana *et al.* 2011; Meehan 1982; Moore 1921; O'Day & Keegan 2001; Przywolnik 2003).

Perforated or modified shells have been recovered from numerous Mesolithic shell midden contexts in western Scotland, with examples also more widely known from western Britain and continental Europe. Worked scallop (*Pecten maximus*) has also been recovered from a number of Mesolithic shell middens in Scotland. A perforated scallop was recovered from Caisteal nan Gillean I on Oronsay (Mellars 1987), and scallops with modified edges from the nearby middens of Cnoc Coig and Cnoc Sligeach were interpreted as "scoops or ladles" by the original excavator (Bishop 1914). At Sand, worn scallop fragments, including a shell where a section had been deliberately cut out, were found and are suggested to have been used at tools (Hardy 2010). Empty scallop shells were also deliberately brought to the midden at Ulva cave, as evidenced by the presence of worm casts inside the shells (Russell *et al.* 1995). The use of limpet (*Patella* sp.) and Mediterranean mussel (*Mytilus galloprovincialis)* for processing non-woody plant matter have also been identified in

Mesolithic deposits in Spain (Cuenca-Solana 2015). There was no evidence for the deliberate modification of limpet shells at the Tràigh na Beirigh 1 sites, however (Evans pers. comm.); any perforations are likely to have been made by natural predators (Barton & Roberts 2015; Bishop 1914; Hardy 2010). Cockles (Cardiidae) bearing edge-wear and perforated hinges have also been recovered from Cnoc Sligeach (Hardy 2010), and further afield at Culverwell on the Isle of Portland, Dorset (Barton & Roberts 2015; Palmer 1999).

Most frequently, perforated shells are interpreted as items of personal adornment such as beads or pendants (Cuenca-Solana *et al.* 2011; Hardy 2010; Simpson 2003). However, perforations allow suspension in many respects, not only for personal ornamentation. The use of perforated bivalves as net sinkers is known from archaeological deposits in Mailu, Papua New Guinea (Irwin 1985). These were expediently perforated with a hole "bashed" close to the hinge of the shell in order to thread the net through (Irwin 1985:223; Przywolnik 2003:15). This treatment contrasts with the meticulous stages of manufacture that were involved in producing thinned, smoothed and perforated shell pendants that have been recovered from Kimberly, western Australia (Akerman & Stanton 1994; Przywolnik 2003:16).

Whilst the use of shells as tools cannot be ruled out during the Mesolithic occupation of the Cnip headland, the evidence for such careful shaping and perforating of the oyster shell from Tràigh na Beirigh 1 suggests it was created for something more meaningful than a fish-net sinker, based on the comparable ethnographic evidence described above. Furthermore, the positioning of the modified shell at the interface between the underlying old ground surface deposits and the overlying shell midden accumulation potentially indicates deliberate deposition. The significance of this is discussed in Chapter Nine.

Figure 260. Perforated oyster shell in situ at Tràigh na Beirigh 1. Photo courtesy of Peter Rowley-Conwy

8.4. Conclusion

This chapter has brought together the results of the technical and typological analysis of each of the Western Isles lithic assemblages, and discussed them in terms of the wider context of the activities conducted at each site. A number of major themes have been identified through the interpretation of the lithic assemblages that, when combined with the supporting contextual evidence for the types of site activities, contribute significantly to the interpretation of hunter-gatherer settlement and subsistence strategies on the island. Overall, the reduction strategies employed at these sites were adapted to suit the raw materials present in terms of their availability, quality, and fracture mechanics. These raw materials were expediently reduced to produce irregular flakes that could be used as a generalised tool-kit, in order to exploit a range of resources. It is evident that whilst at both the earlier, open-air sites on Harris, and the younger shell midden sites on Lewis there is an emphasis on fishing, the Lewisian sites appear more specialised in terms of the resources targeted. Whilst the nature of the site activities appear to have little effect on the lithic assemblages overall, the broader spectrum of foraging and trapping may be one of a multitude of explanations for the presence of microliths at Northton. Furthermore, the importance of fishing at these sites, during the course of over 2000 years of occupation, attests to the use of technology that has no longer survived.

Where deemed appropriate during this chapter, examples of comparable evidence have been drawn from across the Mesolithic of the Atlantic seaboard, as well as ethnographic parallels, to support the interpretations that have been made. The following chapter expands on this further in order to integrate the evidence from the Western Isles Mesolithic more fully with our current understanding of the Mesolithic at the edge of western Europe.

Chapter 9 The Western Isles Mesolithic in its Atlantic Context

9.1. Introduction

In Chapter Eight the current evidence for Mesolithic occupation in the Western Isles was presented, in order to provide a holistic overview of technology and subsistence in the region. In this chapter interpretations that were developed previously are finally placed within the context of the Mesolithic of the north-east Atlantic seaboard. Comparisons and contrasts between the evidence for Mesolithic occupation in the Western Isles, the Inner Hebrides, and the western Scottish mainland will be drawn throughout. This is to ascertain whether the Mesolithic of the Western Isles is representative of the broader Scottish Mesolithic tradition – of island-hopping hunter-gatherers exploiting marine and terrestrial resources, utilising local raw materials to expediently produce composite tools.

This chapter is structured around three themes: inter-island connections; mobility; settlement and subsistence, and overarching trends in the western European Mesolithic. These themes are not only reflected within the immediate context of coastal western Scotland, but also island environments beyond – from the neighbouring areas of the Atlantic seaboard in Ireland and Norway. As outlined in Chapters Two and Three, these areas also exhibit a perceived preference by Mesolithic people for the exploitation of coastal and riverine environments (Woodman 2004:287). Both Ireland and Norway were colonised by Mesolithic hunter-fisher-gatherers after some delay, with subsistence strategies that relied heavily on aquatic resources. By exploring the similarities and differences between the archaeological record in the Western Isles and the broader Atlantic façade, this chapter endeavours to answer the third research question of this thesis: *are the Western Isles sites representative of the Scottish Mesolithic, and how do they fit within the Mesolithic of the north-east Atlantic façade?*

9.2. Inter-Island Connections

In the previous chapter it was discussed in detail that, where non-local raw materials are present at the Mesolithic sites in the Western Isles, the intensive reduction of these materials suggests they were 'expensive' and obtained from distant sources. As such *the Mesolithic communities inhabiting the Western Isles were tied into an existing network of inter-island connections*. Embedded/direct procurement, or small-scale exchange, of exotic raw materials is reflected in the existing evidence for the movement of different raw materials with restricted sources around the Inner Hebrides and mainland during the Mesolithic (Piper 2010). These raw materials comprise baked mudstone, limestone, bloodstone, and pitchstone. Movement of organic materials is also evident but not to the same extent. The evidence for these connections is most apparent in the assemblages on Harris, where baked mudstone has been imported to Northton and Tràigh an Teampuill. The presence of limestone/dolomite at Tràigh na Beirigh 9 also implies connections between the Inner Hebrides with Lewis. Irrespective of whether these raw materials were exchanged, directly procured, or collected as an embedded part of seasonal mobility, a relationship with the communities at the sources of these raw materials is implicit in order to facilitate trade or access. In the absence of large terrestrial ungulates in the Western Isles, organic raw materials such as the red deer antler tine from Tràigh an Teampuill also suggest imported commodities. First, the importance of exchange networks as a risk-reduction strategy in early colonising communities is described with reference to the colonisation of Ireland and Norway, drawing upon ethnographic parallels. Subsequently, tracing raw material movement is considered in order to understand how the Western Isles Mesolithic sites are incorporated into an existing distribution network of raw material movement that extends along the western Scottish coastline between contemporary sites.

9.2.1. The Importance of Trade in Colonising Communities

Maintaining contacts with 'parent' communities is fundamental to ensuring biological survival for colonising groups, or groups with high risk of resource failure (Rowley-Conwy & Piper in press). The importance of exchange networks in supplying resources, such as raw materials, is observed in the Western Desert of Australia where exchange networks of exotic materials including obsidian are extended over significant distances, and consequently social relationships are just as far reaching. These relationships acted as "insurance against local resource failure" (Layton 2005:134). Although the high risk of unpredictable resources in the Australian desert is not analogous for the Mesolithic in Britain and Ireland, this insurance may also be a significant factor in early colonising societies (Kelly & Todd 1988:237-238; Tolan-Smith 2003:122; Whallon 2006). This would be most exaggerated in the occupation of offshore islands (Tolan-Smith 2003:124; 2008:145).

As discussed in Chapter Three, the Early Mesolithic assemblages in Norway and Ireland are almost exclusively comprised of flint. The knapping debris at the Early Mesolithic sites suggests the raw material has been transported wholesale from coastal sources to be reduced at the site. This is characteristic of embedded procurement within groups that have a high degree of residential mobility (Binford 1979; Costa & Sternke 2009:797-979; Torrence 1989b:5; Woodman 1987:142). During the post-glacial colonisation of these regions, the availability of suitable raw materials could not have been guaranteed as communities expanded into new, unknown, areas. Consequently, raw materials would have been imported with groups from familiar sources, frequently over long distances, maintaining contact with their original communities and trading resources as an insurance network. This follows an 'undifferentiated network system', whereby population densities are low, with strong links between 'parent' and colonising groups resulting in technological homogeneity over a wide area, as observed in the Early Mesolithic of Norway (Madden 1983:196). The use of microliths in the Early Mesolithic of Ireland is also suggested to have been due to “retain[ing] strong links with their perceived homeland in Britain” (Woodman 2009a:210).

Similarly, the post-glacial colonisation of Scotland and its islands would have involved movement into an environment rich in glacial erratic raw material, which may have included flint and various other flakeable siliceous raw materials. Throughout the islands quartz, in its various forms, is abundant, predictable and largely of good quality. Other discrete sources of utilisable raw materials are also available including flint, chert, other chalcedonic silicas such as agate and jasper; bloodstone from Rum; pitchstone which is largely derived from Arran; baked mudstone from Skye and the Shiant Isles, and various coarse stones (Saville 1994; Wickham-Jones 1986; 2009c). Based on this, Saville (1994) states that the absence of flint in Scotland was not a factor in the delayed colonisation of the region (contra. Movius 1942:198).

Northton and Tràigh an Teampuill represent the earliest evidence for occupation in the Western Isles of Scotland. The date of the earliest phase of occupation at Northton is c.7000 cal. BC, which is contemporary with the earliest phases of a number of Mesolithic sites in the northern islands of the Inner Hebrides, namely at Kinloch, Rum; Rubha Port an t-Seilich, Islay and Fiskary Bay, Coll (Figure 261; Wicks & Mithen 2014). To date, these sites represent the earliest known occupation of each of their respective locales. Such a broad spread of contemporary Mesolithic activity across a number of separate islands demonstrates significant seafaring capabilities, and rapid maritime adaptation of hunter-gatherer-fishers who had soon familiarised themselves with the resource-rich environment (Bjerck 2009).

Within the early phases of occupation in a region, there is little difference observed between the technology and raw materials used in lithic assemblages (Åkerlund *et al.* 2003; Woodman 2012). The flint-dominated Phase 4 lithic assemblage from Northton has been extensively reduced using bipolar technology to maximise the raw material available, and the ratio of microliths is high (relative to the assemblage as a whole). This closely resembles Mesolithic assemblages from the Inner Hebrides, and suggests that the early inhabitants of Northton maintained close contact with their eastern neighbours.

During the later, more substantial Phase 3 deposits at Northton, the proportion of locally available quartz within the assemblage far outweighs that of flint. Furthermore, whilst a number of flint microliths are present the overall number of formal tools is lacking, and quartz is reduced far more liberally than flint. It is clear that by this point, there is a much greater use of local resources, and technology has developed to suit this as long-term settlement of the environment is established

(Åkerlund *et al.* 2003; Housley *et al.* 1997; Woodman 2012). Many of the sites contemporary with the later phase of occupation at Northton display evidence for localised movement of restricted raw materials such as bloodstone, baked mudstone, and limestone, especially around the Inner Sound region. Baked mudstone is also imported to Northton, which attests to the continued movement of people between the Inner and Outer Hebrides. Despite this contact, the use of flint and microliths decline. These alterations may reflect changes in the networks that existed between communities during the early occupation of these areas, once settlement was well established. This has been attributed in part to the change in technology between the Early and Late Mesolithic in Ireland, and is discussed in more detail with regard to the Scottish evidence in the following section (Woodman 2012).

9.2.2. Procurement and Movement of Exotic Raw Materials

As highlighted in Chapter Two, patterns in the provenance, distribution and usage of different of raw materials between the Scottish islands and mainland have posed interesting questions regarding the movement of – and possible trade networks between – Mesolithic communities. This section expands on the ideas presented in Piper (2010).

9.2.2.1. Baked Mudstone

Baked mudstone is a fine grained sedimentary rock that knaps well when fresh, but becomes very soft as it degrades over time (Wickham-Jones 2009c:455). This raw material is not known to be local to the Western Isles, with the nearest identified sources outcropping on the Shiant Isles (Goodenough 1999); and Staffin on Skye (Hesselbo & Coe 2000; Wickham-Jones 2009c).

To recap the main findings presented in Chapter Five, the Mesolithic baked mudstone assemblage is only found in the Phase 3 deposits at Northton, and comprises over 10% of the total raw material from the site. There is very little 'cortex' present on this material, 97% of the pieces retain between 0-50% of the outer surface. Where enough cortex remains to identify its probable source, it is weathered in appearance, suggesting the material may have been obtained from an outcrop. The absence of primary flakes, and very few cores, suggests that baked mudstone may have been imported to the site in a pre-prepared state, following its extraction from a sill elsewhere. One of the cores displays evidence for bipolar reduction, indicating conservative treatment of a raw material that was 'expensive' to obtain. The mudstone at Tràigh an Teampuill also lacks evidence of primary working, potentially imported as flake blanks that could be modified as needed.

Similarly conservative treatment of this raw material is observed at Mesolithic sites around the Inner Hebrides. The use of baked mudstone around the islands of the Inner Sound appears highly localised. Artefacts made from this raw material have been identified in a number of lithic scatters around this region that contain evidence for Mesolithic activity, but may also be later prehistoric contamination. The small assemblage from Auchareoch, Arran is notable for the distance from the source, however the pieces were retrieved from undated areas of the site (Affleck *et al.* 1988). There are five sites in the region of the Inner Sound that are contemporary with Northton[10], and contain a baked mudstone assemblage (Figure 261). There is a significant relationship between the distance of these sites to the source and the reduction of this raw material.

An Corran is situated closest to the baked mudstone sources at Staffin, Skye and an outcrop was identified at the time of the excavation above the rockshelter overhang (Hardy *et al.* 2012). The lithic assemblage is comprised of 63% baked mudstone, which was used to make large blades and retouched tools. The full *chaîne opératoire* is present, and the production of such large blades is attributed to the immediate availability of "large angular blocks" of raw material (Hardy *et al.* 2012:34). Baked mudstone was also recovered in significant quantities from lithic scatters around the rockshelter, many of which contained diagnostically Mesolithic microliths (Hardy & Wickham-Jones 2009a:93-36). In contrast, the Mesolithic site at Camas Daraich is located at the southern end of Skye, 70km from the baked mudstone source. Baked mudstone comprises around 1% of the total number of lithics in this assemblage, and there are no pebbles or cores present. The limited number of primary flakes again indicate that this material was brought to the site in a pre-prepared form, or as finished tools (Wickham-Jones 2004a:37).

Sand is situated on the Applecross peninsula, in the highland region of western Scotland. Baked mudstone accounts for 43% of the lithic assemblage at this site. Beyond a single unworked pebble of baked mudstone, there is very little evidence for the reduction of this raw material in the assemblage. There are only a small number of flakes retaining cortex, again leading to the suggestion that baked mudstone was reduced at its source, in order to reduce transport costs, and imported in a semi-prepared state or as finished tools (Wickham-Jones 2009b).

Two small assemblages from Raasay – between Skye and the mainland – also contained evidence for the use of baked mudstone during the Mesolithic. A single, heavily worked core fragment was recovered from Clachan Harbour; at Loch a Sguirr 1, baked mudstone debitage, flakes, and a blade were found in test-pits (Ballin *et al.* 2011; Hardy & Wickham-Jones 2009a:169-173). Owing to the small size of these assemblages, they offer little interpretative value other than evidence for distribution.

Overall, the evidence from these sites lends credence to the suggestion that the introduction of baked mudstone to Northton during the later phase of Mesolithic occupation was as a result of

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[10] Clachan Harbour is not depicted as the radiocarbon dates are not directly associated with the lithic assemblage, but derived from overlying peat. The date range of 7598-7084 cal. BC provides a *terminus ante quem* for the deposition of the lithic assemblage, which is cotemporary with Northton.

contact with groups from the Inner Hebrides, following an expansion in settlement of the region. The semi-prepared state of this raw material within these deposits is comparable to those at Sand and Camas Daraich, which are also beyond the immediate vicinity of the source.

These contacts were maintained over the intervening centuries between the occupation of Northton and Tràigh an Teampuill. The dates for the latest occupation of Sand overlap with the latest occupation at Tràigh an Teampuill, which may have facilitated continued access to the baked mudstone by Mesolithic communities across the Minch (Figure 262). It should be noted that the occupation at Tràigh an Teampuill is c.400 years later than the Phase 3 deposits at Northton, when baked mudstone was first introduced to the area. It is therefore unlikely that the occupation deposits at Northton would have still been visible for raw materials to have been scavenged from the site. It is also worth reiterating that baked mudstone is present during the Neolithic/Beaker phases at Northton, as described in the previous chapter (Gregory & Simpson 2006; Phillips 2006b). Consequently, it can be reasonably argued that the long-established contacts between the Toe Head peninsula and the Inner Hebrides endured over millennia, continuing to supply this raw material to their agriculturalist descendants during later prehistory.

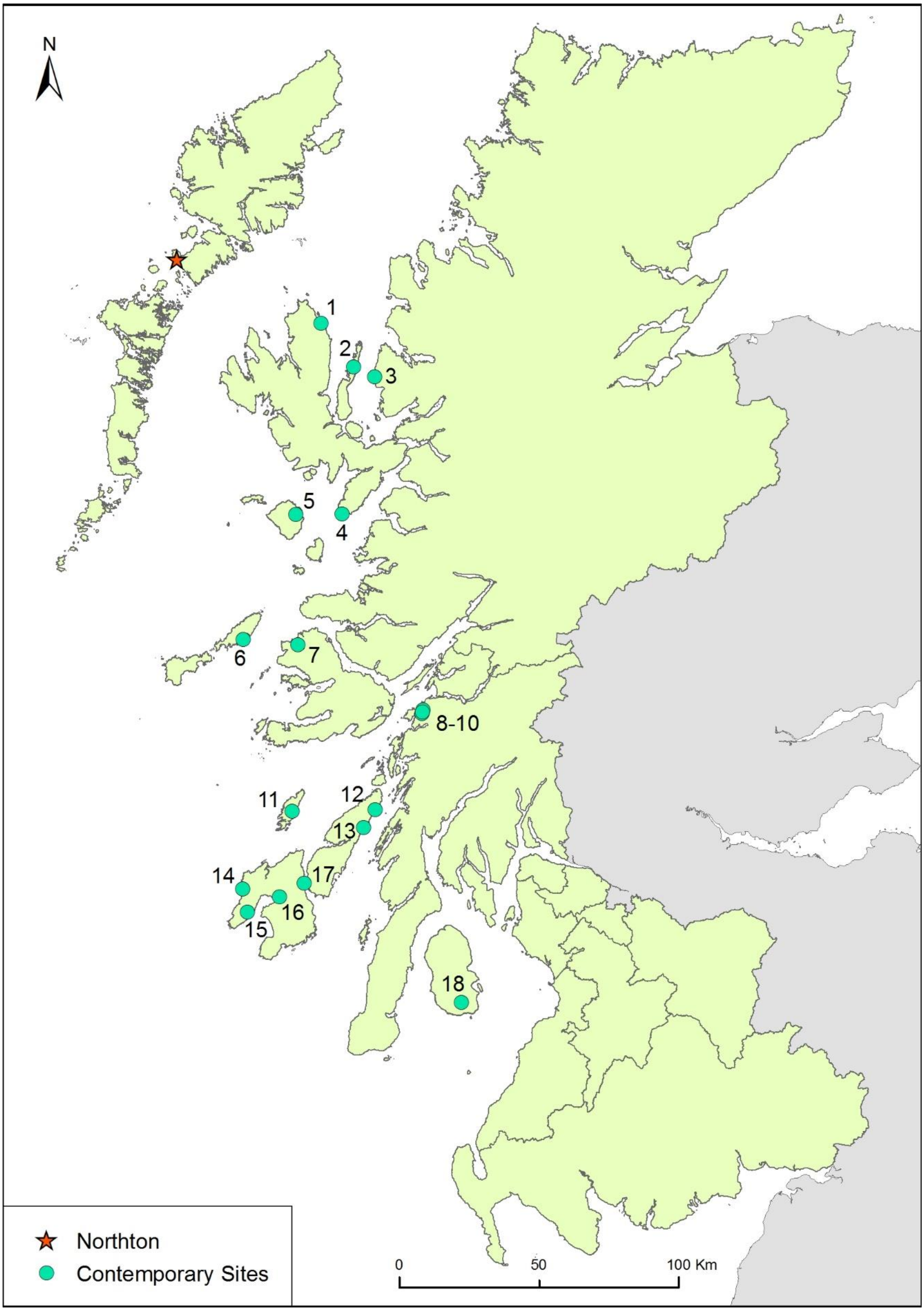

Figure 261. Northton (starred) and contemporary Mesolithic sites from the Inner Hebrides and western Scottish mainland. 1. An Corran; 2. Loch a Sguirr; 3. Sand; 4. Camas Daraich; 5. Kinloch; 6. Fiskary Bay; 7. Creit Dubh; 8. Druimvargie; 9. Lón Mór; 10. Raschoille; 11. Staosnaig; 12. North Carn; 13. Lussa Wood; 14. Coulererach; 15. Bolsay Farm; 16. Newton; 17. Rubha Port an t-Seilich; 18. Auchareoch. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

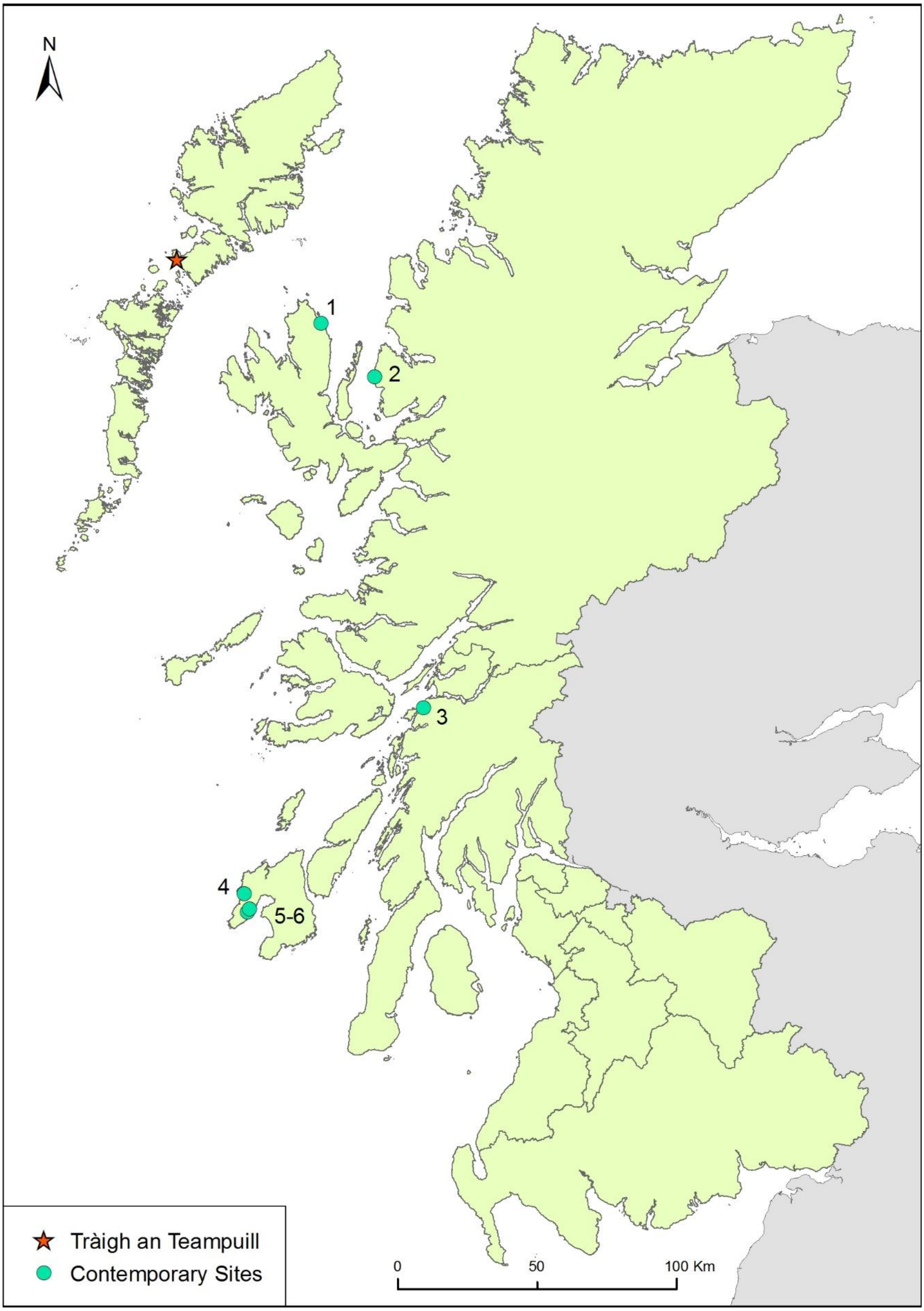

Figure 262. Tràigh an Teampuill (starred) and contemporary Mesolithic sites from the Inner Hebrides and western Scottish mainland. 1. An Corran; 2. Sand; 3. MacArthur Cave; 4. Rockside; 5. Bolsay Farm; 6. Gleann Mor. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

9.2.2.2. Limestone

At Northton and Tràigh na Beirigh 9 three pieces of carbonate rock were found – one from the former and two from the latter site. The closest source of this rock type is found in the Cambro-Ordovician Durness Group of north-west Scotland, which is largely comprised of limestone and dolostone (Raine 2009:1). The Durness Group runs as a belt for c.170 km from Durness on the north coast of Scotland to Skye, with various formations exposed along the west coast (Raine 2009:27). Silicified limestone has also been identified on the west coast of the small island of Eigg in the Inner Hebrides, and artefacts made from this raw material (although initially identified as quartzite) have been recovered in the lithic assemblages from Kinloch, Rum and Camas Daraich, Skye (Durant *et al.* 1990:52; Wickham-Jones 2004a:21). Wickham-Jones states that the outcrops of Durness Group limestone near Loch Slapin and Loch Kishorn would have been available within the annual round of the Mesolithic inhabitants at Camas Daraich (Wickham-Jones 2004a). All of the carbonate flakes from these sites are tertiary flakes. The absence of any evidence for primary working of this raw material suggests it may have been imported in a pre-prepared state, as suggested above for the baked mudstone. At Northton, it may have been imported alongside the baked mudstone, however it is impossible to make any definitive conclusions based on the presence of only three flakes.

9.2.2.3. Bloodstone

In order to consolidate the theory of tracing a network of mobile communities through raw material distribution more fully, other examples of raw material movement between the Hebridean islands are considered. Bloodstone, a variety of chalcedonic silica primarily sourced from Bloodstone Hill on the island of Rum, dominates the Mesolithic assemblage at Kinloch (Durant *et al.* 1990).

In a similar manner to baked mudstone, this raw material appears in a heavily reduced state at Mesolithic sites around the Inner Sound. Bloodstone Hill is situated c.25km away from Camas Daraich, Skye and is clearly visible across the sea. Within this assemblage bloodstone comprises 33% of the assemblage. As described above, the source of baked mudstone is over 70km away from the site and this raw material makes up just 1% of the total assemblage. Despite this, both bloodstone and baked mudstone display similarly low percentages of cortical flakes, indicating that preparation of the material was conducted at the source before being transported to the site (Wickham-Jones 2004a). The lack of evidence for further working or abandonment of cores within the bloodstone assemblages from An Corran and Sand also suggests that the raw material was imported to these sites in a pre-prepared condition (Hardy *et al.* 2012; Wickham-Jones 2009b).

In contrast, there is a higher preponderance of cores and decortical flakes at Kinloch, which is situated far closer to the source than at any of these sites; however, even this was not significant in terms of evidence for the primary reduction of the raw material by task-groups at the site (Tolan-Smith 2008:155). It is proposed that the "majority of nodules were opened for testing and roughly shaped elsewhere, probably on the beach where they were collected", with more specialised blade production occurring at Kinloch (Zetterlund 1990:78). This clearly demonstrates the cost-benefit of decisions made by Mesolithic communities in terms of raw material transport, even where the source of the raw material is close-by.

9.2.2.4. Organic Materials

The network of raw material supply between the Inner Hebrides and the Western Isles may have even extended to organic commodities. The faunal record from the Western Isles Mesolithic indicates that there is very limited evidence for the presence of terrestrial mammals on the islands, as discussed in Chapter Eight. The only evidence thus far is from Tràigh an Teampuill, where a red deer antler tine pressure flaker and small fragments of undiagnostic bone, identified using ZooMS as deer/elk, were recovered (Charlton 2016). The groups which moved between Tràigh an Teampuill and the Inner Hebrides, and supplied the baked mudstone, could have also imported organic materials that were not available in the Western Isles. The deer/elk bone may have been the remains of a haunch of meat that was brought on the journey – similar to the suggestion for the presence of domesticated cattle within the Mesolithic deposits at Ferriter's Cove, Ireland (Whittle 2007).

There is very clear evidence for the import of already-butchered red deer to Oronsay during the Mesolithic occupation of the middens. At Cnoc Coig, a number of meat-bearing bones were recovered, indicating that joints of meat had been transported to the island. It has been suggested that the presence of non-meat bearing elements, including lower limb bones and metapodials, as well as antler, were deliberately imported as raw material for tool manufacture. During the Mesolithic Oronsay would have been too small to sustain a natural population of deer. Analysis of the size of these bones suggested that Mesolithic people were exploiting two separate cervid populations; one group of deer were most likely to have been resident of the neighbouring islands of Colonsay, Islay, or Jura based on their small stature, the second were more consistent with the size of deer from the mainland (Grigson 1981; Mithen & Finlayson 1991; Richards & Mellars 1998).

The above evidence undeniably demonstrates the level of Mesolithic mobility between the islands of the Inner Hebrides, which can be used as a proxy for the Western Isles. In the following section, proposals for a social territory that incorporates the Hebridean islands and the western mainland of Scotland are synthesised. This model is then applied to the Western Isles.

9.2.3. Defining Social Territories

It is clear from the evidence above that there is almost a 'shopping list' of raw materials which are in use at Mesolithic sites around the Inner Hebrides and the western mainland of Scotland. With regard to the distribution of baked mudstone, Hardy and Wickham-Jones suggest this may be representative of "a 'sphere of influence' perhaps even a territory that stretches as far as Staffin Bay in the north and the island of Rum in the south." (2009a:189; Saville 2003). Along a north-south axis this territory would be c.70km in length. By extrapolating the radius, this territory would therefore incorporate the whole of Skye, and the fringes of mainland Scotland to the east. A similar proposal has been made by Ballin regarding the presence of bloodstone at Mesolithic sites around the Inner Sound, although the scale of this is much larger. Mesolithic sites containing bloodstone largely fall within a radius of c.90km from the source on Rum. Ballin states:

> "It is thought that the area around Rhum, with its bloodstone-bearing early prehistoric sites, may define a Mesolithic social territory and its associated exchange network, with the northernmost sites being those at Loch Torridon and the southernmost those in Ardnamurchan, Morvern and on Mull…As the distribution of Staffin baked mudstone from Skye (cf. Saville *et al*. 2012) corresponds roughly to that of Rhum bloodstone it is quite possible that the baked mudstone distribution and the bloodstone distribution define the same exchange network and the same social territory." (Ballin 2016a:35-36)

Within this radius, there is a significant drop-off in the proportion of bloodstone within Mesolithic lithic assemblages. As described above, bloodstone comprises 33% of the assemblage at Camas Daraich, 25km from the source (Wickham-Jones 2004a). At Loch Doilean, situated on the Morvern peninsula of mainland Scotland and 57km straight-line distance from Bloodstone Hill, bloodstone makes up just 3.4% of the assemblage (Ballin 2016a). This adheres to the pattern of 'down the line' exchange (Renfrew 1977), which was observed in the Neolithic distribution of flint in the Western Isles, and inferred for the distribution of flint during the Mesolithic in the preceding chapter.

The movement of raw materials between communities via exchange networks, and the implication for social territories is well documented in southern Norway. As discussed in Chapter Three, the most recognisable example of this is the movement of greenstone and diabase along the coast from their respective island sources. Different stages of artefact manufacture were evident dependent on the proximity to the source. Quarrying and workshop sites were identified at the raw material source, on the islands of Bømlo and Flora; production areas for further working were situated on the mainland away from the immediate sources; blanks and finished products were then removed to other sites within the main distribution area, which extended up to 100km from their sources (Bergsvik & Olsen 2003; Olsen & Alsaker 1984). Whilst it is suggested that quarrying and tool production was conducted via direct procurement by task-groups that had equal access to the sources, the movement of artefacts in these raw materials beyond their main distribution area is evidence of a long-distance exchange network. The social boundary that is inferred, based on the distribution of these two raw materials, is supported by stylistic differences in the adzes and axes that were produced (Bergsvik & Olsen 2003; Olsen & Alsaker 1984).

If the model for a social territory of up to 100km for aquatic hunter-gatherers can be accepted, based upon the observations of Hardy regarding baked mudstone (Hardy & Wickham-Jones 2009a); Ballin in relation to bloodstone (Ballin 2016a); Olsen and Alsaker vis-à-vis greenstone and diabase (Olsen & Alsaker 1984), and Ames' ethnographic reports (Ames 2002), it is highly likely that a similar territory may encompass the western coastline and islands of Scotland. At 70km in diameter, the westward extent of the social territory proposed by Hardy (2009a) would almost overlap with the easternmost extent of a similarly-sized territory that radiates from the Toe Head peninsula, Harris at the Waternish peninsula of Skye (Figure 263). This would facilitate access to distant raw materials such as flint to the south, and baked mudstone and limestone to the east, through an exchange network with other groups closer to the source. This could explain the presence of baked mudstone 250km south of its source at Auchareoch, Arran.

With a radius of 90km, the larger territory suggested by Ballin (2016a) easily incorporates both the Shiant Isles and Toe Head peninsula (Figure 264). Within this model, Mesolithic communities inhabiting both the outer islands and the mainland could easily have obtained these raw materials through embedded/direct procurement from the source, as in Norway.

9.3. Mobility, Settlement and Subsistence

Thus far, the themes outlined in both the previous chapter and above have established: how raw materials were sourced and procured; that approaches to the conservation and treatment of these materials were adapted through the application of different reduction sequences and choice of technology; that inter-island connections were implicit in the access and transport of raw materials between the source and the site of consumption. Each of these are significant in interpreting the settlement and subsistence practices of Mesolithic groups inhabiting the Western Isles. Based on these themes, it is suggested that overall, *the lithic assemblages of the Western Isle Mesolithic are largely representative of an expedient (immediate use) technology, obtained through embedded procurement by logistically organised groups*.

This section integrates the procurement, reduction, and tool-use evidence from the lithic assemblages with the organic evidence for site activities, which were outlined in the previous chapter, in order to strengthen the above interpretation of Mesolithic mobility and subsistence in the Western Isles.

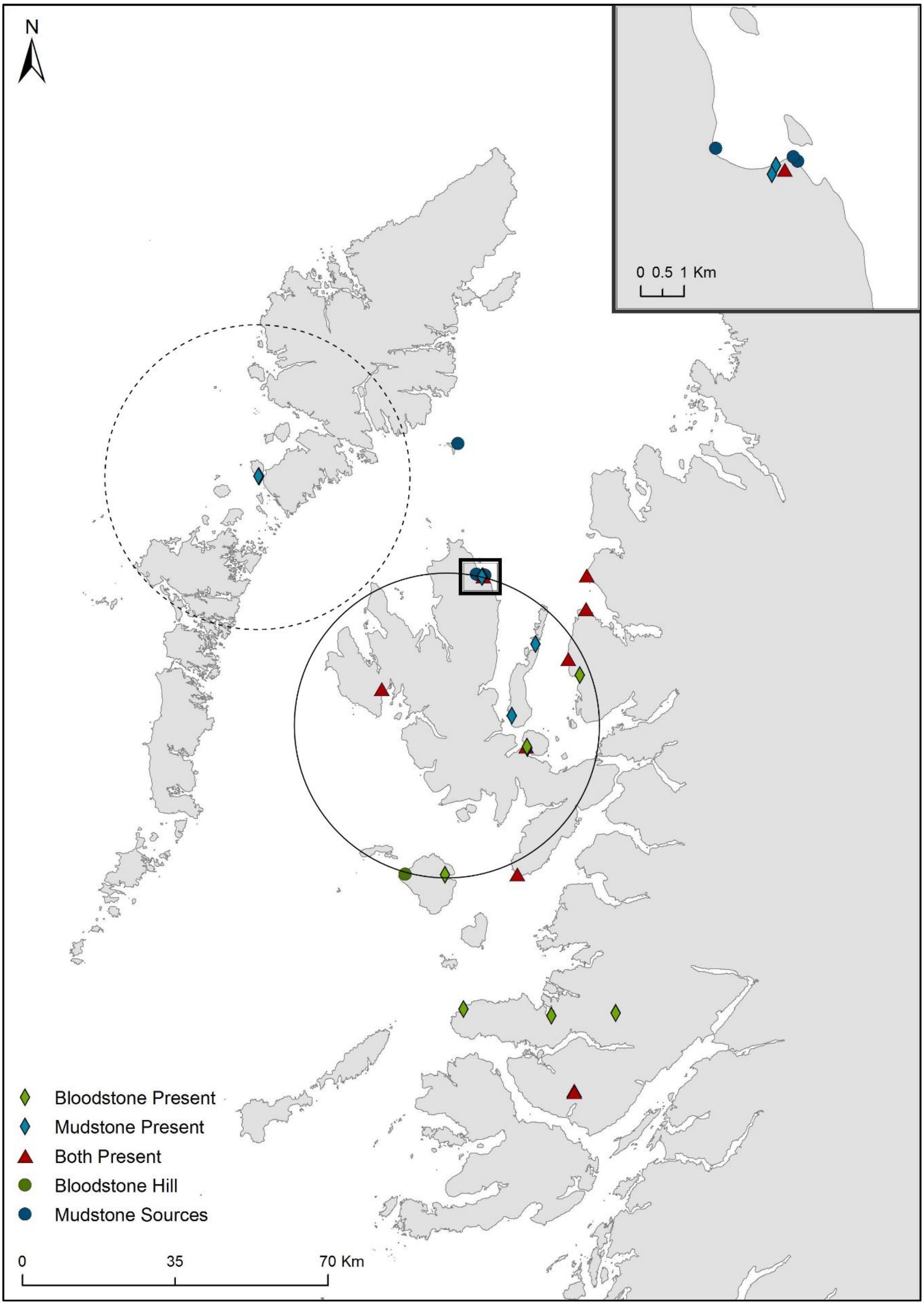

Figure 263. Mesolithic assemblages of western Scotland containing bloodstone and/or mudstone that are encompassed by the 70km-diameter (solid line) social territory suggested by Hardy (2009a). The epicentre of the territory is equidistant between the source of bloodstone on Rum and the mudstone sources at Staffin on Skye. The dashed line is representative of the same sized territory with its centre at the Toe Head peninsula. Inset highlights the sources of mudstone and Mesolithic sites around An Corran at Staffin Bay. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

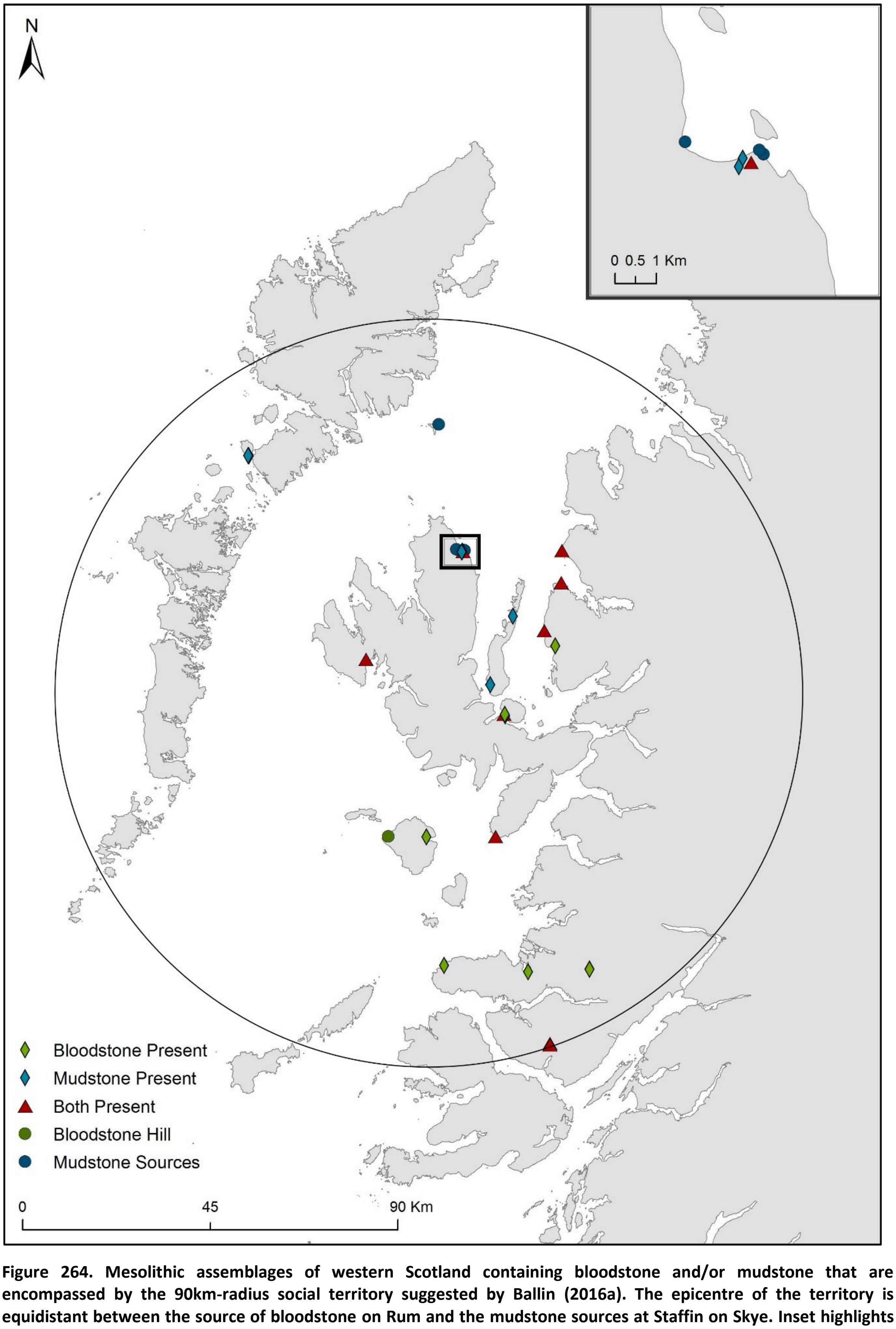

Figure 264. Mesolithic assemblages of western Scotland containing bloodstone and/or mudstone that are encompassed by the 90km-radius social territory suggested by Ballin (2016a). The epicentre of the territory is equidistant between the source of bloodstone on Rum and the mudstone sources at Staffin on Skye. Inset highlights the sources of mudstone and Mesolithic sites around An Corran at Staffin Bay. Ordnance Survey data © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service

9.3.1. Ethnographic Models of Hunter-Gatherer Subsistence

In Chapter Three, ethnographically-derived models of hunter-gatherer subsistence were alluded to by way of explaining the economic systems of Mesolithic communities in Ireland and Norway. A very brief overview of these models is presented in order that the evidence from the Western Isles can be fully interpreted, and subsequently aligned with that of the eastern Atlantic fringe. This enables the third research question of this thesis to be answered, as outlined at the beginning of the chapter.

Binford (1980) defined the variability observed between hunter-gatherer settlement systems in terms of subsistence strategies and organisation of mobility. This was largely based upon interactions with the Alaskan Nunamuit Eskimo (Inuit). At one end of the spectrum are *foragers*. These groups move between resource "patches", practicing an encounter hunting/gathering strategy whereby resources are returned to the residential base on a daily basis for immediate consumption. As such, *foragers* are characterised by high residential mobility. Base-camps reflect the season and duration of occupation of these groups and are characterised by evidence for "most processing, manufacturing and maintenance activities", with very few, ephemeral, extraction camps (a *location*). There is little investment in caching of resources in these instances and tool discard is low, resulting in ephemeral palimpsests as *locations* are re-used (Binford 1980:5-10; Kelly 2013:78). In contrast, *collectors* residentially move to a specific resource and frequently store food for later consumption (Renouf 1991:95-96). In this way, the number of whole-group (residential) moves are lower, and frequent forays are made by logistically organised specialist task-groups that consisted of skilled individuals to procure specific resources, which are brought back to the residential base-camp. The position of the residential camp to one critical resource frequently compromises the proximity of another, as such task-groups may disperse over large areas for a period of time, resulting in more established extraction and field camps. The specialised procurement of large-quantities of specific resources are reflected in the accumulation of material at a *field camp*, whereby resources may be processed and temporarily stored (Binford 1980:10-12; Kelly 2013:78). On the whole, logistical organisation of subsistence strategies results in a higher degree of variability between sites (Binford 1980:13).

In a similar vein, Woodburn identified two economic systems formulated during his work with the Hadza of Tanzania (Woodburn 1980). *Immediate-return* strategies are broadly parallel to Binford's *foragers*: food is obtained and consumed on the same day, utilising equipment that is "simple, portable, utilitarian, easily acquired, replaceable tools and weapons" (Woodburn 1982:432). There are no fixed places within this strategy; camps are occupied by individuals who move freely between camps, and the camps also move. Conversely, *delayed-return* systems are more closely aligned with the *collector* concept. Most significantly, this system entails rights over, or ownership of, assets and people. Assets may comprise specific resource areas, some of which may be managed, as well as “technical facilities” such as boats, traps and weirs which require a significant investment of labour (Newell & Constandse-Westermann 1984). Processing or storage of food is usually practiced, and social relationships entail binding commitments whereby territoriality frequently ensues (Finlayson 2009; Woodburn 1980).

Neither Binford nor Woodburn presuppose that these models represent mutually exclusive dichotomies, indeed both acknowledge that significant variability lies with these systems (Binford 1980; Woodburn 1980). Exceptions to these models are well-known, and it should be made clear that hunter-gatherer settlement systems do not simply lie along a continuum, but move adaptively on axes of variation (Finlayson 2009; Layton 2005; Rowley-Conwy 2001; Rowley-Conwy & Piper in press; Winterhalder 2001).

‘Complex hunters’ is a term coined by Rowley-Conwy (1983) to describe hunter-gatherers that do not fit with the “nomadic norm” of simple, egalitarian, highly mobile foragers. Divergence may be manifest in a number of ways: complex technology; semi-permanent residences; a high number of facilities; social stratification and territoriality. These differences largely arise from the reduced mobility of ‘complex hunters’ in relation to food supply. Residential home-bases are supplied by special-purpose task-sites, which is in-line with Binford’s logistic group organisation. However, these differ in a significant respect; residential home-bases within a logistic system move occasionally, within a ‘complex hunter’ system they are permanent (Rowley-Conwy 1987).

Overall, the statement made above, in which the lithic evidence from the Western Isles generally appears to represent *expedient technology, obtained through embedded procurement by logistically organised groups*, displays elements of both an *immediate-return* and a *delayed-return* strategy. The following section recapitulates the lithic evidence from each site as a whole in order to test this, alongside the subsistence activities at the site.

It should be noted that when reduction in mobility is alluded to, the argument here is that there is a reduction in *terrestrial* mobility. Water transport allows groups to remain mobile, but with a means to significantly reduce the transport cost of moving raw materials, which would facilitate the long-distance contacts for the movement of exotic raw materials. This is most evident in Norway, despite the absence of evidence for boats. The importance of boats in the Mesolithic of western Scotland cannot be underestimated. The number of sites with significant evidence for Mesolithic occupation around the islands of the Inner Hebrides and western mainland, coupled with strong evidence for raw material transport, attests to the sea which was “important as a highway” (Hardy & Wickham-Jones 2002b:832). With the raw material evidence from Harris and Lewis, the Western Isles can now be included in this picture, and resolutely corroborates the recent suggestion that "the character of Late Mesolithic occupation and maritime connectivity in the Outer Hebrides and Orkney will be revealed as similar to the picture of significant maritime activity proposed for the Inner Hebrides" (Garrow & Sturt 2011:66).

9.3.2. Logistic Systems in the Western Isles Mesolithic: Reviewing the Lithic Evidence

There are a number of elements within a lithic assemblage that can be used to discern the probable use of a site, with regards to the differences in activities between residential base-camps and procurement *locations* or specialised *field camp* site-types. The lithic component of a long-term residential home-base will differ markedly from that of an overnight hunting camp for example, given the propensity for debris-heavy manufacturing and maintenance activities to be conducted at the former (Binford 1980:9). In light of this, there are a number of characteristic attributes that are indicative of mobility patterns, and hence site-types. These are largely based on the presence of formal tools. For example, high tool diversity; caching of material; the presence of exhausted tools (due to 'gearing up' or curation), and a small percentage of non-quartz artefacts are suggested to represent an assemblage produced at residential base-camps (Ballin 2008:65-66). In contrast, low tool diversity; the absence of caches; an extremely low number of exhausted tools and an almost exclusive use of quartz are interpreted as an assemblage characteristic of logistic extraction camps (Ballin 2008:65-66). The percentage of locally available raw material within an assemblage appears to be related to the cost-benefit compromise of direct versus embedded procurement. The composition of the assemblages at these different site-types concurs with the evidence proposed for these site-types by Binford (1980); however, as both of these site-types occur within *forager* and *collector* groups, it is difficult to discern between the systems based on the lithic evidence alone.

Site	**Assemblage Characteristics**			
	Tool Diversity	**Tool Cache**	**Exhausted Tools**	**% Locally Available RM (Quartz)**
Northton	Moderate	Absent	Few	69%
Tràigh an Teampuill	Low*	Absent	Absent	49%
Tràigh na Beirigh 1	Extremely low	Absent	Minimal	94%
Tràigh na Beirigh 2	Extremely low	Absent	Absent	97%
Tràigh na Beirigh 3/4	Extremely low	Absent	Minimal	100%
Tràigh na Beirigh 9	Low	Absent	Minimal	96%
Pabaigh Mòr South	Extremely low	Absent	Absent	92%

Table 46. Characteristics to determine between residential and logistic assemblages (adapted from Ballin 2008:65-66; Binford 1979) *this includes the organic component of the assemblage

On the whole, the data presented in Table 46 overwhelmingly conforms to the defining features of a logistic tool-kit; however, the evidence from Lewis is much stronger for this than the evidence from Harris. At Northton and Tràigh an Teampuill, the characteristics of a specialist task-specific assemblage are less pronounced. The presence of a number of different discarded tool types at Northton suggests there may have been more maintenance-based activities at the site. Furthermore, the presence of organic components at Tràigh an Teampuill raises the diversity of the tool-kit in an aspect that is not evident at any of the other sites. As discussed in Chapter Eight, the antler pressure flaker indirectly attests to the production of microliths, and the bone points may have been used in the manufacture or repair of equipment or clothing. The presence of imported exotic raw materials, both organic and stone also suggests that resources were being brought *to* the sites, to facilitate the activities conducted there. This evidence does not support a residential base-camp interpretation for the Mesolithic sites on Harris, but a palimpsest of recurrent resource-procurement activities taking place over an extended period of time, as would be anticipated in a logistically-organised *field camp*. These economic activities are discussed in a subsequent section to further support this interpretation.

Whilst the typological composition of these assemblages (the first three columns of Table 46), is largely indicative of the organisation of mobility, the raw material composition and reduction strategies at these sites – the final category proposed by Ballin (2008) – is less useful as a method of discerning between residential and logistic systems. As outlined in the preceding chapter, Mesolithic technology in this region is characterised by the use of quartz, which has been sourced locally and reduced on an *ad hoc* basis using simple, migrating platform reduction to produce expedient flakes and irregular cores. The ubiquity of quartz in the landscape of the Western Isles, with sources of this raw material situated close to the Mesolithic sites, suggests that quartz procurement was embedded within other activities that were occurring. The location of these sites are close to critical resources: the sea for fishing and transport, and quartz outcrops for raw material procurement. The logistic assemblage could then be used to quickly process fish, birds, and small mammals, in an immediate-return capacity, for consumption by a specialist task-group, or for further processing and storage to be later returned to a residential home-base.

The cost-benefit of procurement strategies proposed by Ballin appear to be based upon compromises introduced by terrestrial mobility (Ballin 2008:64-65). In terms of group mobility, embedded procurement is an optimal strategy given the propensity for quartz to fracture easily. This results in the continual need to replenish supplies, and is reflected in the expedient use and discard of informal flakes. It has been argued that the high transport costs associated with this would not be conducive to groups with high mobility (Ballin 2008:64; Lindgren 1995:96; Tallavaara *et al.* 2010:2447-2448). Furthermore, the frequent discard of irregularly reduced quartz cores before they were exhausted is an uneconomical and inefficient strategy, which has also been associated with low group mobility (Hertell & Tallavaara 2011:98). However, this profligate treatment of quartz would only become problematic if there were no sources of better-quality raw materials available, and sources of lesser-quality raw materials were restricted. This is not the case for the Western Isles. Furthermore, as discussed previously the use of boats would offset high transport costs, facilitating a wider range of movement (Ames 2002).

The complexities of utilising the proportion of locally available raw material as a proxy for the extent of residential mobility is exemplified by contrasting evidence from northern and southern Norway, and Ireland. In the Later Mesolithic of northern Fennoscandia there is a marked diversification of lithic raw materials, in this instance to locally available vein quartz. A less formal toolkit resulted from the technological changes that were made in order to adapt to the poorer-quality of this raw material. On the whole, this "relaxed constraints on mobility posed by the use of specific localized raw materials", allowing *increased* residential mobility associated with larger foraging ranges (Manninen & Knutsson 2014:95). The diversification in raw material use, and subsequent relaxation of those constraints are also observed in the Later Mesolithic of Ireland. In contrast to northern Fennoscandia however, this facilitated *smaller* group movements, as people no longer relied upon long-distance moves in order to directly obtain flint from sources restricted to the north-east (Costa & Sternke 2009:799). Furthermore, the rise of discrete 'social territories' in south-western Norway, implied by the restricted movement of locally available raw materials and stylistic differences of artefacts, attests to diminishing residential mobility (Bang-Andersen 1996a:439; Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012:32-33; Olsen & Alsaker 1984:97).

On the whole, it is abundantly clear from the evidence presented in both Chapter Eight, and the preceding section of this chapter that the proportion of raw materials within an assemblage is a significant informative factor in establishing the *extent* of hunter-gatherer mobility. The percentage of local raw material is one category utilised by Ballin (2008), in order to differentiate between lithic assemblages indicative of the *organisation* of group mobility. In attempting to fit the quartz evidence from the Western Isles Mesolithic assemblages with this category it is evident that, where a local raw material is ubiquitous, there is no differentiation between its frequency in a residential home-base assemblage, or a logistic task-site assemblage. The evidence from the Western Isles, Ireland, and Norway all demonstrate evidence for adaptively diversifying both raw material procurement and lithic technology, to exploit locally available raw material resources. In some cases, this facilitated lower residential mobility, in other cases residential mobility increased. It is therefore impossible to determine which of these mobility strategies are present from the percentage of local raw material, consequently this is an inappropriate criterion suggested by Ballin (2008:65-66).

This review of the lithic evidence has provided a number of tentative indications that the Mesolithic inhabitants of the Western Isles were logistically organised, adapting their lithic technology to suit the availability of raw materials and procurement of different resources. As such, the lithic industries from these sites display aspects of both immediate- and delayed-return strategies. The following section presents the evidence for subsistence activities from these sites, and others along the western Atlantic seaboard, with the purpose of strengthening this proposal.

9.3.3. Variation and Adaptation in Mesolithic Subsistence Strategies

The inextricable relationship between subsistence, technology and mobility is without doubt. This section takes the evidence for economic activities outlined in Chapter Eight, and aligns it with the subsistence models of *foragers* and *collectors*, *immediate-return* and *delayed-return* to form a more coherent foundation for the proposal that the Mesolithic hunter-gatherers of the Western Isles were logistically organised communities.

In the European Mesolithic, a reduction in residential mobility is directly linked with subsistence and the development of marine relations (Bjerck 2007; Hertell & Tallavaara 2011:108; Newell & Constandse-Westermann 1984). Given the extremely high biomass of coastal regions, it has been suggested that this environment could support near sedentary, or higher density, populations (Ames 1994; Arnold 1996; Hayden 1990; Renouf 1991; Rowley-Conwy 1983; 2004; Simmons 1996:26; Williams 1987; Yesner *et al.* 1980). Equally, ethnographic evidence has demonstrated that a heavy reliance on large terrestrial game results in high residential mobility. Longer occupation in environments where terrestrial resources form the main subsistence base is reflected in the broadening of the number of species exploited, as pressure on the surrounding resource base intensifies (Binford 2001; Kelly 1995).

The absence of any conclusive evidence for any large terrestrial game at the Western Isles sites suggests the latter mode of subsistence is unlikely to begin with. The extraordinary preservation conditions at these sites presents a valuable dataset with which to reconstruct Mesolithic subsistence practices. Moreover, the presence of faunal material at Northton and Tràigh an Teampuill provides a unique insight into the organic assemblage of non-shell midden open-air sites in the Western Isles. Only very recently have comparably preserved faunal assemblages been discovered at non-shell midden open-air sites in the Inner Hebrides. Excavations at Rubha Port an t-Seilich and Storakaig on Islay, and Fiskary Bay on Coll have revealed open-air sites rich in fragmented faunal remains and charred palaeobotanical material similar to those at Northton and Tràigh an Teampuill (Mithen & Wicks 2009; 2010; 2011a; 2011b; 2011c; 2012; 2013; Mithen *et al.* 2007d). These sites demonstrate clear marine-oriented subsistence practices, especially at Fiskary Bay, which has been interpreted as a specialised fish processing site. The broad range of fish species present has been taken to suggest that a fish trap was probably used to target these resources, which is comparable to the proposed fishing strategy at Northton (Blake 2011; Mithen & Wicks 2009; Mithen *et al.* 2007d). The faunal assemblages at Rubha Port an t-Seilich and Storakaig are representative of the exploitation of a broader spectrum of resources. Both marine and terrestrial species are present, which include fish, small terrestrial mammals, wild boar, red and roe deer

(Mithen *et al.* 2007d). Collectively, these five sites represent the only non-shell midden sites with faunal remains in Scotland (Mithen & Wicks 2011b; 2011c; 2012; Wicks *et al.* 2014:407). The faunal assemblages from Northton and Tràigh an Teampuill demonstrate that the Toe Head Peninsula was a prime location for hunting, gathering and fishing over the course of a millennium. These sites were ideally situated to exploit both coastal and terrestrial resources, a short distance in land. The diverse range of resources present at Northton demonstrate definite seasonal evidence for occupation from spring to autumn, although year-round occupation may have been feasible (Table 41). The resources at Tràigh an Teampuill also indicate that occupation of the peninsula was viable throughout the year, however without full analysis of the zooarchaeological and archaeobotanical assemblages this cannot yet be verified. The spread of occupation deposits across a wide area of the peninsula, in combination with the above data may suggest the sites served as a base for repeated seasonal occupation, perhaps as a short-term residential base-camp, or longer-term task-site.

The nature of the Late Mesolithic sites on the Toe Head peninsula appears similar to coastal sites of the Middle and Late Mesolithic in Norway, discussed in Chapter Three. During the Middle Mesolithic, there is evidence for decreasing residential (whole group) mobility to the point where the Later Mesolithic is characterised by semi-sedentary groups living in large coastally-situated residential bases. This low level of residential mobility was supported by a broad-spectrum subsistence strategy based largely on marine resources with, occasional, logistically organised forays into the interior (Bergsvik 2001; Bergsvik & Hufthammer 2009; Bergsvik & Storvik 2012; Gundersen 2009:239; Indrelid 1978:166; Nygaard 1990:233; Renouf 1991:92). This fits with the greater carrying-capacity of a rich coastal biomass in sustaining a denser, more settled population suggested above. This does not imply that Mesolithic people were no longer mobile, but that the wholesale movement of communities is more likely to have taken place *within* the coastal zone, rather than from the coast to the interior (Simmons 1996:26).

As in Norway, the Inner Hebridean sites that are contemporary with the occupation of the Toe Head peninsula clearly attest to the movement of Mesolithic groups around the western coast of the mainland and islands of the Inner Hebrides (Figure 261 and Figure 262). However, it is difficult to ascertain whether this movement made by whole residential groups, or by logistically organised task-groups. This issue is highlighted by the seasonality evidence from the Terminal Mesolithic shell middens on Oronsay, in the Inner Hebrides, which have been the subject of a long-standing debate over the occupation of this small island. One interpretation of the evidence is that each of the middens on the island represent different seasonal residential bases of a single group, occupying the island throughout the year (Finlay *et al.* 2002; Mellars *et al.* 1980; Richards & Mellars 1998). Alternatively, it has been proposed that the middens represent logistic task-sites, occupied sporadically at different times of the year, by groups from a number of communities that were more frequently resident on other larger, neighbouring islands (Bonsall 1997; Mithen 2000e; Mithen & Finlayson 1991; Wickham-Jones 2009d:483). Both scenarios fit with the attributes of a *collector* strategy, yet a dearth of comparatively dated sites from the region has, until recently, prohibited any resolution of the debate. The date of the recently discovered open-air occupation at Storakaig, Islay overlaps with those of the shell middens on Oronsay, and Bayesian modelling of the dates from these sites has begun to resolve a number of issues (Wicks *et al.* 2014). Although tentative, one conclusion based on the Bayesian model is that the formation of the shell middens may have been separated by as much as 200 years. This significantly diminishes the likelihood of a single residential community. Furthermore, the presence of a contemporary group on Islay strengthens the probability that Oronsay was visited on a seasonal basis by mobile hunter-gatherer-fishers, but also poses the possibility of two separate groups (Wicks *et al.* 2014:421).

The radiocarbon dates from the Western Isles shell midden sites attest to a third contemporary group occupying these islands. The shell middens on the Cnip headland and Pabaigh Mòr are open-air, similar to contemporary middens on Oronsay and Risga (Wicks & Mithen 2014; Figure 265 and Figure 266). These site-types conform to a distinctive aspect of Late Mesolithic settlement and subsistence along the Atlantic seaboard. Open-air shell middens are also found along the Scottish east coast, Brittany, and the large Ertebølle middens of Denmark (Andersen 2004; Bailey 1992 ; Coles 1971; Dupont *et al.* 2009; MacKie 1972). These differ to the middens on the Oban coastline and Skye, in Ireland, Norway, and the Asturian shell middens of Spain, which are situated in caves or rockshelters (Anderson 1895; 1898; Bjerck 2007; Clark 2004; Connock 1985; Connock *et al.* 1992; Fano Martínez & González Morales 2004; Hardy 2013; Hardy & Wickham-Jones 2009b; Saville *et al.* 2012b).

The general consensus is that the presence of shell middens along the Atlantic seaboard is primarily a result of local coastal geomorphology, preservation conditions, and the nature of the activities conducted at the sites, which were determined by the availability of resources (Bonsall 1996:17; Hardy 2013). The location of these midden sites was contemporary with the shoreline, situated on the rocky coasts of a network of islands, sea lochs, and skerries that would have provided sheltered conditions for fishing and seafaring, and abundant access to marine resources (Bjerck 2007:6-7; Bonsall 1997:31). Furthermore, the seashore acted as a liminal zone between sea (high tide) and land (low tide), which would have provided an opportunity for the intensive exploitation of different resources dependent on the time of day or night (Pollard 1996:202-203).

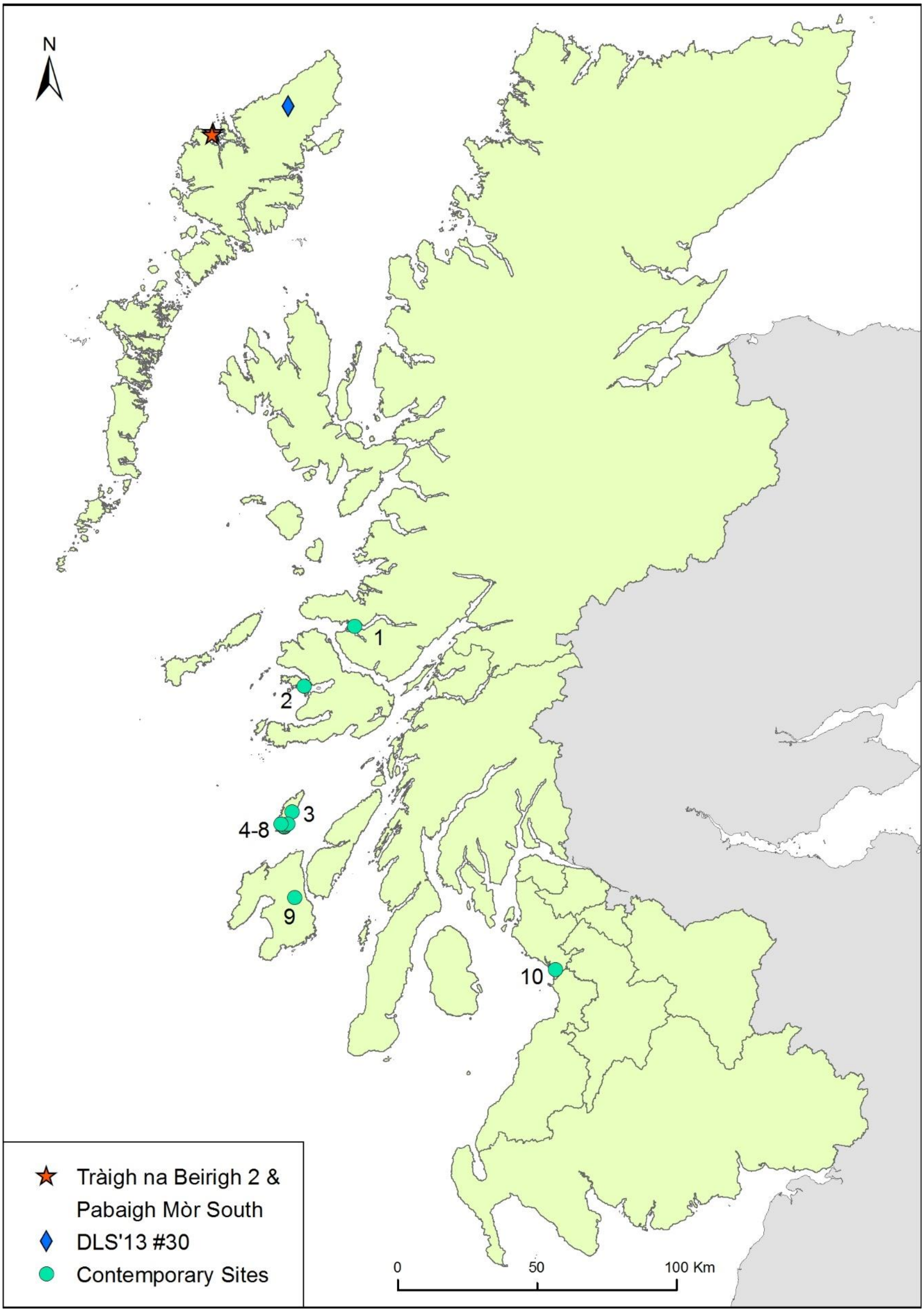

Figure 265. Tràigh na Beirigh 2 and Pabaigh Mòr South (starred) alongside the contemporary palaeoenvironmental site at DLS'13 #30 and Mesolithic sites from the Inner Hebrides and western Scottish mainland. 1. Risga; 2. Ulva Cave; 3. Staosnaig; 4. Caisteal nan Gillean I; 5. Caisteal nan Gillean II; 6. Cnoc Sligeach; 7. Cnoc Coig; 8. Priory Midden; 9. Storakaig; 10. Shewalton. Ordnance Survey data © Crown Copyright/database

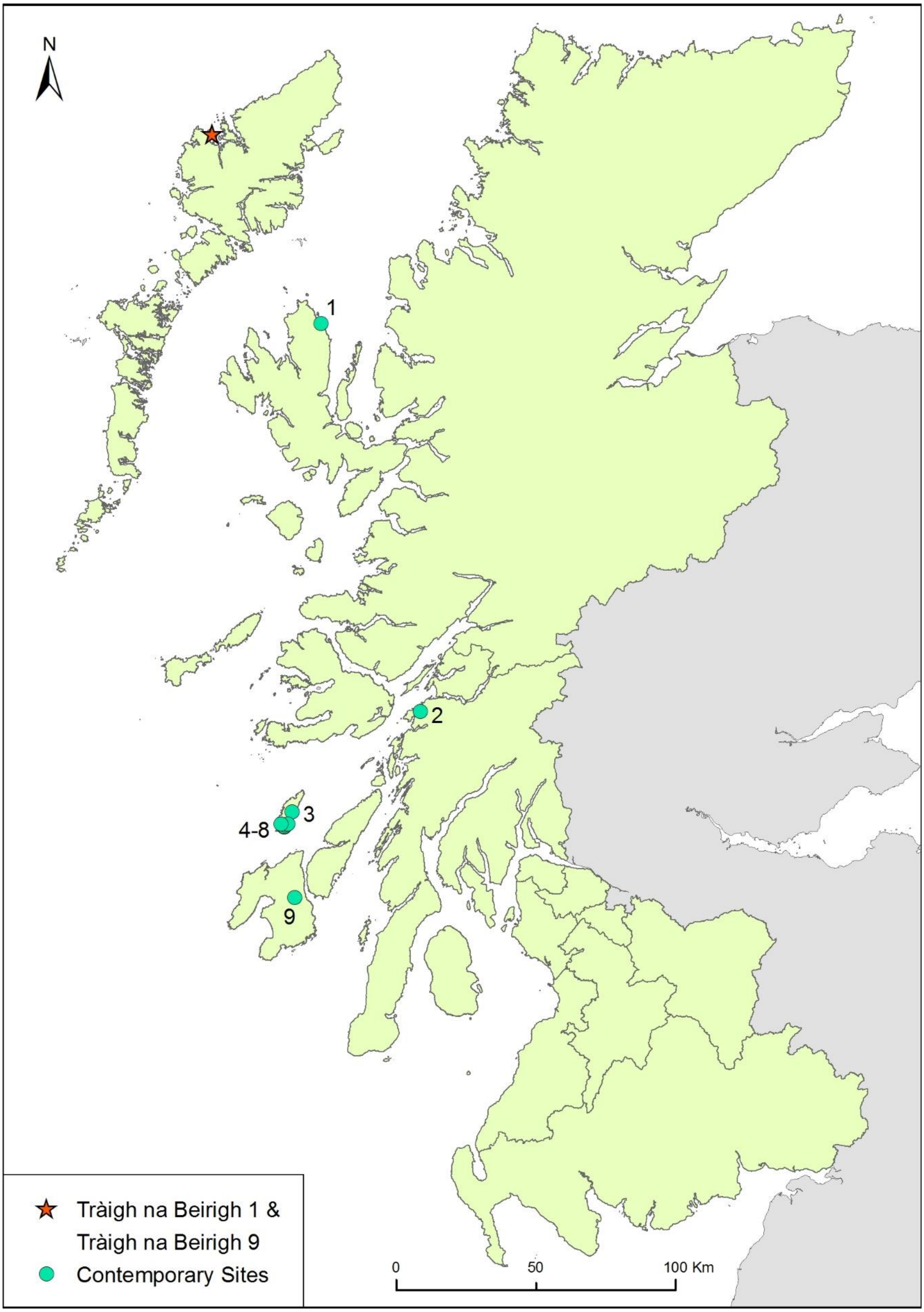

Figure 266. Tràigh na Beirigh 1 and Tràigh na Beirigh 9 (starred) alongside the contemporary Mesolithic sites from the Inner Hebrides and western Scottish mainland. 1. An Corran; 2. Carding Mill Bay; 3. Staosnaig; 4. Caisteal nan Gillean I; 5. Caisteal nan Gillean II; 6. Cnoc Sligeach; 7. Cnoc Coig; 8. Priory Midden; 9. Storakaig. Ordnance Survey data © Crown Copyright/database

The combined otolith data from the Oronsay middens indicated long fishing seasons throughout the summer months, and into the winter (Mellars *et al.* 1980). This contrasts with the middens on the Cnip peninsula of Lewis and Pabaigh Mòr South, where the evidence attests to fishing during the spring, autumn and early winter. There are no seasonal indicators at the middens on Oronsay or Cnip to suggest whether Mesolithic people continued to occupy these areas during the winter offshore migration of young gadids, or whether they moved away to exploit resources elsewhere. There is, so far, limited evidence to suggest that saithe were fished during the summer at Tràigh na Beirigh 1 and Tràigh na Beirigh 2 and Pabaigh Mòr South, in contrast to the sites on Oronsay, which further study may resolve (Morley 2015:38). The summer exploitation of saithe is well documented at Olsteinhelleren, Hardanger, western Norway (Bergsvik & Hufthammer 2009). This rock-shelter site, which contained unusually substantial shell deposits for a Norwegian Mesolithic site, has been interpreted as a field-camp, but one which was occupied over an extended period of time in order to exploit a wider range of species (Bergsvik & Hufthammer 2009).

Similarly, Scottish shell middens are interpreted as special purpose camps for the processing of fish and shellfish, occupied by logistically organised task-groups. These activities occurred on a seasonal basis, often over an extended period of time, which "fulfilled a specific role in the Mesolithic settlement-subsistence system of the region" (Bonsall 1997; 2004:16-19; Finlayson 1990b:203; Pollard 1996; Pollard *et al.* 1996:177; Warren 2000:100). It should also be noted however, that the task-specific nature of shellfish collecting or fish processing at midden sites may have simply been created during a few hours spent collecting resources, as observed during ethnographic study of the Anbarra of northern Arnhem Land in Australia. Discrete episodes of discard within midden deposits represented 'dinnertime camps' of small groups of individuals returning to the same place and consuming shellfish, whilst conducting other activities (Andersen 2004; 2007; Bonsall 1997:30; Meehan 1977; 1982). Discrete layers of ash deposits and lenses of single mollusc species, which were identified at Ulva Cave, are interpreted as "individual deposits of refuse" (Russell *et al.* 1995:278). A similar interpretation may be made for the razor clam 'dump' at Tràigh na Beirigh 1, which indicates this species had been collected specifically, within a short space of time (Evans 2015:69-70). Such activities are examples of immediate-return foraging strategies. Whilst on the surface, this diverges from the overriding argument for a delayed-return, logistically organised system, the specialist task-group must sustain itself in order to conduct the necessary extraction and processing of their designated resources.

Overall, the shell middens from the Bhaltos peninsula and Pabaigh Mòr are largely comparable with contemporary middens of the Inner Hebrides and western Scotland, as well as the broader Atlantic façade – they are collections of "marine shells within a coastal location" (Wickham-Jones 2009d:478). When considered on a micro-scale, however, a high degree of variability is apparent in terms of location, composition, function, formation and duration of occupation. As such, it has been suggested that Mesolithic shell midden sites in Scotland, and Europe as a whole, cannot be interpreted as a homogenous entity, but as a "disparate phenomenon…a varied part of the archaeological record" which require further contextualisation within wider Mesolithic settlement and subsistence practices (Gutiérrez-Zugasti *et al.* 2011; Wickham-Jones 2009d:482).

9.3.3.1. Further Complexities of Mesolithic Subsistence Strategies

From the evidence presented thus far, the marine resource-dominated faunal assemblages and coastal locations of the sites on the Toe Head Peninsula, the Cnip headland, and Pabaigh Mòr certainly attest to a sustained occupation of the littoral zone. When considered alongside the contemporary evidence of the Scottish west coast, the seasonally-based subsistence activities of these sites strongly indicate they functioned as specialised task-camps. This continues to fit with the logistic system first indicated by the lithic evidence. However there is as-yet no definitive evidence for a residential home-base site akin to the Mesolithic house structures of northern England, the Isle of Man, and east Scotland (Brown pers. comm.; Gooder 2007; Robertson *et al.* 2013; Waddington 2015) .

The absence of evidence for a conclusive residential home-base is a similar problem that occurs in the Later Mesolithic of Ireland (Finlay 2003:92). However, this is mitigated by the extensive evidence for delayed-return technology, where there is strong indication that Mesolithic people exhibited "a greater reliance on organic components and fixed equipment" (Finlay 2003:89, 90-92), in the form of fish traps that were described in Chapter Three (McQuade *et al.* 2007; McQuade & O'Donnell 2007; 2009). Although there is strictly no evidence for specialist and complex technology such as traps or nets in the Western Isles, this technology is implicit through the faunal record described in Chapter Eight (Smart 2003). Furthermore, the necessity for boats in facilitating the successful occupation of each of these island locales during the Mesolithic was also discussed in Chapter Three. The investment in time and resources to manufacture and maintain "food-getting technology" (Rowley-Conwy 1983), is substantial for marine adapted hunter-gatherers. Such commitments to fixed facilities implies low group mobility or sedentism, small territories, and rights of ownership – further characteristics of 'delayed-return-logistic', 'collector-complex hunter' economic systems observed throughout this chapter (Binford 1980; Newell & Constandse-Westermann 1984; Rowley-Conwy 1983; Testart 1982; Woodburn 1980; 1982). The investment in fixed facilities and boats hints at a 'complex hunter' system which may include ownership or rights of access to certain resources, both in terms of subsistence and raw materials (Rowley-Conwy 1983).

Delayed-return activities such as the roasting of hazel nuts and drying of fish for storage is also implied throughout the Mesolithic of western Scotland. The faunal remains from Islay and Coll are largely preserved due to charring, which is also a notable feature of the faunal assemblage at Northton. Whilst this may simply be a product of processing for immediate consumption, the evidence from throughout the Mesolithic of Europe attests to the importance of fish as a stored resource, particularly where seasonal fluctuations in resources are most pronounced (Rowley-Conwy & Zvelebil 1989).

Whilst the lack of burnt fish bones from Tràigh an Teampuill suggests this resource may have been processed in another manner to those at Northton, the presence of a scoop or depression at this site may provide potential evidence for the processing of other foodstuffs. The primary fill of the scoop is an ashy-clay deposit, very similar to the description of Later Mesolithic pits found at Suidhe, Argyll, which "…were filled with charcoal, ash and fine white/grey sand with occasional small angular, heat affected stones. One of the pits was lined with ashy clay" (Ellis 2009). One suggestion is that pits were used for roasting hazel nuts. In order to replicate the substantial hazelnut deposits within a pit feature at Staosnaig, experimental roasting of hazel nuts have been conducted in pits that were lined with sand. This was said to aid the recovery of the nuts following roasting. It was concluded that the pit identified at Staosnaig was used for a similar purpose, but as it had been cut straight into the beach deposits, there was no need for a lining (Score & Mithen 2000). In the absence of sand at Tràigh an Teampuill – the site is situated on a rocky platform – this clay-ash deposit may have served a similar function as a lining of the pit for the roasting of hazelnuts (charred shells were recovered from the site), or processing other foods such as fish or shellfish. The scoop was subsequently filled with a dump of periwinkle shells amongst other carbonised material[11]. The numerous pits identified at Mount Sandel have also been taken to suggest that storage and other functions were taking place at the site, as such the site was representative of a home-base (Woodman 1985b).

By drawing together the lithic and subsistence evidence, the Mesolithic of the Western Isles can be classified as both adaptively immediate-return and delayed-return societies, incorporating both simple and complex technology (Layton 2005; Woodburn 1982:449). The expediently produced quartz technology in use during the occupation of these sites accords with the logistically organised exploitation of low to medium-low ranked, but high-return, marine resources present at the sites (Kuhn & Stiner 2001). Across Scotland, specialised shell midden task-sites are characterised by expedient technology in terms of design, manufacture and raw material, where simple flakes were the desired end product that could be used immediately to process large quantities of fish, before being discarded (Bonsall 1997:32; 2004:16; Finlayson 1990b:52; Flenniken 1981; Pollard 1996:203).

The presence of elements of curated technology within the lithic assemblages of the Toe Head peninsula is suggestive of maintenance activities within more generalised task-sites, focussing on less targeted resource procurement than the shell middens. The conservative treatment of flint and

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[11] This cannot be interpreted as a single episode of discard however, as the two radiocarbon dates from this fill are statistically inconsistent.

baked mudstone indicates there is a concerted effort to maximise these high quality raw materials that were expensive to obtain. The abandonment of a small number of microliths at Northton may also indicate an element of ‘gearing-up’ as tools were repaired on-site, before use, to ensure they did not fail when required (Binford 1979:263). If quartz tools *were* being produced at these sites, and the manufacturing debris is all that remains, this may represent a procurement activity by a logistically organised task-group “seeking to procure specific resources in specific context”. This raw material was then reduced at the location to produce flake blanks, in turn lowering transport costs to subsequently return to the group elsewhere (Binford 1980:10, 16; Manninen & Knutsson 2014:95).

Ownership rights and territoriality are difficult traits to identify within such an ephemeral archaeological record. The implied ownership of, or rights to, resources has already been discussed with regards to fixed facilities and food-procuring technology; however, it may also have extended to other resources such as raw materials. Although the extensive distribution of baked mudstone and bloodstone around the Hebridean islands indicates unrestricted access, as for diabase and greenstone in Norway, the prestige that the presence of an exotic raw material symbolises should not be overlooked (Olsen & Alsaker 1984:94; Taffinder 1998). Prestige is a highly influential role within egalitarian hunter-gatherer societies that, since it is an attribute bestowed by others rather than the individual, limits the rise of social stratification (Spikins 2008a; Woodburn 1982).

In sum, it is evident that complexities of distinguishing between the economic systems outlined at the beginning of this section are substantial. Immediate- and delayed-return, *forager* and *collector* systems should not be seen as a dichotomy, but considered as adaptive responses to different group requirements (Binford 1980:12; Layton 2005; Woodburn 1982:449). The different site types on Harris and Lewis are indicative of different activities along the axis of variation in subsistence and settlement, which required a stone tool repertoire for both generalised and specialised economic tasks within a logistically organised system (compare Figure 267 and Figure 268). This accords with localised variation and overarching changes in lithic technology across the Mesolithic of the western Atlantic façade, which is discussed in the following section.

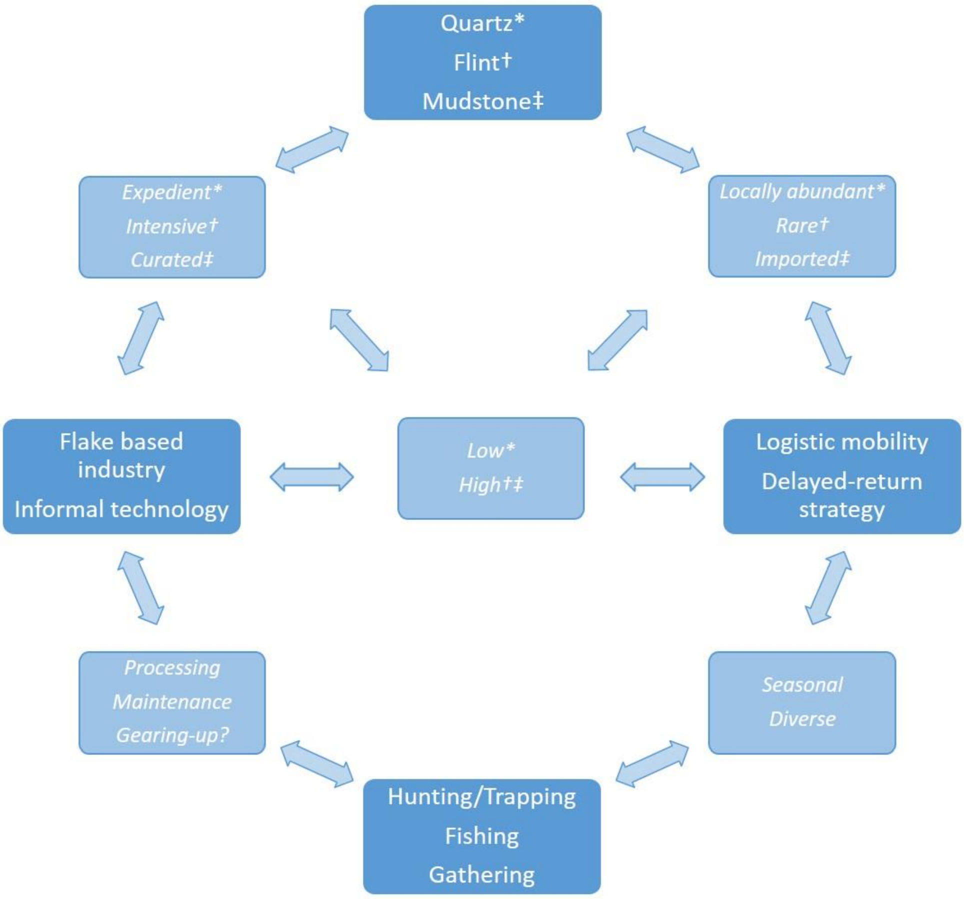

Figure 267. Mesolithic occupation on Harris

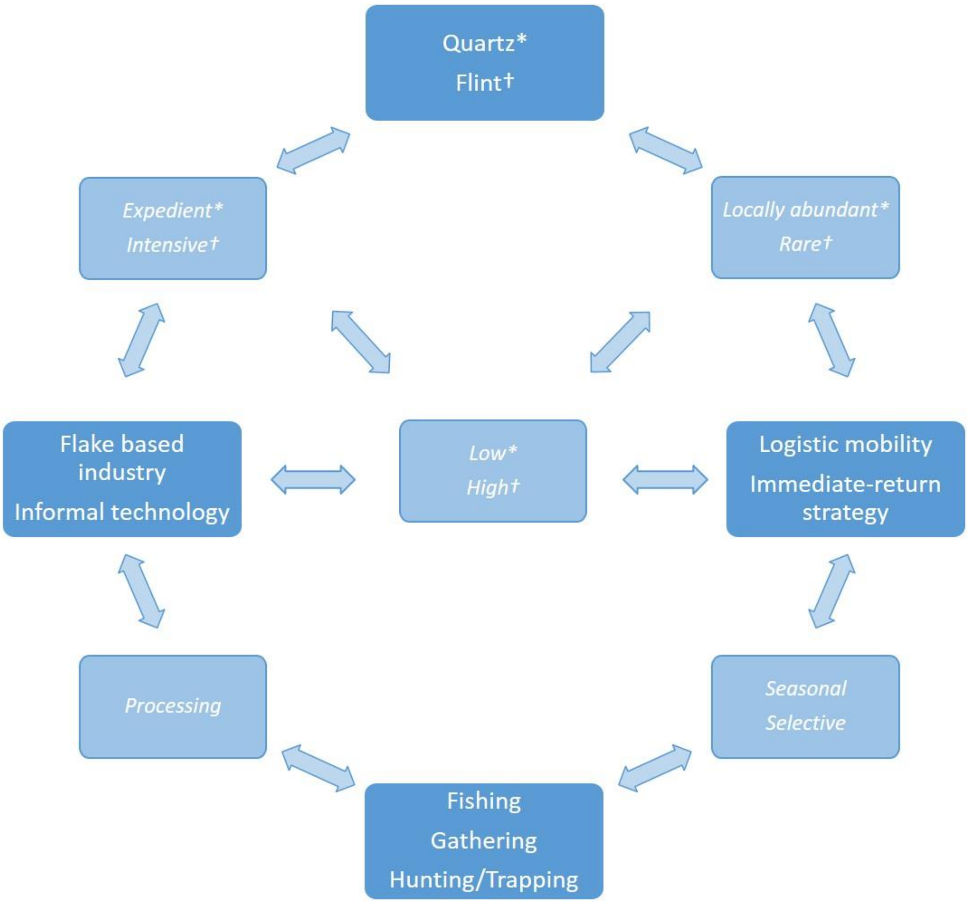

Figure 268. Mesolithic occupation on Lewis

9.4. Change and Continuity Across the Mesolithic of the Atlantic Façade

This final section draws together several notable themes from across the western Atlantic seaboard that have emerged as a result of placing the Western Isles Mesolithic within its wider European Mesolithic context. These trends are all-encompassing, occurring from Norway in the north, to Spain in the south. Primarily, the changes that are observed pertain to raw material use and microlithic technology, which suggest an alteration in subsistence and mobility may be underlying factors. Conversely, continuity across this vast region appears to be related to less tangible aspects of identity and material culture; shell midden construction and their use in funerary tradition is one example which endures into the Neolithic, the aesthetic qualities of quartz is another. The use of modified shell in both mundane and funerary contexts attests to other aspects of material culture that may only be speculated upon.

9.4.1. Raw Materials

The first trend has already been noted in the previous chapter - that the *Later Mesolithic assemblages in the Western Isles are dominated by locally available raw materials*. This is consistent with raw material exploitation patterns in the Later Mesolithic across the Atlantic seaboard in non-flint bearing regions. Small-scale import of non-local raw materials is also a consistent occurrence. This differs significantly from the Early Mesolithic in these regions; therefore in order to contextualise the significance of the changes in raw material choice, it is important to consider the relationship between hunter-gatherer communities and the multitude of associated factors influencing raw material use.

As discussed above, importing raw materials such as flint between sites during the Early Mesolithic was likely to have been a mitigation strategy against the risks of resource acquisition in an unfamiliar environment for colonising groups. During the Later Mesolithic, there is a clear increase in the use of more locally available and diverse range of raw materials, "of generally inferior mechanical properties" (Myers 1989:84). This occurs independently across the Atlantic seaboard in Britain, Ireland, Norway, Spain, and France (Arias *et al.* 2009; Bang-Andersen 1996b; Costa & Marchand 2006; Fuglestvedt 2012; Marchand & Tsobgou Ahoupe 2009; Myers 1989; Nygaard 1990). Myers (1989) criticises the lack of attempts to explain this, stating that it is unlikely that reasons such as the difficulty of obtaining high quality raw materials like flint, due to the rising sea levels, could explain changes throughout the whole of Britain, for example.

The changes in raw material use during this period are evident at the earliest stage – procurement. Where a non-local raw material is imported to sites during the Later Mesolithic, it appears as a pre-formed blank, resulting in significantly less primary knapping debris at the site. This is linked to lower residential group mobility, with smaller 'task' groups procuring material from 'workshop sites' (Andrefsky 1994; Binford 1980:5; Torrence 1989b). The use of local raw materials is therefore associated with the reduction in the size of territories in Later Mesolithic France, Norway, and Ireland (Costa & Marchand 2006; Glørstad 2013:72; Warren 2015a:53). Consequentially, social networks that existed between groups may be affected by reduced group mobility. The significantly lower frequency of 'exotic' raw materials, irrespective of their quality, may indicate that locally available resources were occasionally of equal or better quality, or that lesser-quality material was so abundant this offset the risk of failure (Andrefsky 1994:28-29; Manninen & Knutsson 2014:95). Furthermore, it may be that the tasks conducted at particular sites did not warrant the use of formal tools made from high-quality raw materials, when expedient quartz flakes would suffice, thus imported material could be curated for other purposes. On the whole, once communities were familiar with their surroundings by diversifying raw material use to include locally available resources, there was no longer the need for costly long-distance 'insurance' contacts with other groups (Manninen & Knutsson 2014:95). This is consistent with attributes of the 'undifferentiated network system due to distance' proposed by Madden (1983:196) for the Middle Mesolithic of Norway.

A further aspect of the diversification of raw materials and change in procurement strategies are the direct changes in technology, typology, and stylistic output of artefacts as reduction strategies were modified to fit the available raw material. This is most pronounced in the abandonment of microlithic technology in the Later Mesolithic of Ireland (Costa & Sternke 2009). This change is attributed to both the "weakening" of social relationships with Britain and the exchange networks that supplied flint, which then combined with the change in technological tradition, to have a direct effect of "raw material constraints" (Costa & Sternke 2009; Woodman 2009a:210). Thus,

> "accept[ing] increased technical difficulties associated with the use of non-flint raw materials… [people] chose an increased flexibility of lithic production and a de-specialisation of their toolkits to achieve a significant reduction of social time and energy costs associated with the maintenance of an exchange network that would secure access to high quality raw material" (Costa & Sternke 2009:799).

Overall, the diversification of local raw material use in the Later Mesolithic can be interpreted as an opportunistic and adaptive strategy (Ballin 2009:27; Manninen & Knutsson 2014:94; Saville 1994). The evidence demonstrates how social, functional and economic factors relating to the independent increase in the use of local raw material in newly colonised, non-flint environments along the Atlantic seaboard are intrinsically linked. This has a significant effect on technological organisation. Below, the diminishing use of microliths in the region is considered as a parallel trend, further supporting the demonstrable link between the uptake in use of local raw materials, alongside decreasing residential group mobility, and a rise of logistically organised settlement systems.

9.4.2. Moving Away from Microliths - An Island Adaptation?

The lack of microliths within the Western Isles Mesolithic assemblages was discussed in the previous chapter from a purely functional perspective. This section considers the conspicuous absence of microlithic technology further, as part of an overarching trend in north-east Europe, where social factors may have been just as significant as raw material availability/suitability and subsistence strategies.

It is possible that the scarcity of traditional Mesolithic blade and microlith technology in the Western Isles indicates the development of an independent lithic style or tradition, as in Ireland and the Isle of Man discussed in Chapter Three. The undiagnostic flake technology, and small number of blades, recovered from the early excavations at Northton was interpreted as potentially "representative of a Mesolithic chipped stone assemblage in, at least, this area of the Western Isles" (Gregory & Simpson 2006:79). The combination of adaptations to a more diverse raw material base, and low risk trapping/fishing that were already taking place at Northton, may have initiated a sequence of operational change which led to the eventual abandonment of microlithic technology. The Mesolithic archaeological record from the Western Isles appears no different to the rest of Scotland, except for the fact both large terrestrial game and microlithic technology is largely absent in these islands. This suggests subsistence and microlith use are closely connected, as indicated by the transition from microlithic to macrolithic technology in Ireland.

The factors influencing this change may have been exacerbated by the lack of flint in the region, as discussed in the previous chapter. To reiterate, flint microliths are only present at Northton, the earliest known site in the Western Isles. It is possible that these tools were brought to the site with the first inhabitants of Northton from their place of origin; however another scenario may be presented. The earliest inhabitants of Northton may have arrived without microliths, yet a local source of flint was available to produce these tools. Both suggestions are indicative of the fact that wherever the first settlers of the Western Isles came from, most likely the Inner Hebrides, they brought with them the microlithic tradition of their homeland. If local sources of flint became depleted over time, and the quality of raw materials that replaced it (i.e. quartz) were not conducive to microlith production, this indicates an adaptation of the technology to suit the available raw material (Manninen & Knutsson 2014). A similar situation may have been caused by a change in mobility, or access rights, by the Terminal Mesolithic, as such the occupants of the sites on Lewis were unable to procure enough material for the manufacture of these tools. This seems unlikely however as, although of negligible quantities, flint is still present in the assemblages at most of the Tràigh na Beirigh sites and Pabaigh Mòr South.

As has been repeated throughout this discussion, it is clear that the communities inhabiting the Western Isles were part of a mobile population with access to raw material resources in the Inner

Hebrides. Such mobility may have provided a social impetus for these inhabitants to differentiate themselves from other groups *because of contact*, which was manifested through technological change and, gradually, the abandonment of microlithic technology (Bergsvik & Olsen 2003:401; Garrow & Sturt 2011:66; McCartan 2004:280). This is an extension of the 'differentiated network system due to distance' discussed in the preceding section, whereby regional stylistic differences emerge from the proximity of neighbouring groups, local environment, and available resources in terms of both subsistence and raw materials (Madden 1983:198). The presence of an unfinished quartz oblique point at Tràigh na Beirigh 9 is the first evidence for a microlith in the Western Isles for over 2000 years, which attests to continued contact with microlith-producing groups elsewhere. It is impossible to ascertain whether this artefact may have been imported from the Inner Hebrides by inhabitants or visitors, given the homogeneity of quartz; or whether it may represent an attempt to reinstate such technology if, indeed, microlith technology had been abandoned.

In fact, proposals concerning the loss of microlithic technology during the later Mesolithic of western mainland Scotland and the Inner Hebrides have been made since the turn of the millennium; however, they are frequently buried within 'big picture' discussions, and almost as a passing aside. A "…trend through time towards bipolar and flake based reduction, and evidence is growing for a lack of microliths on some sites during the later part of the period" in Scotland was raised in a review of the Scottish Mesolithic in 2002 (Finlay *et al.* 2002:108). When discussing the lithic assemblage from Camas Daraich, Wickham-Jones noted that "parts of the Mesolithic, especially perhaps the later Mesolithic, may not have used microlithic tools", but did not expand further (Wickham-Jones 2004a:36). Deep within the Scotland's First Settlers sites report, alongside a description of the fieldwalking activities around An Corran Hardy and Wickham-Jones write:

> "One of the characteristics of Mesolithic sites around the Inner Sound, indeed further afield on the west coast of Scotland, is that when radiocarbon determinations are obtained they tend to come out early in the Scottish Mesolithic. There are very few later Mesolithic dates from this area, and one is forced to consider why. It is unlikely that the area became depopulated in the latter half of the Mesolithic and it may be that the archaeological record has been biased by the use of microliths to identify 'Mesolithic' sites. The possibility of a non-microlithic period towards the end of the Mesolithic has been raised on several occasions (for example Wickham-Jones 2004b; Woodman 1989). Late dates exist for microlithic sites in east Scotland (for example Warren forthcoming), but as yet they are rare in the west. Is it possible, therefore, that the Later Mesolithic of the Inner Sound area made much less use of microliths? If this were so, the main element by which we usually recognise Mesolithic sites would be removed." (Hardy & Wickham-Jones 2009a:95-96).

The conspicuous absence of microliths at Cnoc Coig can no longer be attributed to the 'Obanian' tradition, but may in fact relate to a decline in microlith use from the 6th millennium, despite the continuation of narrow blade technology (Pirie *et al.* 2006). Notably, the lack of diagnostic tools has also been described as a feature of Scottish west coast Neolithic (Pirie forthcoming). With the exception of Northton, the fortuitous preservation of organic remains is the only evidence that the sites from the Western Isles represent Mesolithic activity. In the absence of microliths, the type-facies of the Mesolithic, the contextual evidence in terms of dating and faunal remains are critically important – without such these assemblages would remain undiagnostic and unrecognised. If Hardy and Wickham-Jones are correct, this has significant implications for identifying Mesolithic sites throughout the region and "may, for instance, suggest that many of the undiagnostic lithic scatters recovered from the area represent the very evidence that has eluded the recognition of Mesolithic activity in this region for so long" (Gregory *et al.* 2005:954). As archaeologists, we may have to seriously consider revising what constitutes 'characteristic' Mesolithic material in western Scotland. Microliths can no longer "be used as a broadscale marker across the whole chronological, and perhaps even geographical, sweep of the Mesolithic" (Wickham-Jones 2009a:157).

It appears there is a close correlation between the trends described above. The diminishing use of flint across the extreme north-west of Atlantic Europe is observed alongside a change in technology away from microlith production around the 6th-7th millennium cal. BC. It is notable that this contrasts to continental Europe where microlith technology endures; however, changes in microlith forms, such as the appearance of trapeze microliths, have been attributed to "a broader suite of technological shifts that coincided with wider social change" *at the same time* (Anderson-Whymark *et al.* 2015:968; Warren 2015a).

The coincidence of these broad-scale changes in technology and raw material acquisition suggests that there is an overriding causal factor that occurs during the 7th millennium cal. BC. As noted above, this had a significant impact on large-scale social change that occurred across Europe. It is during this millennium that the Later Mesolithic begins in Norway and Ireland. In both regions the uptake of local raw materials is observed; delayed-return subsistence becomes notable in Norway, and there is an abandonment of microlithic technology in Ireland. All of these characteristics seem to combine in Western Scotland, as ascertained throughout this discussion. Crucially, it is also the millennium in which a number of catastrophic events occurred, including the collapse of the Laurentide ice sheet and the Storegga-slide tsunami, which caused devastating flooding and sea-level rise across the North Atlantic, in addition to the 8.2ka BP (c.6200 cal. BC) cold event. The Storegga-slide tsunami is argued to have caused the final inundation of Doggerland in the North Sea basin (Weninger *et al.* 2008:16-17). This event consequently sealed the physical and cultural separation of Britain from the continent. The latter departure is manifest in the absence of trapeze microlith forms in Britain which, as described above, develop throughout continental Europe during this period (Ballin in press; Jacobi 1976).

The impact of this event across Mesolithic Atlantic Europe cannot be over-emphasised, given the extreme maritime adaptations of the Mesolithic communities inhabiting these regions. Below, the effects on major elements of settlement and subsistence are summarised in order to present a viable *rasion d'etre* for the pan-European uptake in local raw materials, and the abandonment of microlithic technology in the far north-west. This is also linked to the end of the seeming unusually long-lived immediate-return subsistence in coastal south-west Norway.

Understandably, the most pronounced effect of the rising sea levels and flooding event would have been felt along the coast. As has been established throughout this thesis, beach pebble flint was a staple raw material during the Mesolithic of Norway, Scotland, and Ireland, and procurement of beach flint was likely to have been embedded within general subsistence activities during the Early Mesolithic. If the 'insurance' hypothesis stands, high mobility would have ensured a plentiful supply for inland groups or island colonists from coastally-based contacts. The scouring of the coast caused by the advance and retreat of waves during this event would have instigated extensive coastal erosion and drowned beach deposits (Weninger *et al.* 2008). This may have seriously compromised the availability of beach flint and disrupted the supply of such, as well-known sources were lost under the encroaching sea. As a result, communities may have had to resort to using more immediately available raw materials that outcropped nearby.

The supply-chain for raw material procurement would also have been catastrophically affected. The Storegga-slide tsunami would have destroyed coastal homes and their resident families – possibly even whole community groups (Weninger *et al.* 2008:16). Small hunter-gatherer societies, particularly island inhabitants, are highly vulnerable to demographic collapse (Riede *et al.* 2009; Wicks & Mithen 2014). Not only would this impact on population densities as a whole, but these communities are "dependent upon extensive alliance networks for the flows of people, information and material items…should one part of the network be de-stabilised the effects might reverberate over an extensive area" (Wicks & Mithen 2014:254).

The short-term effects of population fluctuations "can precipitate archaeologically as regional depopulation, site abandonment or the change or disappearance of particular tool making traditions" (Riede *et al.* 2009:178). Evidence for the former has been proposed by Wicks & Mithen (2014), whereby a palaeodemographic model based on radiocarbon dates indicates a shift in settlement towards the Inner Hebrides in the wake of the 8.2ka BP event. This should be treated with caution however, as the data is heavily skewed by sites with high numbers of dates. It may be that the abandonment of microlithic technology in the north-west of Europe is evidence for the latter. The severance of connections with microlith-using and flint-supplying communities due to such an event, or the weakening of these relationships as colonising communities became more established, may have led to increasing regionalisation as technological change occurred in order to adapt to different raw materials, as proposed for Ireland (Costa *et al.* 2005; Woodman 2009a).

The effects on subsistence and the food resources of coastal communities must also be considered. Flooding of coastlines, and the influx of saltwater into fresh water environments, would have severely imbalanced local ecosystems for significant distances inland following extensive tidal run-up. Not only would this have affected coastal resources such as shell beds, migration and breeding patterns of fish and marine mammals, but the incursion of saltwater would have also destroyed terrestrial ecological systems (Losey 2005; Weninger *et al.* 2008:16; Wicks & Mithen 2014). Food shortages must have been a stark reality, with a risk of starvation, as stored food caches may have also been destroyed (Spikins 2008b:6-7). Given the higher carrying-capacity of coastal environments, the resultant population displacement would have caused significant pressures on inland resources, as communities shifted in reaction to the encroaching sea (Coles 1999:54; Newell & Constandse-Westermann 1984). The concentration in population may have limited the extent of group mobility, and competition over resources has been interpreted as the reason for evidence of interpersonal violence in Mesolithic burials on the Continent. This may have precipitated the establishment of territories and implicit changes toward more a stratified society as a consequence (Spikins 2008a).

It does not appear that Ireland was directly affected by the Storegga-slide tsunami, however (Hall *et al.* 2010). In terms of subsistence, aspects of delayed-return strategies developed very quickly – most likely as an adaptive response to the absence of large terrestrial game, as discussed in Chapter Three. It is only the changes in raw material procurement and technology that are observed, which may be an indirect result of changes in population dynamics caused by this event, and which are not archaeologically visible. By contrast, the effects of this event would have been profound in Norway. As discussed in Chapter Three, during the Early Mesolithic it appears that the inhabitants of Norway subsisted on a forager/immediate-return basis, with a gradual transition during the Middle Mesolithic to a less residentially mobile subsistence strategy. This may have been precipitated by an earlier cooling event within the North Atlantic c. 9.2ka BP, which coincides with the beginning of the Middle Mesolithic Chronozone (Bjerck 2008b; Fleitmann *et al.* 2008; Wicks & Mithen 2014). The climatic changes that took place during this period, and the consequences described above, may be correlated with a shift in settlement patterns to occupy the inner coastal zone. Moreover, this may have accelerated the establishment of a near-sedentary and fully delayed-return subsistence strategy by the Late Mesolithic.

It would appear that the responses of Mesolithic groups in Scotland paralleled those of its Atlantic neighbours. In the outer islands, aspects of delayed-return are already present during the earliest evidence of occupation, which indicates a similar economic adaptation to Ireland. Furthermore, along north-western European seaboard, raw material supplies are affected in a manner that leads to the uptake of locally available raw materials, which are distributed on a regional basis. The abandonment of microlithic technology in Ireland and some areas of Scotland in the Later Mesolithic appears intrinsically connected to this, as an adaptation to local resources both in terms of raw material procurement and subsistence. Whilst true microlithic technology did not develop in south-west Norway, the distinctive regional styles described in Chapter Three are representative of a similar response. On the whole, whilst the changes in raw material procurement and technology cannot be attributed to a single environmental event, it is likely that the adverse climatic conditions of the seventh millennium cal. BC, and the challenges these posed to Mesolithic communities, were a catalyst for the adaptations that were already occurring in relation to subsistence based on local environment and ecology (Woodman 2009a:210). Furthermore, these changes must have had a significant impact on society and identity. Whilst these elements are difficult to trace in the archaeological record, some inferences may be drawn from a number of contexts and are discussed in the section below.

9.4.3. Identity and Material Culture

This final section considers less tangible evidence for connections that span the Atlantic façade. Ideas and identity may be represented through shell midden construction and their use for the deposition of human remains, the latter a practice that bridges the Mesolithic-Neolithic transition. The modification of shells for use as beads, and other purposes, is another similarity that has origins in the Palaeolithic. Finally, an acknowledgement of the non-utilitarian function of raw material acquisition is made.

9.4.3.1. Shell Middens as Monuments and Funerary Places

One aspect of shell midden formation that has been recently highlighted is the deliberate construction of these deposits to function as focal points in the landscape, rather than “simply by products of repeated activity and waste discard at particular places in the landscape” (Bailey *et al.* 2013:4). The open air shell middens on Oronsay and Risga are the only kind of “upstanding monuments” from this time period (Figure 269; Wickham-Jones 2009d:479). Maritime communities that inhabit coastal areas, and continually move around using the sea, are intimately knowledgeable of both their land-scape and their sea-scape. This comes from generations of “local knowledge and lived experience that lie at the heart of the way in which people socialize seascapes. Part of this process of socialization is the recognition and marking of the land and sea in ways that may leave material traces” (Cooney 2004:324); which occurs in both functional and spiritual spheres (Bailey & Milner 2002:6; Robinson 2013). Ethnographically known midden-producing cultures, such as the Maori, have a tradition of using distinctive terrestrial landscape features that could be observed from the sea as landmarks to define boundaries for fishing grounds (Barber 2004). The flocks of scavenging seabirds such as skuas, gulls, fulmars and gannets surrounding fishing trawlers is a common sight at sea and in modern fishing ports (Mitchell *et al.* 2004). This may have been something which occurred during the Mesolithic. Accumulations of shell refuse, fish offal, and other animal remains may have attracted seabirds and other scavenging animals to the site, making it a very visible and audible point along the coast. Colonies of cormorants have been observed nesting on an archaeological shell midden at Daisy Cave, San Miguel Island, California, and gulls have been seen to occupy a prehistoric shell midden in the San Juan Islands, USA (Erlandson & Moss 2001:419-420). Whilst this contributes a note of caution regarding the inter-mixing of natural and cultural deposits at these middens, it also demonstrates how seabirds may have been drawn to these sites to scavenge carrion.

The shell middens on the Cnip headland could have easily been observed from the sea and may have functioned as an important point in the landscape, especially when considering their prominent position on the cliff-top. In a study of Neolithic chambered cairns on Orkney, Woodman (2000) noted that the prominent coastal positioning of the monuments ensured they predominantly overlooked the sea, and that "the view out from them was more important than the view of them *from the land*" (Warren 2007:313); as such the cairns and middens were more visible *from the sea* – a landward perspective (Phillips 2004). Some are strategically placed, marking entrances to wide bays and narrow channels, which would be crucial as navigational aids, and also perhaps represent boundaries. Land is never out of sight around the island-scape of Orkney, therefore the strategic location of the cairns may have formed crucial navigational aids in the strong currents and skerries around the islands (Phillips 2004). During the Mesolithic the white, sun-bleached shell middens along the Cnip headland (Figure 270) may have therefore served, in conjunction with "the sky, the sea, the seabed, [as] seamarks and landmarks [to] articulate navigation, pilotage and safe arrival in port" (Parker 2001), which has been suggested for the Oronsay middens (Mellars 2004:181).

Many of these locations appear to have already been prominent sites for hunter-gatherers prior to the build-up of midden deposits. Evidence from the buried ground surface beneath the main midden deposits suggests that these sites were important locales for the initial inhabitants of the area. At Tràigh na Beirigh 1, the presence of post-holes indicates structural evidence of some nature and at Tràigh na Beirigh 2, lithic debris and faunal remains were recovered from the sand layer beneath the midden. Unfortunately, due to lack of dates from the buried ground surfaces at these sites, it is difficult to interpret the chronological significance of this. However, it is certain that material was incorporated into the ground surface before midden material began accumulating, and is indicative of earlier occupation. The use of sites prior to midden deposition is also seen at West Voe, Shetland; in Ireland at Glendhu, Dalkey Island, and Sutton, as well as in the Danish Ertebølle (Andersen 2004:394; Melton & Nicholson 2007; Milner & Woodman 2007:109; Warren 2007; Woodman 1985a:40).

The continuity in use of these sites is also evident after the main period of midden accumulation. Many of the shell middens along the Atlantic seaboard show evidence for continued use into the Neolithic, whilst frequently "containing a material culture more reminiscent of a hunter-gatherer lifestyle" (Andersen 2004:408; Bjerck 2007; Meiklejohn & Woodman 2012; Melton 2009; Melton & Nicholson 2007; Wickham-Jones 2007:88; 2009d). The evidence for the use of shell middens over several millennia does not support the notion that the 'Obanian' shell middens were a distinct cultural or chronological entity, or that shellfish were consumed as a famine food (Bonsall 1997:36; 2004:14; Wickham-Jones 2009d:481, contra. Mellars 2004:2173-2174). There is a strong likelihood that some of the burials were later insertions into the middens, possibly from the earliest Neolithic in the region (Wicks *et al.* 2014:421), which also occurs in the Western Isles.

Figure 269. Caisteal Nan Gillean I, Oronsay from the north-west © RCAHMS (1980). The sea level would have been c.6m higher during the Mesolithic, thus the shell middens, now inland, would have been situated along the shoreline (Jardine 1987). The shell midden itself also stood a much taller, conical mound in a photograph taken prior to the excavations carried out by William Galloway and Symington Grieve in 1881

Figure 270. Excavation in progress atop the Gridig promontory at Tràigh na Beirigh 1. Situated at the edge of what would have been a cliff-face during the Mesolithic, when the sea level would have been a minimum of two metres lower and the machair formations above would not have existed, this would have formed a focal point along the coastline. Photo courtesy of Mike Church

As discussed in Chapter Eight, the individual buried within the midden deposits at Tràigh na Beirigh 9 closely post-dates the traditional date for the Mesolithic-Neolithic transition. The individual appears to have been laid on its left side, oriented NE-SW, and no grave goods were observed in association with the burial. The age and sex is as yet unknown, although the roots of the teeth are fully formed, and the cusps of the pre-molars are heavily worn, suggesting the individual is an adult (White *et al.* 2012:387-389). The isotope data regarding the diet of the individual is the most relevant aspect concerning the lithic evidence. The isotope results are directly comparable with those from Cnoc Coig and Caisteal nan Gillean II, Oronsay which are of a similar age, or slightly earlier than, Tràigh na Beirigh 9 (Figure 271). The isotope signature of the individuals from Cnoc Coig indicates that their diet was almost exclusively derived from marine resources, and the trophic level indicates that shellfish, fish and sea mammals were likely to have been consumed (Schulting & Richards 2002:159). The isotope values from the Tràigh na Beirigh 9 individual are closer to the one sampled from Caisteal nan Gillean II. This individual is determined to have consumed a mixed terrestrial-marine diet, and the high δ15N value indicates that the marine component of the diet was from a high trophic level, such as marine mammals (Schulting & Richards 2002:159). Given that the δ15N value for the Tràigh na Beirigh 9 individual is higher than that of the one from Caisteal nan Gillean II, it can be reasonably inferred this is representative of a similar diet. The -14.0 $\delta^{13}C$ value for individual from Ferriter's Cove, Ireland, indicates a similarly high level of marine resource consumption as those from Cnoc Coig; the radiocarbon dates also overlap. This is significant as the human remains were recovered in association with domesticated cattle bones, and directly "overlap with the date obtained from cattle bone on the site…thus showing *prima facie* evidence for behavioural overlap between late Mesolithic foraging and early Neolithic style cattle herding prior to 4000 cal. BC" (Meiklejohn & Woodman 2012:28). Although this does not necessarily attest to farming on Ireland – it may simply have been an imported joint of meat – it does provide evidence for connections between hunter-gatherers on Ireland and farming communities elsewhere. Despite this contact, hunting and gathering continued in Ireland for several hundred years longer (Whittle 2007). The earliest Neolithic-dated site containing pottery and domesticated plant remains in the Western Isles is at Eilean Domhnuill, North Uist (3792-3361 cal. BC[12]), which may overlap with the date from the Tràigh na Beirigh 9 individual, once the date has been calibrated with an appropriate marine correction factor. It is notable that continuity of foraging practices between the Mesolithic and Neolithic of western Scotland has also come to light in the archaeobotanical record (Bishop *et al.* 2009). The similarity in Neolithic and Mesolithic lithic assemblages, in terms of the lack of formally diagnostic tools, has also been noted (Ballin 2009:44; Pirie forthcoming). The endurance of Mesolithic hunter-fisher-gatherer subsistence practices in the Western Isles, beyond the traditional date for the Neolithic, is therefore highly plausible.

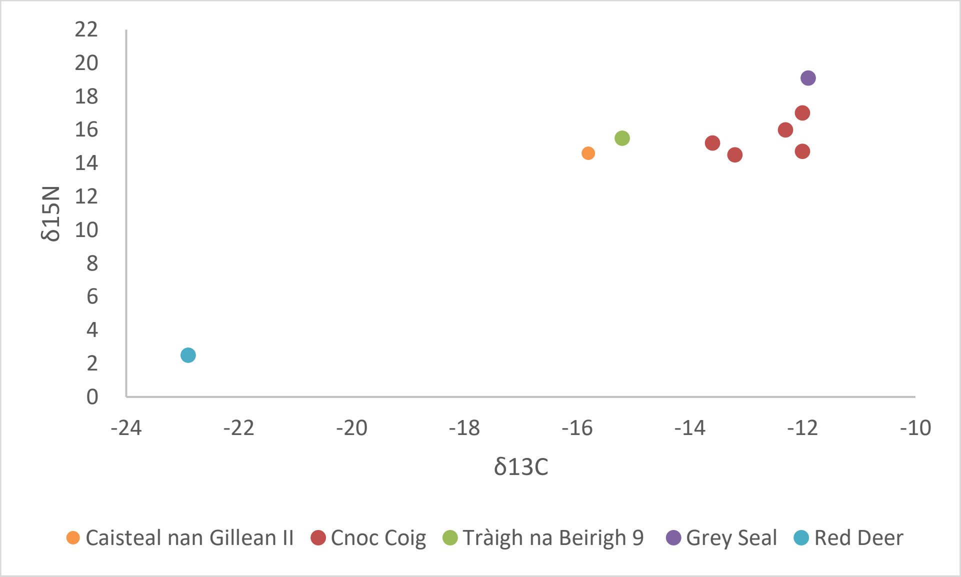

Figure 271. Isotope values from Tràigh na Beirigh 9, compared with those from Oronsay and terrestrial and marine fauna for reference (after Schulting & Richards 2002)

A further aspect pertaining to the human remains at this site is the uniqueness of the burial, which differs from the Mesolithic treatment of the dead in western Scotland, but can be contextualised within the wider Mesolithic Atlantic diaspora. There are no articulated human remains known from Mesolithic sites in Scotland or Ireland, which contrasts to the evidence from the continent. In France, multiple Mesolithic inhumations have been recovered from the Mesolithic open-air shell middens at Téviec and Hoëdic, Morbihan which date to 5640-5220 cal. BC and 6040-4440 cal. BC respectively (Gray Jones 2011:70; Meiklejohn *et al.* 2010). Elaborate graves of the Ertebølle cemeteries at Vedbæk and Skateholm in Denmark also demonstrate deliberate inhumation of the dead

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[12] Date range for the earliest phase of occupation.

(Albrethsen & Brinch Petersen 1977; Larsson 1988). Middle Mesolithic burials in Norway also fit with this pattern. Several female individuals were interred over an extended period of time (7490-6527 cal. BC) at Søgne, Vest-Agder; a single female was buried in Bleivik, Rogaland; several individuals have been recovered at Grønehelleren on the island of Ytre Sule, Sogn og Fjordane; and an adolescent was buried in Svarthola cave, in Viste, Jæren (Bjerck 2008b:97; Sellevold & Skar 1999). Cave sites were also frequently used for the Mesolithic burial of individuals in Cantabrian Spain (Meiklejohn 2009).

The presence of the single human finger bone at Northton is more consistent with the Scottish Mesolithic tradition of the interment of particular disarticulated skeletal elements, although this is also well known across Mesolithic Europe. Remains occur in three key locations: midden deposits, open sites, and caves/rockshelters. The middens of Cnoc Coig, Caisteal nan Gillean II and Priory Midden on Oronsay contained a total of 55 fragments of disarticulated human skeletal remains. These primarily included hand and foot bones, however teeth, cranial fragments, and post-cranial elements of adults and an adolescent/young adult were also present (Meiklejohn & Denston 1987). The Cnoc Coig assemblage is interpreted as the remains of individuals from a place of excarnation (Gray Jones 2011:172). In Ireland, the fragment of human femur was recovered from a midden at Rockmarshall I, Louth, which was noted by the excavator to be similar in nature to the Scottish middens (Meiklejohn & Denston 1987:31; Mitchell 1947). There are also disarticulated human remains recovered from middens in France (Beg-er-Vil, Morbihan), and Cantabrian Spain/Basque Country (Poza L'Egua, Gipuzkoa); however, these are less common locations than cave/rockshelter sites or open sites for the interment of human remains (Meiklejohn 2009; Meiklejohn *et al.* 2010). Mesolithic disarticulated human remains have also frequently been recovered from open sites and cave/rockshelter locations in Ireland, England, Wales, Benelux, and Germany (Gray Jones 2011; Meiklejohn 2009; Meiklejohn *et al.* 2010; Meiklejohn *et al.* 2011; Meiklejohn & Woodman 2012). Only a single instance of disarticulated human hand and foot bones has been recovered from Skipshelleren rockshelter, Norway (Bergsvik & Storvik 2012; Sellevold & Skar 1999). At Vedbæk, Demark both calcined and unburnt loose human bones were recovered alongside formal burials (Brinch Petersen 2015). It is not possible to ascertain whether the deposition of the finger bone fragment at Northton was in intentional act of burial however, if so, it fits within widely understood mortuary practices throughout Atlantic Europe.

The burial of post-Mesolithic human remains in Mesolithic sites is well known in Scotland. A number of articulated burials dating to the Neolithic, Bronze, and Iron Ages have been recovered from midden deposits within caves and rockshelters such as An Corran, Skye; Creag nan Uamh, Assynt; Carding Mill Bay and Raschoille along the Oban coastline, and Killuragh Cave in Ireland (Connock 1990:29-30; Meiklejohn & Woodman 2012:31-31; Milner & Craig 2009:148; Saville 2005a:358; Saville & Hardy 2012b:73; Schulting & Richards 2002:163-164; Warren 2007:315; Wickham-Jones

2009d:482). In France, a later burial of a non-adult in the Mesolithic midden is recorded at Beg-en-Dorchenn, Morbihan (Meiklejohn *et al.* 2010); re-use of other cave sites containing Mesolithic deposits for burial is attested throughout the country, as well as in Norway, the Mediterranean, and beyond (Bergsvik & Skeates 2012; Bergsvik & Storvik 2012).

Burial of individuals is closely associated with territorial behaviour controlled by descent lineages in some hunter-gatherer societies. The formal burial of the dead 'justifies' the occupation of a place, and thus the right to its resources (Goldstein 1981; Pardoe 1988; Rowley-Conwy & Piper in press; Saxe 1970). This is therefore linked with delayed-return behaviour. However, it has been suggested that burial places may have functioned in social roles other than territoriality (Renouf & Bell 2011).

Overall, the treatment of the dead in Mesolithic north-west Europe appears to differ across the entire region, as well as within individual sites. Some of these differences have been taken to reflect complementary aspects of similar practices, such as locations for excarnation and deposition of remains following initial decomposition elsewhere (Gray Jones 2011:181-182). If the burial at Tràigh na Beirigh 9 is categorised as *Mesolithic*, on account of the dietary evidence, it fits within multitudinous ways of treating the dead throughout the Mesolithic in North-West Europe, albeit unique for Scotland. In the same respect, if the individual is taken to be *Neolithic* on account of the radiocarbon date, it is representative of a continuity of practice in burial tradition. The re-use of Mesolithic middens as burial places begins in the 4th millennium cal. BC and extends into the Neolithic and later across the Atlantic seaboard (Milner & Craig 2009:148; Warren 2007). It is pertinent to note that the Cnip headland where the site of Tràigh na Beirigh 9 is situated has been used for the burial of individuals throughout prehistory, most notably during the Bronze Age and Norse periods (Armit 1994; Lacaille 1937). Furthermore, with evidence for hunter-gatherer dietary practices continuing beyond the Neolithic transition, it appears that the Mesolithic way of life endured along the western fringes of Europe for several centuries after farming became the mainstay on the mainland.

9.4.3.2. Modified Shells

In line with the theme of continuity of practice, the deliberate modification of marine shells during the Mesolithic is also evidence of an enduring connection, albeit from the Palaeolithic. The use of deliberately modified mollusc shells as possible tools was briefly discussed in Chapter Eight; however, the archaeological evidence for such is lacking due to insufficienct research into this area (Hardy 2010; Szabó 2013). In contrast, there is abundant evidence for the use of modified shell as objects of personal ornamentation, cheifly from funerary contexts.

The perforated oyster shell artefact from Tràigh na Beirigh 1 is one of a rare suite of deliberately modified oyster shells known from British Mesolithic contexts. In Scotland, a number have been recovered from Cnoc Sligeach (Bishop 1914; Hardy 2010). Two others in Britain have been found at Bryn Newydd, Prestatyn, Wales, and at Culverwell on the Isle of Portland, Dorset (Barton & Roberts 2015; Clark 1938; Palmer 1999). The perforation and wear of the Cnoc Sligeach examples is indicative of the shell having been suspended, perhaps as jewellery (Hardy 2010). This may also have been how the modified oyster from Tràigh na Beirigh 1 was used.

Despite the wide variety of marine molluscs available on Europe's seashores, modified shells species that have been recovered from Mesolithic sites along the Atlantic façade are restricted to only a few species. Scallop, mussel, and limpet were discussed in the previous chapter with regard to possible tool use, other species appear to have been preferred for more decorative purposes. Cowrie (*Trivia monacha*) shells, often found with two symmetrical holes, are frequently interpreted as pendants or ornaments, and their use in funerary contexts during the Palaeolithic and Mesolithic in continental Europe is well known (Álvarez-Fernández 2010; Hardy 2010; Mellars 1987; Simpson 2003). In Scotland alone, perforated cowries are known from three of the Oronsay middens – Cnoc Sligeach, Cnoc Coig, and Caisteal nan Gillean II (Bishop 1914; Mellars 1987); Carding Mill Bay (Connock *et al.* 1992); Ulva Cave (Russell *et al.* 1995), and Sand (Hardy 2009b). A single perforated cowrie was idenitifed in the Baylet midden, Co. Donegal, and is the only known example from Ireland (Barton & Roberts 2015). There is debate over whether these shells may have been humanly modified. Experiments to replicate perforations using an unretouched (presumably flint) bladelet were very successful (Barton & Roberts 2015), whereas metal tools have failed (Hardy 2010). It should also be noted that cowries are one of a number of mollusc species subject to predation by other species of mollusc such as dogwhelk (*Nucella lapillus*). Dogwhelks 'drill' through the shell of their pray to access the flesh inside, creating characteristically shaped holes (Hardy 2010). Naturally perforated cowrie shells may therefore have been deliberately collected, and further modified by human agency. Other common mollusc species that have been recovered from Mesolithic contexts around Britain in a modified state include flat periwinkle (*Littorina obtusata*), *Dentalium*, and possibly limpet (Barton & Roberts 2015; Hardy 2009b; 2010).

The use of many of these mollucs species has been associated with personal decoration in funerary contexts from the Middle Palaeolithic onwards, throughout Europe, Africa, and Asia (Álvarez-Fernández 2011; d'Errico *et al.* 2009; Fano *et al.* 2013; Pettitt 2013; Simpson 2003; Vanhaeren *et al.* 2006). This attests to a strong continuity in the symbolic importance of these materials as "symbols of death and renewal" (Bailey *et al.* 2013:4). Furthermore, the use of shells and shell middens in connection with ancestors is also well evidenced, especially when burials are so closely associated with these contexts, as discussed above (Bailey *et al.* 2013:4). It has been suggested that the presence of shell artefacts in a wide variety of locations and contexts may have been deliberately deposited by Mesolithic people within these places; potentially functioning as intentional "markers" and a means of communicating ideas, territories or signifying a change in the use of a site (Barton & Roberts 2015:203).

The same may also be true for the construction of shell middens themselves. The distribution of such finds along the western coastlines during this period may represent the "spread of Later Mesolithic traditions along the Atlantic façade", that do not penetrate the interior (Barton & Roberts 2015:204). This may be the true to some extent. Along the coastal fringes of France, Spain and Portugal, the use of pierced shells associated with burials is extremely well documented (Álvarez-Fernández 2010; Araújo 2009; Arias & Álvarez-Fernández 2004; Barton & Roberts 2015; Rigaud & Gutiérrez-Zugasti in press; Schulting 1996; Schulting & Richards 2001; Straus 2008). Although no modified shells are known from Norway, where there are very few shell middens, the use of rock art during the Late Mesolithic may have had similar significance (Bjerck 2007). This places Scotland in a unique situation, positioned in the north of the western Atlantic seaboard, yet incorporating traditions more closely associated with the south-west. Such practices would be consistent with the Late Mesolithic trend towards 'complex hunters', whereby increasing sedentim, use of fixed resources, and the establishment of social territories may be validated by the use of ancestral claims through funerary tradition (Goldstein 1981; Pardoe 1988; Saxe 1970). This would have been especially pertinent given the scale of social upheaval that appears to have been caused by the climatic events of the 7th millennium cal. BC, discussed in the preceding section.

The evidence thus far indicates that the shell middens and the modification of shells in the Mesolithic is closely associated with both sacred and mundane. In this respect, the use of other raw materials should be considered with regard to their symbolic properties, although this should not be divorced from their function. This is briefly discussed with regards to quartz in the following section.

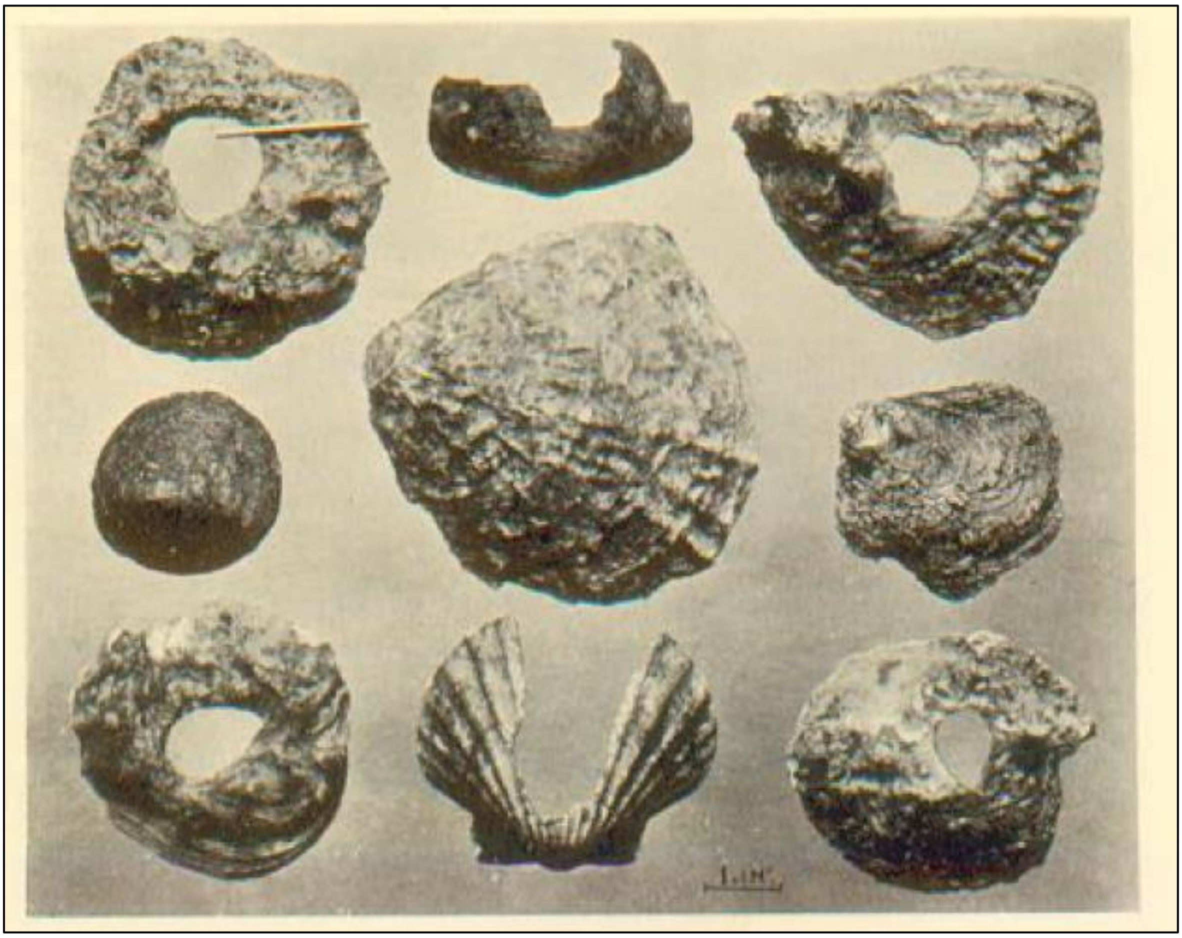

Figure 272. Perforated shells from Cnoc Sligeach (after Bishop 1914)

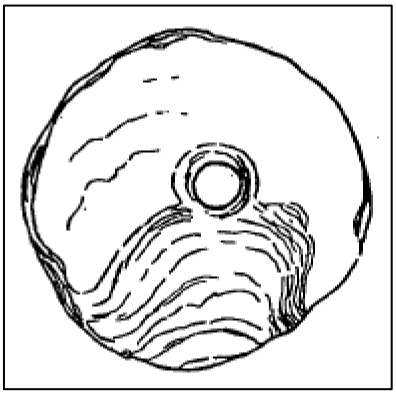

Figure 273. Perforated oyster shell from Bryn Newydd, Prestatyn. Scale 1:1 (after Clark 1938)

9.4.3.3. Non-Utilitarian Aspects of Quartz

Finally, as outlined above, it is important to consider non-utilitarian aspects of artefacts represented at these sites. This is also applicable to the use of lithic raw materials, particularly that of quartz.

Milky quartz is ubiquitous around Western Arnhem Land, which varies in quality and has been used in abundance by Aborigines for millennia. The iridescent, aesthetic properties of quartz and quartzite are imbued with sacred properties, especially the power of the Ancestral Beings (Taçon 1991). It is argued that a purely functionalist perspective could not fully explain the changes in preference of raw materials for the production of stone points by Aboriginal groups, thus the sacred and mundane must be considered alongside one another (Taçon 1991). Although the symbolic meaning of quartz in Australian Aborigine culture cannot be applied to the Western Isles Mesolithic, it would be remiss not to acknowledge that the striking visual properties of quartz were simply ignored by these people.

The use of quartz in “ritual spheres”, such as megalithic structures, is demonstrated throughout prehistory; in Ireland, it is also observed in historic Christian funerary traditions (Driscoll 2010). Similarly, there is strong evidence for symbolic associations of quartz with funerary traditions in later prehistory in the Western Isles. A large quantity of worked and unworked quartz was incorporated into the kerbed cairn at Olcote, Braesclete near Callanish, blurring the lines between “its function as a ritual or symbolic medium from its use as part of a mundane tool kit. Instead it appears to have been both, different characteristics of the material being more or less significant in specific contexts” (Warren 2005a:46).

There is little evidence for such definitive ritualistic use of quartz during the Mesolithic, however. It has been suggested that the high quality rock crystal quarried at Lealt Bay and Lussa River was procured for its appearance, or non-functional use. This is based upon the fact this raw material was reduced in the same manner as the lesser-quality milky quartz, despite its superior flaking qualities (Ballin 2001; 2002). Equally, the small quantity of rock crystal present in the Mesolithic assemblages from the Western Isles displayed no evidence for a particular or distinctive reduction strategy, however it could also be argued that the abundance of the material would preclude any specialist treatment.

Ballin also notes that the visually distinctive characteristics of quartz, and other raw materials, may have functioned as indicators of identity. Possession of raw materials with particularly localised sources may have marked individuals as belonging to particular social groups, or with access to particular resources (Ballin 2008:64, 73-74). This harks back to the discussion of social territories based on raw material distribution in Section 9.2.3, and is another example of the intangible aspects of Mesolithic material culture that can only be guessed at.

9.5. Conclusion

A number of major themes have been identified through the interpretation of the Western Isles Mesolithic lithic assemblages that, when combined with the supporting contextual evidence for the types of site activities, contribute significantly to the interpretation of hunter-gatherer settlement and subsistence strategies on these islands. Throughout this chapter, comparisons have been drawn between the burgeoning evidence from the Western Isles, and how this fits within our current understanding of the Mesolithic period along north-east Atlantic seaboard. Largely, the Mesolithic inhabitants of the Western Isles can be seen as an extension of the western Scottish

Mesolithic. During the earlier occupation of these islands it is clear they were connected to the Inner Hebridean islands through the movement of raw materials; a proposal for a social territory that incorporates the isles of Skye, Rum, and the western mainland was discussed in relation to this. During the terminal Mesolithic, these connections are less clear, and there is increasing evidence for the expression of more regional identities.

Consequently, it is apparent that the scope for further work leading on from this thesis is extensive, with ramifications that may affect our current understanding of this period of time at the westernmost point of Europe. This will be discussed in the following chapter, alongside the initial research questions that were raised in the introductory chapter of this thesis. The main points outlined in this discussion will be reiterated in detail in relation to these questions.

Chapter 10 Expanding the Mesolithic of the Atlantic Façade: Conclusions and Future Work

10.1. Conclusions

The overarching research aim of this thesis was *to contextualise the lithic assemblages from the newly established Mesolithic of the Western Isles of Scotland within a holistic framework that explores the nature of hunter-gatherer interaction with the environment at the extreme edge of the north-west Atlantic façade.* This was addressed through three primary research questions. A detailed summary of the major findings from the preceding chapter will be presented in response to each of these questions.

QI. What is the nature of the lithic technology of the Mesolithic in the context of the Western Isles of Scotland?

Overall the lithic technology of the Mesolithic inhabitants of the Western Isles appears to show an expedient strategy based largely on the embedded procurement of local resources. Quartz is the dominant raw material utilised during the Mesolithic occupation of the Western Isles of Scotland. On both Harris and Lewis, this was locally available as water-rolled pebbles that could have been picked up from the beach, or as exposed veins of material that were exploited through quarrying. The cortex present on the flaked quartz material at all of the sites attests to the use of both types of sources. A number of unworked quartz pebbles from sites on both Harris and Lewis may represent collected beach pebbles that remained unused, and circular marks on the exposed quartz vein at Gridig, next to Tràigh na Beirigh 1, indicates quarrying activity. Overall, the local abundance of quartz was conducive to a 'wasteful' reduction strategy. Flint is present in varying proportions at each of the Mesolithic sites. It is possible that that this was infrequently available as beach pebbles close to the sites, but this supply would quickly have been exhausted; alternatively it may have been imported from elsewhere. Either scenario could explain the extremely conservative reduction strategies employed. The working of flint and quartz in these two very different manners indicates that the earliest known inhabitants of the Western Isles were familiar with the specific natures of both raw materials.

The occupation of Harris, at Northton and Tràigh an Teampuill, represents the earliest Mesolithic settlement in the Western Isles. It is unlikely that Northton signifies the very pioneer occupation of the Western Isles. The flint-dominated assemblage of Phase 4 clearly demonstrates that, at least initially, the earliest known inhabitants were still strongly connected with the Inner Hebrides in terms of technological style, and possibly raw material supply. This resource may have diminished after the population became established, and far-reaching insurance networks were no longer relied upon with groups to supply flint from well-known sources. This does not explain the contribution of mudstone to these sites, however. An alternative suggestion therefore is that flint was locally available for some time, but the supply quickly 'dried up'. In this case, there is a requirement for contact with groups who could supply/allow access to mudstone. This supplementary material may have been necessary due to the poorer quality of the quartz on Harris. It should be noted that interpreting the treatment of different raw materials on-site, solely in terms of the cost of exploitation and fracture mechanics, risks an overtly functionalist perspective. The non-functional aesthetic qualities of quartz, or the fact that baked mudstone may have been imbued with ideological properties, might be reasons for the export of these materials across The Minch (Ballin 2008:70).

Throughout the Mesolithic occupation of the Western Isles there is little investment in the manufacture of formally retouched tools, specifically microliths. This may, in part, be a consequence of raw material availability. Flint was utilised for microlith production at Northton and a single scraper, recovered from the same site, forms the only evidence for secondary working of quartz on Harris. Therefore the available milky quartz may not have been amenable to the production of such tools and higher-quality material was needed. This contrasts to Lewis where a number of retouched quartz tools were found, especially at Tràigh na Beirigh 9. The finer flaking properties of the high quality greasy quartz on Lewis may therefore have rendered flint unnecessary for tool production. However, the dearth of microliths overall appears to suggest that a microlithic tradition had been all but abandoned by the terminal Mesolithic. This may be a consequence of the small dataset, a functional response to subsistence patterns, or indicative of stylistic regionalisation as in Ireland. There are, however, strong indications that the microlithic tradition was waning throughout later Mesolithic Scotland (Finlay *et al.* 2002; Gregory & Simpson 2006; Hardy & Wickham-Jones 2009a; Wickham-Jones 2004a).

QII. How do the lithic assemblages fit into the occupation of the Western Isles sites?

Without site-specific contextual information it is extremely difficult to understand the function of lithic assemblages. Subsistence strategies are vital to explaining hunter-gatherer mobility and settlement patterns. This in turn influences how raw materials are procured and reduced as a consequence of transport costs. The nature of the specific technology produced is governed by a combination of the raw materials available and its end purpose – acquiring and processing means of subsistence.

Understanding the full nature of the activities that were being conducted at each site is currently hampered by incomplete post-excavation analysis of the zooarchaeological and archaeobotanical assemblages. From the information gleaned thus far, the Mesolithic sites on Harris are characterised by a broad-spectrum economy of seasonal fishing and foraging in the littoral zone, which included the exploitation of a variety of marine mollusc and fish species. It is likely that smaller marine mammals, such as seal, were actively hunted; however, larger species of cetacea would no doubt have been scavenged if they became beached. Seabirds were also caught, some on a seasonal basis, and small fur-bearing mammals were captured for their pelts and meat. The evidence for large terrestrial game is extremely circumstantial. The red deer antler tine from Tràigh an Teampuill would have been an easily transportable commodity. The identification of red deer/elk is based upon the analysis of bone collagen from undiagnostic fragments, and does not provide conclusive evidence for the indigenous presence of either of these large herbivores in the Western Isles.

At Northton, there is clear evidence for the large-scale exploitation of hazel nuts and gathering of other locally available flora, which included plants with edible seeds and tubers. The presence of a large quantity of charred hazel nutshell fragments and calcined bone – especially that of fish – suggests that processing activities such as roasting or smoking were taking place at the site. The vast amount of unburnt fish bone from Tràigh an Teampuill indicates that other methods of fish processing were also conducted on the peninsula. The function of the scooped feature at this site remains unknown, however it is interesting that the ash-clay primary deposit is replicated at another late Mesolithic site on the mainland, suggesting a deliberate act of lining the scoop.

On Lewis there is a specific and intensive focus on the exploitation of young saithe throughout the 600 years of Mesolithic occupation on the Cnip headland and at Pabaigh Mòr. The various sites indicate that there was a targeted and selective catch of first year fish during the seasons in which they shoal inshore. The most intensive periods of activity at Tràigh na Beirigh 1 were late spring and mid-winter, whereas at Tràigh na Beirigh 2 the focus was largely on mid-winter fishing; springtime fishing is evidenced at Pabaigh Mòr. The presence of charred hazel nutshell at Tràigh na Beirigh 1, 2, and 9 potentially indicates occupation during autumn, however dried nuts may have been consumed at any time of the year. At all of the shell midden sites there was also extensive exploitation of the littoral zone with limpets, periwinkles/dogwhelk, razor clam, and crustacean primarily targeted. The discrete nature of some of the shell deposits points to evidence for single episodes of discard. Thus far, the only evidence for the procurement of terrestrial resources at these sites is represented by a number of hare bone and charred hazel nutshell fragments.

Small assemblages of lithics were recovered from the relic ground surfaces below the main midden formations. When combined with the presence of a number of negative features at Tràigh na Beirigh 1, including post-holes, there is clear evidence for anthropogenic activity at the sites prior to the formation of the middens deposits. However, in the absence of any dates from these contexts, no comment can be made as to the relationship between the stratigraphically earlier activities and the middens. The apparent deliberate deposition of the perforated oyster shell at the interface between the relic ground surface and the shell midden may be interpreted as an act that extends beyond function. This could also apply to the construction of the middens themselves, which may represent more meaningful activities than the simple discard of food waste. The terminal-Mesolithic interment of an individual into the midden at Tràigh na Beirigh 9 certainly attests to ritual activity, and potential re-use of the site beyond the traditional end of the Mesolithic.

The flake-based, *ad hoc* nature of the lithic assemblage, coupled with a dearth of formally recognisable tools, offers little insight into the relationship between subsistence activities and the means of processing food at these sites. Microliths have long been associated with projectile technology for hunting 'big game'. Whilst this interpretation no longer stands in isolation, the overall scarcity of microliths, or associated blade manufacture at any of the sites, and the absence of definitive evidence for large terrestrial herbivores in the region makes for a striking correlation. As such, the lithic assemblages of the Western Isles Mesolithic are largely representative of an expedient, maintainable technology that was utilised for the immediate processing of seasonally available, medium-to-low ranked, but high-return resources. The lithics would therefore have played a direct role in the subsistence economy. However, it is also likely that the lithics at these sites were intended for "the production of the means of production" (Costa *et al.* 2005:30); the working of organic materials such as wood and plant fibres to produce nets, traps, baskets, and lines, all of which could have been successfully used in fishing, trapping, and snaring the faunal species exploited at these sites, without the need for a complex stone tool technology. Furthermore, the bone points recovered from Tràigh an Teampuill may have functioned as needles or awls in fixing nets or, indeed, clothing. Without conducting residue or use-wear analysis, however, it cannot be directly determined how the lithic assemblage was utilised in the hunting, gathering, and fishing activities of these Mesolithic sites.

On the whole, the evidence that has been comprehensively synthesised in this thesis indicates that the Mesolithic inhabitants of the Western Isles of Scotland were logistically organised communities, adaptively combining both immediate- and delayed-return subsistence practices. By drawing upon ethnographic models of settlement patterning and resource scheduling it is evident that logistic organisation is inferred through low tool diversity, the absence of caches, a low number of exhausted tools, and embedded procurement of locally available raw materials. The shell midden sites also attest to specialised activity areas frequented by task-groups on a short term, seasonal basis. One issue with this interpretation is the notable absence of any definitive home-base type site. Whilst many of the resources present at Northton could be immediately consumed, there is also evidence for delayed-return strategies. The discard of microliths for example, suggests an element of 'gearing up'; the extensive processing of hazel nuts and the wide faunal diversity may also indicate a more sustained period of residence. The implied investment in a fixed fish trap capable of returning the diverse catch, and the requirement of boats to reach the Western Isles also attests to this. The occupation of these productive coastal zones, and the evidence to suggest that fish and hazelnuts from these sites may have been processed for storage, could have supported residential groups, who may have inhabited these areas for several seasons. Whilst open-air middens appear inherently functional, the monumentality of their presence cannot be overlooked – they are very visual statements of occupied place. The burial of the individual at Tràigh na Beirigh 9 is another line of evidence that may indicate a conscious perception of permanence and belonging (Goldstein 1981; Pardoe 1988; Saxe 1970).

QIII. Are the Western Isles sites representative of the Scottish Mesolithic, and how do they fit within the Mesolithic of the north-east Atlantic façade?

The review of the current understanding of the Mesolithic in western Scotland, presented in Chapter Two, concluded that after several decades of intensive and holistic investigations our knowledge of the Mesolithic in the region was "no longer as 'dull and impoverished' as traditionally perceived". Nor however, is it as bright and rich as we may like. The number of Mesolithic sites containing stratified, dated, and preserved faunal remains totals 28, just 8% of the Mesolithic sites and artefact scatters in western Scotland. The number of newly discovered and securely dated sites with Mesolithic occupation from the Western Isles totals six – a little over a fifth of that number[13]. In this respect, the known Mesolithic of the Western Isles is therefore *not* representative of the Scottish Mesolithic – it is something far more exceptional.

The use of locally available raw materials in the Western Isles fits within a general trend in the Later Mesolithic of the Atlantic seaboard that may have been precipitated by climatic anomalies towards the end of the 7th millennium cal. BC. In Ireland and Norway there is a clear shift away from a reliance on high quality flint from the coastal zone, towards a greater uptake in a variety of different raw material types. Whilst in Norway this does not appear to have any palpable effect on the lithic technology – the true microlithic technique does not feature significantly in the Mesolithic of the south-west of the country – the decline of the microlithic tradition in Ireland is innately connected to this. As such, the remarkable lack of microliths in the Later Mesolithic, both in the Western Isles and Ireland, is a unique feature along the western Atlantic façade.

The commonality of an expedient technology in Ireland (in the form of Bann flakes), and the *ad hoc* reduction of quartz in the Western Isles to produce immediately utilisable flakes, may be connected to the absence of indigenous large terrestrial herbivores on these islands. Niche construction during the Mesolithic is demonstrated through the introduction of wild boars to Ireland, and although

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[13] This excludes the undated sites of Tràigh na Beirigh 3, Tràigh na Beirigh 4, and DLS'13 #30, which is purely palaeoenvironmental. Inclusion of Tràigh na Beirigh 3 and Tràigh na Beirigh 4 has no effect on the total percentage of shell middens within the overall dataset, which remains at 8%, but raises the contribution of Western Isles sites to 27% of this.

there is tentative evidence for the presence of red deer at Tràigh an Teampuill, such deliberate management of resources cannot yet be verified. The evidence for the movement of red deer between islands of the Inner Hebrides is restricted to the presence of meat-bearing elements or elements most conducive to tool manufacture. Any red deer remains in the Western Isles Mesolithic remain likely to be an imported commodity.

The occurrence of ‘exotic’ imported resources such as red deer antler, baked mudstone, limestone, and possibly flint connects the inhabitants of the Western Isles within social networks that either facilitated access to directly procure the material from its source, or relationships that involved exchange. The movement of localised raw materials between the islands of the Inner Hebrides is paralleled on a much greater scale in the Late Mesolithic of south-west Norway. These social networks would have been vital during the colonisation of the Western Isles, which appears to have been delayed by over a thousand years, when compared to the earliest evidence for settlement in the Inner Hebrides at Crait Dubh. Both Northton and Mount Sandel represent the earliest evidence for Mesolithic settlement in their respective regions, in the centuries before 7000 cal. BC. A number of possible reasons for the delayed colonisation of Ireland were outlined in Chapter Three that are equally applicable to western Scotland. It is most likely that the “elaborate marine relations”, which facilitated the successful colonisation of western Norway three millennia earlier, were not sufficiently developed to ensure safe passage across the formidable open waters of the Irish Sea and The Minch until late in the 8th millennium cal. BC.

The coastally adapted subsistence strategy of the Western Isles is paralleled throughout western Scotland and the Atlantic seaboard. Comparable open air sites to Northton and Tràigh an Teampuill have recently been identified on Islay and Coll, incorporating a broad subsistence base of both terrestrial and marine resources, like those well evidenced in Ireland and the inner coastal zone of south-west Norway. It is possible that DLS’13 #30 represents the activities of Mesolithic individuals in the interior of the Western Isles, although this is not certain. The open air shell middens of Lewis and Pabaigh Mòr, and the associated specialised exploitation of marine resources at these sites, are a phenomenon that is echoed across the Mesolithic Atlantic coastal diaspora.

Overall, the archaeological record for the Mesolithic in the Western Isles forms part of a body of evidence that is in an unprecedented minority in western Scotland. Whilst there are tentative indications for the development of insular traits and traditions, the evidence accords well with broad trends of hunter-gatherer coastal settlement and subsistence throughout the north-east Atlantic façade.

10.2. Future Work

The Mesolithic of the Western Isles of Scotland is, arguably, one of the most significant discoveries in Britain since the turn of the millennium. It has expanded the Mesolithic of the Atlantic seaboard to its westernmost extent – to the very edge of Europe – and has filled a substantial gap in the archaeological record. In filling this gap, however, a plethora of issues have been subsequently raised.

The most pertinent issue is completing the post-excavation analysis, principally of the faunal and floral remains, to ensure a complete and accurate picture of the resources that were being exploited at the sites. This will enable the sites to be tied more securely into models of hunter-gatherer subsistence in the region, and understand modes of settlement, such as seasonal or year-round occupation, more clearly. One important aspect of this that requires elucidation is the apparent absence of native large terrestrial game in the Western Isles, in particular red deer. If so, this would infer deliberate niche construction by Mesolithic inhabitants by importing deer to the Western Isles, in a similar manner to the introduction of wild boar to Ireland. This would have significant ramifications for our understanding of the relationship between hunter-gatherers and deliberate economic management strategies.

Furthermore, there is substantial scope to return to the Western Isles and continue fieldwork there. With the exception of Tràigh na Beirigh 1, only a very small sample of material has been excavated from the sites discussed in this thesis. It must be stressed that this thesis has been written during the on-going post-excavation process of the first Mesolithic sites in the Western Isles of Scotland. As such, the interpretations and conclusions herein are based on a very small dataset. The recovery of more data through further excavation and analysis could make the interpretations of this thesis more robust, or dispel them entirely once the project has been completed.

With regard to the lithic analysis in particular, it would be pertinent to continue any future excavation with a strategy that would facilitate a greater recording and recovery rate of lithics *in situ*. This would enable a greater understanding of the spatial distribution of lithic debris throughout the sites, for example potentially identifying areas of working. The recovery of a higher proportion of lithic material *in situ*, rather than during post-excavation after the processing of samples for environmental remains, would also increase the likelihood of conducting successful use-wear and residue analysis. By conducting such analysis, this could further corroborate the interpretation that *ad hoc* quartz flakes were the primary technology in use in this region.

This raises the question of insularity and the nature of contact between other regions. Whilst there is very clear evidence for contact between Northton and the Inner Hebrides, both in terms of raw material transport and technological tradition, this is less clear in the later dated sites. In 2002 Finlay, Warren, and Wickham-Jones recognised that “The microlith has been integral, as a lithic signature, to an understanding of the Mesolithic, but the time is ripe to consider its constraints as the dominant leitmotif.” (Finlay *et al.* 2002:108; Warren 2015a; Wickham-Jones 2004a). In the face of ever-increasing evidence for the lack of microliths in the latter part of the Mesolithic since then, our current understanding of microlith use in the Mesolithic is an issue which is overdue to be addressed. This is especially pertinent in the Western and Northern Isles where microlithic evidence for the Mesolithic is rare, yet hundreds of undiagnostic lithic scatters are known (Gregory *et al.* 2005:948; Saville 1996; Wickham-Jones & Firth 2000), and in light of the documented absence of a microlithic tradition in the Later Mesolithic of Ireland and the Isle of Man.

The methodology employed in identifying the Mesolithic sites along the coast was tested inland, following the success of similar interior surveys in Scotland, North Yorkshire, and Norway. The identification of Mesolithic-age palaeoenvironmental material at DLS’13 #30 proves that this is clearly a methodology that works, despite the fact anthropogenic activity cannot be verified. With time, resources, and funding this methodology can be employed in surveying to extensive tracts of the Scottish coastline where the Mesolithic has not yet been identified – primarily in the more southerly islands of the Western Isles, and the substantial tract of coast in the northern Highland region between Torridon and Cape Wrath. Employing the methodology that has proved successful in other inland regions is equally important. The Mesolithic sites of the Western Isles have made a major contribution to the number of known sites in the region with faunal preservation. However, they continue to reinforce the coastal bias of this dataset. The discovery of Storakaig in the interior of Islay has demonstrated that if conditions are favourable, the preservation of a Mesolithic faunal assemblage in the interior is possible (Mithen & Wicks 2011c; 2012; Wicks *et al.* 2014). It is imperative that more interior sites with faunal preservation are to be located in order to fully understand Mesolithic subsistence practices.

Continued work on a detailed radiocarbon dating program would help further resolve the chronology and formation processes of these sites. Understanding the relationship between the evidence for activity below the midden deposits, and the formation of the midden deposits themselves during the centuries leading up to the traditional end of hunter-gatherer subsistence, is one instance where this would be particularly insightful. Thus, another significant issue is that of a delayed Mesolithic-Neolithic transition in the region. In 1954, Lacaille recognised that:

> “It has been indicated that the true Mesolithic cultures spread very slowly, and gave rise to regional growths along the much indented west coast and adjacent islands from Kintyre northward. Comparable retardation and developments are illustrated in the diffusion of later strains in the same area of distribution, and appear in the mixed industries of the long-persisting food-collecting economy that is clearly evidenced at coastal sites…Intermediate

> localities [of the western seaboard] enable us to trace the spread of the most primitive expressions of culture, to assess contacts and survivals of ancient industrial traditions, and to conclude that the Stone Age lasted a long time on the periphery of the Highland Zone of Britain" (Lacaille 1954:288).

The burgeoning evidence for a general absence of formal tools during the Mesolithic of the region that persisted into Neolithic (Pirie forthcoming); the unequivocal continuing exploitation of wild plants (Bishop *et al.* 2009; Bishop *et al.* 2014b); and the significant contribution of marine resources to the diet of the individual buried at Tràigh na Beirigh 9 all suggest that the Mesolithic way of life endured on the islands long beyond the time farming was present in large parts of mainland Britain. Lacaille's synthesis still stands over 60 years on.

Lithic and Raw Material Variability in the Mesolithic of the Western Isles: Contextualising "The Hybrid Industries of the Western Seaboard"

(Lacaille 1954:288)

Volume 2 of 2

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Appendix 1 Catalogue of Mesolithic Sites Containing Lithic Material (to June 2016) in Western Scotland and the Hebrides

Table 47. Catalogue of Mesolithic sites containing lithic material (to June 2016) in Western Scotland and the Hebrides

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Albyn Distillery	Argyll	NR715209	Y					Y		Schistose	Excavation (intentional)	Lithic scatter	(Lacaille 1954; McCallien & Lacaille 1941)
Arinarach Hill	Argyll	NR722150	Y								Excavation (accidental)	Isolated finds	(Siggins 1991)
Balaghoun	Argyll	NR989975	Y								Excavation (accidental)	Isolated find	(Webb 2007)
Carding Mill Bay	Argyll	NM847293						Y			Excavation (accidental)	Shell midden	(Connock 1990; Connock *et al.* 1992)
Cave of the Crags	Argyll	NM822175	Y								Excavation (intentional)	Lithic scatter	(Coles 1963)
Clachbreck	Argyll	NR765759	Y								Surface collection	Lithic scatter	(Campbell 1962)
Dalaruan	Argyll	NR717211	Y								Excavation (accidental)	Lithic scatter	(Lacaille 1954)
Distillery Cave	Argyll	NM859301	Y								Excavation (accidental)	Shell midden	(Anderson 1895; Turner 1895)
Druimvargie	Argyll	NM857296	Y								Excavation (accidental)	Shell midden	(Anderson 1898)
Kilmore	Argyll	NM881252	Y			Y		Y			Excavation (intentional)	Lithic scatter	(Bonsall *et al.* 2009)
Lange Links	Argyll	NR674248	Y					Y		Schistose	Surface collection	Lithic scatter	(Lacaille 1954)
Lón Mór	Argyll	NM853284	Y					Y			Excavation (intentional)	Lithic scatter	(Bonsall *et al.* 1993)

Site Name	**Location**	**NGR**	**Flint**	**Chert**	**Bloodstone**	**Pitchstone**	**Mudstone**	**Quartz**	**Limestone**	**Other Raw Material**	**Initial Identification**	**Subsequent Interpretation**	**References**
Low Nerabus	Argyll	NR225551	Y								Excavation (intentional)	Occupation deposit	(Ellis 2014)
New Peninver Farm	Argyll	NR758250	Y			Y		Y		Hematite	Excavation (intentional)	Lithic scatter	(Baker 2013)
MacArthur's Cave	Argyll	NM859304	Y								Excavation (accidental)	Shell midden	(Anderson 1895)
Macharioch Field 1	Argyll	NR738094	Y					Y			Field-walking	Lithic scatter; subsequently excavated	(Cummings & Robinson 2007)
Machribeg	Argyll	NR687083	Y								Field-walking	Lithic scatter	(Cummings & Robinson 2007)
Mackay Cave	Argyll	NM859305	Y								Excavation (accidental)	Occupation deposit	(Anderson 1895; Turner 1895)
Millknowe	Argyll	NR715211	Y								Excavation (accidental)	Lithic scatter	(Lacaille 1954)
Raschoille Cave	Argyll	NM854288								No raw material information	Excavation (accidental)	Shell midden	(Connock 1985)
Rusehill, Glenbarr	Argyll	NR666377	Y								Surface collection	Lithic scatter	(Purvis 2002)
Springbank Distillery	Argyll	NR718204	Y								Excavation (accidental)	Lithic scatter	(Scott 1956)
Sron-a-Bruic, Minard	Argyll	NR958935	Y								Surface collection	Lithic scatter	(Gladwin 1993)
Tiretigan Cave	Argyll	NR717611	Y					Y			Excavation (intentional)	Occupation deposit	(Coles 1961; 1983)
Auchareoch	Arran	NR995247	Y			Y	Y	Y			Excavation (accidental)	Lithic scatter; subsequently excavated	(Affleck *et al.* 1985; Affleck *et al.* 1988)
Bridge Farm	Arran	NR926321	Y			Y					Excavation (intentional)	Lithic scatter	(Baker 1999; Ballin-Smith *et al.* 1999)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Kildonan	Arran	NS031208	Y			Y		Y			Field-walking	Lithic scatter	(Gorman *et al.* 1995a)
Knockenkelly 12	Arran	NS039276	Y			Y					Surface collection	Lithic scatter	(Allen & Edwards 1987)
Knockenkelly 15	Arran	NS036278	Y			Y					Surface collection	Lithic scatter	(Allen & Edwards 1987)
Lamlash	Arran	NS020310	Y	Y		Y		Y			Excavation (intentional)	Lithic scatter	(Ballin-Smith *et al.* 1999)
Machrie	Arran	NR898329	Y							Quartzite hammer-stones	Field-walking	Lithic scatter	(Gorman *et al.* 1993a; 1993b; Gorman *et al.* 1995b)
Machrie Moor	Arran	NR905315									Palaeo-environmental core	N/A	(Robinson 1983a; 1983b; Robinson & Dickson 1988)
Machrie North Test Pit 0610	Arran	NR910355	Y			Y		Y			Excavation (intentional)	Lithic scatter	(Finlay 1997)
Moss Farm Site 1	Arran	NR912323								No raw material information	Excavation (intentional)	Lithic scatter	(Haggarty 1991)
Moss Farm Site 11	Arran	NR912324								No raw material information	Excavation (intentional)	Lithic scatter	(Haggarty 1991)
Borve	Benbecula	NF769498									Palaeo-environmental core	N/A	(Edwards *et al.* 2005)
Glecknabae	Bute	NS007682	Y								Surface collection	Isolated find	(Cormack 1986a)
Little Kilchattan	Bute	NS105565	Y								Surface collection	Lithic scatter	(Cormack 1986b)
St Blane's Church	Bute	NS099531								Agate	Unknown	Lithic scatter	(McFadzean 1987)
The Plan	Bute	NS092527	Y			Y					Field-walking	Lithic scatter	(Finlay 2004)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Fiskary Bay	Coll	NM211549								No raw material information	Surface collection	Lithic scatter; subsequently excavated	(Mithen *et al.* 2007a; Mithen *et al.* 2007d; Mithen & Wicks 2009)
Rubha Sgor-innis	Coll	NM273638	Y							Bevelled stone pebbles	Surface collection	Lithic scatter	(Ritchie *et al.* 1978)
Baleromindubh 2	Colonsay	NR390910	Y					Y			Excavation (intentional)	Lithic scatter	(Marshall 2000a)
Baleromindubh 4	Colonsay	NR392914	Y								Excavation (intentional)	Lithic scatter	(Marshall 2000a)
Baleromindubh 5	Colonsay	NR390924	Y			Y				Agate	Excavation (intentional)	Lithic scatter	(Marshall 2000a)
Loch Cholla	Colonsay	NR382917									Palaeo-environmental core	N/A	(Andrews in Mellars 1987)
Machrins 3	Colonsay	NR373933	Y					Y			Field-walking	Lithic scatter	(Mithen 2000b)
Machrins A	Colonsay	NR371933	Y								Field-walking	Lithic scatter	(Mithen 1989b)
Scalasaig 2	Colonsay	NR391942	Y					Y			Excavation (intentional)	Lithic scatter	(Mithen 2000b)
Scalasaig Hotel	Colonsay	NR394940	Y								Field-walking	Lithic scatter	(Mithen 1989d)
Staosnaig	Colonsay	NR387932	Y	Y		Y		Y		Rock crystal, siltstone	Field-walking	Lithic scatter; subsequently excavated	(Mithen *et al.* 2000a)
Aird	Dumfries & Galloway	NX089606	Y			Y					Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Airlour	Dumfries & Galloway	NX344428	Y								Surface collection	Lithic scatter	(Coles 1964)
Auchenmalg	Dumfries & Galloway	NX233521	Y								Surface collection	Lithic scatter	(Coles 1964; Saville 2004)
Balgown	Dumfries & Galloway	NX118422	Y								Surface collection	Lithic scatter	(Coles 1964)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Balmaclellan	Dumfries & Galloway	NX639792	Y	Y							Surface collection	Lithic scatter	(Ansell 1971)
Bargrennan White Cairn	Dumfries & Galloway	NX352783								No raw material information	Excavation (intentional)	Lithic scatter	(Cummings & Fowler 2005)
Barhobble	Dumfries & Galloway	NX310494	Y							Coarse stone bevel ended tools	Excavation (intentional)	Isolated finds	(Cormack 1995)
Barmore Moss	Dumfries & Galloway	NX280600								No raw material described in *DES*, CANMORE site type states 'flint scatter'	Excavation (intentional)	Lithic scatter	(Bain 1995)
Barsalloch	Dumfries & Galloway	NX343421	Y								Excavation (intentional)	Lithic scatter	(Cormack 1967; 1968a; 1969a)
Black Water of Dee	Dumfries & Galloway	NX501793	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Bladnoch	Dumfries & Galloway	NX418540	Y								Surface collection	Lithic scatter	(Cormack 1985a)
Blairbuy	Dumfries & Galloway	NX365411	Y								Surface collection	Lithic scatter	(Coles 1964)
Bogrie	Dumfries & Galloway	NX816849	Y								Unknown	Isolated find	(Truckell 1974)
Borron Point	Dumfries & Galloway	NX998581	Y	Y							Surface collection	Lithic scatter	(Truckell 1973)
Buittle Castle Bailey	Dumfries & Galloway	NX819616								No raw material information	Excavation (intentional)	Lithic scatter	(Penman 1994; 1995)
Carsethorn A	Dumfries & Galloway	NX992599	Y								Unknown	Isolated find	(Truckell 1974)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Carsethorn B	Dumfries & Galloway	NX985602	Y								Unknown	Isolated find	(Anonymous 1976)
Carsethorn Beach	Dumfries & Galloway	NX988601	Y	Y							Unknown	Lithic scatter?	(Anonymous 1975)
Chippermore Fort	Dumfries & Galloway	NX296483	Y							Coarse stone BET	Unknown	Lithic scatter?	(Truckell 1955)
Clatteringshaws Loch A	Dumfries & Galloway	NX552777	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch B	Dumfries & Galloway	NX554777	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch C	Dumfries & Galloway	NX538767	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch D	Dumfries & Galloway	NX539767	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch E	Dumfries & Galloway	NX536754	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch F	Dumfries & Galloway	NX536753	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch G	Dumfries & Galloway	NX537754	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch H	Dumfries & Galloway	NX537753	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Clatteringshaws Loch I	Dumfries & Galloway	NX531778	Y	Y							Surface collection	Lithic scatter	(Affleck 1984a)
Clatteringshaws Loch J	Dumfries & Galloway	NX542770									Palaeo-environmental core	N/A	(Birks 1975)
Cooran Lane	Dumfries & Galloway	NX469828									Palaeo-environmental core	N/A	(Birks 1975)
Cowcorse Farm	Dumfries & Galloway	NX948564	Y	Y							Surface collection	Lithic scatter	(Williams 1968)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Cruggleton	Dumfries & Galloway	NX480425	Y								Field-walking	Lithic scatter	(Cormack 1983a)
Drummore	Dumfries & Galloway	NX137367								No raw material information	Unknown	Lithic scatter?	(Cormack 1964b)
Gillespie	Dumfries & Galloway	NX248517	Y								Surface collection	Lithic scatter	(Cormack 1965a)
Gillfoot	Dumfries & Galloway	NX979560	Y	Y		Y					Surface collection	Lithic scatter	(Cormack 1965b)
Grennan	Dumfries & Galloway	NX127394	Y								Surface collection	Lithic scatter	(Cormack 1969b)
Innerwell	Dumfries & Galloway	NX477493								No raw material information	Unknown	Lithic scatter?	(Cormack 1964b)
73-75 Irish Street	Dumfries & Galloway	NX971759		Y							Excavation (intentional)	Lithic scatter	(Cachart 1989; Mackenzie 1995; 1996; 2002)
Isle Farm	Dumfries & Galloway	NX484370	Y								Surface collection	Lithic scatter	(Coles 1964; Truckell 1963)
Kilfillan A	Dumfries & Galloway	NX203543	Y								Surface collection	Lithic scatter	(McCracken 1967)
Kilfillan B	Dumfries & Galloway	NX469466	Y								Surface collection	Lithic scatter	(Cormack 1984)
Kilfillan C	Dumfries & Galloway	NX205541	Y								Surface collection	Lithic scatter	(Coles 1964)
Kirkguneon Parish	Dumfries & Galloway	NX846666	Y	Y							Surface collection	Lithic scatter; subsequently excavated	(Cunningham 1984)
Kirkmabreck	Dumfries & Galloway	NX106476	Y								Surface collection	Lithic scatter	(Coles 1964)
Loch Arthur	Dumfries & Galloway	NX903690	Y								Excavation (intentional)	Isolated find	(Williams 1967a)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Loch Dee	Dumfries & Galloway	NX472790	Y	Y							Unknown	Lithic scatter	(Affleck 1984b)
Loch Dungeon	Dumfries & Galloway	NX523845									Palaeo-environmental core	N/A	(Birks 1975)
Loch Grannoch A	Dumfries & Galloway	NX548714	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Grannoch B	Dumfries & Galloway	NX547713	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Grannoch C	Dumfries & Galloway	NX546713	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Grannoch D	Dumfries & Galloway	NX545711	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Grannoch E	Dumfries & Galloway	NX540684	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Grannoch F	Dumfries & Galloway	NX541695	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Lochfoot School	Dumfries & Galloway	NX898737	Y								Surface collection	Isolated find	(Anonymous 1968a)
Low Balyett	Dumfries & Galloway	NX085615	Y								Surface collection	Lithic scatter	(Coles 1964)
Low Clone North	Dumfries & Galloway	NX334453	Y								Surface collection	Lithic scatter	(Coles 1964)
Low Clone South	Dumfries & Galloway	NX334450	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Coles 1964; Cormack 1965c; Cormack & Coles 1968)
Luce Sands A	Dumfries & Galloway	NX140555	Y								Surface collection	Lithic scatter	(Truckell 1962)
Luce Sands B	Dumfries & Galloway	NX138556	Y								Surface collection	Lithic scatter	(Anonymous 1968b; Coles 1964)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Maxwellfield	Dumfries & Galloway	NX980560	Y	Y				Y			Surface collection	Lithic scatter	(Blackett 1967; Cormack 1964a; 1965d)
McCulloch's Castle	Dumfries & Galloway	NX997577	Y	Y				Y			Surface collection	Lithic scatter	(Blackett 1967)
Millhill	Dumfries & Galloway	NX964762		Y							Surface collection	Isolated finds	(Williams 1966a)
Monreith	Dumfries & Galloway	NX364406	Y								Surface collection	Lithic scatter	(Cormack 1968b)
Morrach	Dumfries & Galloway	NX473353	Y								Surface collection	Lithic scatter	(Coles 1964)
Moss Raploch	Dumfries & Galloway	NX554776	Y								Surface collection	Lithic scatter	(Ansell & Conary 1974)
Mossyard	Dumfries & Galloway	NX551523	Y								Surface collection	Lithic scatter	(Cormack 1964a)
Mote of Mark	Dumfries & Galloway	NX845540	Y								Unknown	Lithic scatter?	(Truckell 1963)
Motte of Ur	Dumfries & Galloway	NX815647	Y								Surface collection	Isolated find	(Williams 1966b)
Mull Glen	Dumfries & Galloway	NX137315								No raw material information	Unknown	Lithic scatter?	(Cormack 1964b)
Newton	Dumfries & Galloway	NX555531	Y								Surface collection	Lithic scatter	(Cormack 1964a)
North Barsalloch	Dumfries & Galloway	NX344419	Y								Surface collection	Lithic scatter	(Cormack 1969a)
Pate's Port	Dumfries & Galloway	NX344422	Y								Surface collection	Lithic scatter	(Coles 1964)
Polmaddie Farm	Dumfries & Galloway	NX601883	Y								Unknown	Lithic scatter?	(Anonymous 1975)
Portankill	Dumfries & Galloway	NX138325	Y								Surface collection	Lithic scatter	(Cormack 1982a)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Portyerrock	Dumfries & Galloway	NX473390	Y								Surface collection	Lithic scatter	(Cormack 1985b)
Powillimount	Dumfries & Galloway	NX990668	Y	Y				Y			Surface collection	Lithic scatter	(Blackett 1967; Cormack 1964a)
Shaddock	Dumfries & Galloway	NX476397	Y								Surface collection	Lithic scatter	(Coles 1964)
Sheddock	Dumfries & Galloway	NX477392	Y								Surface collection	Lithic scatter	(Cormack 1982b; 1983b)
Sinniness	Dumfries & Galloway	NX228518	Y								Surface collection	Isolated find	(Coles 1964)
Smeeton	Dumfries & Galloway	NX635920	Y	Y							Surface collection	Lithic scatter	(Ansell 1969d)
Smittons	Dumfries & Galloway	NX635918	Y	Y							Excavation (intentional)	Occupation deposit	(Affleck 1983)
Snibe Bog	Dumfries & Galloway	NX468810									Palaeo-environmental core	N/A	(Birks 1972)
Stairhaven North	Dumfries & Galloway	NX209540	Y								Surface collection	Lithic scatter	(Coles 1964)
Stairhaven South	Dumfries & Galloway	NX208539	Y								Surface collection	Lithic scatter	(Coles 1964)
Stony Park	Dumfries & Galloway	NX989574	Y	Y				Y			Surface collection	Lithic scatter	(Blackett 1967)
Stroangassel	Dumfries & Galloway	NX605874	Y	Y							Surface collection	Lithic scatter	(Ansell 1967)
Stroanpatrick	Dumfries & Galloway	NX635917	Y	Y							Excavation (intentional)	Lithic scatter	(Ansell 1966)
Tallowquhairn	Dumfries & Galloway	NX996587	Y	Y				Y			Surface collection	Lithic scatter	(Blackett 1967; Cormack 1965e)
Terally A	Dumfries & Galloway	NX120410	Y								Excavation (intentional)	Lithic scatter	(Livens 1956b)

Site Name	Location	NGR	Flint	Chert	Bloodstone	Pitchstone	Mudstone	Quartz	Limestone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Terally B	Dumfries & Galloway	NX123409	Y								Surface collection	Lithic scatter	(Coles 1964)
Torrs Warren Site J	Dumfries & Galloway	NX150550	Y								Unknown	Isolated find	(Cowie 1996)
Water of Ken A	Dumfries & Galloway	NX635751	Y								Excavation (accidental)	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken B	Dumfries & Galloway	NX611806	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken C	Dumfries & Galloway	NX613808	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken D	Dumfries & Galloway	NX606849	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken E	Dumfries & Galloway	NX607852	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken F	Dumfries & Galloway	NX606853	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken G	Dumfries & Galloway	NX606854	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken H	Dumfries & Galloway	NX603875	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken I	Dumfries & Galloway	NX605876	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken J	Dumfries & Galloway	NX618902	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken K	Dumfries & Galloway	NX619902	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken L	Dumfries & Galloway	NX621901	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken M	Dumfries & Galloway	NX622902	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken N	Dumfries & Galloway	NX638909	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)

Site Name	Location	NGR	Flint	Chert	Bloodstone	Pitchstone	Mudstone	Quartz	Limestone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Water of Ken O	Dumfries & Galloway	NX639909	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken P	Dumfries & Galloway	NX634918	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken Q	Dumfries & Galloway	NX635921	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken R	Dumfries & Galloway	NX633933	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken S	Dumfries & Galloway	NX635935	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken T	Dumfries & Galloway	NX637947	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Water of Ken U	Dumfries & Galloway	NX638948	Y								Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Black Craig	East Ayrshire	NX496954	Y	Y							Surface collection	Lithic scatter	(Ansell 1969b)
Donald's Isle	East Ayrshire	NX495965	Y	Y							Surface collection	Lithic scatter	(Ansell 1969a)
Loch Doon A	East Ayrshire	NS477013	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon B	East Ayrshire	NS478012	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon C	East Ayrshire	NX495995	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon D	East Ayrshire	NX496997	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon E	East Ayrshire	NX496998	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon F	East Ayrshire	NX498998	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Loch Doon G	East Ayrshire	NX499996	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon H	East Ayrshire	NX494964	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon I	East Ayrshire	NX485949	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon J	East Ayrshire	NX484948	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon K	East Ayrshire	NX483947	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon L (Starr)	East Ayrshire	NX479941	Y	Y							Surface collection	Lithic scatter	(Ansell 1968c; Edwards *et al.* 1983)
Loch Doon M	East Ayrshire	NX481941	Y	Y							Surface collection	Lithic scatter	(Ansell 1968a; Edwards *et al.* 1983)
Loch Doon N	East Ayrshire	NX483939	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon O	East Ayrshire	NX483937	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon P	East Ayrshire	NX484936	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon Q	East Ayrshire	NX482927	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon R	East Ayrshire	NX482928	Y	Y							Surface collection	Lithic scatter	(Edwards *et al.* 1983)
Loch Doon S	East Ayrshire	NS482016	Y	Y							Surface collection	Lithic scatter	(Affleck 1984c)
Loch Doon Starr 1a	East Ayrshire	NX483939	Y	Y							Surface collection	Lithic scatter; subsequently excavated	(Affleck 1984d; 1985a)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Loch Doon Starr 1b	East Ayrshire	NX488933	Y	Y							Surface collection	Lithic scatter	(Affleck 1985b)
Loch Doon Starr 1c	East Ayrshire	NX483929	Y	Y							Surface collection	Lithic scatter	(Affleck 1985a)
Loch Doon T	East Ayrshire	NS483004	Y	Y						Agate	Unknown	Lithic scatter?	(McFadzean *et al.* 1984b)
Loch Head A	East Ayrshire	NX486932	Y	Y							Surface collection	Lithic scatter	(Ansell 1968a)
Loch Head B	East Ayrshire	NX486935	Y	Y							Surface collection	Lithic scatter	(Ansell 1968a)
Loch Head C	East Ayrshire	NX484929	Y	Y							Surface collection	Lithic scatter	(Ansell 1968a; Edwards *et al.* 1983)
Loch Head D	East Ayrshire	NX485930	Y	Y							Surface collection	Lithic scatter	(Ansell 1969c)
Portmark A	East Ayrshire	NX493950								No raw material information	Unknown	Lithic scatter?	(Ansell 1968b)
Portmark B	East Ayrshire	NX488939								No raw material information	Unknown	Lithic scatter?	(Ansell 1968b)
Portmark C	East Ayrshire	NX487935								No raw material information	Unknown	Lithic scatter?	(Ansell 1968b)
Starr A	East Ayrshire	NX482939								No raw material information	Unknown	Lithic scatter?	(Ansell 1968c)
Starr B	East Ayrshire	NX483937								No raw material information	Unknown	Lithic scatter?	(Ansell 1968c)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Starr C	East Ayrshire	NX484931								No raw material information	Unknown	Lithic scatter?	(Ansell 1968c)
Kallin	Grimsay	NF875535									Palaeo-environmental core	N/A	(Edwards *et al.* 2005)
Tràigh an Teampuill	Harris	NF973913	Y				Y	Y			Excavation (intentional)	Occupation deposit	(Blake *et al.* 2012b; Church *et al.* 2012a; 2013a; Piper & Church 2015)
Northton	Harris	NF975912	Y				Y	Y		Hornfels	Excavation (intentional)	Occupation deposit	(Bishop *et al.* 2012a; Bishop *et al.* 2011a; 2011b; 2012b; Gregory *et al.* 2005)
Acharn Farm A	Highland	NM697504	Y	Y	Y		Y	Y		Quartzite, granite	Surface collection	Lithic scatter	(Rich Gray 1977; Thornber 1974a)
Acharn Farm B	Highland	NM697501	Y		Y		Y	Y		Quartzite	Surface collection	Lithic scatter	(Rich Gray 1977)
Applecross Manse	Highland	NG710457	Y		Y			Y			Surface collection	Lithic scatter; subsequently excavated	(Hardy & Wickham-Jones 2009a)
Baile Mhargait, Invernavar	Highland	NC700614	Y							Chalcedony	Surface collection	Lithic scatter	(Wickham-Jones & Firth 1990)
Barr River	Highland	NM615564	Y			Y				Tachylyte, silicified bole, silicified sediment	Surface collection	Lithic scatter; subsequently excavated	(Mercer 1979)
Bruach na Maorach	Highland	NM643675	Y					Y			Surface collection	Lithic scatter	(Lacaille 1954)
Cul na Croise/ Drynan Bay	Highland	NM622698	Y					Y			Surface collection	Lithic scatter	(Lacaille 1954)

Site Name	Location	NGR	Flint	Chert	Bloodstone	Pitchstone	Mudstone	Quartz	Limestone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Dahl Lay-by	Highland	NM792683	Y		Y			Y			Surface collection	Lithic scatter; subsequently excavated	(Pollard 1993)
Fearnmore 1	Highland	NG724608	Y		Y		Y	Y			Field-walking	Lithic scatter; subsequently excavated	(Hardy & Wickham-Jones 2009a)
Kentra Bay	Highland	NM645676	Y		Y						Unknown	Lithic scatter	(Thornber 1974b)
Kinlochaline Cottages	Highland	NM692477	Y								Excavation (accidental)	Lithic scatter	(Robertson 2004)
Loch Doilean	Highland	NM792682	Y		Y			Y		Other exotic stone	Excavation (intentional)	Lithic scatter	(Ellis 2015)
Lub Dubh Aird 1	Highland	NG872550	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Hardy 2014; Hardy *et al.* 2013)
Lub Dubh Aird 2	Highland	NG871550	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Hardy 2014; Hardy *et al.* 2013)
Lub Dubh Aird 3	Highland	NG873549	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Hardy 2014; Hardy *et al.* 2013)
Lub Dubh Aird 4	Highland	NG869552	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Hardy 2014; Hardy *et al.* 2013)
Redpoint	Highland	NG726685	Y	Y	Y		Y	Y			Surface collection	Lithic scatter; subsequently excavated	(Hardy & Wickham-Jones 2009a)
Rubh' An Achaidh Mhoir	Highland	NM663922	Y					Y			Unknown	Lithic scatter?	(Lacaille 1951)
Sand	Highland	NG684493	Y	Y	Y		Y	Y		Agate, rock crystal, jasper	Excavation (intentional)	Shell midden	(Cressey *et al.* 2001c; Finlayson *et al.* 1999a; Hardy & Wickham-Jones 2001; 2009b)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Sanna Bay	Highland	NM443691	Y		Y						Surface collection	Lithic scatter	(Crerar 1961)
Shieldaig	Highland	NG816523	Y			Y		Y			Excavation (accidental)	Lithic scatter	(Birch 2013; Hardy & Wickham-Jones 2009a; Walker 1973; Walker & Jardine 1974)
Shieldaig (new)	Highland	NG812558	Y								Surface collection	Lithic scatter	(Hardy 2015)
Smoo Cave	Highland	NC418671						Y			Excavation (intentional)	Occupation deposit	(Kiellar 1972; Pollard 1992)
Inchmarnock	Inch-marnock	NS023596	Y								Excavation (intentional)	Isolated find	(Conolly 2005)
Relig Odhran	Iona	NM285245	Y								Excavation (intentional)	Lithic scatter	(Barber 1979)
Aoradh	Islay	NR275675	Y					Y			Field-walking	Lithic scatter; subsequently excavated	(Mithen *et al.* 2000f)
Black Park Quarry	Islay	NR288638								No raw material information	Surface collection	Lithic scatter	(Mithen *et al.* 2000c)
Bolsay Farm	Islay	NR227571	Y			Y		Y			Surface collection	Lithic scatter; subsequently excavated	(Mithen 1990a; 1992; Mithen *et al.* 1992; Mithen *et al.* 2000d; Newall 1962b; Newall & Newall 1961a)
Bowmore 16	Islay	NR330612	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bowmore 4	Islay	NR328611	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bowmore 9	Islay	NR308570	Y								Field-walking	Lithic scatter; subsequently excavated	(Mithen *et al.* 2000e)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Bowmore10	Islay	NR321602	Y								Field-walking	Lithic scatter; subsequently excavated	(Mithen *et al.* 2000e)
Bridgend 1	Islay	NR345636								No raw material information	Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bridgend 11	Islay	NR347646	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bridgend 14	Islay	NR355648	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bridgend 5	Islay	NR345632								No raw material information	Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bridgend 7	Islay	NR357643								No raw material information	Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Bridgend 9	Islay	NR350641	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Cill Michael	Islay	NR243569	Y								Surface collection	Lithic scatter	(Newall 1962a; Newall & Newall 1961b)
Cnoc Seannda	Islay	NR391684	Y								Excavation (intentional)	Lithic scatter	(Caldwell 1997)
Coulererach	Islay	NR209654	Y					Y			Surface collection; Palaeo-environmental core	Lithic scatter; subsequently excavated	(Mithen & Finlay 2000)
Gleann Mor Site A	Islay	NR234582	Y			Y		Y			Surface collection	Lithic scatter; subsequently excavated	(Mithen 1989a; 1990b; Mithen & Finlayson 2000a)
Gruinart 13	Islay	NR284705								No raw material information	Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Gruinart 7	Islay	NR280670	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Kiells 3	Islay	NR420686								No raw material information	Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Kilchiarain Road Stone Quarry A	Islay	NR233582	Y								Surface collection	Lithic scatter	(Davies 1970; Newall 1959; 1960)
Kilchiarain Road Stone Quarry B	Islay	NR233585	Y								Surface collection	Lithic scatter	(Newall 1960)
Kilchiarain Road Stone Quarry C	Islay	NR235582	Y								Surface collection	Lithic scatter	(Newall 1960)
Kilchiarain Road Stone Quarry D	Islay	NR239582	Y								Surface collection	Lithic scatter	(Newall 1960)
Kilchiarain Road Stone Quarry E	Islay	NR232585	Y								Surface collection	Lithic scatter	(Newall 1960)
Kilellan Farm	Islay	NR286721	Y								Excavation (intentional)	Lithic scatter	(Burgess 1973; Mithen *et al.* 2000c)
Kindrochid	Islay	NR234685	Y			Y		Y			Surface collection	Lithic scatter; subsequently excavated	(Marshall & Mithen 2000)
Kindrochid 4	Islay	NR231686								No raw material information	Surface collection	Lithic scatter	(Mithen *et al.* 2000c)
Kindrochid area 2	Islay	NR238667	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Kindrochid area 3	Islay	NR214681	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Kindrochid ditch	Islay	NR232687								No raw material information	Surface collection	Lithic scatter	(Mithen *et al.* 2000c)
Loch a'Bhogaidh	Islay	NR225576									Palaeo-environmental core	N/A	(Edwards & Berridge 1994; Sugden 1999)
Loch Gorm 1	Islay	NR248649	Y					Y			Field-walking	Lithic scatter	(Mithen *et al.* 2000e)
Loch Gorm 10	Islay	NR229641	Y					Y			Field-walking	Lithic scatter	(Mithen *et al.* 2000c)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Loch Gorm 2	Islay	NR218637	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000e)
Loch Gorm 5	Islay	NR211676	Y								Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Loch Gorm 9	Islay	NR243647	Y					Y			Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Loch Gorm A	Islay	NR216646									Palaeo-environmental core	N/A	(Bunting *et al.* 2000)
Loch Gorm B	Islay	NR227666									Palaeo-environmental core	N/A	(Bunting *et al.* 2000)
Mulindry 10	Islay	NR373588								No raw material information	Field-walking	Lithic scatter	(Mithen *et al.* 2000c)
Newton	Islay	NR342626	Y								Excavation (intentional)	Lithic scatter	(McCullagh *et al.* 1989)
Port Charlotte	Islay	NR253585	Y								Surface collection	Lithic scatter	(Newall 1960)
Port Charlotte 3	Islay	NR260604	Y								Surface collection	Lithic scatter	(Mithen *et al.* 2000e)
Rockside	Islay	NR216636	Y								Field-walking	Lithic scatter; subsequently excavated	(Lowe & Dalland 1996; Mithen *et al.* 2000b)
Rubha Port an t-Seilich	Islay	NR430675	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Mithen *et al.* 2010a; Mithen & Wicks 2011b; 2014)
Scarrabus	Islay	NR348653								No raw material information	Surface collection	Lithic scatter	(Mithen *et al.* 2000c)
Sorn Valley	Islay	NR345620									Palaeo-environmental core	N/A	(Andrews in McCullagh *et al.* 1989)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Storakaig	Islay	NR396626	Y					Y			Surface collection	Lithic scatter; subsequently excavated	(Mithen *et al.* 2010b; Mithen & Wicks 2010; 2011c; 2012; Wicks & Mithen 2013)
Carn Southern Raised Beach	Jura	NR684937	Y					Y			Excavation (intentional)	Lithic scatter	(Searight 1990)
Glenbatrick Waterhole	Jura	NR518798	Y			Y		Y			Excavation (intentional)	Lithic scatter	(Mercer 1974)
Glengarrisdale	Jura	NR647968	Y								Excavation (intentional)	Lithic scatter	(Brabin 1984; Mercer & Searight 1986)
Kinuachdrach	Jura	NR706988	Y								Surface collection	Lithic scatter	(Campbell 1965)
Lealt Bay	Jura	NR662902	Y					Y			Excavation (intentional)	Lithic scatter	(Mercer 1968)
Lussa Bay	Jura	NR643868	Y								Field-walking	Lithic scatter	(Mercer 1969; Searight 1993)
Lussa River	Jura	NR644873	Y					Y			Excavation (intentional)	Lithic scatter	(Mercer 1971)
Lussa Wood	Jura	NR644874	Y			Y		Y		Brownstone and quartz crystal	Excavation (intentional)	Lithic scatter	(Mercer 1980)
North Carn	Jura	NR685939	Y					Y			Excavation (intentional)	Lithic scatter	(Mercer 1972)
Aird Calanais	Lewis	NB206335									Palaeo-environmental sample	N/A	(O'Brien *et al.* 2009)
Callanish	Lewis	NB209332									Palaeo-environmental core	N/A	(Bohncke 1988)
DLS'13 #30	Lewis	NB374464									Palaeo-environmental sample	N/A	(Piper *et al.* 2014; 2015)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Pabaigh Mòr South	Lewis	NB104372						Y			Excavation (intentional)	Shell midden	(Church & Rowley-Conwy 2014)
Tràigh na Beirigh	Lewis	NB100362	Y					Y			Excavation (intentional)	Shell midden	(Blake *et al.* 2012a; Church *et al.* 2012b; Church *et al.* 2013b; Piper & Church 2014)
Tràigh na Beirigh 2	Lewis	NB100363						Y			Excavation (intentional)	Shell midden	(Bishop *et al.* 2014a)
Tràigh na Beirigh 9	Lewis	NB100364						Y			Excavation (intentional)	Shell midden	(Snape-Kennedy *et al.* 2014)
Crait Dubh/Creit Dhu	Mull	NM408531								No raw material information	Surface collection	Lithic scatter; subsequently excavated	(Mithen *et al.* 2006; Mithen & Wicks 2011a)
Croig	Mull	NM401539								No raw material information	Surface collection	Lithic scatter; subsequently excavated	(Mithen *et al.* 2007b; Mithen & Wicks 2010)
Loch an t-Suidhe	Mull	NM371215									Palaeo-environmental core	N/A	(Sugden 1999)
Mull - various locations	Mull	NM500300	Y								Field-walking	Lithic scatter	(Anonymous 1993a)
Suidhe	Mull	NM371216								No raw material information	Excavation (intentional)	Occupation deposit	(Ellis 2009)
Tenga	Mull	NM512458								No raw material information	Excavation (accidental)	Lithic scatter	(Mithen *et al.* 2007b)
Torr Daraich	Mull	NM451404	Y								Surface collection	Isolated find	(Anonymous 1993b)
Dreghorn A	North Ayrshire	NS345373	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Dreghorn B	North Ayrshire	NS353375	Y								Unknown	Lithic scatter?	(Anonymous 1976)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Glenhead Farm	North Ayrshire	NS215455	Y								Surface collection	Isolated find	(Macneill 1965c)
Kilwinning	North Ayrshire	NS324425	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Portencross	North Ayrshire	NS181489	Y					Y			Surface collection	Lithic scatter	(Macneill 1973)
Seamill A	North Ayrshire	NS208465	Y								Surface collection	Lithic scatter	(Macneill 1973)
Seamill B	North Ayrshire	NS195480	Y					Y			Surface collection	Lithic scatter	(Macneill 1973)
Shewalton Moor	North Ayrshire	NS332367	Y					Y		Jasper, chalcedony	Surface collection	Lithic scatter	(Lacaille 1930; Macneill 1965d; Williams 1967b)
Stevenson	North Ayrshire	NS280425	Y								Unknown	Lithic scatter?	(Anonymous 1976)
West Kilbride A	North Ayrshire	NS199504	Y								Surface collection	Lithic scatter	(Macneill 1973)
West Kilbride B	North Ayrshire	NS202506	Y								Surface collection	Lithic scatter	(Macneill 1973)
West Kilbride C	North Ayrshire	NS202508	Y								Surface collection	Lithic scatter	(Macneill 1973)
West Kilbride D	North Ayrshire	NS187513	Y								Unknown	Lithic scatter?	(Anonymous 1976)
West Kilbride E	North Ayrshire	NS198506	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Caisteal nan Gillean I	Oronsay	NR358879	Y							Stone, bone & antler 'limpet scoops'	Excavation (intentional)	Shell midden	(Mellars 1987)
Caisteal nan Gillean II	Oronsay	NR358880	Y							Stone, bone & antler 'limpet scoops'	Excavation (intentional)	Shell midden	(Mellars 1987)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Cnoc Coig	Oronsay	NR360885	Y					Y		Stone 'limpet scoops'	Excavation (intentional)	Shell midden	(Mellars 1987)
Cnoc Sligeach	Oronsay	NR372890	Y							Stone 'limpet scoops'	Excavation (intentional)	Shell midden	(Mellars 1971; 1987)
Priory Midden	Oronsay	NR347889								No raw material information	Excavation (intentional)	Shell midden	(Jardine 1973; Mellars 1987)
Clachan Harbour	Raasay	NG554364					Y			Skye tuff	Excavation (intentional)	Lithic scatter	(Ballin *et al.* 2011)
North Bay	Raasay	NG546367								No raw material information	Excavation (intentional)	Occupation deposit	(Wildgoose 2004)
Bishopton	Renfrew-shire	NS433725	Y								Surface collection	Lithic scatter	(Macneill *et al.* 1994)
Renfrew	Renfrew-shire	NS517666								No raw material information. Stone mace-head	Surface collection	Isolated find	(Scott 1958)
Bealach a'Braigh Bhig	Rum	NM340990	Y								Surface collection	Isolated find	(Saville 2008)
Kinloch Farm Fields	Rum	NM401998	Y		Y	Y		Y	Y	Agate - only flint and bloodstone artefacts analysed	Surface collection; Palaeo-environmental core	Lithic scatter; subsequently excavated	(Wickham-Jones 1990c; Wickham-Jones & Pollock 1985; 1986; Wickham-Jones *et al.* 1984)
Risga	Risga	NM611599	Y					Y			Excavation (intentional)	Shell midden	(Atkinson *et al.* 1993; Pollard *et al.* 1994; 1996)
Scalpay 6a	Scalpay	NG587293	Y		Y		Y	Y		Pumice, volcanic glass	Field-walking	Lithic scatter; subsequently excavated	(Hardy & Wickham-Jones 2009a)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Scalpay 7	Scalpay	NG590289	Y		Y			Y			Field-walking	Lithic scatter	(Hardy & Wickham-Jones 2009a)
Scalpay 8	Scalpay	NG589293	Y		Y						Excavation (intentional)	Lithic scatter	(Hardy & Wickham-Jones 2009a)
An Corran A	Skye	NG490685	Y								Excavation (accidental)	Shell midden	(Hardy & Wickham-Jones 2009a; Saville 1998a; Saville *et al.* 2012b; Saville & Miket 1994b; 1994a)
An Corran C	Skye	NG487684	Y				Y	Y		Volcanic glass	Field-walking	Lithic scatter	(Hardy & Wickham-Jones 2002a; 2009a)
An Corran E	Skye	NG489683	Y		Y		Y	Y			Field-walking	Lithic scatter	(Hardy & Wickham-Jones 2009a)
An Corran F	Skye	NG486682	Y				Y				Field-walking	Lithic scatter	(Hardy & Wickham-Jones 2009a)
Camas Daraich	Skye	NG567000			Y		Y			Coarse stone, pumice	Excavation (accidental)	Lithic scatter	(Birch *et al.* 2001; Cressey 2002; Cressey *et al.* 2001a; Wickham-Jones & Hardy 2004a)
Kati's Bay	Skye	NG256425			Y		Y	Y		Chalcedony, agate, rock crystal	Surface collection	Lithic scatter; subsequently excavated	(Kozikowski *et al.* 1999)
Loch a Sguirr 1	Skye	NG608528	Y				Y	Y			Excavation (intentional)	Shell midden	(Hardy & Wickham-Jones 2009a)
Ballantrae A	South Ayrshire	NX087818	Y								Surface collection	Lithic scatter	(Edgar 1939; Lacaille 1945; Macneill 1965a)
Ballantrae B	South Ayrshire	NX084814	Y								Surface collection	Lithic scatter	(Macneill 1965a)
Bower Hill	South Ayrshire	NS282182	Y								Surface collection	Lithic scatter	(Macneill 1973)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Crossraguel Abbey	South Ayrshire	NS273085	Y			Y					Surface collection	Lithic scatter	(Macneill 1965b)
Culzean Bay	South Ayrshire	NS246118	Y								Field-walking	Lithic scatter	(Addyman 1998)
Dowhill Farm	South Ayrshire	NS204035	Y								Surface collection	Lithic scatter	(Macneill 1973)
Dunure A	South Ayrshire	NS249144	Y								Surface collection	Isolated find	(Macneill 1973)
Dunure B	South Ayrshire	NS258166	Y								Surface collection	Lithic scatter	(Macneill 1973)
Dunure C	South Ayrshire	NS262171	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Dunure D	South Ayrshire	NS249129	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Enoch Farm	South Ayrshire	NX204987	Y								Surface collection	Lithic scatter	(Macneill 1973)
Girvan A	South Ayrshire	NS223001	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan B	South Ayrshire	NX199997	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan C	South Ayrshire	NX200997	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan D	South Ayrshire	NS209000	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan E	South Ayrshire	NX210998	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan F	South Ayrshire	NX209993	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan G	South Ayrshire	NX213996	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Girvan H	South Ayrshire	NX214997	Y								Unknown	Lithic scatter?	(Anonymous 1976)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Girvan Mains	South Ayrshire	NX192991								Limpet scoop of fine-grained igneous rock	Excavation (intentional)	Isolated find	(St Joseph & Maxwell 1982)
Girvan Mains Farm A	South Ayrshire	NX186988	Y								Surface collection	Lithic scatter	(Macneill 1973)
Girvan Mains Farm B	South Ayrshire	NX192999	Y								Surface collection	Lithic scatter	(Macneill 1973)
Girvan Mains Farm C	South Ayrshire	NS195000	Y								Surface collection	Lithic scatter	(Macneill 1973)
Greenan	South Ayrshire	NS314187								No raw material information	Excavation (intentional)	Lithic scatter	(Engl 2011; 2012)
Knockdolian	South Ayrshire	NX121850	Y								Surface collection	Isolated find	(Wright 2013)
Maidens	South Ayrshire	NS210075	Y								Surface collection	Lithic scatter	(Macneill 1973)
Monkton A	South Ayrshire	NS350280								No raw material information	Field-walking	Lithic scatter	(Cameron 2001)
Monkton B	South Ayrshire	NS354282	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Prestwick A	South Ayrshire	NS377259	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Prestwick B	South Ayrshire	NS369261	Y								Unknown	Lithic scatter?	(Anonymous 1976)
Turnberry Hotel Outdoor Pursuits Centre	South Ayrshire	NS207065								No raw material information	Excavation (intentional)	Lithic scatter	(MacGregor 2002)
Avondale Parish A	South Lanarkshire	NS612346								Agate microlith	Unknown	Isolated find	(McFadzean *et al.* 1984a)

Site Name	Location	NGR	Flint	Chert	Bloodstone	Pitchstone	Mudstone	Quartz	Limestone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Brown Hill	South Lanarkshire	NS678337								No raw material information	Unknown	Lithic scatter	(McFadzean *et al.* 1984a)
Carmichael Church	South Lanarkshire	NS924383								No raw material information	Field-walking	Lithic scatter; subsequently excavated	(Lelong *et al.* 1999)
Charleston Farm	South Lanarkshire	NS917418		Y							Field-walking	Lithic scatter	(Archer 2001)
Coom Rig (Daer Valley) Site 84	South Lanarkshire	NS952103	Y	Y							Surface collection	Lithic scatter; subsequently excavated	(Ward 2006a)
Coom Rig (Daer Valley) Site 85	South Lanarkshire	NS951102	Y	Y							Surface collection	Lithic scatter; subsequently excavated	(Ward 2006b)
Crookedstane Farm	South Lanarkshire	NS969161	Y	Y							Excavation (intentional)	Lithic scatter	(Anonymous 1991)
Daer Reservoir 3, Crawford	South Lanarkshire	NS975078	Y								Surface collection	Lithic scatter; subsequently excavated	(Ward 2001)
Daer Reservoir 1, Crawford	South Lanarkshire	NS986082	Y	Y						Siltstone	Surface collection	Lithic scatter; subsequently excavated	(Ward 1995; 1997)
Daer Reservoir 2, Crawford	South Lanarkshire	NS984080		Y							Surface collection	Lithic scatter; subsequently excavated	(Ward 1997)
Daer Reservoir O	South Lanarkshire	NS968071		Y							Surface collection	Lithic scatter; subsequently excavated	(Ward 2001; 2004)
Glentaggart	South Lanarkshire	NS798266		Y						Chalcedony	Excavation (intentional)	Lithic scatter	(Ballin & Johnson 2005; Mitchell 2002; Mitchell & Neighbour 2003)

Site Name	Location	NGR	Flint	Chert	Blood-stone	Pitch-stone	Mud-stone	Quartz	Lime-stone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
Hare Hill/Climpy	South Lanarkshire	NS922546		Y							Excavation (intentional)	Lithic scatter	(Duncan 1997)
Lanark Racecourse	South Lanarkshire	NS901429		Y							Surface collection	Isolated find	(Archer 1985)
Midlinbank Farm	South Lanarkshire	NS663409	Y	Y						Agate	Unknown	Lithic scatter	(McFadzean *et al.* 1984a)
Shieloans	South Lanarkshire	NS627365		Y						Agate	Unknown	Lithic scatter	(McFadzean *et al.* 1984a)
Snabe Gravel Pit	South Lanarkshire	NS648387		Y						Agate	Unknown	Lithic scatter	(McFadzean *et al.* 1984a)
Loch Airigh na h-Aon Oidhche	South Uist	NF796257									Palaeo-environmental core	N/A	(Edwards *et al.* 1995)
Loch an t-Sil	South Uist	NF736235									Palaeo-environmental core	N/A	(Edwards *et al.* 1995)
Loch Lang	South Uist	NF806295									Palaeo-environmental core	N/A	(Bennett *et al.* 1990)
North Locheynort	South Uist	NF775293									Palaeo-environmental core	N/A	(Edwards 1990)
Peninerine	South Uist	NF737353									Palaeo-environmental core	N/A	(Edwards *et al.* 1995)
Balephuil Bay	Tiree	NL946407								No raw material information	Surface collection	Lithic scatter	(Mithen *et al.* 2007c)
Ballevullin	Tiree	NL950460	Y								Excavation (intentional)	Isolated find	(Livens 1956a; MacKie 1963)
A'Chrannag 1	Ulva	NM432391									Palaeo-environmental core	N/A	(Sugden 1999)

Site Name	Location	NGR	Flint	Chert	Bloodstone	Pitchstone	Mudstone	Quartz	Limestone	Other Raw Material	Initial Identification	Subsequent Interpretation	References
A'Chrannag 2	Ulva	NM432389									Palaeo-environmental core	N/A	(Sugden 1999)
Ulva Cave	Ulva	NM431384	Y		Y?	Y		Y		Some raw material may be intrusive	Excavation (intentional)	Occupation deposit	(Bonsall *et al.* 1991; Bonsall *et al.* 1992; Bonsall *et al.* 1994; Pickard 2013; Russell *et al.* 1995)

Appendix 2 Catalogue of Radiocarbon Dated Mesolithic Sites (to June 2016) in Western Scotland and the Hebrides

Table 48. Catalogue of radiocarbon dated Mesolithic sites (to June 2016) in Western Scotland and the Hebrides

Site Name	Location	Material	Description	Laboratory No.	Date BP	Cal. BC (95.4%)	d13C	References
Carding Mill Bay	Argyll	Antler	A bevel-ended antler artefact recovered from a shell midden	OxA-3740	5190±85	4236-3796	-20.5	(Bonsall & Smith 1992; Hedges *et al.* 1993)
Carding Mill Bay	Argyll	Marine shell	Shells (*Patella* sp.) recovered from context XIV - an early shell midden layer	GU-2898	5410±60	4080-3691		(Connock *et al.* 1992; Wicks *et al.* 2014)
Carding Mill Bay	Argyll	Marine shell	Shells *(Patella* sp.) recovered from context XV - an early shell midden layer	GU-2899	5440±50	4140-3750		(Connock *et al.* 1992; Wicks *et al.* 2014)
Druimvargie	Argyll	Bone (mammal?)	A bevel-ended bone artefact (HL416) recovered from a midden	OxA-4608	8340±80	7596-7177	-22.1	(Bonsall *et al.* 1995; Hedges *et al.* 1990; Hedges *et al.* 1998)
Druimvargie	Argyll	Bone (mammal?)	A bevel-ended bone artefact (HL424) recovered from a midden	OxA-4609	7890±80	7042-6600	-22.6	(Bonsall *et al.* 1995; Hedges *et al.* 1998)
Druimvargie	Argyll	Bone (mammal?)	A uniserial barbed bone point recovered from a midden	OxA-1948	7810±90	7028-6467	-21	(Bonsall & Smith 1989; Hedges *et al.* 1990)
Lón Mór	Argyll	Hazel nutshell	Nutshell recovered from an organic-rich horizon containing lithic artefacts, burnt bone, charcoal, and charred hazel nutshell	AA-8793	7385±60	6395-6095		(Bonsall *et al.* 1993)
Low Nerabus	Argyll	Wood	Willow recovered from occupation deposit comprising two postholes, two gullies, and two pit hearths	Unknown	-	7194-7069		(Ellis 2014)
MacArthur's Cave	Argyll	Antler	A biserial barbed antler point recovered from a shell midden	OxA-1949	6700±80	5728-5489	-21	(Bonsall & Smith 1989; Hedges *et al.* 1990)
Raschoille	Argyll	Mammal bone	A bevel-ended bone artefact (red deer metapodial) recovered from lower deposits in a cave	OxA-8398	7480±75	6469-6216	-21.6	(Ashmore in Bronk Ramsey *et al.* 2002; Bonsall 1999)
Raschoille	Argyll	Hazel nutshell	Hazel nutshell recovered from lower deposits in a cave	OxA-8439	7250±55	6225-6021	-25.1	(Ashmore in Bronk Ramsey *et al.* 2002; Bonsall 1999)
Raschoille	Argyll	Mammal bone	A bevel-ended bone artefact (red deer metatarsal) recovered from lower deposits in a cave	OxA-8535	7265±80	6352-5990	-21.4	(Ashmore in Bronk Ramsey *et al.* 2002; Bonsall 1999)
Auchareoch	Arran	Hazel nutshell	Nutshell recovered from a platform fire-spot	OxA-1599	7300±90	6373-6015	-26	(Affleck *et al.* 1988; Hedges *et al.* 1989)
Auchareoch	Arran	Wood charcoal	Charcoal (oak) recovered from west quarry face; stratigraphic integrity less than satisfactory	OxA-1600	7870±90	7046-6515	-26	(Affleck *et al.* 1988; Hedges *et al.* 1989)

Auchareoch	Arran	Hazel nutshell	Nutshell recovered from south quarry pit	OxA-1601	8060±90	7303-6692	-26	(Affleck *et al.* 1988; Hedges *et al.* 1989)
Fiskary Bay	Coll	Hazel nutshell	Nutshell recovered from the upper levels of a beach sand overlain by mid- to late Holocene coastal sediments; also see Beta-251109, Beta-251111-251113, Beta-251115 and Beta-234855	Beta-251114	7460±50	6425-6236	-22.9	(Wicks *et al.* 2014)
Fiskary Bay	Coll	Hazel nutshell	Nutshell recovered from the upper levels of a beach sand overlain by mid- to late Holocene coastal sediments; also see Beta-251109, Beta-251111, Beta-251112-Beta-251115 and Beta-234855	Beta-251111	7470±50	6429-6240	-23.9	(Wicks *et al.* 2014)
Fiskary Bay	Coll	Hazel nutshell	Nutshell recovered from the upper levels of a beach sand overlain by mid- to late Holocene coastal sediments; also see Beta-251111-251115 and Beta-234855	Beta-251109	7730±60	6557-6457	-25.1	(Wicks *et al.* 2014)
Fiskary Bay	Coll	Hazel nutshell	Nutshell recovered from the upper levels of a beach sand overlain by mid- to late Holocene coastal sediments; also see Beta-251109, Betal-251111, Beta-251113-Beta-251115 and Beta-234855	Beta-251112	7760±50	6678-6477	-24.4	(Wicks *et al.* 2014)
Fiskary Bay	Coll	Hazel nutshell	Nutshell recovered from the upper levels of a beach sand overlain by mid- to late Holocene coastal sediments; also see Beta-251109, Beta-251111-Beta-251112, Beta-251114-Beta-251115 and Beta-234855	Beta-251113	8070±50	7181-6819	-25.3	(Wicks *et al.* 2014)
Fiskary Bay	Coll	Hazel nutshell	Nutshell recovered from the upper levels of a beach sand overlain by mid- to late Holocene coastal sediments; also see Also see Beta-251109 and Beta-251111-Beta-251115	Beta-234855	8200±50	7351-7066	-26.1	(Wicks *et al.* 2014)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 1 in shallow pit F24 primarily containing hazel nutshells	AA-21619	7760±55	6683-6473	-24.8	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 4 in shallow pit F24 primarily containing hazel nutshells. REDATED (AA-26227)	AA-21620	7040±55	6020-5792	-25.5	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 2 in shallow pit F24 primarily containing hazel nutshells	AA-21621	7780±55	6747-6473	-25.6	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 3 in shallow pit F24 primarily containing hazel nutshells	AA-21622	7660±55	6610-6428	-25.7	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 2 in shallow pit F24 primarily containing hazel nutshells	AA-21623	7665±55	6611-6431	-27.6	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 2 in shallow pit F24 primarily containing hazel nutshells	AA-21624	7935±55	7040-6661	-25.1	(Mithen 1997b)

Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from lower fill C57 in stone-lined pit F41, 2m from shallow pit (AA-21619 to AA-21624); also see AA-21626	AA-21625	7780±55	6747-6473	-25.5	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell from upper fill C42 of stone-lined pit F41; also see AA-21625	AA-21626	7480±55	6437-6240	-26.6	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell from C48 in small pit F49	AA-21627	8110±60	7320-6831	-25.1	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell from upper fill C31 of pebble-filled amorphous feature F30 interpreted as a post-hole/pit	AA-21629	5415±60	4360-4055	-23.4	(Mithen 1997b)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from C17 at the base of shallow pit F24 primarily containing hazel nutshells; also see AA-21619 to AA-21624 and AA-26227	Q-3278	7720±110	7022-6381		(Mithen *et al.* 2000a)
Staosnaig	Colonsay	Hazel nutshell	Nutshell recovered from Spit 4 in shallow pit F24 primarily containing hazel nutshells; also see AA-21619 to AA-21624 and Q-3278. REDATED AA-21620	AA-26227	7420±65	6432-6102		(Mithen *et al.* 2000a)
Barsalloch	Dumfries and Galloway	Wood charcoal	A layer of wood charcoal (no species specified) recovered from square H7 below a stone setting	GaK-1601	6000±110	5216-4618		(Cormack 1970)
Cumstoun	Dumfries and Galloway	Antler	A biserial antler barbed point recovered from the bed of the River Dee, isolated find	OxA-3735	6665±70	5706-5484	-21.4	(Bonsall & Smith 1992; Hedges *et al.* 1993; Lacaille 1954)
Smittons	Dumfries and Galloway	Hazel nutshell	Nutshell recovered from a fire spot in Trench T1	OxA-1595	6260±80	5464-5003	-26	(Hedges *et al.* 1989; Tolan-Smith 2008)
Smittons	Dumfries and Galloway	Hazel nutshell	Nutshell recovered from a fire spot in Trench T3	OxA-1594	5470±80	4464-4057	-26	(Hedges *et al.* 1989; Tolan-Smith 2008)
Starr 1	East Ayrshire	Wood charcoal	Charcoal (*Corylus*) recovered from a fire spot 38m south of the 1989 trench 2	OxA-1596	6230±80	5370-4981	-26	(Hedges et al. 1989; Tolan-Smith 2008)
Cramond	Edinburgh	Hazel nutshell	Recovered from CR95/1066 from context 1431, fill of scoop 1432, cut into the N side of pit 1430, sealed by context 1409	OxA-10180	9250±60	8621-8308	-26.03	(Ashmore in Bronk Ramsey *et al.* 2002; Lawson 2001)
Cramond	Edinburgh	Hazel nutshell	Recovered from CR95/291 from context 1409	OxA-10145	9230±50	8596-8302	-24.89	(Ashmore in Bronk Ramsey *et al.* 2002; Lawson 2001)
Cramond	Edinburgh	Hazel nutshell	Recovered from CR95/958 from context 1426, level K, fill of pit 1430	OxA-10179	9130±65	8542-8247	-23.95	(Ashmore in Bronk Ramsey *et al.* 2002; Lawson 2001)
Cramond	Edinburgh	Hazel nutshell	Recovered from CR95/956 from context 1426, level M, fill of pit 1430	OxA-10178	9105±65	8537-8229	-23.34	(Ashmore in Bronk Ramsey *et al.* 2002; Lawson 2001)
Cramond	Edinburgh	Hazel nutshell	Recovered from CR95/74 from context 1409, sealing pits below and sealed by possible topsoil	OxA-10143	9150±45	8532-8278	-23.48	(Ashmore in Bronk Ramsey *et al.* 2002; Lawson 2001)
Cramond	Edinburgh	Hazel nutshell	Recovered from CR95/283 from context 1402; fill of truncated pit 1425 sealed by context 1409	OxA-10144	9110±60	8532-8236	-23.09	(Ashmore in Bronk Ramsey *et al.* 2002; Lawson 2001)

Northton	Harris	Hazel nutshell	Nutshell (Sample A - AMS26) recovered from context 5 in a possible occupation horizon (context 7) sealed by context 10 which may also represent an occupation layer associated with the Neolithic 1 phase of the site; also see AA-50333 and AA-50334	AA-50332	7525±80	6560-6226	-24.4	(Gregory 2003)
Northton	Harris	Hazel nutshell	Nutshell (Sample B - AMS27) recovered from context 5 in a possible occupation horizon (context 7) sealed by context 10 which may also represent an occupation layer associated with the Neolithic 1 phase of the site; also see AA-50332 and AA-50334	AA-50333	7395±45	6396-6104	-23.7	(Gregory 2003)
Northton	Harris	Hazel nutshell	Nutshell (Sample C - AMS28) recovered from context 5 in a possible occupation horizon (context 7) sealed by context 10 which may also represent an occupation layer associated with the Neolithic 1 phase of the site; also see AA-50332 and AA-50333	AA-50334	7420±45	6403-6220	-24.1	(Gregory 2003)
Northton	Harris	Hazel nutshell	Nutshell (Sample D - AMS29) recovered from context 7 in a possible anthropogenic horizon above natural boulder clay and sealed by context 5; also see AA-50336	AA-50335	7980±50	7051-6700	-24	(Gregory 2003)
Northton	Harris	Hazel nutshell	Nutshell (Sample E - AMS30) recovered from context 7 in a possible anthropogenic horizon above natural boulder clay and sealed by context 5; also see AA-50335	AA-50336	7925±55	7032-6659	-26.3	(Gregory 2003)
Northton	Harris	Hazel nutshell	Nutshell recovered from an old ground surface (014)	SUERC-33736	7470±30	6417-6251	-23.5	(Bishop *et al.* 2012a; Bishop *et al.* 2011a; Church pers. comm.)
Northton	Harris	Hazel nutshell	Nutshell recovered from an old ground surface (014)	SUERC-33737	7440±30	6391-6241	-23.3	(Bishop *et al.* 2012a; Bishop *et al.* 2011a; Church pers. comm.)
Northton	Harris	Hazel nutshell	Nutshell recovered from an old ground surface (014)	SUERC-34911	7460±40	6416-6241	-25	(Bishop *et al.* 2012a; Bishop *et al.* 2011a; Church pers. comm.)
Northton	Harris	Hazel nutshell	Nutshell recovered from an old ground surface (014)	SUERC-34912	7400±40	6395-6121	-21.9	(Bishop *et al.* 2012a; Bishop *et al.* 2011a; Church pers. comm.)
Tràigh an Teampuill	Harris	Hazel nutshell	Nutshell recovered from an old ground surface (003)	SUERC-38832	6750±30	5713-5624	-23.2	(Blake *et al.* 2012b; Church pers. comm.)
Tràigh an Teampuill	Harris	Hazel nutshell	Nutshell recovered from an old ground surface (003)	SUERC-38833	6690±30	5662-5556	-23.8	(Blake *et al.* 2012b; Church pers. comm.)
Tràigh an Teampuill	Harris	Hazel nutshell	Nutshell recovered from a shell midden (007)	SUERC-38834	6525±30	5557-5386	-27.3	(Blake *et al.* 2012b; Church pers. comm.)
Tràigh an Teampuill	Harris	Hazel nutshell	Nutshell recovered from a shell midden (007)	SUERC-38838	6735±30	5715-5576	-24.9	(Blake *et al.* 2012b; Church pers. comm.)

Sand	Highland	Mammal bone	A bevel-ended bone artefact (N62) recovered from sample B24A NE Spit 8 - a loose unconsolidated limpet midden (013) overlying a rock fall and covered by crushed shell and turf	OxA-12096 (OxA-10152)	8470±90	7703-7309	-22.12	(Ashmore in Bronk Ramsey *et al.* 2002; Hardy & Wickham-Jones 2001)
Sand	Highland	Antler	A piece of antler (Sample 9/8) recovered from Spit 8 at the outer edge of a midden; also see OxA-9281 and OxA-9343	OxA-9280	7520±50	6461-6253	-21.75	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001c)
Sand	Highland	Mammal bone	A bevel-ended bone artefact recovered from Spit 8 at the outer edge of a midden; also see OxA-9280 and OxA-9343	OxA-9281	7715±55	6643-6462	-21.31	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001c)
Sand	Highland	Mammal bone	A bevel-ended bone artefact (N18) recovered from Spit 7 of a midden	OxA-9282	7545±50	6477-6257	-20.83	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001c)
Sand	Highland	Wood charcoal	A piece of charcoal (birch), (Sample 9/8) recovered from Spit 8 at the outer edge of a midden; also see OxA-9281 and OxA-9280	OxA-9343	7765±50	6679-6479	-24.60	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001c)
Sand	Highland	Mammal bone	A bevel-ended bone artefact (N60) recovered from sample B24B NE Spit 7 - a loose unconsolidated limpet midden (013) overlying a rock fall and covered by crushed shell and turf	OxA-16487 (OxA-10175)	7666±45	6596-6441		(Ashmore in Bronk Ramsey *et al.* 2002; Sheridan & Higham 2007)
Sand	Highland	Mammal bone	A bevel-ended bone artefact recovered from sample A1B NE Spit 9 - a shell-free organic midden (022) overlying a sterile palaeosol and covered by the main shell midden	OxA-16488 (OxA-10176)	6497±44	5542-5365		(Ashmore in Bronk Ramsey *et al.* 2002; Sheridan & Higham 2007)
Sand	Highland	Mammal bone	A bevel-ended bone artefact recovered from sample A2B SW Spit 10 - a shell-free organic midden (022) overlying a sterile palaeosol and covered by the main shell midden	OxA-16489 (OxA-10177)	6343±43	5466-5221		(Ashmore in Bronk Ramsey *et al.* 2002; Sheridan & Higham 2007)
Bolsay Farm	Islay	Wood charcoal	Charcoal (*Corylus*) recovered from Trench 2, context 4 (underlies context 5); also see AA-21633	AA-21632	7400±55	6412-6101	-24.3	(Mithen 1997a)
Bolsay Farm	Islay	Wood charcoal	Charcoal (*Alnus*) recovered from Trench 2, context 4 (underlies context 5); also see AA-21632	AA-21633	6810±55	5808-5623	-26.2	(Mithen 1997a)
Bolsay Farm	Islay	Wood charcoal	Bulk sample of charcoal (no species specified) recovered from Trench 1, context 16 (pit fill)	Q-3219	7250±145	6425-5847		(Mithen *et al.* 2000d)
Coulererach	Islay	Wood charcoal	Charcoal (no species specified) recovered from the base of a peat monolith from the lower artefact bearing horizon in Trench 1, sealed by peat	OxA-4924	7530±80	6561-6228	-26.4	(Bunting *et al.* 2000; Mithen & Finlay 2000)
Gleann Mor	Islay	Wood charcoal	Charcoal (no species specified) recovered from Trench 1, spit 2; high risk of contamination likely	Beta-32228	7100±125	6222-5737		(Mithen & Finlayson 2000a)
Newton	Islay	Hazel nutshell	Nutshell recovered from the surface layer in F35, Area 2	GU-1953	7765±225	7305-6216		(McCullagh *et al.* 1989)
Newton	Islay	Hazel nutshell	Nutshell recovered from the basal layer in F35, Area 2	GU-1954	7805±90	7027-6464		(McCullagh *et al.* 1989)

Rockside	Islay	Wood charcoal	Charcoal (no species specified) recovered from exposed section of Trench 1, context 10 (below contexts 8 and 9)	Beta-37624	6800±40	5741-5631	-25	(Mithen *et al.* 2000b)
Rubha Port an t-Seilich	Islay	Hazel nutshell	Nutshell recovered from c.177 exposed at the base of Test-pit 0/15 that was shown to overlie bedrock	Beta-288425	7010±50	5998-5775	-23.4	(Wicks *et al.* 2014)
Rubha Port an t-Seilich	Islay	Hazel nutshell	Nutshell recovered from c.34 exposed at the base of Test-pit 0/10 that was shown to overlie bedrock	Beta-288424	7540±40	6467-6266	-24.3	(Wicks *et al.* 2014)
Rubha Port an t-Seilich	Islay	Hazel nutshell	Nutshell recovered from c.132 exposed at the base of test-pit 10/5 that was shown to overlie bedrock	Beta-288428	7660±40	6591-6444	-21.6	(Wicks *et al.* 2014)
Rubha Port an t-Seilich	Islay	Hazel nutshell	Nutshell recovered from c.153 exposed at the base of Test-pit 0/5 that was shown to overlie bedrock	Beta-288423	7820±40	6774-6530	-25	(Wicks *et al.* 2014)
Rubha Port an t-Seilich	Islay	Hazel nutshell	Nutshell recovered from c.166 exposed at the base of test-pit 5/0 that was shown to overlie bedrock	Beta-288426	8230±40	7447-7082	-25.1	(Wicks *et al.* 2014)
Rubha Port an t-Seilich	Islay	Hazel nutshell	Nutshell recovered from c.142 exposed at the base of test-pit 5/15 that was shown to overlie bedrock	Beta-288427	8240±40	7451-7084	-24.8	(Wicks *et al.* 2014)
Storakaig	Islay	Hazel nutshell	Nutshell recovered from exposed section in ditch upthrow upon identification of the site in 2009, likely context 106	Beta-264734	5350±50	4327-4048	23.9	(Wicks *et al.* 2014)
Storakaig	Islay	Hazel nutshell	Nutshell recovered from context 106 grid square J2; also see Beta-288430	Beta-288431	5130±40	4037-3800	-23.3	(Wicks *et al.* 2014)
Storakaig	Islay	Hazel nutshell	Nutshell recovered from context 106 in grid square A4	Beta-307787	5540±40	4456-4335	-21.3	(Wicks *et al.* 2014)
Storakaig	Islay	Hazel nutshell	Nutshell recovered from context 106 in grid square C12	Beta-307788	5250±40	4230-3973	-24.3	(Wicks *et al.* 2014)
Glenbatrick Waterhole	Jura	Wood charcoal	Charcoal (*Quercus*) recovered from the fill of a trough	GX-2564	5045±215	4335-3374		(Mercer 1974)
Lussa Wood 1	Jura	Wood charcoal	Charcoal (hawthorn) recovered from the base of the NE stone ring	SRR-160	8194±350	8197-6430		(Mercer 1980)
Lussa Wood 1	Jura	Wood charcoal	Charcoal (hawthorn and ?maple) recovered from the centre and SW stone rings	SRR-159	7963±200	7451-6459		(Mercer 1980)
North Carn	Jura	Wood charcoal	Bulk sample of charcoal (no species specified) recovered from a stone setting	SRR-161	7414±80	6431-6096		(Mercer 1972)
DLS'13 #30	Lewis	Charcoal	Charred deciduous roundwood fragment (*Calluna* sp.)	SUERC-55370	5583±27	4460-4355	-26.8	(Piper *et al.* 2015)
Tràigh na Beirigh 1	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (008)	SUERC-33731	5415±30	4341-4233	-27.4	(Blake *et al.* 2012a; Church pers. comm.)
Tràigh na Beirigh 1	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (008)	SUERC-33732	5415±30	4341-4233	-26.9	(Blake *et al.* 2012a; Church pers. comm.)
Tràigh na Beirigh 1	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (008)	SUERC-34902	5355±35	4325-4053	-26	(Blake *et al.* 2012a; Church pers. comm.)

Tràigh na Beirigh 1	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (008)	SUERC-34903	5280±35	4233-3994	-27.9	(Blake *et al.* 2012a; Church pers. comm.)
Tràigh na Beirigh 2	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (005)	SUERC-44850	5687±18	4549-4462	-24.5	Church pers. comm.
Tràigh na Beirigh 2	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (005)	SUERC-44854	5677±23	4548-4457		Church pers. comm.
Tràigh na Beirigh 2	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (005)	SUERC-44855	5654±23	4542-4450		Church pers. comm.
Tràigh na Beirigh 2	Lewis	Hazel nutshell	Nutshell recovered from a shell midden (005)	SUERC-44856	5692±23	4582-4459		Church pers. comm.
Tràigh na Beirigh 9	Lewis	Hazel nutshell	Nutshell recovered from old ground surface deposit (006)	SUERC-55365	5372±26	4330-4071	-24.7	Church pers. comm.
Tràigh na Beirigh 9	Lewis	Hazel nutshell	Nutshell recovered from old ground surface deposit (006)	SUERC-55366	5297±27	4233-4044	-25.8	Church pers. comm.
Tràigh na Beirigh 9	Lewis	Human bone	Tooth recovered from burial within shell midden (005)	SUERC-56982	5143±33	3892-3539	-15.2	Church pers. comm.
Crait Dubh	Mull	Hazel nutshell	Nutshell recovered from black organic-rich fill of a linear feature	Beta-221402	7830±80	7028-6481	-26.4	(Wicks *et al.* 2014)
Crait Dubh	Mull	Wood charcoal	Wood charcoal (unidentified) twig recovered from black organic-rich spread of cultural material which overlies the linear feature	Beta-288420	7900±40	7027-6646	-25.5	(Wicks *et al.* 2014)
Crait Dubh	Mull	Hazel nutshell	Nutshell recovered from fill of intercutting pit complex denoting initial phase of activity	Beta-288421	9080±40	8419-8233	-29.3	(Wicks *et al.* 2014)
Suidhe	Mull	Wood charcoal	Charcoal (*Quercus*) from fill of a lined pit	SUERC-18896 (GU-16717)	5845±30	4791-4615		(Ellis 2009)
Shewalton	North Ayrshire	Antler	A biserial barbed antler point, isolated find	OxA-1947	5840±80	4901-4499	-21	(Bonsall & Smith 1989; Hedges *et al.* 1990)
Caisteal Nan Gillean I	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench C, layer 3 (overlying layer 4); also see Q-3010	Q-3011	5450±50	4446-4081		(Switsur & Mellars 1987)
Caisteal Nan Gillean I	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench C, layer 3 (overlying layer 4); also see Q-3011	Q-3010	5485±50	4449-4247		(Switsur & Mellars 1987)
Caisteal Nan Gillean I	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench C, layer 4 (upper)	Q-3009	6035±70	5207-4771		(Switsur & Mellars 1987)
Caisteal Nan Gillean I	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench C, layer 4 (base); also see Q-3008	Q-3007	6120±80	5291-4842		(Switsur & Mellars 1987)
Caisteal Nan Gillean I	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench C, layer 4 (base); also see Q-3007	Q-3008	6190±80	5321-4938		(Switsur & Mellars 1987)

Caisteal Nan Gillean II	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench P, layer 3 (overlies layer 4)	Birm-346	5150±380	4842-3024		(Switsur & Mellars 1987)
Caisteal Nan Gillean II	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench P, layer 4 (basal layer); also see Q-1355 and Birm-348a/b/c	Birm-347	5450±140	4581-3970		(Switsur & Mellars 1987)
Caisteal Nan Gillean II	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench P, layer 4 (basal layer); also see Birm-347 and Birm-348a/b/c	Q-1355	5460±65	4455-4072		(Switsur & Mellars 1987)
Caisteal Nan Gillean II	Oronsay	Marine shell	Outer fraction of *Patella* sp. recovered from Trench P, layer 4 (basal layer); also see Birm-347 and Q-1355	Birm-348C	5570±140	4410-3950		(Switsur & Mellars 1987; Wicks *et al.* 2014)
Caisteal Nan Gillean II	Oronsay	Marine shell	Middle fraction of *Patella* sp. recovered from Trench P, layer 4 (basal layer); also see Birm-347 and Q-1355	Birm-348B	5720±140			(Switsur & Mellars 1987; Wicks *et al.* 2014)
Caisteal Nan Gillean II	Oronsay	Marine shell	Inner fraction of *Patella* sp. recovered from Trench P, layer 4 (basal layer); also see Birm-347 and Q-1355	Birm-348A	5850±310			(Switsur & Mellars 1987; Wicks *et al.* 2014)
Caisteal Nan Gillean II	Oronsay	Human bone	Bone recovered from Trench P/N, layer 1/2 unit 4	OxA-8005	5480±55	4330-3990	-16	(Bronk Ramsey *et al.* 2000; Richards & Sheridan 2000; Wicks *et al.* 2014)
Cnoc Coig	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench A, Unit 3 Phase 3 deposits, although may have been mixed with Phase 2 material; also see Q-1351, Q1353 and Q-1354	Q-1352	5430±130	4518-3976		(Switsur & Mellars 1987)
Cnoc Coig	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench E, Unit 2 Phase 3 deposits; also see Q1352, Q353 and Q1354	Q-1351	5495±75	4501-4076		(Switsur & Mellars 1987)
Cnoc Coig	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench E, Unit 6 Phase 3 deposits; also see Q-1351, Q-1352 and Q-1353	Q-1354	5535±140	4689-4048		(Switsur & Mellars 1987)
Cnoc Coig	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Trench E, Unit 8 Phase 3 deposits; also see Q-1351, Q-1352 and Q-1354	Q-1353	5645±80	4683-4346		(Switsur & Mellars 1987)
Cnoc Coig	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Square N4 Pre-midden layer; also see Q-3006	Q-3005	5650±60	4652-4354		(Switsur & Mellars 1987)
Cnoc Coig	Oronsay	Wood charcoal	Charcoal (no species specified) recovered from Square 04 pre-midden layer; also see Q-3005	Q-3006	5675±60	4682-4369		(Switsur & Mellars 1987)
Cnoc Coig	Oronsay	Human bone	Bone recovered from square H13, unit 4 Phase 3 deposits; also see Q-1351, Q-1352, Q-1353, Q-1354 and OxA-8014	OxA-8019	5615±45	4534-4356	-12.4	(Bronk Ramsey *et al.* 2000; Richards & Sheridan 2000)
Cnoc Coig	Oronsay	Human bone	Bone recovered from square I13, unit 4 Phase 3 deposits; also see Q1351, Q-1352, Q-1353, Q-1354 and OxA-8019	OxA-8014	5495±55	4454-4249	-12	(Bronk Ramsey *et al.* 2000; Richards & Sheridan 2000)
Cnoc Coig	Oronsay	Human bone	Bone recovered from square I5, unit 4 Phase 1 deposits	OxA-8004	5740±65	4765-4450	-12.4	(Bronk Ramsey *et al.* 2000; Richards & Sheridan 2000)
Cnoc Sligeach	Oronsay	Charcoal	Charcoal (no species specified - "composite sample") recovered from Trench B, layer 7 - upper part of midden	BM-670	5426±159	4669-3945		(Jardine 1977)

Priory Midden	Oronsay	Charcoal	Charcoal (no species specified) recovered from control trench layer 7 which abuts layers 9/10	Q-3004	5470±50	4349-4326		(Switsur & Mellars 1987)
Priory Midden	Oronsay	Charcoal	Charcoal (no species specified) recovered from control trench layer 9/10 which abuts layer 7 and overlies level 18	Q-3003	5510±50	4359-4339		(Switsur & Mellars 1987)
Priory Midden	Oronsay	Charcoal	Charcoal (no species specified) recovered from control trench layer 18 which overlies level 19	Q-3002	5717±50	4586-4501		(Switsur & Mellars 1987)
Priory Midden	Oronsay	Charcoal	Charcoal (no species specified) recovered from control trench layer 19 (basal layer); also see Q-3001	Q-3000	5825±50	4722-4686		(Switsur & Mellars 1987)
Priory Midden	Oronsay	Charcoal	Charcoal (no species specified) recovered from control trench layer 19 (Basal layer); also see Q-3000	Q-3001	5870±50	4781-4715		(Switsur & Mellars 1987)
Pabaigh Mòr South	Pabaigh Mòr	Hazel nutshell	Nutshell recovered from shell midden (002)	SUERC-55363	8098±28	7167-7156	-26.3	Church pers. comm.
Pabaigh Mòr South	Pabaigh Mòr	Hazel nutshell	Nutshell recovered from shell midden (002)	SUERC-55364	5670±28	4576-4449	-26.1	Church pers. comm.
Loch a Sguirr	Raasay	Mammal bone	A bevel-ended bone artefact (N25) recovered from spit 2 from midden layers at the rear of a rockshelter; spit is higher than OxA-9254	OxA-9255	7245±55	6622-6020	-21.63	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001b)
Loch a Sguirr	Raasay	Wood charcoal	Charcoal (birch), (1/3) recovered from Spit 3 from midden layers at the rear of a rockshelter; spit is higher than OxA-9254	OxA-9305	7620±75	6640-6272	-26.58	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001b)
Risga	Risga	Antler	A bevel-ended antler artefact recovered from a shell midden	OxA-3737	5875±65	4906-4555	-20.6	(Bonsall & Smith 1992; Hedges *et al.* 1993)
Risga	Risga	Antler	A distal fragment of a biserial red deer antler mattock associated with a barbed point	OxA-2023	6000±90	5207-4705		(Bonsall & Smith 1992; Hedges *et al.* 1993)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from fill of pit feature AD 5; also see GU-1874	GU-1873a	8590±95	7590-7360	-24.9	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	RECOUNTED Nutshell recovered from fill of pit feature AD 5	GU-1873b	8360±70			(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from the lower fill of a truncated pit feature AJ 2	GU-2040a	8560±75	7596-7518	-25.1	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	RECOUNTED Nutshell recovered from the lower fill of a truncated pit feature AJ 2	GU-2040b	8490±50			(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from fill of pit feature AD 5; also see GU-1873	GU-1874a	8515±190	7572-7032	-23.8	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	RECOUNTED Nutshell recovered from fill of pit feature AD 5; also see GU-1873	GU-1874b	8060±150			(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from structural feature BA S2	GU-2150	8310±150	7608-6838	-25.7	(Cook & Scott 1990)

Kinloch	Rum	Hazel nutshell	Nutshell recovered from fill of pit feature BA 1	GU-2146	8080±50	7283-6822	-25	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from part of a pit complex further investigated in trench BA; also see GU-2149	GU-2039a	7925±65	7024-6639	-25.3	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	RECOUNTED Nutshell recovered from part of a pit complex further investigated in trench BA; also see GU-2149	GU-2039b	7860±50			(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from hollow feature BA 10 sealed by dumps on the edge of the burn; TPQ for the dumps	GU-2147a	7880±70	7031-6679	-25.1	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	RECOUNTED Nutshell recovered from hollow feature BA 10 sealed by dumps on the edge of the burn; TPQ for the dumps	GU-2147b	7950±50			(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	Nutshell recovered from fill of pit feature BA 3	GU-2145a	7850±50	7004-6633	-25	(Cook & Scott 1990)
Kinloch	Rum	Hazel nutshell	RECOUNTED Nutshell recovered from fill of pit feature BA 3	GU-2145b	7900±50			(Cook & Scott 1990)
Kinloch	Rum	Wood charcoal	Charcoal (no species specified) recovered from the fill of pit complex feature BA 4/5; also see GU-2039	GU-2149a	7570±50	6483-6394	-25.3	(Cook & Scott 1990)
Kinloch	Rum	Wood charcoal	RECOUNTED Charcoal (no species specified) recovered from the fill of pit complex feature BA 4/5; also see GU-2039	GU-2149b	7600±50			(Cook & Scott 1990)
An Corran	Skye	Mammal bone	Burnt animal bone (ruminant) recovered from the basal layer of red clay (C41); potential mixing of later intrusions; see OxA-4994 for earlier date of context above; excluded by Wicks et al 2014 as too unreliable due to burning and chronologically/stratigraphically inconsistent	AA-27746	6420±75	5518-5227	-22.8	(Saville 1998a; Saville *et al.* 2012b)
An Corran	Skye	Mammal bone	A bevel-ended bone artefact (deer metatarsus) recovered from the main shell midden (mostly of limpet shells) at the rear of the rock shelter (C36); also see AA-29316	AA-29315	5190±55	4229-3807	-21.3	(Saville 1998a; Saville *et al.* 2012b)
An Corran	Skye	Mammal bone	A broken bevel-ended bone artefact (ruminant long-bone) recovered from the main shell midden (mostly of limpet shells) at the rear of the rock shelter (C36); also see AA-29315	AA-29316	6215±60	5312-5019	-20.6	(Saville 1998a; Saville *et al.* 2012b)
An Corran	Skye	Mammal bone	A bevel-ended bone artefact (deer metatarsus) recovered from the base of the main shell midden (C36 base); very disturbed stratigraphy	OxA-4994	7590±90	6607-6247	-21.6	(Bronk Ramsey *et al.* 2000; Saville 1998a; Saville *et al.* 2012b)
An Corran	Skye	Mammal bone	Animal bone (pig - rib) ACO143 recovered from bioturbated midden deposits (C36)	OxA-13551	7485±55	6440-6210	-21.5	(Bronk Ramsey *et al.* 2009; Saville *et al.* 2012b)

An Corran	Skye	Mammal bone	Animal bone (*Bos taurus*) ACO132 recovered from bioturbated midden deposits (C36)	OxA-14751	7555±45	6480-6265	-22.3	(Bronk Ramsey *et al.* 2009; Saville *et al.* 2012b)
An Corran	Skye	Mammal bone	Animal bone (*Bos taurus*) ACO178 recovered from bioturbated midden deposits (C36)	OxA-14752	7595±50	6587-6379	-22	(Bronk Ramsey *et al.* 2009; Saville *et al.* 2012b)
An Corran	Skye	Mammal bone	Animal bone (*Bos taurus*) ACO713 recovered from bioturbated midden deposits (C34)	OxA-14753	7525±45	6462-6256	-21.6	(Bronk Ramsey *et al.* 2009; Saville *et al.* 2012b)
Camas Daraich	Skye	Hazel nutshell	Nutshell (Sample 5) recovered from B3 SW C8 a black layer in a scoop high in fuel ash and lithics	OxA-9782	7670±55	6612-6434	-24.17	(Ashmore in Bronk Ramsey *et al.* 2002; Cressey *et al.* 2001a; Wickham-Jones & Hardy 2004a)
Camas Daraich	Skye	Hazel nutshell	Nutshell (Sample 6) recovered from B3 NW C8 a black layer in a scoop rich in lithics	OxA-9783	7985±50	7057-6701	-25.07	(Cressey *et al.* 2001a; Wickham-Jones & Hardy 2004a)
Camas Daraich	Skye	Hazel nutshell	Nutshell (CD 15(B)) recovered from B1 SE C10 a possible hearth under a series of layers rich in fuel ash	OxA-9784	7545±55	6481-6251	-25.37	(Cressey *et al.* 2001a; Wickham-Jones & Hardy 2004a)
Camas Daraich	Skye	Hazel nutshell	Nutshell CD 15(A) recovered from B1 SE C10 a possible hearth overlain by more fuel deposits	OxA-9971	7575±75	6591-6254	-27.41	(Cressey *et al.* 2001a; Wickham-Jones & Hardy 2004a)
Coom Rig (Daer Valley) Site 84	South Lanarkshire	Wood charcoal	Charcoal (hazel) recovered from pit 6 East containing charcoal and Mesolithic chert	SUERC-6829	5390±35	4338-4072	-25.6	(Ward 2006a)
Daer Reservoir 1, Crawford	South Lanarkshire	Wood charcoal	Charcoal (*Pomoideae*) recovered from a pit in the Mesolithic flint-knapping site reported in *DES* 1995:87 and *DES* 1997:75	AA-30354	9075±80	8544-7985	-26.7	(Ward 1998a)
Daer Reservoir 2, Crawford	South Lanarkshire	Wood charcoal	Charcoal (Birch) recovered from a pit in the Mesolithic flint knapping site reported in *DES* 1995:87 and *DES* 1997:75	AA-30355	8055±75	7285-6695	-25.1	(Ward 1998b)
Daer Reservoir 3, Crawford	South Lanarkshire	Wood charcoal	Charcoal (Hazel), sample 002 recovered from a deposit/pit containing charcoal and flint on Site No. 3	AA-43004	5355±45	4327-4052	-25.9	(Ward 2001)
Ulva Cave	Ulva	Marine shell	Inner fraction of *Patella* sp. shells recovered from Area C: basal 5-10cm of midden deposit, also see GU-2601	GU-2600	8060±50	6800-6460		(Bonsall *et al.* 1992; Wicks *et al.* 2014)
Ulva Cave	Ulva	Marine shell	Outer fraction of *Patella* sp. shells recovered from basal 10cm of midden deposit; also see GU-2600	GU-2601	8020±50			(Bonsall *et al.* 1992; Wicks *et al.* 2014)
Ulva Cave	Ulva	Marine shell	Inner fraction of Patella sp. shells recovered from Area C: top 10cm of midden deposit; also see GU-2603	GU-2602	6090±50	4700-4400		(Bonsall *et al.* 1992; Hedges *et al.* 1993 ; Wicks *et al.* 2014)
Ulva Cave	Ulva	Marine shell	Outer fraction of Patella sp. shells recovered from top 10cm of midden deposit; also see GU-2602	GU-2603	5930±50			(Bonsall *et al.* 1992; Wicks *et al.* 2014)
Ulva Cave	Ulva	Antler	A bevel-ended antler artefact (red deer) recovered from Area C: upper part of midden	OxA-3738	5750±70	4770-4454	-23.6	(Bonsall & Smith 1992; Bonsall *et al.* 1994; Hedges *et al.* 1993)

Appendix 3 Northton Lithic Catalogue

Table 49. Northton 2010 Phase 3 coarse stone tools

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Notes
SF16	3	Quartz	Milky	Manuport	46.93	32.46	16.59	Rounded cobble
SF23	9	Gneiss		Manuport	157.00	121.39	77.59	Sub-rounded cobble
SF24	9	Gneiss		Manuport	127.22	64.28	38.59	Sub-rounded cobble
SF59	9	Gneiss		Manuport	42.14	40.17	17.78	Smooth, rounded pebble
SF67b	9	Quartz	Quartz-feldspar	Manuport	55.15	46.86	30.79	Rounded cobble
SF67c	9	Quartz	Quartz-feldspar	Manuport	61.68	50.02	37.93	Sub-rounded cobble
SF67d	9	Quartz	Quartz-feldspar	Manuport	55.52	39.13	24.41	Sub-angular cobble
SF67e	9	Gneiss		Manuport	55.06	51.99	25.24	Rounded cobble
SF67f	9	Metabasalt		Manuport	49.28	45.13	25.08	Rounded cobble
SF67g	9	Gneiss		Manuport	63.02	61.97	35.67	Rounded cobble
SF67h	9	Gneiss		Manuport	58.65	42.3	27.39	Sub-rounded cobble
SF67i	9	Gneiss		Manuport	57.3	44.54	27.09	Sub-rounded cobble
SF67j	9	Gneiss		Manuport	63.49	48.08	32.17	Sub-rounded cobble
SF95g	9	Gneiss		Manuport	51.10	48.75	26.87	Sub-rounded pebble
SF98	9	Unknown	Igneous	Manuport	59.16	59.90	26.37	Smooth and rounded cobble, broken in half
SF99	9	Gneiss		Manuport	70.71	63.73	53.82	Rounded cobble, some pitting on one face - possible percussion damage
L517	3	Feldspar		Hammerstone	44.40	57.30	27.60	Probable hammerstone; semi-circular shape - break c.135° to flat plane; some pitting
L595	3	Gneiss		Manuport	79.31	53.86	19.54	Fracture appears natural; opposing surface smooth - appears worn

Table 50. Northton 2010 Phase 3 cores and anvil

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF17	14	Flint		Core	18.60	2.27	P	5	Bidirectional	Unprepared	Cortex rounded - pebble
SF22	9	Gneiss		Anvil	112.50	746.50	P	7	Multidirectional	Unprepared	
SF38	9	Quartz	Milky	Core	31.50	24.69	P	3	Unidirectional	Unprepared	Cortex rounded - pebble; possibly burnt
SF40	9	Mudstone		Core	12.67	0.87	A	5	Bidirectional	Unprepared	
SF48	9	Quartz	Greasy-fine grained	Core	48.17	17.99	A	7	Multidirectional	Simple/lost	
SF56	9	Quartz	Milky	Core	27.60	34.65	P	2	Multidirectional	Simple	Cortex flat and pink - block; single flake struck from cortical side then rotated 90 degrees and flake scar used as a platform, flake removed, rotated again
SF58	9	Quartz	Milky	Core	30.37	9.28	P	1	Unidirectional	Unprepared	Cortex smooth, flat and frosted - block/plate
SF60	9	Quartz	Milky	Core	23.80	15.84	P	3	Multidirectional	Unprepared	Cortical surface used as a single platform; cortex flat and frosted - block/plate
SF63	9	Chalcedony		Core	21.06	5.04	A	1	Unidirectional	Unprepared	Very rounded and rolled - pebble
SF67a	9	Quartz	Milky	Core	63.80	180.68	P	4	Multidirectional	Unprepared	Cortex smooth and rounded - pebble
SF77	9	Quartz	Milky	Core	58.70	69.36	P	5	Multidirectional	Simple	Cortex smooth and flat - block/plate
SF85b	9	Quartz	Milky	Core	58.70	70.13	P	4	Multidirectional	Unprepared/ lost	Cortex smooth and rounded - pebble
SF91	9	Gneiss		Core tool	94.50	342.93	A	6	Unidirectional	Unprepared	Possible chopper
SF95a	9	Quartz	Greasy-fine grained	Core	30.71	12.33	P	3	Multidirectional	Unprepared/ lost	Cortex smooth and rounded - pebble
SF95d	9	Quartz	Milky	Core	35.40	40.23	P	2	Multidirectional	Simple/lost	Cortex smooth and rounded - pebble
SF95i	9	Quartz	Milky	Core	37.20	103.51	P	4	Multidirectional	Unprepared/ simple	Cortex smooth and flat - likely block/plate
SF95j	9	Quartz	Milky	Core	52.30	109.83	P	6	Multidirectional	Simple/lost	Cortex smooth and flat - block/plate

SF95k	9	Quartz	Quartzite	Core	81.60	141.16	P	6	Multidirectional	Simple/lost	Cortex smooth and rounded - pebble
SF95n	9	Quartz	Milky	Core	38.20	20.54	P	3	Multidirectional	Unprepared	Cortex smooth and rounded - pebble
SF95s	9	Quartz	Milky	Core	21.29	5.84	P	6	Multidirectional	Simple/lost	Cortex smooth and rounded - pebble
L58	9	Mudstone		Core	21.00	1.55	P	4	Multidirectional	Lost	Cortex flat and weathered - outcrop?
L187	9	Quartz	Greasy-fine grained	Core	23.75	3.67	A	6	Multidirectional	Lost	
L385	9	Quartz	Milky-fine grained	Core	10.71	0.48	P	3	Multidirectional	Unprepared/ lost	Cortex smooth and rounded - pebble
L415	9	Quartz	Milky	Core	11.60	0.30	P	3	Multidirectional	Unprepared/ lost	Cortex smooth and flat - likely pebble
L439	9	Quartz	Greasy	Core	31.90	7.63	P	3	Unidirectional	Unprepared	Cortex smooth and rounded - pebble
L460	9	Quartz	Milky-fine grained	Core	13.90	0.92	P	2	Multidirectional	Unprepared/ lost	Cortex smooth and rounded - pebble
L483	9	Quartz	Milky	Core	18.90	1.62	P	3	Multidirectional	Unprepared/ lost	Cortex flat and frosted - block/plate
L486	9	Quartz	Milky-rock crystal	Core	17.40	1.09	P	3	Unidirectional	Simple	Cortex flat - likely block/plate
L503	9	Quartz	Milky	Core	16.70	3.56	P	3	Multidirectional	Unprepared	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L507	9	Quartz	Greasy	Core	30.00	23.62	P	4	Multidirectional	Unprepared/ lost	Cortex smooth and flat - pebble
L509	9	Quartz	Fine grained	Core	66.70	68.17	P	6	Multidirectional	Unprepared/ lost	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L516	14	Quartz	Milky	Core	15.10	1.17	P	2	Multidirectional	Unprepared/ simple	Cortex smooth and rounded - pebble
L557	14	Quartz	Milky	Core	59.80	45.73	P	2	Multidirectional	Unprepared/ lost	Cortex flat and frosted - block/plate
L643	9	Quartz	Milky	Core	26.88	6.48	P	3	Bidirectional	Simple/lost	Cortex flat - block/plate; bidirectional removals but not indicative of bipolar reduction; absent platform preparation due to breakage
L648	9	Quartz	Quartzite	Core	51.32	40.74	P	2	Multidirectional	Unprepared/ lost	Cortex rounded and flat - pebble

Table 51. Northton 2010 Phase 4 cores

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
L163	16	Flint		Core	18.30	2	A	8	Bidirectional	Unprepared	
L164	16	Flint		Core	11.60	0.44	A	11	Bidirectional	Unprepared	
L559	16	Quartz	Milky	Core	34.20	18.12	P	4	Multidirectional	Unprepared	Cortex flat and frosted - block/plate
L578	17	Quartz	Milky	Core	44.20	38.84	P	4	Multidirectional	Unprepared/lost	Cortex flat and frosted - block/plate
L625	16	Quartz	Milky	Core	29.76	17.81	P	6	Multidirectional	Simple	Cortex flat and smooth - block/plate

Table 52. Northton 2010 Phase 3 flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF1	3	Flint		Flake	33.20	27.20	4.10								Archived for residue/microwear analysis
SF2	14	Quartz		Flake	43.30	50.10	9.40								Archived for residue/microwear analysis
SF4	14	Mudstone		Flake	21.40	18.20	9.20	0	Absent			2	Indet	P	
SF18	3	Quartz	Milky	Flake	23.50	22.10	12.00	0	Broken			2	Uni	P	
SF19	14	Mudstone		Flake	27.10	24.90	8.70	<50	Plain	14.4	8.2	3	Multi	P	Cortex weathered
SF21	14	Quartz		Flake	34.20	45.20	15.20								Archived for residue/microwear analysis
SF25	9	Mudstone		Flake core	16.10	15.00	5.70	0	Plain	5.7	5.8	4	Multi	A	Further flake removal from the ventral face and same platform, refits with SF26
SF26	9	Mudstone		Flake	24.20	18.20	2.70	0	Absent			3	Multi	A	Flaked flake spall, refits with SF25

SF27	9	Quartz	Greasy	Flake	31.40	8.90	8.10	0	Absent			1	Uni	P	Edge damage resembles retouch
SF28	9	Quartz	Greasy	Flake	28.10	40.40	7.80	0	Absent			1	Uni	P	
SF29	9	Quartz		Flake	30.80	39.20	14.60								Archived for residue/microwear analysis
SF30	9	Quartz	Milky	Flake	14.70	11.70	2.50	0	Absent			1	Uni	P	
SF31	9	Quartz	Milky	Flake	18.20	25.60	5.50	0	Plain	16.1	3	2	Indet	P	
SF32	9	Quartz	Milky	Flake	12.00	17.30	5.60	0	Broken			4	Multi	A	
SF33	9	Gneiss		Flake	23.60	18.30	8.90	<50	Broken			4	Multi	A	Cortex weathered
SF34	9	Flint		Flake	15.70	11.10	5.20	<50	Absent			4	Multi	P	Only inner cortex present
SF36	9	Flint		Flake	20.40	9.70	4.50	0	Plain	3.2	2.2	1	Uni	P	Parallel snap from previous flake removal created platform
SF37	9	Flint		Flake	10.10	12.50	5.50	0	Plain	9.6	4.4	1	Uni	P	
SF39	9	Quartz	Fine grained	Flake	27.80	18.60	5.70	0	Broken			1	Uni	P	
SF42	9	Quartz	Fine grained	Flake	36.99	15.15	12.25	100	Broken			N/A	N/A	P	Cortex smooth and frosted - weathered block
SF43	9	Quartz	Milky	Flake	20.00	28.00	7.10	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
SF44	9	Quartz	Milky	Flake	22.64	24.64	8.30	<50	Broken			2	Multi	P	Cortex flat and frosted - block/plate
SF45	9	Quartz	Milky	Flake	22.00	20.00	7.70	>50	Plain	11.62	5.47	1	Uni	P	Cortex smooth and - pebble
SF46	9	Quartz		Flake	30.20	29.70	9.80								Archived for residue/microwear analysis
SF47	9	Quartz	Greasy-fine grained	Flake	19.50	8.72	5.93	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
SF49	9	Quartz	Fine grained	Flake	13.70	20.10	5.80	<50	Plain	12.8	4.4	2	Uni	P	Cortex weathered - outcrop?

SF50	9	Quartz	Greasy	Flake	18.00	14.20	4.80	0	Plain	10.5	2.4	4	Multi	P	
SF51	9	Quartz	Milky	Flake	10.80	10.10	3.70	0	Absent			3	Indet	P	
SF52	9	Quartz	Milky	Flake	17.40	16.40	5.50	0	Plain	9	2.7	3	Indet	P	
SF53	9	Quartz	Milky	Flake	36.00	12.46	10.60	0	Broken			1	Uni	P	
SF55a	9	Quartz	Milky-rock crystal	Flake	10.50	6.70	2.50	0	Plain	3.3	2.1	2	Multi	P	
SF55b	9	Quartz	Fine grained	Flake	17.70	27.60	5.50	>50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
SF57	9	Quartz	Milky	Flake	20.20	16.70	11.10	<50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
SF62	9	Flint		Flake	11.10	6.00	3.50	0	Broken			2	Multi	P	
SF68	9	Flint		Flake	14.30	13.60	4.40	<50	Broken			4	Multi	P	Flaked flake spall; cortex smooth - pebble
SF69	9	Quartz	Milky	Flake	31.70	15.50	10.00	0	Broken			1	Uni	P	
SF71	9	Quartz		Flake	58.40	63.90	24.80								Archived for residue/microwear analysis
SF72	9	Quartz	Milky	Flake	19.10	35.80	9.70	<50	Absent			3	Multi	P	Not enough cortex present to ascertain probable source
SF74	9	Quartz	Milky	Flake	28.40	21.40	12.00	<50	Plain	7.8	5.6	3	Multi	P	Cortex flat and frosted - block/plate
SF75	9	Quartz		Flake	29.00	30.20	9.30								Archived for residue/microwear analysis
SF76	9	Flint		Flake	23.00	13.60	9.70	100	Broken			N/A	N/A	A	Two ventral faces created through bipolar reduction; cortex smooth and rounded - pebble
SF78	9	Mudstone		Blade	20.60	14.00	3.40	<50	Broken			2	Multi	P	Broken blade, not enough cortex to ascertain probable source
SF81	9	Carbonate		Flake	27.10	18.40	7.40	0	Absent			3	Multi	A	

SF82	9	Quartz	Milky	Flake	24.90	14.60	4.40	0	Broken			1	Uni	P	Cortex flat and micaceous - block/plate
SF83	9	Quartz	Milky	Flake	22.60	9.3	6.10	0	Absent			1	Uni	P	
SF84	9	Quartz	Milky	Flake	11.30	17.20	12.90	0	Plain	21.2	11.2	3	Multi	P	
SF85a	9	Pegmatite		Flake	27.40	26.70	13.50	>50	Plain	20.8	11.2	1	Uni	P	
SF85c	9	Quartz	Milky	Flake	29.10	26.00	15.30	>50	Absent			1	Uni	P	Cortex smooth and rounded - pebble
SF85d	9	Quartz	Milky	Flake	26.50	23.70	10.10	0	Absent			2	Uni	P	
SF85e	9	Quartz	Milky	Flake	19.30	28.60	10.80	<50	Broken			2	Uni	P	Cortex smooth and rounded - pebble
SF85f	9	Quartz	Greasy-fine grained	Flake	35.07	13.34	10.02	0	Broken			2	Multi	P	
SF86	9	Quartz	Greasy-fine grained	Flake	11.00	12.00	8.27	>50	Plain	8.86	8.27	1	Uni	A	Cortex flat and frosted - block/plate
SF88	9	Quartz	Milky	Flake	34.80	46.20	8.70	0	Broken			1	Uni	P	
SF89	9	Quartz	Milky	Flake	18.90	23.40	6.50	<50	Broken			1	Uni	P	Cortex is flat and another raw material - outcrop
SF92	9	Quartz	Milky	Flake	30.69	29.61	11.10	0	Plain	14.40	5.32	4	Multi	P	Further flake removed from same platform
SF94	9	Flint		Flake	16.90	15.20	1.30	0	Broken			2	Uni	P	Flaked flake spall
SF95b	9	Quartz		Flake	24.20	30.60	6.20								Archived for residue/microwear analysis
SF95c	9	Quartz	Greasy-fine grained	Flake	33.00	40.40	18.90	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
SF95e	9	Quartz	Milky	Flake	38.84	38.49	18.54	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
SF95f	9	Quartz	Greasy-fine grained	Flake	33.70	21.60	6.70	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble

SF95h	9	Quartz	Greasy-fine grained	Flake	14.20	24.90	4.80	>50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
SF95l	9	Quartz	Greasy-fine grained	Flake	30.30	15.42	8.29	0	Absent			1	Uni	A	
SF95m	9	Quartz	Greasy-fine grained	Flake core	31.09	11.08	5.84	0	Broken			3	Multi	P	Broken lateral edge used as a platform to remove a further flake in the dorsal side
SF95o	9	Quartz	Milky	Flake	37.50	37.10	15.90	<50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
SF95p	9	Quartz	Greasy-fine grained	Flake	17.40	21.50	10.70	0	Absent			2	Indet	P	
SF95q	9	Quartz	Greasy-fine grained	Flake	24.00	9.50	5.40	<50	Absent			1	Uni	P	Cortex smooth and rounded - pebble
SF95r	9	Quartz	Greasy-fine grained	Flake core	22.92	14.61	8.78	<50	Absent			2	Multi	P	One dorsal scar used as platform for further removal; cortex smooth and rounded – pebble
SF95t	9	Quartz	Greasy-fine grained	Flake	29.67	14.90	10.15	0	Absent			2	Multi	P	
SF102	9	Mudstone		Flake	26.80	36.20	6.00								Archived for residue/microwear analysis
SF103b	9	Mudstone		Flake	27.00	16.70	4.30	0	Broken			2	Uni	P	
SF103c	9	Quartz	Greasy-fine grained	Flake	14.40	13.20	3.90	0	Absent			1	Uni	P	
SF103d	9	Mudstone		Flake	25.01	23.31	5.90	0	Absent			1	Uni	P	
SF103e	9	Mudstone		Flake	22.20	19.70	7.90	<50	Absent			3	Uni	A	Cortex flat and weathered

SF103f	9	Quartz	Greasy-fine grained	Flake	16.90	23.30	6.80	>50	Plain	3.9	2.2	2	Uni	A	Cortex flat and frosted - block/plate
SF103g	9	Quartz	Fine grained	Flake	27.80	24.50	5.20	0	Plain	18.14	4.99	1	Uni	P	
SF103i	9	Quartz	Milky	Blade	20.10	11.70	2.80	0	Plain	7.8	2.7	2	Uni	P	
SF103k	9	Quartz	Milky-rock crystal	Flake	12.17	9.40	2.05	0	Broken			2	Indet	P	
SF103l	9	Quartz	Greasy-fine grained	Flake	15.50	10.20	3.00	0	Broken			1	Uni	P	Flake removal scar on dorsal, snap used as a platform?
L4	9	Mudstone		Flake	14.10	12.70	1.80	0	Broken			3	Multi	P	
L5	9	Mudstone		Flake	10.80	7.70	2.60	0	Plain	5.2	2.5	2	Multi	A	
L6	9	Mudstone		Flake	16.50	16.60	5.80	0	Broken			4	Multi	A	
L7	9	Mudstone		Flake	11.46	9.67	3.90	0	Plain	6.34	3.05	3	Multi	P	
L8	9	Mudstone		Flake	17.10	19.40	2.60	0	Broken			2	Multi	P	
L9	9	Mudstone		Flake	12.30	12.80	2.90	0	Broken			1	Uni	P	
L10	9	Mudstone		Flake	12.00	8.00	3.00	0	Broken			2	Multi	A	
L11	9	Mudstone		Flake	11.80	16.60	1.30	0	Absent			1	Uni	P	Distal end of broken flake
L13	9	Mudstone		Flake	10.90	14.40	4.10	<50	Plain	11.9	6.3	3	Multi	P	Cortex weathered
L14	9	Mudstone		Flake	10.80	15.10	4.40	<50	Broken			3	Multi	A	Not enough cortex present to ascertain probable source
L15	9	Mudstone		Flake	13.60	8.90	2.40	<50	Broken			2	Multi	P	Cortex weathered
L16	9	Mudstone		Flake	11.80	11.40	1.90	0	Broken			1	Uni	P	
L17	9	Mudstone		Flake	16.40	11.60	3.50	0	Broken			3	Multi	A	
L19	9	Mudstone		Flake	10.30	10.20	3.30	<50	Plain	5.3	1.6	2	Uni	P	Not enough cortex present to ascertain probable source
L44	9	Mudstone		Flake	14.60	8.40	4.80	0	Broken			3	Multi	A	
L45	9	Unknown	Igneous	Flake	11.50	9.70	2.20	0	Broken			1	Uni	P	
L47	9	Mudstone		Flake	18.00	10.40	4.50	<50	Absent			2	Multi	A	Cortex weathered

L49	9	Mudstone		Flake	14.80	9.30	6.50	0	Broken			3	Multi	A	
L53	9	Mudstone		Flake	10.35	5.65	3.82	<50	Broken			2	Multi	P	Cortex flat and weathered - outcrop?
L57	9	Mudstone		Flake	15.70	5.00	2.20	0	Absent			2	Indet	P	
L59	9	Flint		Flake	21.40	9.40	3.30	0	Broken			6	Multi	P	
L60	9	Flint		Flake	20.20	22.60	3.70	>50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L61	9	Flint		Flake	14.10	9.40	5.90	<50	Plain	7.6	2.2	2	Multi	A	Cortex smooth and rounded - pebble
L62	9	Flint		Flake	14.80	9.80	4.10	0	Broken			3	Multi	P	
L64	9	Flint		Flake	16.80	20.90	3.10	0	Plain	12.8	3.1	2	Indet	P	
L67	9	Flint		Flake	18.30	7.80	4.40	0	Absent			3	Multi	P	
L69	9	Flint		Flake	10.60	12.06	3.00	0	Broken			2	Multi	P	
L70	9	Flint		Flake	10.50	12.20	2.40	0	Plain	3.2	0.8	1	Uni	P	
L73	9	Flint		Flake	13.80	10.67	4.30	0	Broken			1	Uni	P	
L74	9	Flint		Flake	12.70	9.40	2.50	0	Broken			2	Multi	A	
L75	9	Flint		Flake	13.96	10.48	2.57	0	Broken			1	Uni	A	Burnt
L76	9	Flint		Flake	11.60	7.00	1.00	0	Absent			2	Uni	P	
L78	9	Flint		Flake	11.40	8.40	2.40	0	Broken			3	Multi	P	
L80	9	Flint		Flake	16.00	4.70	2.90	0	Broken			2	Multi	P	Burnt
L81	9	Flint		Flake	13.20	5.50	2.40	<50	Crushed			2	Uni	P	Cortex smooth - likely pebble
L112	9	Flint		Flake	12.30	5.40	2.40	0	Broken			2	Uni	P	
L115	9	Flint		Flake	11.60	3.50	4.60	0	Absent			2	Multi	P	
L118	9	Flint		Flake	10.90	4.90	2.70	<50	Broken			4	Multi	A	Only inner cortex present
L120	14	Mudstone		Flake	10.90	14.50	3.80	0	Plain	6.3	1.7	4	Multi	A	
L122	14	Mudstone		Flake	12.70	10.20	2.90	0	Plain	6.5	2.9	3	Multi	A	
L124	14	Mudstone		Flake	17.50	9.80	5.10	0	Broken			6	Multi	A	Burnt
L125	14	Mudstone		Flake	13.64	13.18	4.50	<50	Broken			2	Multi	P	Cortex weathered

L126	14	Mudstone		Flake	11.70	10.80	3.50	0	Absent			3	Multi	P	
L129	14	Flint		Flake	11.40	8.10	0.90	0	Absent			2	Multi	P	
L130	14	Flint		Flake	10.50	8.70	1.50	0	Absent			1	Uni	P	
L168	9	Quartz	Greasy	Flake	15.40	13.90	2.80	0	Broken			3	Multi	P	
L169	9	Quartz	Fine grained	Flake	17.80	14.00	5.00	0	Plain	9.4	3.9	3	Multi	A	
L170	9	Quartz	Milky	Flake	23.54	15.70	3.80	<50	Broken			1	Uni	P	Cortex is flat and smooth - pebble?
L171	9	Quartz	Greasy-fine grained	Flake	10.90	17.10	3.10	0	Plain	14.1	3.2	1	Uni	P	
L172	9	Quartz	Milky	Flake	11.00	10.60	2.40	>50	Broken			1	Uni	A	Cortex flat - likely block/plate
L173	9	Quartz	Greasy-fine grained	Flake	10.60	17.90	3.20	0	Plain	12.6	3.2	1	Uni	P	
L174	9	Quartz	Milky	Flake	17.50	10.20	6.10	>50	Broken			1	Uni	A	Cortex flat and square - block/plate
L175	9	Quartz	Milky	Flake	10.00	18.00	3.40	100	Plain	7.5	3.4	N/A	N/A	A	Cortex smooth and rounded - pebble
L176	9	Quartz	Milky-rock crystal	Flake	13.20	11.00	4.00	0	Broken			1	Uni	A	
L177	9	Quartz	Milky	Flake	15.40	23.90	3.00	0	Broken			1	Uni	P	Further flake removed from dorsal face from same platform; refits with L178
L178	9	Quartz	Milky	Flake	10.50	15.10	1.80	0	Absent			1	Uni	P	Refits with L177
L179	9	Quartz	Milky	Flake	14.60	9.70	2.60	0	Broken			1	Uni	P	Flaked flake spall
L180	9	Quartz	Milky	Flake	13.50	11.60	2.40	0	Broken			2	Uni	A	Flaked flake spall
L182	9	Quartz	Milky	Flake	13.18	8.90	2.04	0	Absent			1	Uni	P	
L188	9	Quartz	Greasy-fine grained	Flake	19.40	14.80	5.20	0	Absent			2	Uni	P	
L189	9	Quartz	Milky	Flake	11.20	11.80	3.30	0	Broken			2	Uni	P	

L190	9	Quartz	Milky	Flake	10.70	13.60	4.10	0	Plain	8.3	4.1	1	Uni	P	
L193	9	Quartz	Milky-rock crystal	Flake	16.90	8.50	3.50	<50	Broken			3	Multi	P	Not enough cortex present to ascertain probable source
L196	9	Quartz	Milky-fine grained	Flake	10.60	8.70	1.90	0	Plain	5.4	1.4	1	Uni	A	
L197	9	Quartz	Greasy-fine grained	Flake	12.40	13.20	4.40	<50	Broken			2	Multi	P	Cortex is smooth - pebble
L198	9	Quartz	Milky	Flake	10.30	10.00	3.20	0	Broken			3	Multi	P	
L199	9	Quartz	Milky	Flake	12.50	13.70	4.10	<50	Cortical	4.1	9.1	1	Uni	P	Cortex smooth and rounded - pebble
L200	9	Quartz	Fine grained	Flake	26.10	26.20	6.60	0	Broken			2	Multi	P	
L201	9	Quartz	Greasy	Flake	19.20	22.40	5.50	0	Broken			2	Multi	P	
L202	9	Quartz	Milky	Flake	11.60	5.90	3.40	0	Broken			1	Uni	P	
L203	9	Quartz	Milky	Flake	13.60	6.30	5.00	0	Broken			1	Uni	A	
L204	9	Quartz	Fine grained	Flake	12.20	18.60	11.20	<50	Cortical	16.2	8.1	2	Multi	P	Cortex smooth and rounded - pebble
L205	9	Quartz	Milky	Flake	27.30	12.00	9.00	0	Broken			2	Bi	P	Characteristics of a 'split cobble core'
L206	9	Quartz	Fine grained-feldspar	Flake	12.70	7.80	4.80	0	Broken			1	Uni	A	Possibly burnt
L207	9	Quartz	Fine grained-feldspar	Flake	12.89	8.97	3.68	0	Broken			1	Uni	P	Possibly burnt
L208	9	Quartz	Fine grained-feldspar	Flake	15.90	11.30	3.50	0	Absent			1	Uni	A	Possibly burnt
L209	9	Quartz	Fine grained	Flake	12.10	10.70	2.10	0	Absent			1	Uni	P	
L212	9	Quartz	Fine grained	Flake	11.30	8.90	2.30	0	Broken			1	Uni	P	
L213	9	Quartz	Milky	Flake	14.70	16.40	5.80	0	Plain	8.4	3.4	2	Multi	P	

L215	9	Quartz	Fine grained	Flake	11.90	9.50	2.50	0	Plain	3.4	1.6	3	Uni	P	
L216	9	Quartz	Rock crystal	Flake	12.90	8.90	2.40	0	Broken			1	Uni	A	
L218	9	Quartz	Milky-fine grained	Flake	10.70	8.80	1.60	0	Broken			1	Uni	P	
L224	9	Quartz	Greasy-fine grained	Flake	21.60	15.10	3.50	0	Broken			1	Uni	P	
L225	9	Quartz	Milky-rock crystal	Flake	11.10	12.60	3.10	<50	Broken			1	Uni	A	Cortex flat and frosted - block/plate
L226	9	Quartz	Fine grained	Flake	11.50	8.50	2.30	0	Broken			1	Uni	A	
L229	9	Quartz	Milky	Flake	11.50	13.00	3.80	0	Broken			2	Multi	P	
L230	9	Quartz	Milky	Flake	10.62	15.85	3.00	0	Broken			2	Indet	A	
L231	9	Quartz	Greasy-fine grained	Flake	10.40	7.70	2.40	0	Broken			2	Multi	P	
L232	9	Quartz	Milky	Flake	11.70	9.30	3.10	0	Broken			1	Uni	P	
L234	9	Quartz	Milky	Flake	16.10	21.60	5.00	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L235	9	Quartz	Milky	Flake	19.80	10.70	4.20	100	Plain	5.2	1.5	N/A	N/A	P	Cortex smooth and rounded - pebble
L237	9	Quartz	Milky-fine grained	Flake	12.40	9.50	2.80	0	Broken			1	Uni	P	
L238	9	Quartz	Milky	Flake	16.00	18.80	4.30	<50	Plain	14.96	3.88	1	Uni	P	Cortex is smooth and rounded - pebble
L239	9	Quartz	Milky	Flake	10.60	9.70	2.40	0	Broken			1	Uni	A	
L244	9	Quartz	Milky	Flake	15.60	21.40	6.20	<50	Broken			1	Uni	A	Cortex flat and frosted - block/plate
L246	9	Quartz	Milky	Flake	30.80	21.60	10.10	0	Broken			3	Uni	P	
L247	9	Quartz	Milky	Flake	12.60	10.60	5.10	0	Broken			3	Multi	P	
L251	9	Quartz	Milky-fine grained	Flake	14.10	8.80	1.90	0	Absent			2	Multi	P	

L252	9	Quartz	Milky	Flake	10.60	6.50	3.50	0	Broken			1	Uni	P	
L255	9	Quartz	Milky-rock crystal	Flake	13.80	13.10	3.30	0	Broken			1	Uni	A	
L256	9	Quartz	Greasy-fine grained	Flake	15.40	13.40	6.20	0	Plain	12	6.5	3	Multi	A	
L257	9	Quartz	Milky	Flake	14.10	14.20	4.80	0	Plain	8.5	3	2	Multi	P	
L258	9	Quartz	Milky-fine grained	Flake	16.20	21.90	5.30	100	Broken			N/A	N/A	A	Cortex smooth and rounded - pebble, also flat fracture planes along lateral edges
L259	9	Quartz	Milky	Flake	22.40	36.60	20.20	100	Plain	32.7	20.2	N/A	N/A	A	Cortex smooth and rounded - pebble, also flat fracture planes along lateral edges
L260	9	Quartz	Milky	Flake	26.40	31.40	11.30	<50	Cortical	27.6	11.3	1	Uni	P	Cortex smooth and rounded - pebble
L261	9	Quartz	Greasy-fine grained	Flake	11.90	18.70	4.70	<50	Plain	11	4.1	2	Multi	P	Cortex smooth and flat - pebble
L262	9	Quartz	Milky	Flake	11.50	14.60	9.40	<50	Plain	14.6	9.4	1	Uni	P	Cortex flat and frosted - block/plate
L263	9	Quartz	Fine grained	Flake	16.80	15.50	4.80	<50	Absent			2	Multi	P	Not enough cortex present to ascertain probable source
L264	9	Quartz	Milky	Flake	21.60	17.60	6.70	<50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L265	9	Quartz	Fine grained	Flake	10.40	8.90	2.30	0	Plain	7.8	1.7	1	Uni	A	
L266	9	Quartz	Milky	Flake	10.20	7.40	1.50	0	Absent			1	Uni	P	
L268	9	Quartz	Milky	Flake	11.20	10.00	4.00	0	Broken			1	Uni	P	
L269	9	Quartz	Milky	Flake	11.70	8.80	1.80	0	Broken			1	Uni	A	
L270	9	Quartz	Greasy-fine grained	Flake	13.50	11.40	6.40	0	Broken			2	Multi	A	

L271	9	Quartz	Milky-rock crystal	Flake	19.00	5.30	3.20	0	Broken			1	Uni	P	
L273	9	Quartz	Milky-rock crystal	Flake	10.30	5.10	1.90	0	Broken			1	Uni	A	
L278	9	Quartz	Milky	Flake	15.90	9.20	4.60	0	Broken			1	Uni	A	
L279	9	Quartz	Greasy-fine grained	Flake	19.20	24.50	6.80	0	Broken			2	Multi	P	
L280	9	Quartz	Greasy-fine grained	Flake	10.00	6.00	1.50	0	Broken			1	Uni	P	
L282	9	Quartz	Milky	Flake	12.60	8.16	3.40	<50	Broken			1	Uni	A	Cortex flat and frosted - block/plate
L288	9	Quartz	Greasy-fine grained	Flake	13.66	10.71	3.06	0	Absent			1	Uni	P	
L297	9	Quartz	Milky	Flake	12.40	12.00	5.40	0	Broken			3	Uni	P	
L298	9	Quartz	Fine grained	Flake	11.50	10.60	2.30	0	Absent			1	Uni	P	
L299	9	Quartz	Milky	Flake	13.00	8.60	5.30	0	Broken			3	Multi	A	
L302	9	Quartz	Milky-fine grained	Flake	11.00	8.20	4.40	<50	Absent			2	Multi	A	Not enough cortex present to ascertain probable source
L304	9	Quartz	Greasy-fine grained	Flake	10.90	7.80	3.20	0	Broken			2	Multi	P	
L308	9	Quartz	Fine grained	Flake	11.30	14.60	2.50	100	Absent			N/A	N/A	P	Cortex smooth and flat - pebble
L310	9	Quartz	Milky	Flake	11.60	9.10	2.80	>50	Absent			1	Uni	P	Cortex flat - block/plate
L314	9	Quartz	Milky-fine grained	Flake	10.22	7.45	4.69	0	Broken			1	Uni	P	
L315	9	Quartz	Greasy-fine grained	Flake	11.76	8.19	2.53	>50	Absent			1	Uni	P	Cortex smooth and rounded - pebble
L316	9	Quartz	Milky-rock crystal	Flake	14.20	6.63	3.81	0	Absent			1	Uni	P	

L318	9	Quartz	Milky-greasy	Flake	10.40	8.70	6.50	<50	Cortical	8.6	6.5	2	Multi	A	Cortex flat and frosted - block/plate
L319	9	Quartz	Greasy-fine grained	Flake	11.80	11.30	2.30	0	Broken			1	Uni	A	
L323	9	Quartz	Fine grained	Flake	15.10	6.60	10.40	<50	Cortical	6.2	7.4	2	Uni	P	Cortex smooth and rounded - pebble
L324	9	Quartz	Milky	Flake	17.30	4.60	9.10	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L331	9	Quartz	Greasy-fine grained	Flake	10.10	7.80	3.30	0	Broken			1	Uni	A	
L336	9	Quartz	Milky	Flake	12.20	12.50	2.10	0	Absent			1	Uni	P	
L339	9	Quartz	Greasy-fine grained	Flake	12.62	6.03	3.99	0	Broken			1	Uni	A	
L342	9	Quartz	Fine grained	Flake	12.40	4.60	4.20	0	Broken			1	Uni	P	
L346	9	Quartz	Greasy	Flake	11.70	13.40	3.40	0	Broken			2	Multi	P	
L347	9	Quartz	Milky	Flake	10.30	11.10	3.40	0	Broken			2	Multi	P	
L348	9	Quartz	Milky	Flake	11.72	5.77	1.90	0	Broken			2	Multi	A	
L349	9	Quartz	Milky	Flake	10.15	6.75	3.47	0	Broken			1	Uni	A	
L350	9	Quartz	Greasy	Flake	19.20	12.80	5.80	0	Broken			2	Multi	P	
L354	9	Quartz	Milky-greasy	Flake	10.90	8.30	3.50	0	Broken			3	Multi	A	
L355	9	Quartz	Milky	Flake	11.21	6.49	2.40	0	Absent			1	Uni	A	
L359	9	Quartz	Milky	Flake	10.30	9.40	4.60	0	Broken			3	Multi	A	Ventral side completely destroyed by shattering
L360	9	Quartz	Milky	Flake	10.60	10.80	4.40	0	Broken			1	Uni	P	
L366	9	Quartz	Greasy	Flake	15.20	14.00	6.90	<50	Absent			2	Multi	P	Cortex smooth and flat - pebble
L367	9	Quartz	Milky	Flake	13.00	10.80	3.20	0	Absent			1	Uni	P	
L372	9	Quartz	Milky	Flake	10.60	4.50	2.80	0	Broken			1	Uni	P	

L383	9	Quartz	Milky	Flake	12.30	5.70	3.10	<50	Broken			2	Multi	A	Cortex flat and frosted - block/plate
L384	9	Quartz	Greasy	Flake	10.90	5.10	1.80	0	Broken			2	Multi	P	
L387	9	Quartz	Greasy-fine grained	Flake	10.50	11.40	4.00	0	Broken			1	Uni	A	
L393	9	Quartz	Milky	Flake	10.53	5.59	2.54	0	Absent			1	Uni	P	
L394	9	Quartz	Milky-fine grained	Flake	11.50	5.30	1.90	0	Broken			1	Uni	A	
L395	9	Quartz	Milky	Flake	10.92	8.31	4.84	0	Broken			1	Uni	A	
L402	9	Quartz	Milky	Flake	11.60	5.80	3.60	0	Broken			1	Uni	A	
L404	9	Quartz	Milky	Flake	15.85	12.35	5.66	<50	Absent			1	Uni	P	Cortex smooth - pebble
L410	9	Quartz	Milky-rock crystal	Flake	10.00	8.40	3.20	<50	Broken			2	Multi	A	Cortex flat and frosted - block/plate
L412	9	Quartz	Greasy-fine grained	Flake	14.70	7.70	3.10	0	Absent			1	Uni	P	
L413	9	Quartz	Milky	Flake	11.75	7.45	3.24	0	Broken			2	Multi	A	
L421	9	Quartz	Fine grained	Flake	10.00	9.90	3.00	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L423	9	Quartz	Greasy	Flake	14.40	11.90	4.60	0	Broken			1	Uni	P	
L424	9	Quartz	Milky	Flake	15.25	9.66	4.06	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L429	9	Quartz	Milky-fine grained	Flake	10.90	12.70	3.00	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L430	9	Quartz	Greasy	Flake	18.20	7.80	4.20	0	Broken			2	Multi	P	
L431	9	Quartz	Milky	Flake	10.10	11.00	4.70	100	Broken			N/A	N/A	P	Cortex flat and frosted - block/plate
L432	9	Quartz	Milky-rock crystal	Flake	17.10	9.00	4.20	0	Broken			1	Uni	A	
L433	9	Quartz	Milky-fine grained	Flake	11.30	5.20	3.20	100	Broken			N/A	N/A	P	Cortex smooth and flat - pebble

L438	9	Quartz	Milky	Flake	21.90	15.00	7.40	100	Plain	11.6	7.5	N/A	N/A	A	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L440	9	Quartz	Milky-fine grained	Flake	33.00	30.30	10.00	>50	Plain	11.2	3.7	1	Uni	A	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L445	9	Quartz	Milky	Flake	11.50	6.20	3.10	100	Broken			N/A	N/A	A	Cortex rounded and frosted - weathered block?
L449	9	Quartz	Greasy	Flake	11.50	6.90	1.90	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
L452	9	Quartz	Milky-fine grained	Flake	10.20	8.00	4.70	<50	Broken			1	Uni	P	Cortex smooth - likely pebble
L453	9	Quartz	Milky-rock crystal	Flake	16.40	11.10	3.00	<50	Absent			1	Uni	P	Not enough cortex present to ascertain probable source
L457	9	Quartz	Greasy	Flake	12.50	9.50	5.40	<50	Plain	5.00	2.20	3	Multi	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L466	9	Quartz	Milky	Flake	10.30	7.00	3.40	0	Broken			1	Uni	P	
L468	9	Quartz	Greasy-fine grained	Flake	11.70	10.12	2.53	0	Broken			1	Uni	P	
L472	9	Quartz	Milky	Flake	10.70	14.90	3.50	<50	Broken			2	Multi	P	Cortex is flat and smooth - pebble
L478	9	Quartz	Milky-fine grained	Flake	16.00	15.50	8.50	<50	Plain	15.6	8.6	2	Multi	A	Cortex smooth and rounded - pebble; Characteristics of a 'split cobble core'
L479	9	Quartz	Milky	Flake	14.03	12.10	4.93	<50	Broken			3	Multi	A	Cortex smooth and rounded - pebble
L480	9	Quartz	Greasy	Flake	15.63	9.38	3.78	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate

L481	9	Quartz	Fine grained	Core rejuvenation flake	31.00	12.00	10.60	0	Broken			4	Multi	A	
L482	9	Quartz	Fine grained	Core rejuvenation flake	33.10	9.30	9.60	<50	Broken			3	Multi	A	Cortex smooth and rounded - pebble
L484	9	Quartz	Milky	Flake	15.40	15.20	3.70	0	Broken			1	Uni	P	
L485	9	Quartz	Milky	Flake	12.70	8.60	3.00	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L487	9	Quartz	Milky	Flake	15.50	17.20	6.40	100	Plain	10.9	6.4	N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L488	9	Quartz	Milky	Flake	11.93	15.75	5.61	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L489	9	Quartz	Milky-fine grained	Flake	17.30	14.90	3.10	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L491	9	Quartz	Milky	Flake	10.70	10.40	4.90	0	Broken			2	Multi	P	
L492	9	Quartz	Milky	Flake	11.59	9.90	4.14	0	Broken			1	Uni	P	
L493	9	Quartz	Fine grained	Flake	22.80	41.70	11.20	0	Absent			2	Multi	P	
L494	9	Quartz	Milky	Flake	29.80	17.90	7.70	100	Broken			N/A	N/A	P	Cortex rounded and frosted - weathered block?
L495	9	Quartz	Milky	Flake	17.97	23.74	9.38	100	Broken			N/A	N/A	P	Cortex rounded and frosted - weathered block?
L496	9	Quartz	Milky	Flake	14.20	10.50	7.50	<50	Broken			1	Uni	A	Cortes smooth and rounded - pebble; characteristics of a 'split cobble core'
L497	9	Quartz	Greasy	Flake	16.49	9.25	3.65	0	Broken			1	Uni	A	
L498	9	Quartz	Milky-fine grained	Flake	19.10	14.80	8.20	0	Broken			1	Uni	P	

L499	9	Quartz	Milky	Flake	17.39	21.37	10.25	<50	Cortical	17.48	10.26	1	Uni	P	Cortex flat and frosted - block/plate
L500	9	Quartz	Greasy	Flake	19.10	16.30	8.20	0	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L501	9	Quartz	Greasy-fine grained	Flake core	17.50	24.40	9.20	0	Broken			2	Uni	P	Further flake removed from the ventral face from the same platform
L502	9	Quartz	Milky	Flake	18.80	27.30	12.40	0	Broken			1	Uni	P	
L505	9	Quartz	Greasy-fine grained	Flake	16.50	30.50	12.70	<50	Broken			2	Uni	P	Cortex flat and frosted - block/plate
L506	9	Quartz	Milky	Flake	33.00	33.20	22.20	>50	Cortical	19.12	17.55	2	Multi	A	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L508	9	Feldspar		Flake	47.50	52.00	26.30	<50	Cortical	50.2	24.7	2	Multi	P	Cortex smooth and rounded - pebble
L510	14	Quartz	Fine grained	Flake	18.10	18.70	9.50	0	Plain	16.6	9.5	3	Uni	A	
L511	14	Quartz	Milky-fine grained	Flake	18.70	7.5	6.00	0	Absent			2	Indet	P	
L513	14	Quartz	Milky	Flake	10.80	18.20	4.60	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L515	14	Quartz	Coarse grained	Flake	24.40	15.30	8.40	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
L518	14	Quartz	Milky	Flake	15.30	27.70	9.90	100	Plain	25.4	10.9	N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L519	14	Quartz	Milky	Flake	19.80	17.90	9.70	>50	Plain	7.8	2.6	1	Uni	A	Cortex smooth and rounded - pebble
L520	14	Quartz	Milky	Flake	19.30	8.20	3.80	0	Plain	6.8	4.2	1	Uni	P	
L521	14	Quartz	Milky-fine grained	Flake	17.40	6.20	4.10	0	Broken			1	Uni	P	
L522	14	Quartz	Fine grained	Flake	10.10	8.50	2.40	0	Broken			1	Uni	A	

L523	14	Quartz	Milky	Flake	13.00	10.20	7.40	0	Plain	8.5	4.5	2	Multi	P	
L524	14	Quartz	Milky	Flake	11.40	6.90	2.20	0	Broken			1	Uni	P	
L525	14	Quartz	Milky	Flake	16.30	10.60	3.40	0	Plain	3.1	1.7	2	Multi	A	
L527	14	Quartz	Coarse grained-quartzite	Flake	17.30	22.20	9.50	0	Broken			3	Multi	P	
L534	14	Quartz	Greasy	Flake	15.90	8.50	6.00	0	Broken			3	Multi	A	
L540	14	Quartz	Milky-rock crystal	Flake	10.40	5.90	3.30	0	Broken			2	Multi	P	
L543	14	Quartz	Milky-fine grained	Flake	12.10	10.40	3.70	0	Broken			1	Uni	P	
L544	14	Quartz	Milky	Flake	11.90	8.90	5.10	0	Broken			2	Uni	P	
L545	14	Quartz	Milky	Flake	14.50	11.60	5.00	<50	Broken			N/A	N/A	P	Dorsal face partly destroyed due to knapping shatter; cortex flat and frosted - block/plate
L546	14	Quartz	Milky	Flake	11.40	7.00	5.80	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L547	14	Quartz	Greasy-fine grained	Flake	17.40	22.60	9.10	<50	Broken			1	Uni	A	Cortex flat and frosted - block/plate
L553	14	Quartz	Milky-rock crystal	Flake	17.50	10.50	4.70	100	Broken			N/A	N/A	A	Cortex smooth and rounded - pebble
L554	14	Quartz	Greasy-fine grained	Flake	14.20	12.00	3.20	0	Broken			1	Uni	P	
L579	3	Quartz	Milky	Flake	25.63	26.52	11.29	0	Broken			2	Indet	A	
L580	3	Mudstone		Flake	22.18	13.40	6.95	0	Broken			4	Multi	P	
L583	3	Quartz	Milky	Flake	15.39	15.80	4.12	0	Absent			2	Multi	P	

L584	3	Quartz	Milky	Flake	17.07	22.67	4.57	0	Broken			1	Uni	P	Crushing around left lateral edge between platform and proximal end creating a sub-round smooth edge; no evidence of retouch
L585	3	Quartz	Fine grained	Flake	14.82	16.68	6.97	0	Broken			1	Uni	A	
L589	3	Quartz	Milky	Flake	14.95	11.34	3.94	0	Absent			1	Uni	P	
L590	3	Quartz	Milky-rock crystal	Flake	11.08	9.83	1.92	0	Absent			1	Uni	P	
L591	3	Quartz	Greasy	Flake	11.86	7.04	1.50	0	Absent			1	Uni	P	
L597	9	Quartz	Milky-fine grained	Flake	50.00	33.03	18.39	<50	Cortical	30.73	17.99	1	Uni	P	This piece has two ventral faces; cortex smooth and rounded - pebble
L598	9	Quartz	Milky	Flake	11.88	16.83	4.69	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L601	9	Quartz	Milky-rock crystal	Flake	11.11	8.15	3.27	0	Broken			2	Multi	A	
L603	9	Quartz	Milky	Flake	10.13	7.07	2.80	0	Absent			2	Multi	A	

L605	9	Mudstone		Flake	16.44	24.53	3.62	<50	Absent			1	Uni	A	The platform for the dorsal removal is a flat area of cortex on the right lateral side of the flake, therefore this appears also as a ventral face; removal of L605 and subsequent shattering of its platform has destroyed part of the flake scar indicating it had been detached from a core prior to the final flake removal; cortex weathered
L629	9	Flint		Flake	10.67	7.36	2.03	>50	Crushed			1	Uni	P	Cortex smooth and flat - pebble; partly burnt
L630	9	Mudstone		Flake	11.23	7.33	2.08	0	Absent			2	Uni	P	
L631	9	Mudstone		Flake	15.50	13.79	4.07	>50	Absent			1	Uni	P	Cortex weathered - outcrop?
L632	9	Quartz	Fine grained	Flake	11.48	17.74	3.98	100	Cortical	14.35	3.81	N/A	N/A	A	Cortex rounded - pebble
L634	9	Quartz	Coarse grained	Flake	26.38	19.31	5.34	0	Crushed			3	Multi	P	
L635	9	Quartz	Rock crystal	Flake	16.07	10.44	4.59	0	Broken			2	Multi	P	
L637	9	Quartz	Fine grained	Blade	20.01	7.59	3.81	0	Absent			2	Uni	P	
L639	9	Quartz	Fine grained	Flake	10.07	13.97	4.27	0	Crushed			3	Multi	P	
L641	9	Quartz	Milky	Flake	19.66	13.41	9.82	0	Broken			4	Multi	A	

L645	9	Quartz	Milky	Flake	12.66	6.65	3.05	<50	Plain	6.63	3.05	1	Uni	A	Not enough cortex present to ascertain probable source
L646	9	Quartz	Greasy	Flake	12.97	11.84	4.11	<50	Absent			2	Multi	P	Cortex smooth and rounded - pebble
SF64	9	Flint		Small fraction flake	8.90	13.30	2.70	0						P	
SF66	9	Flint		Small fraction flake	9.60	8.60	2.10	0						P	
SF73	9	Quartz	Greasy-fine grained	Small fraction flake	9.30	17.20	3.90	<50						P	
SF87	9	Mudstone		Small fraction flake	9.80	10.40	3.10	<50						P	
SF93	9	Flint		Small fraction flake	4.90	10.10	2.00	0						P	
SF103j	9	Unknown	Igneous	Small fraction flake	9.10	7.60	3.40	0						P	
L1	9	Mudstone		Small fraction flake	9.20	11.90	2.10	0						P	
L2	9	Mudstone		Small fraction flake	9.60	11.00	1.80	0						P	
L3	9	Mudstone		Small fraction flake	8.00	12.10	1.20	0						P	
L12	9	Mudstone		Small fraction flake	7.60	16.10	1.60	0						P	Distal end of broken flake
L18	9	Mudstone		Small fraction flake	8.70	12.60	2.80	100						P	Distal end of broken flake

L20	9	Mudstone		Small fraction flake	5.70	10.50	1.60	0						P	
L21	9	Mudstone		Small fraction flake	5.30	7.90	2.40	<50						A	
L22	9	Mudstone		Small fraction flake	6.60	8.90	2.10	100						P	
L23	9	Mudstone		Small fraction flake	6.80	8.50	1.30	0						P	
L24	9	Mudstone		Small fraction flake	9.80	10.10	0.70	0						P	
L25	9	Mudstone		Small fraction flake	8.20	9.40	3.20	0						P	
L26	9	Mudstone		Small fraction flake	4.20	5.70	3.10	0						P	
L27	9	Mudstone		Small fraction flake	9.90	6.60	2.60	0						P	
L28	9	Mudstone		Small fraction flake	8.40	10.40	4.40	0						P	
L29	9	Mudstone		Small fraction flake	8.10	6.20	1.60	0						P	
L30	9	Mudstone		Small fraction flake	8.60	6.50	3.10	0						P	
L31	9	Mudstone		Small fraction flake	4.00	6.60	4.10	0						P	

L32	9	Mudstone		Small fraction flake	5.60	8.50	3.20	0						P	Distal end of broken flake
L33	9	Mudstone		Small fraction flake	6.70	7.70	1.20	0						P	
L34	9	Mudstone		Small fraction flake	7.70	5.90	0.80	0						P	
L35	9	Mudstone		Small fraction flake	8.80	5.90	0.90	0						P	
L36	9	Mudstone		Small fraction flake	8.78	7.60	2.60	<50						P	
L37	9	Mudstone		Small fraction flake	3.60	7.30	1.00	0						P	
L38	9	Mudstone		Small fraction flake	6.40	5.60	1.50	0						A	
L39	9	Mudstone		Small fraction flake	6.60	6.20	0.90	0						P	Flaked flake spall
L40	9	Mudstone		Small fraction flake	6.50	6.00	1.40	0						A	
L41	9	Mudstone		Small fraction flake	6.90	5.40	2.40	0						P	
L42	9	Mudstone		Small fraction flake	5.70	5.10	2.40	0						P	
L43	9	Mudstone		Small fraction flake	6.50	14.70	2.00	0						P	

L46	9	Mudstone		Small fraction flake	5.30	10.90	2.30	0						P	Flaked flake spall
L52	9	Mudstone		Small fraction flake	9.20	8.37	4.19	0						P	
L54	9	Mudstone		Small fraction flake	7.60	6.20	3.10	<50						P	
L63	9	Flint		Small fraction flake	8.90	12.00	4.70	0						P	
L66	9	Flint		Small fraction flake	9.20	16.60	2.00	<50						P	
L68	9	Flint		Small fraction flake	8.60	11.30	3.40	0						P	
L71	9	Flint		Small fraction flake	9.40	12.60	1.20	0						P	Flaked flake spall
L72	9	Flint		Small fraction flake	9.90	8.70	2.60	<50						P	
L77	9	Flint		Small fraction flake	9.00	11.70	0.80	0						P	
L82	9	Flint		Small fraction flake	7.70	10.00	2.50	0						P	
L83	9	Flint		Small fraction flake	7.80	9.00	2.00	<50						A	
L84	9	Flint		Small fraction flake	8.00	9.20	1.10	0						P	

L85	9	Flint		Small fraction flake	6.70	7.90	1.50	0						P	
L86	9	Flint		Small fraction flake	8.30	9.40	2.40	0						P	
L87	9	Flint		Small fraction flake	4.10	10.90	1.90	>50						P	
L88	9	Flint		Small fraction flake	8.00	7.50	1.50	<50						A	
L89	9	Flint		Small fraction flake	6.20	7.80	1.90	<50						P	
L91	9	Flint		Small fraction flake	8.90	9.10	2.00	0						P	
L92	9	Flint		Small fraction flake	6.50	8.40	2.10	0						P	
L93	9	Flint		Small fraction flake	8.60	7.30	1.60	<50						A	
L94	9	Flint		Small fraction flake	7.80	5.70	1.10	0						P	
L95	9	Flint		Small fraction flake	6.40	6.40	1.40	0						P	
L96	9	Flint		Small fraction flake	6.10	5.70	1.80	0						A	
L97	9	Flint		Small fraction flake	5.50	6.00	1.10	0						A	

L98	9	Flint		Small fraction flake	5.10	4.70	0.50	0						P	
L99	9	Flint		Small fraction flake	8.60	9.40	1.80	<50						P	
L100	9	Flint		Small fraction flake	6.50	6.90	0.80	0						P	
L102	9	Flint		Small fraction flake	9.20	6.93	5.50	0						P	
L104	9	Flint		Small fraction flake	7.10	6.40	4.40	100						P	
L105	9	Flint		Small fraction flake	9.30	7.00	2.70	0						P	
L106	9	Mudstone		Small fraction flake	6.70	3.90	1.90	100						P	
L107	9	Flint		Small fraction flake	4.50	5.70	2.90	0						P	
L108	9	Flint		Small fraction flake	5.60	7.30	2.70	100						P	
L109	9	Flint		Small fraction flake	6.00	9.00	2.20	0						P	
L110	9	Flint		Small fraction flake	8.30	5.70	1.90	<50						P	
L111	9	Flint		Small fraction flake	4.80	8.10	1.20	100						P	

L114	9	Flint		Small fraction flake	6.90	9.60	2.10	0						P	Burnt
L116	9	Flint		Small fraction flake	9.26	7.94	3.33	0						P	Burnt
L117	9	Flint		Small fraction flake	6.80	5.90	2.20	<50						P	
L119	9	Flint		Small fraction flake	7.50	6.20	3.50	<50						P	
L121	14	Mudstone		Small fraction flake	7.00	10.80	3.00	0						P	
L123	14	Mudstone		Small fraction flake	9.00	9.60	1.60	0						P	Flaked flake spall
L127	14	Mudstone		Small fraction flake	7.70	9.40	3.00	<50						P	
L128	14	Flint		Small fraction flake	9.50	11.60	2.60	0						A	
L131	14	Flint		Small fraction flake	7.30	8.20	1.00	0						P	Flaked flake spall
L181	9	Quartz	Milky	Small fraction flake	5.50	16.80	4.00	<50						P	Flaked flake spall
L183	9	Quartz	Fine grained	Small fraction flake	7.20	7.50	1.80	0						P	
L184	9	Quartz	Milky	Small fraction flake	8.80	8.30	2.50	0						A	

L185	9	Quartz	Milky	Small fraction flake	9.50	12.30	3.70	<50						P	
L186	9	Quartz	Milky	Small fraction flake	5.70	9.00	1.50	0						A	
L191	9	Quartz	Milky-rock crystal	Small fraction flake	9.70	9.20	2.00	0						P	
L192	9	Quartz	Milky-rock crystal	Small fraction flake	7.70	9.50	2.10	0						P	
L194	9	Quartz	Milky-rock crystal	Small fraction flake	9.80	7.40	2.60	100						P	
L195	9	Quartz	Greasy-fine grained	Small fraction flake	6.70	8.50	1.40	0						A	Flaked flake spall
L210	9	Quartz	Greasy-fine grained	Small fraction flake	7.30	8.70	1.90	0						P	
L211	9	Quartz	Milky-rock crystal	Small fraction flake	7.00	6.20	1.80	0						P	
L214	9	Quartz	Milky-fine grained	Small fraction flake	8.60	10.50	2.80	0						P	Flaked flake spall
L217	9	Quartz	Milky	Small fraction flake	9.80	7.30	2.10	0						P	
L219	9	Quartz	Milky-fine grained	Small fraction flake	9.70	10.00	3.20	0						P	
L220	9	Quartz	Milky	Small fraction flake	9.10	6.40	1.70	>50						P	

L221	9	Quartz	Milky-fine grained	Small fraction flake	5.50	8.90	2.40	0						A	
L222	9	Quartz	Fine grained	Small fraction flake	9.10	13.40	2.20	0						P	
L223	9	Quartz	Fine grained	Small fraction flake	7.20	7.50	1.00	0						P	
L227	9	Quartz	Fine grained	Small fraction flake	8.00	7.30	1.40	0						P	
L228	9	Quartz	Greasy-fine grained	Small fraction flake	7.40	6.60	1.20	0						P	
L233	9	Quartz	Greasy-fine grained	Small fraction flake	5.80	8.90	1.70	0						P	
L236	9	Quartz	Greasy-fine grained	Small fraction flake	8.00	11.90	3.00	0						P	
L240	9	Quartz	Milky	Small fraction flake	6.60	7.10	1.40	0						P	
L241	9	Quartz	Fine grained	Small fraction flake	6.80	6.80	1.80	0						P	
L242	9	Quartz	Fine grained	Small fraction flake	8.00	6.30	2.60	0						P	
L243	9	Quartz	Milky	Small fraction flake	7.80	8.50	0.90	>50						P	
L245	9	Quartz	Milky	Small fraction flake	9.00	8.30	1.50	100						A	

L248	9	Quartz	Milky-fine grained	Small fraction flake	9.10	7.40	2.90	0						P	
L249	9	Quartz	Fine grained	Small fraction flake	8.60	8.70	1.40	0						P	
L250	9	Quartz	Greasy	Small fraction flake	7.60	8.80	2.80	0						P	
L253	9	Quartz	Milky-rock crystal	Small fraction flake	5.40	8.60	1.30	0						P	
L254	9	Quartz	Milky-rock crystal	Small fraction flake	7.50	7.90	1.90	0						P	
L267	9	Quartz	Milky	Small fraction flake	9.40	6.40	1.20	0						P	
L272	9	Quartz	Milky-rock crystal	Small fraction flake	6.30	6.80	1.70	0						A	
L274	9	Quartz	Milky-rock crystal	Small fraction flake	7.30	9.60	1.90	0						P	
L275	9	Quartz	Milky-rock crystal	Small fraction flake	9.70	8.10	2.40	<50						P	
L276	9	Quartz	Milky-rock crystal	Small fraction flake	4.50	6.70	2.70	0						A	
L277	9	Quartz	Greasy-fine grained	Small fraction flake	6.40	6.50	1.00	0						P	
L281	9	Quartz	Greasy-fine grained	Small fraction flake	5.80	8.40	1.50	>50						P	

L283	9	Quartz	Greasy-fine grained	Small fraction flake	8.00	7.50	2.90	0						P	
L284	9	Quartz	Milky	Small fraction flake	9.30	5.65	2.28	>50						P	
L285	9	Quartz	Milky-rock crystal	Small fraction flake	6.90	8.80	2.10	<50						P	
L286	9	Quartz	Milky	Small fraction flake	5.80	8.00	4.10	<50						P	
L287	9	Quartz	Milky-fine grained	Small fraction flake	6.10	6.13	3.30	0						P	
L289	9	Quartz	Milky-fine grained	Small fraction flake	7.20	11.00	3.30	0						P	
L290	9	Quartz	Milky-fine grained	Small fraction flake	8.40	6.20	1.50	0						P	
L291	9	Quartz	Greasy-fine grained	Small fraction flake	6.90	9.40	2.20	0						P	
L292	9	Quartz	Milky	Small fraction flake	7.20	11.00	2.20	0						P	
L293	9	Quartz	Greasy-fine grained	Small fraction flake	7.70	10.70	1.90	0						P	
L294	9	Quartz	Greasy-fine grained	Small fraction flake	9.90	7.40	2.60	0						P	
L295	9	Quartz	Rock crystal	Small fraction flake	5.40	10.60	3.00	0						P	

L296	9	Quartz	Milky	Small fraction flake	9.60	5.60	4.00	<50						P	
L300	9	Quartz	Milky	Small fraction flake	5.70	9.50	2.50	0						P	
L301	9	Quartz	Milky	Small fraction flake	8.20	8.00	3.40	100						P	
L303	9	Quartz	Greasy-fine grained	Small fraction flake	5.60	12.50	4.70	<50						P	
L305	9	Quartz	Fine grained	Small fraction flake	8.30	5.80	3.80	100						P	
L306	9	Quartz	Milky	Small fraction flake	6.40	5.00	2.50	0						P	
L307	9	Quartz	Milky	Small fraction flake	8.10	6.00	2.30	0						P	
L309	9	Quartz	Milky	Small fraction flake	9.10	15.00	4.20	0						P	
L311	9	Quartz	Milky-rock crystal	Small fraction flake	6.70	9.70	2.30	100						P	
L312	9	Quartz	Milky-rock crystal	Small fraction flake	5.30	8.60	1.50	0						P	
L313	9	Quartz	Fine grained	Small fraction flake	9.44	9.13	3.09	>50						A	
L317	9	Quartz	Milky-fine grained	Small fraction flake	9.70	10.00	1.40	0						P	

L320	9	Quartz	Milky	Small fraction flake	5.50	7.00	1.50	100						P	
L321	9	Quartz	Milky	Small fraction flake	7.60	6.70	2.00	100						P	
L322	9	Quartz	Greasy-fine grained	Small fraction flake	7.70	9.40	2.10	<50						A	
L325	9	Quartz	Milky	Small fraction flake	8.30	5.20	2.50	0						P	
L326	9	Quartz	Greasy-fine grained	Small fraction flake	5.50	8.40	1.60	0						P	
L327	9	Quartz	Rock crystal-fine grained	Small fraction flake	8.10	8.30	3.30	>50						P	
L328	9	Quartz	Milky-fine grained	Small fraction flake	9.80	8.40	2.50	0						P	
L329	9	Quartz	Milky-fine grained	Small fraction flake	9.60	6.50	2.90	0						P	
L330	9	Quartz	Milky-fine grained	Small fraction flake	6.70	7.80	1.60	0						P	
L332	9	Quartz	Milky-rock crystal	Small fraction flake	6.10	6.70	1.40	0						P	
L333	9	Quartz	Milky	Small fraction flake	9.30	8.90	2.90	0						P	
L334	9	Quartz	Milky-rock crystal	Small fraction flake	5.10	7.80	1.40	0						P	

L335	9	Quartz	Milky	Small fraction flake	8.30	8.30	3.20	0						P	
L337	9	Quartz	Milky-fine grained	Small fraction flake	8.11	9.00	3.20	100						P	
L338	9	Quartz	Milky-fine grained	Small fraction flake	5.30	6.00	2.90	0						P	
L340	9	Quartz	Greasy-fine grained	Small fraction flake	7.50	6.40	1.50	0						P	
L341	9	Quartz	Greasy-fine grained	Small fraction flake	8.80	9.80	3.80	0						P	
L343	9	Quartz	Greasy-fine grained	Small fraction flake	4.60	8.00	2.20	0						P	
L344	9	Quartz	Milky-fine grained	Small fraction flake	7.10	5.00	2.60	0						P	
L345	9	Quartz	Greasy	Small fraction flake	5.50	9.00	3.60	<50						P	
L351	9	Quartz	Milky-fine grained	Small fraction flake	7.60	6.40	1.50	<50						P	
L352	9	Quartz	Milky	Small fraction flake	6.40	7.60	1.50	0						P	
L353	9	Quartz	Greasy	Small fraction flake	7.20	6.40	1.30	0						P	
L356	9	Quartz	Milky-fine grained	Small fraction flake	7.10	5.50	2.90	0						P	

L357	9	Quartz	Fine grained	Small fraction flake	8.70	5.70	2.60	100						P	
L361	9	Quartz	Greasy-fine grained	Small fraction flake	9.60	6.90	3.00	0						P	
L362	9	Quartz	Milky-fine grained	Small fraction flake	7.20	10.80	3.20	<50						A	
L363	9	Quartz	Greasy	Small fraction flake	5.30	4.30	2.30	0						P	
L364	9	Quartz	Milky	Small fraction flake	9.60	6.40	4.80	100						P	
L365	9	Quartz	Greasy	Small fraction flake	5.30	6.50	2.90	0						P	
L369	9	Quartz	Milky	Small fraction flake	7.90	9.70	3.50	<50						P	
L371	9	Quartz	Fine grained	Small fraction flake	7.70	5.60	2.10	0						P	
L373	9	Quartz	Milky	Small fraction flake	9.10	5.50	3.10	<50						P	
L374	9	Quartz	Milky	Small fraction flake	7.30	5.10	2.40	0						P	
L376	9	Quartz	Milky-fine grained	Small fraction flake	5.80	8.20	2.20	0						A	
L377	9	Quartz	Greasy-fine grained	Small fraction flake	6.40	6.50	2.70	0						P	

L378	9	Quartz	Milky	Small fraction flake	7.80	12.80	2.70	0						A	
L379	9	Quartz	Milky-fine grained	Small fraction flake	6.50	6.70	1.60	0						P	
L380	9	Quartz	Milky	Small fraction flake	8.20	5.10	2.10	0						P	
L381	9	Quartz	Greasy-fine grained	Small fraction flake	4.50	7.90	2.60	0						A	
L382	9	Quartz	Milky	Small fraction flake	6.40	7.00	3.30	0						P	
L386	9	Quartz	Greasy	Small fraction flake	6.70	6.10	0.90	0						P	
L388	9	Quartz	Milky	Small fraction flake	4.60	6.60	2.70	100						P	
L389	9	Quartz	Fine grained	Small fraction flake	5.90	5.70	1.50	0						P	
L390	9	Quartz	Milky-rock crystal	Small fraction flake	7.00	9.50	2.20	100						P	
L392	9	Quartz	Milky-fine grained	Small fraction flake	5.50	8.30	1.30	0						P	
L396	9	Quartz	Milky	Small fraction flake	7.60	13.20	3.00	0						P	
L397	9	Quartz	Greasy-fine grained	Small fraction flake	6.20	9.40	2.00	0						P	

L398	9	Quartz	Greasy-fine grained	Small fraction flake	4.60	9.80	2.20	0						P	
L399	9	Quartz	Milky-fine grained	Small fraction flake	5.60	5.20	1.70	0						P	
L400	9	Quartz	Fine grained	Small fraction flake	7.90	7.10	2.40	0						A	
L401	9	Quartz	Milky	Small fraction flake	8.00	5.60	4.30	<50						P	
L403	9	Quartz	Milky	Small fraction flake	5.60	8.00	3.00	<50						P	
L405	9	Quartz	Milky-rock crystal	Small fraction flake	6.50	6.30	2.70	100						P	
L406	9	Quartz	Milky-fine grained	Small fraction flake	7.90	9.40	2.10	0						P	
L407	9	Quartz	Milky	Small fraction flake	9.30	10.20	2.70	>50						P	
L408	9	Quartz	Milky-fine grained	Small fraction flake	6.80	7.50	1.80	0						P	
L409	9	Quartz	Milky-fine grained	Small fraction flake	3.80	7.60	2.10	0						P	
L414	9	Quartz	Greasy-fine grained	Small fraction flake	7.40	10.80	1.50	0						P	
L416	9	Quartz	Greasy-fine grained	Small fraction flake	6.60	12.00	5.70	0						P	

L418	9	Quartz	Greasy-fine grained	Small fraction flake	7.00	7.10	3.90	<50						P	
L419	9	Quartz	Greasy-fine grained	Small fraction flake	5.70	9.00	1.70	0						P	
L420	9	Quartz	Milky-rock crystal	Small fraction flake	8.00	8.22	2.30	0						P	
L422	9	Quartz	Milky	Small fraction flake	8.00	11.10	3.60	0						A	
L425	9	Quartz	Milky-rock crystal	Small fraction flake	7.70	5.20	1.90	0						P	
L427	9	Quartz	Milky	Small fraction flake	9.90	5.70	1.80	0						P	
L428	9	Quartz	Fine grained	Small fraction flake	8.00	9.30	2.00	0						P	
L434	9	Quartz	Rock crystal	Small fraction flake	7.70	6.60	3.10	0						P	
L436	9	Quartz	Milky-fine grained	Small fraction flake	9.50	8.70	1.80	0						P	
L437	9	Quartz	Milky-fine grained	Small fraction flake	9.10	8.10	3.50	<50						A	
L441	9	Quartz	Greasy	Small fraction flake	6.20	6.30	2.20	0						P	
L442	9	Quartz	Greasy	Small fraction flake	4.50	9.40	2.70	0						A	

L443	9	Quartz	Milky	Small fraction flake	8.40	5.00	1.60	0						P	
L444	9	Quartz	Milky	Small fraction flake	6.20	9.80	2.30	0						P	
L446	9	Quartz	Milky	Small fraction flake	6.00	5.20	2.00	0						P	
L447	9	Quartz	Milky-fine grained	Small fraction flake	8.00	7.60	2.70	<50						A	
L448	9	Quartz	Milky	Small fraction flake	9.00	9.70	6.40	0						A	
L450	9	Quartz	Milky-rock crystal	Small fraction flake	8.30	6.70	4.10	0						P	
L451	9	Quartz	Milky-rock crystal	Small fraction flake	5.00	8.40	3.10	<50						P	
L455	9	Quartz	Milky-fine grained	Small fraction flake	7.60	10.40	4.30	100						P	
L456	9	Quartz	Milky	Small fraction flake	8.70	5.60	3.00	0						P	
L458	9	Quartz	Milky	Small fraction flake	5.62	10.64	3.40	>50						P	
L459	9	Quartz	Milky	Small fraction flake	9.30	10.70	4.00	0						P	
L461	9	Quartz	Greasy-fine grained	Small fraction flake	9.60	9.40	4.50	0						P	

L462	9	Quartz	Milky	Small fraction flake	6.00	14.40	4.70	0						A	
L463	9	Quartz	Milky	Small fraction flake	9.20	7.70	3.40	0						P	
L464	9	Quartz	Fine grained	Small fraction flake	8.70	6.00	2.10	0						A	
L465	9	Quartz	Milky-rock crystal	Small fraction flake	8.00	5.70	3.20	<50						P	
L470	9	Quartz	Milky-fine grained	Small fraction flake	9.70	7.20	3.10	100						P	
L471	9	Quartz	Milky-rock crystal	Small fraction flake	8.90	9.20	2.90	0						P	
L473	9	Quartz	Milky-rock crystal	Small fraction flake	4.10	6.70	3.20	100						P	
L474	9	Quartz	Milky-rock crystal	Small fraction flake	9.30	6.40	2.50	0						P	
L475	9	Quartz	Milky-rock crystal	Small fraction flake	5.90	6.80	3.60	100						P	
L476	9	Quartz	Greasy-fine grained	Small fraction flake	6.80	5.10	3.70	0						P	
L490	9	Quartz	Milky	Small fraction flake	9.70	9.40	4.70	<50						P	
L512	14	Quartz	Greasy	Small fraction flake	9.90	12.50	3.20	0						P	

L514	14	Quartz	Milky	Small fraction flake	8.80	16.40	3.60	0						P	
L526	14	Quartz	Milky	Small fraction flake	8.70	9.10	2.80	0						P	
L528	14	Quartz	Rock crystal	Small fraction flake	6.50	7.00	1.40	0						P	
L529	14	Quartz	Milky	Small fraction flake	5.18	5.44	6.35	<50						P	
L531	14	Quartz	Milky-fine grained	Small fraction flake	6.00	7.80	4.10	100						A	
L535	14	Quartz	Greasy	Small fraction flake	8.80	6.10	2.80	0						P	
L536	14	Quartz	Fine grained	Small fraction flake	6.00	6.70	2.00	0						P	
L537	14	Quartz	Milky	Small fraction flake	5.80	6.40	1.80	0						P	
L538	14	Quartz	Milky-fine grained	Small fraction flake	9.10	9.80	1.60	0						P	
L539	14	Quartz	Milky-rock crystal	Small fraction flake	7.10	5.50	2.20	0						P	
L541	14	Quartz	Milky	Small fraction flake	7.50	10.30	3.70	0						P	
L542	14	Quartz	Fine grained	Small fraction flake	6.10	7.40	3.70	0						P	

L549	14	Quartz	Milky	Small fraction flake	6.60	8.60	1.50	0						P	
L550	14	Quartz	Milky	Small fraction flake	7.00	7.40	2.30	0						P	
L551	14	Quartz	Fine grained	Small fraction flake	7.00	7.80	2.60	0						P	
L552	14	Quartz	Milky-rock crystal	Small fraction flake	6.10	7.60	2.20	>50						P	
L556	14	Quartz	Greasy-fine grained	Small fraction flake	8.10	10.70	22.60	<50						A	
L581	3	Quartz	Coarse grained-feldspar	Small fraction flake	6.00	5.64	1.55	0						P	
L582	3	Quartz	Milky	Small fraction flake	8.88	8.79	5.07	0						P	
L587	3	Quartz	Milky	Small fraction flake	8.50	11.23	2.43	0						P	
L588	3	Quartz	Milky	Small fraction flake	8.51	9.05	3.73	<50						P	
L592	3	Quartz	Greasy	Small fraction flake	7.13	9.78	3.48	0						P	
L594	3	Quartz	Greasy	Small fraction flake	6.92	7.18	0.91	0						P	
L596	3	Quartz	Milky	Small fraction flake	7.05	12.62	4.59	0						P	

L599	9	Quartz	Milky	Small fraction flake	7.02	8.61	1.82	0						P	
L600	9	Quartz	Milky	Small fraction flake	7.86	9.40	4.56	0						A	
L602	9	Quartz	Milky	Small fraction flake	5.36	8.86	3.41	0						P	
L604	9	Quartz	Greasy	Small fraction flake	5.05	5.20	3.82	<50						A	
L614	9	Flint		Small fraction flake	5.92	10.76	1.73	0						P	
L615	9	Flint		Small fraction flake	8.95	6.74	0.90	0						P	
L626	9	Feldspar		Small fraction flake	7.71	6.09	2.49	>50						P	
L627	9	Flint		Small fraction flake	9.66	10.08	1.46	0						P	
L628	9	Flint		Small fraction flake	8.13	5.79	2.38	<50						A	
L633	9	Quartz	Milky	Small fraction flake	9.50	7.77	2.21	100						P	
L636	9	Quartz	Milky-fine grained	Small fraction flake	6.92	10.16	1.29	0						A	Flaked flake spall
L638	9	Quartz	Milky	Small fraction flake	6.07	7.59	1.93	<50						P	

L640	9	Quartz	Milky	Small fraction flake	9.21	6.11	2.60	0						P	
L642	9	Quartz	Milky	Small fraction flake	7.62	5.90	4.02	<50						P	
L644	9	Quartz	Fine grained	Small fraction flake	8.86	6.38	2.54	<50						P	
L647	9	Quartz	Milky	Small fraction flake	9.14	10.85	2.57	<50						P	Flaked flake spall

Table 53. Northton 2010 Phase 4 flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF100	17	Flint		Flake	11.60	10.30	4.70	>50	Plain	7.8	4.5	1	Uni	P	Cortex rounded - pebble; edge damage resembling retouch present
SF101	17	Flint		Flake	16.80	11.00	3.10	<50	Plain	5.6	2.6	1	Uni	P	Cortex rounded - pebble
L132	16	Flint		Flake	12.10	11.30	4.10	0	Broken			5	Multi	P	
L133	16	Flint		Flake	11.00	7.30	1.80	100	Broken			N/A	N/A	P	
L153	16	Flint		Flake	13.90	7.30	4.20	>50	Absent			2	Multi	P	Pinky cortex, same unit as flakes L147-L155, refit with L167; distal end of broken flake - perpendicular snap across centre of piece; characteristics of a 'split cobble core'
L158	16	Flint		Flake	11.20	5.40	2.90	<50	Broken			1	Uni	A	Refit with L157; only inner cortex present

L159	16	Flint		Flake	11.40	6.75	5.04	<50	Absent			2	Uni	P	Retouch along cortical edge - function indeterminate due to breakage; only inner cortex present
L160	16	Flint		Flake	11.00	4.60	3.20	0	Absent			3	Multi	P	
L161	16	Flint		Flake	12.40	8.10	2.10	0	Absent			3	Multi	P	
L165	17	Flint		Flake	10.40	11.20	1.60	<50	Absent			1	Uni	P	Flaked flake spall; only inner cortex present
L167	17	Flint		Flake	13.30	6.20	4.90	>50	Broken			2	Multi	P	Pinky cortex, same unit as flakes L147-L155; refits with L153; proximal end of broken flake; characteristics of a 'split cobble core'
L558	16	Quartz	Fine grained	Flake	37.10	27.20	12.70	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L560	16	Quartz	Milky	Flake	10.00	12.80	2.00	>50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L561	16	Quartz	Milky	Flake	12.30	10.80	4.50	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
L565	16	Quartz	Milky-greasy	Flake	16.00	10.30	5.70	100	Broken			N/A	N/A	P	
L566	17	Quartz	Milky	Flake	13.00	14.70	7.50	0	Absent			1	Uni	P	
L577	17	Quartz	Coarse grained	Flake	17.70	25.10	7.50	0	Absent			1	Uni	P	
L606	16	Quartz	Milky	Flake	24.12	32.97	8.76	0	Plain	25.29	7.29	1	Uni	P	
L610	16	Flint		Flake	12.61	10.40	1.54	0	Absent			2	Indet	P	
L611	16	Flint		Core rejuv-enation flake	11.94	3.01	7.73	0	Broken			4	Multi	A	

L612	16	Flint		Core rejuv-enation flake	3.88	15.29	7.26	<50	Plain			3	Multi	P	Cortex smooth and rounded - pebble; one previous flake removal used as platform for other two flake removals; secondary working present - used to prepare edge
L616	17	Flint		Flake	10.82	6.04	1.81	0	Absent			1	Uni	P	
L618	17	Unknown		Flake	19.33	20.59	5.10	0	Broken			1	Uni	P	Dorsal flake scar difficult to determine due to the nature of the raw material
L619	16	Flint		Flake	10.64	8.50	2.14	<50	Broken			3	Multi	A	Cortex smooth and rounded - pebble; pink colour
L620	16	Flint		Flake	10.04	11.36	1.75	0	Absent			2	Multi	P	
L621	16	Quartz	Milky	Flake	11.88	14.69	8.45	<50	Plain	11.09	8.61	3	Multi	P	Cortex flat and frosted - block/plate; one dorsal flake scar retains an incipient cone of percussion
L134	16	Flint		Small fraction flake	9.80	6.40	1.60	0						P	
L135	16	Flint		Small fraction flake	7.50	9.80	4.90	<50						P	
L136	16	Flint		Small fraction flake	8.00	8.70	1.30	<50						A	Cortex smooth and rounded - pebble; flake core
L137	16	Flint		Small fraction flake	6.40	7.30	2.10	<50						P	
L138	16	Flint		Small fraction flake	9.80	6.80	1.20	0						P	

L139	16	Flint		Small fraction flake	8.10	7.80	2.20	>50						P	
L140	16	Flint		Small fraction flake	6.00	7.20	1.00	0						P	
L141	16	Flint		Small fraction flake	8.80	9.20	1.90	0						P	
L142	16	Flint		Small fraction flake	8.80	8.30	2.50	0						P	
L143	16	Flint		Small fraction flake	5.70	6.30	2.20	<50						P	
L144	16	Flint		Small fraction flake	6.40	8.10	2.20	0						P	
L145	16	Flint		Small fraction flake	4.80	12.30	2.50	<50						P	
L146	16	Flint		Small fraction flake	9.40	5.60	0.50	<50						P	
L147	16	Flint		Small fraction flake	8.40	6.50	1.50	<50						P	Pinky cortex; same unit as flakes L147-L155
L148	16	Flint		Small fraction flake	8.50	6.80	0.90	<50						A	Pinky cortex; same unit as flakes L147-L155
L149	16	Flint		Small fraction flake	6.90	7.40	0.70	<50						P	Pinky cortex; same unit as flakes L147-L155
L150	16	Flint		Small fraction flake	6.40	7.10	2.80	<50						P	Pinky cortex; same unit as flakes L147-L155

L151	16	Flint		Small fraction flake	8.80	6.10	2.80	>50						P	Pinky cortex; same unit as flakes L147-L155
L155	16	Flint		Small fraction flake	9.90	4.20	4.90	<50						P	Pinky cortex; same unit as flakes L147-L155
L562	16	Quartz	Milky	Small fraction flake	8.60	10.90	3.10	0						P	
L563	16	Quartz	Milky	Small fraction flake	7.60	9.00	5.40	<50						P	
L564	16	Quartz	Milky	Small fraction flake	5.80	7.20	1.70	<50						P	
L567	17	Quartz	Fine grained	Small fraction flake	4.60	10.00	2.80	<50						P	
L568	17	Quartz	Fine grained	Small fraction flake	6.50	11.30	1.60	0						P	
L569	17	Quartz	Milky-rock crystal	Small fraction flake	6.60	7.60	1.20	0						P	
L570	17	Quartz	Milky	Small fraction flake	6.10	5.60	1.60	0						P	
L572	17	Quartz	Fine grained	Small fraction flake	8.90	7.30	3.40	<50						P	
L573	17	Quartz	Fine grained	Small fraction flake	8.90	9.90	6.20	0						P	Dorsal side destroyed by shattering
L575	17	Quartz	Fine grained	Small fraction flake	5.30	4.70	3.50	0						P	

L607	16	Quartz	Milky-rock crystal	Small fraction flake	6.12	8.82	3.12	0						P	
L608	16	Flint		Small fraction flake	5.61	6.91	1.75	0						P	
L623	16	Quartz	Milky	Small fraction flake	6.97	5.46	2.09	0						P	

Table 54. Northton 2010 Phase 3 chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
SF41	9	Flint		Chunk	14.70	10.10	7.00	<50	P	
SF61	9	Feldspar		Chunk	19.30	25.90	13.30	0	P	Burnt and fire fractured
F70b	9	Quartz	Milky	Chunk	15.91	12.47	11.42	<50	P	
SF95u	9	Quartz	Milky	Chunk	25.30	18.34	8.45	0	P	
SF95v	9	Quartz	Milky	Chunk	33.29	15.70	10.97	0	P	
SF96	9	Mudstone		Chunk	28.10	22.10	11.30	0	A	Very weathered and rolled
SF103h	9	Quartz	Milky	Chunk	26.90	10.20	5.90	0	P	
L48	9	Mudstone		Chunk	13.30	7.70	3.40	0	P	
L370	9	Quartz	Milky	Chunk	9.40	7.00	6.30	0	P	
L368	9	Quartz	Greasy-fine grained	Chunk	11.00	4.30	3.80	0	A	
L391	9	Quartz	Milky	Chunk	10.00	6.40	4.80	0	P	
L411	9	Quartz	Milky	Chunk	11.30	5.20	3.40	0	P	
L426	9	Quartz	Greasy-fine grained	Chunk	11.80	11.70	8.80	<50	A	
L469	9	Quartz	Milky	Chunk	10.40	10.30	7.80	<50	P	
L504	9	Feldspar		Chunk	11.41	9.36	7.18	0	P	

L555	14	Quartz	Milky	Chunk	15.00	10.80	6.40	<50	P	
L50	9	Mudstone		Small fraction chunk	9.10	7.50	6.50	0	P	
L51	9	Mudstone		Small fraction chunk	8.10	8.60	3.61	0	A	
L55	9	Mudstone		Small fraction chunk	7.30	4.60	4.40	0	P	
L56	9	Mudstone		Small fraction chunk	5.30	5.60	3.60	0	P	
L101	9	Flint		Small fraction chunk	8.80	8.80	4.50	<50	P	
L103	9	Flint		Small fraction chunk	8.20	7.60	3.50	0	P	
L358	9	Quartz	Greasy-fine grained	Small fraction chunk	7.60	4.80	2.80	0	P	
L375	9	Quartz	Milky	Small fraction chunk	7.60	7.50	4.40	0	P	
L417	9	Quartz	Milky	Small fraction chunk	6.40	6.00	3.60	<50	P	
L435	9	Quartz	Milky	Small fraction chunk	6.70	5.20	4.10	0	P	
L454	9	Quartz	Milky-rock crystal	Small fraction chunk	9.80	9.30	7.90	0	P	
L477	9	Quartz	Greasy	Small fraction chunk	8.10	10.70	4.62	100	P	

L530	14	Quartz	Fine grained	Small fraction chunk	5.00	5.80	3.70	0	P	
L532	14	Quartz	Milky-fine grained	Small fraction chunk	5.40	3.70	4.10	0	P	
L533	14	Quartz	Milky	Small fraction chunk	6.50	4.60	4.50	0	P	
L548	14	Quartz	Milky-rock crystal	Small fraction chunk	7.00	7.40	3.10	0	P	
L586	3	Quartz	Milky	Small fraction chunk	8.89	6.69	4.46	0	P	
L593	3	Quartz	Milky	Small fraction chunk	9.47	4.44	4.24	<50	P	

Table 55. Northton 2010 Phase 4 chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
L154	16	Flint		Chunk	13.50	4.50	4.10	>50	P	Pinky cortex; same unit as flakes L147-L155
L157	16	Flint		Chunk	11.70	10.10	4.30	>50	P	Refit with L158
L622	16	Quartz	Coarse grained-quartzite	Chunk	15.83	8.21	7.11	0	P	
L152	16	Flint		Small fraction chunk	6.20	9.20	5.70	<50	P	Pinky cortex; same unit as flakes L147-L155
L156	16	Flint		Small fraction chunk	5.70	4.40	3.90	0	P	
L166	17	Flint		Small fraction chunk	6.40	6.40	1.90	100	P	
L571	17	Quartz	Milky-rock crystal	Small fraction chunk	7.50	7.30	4.70	0	P	
L574	17	Quartz	Milky	Small fraction chunk	7.70	4.70	2.90	0	P	
L576	17	Quartz	Milky	Small fraction chunk	4.70	4.70	3.40	0	P	
L617	17	Flint		Small fraction chunk	6.83	6.78	3.46	0	P	
L624	16	Quartz	Milky	Small fraction chunk	8.07	4.62	3.07	<50	P	

Table 56. Northton 2010 Phase 3 secondary technology on flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF65	9	Flint		Microlith	29.50	13.40	5.40	0	Absent			3	Uni	A	Double backed blade
SF79	9	Flint		Burin	21.80	14.80	5.50	<50	Plain	10.1	2.2	4	Multi	P	Burin spall removed from right distal end; cortex smooth and flat - pebble
SF97	9	Flint		Microlith	27.70	21.90	4.10	<50	Crushed			3	Multi	P	Microburin; breakage caused by microburin snap
SF103a	9	Quartz		Scraper	42.60	23.20	12.10								Archived for residue/microwear analysis
L65	9	Flint		Microlith	16.20	13.30	8.20	0	Absent			4	Indet	P	Broken, possibly *lamelles a cran*
L79	9	Flint		Microlith	14.00	4.90	1.90	0	Absent			1	Uni	A	Scalene triangle
L90	9	Flint		Microlith	14.70	5.60	1.70	0	Absent			1	Uni	P	Fine point; breakage retouched to cover dorsal side from dorsal side of break
L113	9	Flint		Burin	14.00	8.00	2.40	0	Broken			4	Multi	A	Burin spall removed from right distal end
L467	9	Quartz	Milky-rock crystal	Burin	11.80	8.40	4.20	0	Broken			2	Multi	A	Burin spall removed from proximal to left lateral

Table 57. Northton 2010 Phase 3 detail of retouch

ID No.	Type	Extent	Orientation	Fineness	Morphology	Angle	Course
SF65	Edge	Continuous	Normal	Fine	Sub-parallel	Acute	Straight
SF97	Invasive	Sporadic	Normal	Very coarse	Scaled	Acute	Notched
L65	Edge	Continuous	Normal	Fine to very coarse	Sub-parallel	Very abrupt	Straight to concave
L79	Edge	Continuous	Propeller	Very fine to fine	Sub-parallel	Very abrupt	Straight to convex
L90	Invasive	Continuous	Normal	Very fine to fine	Sub-parallel	Acute	Straight

Table 58. Northton 2010 Phase 4 flake secondary technology

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
L162	16	Flint		Microlith	13.60	6.40	3.90	<50	Absent			2	Multi	A	Crescent
L609	16	Flint		Microlith	8.16	4.11	0.81	0	Absent			1	Uni	P	Oblique point
L613	16	Flint		Microlith	8.64	3.15	1.27	0	Absent			2	Uni	A	Crescent

Table 59. Northton 2010 Phase 4 detail of retouch

ID No.	Type	Extent	Orientation	Fineness	Morphology	Angle	Course
L162	Edge	Continuous	Normal	Fine to coarse	Parallel	Very abrupt	Convex
L609	Edge	Sporadic	Normal	Very fine	Scaled	Abrupt	Straight
L613	Edge	Continuous	Normal	Fine	Scaled	Very abrupt	Convex

Table 60. Northton 2011 Phase 3 coarse stone tool

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Notes
L659	9	Quartz	Greasy	Manuport	49.71	32.50	22.56	Sub-rounded water worn pebble of quartz; no visible evidence of working

Table 61. Northton 2011 Phase 3 cores

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF105	9	Quartz	Greasy	Core	29.40	8.98	P	6	Multidirectional	Unprepared/ lost	Cortex smooth and rounded - pebble
L660	9	Quartz	Fine grained	Core	9.15	0.24	P	1	Unidirectional	Unprepared	Broken core fragment; cortex smooth and rounded - pebble

Table 62. Northton 2011 Phase 3 flakes and small fraction flakes

ID No.	Con-text No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF103	9	Quartz	Milky	Flake	25.51	19.04	8.94	0	Broken			1	Uni	P	
SF104	9	Quartz	Rock crystal	Flake	14.07	6.41	6.83	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
L649	9	Unknown	Igneous	Flake	41.77	40.71	13.44	0	Broken			1	Uni	P	
L654	9	Quartz	Milky	Flake	14.63	13.41	6.03	0	Absent			1	Uni	P	
L656	9	Quartz	Milky	Flake	12.68	12.00	1.64	0	Broken			1	Uni	P	
L657	9	Quartz	Milky	Flake	14.33	7.79	3.41	<50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L658	9	Quartz	Milky-rock crystal	Flake	11.14	9.66	2.28	0	Absent			2	Indet	P	
L661	9	Quartz	Milky	Flake	17.59	18.48	9.97	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'

L650	9	Flint		Small fraction flake	6.17	5.72	2.48	0						P	
L651	9	Quartz	Milky	Small fraction flake	7.77	16.80	3.97	100						P	
L652	9	Quartz	Coarse grained	Small fraction flake	7.06	10.78	2.33	100						P	
L653	9	Quartz	Milky-fine grained	Small fraction flake	6.54	7.35	2.25	100						P	
L655	9	Quartz	Milky-fine grained	Small fraction flake	7.10	5.65	2.30	0						P	

Table 63. Northton 2011 Phase 4 flakes and small fraction flakes

ID No.	Con-text No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
SF107	18	Quartz	Fine grained	Flake	30.18	15.22	4.81	100	Absent			N/A	N/A	A	One small further removal made into the ventral face on the right lateral side at a very abrupt angle; cortex smooth - pebble
L662	16/17	Flint		Flake	16.44	12.35	5.26	<50	Absent			1	Uni	P	Cortex smooth and rounded - pebble
L664	18	Feldspar		Flake	13.59	11.77	2.87	0	Absent			1	Uni	P	
L666	18	Quartz	Milky-fine grained	Flake	11.40	9.25	5.90	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L667	18	Quartz	Milky	Flake	11.87	9.49	2.96	0	Absent			1	Uni	P	

L668	18	Quartz	Milky	Flake	13.74	6.60	5.40	<50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L669	18	Quartz	Milky	Flake	11.09	7.90	5.12	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L670	18	Quartz	Milky	Flake	14.94	6.77	2.30	0	Absent			1	Uni	P	
L663	16/17	Flint		Small fraction flake	5.49	8.93	1.58	<50						P	
L665	18	Quartz	Fine grained	Small fraction flake	8.30	8.66	1.68	0						P	
L671	18	Quartz	Rock crystal	Small fraction flake	7.07	7.59	2.55	0						P	
L672	18	Quartz	Quartzite	Small fraction flake	5.59	7.81	1.77	0						P	

Table 64. Northton material collected during Historic Scotland warden site visit

Small Find No.	Raw Material	Typology	Notes
1	Ceramic	Decorated rim	
2	Quartzite?	Possible polished tool fragment	
3	Quartz	Crested blade/point	
3	Quartz	Platform core	
4	Bone		
5	Quartz	Facetted core	
6	Quartz	Flake	Possible scraper - retouched
7	Mylonite	Chunk	
7	Quartz	Chip	With retouch?
7	Unidentified	Chip	
8	Quartz	Bipolar core	
8	Quartz	Flake	

8	Quartz	Possible core	
9	Mylonite	Chips	
9	Quartz	Bladelet	
10	Mylonite		
10	Quartz	Chip	
10	Quartz	Chip	Possible microlith
11	Quartz	Debitage	
11	Quartz	Debitage	
11	Quartz	Debitage	
11	Flint	Retouched	Burin?
12	Mylonite	Flake	
12	Quartz	Flake debitage	
13	Quartz	Core	
14	Quartz	Chip/bladelet	
15	Quartz	Snapped blade	
15	Quartz		
15	Quartz		
15	Mylonite		
16	Mylonite	Rejuvenation flake?	Broad flake/ blade scars
17	Quartz	Bipolar flake	
17	Flint	Irregular flake	Pebble flint
17	Flint	Blade (snapped)	Pebble flint
18	Quartz	Flake	Blade scars?
19	Quartz	Debitage	
19	Quartz	Possible retouched bladelet	
19	Mylonite	Debitage	
20	Quartz	Pebble core	

20	Quartz		
21	Quartz		
21	Unidentified		
23	Quartz	Core fragment	
24	Quartz	Core?	
25	Quartzite	Chunk	
28	Gneiss derived	Fragment	
32	Quartz		
35	Mylonite	Flake	
36	Quartz	Flake	
37	Quartz	Debitage	
38	Quartz	Core	
38	Quartz	Core rejuvenation	
40	Quartz		
41	Quartz		
42	Quartz	Chunk/core	
U/S	Quartz	Core	From below eroding edge/ back of boulders on beach
U/S	Quartz	Core	From below eroding edge/ back of boulders on beach
U/S	Quartz	Core	From below eroding edge/ back of boulders on beach
U/S	Quartz	Flake	From below eroding edge/ back of boulders on beach
U/S	Quartz	Flake	From below eroding edge/ back of boulders on beach
U/S	Quartzite	Flake	From below eroding edge/ back of boulders on beach
U/S	Quartz	Hammerstone	From foot of site/ edge of beach

Appendix 4 Tràigh an Teampuill Lithic Catalogue

Table 65. Tràigh an Teampuill coarse stone tools

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Notes
L35	8	Gneiss		Manuport/ Hammerstone	97.58	68.99	39.83	Possible hammerstone; sub-rounded stone; large number of peck-marks and depressions situated along two edges, causing cracks to radiate out and active disintegration of the outer surface – one of these has crushing and white discolouration possibly resulting from the striking of quartz
L40	4	Gneiss		Manuport/ Hammerstone	52.38	61.04	27.98	Possible hammerstone; sub-rounded pebble with peck-marks along the shortest edge; fits comfortably in either hand

Table 66. Tràigh an Teampuill cores

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF5	3	Quartz	Milky	Core	40.88	16.98	P	4	Multidirectional	Unprepared/ simple	Pyramid shaped core; cortex smooth and flat - block/plate
L21	10	Quartz	Milky	Core	28.40	6.90	P	4	Unidirectional	Unprepared/ lost	Cortex flat and frosted - block/plate
L31	8	Quartz	Milky	Core	9.36	0.53	P	2	Multidirectional	Simple	The scar from one removal has been used as a platform for the second; cortex smooth and rounded - pebble
L72	3	Quartz	Fine grained	Core	13.91	3.17	P	3	Multidirectional	Unprepared/ lost	Cortex indicates possible pebble
L73	3	Quartz	Coarse grained	Core	19.32	3.53	A	2	Unidirectional	Simple	
L74	3	Quartz	Milky	Core	36.50	18.67	P	2	Unidirectional	Simple	Cortex smooth, flat and weathered - block/plate

Table 67. Tràigh an Teampuill flakes and small fraction flakes

ID No.	Con text No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF2	5	Flint		Flake	12.89	11.07	2.97	0	Absent			6	Uni	P	Refits with L6 - breakage happened in antiquity as the staining and patination on the two pieces is different
SF3	5	Flint		Flake	21.96	14.00	5.06	<50	Crushed			1	Uni	P	Rounded flint pebble with smooth/hard cortex knapped with a bipolar reduction as ventral ripples are opposite those on the dorsal side and distal platform has collapsed; burnt
SF4	5	Quartz	Milky	Flake	41.30	38.36	12.30	<50	Broken			1	Uni	P	Cortex smooth and rounded but still with angular fractures
SF6	3	Quartz	Milky	Flake	13.73	13.20	3.79	0	Broken			1	Uni	P	
L2	1	Quartz	Greasy	Flake	10.21	6.60	4.59	0	Absent			3	Multi	P	
L5	5	Flint		Flake	10.65	11.73	1.30	0	Absent			2	Multi	P	
L6	5	Flint		Flake	10.51	4.69	3.24	0	Absent			2	Uni	P	Refits with SF2 - breakage happened in antiquity as the staining and patination on the two pieces is different
L7	7	Quartz	Greasy	Flake	10.43	7.56	2.00	<50	Absent			1	Uni	P	Cortex flat and frosted - block/plate

L10	3	Flint		Flake	11.27	7.04	1.14	0	Absent			1	Uni	P	
L11	3	Metabasalt		Blade	17.61	8.84	3.02	<50	Absent			1	Uni	A	Possible bladelet
L12	3	Metabasalt		Flake	16.42	7.62	4.59	0	Absent			7	Multi	P	Dorsal flake scars may be retouch, it is very difficult to tell due to the nature of the raw material, therefore the retouch attributes were not recorded
L14	4	Flint		Blade	11.40	5.36	1.72	0	Crushed			2	Uni	A	Same pink flint as L13; possible blade
L15	4	Flint		Flake	16.82	12.37	2.57	0	Crushed			4	Multi	P	Burnt; dorsal side patinated
L17	4	Flint		Flake	11.16	10.42	2.47	0	Broken			1	Uni	P	
L20	8	Quartz	Greasy	Flake	13.21	14.70	3.81	0	Crushed			2	Multi	A	Broken blade
L26	10	Quartz	Milky	Flake core	13.26	19.26	6.47	<50	Broken			2	Multi	A	Flake appears to have been detached then a rejuvenation initiated from the proximal end to create a platform on the right lateral edge, from which a further flake has been detached on the dorsal surface
L30	8	Quartz	Milky	Flake	14.60	9.76	7.15	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L33	8	Quartz	Greasy	Flake	10.09	12.54	3.09	0	Broken			2	Indet	A	
L34	8	Quartz	Greasy	Flake	10.03	7.61	3.83	0	Broken			1	Uni	P	
L37	5	Mudstone		Flake	10.30	5.61	1.71	<50	Broken			1	Uni	P	Cortex smooth and weathered
L38	5	Quartz	Milky	Flake	21.79	14.16	6.03	0	Broken			1	Uni	P	

L39	5	Quartz	Fine grained	Flake	13.93	14.06	4.25	100	Broken			N/A	N/A	P	Cortex flat break along fracture plane
L41	4	Flint		Flake	18.35	10.78	3.43	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L43	4	Quartz	Milky	Flake	11.99	7.33	3.11	<50	Cortical	3.90	1.47	1	Uni	P	Not enough cortex present to ascertain probable source
L45	4	Quartz	Milky	Flake core	12.57	11.94	4.91	<50	Cortical	7.12	3.88	1	Uni	A	Dorsal flake scar is a prior removal from the same platform
L50	3	Flint		Flake	12.91	12.55	8.68	>50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L51	3	Flint		Flake	14.36	10.55	3.52	0	Absent			1	Uni	P	
L53	3	Flint		Flake	15.62	9.26	2.98	0	Absent			2	Multi	P	Same pink flint as L13 and L14; white patina at distal end of dorsal face - burnt?
L57	3	Quartz	Greasy	Flake	11.72	16.38	3.93	0	Broken			2	Multi	P	
L58	3	Quartz	Milky	Flake	15.89	15.19	3.45	0	Broken			1	Uni	A	
L59	3	Quartz	Fine grained	Flake	20.10	15.54	4.39	0	Broken			2	Indet	P	
L60	3	Quartz	Fine grained	Flake	15.04	13.34	4.60	0	Broken			1	Uni	P	
L61	3	Quartz	Milky-Rock crystal	Flake	14.89	13.19	3.44	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L63	3	Quartz	Coarse grained	Flake	15.67	12.52	5.32	<50	Absent			1	Uni	P	Cortex rounded – pebble
L66	3	Quartz	Milky	Flake	11.61	11.25	2.86	0	Broken			1	Uni	P	
L75	5	Flint		Flake	10.52	6.49	2.87	<50	Crushed			1	Uni	A	Cortex smooth and rounded - pebble
L76	5	Flint		Flake	10.68	10.07	3.60	0	Broken			2	Uni	P	
L77	5	Flint		Flake	15.32	5.42	1.40	0	Absent			3	Bi	P	
L78	5	Flint		Flake	10.48	6.24	2.72	0	Broken			1	Uni	A	

L1	1	Flint		Small fraction flake	9.47	4.39	2.49	0						P	Burnt and stained
L3	1	Quartz	Milky	Small fraction flake	7.30	6.08	1.46	0						P	
L4	1	Quartz	Milky	Small fraction flake	6.12	6.15	2.35	0						A	
L9	3	Flint		Small fraction flake	7.24	7.65	2.24	0						P	
L16	4	Flint		Small fraction flake	6.83	8.11	1.61	0						A	
L19	8	Flint		Small fraction flake	9.03	6.21	1.79	0						P	
L22	10	Quartz	Milky	Small fraction flake	6.33	9.55	4.51	0						A	
L23	10	Quartz	Fine grained	Small fraction flake	6.54	4.73	4.11	<50						A	
L24	10	Quartz	Greasy-Milky	Small fraction flake	9.50	9.35	2.79	<50						P	
L25	10	Quartz	Milky	Small fraction flake	6.84	6.57	3.72	100						P	
L28	8	Flint		Small fraction flake	7.01	8.55	1.78	0						P	
L32	8	Quartz	Milky	Small fraction flake	9.41	8.89	4.18	100						P	

L36	5	Flint		Small fraction flake	8.91	9.90	3.01	0						P	
L42	4	Flint		Small fraction flake	5.27	9.09	2.78	0						P	
L46	4	Flint		Small fraction flake	9.92	7.57	3.00	0						P	Irregular patination
L47	4	Flint		Small fraction flake	9.73	5.65	2.97	<50						P	
L49	3	Flint		Small fraction flake	8.11	5.34	2.03	0						P	
L52	3	Flint		Small fraction flake	5.88	8.20	1.53	100						A	
L54	3	Flint		Small fraction flake	8.84	12.58	1.84	100						A	
L55	3	Flint		Small fraction flake	7.12	9.09	1.14	100						P	
L56	3	Flint		Small fraction flake	8.90	7.31	0.99	0						P	
L62	3	Quartz	Greasy	Small fraction flake	9.71	6.45	1.14	100						A	
L64	3	Quartz	Milky	Small fraction flake	9.18	9.25	3.33	0						P	
L65	3	Quartz	Milky	Small fraction flake	7.80	7.05	4.74	100						P	

L67	3	Quartz	Rock crystal	Small fraction flake	9.48	8.05	1.14	<50						P	
L68	3	Quartz	Milky	Small fraction flake	6.38	9.45	3.00	0						P	
L69	3	Quartz	Milky	Small fraction flake	7.75	6.35	3.13	100						P	
L70	3	Quartz	Fine grained	Small fraction flake	6.94	6.58	3.49	0						P	
L79	5	Flint		Small fraction flake	4.64	6.59	4.89	<50						P	
L80	5	Flint		Small fraction flake	2.31	8.01	6.87	>50						P	
L81	5	Quartz	Fine grained	Small fraction flake	7.70	8.90	2.61	0						A	
L82	5	Quartz	Milky	Small fraction flake	7.57	7.10	4.44	<50						A	
L83	12	Quartz	Milky	Small fraction flake	6.79	8.17	2.95	0						A	

Table 68. Tràigh an Teampuill chunk and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
L13	4	Flint		Chunk	13.10	7.94	4.55	0	P	Same pink flint as L14
L18	11	Flint		Chunk	10.22	5.99	3.21	0	P	Burnt
L48	2	Quartz	Milky	Chunk	18.26	12.65	6.82	0	P	
L8	3	Flint		Small fraction chunk	9.63	5.43	4.33	0	P	
L27	10	Quartz	Milky	Small fraction chunk	9.57	10.84	4.65	0	P	
L29	8	Quartz	Milky	Small fraction chunk	8.50	6.75	5.11	<50	P	
L44	4	Quartz	Greasy	Small fraction chunk	6.30	5.61	2.65	>50	P	
L71	3	Quartz	Milky	Small fraction chunk	7.70	5.69	2.92	<50	P	

Appendix 5 Tràigh na Beirigh 1 Lithic Catalogue

Table 69. Tràigh na Beirigh 1 coarse stone tools

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Notes
SF2	8	Gneiss		Manuport	96.63	76.47	60.31	Sub-rounded piece of metamorphic rock, split down the centre and is actively degrading - several small pieces have become detached post-retrieval; one face is flat, caused by a sheer break; opposite face several irregular cracks visible causing further degradation
SF3	14	Diorite		Manuport	99.07	73.56	30.84	Flattish, sub-rounded - well-worn and smooth
SF9	8	Gneiss		Manuport	148.77	115.02	38.00	Broken, sub-rounded and flattish; cracked and actively degrading
L181	9	Quartz	Greasy	Manuport	135.15	90.19	54.39	Large angular block with micaceous, granitic 'cortex' on one face; no evidence of working
L309	26	Quartz	Greasy	Manuport	43.14	33.70	31.32	Sub-rounded and smooth - pebble; no sign of working

Table 70. Tràigh na Beirigh 1 cores and core tools

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF7	8	Quartz	Greasy	Core	60.85	23.12	P	4	Multidirectional	Simple/lost	
SF14	22	Quartz	Greasy	Core tool	40.72	13.58	P	6	Multidirectional	Unprepared /simple/lost	Possible borer - two very abrupt removals from one edge to create a pointed end; cortex flat and frosted - block/plate
SF18	28	Flint		Core	23.60	2.97	A	8	Multidirectional	Simple/lost	
L1	2	Quartz	Greasy-coarse grained	Core	40.56	20.70	P	1	Unidirectional	Unprepared	Cortex rounded and weathered - outcrop
L2	2	Quartz	Greasy-coarse grained	Core	32.57	15.39	P	3	Unidirectional	Unprepared	Cortex rounded and weathered - outcrop
L32	5	Quartz	Milky-greasy	Core	21.01	2.33	P	3	Multidirectional	Simple/lost	Cortex flat and weathered - block/plate

L38	5	Quartz	Milky	Core	16.87	0.66	P	2	Multidirectional	Unprepared /simple	Cortex smooth and rounded - pebble
L52	5	Quartz	Greasy	Core	23.64	5.57	P	1	Unidirectional	Unprepared	Cortex of another raw material, flat and frosted - block/outcrop; possibly tested piece rather than a true core
L53	5	Quartz	Milky	Core	37.24	12.17	P	1	Unidirectional	Unprepared	Cortex of another raw material and weathered - block/outcrop; possibly tested piece rather than a true core
L54	5	Quartz	Greasy	Core	34.87	16.38	P	1	Unidirectional	Unprepared	Cortex mixed quartzite and another raw material, flat and weathered - block/outcrop; possibly tested piece rather than a true core
L55	5	Quartz	Greasy	Core	41.39	43.54	P	4	Multidirectional	Unprepared /lost	Cortex weathered quartzite - outcrop; flake removals largely indeterminate, however clear notch present in cortex may indicate where detached at source
L56	5	Quartz	Greasy	Core	51.67	38.62	P	4	Multidirectional	Unprepared /simple	Cortex smooth and rounded – pebble
L57	5	Quartz	Greasy-feldspar	Core	53.50	95.90	P	2	Multidirectional	Simple/lost	Cortex smooth and rounded – pebble
L58	5	Gneiss		Core tool	72.61	65.95	P	3	Unidirectional	Unprepared	Cortex/outer faces smooth and weathered; up to three concave notches indicative of flake removal creating a concave feature - subsequently fractured
L59	8	Quartz	Milky-greasy	Core	61.26	63.78	P	4	Multidirectional	Lost	Cortex quartzite/pegmatite - outcrop
L60	8	Quartz	Milky-greasy	Core	40.80	21.13	P	3	Multidirectional	Simple/lost	Cortex smooth and rounded - pebble
L61	8	Quartz	Milky-greasy	Core	38.16	20.26	P	4	Multidirectional	Unprepared /simple	Cortex smooth, weathered and rounded - source indeterminate; characteristics of a 'split cobble core'
L62	8	Quartz	Milky	Core	30.19	7.48	P	3	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble

L65	8	Quartz	Greasy-feldspar	Core	22.56	4.24	P	1	Unidirectional	Simple	Cortex quartzite/pegmatite - outcrop; characteristics of a 'split cobble core'
L73	8	Quartz	Milky	Core	13.33	0.91	P	2	Multidirectional	Simple/lost	Cortex mixed raw material - outcrop?
L109	17	Quartz	Milky	Core	29.72	69.00	P	4	Multidirectional	Unprepared	Cortex mixed raw material - outcrop?
L117	5	Quartz	Greasy (dark)	Core	17.91	4.27	P	1	Unidirectional	Unprepared	Cortex mixed raw material - outcrop?
L142	8	Quartz	Greasy	Core	13.49	0.98	A	7	Multidirectional	Simple/lost	
L166	8	Flint		Core	19.98	0.92	A	6	Bidirectional	Unprepared	Bipolar core
L203	8	Quartz	Greasy	Core	19.09	1.77	P	6	Multidirectional	Unprepared /lost	Cortex flat and frosted - block/plate
L204	8	Quartz	Milky	Core	36.31	7.16	P	4	Multidirectional	Simple/lost	Cortex flat and smooth - pebble
L247	8	Quartz	Greasy	Core	28.39	4.56	A	7	Multidirectional	Lost	
L254	8	Quartz	Milky	Core	25.84	5.59	P	5	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble; rejuvenated core
L264	8	Quartz	Milky	Core	25.82	5.22	P	1	Unidirectional	Unprepared	Cortex flat and frosted - block/plate
L265	8	Quartz	Milky	Core	66.73	54.59	P	3	Multidirectional	Unprepared /lost	Cortex smooth and rounded – pebble
L266	8	Quartz	Greasy	Core	67.17	158.73	P	2	Multidirectional	Unprepared	Cortex smooth and rounded – pebble
L274	14	Quartz	Greasy	Core	17.61	0.96	P	3	Multidirectional	Lost	Cortex flat and frosted - block/plate
L276	14	Quartz	Greasy	Core	20.69	4.19	A	7	Multidirectional	Simple/lost	
L280	14	Quartz	Greasy	Core	24.77	1.50	P	3	Multidirectional	Unprepared /lost	Cortex flat and frosted - block/plate
L310	16	Quartz	Greasy	Core	64.66	170.92	P	2	Unidirectional	Unprepared	Cortex smooth and rounded – pebble

Table 71. Tràigh na Beirigh 1 flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
SF1	8	Quartz	Milky	Flake	32.70	29.79	7.70	<50	Plain	21.89	6.04	1	Uni	P	Cortex flat and frosted - block/plate
SF4	16	Quartz	Greasy	Flake	29.28	32.55	7.17	0	Broken			1	Uni	P	
SF5	16	Quartz	Milky	Flake	21.79	18.13	5.74	0	Broken			4	Multi	A	
SF8	8	Quartz	Greasy	Flake core	22.16	21.65	5.49	0	Absent			1	Uni	P	Broken platform used to remove another flake on the dorsal face
SF10	8	Quartz	Milky	Flake	27.50	19.80	8.60	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
SF11	8	Quartz	Greasy	Flake	17.17	17.60	8.47	0	Plain	14.79	8.47	1	Uni	P	
SF12	8	Quartz	Greasy	Flake	42.89	38.13	10.56	>50	Cortical	25.52	6.17	3	Uni	P	Cortex flat and weathered - outcrop?
SF13	8	Quartz	Milky	Flake	12.91	6.77	27.29	>50	Cortical	8.31	25.31	3	Multi	A	Cortex smooth and round - pebble; characteristics of a 'split cobble core'
SF16	14	Quartz	Greasy	Flake	30.23	24.77	12.86	0	Plain	20.66	11.43	4	Multi	A	
SF17	14	Quartz	Greasy (dark)	Flake	28.39	26.67	6.34	100	Cortical	14.60	4.33	N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
SF19	28	Quartz	Greasy	Flake core	15.73	21.12	6.59	<50	Cortical	18.13	4.90	1	Uni	P	Breakage on right lateral used as a platform for a further flake removal; cortex flat and frosted - block/plate

L4	2	Quartz	Milky	Flake	17.70	9.73	5.36	<50	Cortical	7.59	5.33	2	Multi	A	
L5	2	Quartz	Greasy	Flake	14.06	10.91	2.54	0	Broken			1	Uni	P	
L6	2	Quartz	Milky	Flake	12.95	11.57	4.93	0	Broken			1	Uni	P	
L7	2	Quartz	Milky	Flake	12.14	7.50	3.55	0	Absent			2	Multi	P	Cortex flat and frosted - block/plate
L8	2	Quartz	Greasy	Flake	10.14	7.54	1.10	0	Absent			1	Uni	P	
L13	4	Quartz	Milky	Flake	20.01	12.41	5.65	>50	Absent			3	Multi	P	Ventral face sheer, flat and frosted as if split along a natural fracture plane; however clear signs of previous working on dorsal face; dorsal cortex also flat and frosted - block/plate
L14	4	Quartz	Milky-coarse grained	Flake	23.40	10.22	6.03	0	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L16a	4	Flint		Flake	17.50	7.12	4.77	0	Broken			2	Indet	P	
L31	5	Quartz	Greasy	Flake	13.73	6.59	1.90	0	Absent			1	Uni	P	
L33	5	Quartz	Greasy	Flake core	18.93	14.62	4.07	100	Absent			N/A	N/A	P	Cortex also present on the ventral face, flat and frosted - block/plate; two further very small flake removals made into the ventral face from the broken left lateral edge
L34	5	Quartz	Greasy	Flake	11.32	7.86	2.71	0	Absent			4	Multi	P	
L35	5	Quartz	Greasy	Flake	11.70	16.45	2.78	0	Broken			1	Uni	A	

L39	5	Quartz	Milky-quartzite	Flake	14.64	13.34	6.61	<50	Broken			1	Uni	A	Cortex flat and frosted - block/plate
L63	8	Quartz	Milky	Flake	34.65	31.96	8.24	0	Broken			3	Multi	P	
L64	8	Quartz	Greasy	Flake	31.59	18.77	14.50	<50	Absent			2	Indet	P	Cortex flat and frosted and mixed raw material - outcrop
L66	8	Quartz	Greasy	Flake	12.30	11.71	3.34	0	Absent			1	Uni	P	
L67	8	Quartz	Greasy	Flake	12.96	10.40	4.24	0	Plain	9.05	3.93	2	Bi	A	Bidirectional removals but not bipolar technology
L68	8	Quartz	Greasy	Flake	11.57	14.58	5.22	0	Broken			1	Uni	A	
L69	8	Quartz	Greasy	Flake	11.31	9.23	7.64	<50	Cortical	9.11	8.17	2	Multi	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L70	8	Quartz	Greasy	Flake	13.96	9.35	4.52	100	Broken			N/A	N/A	P	Cortex flat and frosted – block/plate
L71	8	Quartz	Greasy	Flake	10.82	10.55	5.11	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L72	8	Quartz	Milky	Flake	11.00	6.92	3.91	>50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L74	8	Quartz	Milky	Flake	15.09	12.29	3.51	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L91	9	Quartz	Greasy	Flake	12.45	11.63	3.40	0	Absent			2	Multi	P	
L94	9	Quartz	Quartzite	Flake core	17.94	13.93	4.54	0	Broken			1	Uni	P	Break on right lateral used as platform for further removal
L95	11	Quartz	Greasy	Flake	11.36	15.81	3.84	<50	Cortical	6.89	2.00	3	Multi	P	Cortex smooth and rounded - pebble

L96	14	Quartz	Greasy	Flake	15.77	9.78	4.74	0	Absent			2	Multi	P	
L102	17	Quartz	Milky	Flake	13.57	6.68	3.48	<50	Cortical	6.28	3.07	2	Uni	P	Cortex mixed raw material - outcrop
L107	17	Quartz	Milky	Flake	18.36	15.96	7.15	<50	Broken			1	Uni	P	Cortex mixed raw material - outcrop
L116	4	Quartz	Milky-feldspar	Flake	34.59	21.77	17.71	<50	Broken			1	Uni	A	Cortex smooth, rounded and mixed raw material – pebble
L119	5	Quartz	Greasy	Flake	11.58	5.06	3.33	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
L121	5	Quartz	Greasy	Flake	14.20	9.90	2.65	0	Broken			1	Uni	P	
L123	5	Quartz	Greasy (dark)	Flake	20.29	9.92	4.98	0	Broken			1	Uni	P	
L125	5	Quartz	Fine grained	Flake	11.55	8.75	5.44	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L128	5	Quartz	Greasy	Flake	16.19	14.48	5.41	>50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L129	5	Quartz	Greasy	Flake	10.71	13.55	2.58	<50	Cortical	9.66	2.50	1	Uni	P	Cortex smooth and rounded - pebble
L131	5	Quartz	Greasy	Flake	10.06	5.75	2.41	0	Broken			1	Uni	A	
L140	8	Quartz	Greasy	Flake	13.61	5.00	5.11	<50	Broken			2	Multi	A	Cortex flat and frosted - block/plate
L141	8	Quartz	Greasy (dark)	Flake	10.64	12.28	5.66	>50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L143	8	Quartz	Greasy	Flake	22.56	23.97	5.62	>50	Cortical	15.96	5.59	1	Uni	P	Cortex smooth and rounded - pebble
L144	8	Quartz	Greasy	Flake	17.61	26.53	5.34	0	Broken			1	Uni	P	
L145	8	Quartz	Greasy	Flake	18.10	21.01	4.02	100	Cortical	8.46	3.67	N/A	N/A	P	Cortex smooth and rounded - pebble

L146	8	Quartz	Greasy	Flake	12.09	11.41	5.71	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L147	8	Quartz	Greasy	Flake	13.68	12.53	5.03	<50	Broken			1	Uni	P	Not enough cortex to ascertain probable source
L148	8	Quartz	Greasy	Flake	21.29	20.27	6.88	<50	Cortical	14.29	5.75	3	Uni	A	Cortex smooth and rounded - pebble
L149	8	Quartz	Greasy	Flake	11.09	14.59	3.08	0	Absent			1	Uni	P	
L151	8	Quartz	Milky	Flake	11.76	23.72	6.28	>50	Cortical	12.71	3.26	2	Indet	P	Cortex smooth and rounded - pebble
L156	8	Quartz	Greasy-feldspar	Flake	19.64	16.33	7.01	100	Broken			N/A	N/A	P	Cortex mixed raw material, smooth and rounded – pebble
L157	8	Quartz	Greasy	Flake	11.14	9.07	2.54	0	Broken			1	Uni	P	
L158	8	Quartz	Greasy	Flake	10.18	11.92	4.22	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L160	8	Quartz	Milky	Flake core	10.39	11.74	3.60	>50	Absent			1	Uni	P	Cortex smooth and rounded - pebble; further flake removal on ventral face initiated from the right lateral at the proximal end, removing the platform of the original flake
L162	8	Quartz	Greasy	Core rejuv-enation flake	18.95	12.76	14.62	<50	Broken			2	Multi	P	Cortex smooth and rounded - pebble
L163	8	Granite		Flake	13.69	13.20	3.18	>50	Absent			1	Uni	A	Cortex smooth and weathered - outcrop?
L164	8	Flint		Flake	16.34	12.61	6.08	<50	Broken			3	Multi	A	Cortex smooth and flat - pebble

L165	8	Flint		Flake	25.39	15.61	6.30	<50	Broken			8	Multi	P	Cortex smooth and rounded - pebble
L168	8	Quartz	Greasy	Flake	11.09	10.65	5.69	<50	Absent			3	Multi	A	Cortex mixed raw material - outcrop
L169	8	Quartz	Milky	Flake	11.63	14.23	4.13	0	Broken			2	Indet	P	Burnt?
L171	15	Flint		Flake	16.99	17.15	4.71	>50	Crushed			1	Uni	P	Partially burnt; cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L174	19	Quartz	Milky	Flake	20.90	14.39	8.24	0	Plain	13.21	8.24	2	Uni	A	
L176	20	Quartz	Greasy	Flake	13.39	9.82	3.25	0	Broken			1	Uni	P	
L180	20	Quartz	Greasy	Flake	14.09	14.42	4.12	<50	Crushed			2	Uni	P	Cortex smooth and rounded - pebble
L182	8	Feldspar		Flake	19.60	18.92	7.08	>50	Absent			1	Uni	P	Cortex smooth and rounded - pebble
L187	8	Quartz	Greasy	Flake	10.11	5.42	6.69	<50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L188	8	Quartz	Milky	Flake	11.96	11.77	4.09	0	Broken			1	Uni	A	
L190	8	Quartz	Greasy	Flake	13.29	15.43	4.21	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L191	8	Quartz	Milky	Flake	11.61	8.71	2.43	<50	Absent			1	Uni	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L195	8	Quartz	Greasy	Flake	11.99	18.27	3.47	0	Broken			1	Uni	P	
L199	8	Quartz	Greasy	Flake	11.57	11.04	1.95	100	Plain	4.10	1.05	N/A	N/A	P	Cortex smooth and rounded - pebble
L200	8	Quartz	Greasy	Flake	12.11	14.24	5.31	0	Absent			1	Uni	P	
L201	8	Quartz	Greasy	Flake	11.22	16.05	2.93	0	Plain	11.99	2.93	1	Uni	P	
L202	8	Quartz	Greasy	Flake	12.66	15.91	2.68	<50	Cortical	8.48	2.58	1	Uni	P	Cortex smooth and rounded - pebble
L206	8	Quartz	Milky	Flake	19.32	20.92	5.11	0	Plain	14.76	5.11	1	Uni	P	

L207	8	Quartz	Greasy	Flake	18.50	23.75	7.80	<50	Crushed			1	Uni	P	Cortex smooth and rounded - pebble
L216	8	Quartz	Fine grained	Flake	16.21	8.27	2.74	0	Broken			1	Uni	P	
L226	8	Quartz	Greasy	Flake core	5.37	15.13	2.20	<50	Cortical	13.65	2.20	4	Multi	P	Two bulbs of percussion present on the ventral face which has subsequently been destroyed by a later flake removal; cortex is smooth - pebble
L231	8	Quartz	Greasy	Flake	11.99	7.40	5.20	0	Broken			2	Multi	A	
L234	8	Flint		Flake	26.10	13.50	7.59	0	Crushed			5	Bi	P	
L235	8	Flint		Flake	26.99	22.40	5.48	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L237	8	Quartz	Greasy	Flake	25.53	22.47	12.03	>50	Cortical	16.82	8.17	1	Uni	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L238	8	Quartz	Greasy	Flake	34.22	30.24	8.11	>50	Cortical	28.96	4.64	1	Uni	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L239	8	Quartz	Greasy	Flake	12.27	8.64	2.99	<50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L241	8	Quartz	Greasy	Flake	15.14	16.16	4.16	0	Plain	7.87	2.32	2	Uni	P	
L244	8	Quartz	Fine grained	Flake	11.76	11.72	3.47	0	Plain	7.23	2.73	1	Uni	P	
L246	8	Quartz	Greasy	Flake	17.57	23.97	4.57	<50	Broken			1	Uni	P	Cortex mixed raw material - outcrop
L248	8	Quartz	Fine grained	Flake	15.80	21.36	6.26	<50	Broken			2	Indet	P	Cortex smooth and rounded - pebble
L249	8	Quartz	Greasy	Flake	10.18	18.05	7.60	0	Broken			2	Uni	P	

L251	8	Quartz	Greasy	Flake	17.71	15.40	2.74	0	Broken			2	Uni	P	
L252	8	Quartz	Greasy	Flake	24.84	18.63	6.17	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L253	8	Quartz	Greasy	Flake	13.88	12.01	3.42	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L255	8	Quartz	Greasy	Flake	13.48	16.67	3.85	0	Broken			2	Multi	P	
L256	8	Quartz	Greasy	Flake	12.38	8.23	1.47	0	Absent			1	Uni	P	
L257	8	Quartz	Greasy (dark)	Flake	18.56	14.27	6.41	<50	Broken			2	Multi	P	Cortex smooth and rounded - pebble
L258	8	Quartz	Greasy	Flake	22.40	29.32	4.36	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L262	8	Quartz	Greasy	Flake	11.05	14.26	4.78	<50	Broken			1	Uni	A	Cortex flat and frosted - block/plate
L263	8	Quartz	Greasy-feldspar	Flake	26.90	20.10	9.33	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L268	14	Quartz	Greasy	Flake	16.30	14.10	4.15	0	Broken			2	Multi	P	
L270	14	Quartz	Greasy	Flake	14.58	16.43	2.97	0	Broken			2	Uni	P	
L271	14	Quartz	Greasy	Flake	28.68	16.04	4.83	<50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L273	14	Quartz	Milky	Flake core	15.29	11.66	4.08	0	Crushed			1	Uni	P	Breakage on the right lateral has created a new platform for a flake removal on the dorsal face
L275	14	Quartz	Greasy	Flake	15.15	11.31	1.97	0	Broken			2	Multi	A	
L277	14	Quartz	Greasy	Flake	11.96	10.10	3.38	0	Absent			2	Multi	P	
L278	14	Quartz	Greasy	Flake	10.19	5.92	3.12	0	Broken			2	Uni	A	
L286	14	Quartz	Greasy	Flake	11.21	8.83	2.47	0	Plain	5.70	1.91	2	Multi	P	
L287	14	Quartz	Greasy	Flake	10.08	7.56	1.77	100	Broken			N/A	N/A	A	Cortex flat and frosted - block/plate

L296	14	Quartz	Greasy	Flake	12.05	9.99	4.41	<50	Broken			2	Uni	A	Cortex smooth and rounded - pebble
L299	14	Quartz	Greasy	Flake	11.50	7.21	3.26	0	Broken			1	Uni	P	
L300	14	Quartz	Milky	Flake	19.65	10.94	7.03	<50	Broken			2	Multi	A	Cortex smooth and rounded - pebble; characteristics of a 'split cobble core'
L305	14	Feldspar		Flake	20.10	25.22	5.57	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L307	26	Quartz	Greasy	Flake	11.27	15.25	3.25	<50	Cortical	13.16	3.17	1	Uni	P	Cortex smooth and rounded - pebble
L308	26	Quartz	Greasy	Flake	16.34	7.37	4.43	0	Crushed			3	Multi	P	
L311	16	Quartz	Greasy	Flake	18.07	11.67	2.96	0	Broken			1	Uni	P	
L312	16	Quartz	Greasy	Flake	14.05	14.06	3.56	0	Broken			1	Uni	A	
L314	16	Quartz	Greasy	Flake	22.80	15.37	3.54	100	Broken			N/A	N/A	P	Cortex flat and frosted - block/plate
L316	32	Quartz	Greasy	Flake	10.67	5.41	3.04	<50	Absent			2	Uni	P	Not enough cortex to ascertain probable source
SF6	14	Quartz	Greasy	Small fraction flake	9.37	7.68	2.88	<50						P	
L10	2	Quartz	Milky	Small fraction flake	4.05	9.61	3.26	0						A	
L11	2	Quartz	Milky	Small fraction flake	7.82	6.03	2.20	0						A	
L15	4	Quartz	Rock crystal	Small fraction flake	6.76	10.00	3.05	0						P	
L16b	4	Quartz	Milky-rock crystal	Small fraction flake	8.16	10.18	1.43	0						P	

L17	4	Quartz	Milky	Small fraction flake	8.44	11.95	2.31	0						P	
L20	4	Quartz	Rock crystal	Small fraction flake	6.43	7.41	1.76	0						P	
L21	4	Quartz	Rock crystal-quartzite	Small fraction flake	9.52	9.76	2.07	<50						P	
L22	4	Quartz	Milky-rock crystal	Small fraction flake	9.41	8.48	2.68	0						P	
L23	4	Quartz	Milky-rock crystal	Small fraction flake	6.27	6.04	1.43	0						P	
L25	4	Quartz	Rock crystal	Small fraction flake	4.77	7.69	3.52	0						P	
L27	4	Quartz	Milky-rock crystal	Small fraction flake	9.11	5.66	2.85	0						P	
L28	4	Quartz	Milky-rock crystal	Small fraction flake	8.02	6.40	2.05	0						P	
L29	4	Quartz	Milky-rock crystal	Small fraction flake	9.36	6.52	2.75	0						P	
L30	5	Flint		Small fraction flake	6.51	6.40	2.32	0						A	
L36	5	Quartz	Greasy	Small fraction flake	6.63	12.49	3.04	0						P	
L40	5	Quartz	Milky-rock crystal	Small fraction flake	7.77	9.79	3.53	<50						A	

L41	5	Quartz	Rock crystal-quartzite	Small fraction flake	8.32	7.13	2.12	0						P	
L42	5	Quartz	Milky-rock crystal	Small fraction flake	8.27	5.49	2.64	0						P	
L43	5	Quartz	Greasy	Small fraction flake	5.61	6.38	1.68	0						A	
L44	5	Quartz	Greasy	Small fraction flake	5.04	7.41	1.66	100						A	
L45	5	Quartz	Greasy	Small fraction flake	9.47	8.62	3.21	0						P	
L46	5	Quartz	Greasy	Small fraction flake	8.82	6.28	3.28	0						P	
L47	5	Quartz	Milky-rock crystal	Small fraction flake	6.19	6.03	1.85	0						P	
L48	5	Quartz	Milky-rock crystal	Small fraction flake	5.09	7.65	2.51	0						P	
L49	5	Quartz	Milky	Small fraction flake	6.59	6.06	2.86	0						P	
L75	8	Quartz	Greasy	Small fraction flake	3.80	7.38	2.58	0						A	
L76	8	Quartz	Milky	Small fraction flake	5.27	7.41	3.14	0						P	
L77	8	Quartz	Greasy	Small fraction flake	8.62	6.43	3.07	>50						A	

L78	8	Quartz	Milky	Small fraction flake	4.85	9.26	4.05	<50						P	
L79	8	Quartz	Milky-rock crystal	Small fraction flake	7.45	6.77	2.37	>50						P	
L80	8	Quartz	Milky	Small fraction flake	8.65	6.89	3.88	>50						A	
L81	8	Quartz	Milky	Small fraction flake	7.13	11.18	3.89	100						A	
L82	8	Quartz	Milky	Small fraction flake	9.57	6.04	3.00	>50						A	
L83	8	Quartz	Milky	Small fraction flake	6.54	6.35	4.30	>50						P	
L85	8	Quartz	Greasy	Small fraction flake	7.92	5.64	3.93	<50						P	
L86	8	Quartz	Milky	Small fraction flake	6.94	5.00	3.62	>50						A	
L87	8	Quartz	Milky	Small fraction flake	5.65	6.45	3.09	<50						A	
L89	8	Quartz	Milky-feldspar	Small fraction flake	6.89	9.75	2.84	0						P	
L92	9	Quartz	Fine grained	Small fraction flake	8.66	8.13	3.90	<50						P	
L93	9	Quartz	Milky	Small fraction flake	8.35	17.92	3.34	<50						P	

L97	15	Quartz	Milky	Small fraction flake	8.14	5.83	1.88	0						P	
L98	16	Quartz	Greasy	Small fraction flake	5.93	6.36	0.94	0						P	
L99	16	Quartz	Milky-rock crystal	Small fraction flake	5.65	9.17	2.36	0						P	
L103	17	Quartz	Milky	Small fraction flake	7.73	11.06	2.96	>50						P	
L105	17	Quartz	Milky	Small fraction flake	7.43	6.46	1.97	0						P	
L110	18	Quartz	Milky-rock crystal	Small fraction flake	6.44	8.26	1.63	0						P	
L111	4	Quartz	Milky	Small fraction flake	9.18	6.50	2.78	<50						A	
L112	4	Quartz	Milky	Small fraction flake	5.36	8.18	1.90	0						P	
L113	4	Quartz	Milky	Small fraction flake	7.48	6.44	2.23	0						P	
L115	4	Quartz	Milky	Small fraction flake	6.83	13.11	2.32	0						P	
L118	5	Quartz	Milky	Small fraction flake	9.76	6.14	1.65	0						P	
L120	5	Quartz	Milky	Small fraction flake	4.99	9.29	2.53	<50						A	

L122	5	Quartz	Greasy	Small fraction flake	9.15	6.95	1.80	0						P	
L124	5	Quartz	Milky	Small fraction flake	5.03	5.72	3.72	<50						P	
L126	5	Quartz	Greasy	Small fraction flake	8.10	10.02	2.88	<50						P	
L127	5	Quartz	Greasy	Small fraction flake	7.93	4.76	2.04	0						P	
L130	5	Quartz	Milky	Small fraction flake	7.96	12.18	4.31	0						P	
L132	5	Quartz	Greasy	Small fraction flake	5.15	7.49	2.10	0						A	
L133	5	Quartz	Greasy	Small fraction flake	7.00	7.13	1.38	0						P	
L134	5	Quartz	Greasy	Small fraction flake	9.58	7.50	1.50	>50						A	
L135	5	Flint		Small fraction flake	5.12	7.56	4.61	<50						P	
L136	5	Flint		Small fraction flake	8.66	11.27	1.75	0						A	
L137	8	Quartz	Milky	Small fraction flake	5.38	9.86	2.83	0						A	
L138	8	Quartz	Milky	Small fraction flake	6.86	8.79	2.40	0						P	

L139	8	Quartz	Greasy	Small fraction flake	6.10	7.90	1.76	0						P	
L150	8	Quartz	Greasy	Small fraction flake	7.89	11.47	3.41	<50						P	
L152	8	Quartz	Greasy	Small fraction flake	7.70	16.42	3.96	0						P	
L153	8	Quartz	Greasy	Small fraction flake	6.51	9.95	3.93	<50						P	
L154	8	Quartz	Greasy	Small fraction flake	7.37	6.33	5.72	0						P	
L155	8	Quartz	Greasy	Small fraction flake	6.64	5.40	4.10	0						P	
L159	8	Quartz	Greasy	Small fraction flake	5.79	4.84	1.56	100						P	
L161	8	Quartz	Greasy	Small fraction flake	8.35	7.41	2.61	<50						P	
L167	8	Quartz	Greasy	Small fraction flake	5.96	5.95	3.16	0						P	
L172	15	Quartz	Greasy	Small fraction flake	5.87	10.14	2.72	<50						A	
L173	15	Quartz	Greasy	Small fraction flake	4.88	8.98	4.44	0						P	
L175	20	Quartz	Greasy	Small fraction flake	6.28	5.76	1.00	0						A	

L177	20	Quartz	Milky	Small fraction flake	7.43	12.96	3.95	0						P	
L178	20	Feldspar		Small fraction flake	9.25	9.43	1.16	<50						P	
L179	20	Quartz	Greasy	Small fraction flake	8.19	5.95	9.00	0						P	
L183	8	Quartz	Fine grained	Small fraction flake	5.82	7.34	3.51	0						P	
L184	8	Quartz	Greasy	Small fraction flake	8.89	8.89	3.02	<50						P	
L185	8	Quartz	Greasy	Small fraction flake	7.04	9.06	2.93	0						P	
L186	8	Quartz	Greasy	Small fraction flake	8.92	5.50	3.61	0						P	
L189	8	Quartz	Greasy	Small fraction flake	7.32	13.27	3.80	<50						P	
L192	8	Quartz	Greasy	Small fraction flake	6.23	4.65	3.04	0						P	
L193	8	Quartz	Greasy	Small fraction flake	6.09	8.63	1.68	100						P	
L194	8	Quartz	Greasy	Small fraction flake	8.29	9.37	3.92	0						P	
L196	8	Quartz	Greasy	Small fraction flake	6.59	8.56	1.50	0						P	

L197	8	Quartz	Milky	Small fraction flake	4.84	7.87	1.14	0						P	
L198	8	Quartz	Greasy	Small fraction flake	6.27	8.78	1.29	100						P	
L205	17	Quartz	Greasy	Small fraction flake	5.30	5.82	1.47	0						P	
L208	8	Quartz	Fine grained	Small fraction flake	5.74	7.18	2.84	0						P	
L209	8	Quartz	Greasy	Small fraction flake	6.86	7.95	1.65	0						P	
L210	8	Quartz	Fine grained	Small fraction flake	6.38	4.86	1.73	0						P	
L211	8	Quartz	Greasy	Small fraction flake	7.38	6.37	1.58	100						P	
L212	8	Quartz	Milky	Small fraction flake	6.05	6.22	1.15	100						P	
L213	8	Quartz	Milky	Small fraction flake	8.03	10.14	2.38	0						P	
L214	8	Quartz	Milky	Small fraction flake	7.97	10.77	3.01	0						P	
L215	8	Quartz	Greasy-fine grained	Small fraction flake	8.17	5.54	1.37	0						P	
L217	8	Quartz	Greasy	Small fraction flake	9.28	8.63	1.78	0						P	

L218	8	Quartz	Milky	Small fraction flake	7.53	5.93	3.41	0						P	
L219	8	Quartz	Greasy	Small fraction flake	6.74	5.80	1.20	100						P	
L220	8	Quartz	Fine grained	Small fraction flake	8.22	7.71	11.25	<50						A	
L221	8	Quartz	Milky	Small fraction flake	6.68	5.78	2.26	<50						P	
L222	8	Quartz	Greasy	Small fraction flake	8.88	9.14	1.92	0						P	
L223	8	Quartz	Greasy	Small fraction flake	9.75	7.83	4.22	<50						P	
L224	8	Quartz	Greasy	Small fraction flake	7.90	8.61	2.17	0						P	
L225	8	Quartz	Greasy	Small fraction flake	8.31	6.38	1.41	0						P	
L227	8	Quartz	Greasy	Small fraction flake	9.34	4.50	2.74	0						P	
L228	8	Quartz	Fine grained	Small fraction flake	7.92	12.96	1.91	0						P	
L229	8	Quartz	Greasy	Small fraction flake	5.94	8.05	1.67	0						P	
L230	8	Quartz	Greasy	Small fraction flake	7.50	6.28	1.73	0						P	

L232	8	Quartz	Greasy	Small fraction flake	8.36	7.16	3.11	100						P	
L233	8	Quartz	Greasy	Small fraction flake	5.48	7.43	1.28	100						P	
L240	8	Quartz	Milky	Small fraction flake	8.71	13.54	2.89	<50						P	
L242	8	Quartz	Greasy	Small fraction flake	9.95	12.23	1.96	0						P	
L243	8	Quartz	Greasy	Small fraction flake	8.01	12.05	2.33	0						P	
L245	8	Quartz	Greasy	Small fraction flake	8.75	7.86	1.32	0						P	
L250	8	Quartz	Milky	Small fraction flake	5.08	6.82	1.67	<50						P	
L259	8	Quartz	Milky	Small fraction flake	6.49	8.03	3.17	<50						P	
L261	8	Quartz	Milky	Small fraction flake	8.33	14.55	3.13	0						A	
L267	14	Quartz	Greasy	Small fraction flake	9.70	9.01	2.15	0						P	
L269	14	Quartz	Greasy	Small fraction flake	7.11	8.47	1.54	0						P	
L272	14	Quartz	Greasy	Small fraction flake	8.82	9.36	7.38	<50						P	

L281	14	Quartz	Greasy	Small fraction flake	9.12	8.46	2.70	0						P	
L282	14	Quartz	Greasy	Small fraction flake	7.60	9.14	1.51	0						P	
L283	14	Quartz	Greasy	Small fraction flake	6.19	10.72	1.59	0						P	
L284	14	Quartz	Greasy	Small fraction flake	4.79	9.27	1.05	<50						P	
L285	14	Quartz	Milky	Small fraction flake	9.43	15.41	2.99	0						P	
L288	14	Quartz	Milky	Small fraction flake	7.92	8.28	1.23	100						A	
L289	14	Quartz	Milky	Small fraction flake	5.71	6.83	1.00	0						P	
L290	14	Quartz	Greasy	Small fraction flake	7.33	6.28	2.52	0						P	
L291	14	Quartz	Milky	Small fraction flake	9.83	8.11	2.61	0						P	
L292	14	Quartz	Greasy	Small fraction flake	9.81	6.68	1.82	100						P	
L293	14	Quartz	Greasy	Small fraction flake	9.14	8.37	3.88	0						P	
L294	14	Quartz	Greasy	Small fraction flake	7.07	6.75	1.73	0						P	

L295	14	Quartz	Fine grained	Small fraction flake	6.43	6.50	2.52	100						P	
L297	14	Quartz	Greasy	Small fraction flake	7.50	7.76	2.07	100						P	
L298	14	Quartz	Greasy	Small fraction flake	8.04	4.62	1.56	100						P	
L301	14	Quartz	Milky	Small fraction flake	7.74	6.19	2.95	0						P	
L303	14	Quartz	Greasy	Small fraction flake	9.18	10.54	1.88	100						P	
L304	14	Quartz	Greasy	Small fraction flake	8.24	4.76	3.08	0						P	
L306	26	Quartz	Milky	Small fraction flake	8.18	8.57	4.19	<50						P	
L313	16	Quartz	Greasy	Small fraction flake	5.67	7.22	2.79	0						P	
L315	16	Quartz	Greasy	Small fraction flake	9.22	5.60	2.63	0						P	

Table 72. Tràigh na Beirigh 1 chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
L3	2	Quartz	Greasy	Chunk	14.12	20.23	9.60	<50	P	
L18	4	Quartz	Milky	Chunk	13.10	5.53	4.72	0	P	
L37	5	Quartz	Greasy	Chunk	11.37	7.21	3.52	0	A	
L90	6	Quartz	Greasy	Chunk	17.18	11.56	6.65	100	P	

L104	17	Quartz	Milky	Chunk	12.88	9.19	4.48	<50	P	
L106	17	Quartz	Milky	Chunk	13.04	8.26	3.28	0	P	
L108	17	Quartz	Milky	Chunk	37.41	20.77	13.53	<50	P	
L114	4	Quartz	Milky	Chunk	17.46	6.90	5.46	<50	P	
L170	8	Quartz	Milky	Chunk	17.10	15.30	9.69	<50	P	
L279	14	Quartz	Greasy	Chunk	13.25	10.65	7.25	<50	P	
L9	2	Quartz	Rock crystal	Small fraction chunk	7.80	4.73	3.90	0	A	
L12	2	Quartz	Milky	Small fraction chunk	9.12	7.80	4.31	0	P	
L19	4	Quartz	Milky	Small fraction chunk	8.24	7.01	6.66	0	P	
L24	4	Quartz	Milky-rock crystal	Small fraction chunk	9.93	5.22	3.44	0	P	
L26	4	Quartz	Milky-rock crystal	Small fraction chunk	7.36	4.12	2.74	0	P	
L50	5	Quartz	Milky-rock crystal	Small fraction chunk	7.77	6.77	5.35	0	P	
L51	5	Quartz	Milky-rock crystal	Small fraction chunk	6.64	5.46	3.37	0	P	
L84	8	Quartz	Milky-greasy	Small fraction chunk	9.95	7.19	4.85	<50	A	
L88	8	Quartz	Milky	Small fraction chunk	9.38	5.76	4.01	<50	A	
L100	16	Quartz	Milky	Small fraction chunk	9.98	7.75	3.46	<50	P	

L101	16	Quartz	Milky	Small fraction chunk	8.46	5.91	2.92	<50	P	
L260	8	Quartz	Greasy	Small fraction chunk	6.26	4.37	2.76	0	P	
L302	14	Quartz	Greasy	Small fraction chunk	8.04	6.66	4.27	<50	P	

Table 73. Tràigh na Beirigh 1 natural quartz fragments by weight per sample

Sample No.	Context No.	Weight
S.17	18	7.47
S.22	4	93.03
S.23	5	9.59
S.25	8	3.06
S.26	15	0.82
S.28	19	1.21
S.31	17	777.7
S.32	15	5.76
S.33	8	13.65
S.36	14	7.55
S.40	16	31.57

Appendix 6 Tràigh na Beirigh 2 Lithic Catalogue

Table 74. Tràigh na Beirigh 2 coarse stone tools

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Notes
L145	21	Gneiss		Manuport	101.78	56.89	19.41	Sub-angular, flattish stone, chipped along one edge
L240	5	Quartz	Quartz-feldspar (metamorphosed)	Manuport	58.58	47.91	24.75	Rounded, water worn pebble broken laterally - possible test piece
L316	11	Quartz	Quartzite	Manuport	91.19	55.88	25.40	Sub-angular, water worn and flattish; no signs of working
L317	11	Quartz	Quartz-feldspar (metamorphosed)	Manuport	68.63	36.23	24.04	Sub-angular and water worn with a pointed end; no signs of working
L318	11	Quartz	Quartz-feldspar (metamorphosed)	Manuport	69.79	44.12	21.05	Sub-rounded and water worn with small chips and a crack present around the edge; no signs of working
L319	11	Quartz	Quartzite	Manuport	43.12	42.55	22.94	Sub-rounded and water worn; no signs of working
L320	11	Quartz	Quartz-feldspar (metamorphosed)	Manuport	50.75	33.86	19.67	Possible hammerstone; sub-rounded and water worn - pitted and fractured along one face

Table 75. Tràigh na Beirigh 2 cores

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF11	21	Quartz	Greasy (dark)	Core	22.07	4.51	P	3	Multidirectional	Unprepared /lost	Cortex flat and frosted - block/plate
SF13	3	Quartz	Greasy (dark)	Core	49.38	67.24	P	7	Multidirectional	Simple/lost	Cortex smooth and rounded - pebble
SF14	3	Quartz	Milky	Core	78.39	262.23	P	10	Multidirectional	Simple/lost	Cortex smooth and rounded - pebble
SF15	4	Quartz	Greasy	Core	66.82	314.98	P	8	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble; circular mark present on flat cortical face - evidence of prior attempts to remove flakes
SF16	5	Quartz	Greasy	Core	59.87	90.75	P	3	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
SF17	6	Quartz	Greasy	Core	24.30	5.02	P	5	Multidirectional	Lost	Cortex flat and frosted - block/plate
L18	3	Quartz	Greasy	Core	30.10	4.10	P	3	Multidirectional	Lost	Cortex smooth and rounded - pebble

L19	3	Quartz	Greasy	Core	32.69	3.07	P	4	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L26	3	Quartz	Greasy	Core	36.60	12.62	P	4	Multidirectional	Unprepared /lost	Cortex flat and weathered - pebble
L27	5	Quartz	Greasy (dark)	Core	27.23	10.71	P	5	Multidirectional	Simple/lost	Cortex mixed raw material - outcrop
L28	5	Quartz	Greasy	Core	24.43	6.19	P	5	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L36	5	Quartz	Greasy	Core	11.04	0.40	P	6	Multidirectional	Lost	Cortex flat and frosted - block/plate
L42	5	Quartz	Greasy (dark)	Core	38.16	35.88	P	5	Multidirectional	Unprepared	Cortex smooth and rounded - pebble
L74	11	Quartz	Milky	Core	9.82	0.27	A	6	Multidirectional	Lost	
L85	11	Quartz	Greasy	Core	18.83	2.52	P	4	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L86	11	Quartz	Greasy	Core	17.87	2.29	P	2	Multidirectional	Unprepared	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L88	11	Quartz	Greasy-fine grained	Core	15.85	1.40	A	6	Multidirectional	Lost	
L89	11	Quartz	Greasy	Core	21.20	3.65	P	7	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L94	11	Quartz	Milky	Core	77.77	200.72	P	2	Unidirectional	Unprepared	Flattish, water rounded block with two removals - appear to have been removed with the purpose of testing the block
L111	5	Quartz	Greasy	Core	20.90	3.98	P	4	Multidirectional	Unprepared	Cortex smooth and rounded - pebble
L113	5	Quartz	Greasy	Core	20.14	4.51	P	4	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L114	5	Quartz	Greasy	Core	38.15	17.84	P	4	Multidirectional	Unprepared /lost	Cortex frosted and flat - block/plate
L115	5	Quartz	Milky	Core	27.13	14.48	P	6	Multidirectional	Unprepared /simple/lost	Cortex frosted and flat - block/plate
L117	5	Quartz	Quartzite	Core	65.38	101.00	P	4	Unidirectional	Unprepared	Sub-rounded water worn pebble, split laterally with four possible removals from the edges
L136	16	Quartz	Greasy (dark)	Core	30.93	8.92	P	1	Unidirectional	Unprepared	Cortex mixed raw material, flat and frosted – outcrop
L152	22	Quartz	Greasy	Core	9.83	0.75	A	7	Multidirectional	Simple/lost	

L171	3	Quartz	Greasy	Core	31.87	8.41	P	2	Unidirectional	Unprepared /lost	Cortex flat and frosted - block/plate
L175	5	Quartz	Greasy	Core	25.26	1.86	P	2	Multidirectional	Lost	Cortex flat and frosted - block/plate
L178	5	Quartz	Greasy	Core	30.58	4.28	P	6	Multidirectional	Lost	Cortex flat and frosted - block/plate
L180	5	Quartz	Greasy (dark)	Core	17.29	1.79	P	5	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L187	5	Quartz	Greasy	Core	9.82	0.88	P	3	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L237	5	Feldspar		Core	64.97	39.48	P	2	Multidirectional	Lost	Cortex - weathered outer surface of the rock
L238	5	Quartz	Greasy	Core	20.02	10.84	P	3	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble
L239	5	Quartz	Greasy	Core	31.82	7.79	P	3	Unidirectional	Simple	Cortex smooth, rounded and mixed raw material - pebble; percussion marks are visible on one face
L241	19	Quartz	Greasy	Core	62.93	83.96	P	6	Multidirectional	Unprepared	Cortex smooth and rounded - pebble; percussion marks are visible on one face
L242	11	Quartz	Greasy (dark)	Core	29.68	11.56	P	2	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L244	11	Quartz	Greasy (dark)	Core	17.82	5.84	P	2	Unidirectional	Lost	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L245	11	Quartz	Greasy (dark)	Core	19.60	3.27	P	3	Multidirectional	Unprepared /lost	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L246	11	Quartz	Greasy	Core	21.75	3.86	P	6	Multidirectional	Unprepared /simple/lost	Cortex flat and frosted - block/plate
L247	11	Quartz	Greasy	Core	24.88	4.19	P	3	Multidirectional	Unprepared	Cortex flat and smooth - pebble
L249	11	Quartz	Greasy (pink)	Core	26.21	2.61	P	2	Unidirectional	Unprepared /lost	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L260	11	Quartz	Greasy	Core	14.68	0.80	A	4	Multidirectional	Simple/lost	
L331	6	Quartz	Greasy (dark)	Core	27.36	6.27	P	4	Unidirectional	Unprepared	Cortex smooth and rounded - pebble

Table 76. Tràigh na Beirigh 2 flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF2	3	Quartz	Greasy	Flake	28.93	18.17	6.65	<50	Broken			2	Multi	P	Cortex flat and frosted - block/plate
SF3	5	Quartz	Greasy	Flake	11.90	13.25	3.07	>50	Broken			2	Uni	P	Cortex smooth and rounded - pebble
SF4	3	Quartz	Greasy (dark)	Flake	18.83	20.09	6.25	<50	Absent			1	Uni	P	Cortex smooth and rounded - pebble
SF5	7	Quartz	Milky-greasy	Flake	19.03	16.27	8.14	0	Broken			3	Uni	P	
SF7	16	Quartz	Greasy	Flake	31.10	22.58	10.54	<50	Crushed			3	Uni	P	Cortex flat and frosted - block/plate
SF8	16	Quartz	Greasy	Flake	26.37	34.06	19.71	<50	Cortical	30.49	11.60	5	Multi	P	Cortex smooth and rounded - pebble
SF10	16	Quartz	Greasy (dark)	Flake	24.19	22.64	7.30	0	Plain	16.82	7.29	2	Multi	P	
SF12	3	Quartz	Greasy	Flake	16.02	30.39	3.47	0	Broken			2	Multi	P	
L1	1	Quartz	Greasy	Flake	13.24	8.11	1.89	0	Absent			3	Multi	P	
L2	3	Quartz	Greasy	Flake	20.74	27.48	4.06	0	Broken			4	Multi	P	
L4	3	Quartz	Greasy	Flake	15.01	12.80	3.24	>50	Absent			3	Multi	P	Cortex smooth and rounded - pebble
L5	3	Quartz	Greasy	Flake	16.74	14.97	4.35	100	Broken			N/A	N/A	P	Cortex flat and frosted - block/plate
L13	3	Quartz	Greasy	Flake	10.66	3.18	1.98	0	Absent			1	Uni	P	
L16	3	Quartz	Greasy	Flake	12.97	13.39	9.09	0	Broken			2	Uni	P	
L17	3	Quartz	Greasy	Flake	15.58	16.30	5.16	0	Plain	6.64	3.19	2	Indet	A	
L20	3	Quartz	Greasy	Flake	23.01	5.40	7.17	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L21	3	Quartz	Greasy	Flake	10.54	7.60	4.23	0	Absent			2	Multi	P	
L23	3	Quartz	Greasy	Flake	10.25	14.63	2.51	0	Broken			1	Uni	P	
L29	5	Quartz	Greasy	Flake	32.32	16.19	7.16	0	Broken			2	Multi	P	

L30	5	Quartz	Milky	Flake	29.73	20.69	10.21	<50	Absent			1	Uni	A	Cortex smooth and rounded - pebble
L31	5	Quartz	Milky	Flake	18.06	18.66	9.98	>50	Absent			3	Multi	P	Cortex smooth and rounded - pebble
L32	5	Quartz	Greasy (dark)	Flake	17.77	17.56	4.18	0	Absent			3	Multi	P	
L33	5	Quartz	Greasy	Flake	12.66	20.16	3.78	0	Broken			1	Uni	P	
L35	5	Quartz	Greasy	Flake	12.00	7.59	3.53	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L38	5	Quartz	Milky	Flake	10.53	6.54	4.17	<50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L41	5	Flint		Flake	11.28	8.60	6.24	>50	Broken			2	Multi	A	Cortex smooth and rounded - pebble
L43	7	Quartz	Greasy-feldspar	Flake	24.92	11.35	8.02	>50	Absent			1	Uni	A	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L44	7	Quartz	Greasy	Flake	14.81	9.86	4.30	0	Plain	9.28	3.87	1	Uni	P	
L48	14	Quartz	Greasy	Flake	24.50	16.31	7.14	<50	Broken			1	Uni	P	Cortex smooth - pebble
L53	11	Quartz	Coarse grained-feldspar	Flake	14.80	10.03	3.44	0	Broken			2	Indet	P	
L68	11	Quartz	Milky	Flake	14.05	5.74	3.15	0	Absent			4	Bi	P	Bidirectional flake removals but not bipolar reduction
L69	11	Quartz	Greasy	Flake	10.00	12.94	3.33	<50	Broken			2	Uni	P	Cortex smooth and rounded - pebble
L72	11	Quartz	Greasy	Flake	14.63	9.49	3.08	0	Broken			1	Uni	P	
L73	11	Quartz	Milky	Flake	13.17	7.23	4.22	0	Broken			1	Uni	P	
L75	11	Quartz	Greasy	Flake	22.09	10.26	8.99	<50	Broken			2	Indet	P	Cortex flat and frosted - block/plate
L76	11	Quartz	Greasy	Flake	11.23	13.85	3.75	0	Broken			1	Uni	A	
L77	11	Quartz	Milky	Flake	10.23	6.10	3.15	0	Absent			1	Uni	P	
L79	11	Quartz	Greasy	Flake	12.51	7.71	4.92	0	Absent			1	Uni	P	

L80	11	Quartz	Greasy (dark)	Flake	16.77	13.05	8.35	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L81	11	Quartz	Coarse grained-feldspar	Flake	22.13	21.47	4.79	0	Broken			1	Uni	P	
L82	11	Quartz	Greasy	Flake	27.15	18.01	5.00	0	Broken			2	Uni	P	
L83	11	Quartz	Greasy-fine grained	Flake	18.70	21.66	8.75	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L84	11	Quartz	Greasy	Flake	16.43	13.45	4.80	0	Absent			5	Multi	P	
L87	11	Quartz	Milky	Flake	18.92	13.01	7.55	<50	Absent			1	Uni	A	Cortex smooth and rounded - pebble
L90	11	Quartz	Greasy	Flake	22.94	35.83	8.43	<50	Cortical	12.72	6.09	2	Multi	P	Cortex smooth and rounded - pebble
L91	11	Quartz	Greasy	Flake	22.91	19.85	6.73	0	Crushed			1	Uni	P	
L92	11	Quartz	Milky	Flake	30.78	12.67	9.03	<50	Broken			2	Multi	P	Cortex flat and smooth - likely pebble
L93	11	Quartz	Greasy	Flake	28.26	25.93	10.95	<50	Cortical	14.19	10.94	3	Multi	P	Incipient Hertzian cone present on one of the dorsal flake scars; cortex smooth and rounded - pebble
L109	5	Quartz	Greasy	Flake	15.44	16.08	4.44	0	Broken			2	Multi	P	
L110	5	Quartz	Milky-feldspar	Flake	25.99	16.99	7.20	0	Broken			1	Uni	A	
L112	5	Flint		Flake	10.79	7.22	3.24	<50	Absent			2	Multi	A	Cortex smooth and rounded - pebble
L116	5	Quartz	Greasy	Flake	42.84	42.40	23.04	100	Cortical	39.38	23.04	N/A	N/A	A	Cortex smooth and rounded - pebble
L121	15	Flint		Flake	10.84	9.90	1.95	<50	Absent			1	Uni	P	No outer cortex present to determine source
L122	14	Quartz	Greasy	Flake	14.13	8.34	2.60	<50	Broken			2	Uni	A	Cortex smooth and rounded - pebble

L124	18	Quartz	Greasy	Flake	11.16	3.19	2.04	<50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L131	6	Quartz	Milky-feldspar	Flake	23.56	12.91	5.23	0	Absent			2	Multi	P	
L132	17	Quartz	Milky	Flake	21.00	12.71	7.47	100	Broken			N/A	N/A	A	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L133	17	Quartz	Greasy	Flake	13.35	5.52	4.16	>50	Crushed			1	Uni	A	Cortex smooth and rounded - pebble
L135	16	Flint		Flake	10.30	9.29	1.90	0	Absent			1	Uni	P	
L137	16	Quartz	Greasy	Flake	20.49	30.33	8.36	>50	Cortical	25.46	6.68	1	Uni	A	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L138	16	Quartz	Greasy	Flake	10.50	14.99	3.62	100	Plain	13.76	3.54	N/A	N/A	P	Cortex smooth and rounded - pebble
L139	16	Quartz	Milky	Flake	16.82	7.76	4.46	0	Absent			1	Uni	P	
L142	16	Quartz	Milky	Flake	11.26	5.20	1.94	0	Broken			1	Uni	P	
L143	16	Quartz	Greasy	Flake	12.32	10.50	2.52	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L146	21	Quartz	Greasy	Flake	20.91	21.92	7.41	>50	Crushed			1	Uni	P	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L147	21	Quartz	Greasy	Flake	22.75	9.52	4.73	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L148	21	Quartz	Greasy	Flake	16.00	11.03	5.34	<50	Broken			2	Uni	A	Cortex smooth and rounded - pebble
L153	22	Quartz	Greasy	Flake	11.72	10.72	4.34	<50	Absent			2	Multi	P	Cortex flat and frosted - block/plate
L156	3	Flint		Flake	15.25	16.84	2.81	0	Absent			1	Uni	P	
L157	3	Flint		Flake	12.12	14.77	4.23	100	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble

L166	3	Quartz	Greasy	Flake	12.44	7.53	2.00	0	Absent			1	Uni	A	
L167	3	Quartz	Milky	Flake	13.80	15.50	3.16	0	Broken			1	Uni	P	Refits with L168 - this is the proximal end of the flake
L170	3	Quartz	Greasy	Flake	12.33	15.22	2.68	<50	Cortical	7.33	2.68	1	Uni	P	Cortex smooth and rounded - pebble
L172	3	Quartz	Greasy	Flake	27.83	36.22	13.88	<50	Broken			3	Multi	P	Cortex smooth and rounded - pebble
L173	5	Flint		Flake	23.44	17.93	3.21	0	Absent			1	Uni	P	
L174	5	Quartz	Milky	Flake	34.57	28.95	6.18	0	Broken			2	Uni	A	
L176	5	Quartz	Greasy	Flake	18.01	16.05	3.96	0	Absent			2	Multi	P	
L177	5	Quartz	Greasy	Flake	16.52	12.99	4.13	0	Broken			1	Uni	P	
L179	5	Quartz	Greasy	Flake core	22.96	23.75	7.84	0	Absent			1	Uni	P	The proximal end of the flake has been removed by a further flake initiated from the distal end of the flake, destroying the distal ventral face with knapping shatter
L181	5	Quartz	Greasy	Flake	14.29	17.15	3.04	0	Broken			1	Uni	A	
L182	5	Quartz	Greasy-feldspar	Flake	16.00	12.89	4.00	<50	Absent			1	Uni	A	Cortex mixed raw material - outcrop
L183	5	Quartz	Greasy	Flake	11.42	16.42	4.37	<50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L184	5	Quartz	Milky	Flake	10.38	18.76	1.65	0	Absent			1	Uni	P	
L185	5	Quartz	Fine grained	Flake	13.24	15.71	4.98	0	Absent			1	Uni	P	
L190	5	Quartz	Fine grained	Flake	11.34	9.96	1.84	100	Absent			N/A	N/A	A	Cortex smooth and rounded - pebble
L191	5	Quartz	Greasy	Flake	12.58	10.64	2.87	0	Broken			1	Uni	P	
L193	5	Quartz	Greasy	Flake	12.30	8.93	2.59	0	Broken			2	Indet	P	
L195	5	Quartz	Milky	Flake	10.21	10.70	2.83	0	Absent			1	Uni	P	

L196	5	Quartz	Milky	Flake	12.77	8.59	2.11	0	Absent			2	Uni	P	
L214	5	Quartz	Greasy (dark)	Flake	11.25	7.65	4.68	<50	Broken			2	Uni	P	Cortex flat and frosted - block/plate
L220	5	Quartz	Greasy	Flake	11.01	7.40	2.05	0	Absent			1	Uni	P	
L221	5	Quartz	Greasy	Flake	10.69	4.96	3.86	0	Absent			2	Uni	P	
L235	5	Quartz	Greasy	Flake	11.50	5.60	3.42	0	Absent			1	Uni	P	
L243	11	Quartz	Greasy (dark)-feldspar	Flake	33.44	22.28	11.92	100	Cortical	10.36	9.95	N/A	N/A	A	Cortex smooth and rounded - pebble; characteristics of a 'split pebble core'
L248	11	Quartz	Greasy-feldspar	Flake	25.73	17.39	5.81	100	Broken			N/A	N/A	P	Cortex flat and frosted - block/plate
L250	11	Quartz	Fine grained	Flake	22.29	13.04	5.49	0	Broken			1	Uni	P	
L251	11	Quartz	Greasy	Core rejuv-enation flake	19.03	7.31	17.63	0	Plain	2.28	3.79	3	Multi	A	There is one removal from the rejuvenated platform
L252	11	Quartz	Milky	Flake	18.44	12.73	3.42	0	Broken			2	Multi	P	
L253	11	Quartz	Greasy	Flake	19.95	15.53	7.62	0	Broken			2	Multi	A	
L254	11	Quartz	Greasy	Flake	20.19	12.85	5.13	<50	Broken			1	Uni	A	Cortex smooth and rounded - pebble
L255	11	Quartz	Greasy	Flake	21.21	17.00	6.68	0	Broken			1	Uni	P	
L256	11	Quartz	Milky	Flake	16.31	16.37	6.23	0	Broken			1	Uni	P	
L257	11	Quartz	Greasy	Flake	13.54	21.72	2.53	0	Broken			2	Multi	P	
L258	11	Quartz	Greasy	Flake	12.86	13.89	3.12	0	Absent			1	Uni	P	
L259	11	Quartz	Greasy	Flake	16.14	14.86	5.58	100	Broken			N/A	N/A	P	Cortex smooth and rounded - pebble
L261	11	Quartz	Fine grained	Flake	14.02	16.21	2.60	<50	Absent			2	Multi	P	Cortex flat and frosted - block/plate
L262	11	Quartz	Greasy	Flake	12.71	10.51	5.31	0	Broken			1	Uni	P	

L263	11	Quartz	Milky	Core rejuv-enation flake	10.92	9.21	10.84	0	Plain	5.53	8.38	4	Multi	A	
L264	11	Quartz	Greasy	Flake	19.30	12.71	5.60	0	Broken			1	Uni	P	
L265	11	Quartz	Greasy	Flake	13.00	12.90	3.44	0	Absent			1	Uni	P	
L266	11	Quartz	Milky	Flake	11.69	10.55	6.16	<50	Broken			3	Multi	A	Cortex smooth and rounded - pebble
L268	11	Quartz	Fine grained	Flake	16.00	9.84	3.20	0	Broken			1	Uni	P	
L269	11	Quartz	Greasy	Flake	16.60	6.18	3.85	<50	Absent			1	Uni	P	Not enough cortex present to ascertain probable source
L272	11	Quartz	Greasy	Flake	11.77	9.85	2.81	0	Absent			1	Uni	P	
L279	11	Quartz	Greasy	Flake	10.37	6.60	2.68	0	Absent			1	Uni	P	
L280	11	Quartz	Greasy	Flake	10.41	5.85	2.70	0	Broken			1	Uni	P	
L287	11	Quartz	Milky-fine grained	Flake	12.40	8.13	1.83	0	Broken			1	Uni	P	
L289	11	Quartz	Greasy	Flake	10.04	4.53	2.83	0	Absent			1	Uni	P	
L292	11	Quartz	Greasy	Flake	12.32	4.39	2.48	0	Broken			2	Indet	P	
L304	11	Quartz	Milky	Flake	10.29	7.47	2.73	0	Absent			1	Uni	P	
L321	5/11	Quartz	Greasy	Flake	20.42	11.92	7.34	0	Absent			1	Uni	P	
L322	5/11	Quartz	Greasy	Flake	22.20	18.25	8.83	0	Broken			1	Uni	A	
L323	5/11	Quartz	Greasy	Flake	13.66	12.86	5.20	<50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
L324	5/11	Quartz	Greasy	Flake	11.93	17.42	4.69	0	Absent			1	Uni	P	
L328	17	Quartz	Greasy	Flake	11.83	8.61	2.86	0	Absent			2	Indet	P	
L334	6	Quartz	Greasy (dark)	Flake	11.19	7.42	2.40	<50	Broken			1	Uni	P	Cortex mixed raw material - outcrop
SF9	16	Quartz	Greasy	Small fraction flake	9.51	5.75	1.44	0						P	

L3	3	Quartz	Greasy	Small fraction flake	5.82	12.35	3.55	0						P	
L6	3	Quartz	Greasy	Small fraction flake	4.94	4.06	4.76	0						P	
L7	3	Quartz	Greasy	Small fraction flake	8.55	7.13	2.17	0						P	
L8	3	Quartz	Greasy	Small fraction flake	7.21	7.38	1.83	0						P	
L9	3	Quartz	Greasy	Small fraction flake	5.44	5.97	2.55	0						P	
L10	3	Quartz	Greasy	Small fraction flake	6.51	5.89	3.27	0						P	
L11	3	Quartz	Greasy	Small fraction flake	8.51	7.85	1.81	0						P	
L12	3	Quartz	Greasy	Small fraction flake	8.63	5.49	2.01	0						P	
L14	3	Quartz	Milky	Small fraction flake	9.17	6.63	1.25	0						P	
L15	3	Quartz	Greasy	Small fraction flake	6.99	10.56	1.49	100						P	
L22	3	Quartz	Greasy	Small fraction flake	5.92	6.35	2.32	100						P	
L24	3	Quartz	Milky	Small fraction flake	6.57	6.94	5.49	0						P	

L34	5	Quartz	Greasy	Small fraction flake	9.10	11.22	3.61	<50						P	
L37	5	Quartz	Greasy	Small fraction flake	5.01	10.13	3.15	0						P	
L39	5	Quartz	Greasy	Small fraction flake	9.39	11.79	1.89	0						P	
L40	5	Quartz	Greasy	Small fraction flake	9.56	11.41	2.69	0						P	
L45	7	Quartz	Greasy	Small fraction flake	9.37	3.16	2.14	<50						P	
L46	9	Quartz	Fine grained	Small fraction flake	8.45	5.86	2.45	0						P	
L47	12	Quartz	Greasy	Small fraction flake	9.46	9.21	1.39	0						P	
L49	14	Quartz	Greasy	Small fraction flake	5.64	7.19	2.62	0						P	
L50	14	Quartz	Greasy	Small fraction flake	6.67	7.22	1.40	100						P	
L51	14	Quartz	Greasy	Small fraction flake	8.03	7.82	2.17	0						P	
L52	14	Flint		Small fraction flake	6.30	6.92	2.30	0						P	
L54	11	Quartz	Greasy	Small fraction flake	9.59	4.87	2.89	<50						P	

L56	11	Quartz	Fine grained	Small fraction flake	5.12	7.30	1.94	0						P	
L57	11	Quartz	Greasy	Small fraction flake	8.45	9.51	3.04	<50						P	
L58	11	Quartz	Milky	Small fraction flake	5.81	8.96	3.35	0						P	
L59	11	Quartz	Greasy	Small fraction flake	8.18	7.82	3.97	100						P	
L60	11	Quartz	Greasy	Small fraction flake	6.72	6.07	1.68	0						A	
L61	11	Quartz	Greasy	Small fraction flake	6.39	8.67	4.87	<50						A	
L62	11	Quartz	Greasy	Small fraction flake	7.37	9.06	3.32	0						P	
L63	11	Quartz	Greasy	Small fraction flake	7.92	4.67	3.12	0						P	
L64	11	Quartz	Greasy	Small fraction flake	7.61	7.30	2.72	>50						P	
L65	11	Quartz	Greasy	Small fraction flake	5.06	7.24	1.91	0						P	
L66	11	Quartz	Milky	Small fraction flake	7.98	4.84	2.10	0						P	
L67	11	Quartz	Milky	Small fraction flake	8.22	7.40	1.73	0						P	

L70	11	Quartz	Milky	Small fraction flake	9.77	11.66	2.14	0						P	
L71	11	Quartz	Greasy	Small fraction flake	8.37	10.38	2.09	0						P	
L95	5	Quartz	Greasy	Small fraction flake	9.15	7.50	1.54	0						P	
L96	5	Quartz	Greasy	Small fraction flake	7.78	9.14	3.80	<50						P	
L97	5	Quartz	Greasy	Small fraction flake	6.29	6.95	1.11	0						P	
L98	5	Quartz	Greasy	Small fraction flake	7.89	5.36	2.08	0						P	
L99	5	Quartz	Greasy	Small fraction flake	6.49	6.83	2.48	0						P	
L100	5	Quartz	Greasy	Small fraction flake	5.63	7.47	0.80	0						P	
L101	5	Quartz	Fine grained	Small fraction flake	6.09	11.12	2.95	0						P	
L102	5	Quartz	Milky	Small fraction flake	8.20	9.33	7.04	<50						A	
L103	5	Quartz	Greasy	Small fraction flake	8.11	8.67	2.00	0						P	
L104	5	Quartz	Greasy	Small fraction flake	8.03	8.12	3.26	0						P	

L105	5	Quartz	Greasy	Small fraction flake	8.15	9.57	3.15	0						A	
L106	5	Quartz	Fine grained-greasy	Small fraction flake	6.52	9.94	2.59	0						P	
L107	5	Quartz	Milky-quartzite	Small fraction flake	9.04	14.12	4.30	<50						P	
L108	5	Quartz	Greasy	Small fraction flake	6.71	8.65	2.33	0						P	
L118	10	Quartz	Greasy	Small fraction flake	8.92	6.55	2.78	0						P	
L119	10	Quartz	Greasy	Small fraction flake	8.89	7.25	2.20	0						P	
L120	15	Quartz	Milky	Small fraction flake	8.71	19.41	4.46	<50						A	
L123	18	Quartz	Fine grained	Small fraction flake	9.35	11.96	3.08	0						A	
L125	18	Quartz	Greasy	Small fraction flake	7.40	12.47	4.84	<50						P	
L126	18	Quartz	Greasy	Small fraction flake	7.96	9.35	2.92	<50						P	
L127	18	Quartz	Greasy	Small fraction flake	8.47	5.48	1.57	0						A	
L128	18	Quartz	Greasy	Small fraction flake	7.34	4.54	3.10	0						P	

L129	18	Quartz	Greasy	Small fraction flake	6.63	5.53	3.45	0						P	
L130	18	Quartz	Greasy	Small fraction flake	6.68	8.59	1.44	<50						A	
L140	16	Quartz	Greasy	Small fraction flake	7.23	7.12	1.35	0						P	
L141	16	Quartz	Greasy	Small fraction flake	6.57	5.54	1.66	0						P	
L144	16	Quartz	Greasy	Small fraction flake	7.14	8.84	2.91	0						P	
L150	21	Quartz	Milky	Small fraction flake	6.68	6.38	2.51	0						P	
L151	21	Quartz	Greasy	Small fraction flake	9.88	6.98	1.66	100						P	
L154	22	Quartz	Fine grained	Small fraction flake	4.44	7.45	2.08	0						P	
L155	22	Quartz	Greasy	Small fraction flake	8.74	6.35	1.46	0						P	
L158	3	Quartz	Greasy	Small fraction flake	8.42	7.71	0.87	100						P	
L159	3	Quartz	Greasy	Small fraction flake	7.74	4.43	1.94	0						P	
L160	3	Quartz	Greasy	Small fraction flake	5.68	5.03	1.68	0						P	

L161	3	Quartz	Greasy	Small fraction flake	5.90	4.34	3.31	0						P	
L162	3	Quartz	Fine grained	Small fraction flake	5.75	8.79	3.26	<50						P	
L163	3	Quartz	Greasy	Small fraction flake	6.98	6.21	1.39	0						P	
L164	3	Quartz	Greasy	Small fraction flake	7.92	13.94	2.13	100						P	
L165	3	Quartz	Fine grained-feldspar	Small fraction flake	8.32	6.83	1.78	100						P	
L168	3	Quartz	Milky	Small fraction flake	5.13	15.64	3.76	0						P	Refits with L167 - this is the distal end of the flake
L169	3	Quartz	Greasy	Small fraction flake	9.55	7.84	4.36	0						P	
L188	5	Quartz	Greasy	Small fraction flake	7.81	11.27	2.23	0						P	
L189	5	Quartz	Greasy	Small fraction flake	7.71	8.51	3.59	<50						P	
L192	5	Quartz	Milky	Small fraction flake	8.16	10.04	1.66	0						P	
L194	5	Quartz	Milky	Small fraction flake	9.28	10.52	2.95	0						P	
L197	5	Quartz	Milky	Small fraction flake	8.03	8.71	1.29	0						P	

L198	5	Quartz	Greasy	Small fraction flake	9.40	3.01	2.74	0						P	
L199	5	Quartz	Greasy	Small fraction flake	8.23	6.05	1.53	100						P	
L200	5	Quartz	Milky	Small fraction flake	6.95	7.33	2.45	0						P	
L201	5	Quartz	Greasy	Small fraction flake	7.48	5.45	2.62	0						P	
L202	5	Quartz	Greasy	Small fraction flake	8.47	3.95	3.15	0						P	
L203	5	Quartz	Greasy	Small fraction flake	5.30	5.29	1.30	0						A	
L204	5	Quartz	Greasy	Small fraction flake	5.27	5.53	1.78	>50						P	
L205	5	Quartz	Greasy	Small fraction flake	5.12	6.03	1.77	<50						P	
L206	5	Quartz	Greasy	Small fraction flake	6.31	6.43	1.59	0						P	
L207	5	Quartz	Greasy	Small fraction flake	6.55	4.90	2.92	0						P	
L208	5	Quartz	Greasy (dark)	Small fraction flake	7.89	6.51	1.58	0						P	
L211	5	Quartz	Fine grained	Small fraction flake	4.10	5.96	3.05	0						P	

L212	5	Quartz	Milky	Small fraction flake	6.66	6.58	1.28	0						A	
L213	5	Quartz	Greasy	Small fraction flake	6.78	5.45	2.15	0						P	
L215	5	Quartz	Milky	Small fraction flake	8.32	9.97	1.81	0						P	
L216	5	Quartz	Fine grained	Small fraction flake	9.09	8.03	1.34	0						P	
L217	5	Quartz	Greasy	Small fraction flake	8.07	5.93	1.39	0						P	
L218	5	Quartz	Greasy	Small fraction flake	6.62	7.15	1.78	0						P	
L219	5	Quartz	Greasy	Small fraction flake	7.28	7.45	2.95	0						P	
L222	5	Quartz	Greasy	Small fraction flake	9.40	9.15	1.79	0						P	
L223	5	Quartz	Greasy	Small fraction flake	6.31	7.01	1.26	0						P	
L224	5	Quartz	Greasy	Small fraction flake	6.76	7.55	3.05	0						P	
L225	5	Quartz	Milky	Small fraction flake	4.85	7.04	2.56	0						P	
L226	5	Quartz	Greasy	Small fraction flake	6.09	9.98	1.50	<50						P	

L227	5	Quartz	Greasy	Small fraction flake	5.31	6.02	1.69	0						P	
L228	5	Quartz	Greasy	Small fraction flake	5.52	10.29	1.33	0						P	
L229	5	Quartz	Milky	Small fraction flake	6.28	6.58	1.57	0						P	
L230	5	Quartz	Greasy	Small fraction flake	5.71	5.41	2.81	0						P	
L231	5	Quartz	Milky	Small fraction flake	5.71	6.94	1.16	0						P	
L232	5	Quartz	Greasy	Small fraction flake	5.62	5.76	2.91	0						P	
L233	5	Quartz	Greasy	Small fraction flake	8.83	2.63	1.14	0						P	
L234	5	Quartz	Greasy	Small fraction flake	5.65	11.58	2.84	0						P	
L236	5	Quartz	Milky	Small fraction flake	8.03	4.75	1.14	0						P	
L270	11	Quartz	Greasy (dark)	Small fraction flake	7.48	8.03	2.98	0						P	
L271	11	Quartz	Greasy (dark)	Small fraction flake	7.72	11.77	2.83	0						P	
L273	11	Quartz	Greasy	Small fraction flake	6.26	5.65	6.06	0						P	

L275	11	Quartz	Milky	Small fraction flake	8.68	8.07	3.10	0						P	
L276	11	Quartz	Greasy (dark)	Small fraction flake	7.09	12.84	4.21	<50						A	
L277	11	Quartz	Greasy	Small fraction flake	8.50	9.17	2.04	0						P	
L278	11	Quartz	Greasy	Small fraction flake	8.51	7.04	3.24	100						P	
L281	11	Quartz	Greasy	Small fraction flake	7.78	7.32	1.59	0						P	
L282	11	Quartz	Milky	Small fraction flake	4.74	8.76	2.95	0						P	
L283	11	Quartz	Milky	Small fraction flake	8.04	6.02	4.55	0						P	
L284	11	Quartz	Greasy	Small fraction flake	6.65	8.33	2.61	0						P	
L285	11	Quartz	Greasy	Small fraction flake	6.39	4.84	1.71	0						P	
L286	11	Quartz	Greasy	Small fraction flake	7.02	6.36	2.54	0						P	
L288	11	Quartz	Greasy	Small fraction flake	6.81	6.31	3.44	0						P	
L290	11	Quartz	Greasy	Small fraction flake	8.31	4.00	3.49	0						P	

L291	11	Quartz	Greasy	Small fraction flake	5.58	7.73	3.80	0						P	
L293	11	Quartz	Greasy	Small fraction flake	7.70	5.84	0.72	0						P	
L294	11	Quartz	Greasy	Small fraction flake	5.63	3.92	1.50	0						P	
L295	11	Quartz	Greasy	Small fraction flake	8.12	4.24	1.82	0						P	
L296	11	Quartz	Greasy	Small fraction flake	7.45	5.79	0.62	0						P	
L297	11	Quartz	Greasy	Small fraction flake	9.49	10.20	1.30	0						P	
L298	11	Quartz	Greasy	Small fraction flake	7.93	4.56	4.32	0						P	
L299	11	Quartz	Greasy	Small fraction flake	6.71	5.69	1.08	0						P	
L300	11	Quartz	Milky	Small fraction flake	5.57	5.24	2.32	0						P	
L301	11	Quartz	Greasy-milky	Small fraction flake	8.70	7.88	1.81	0						P	
L302	11	Quartz	Greasy	Small fraction flake	7.29	6.04	1.07	0						P	
L303	11	Quartz	Fine grained	Small fraction flake	6.61	6.86	3.97	<50						P	

L305	11	Quartz	Greasy	Small fraction flake	6.54	3.70	2.40	0						P	
L306	11	Quartz	Greasy	Small fraction flake	6.91	3.58	1.59	0						P	
L307	11	Quartz	Milky	Small fraction flake	5.12	4.58	1.22	0						P	
L308	11	Quartz	Greasy	Small fraction flake	7.70	4.64	2.05	0						P	
L309	11	Quartz	Greasy	Small fraction flake	6.67	6.40	2.60	0						P	
L310	11	Quartz	Greasy	Small fraction flake	6.82	4.22	1.31	0						P	
L311	11	Quartz	Greasy	Small fraction flake	7.75	4.88	3.51	0						P	
L312	11	Quartz	Greasy	Small fraction flake	7.33	5.67	1.42	<50						P	
L313	11	Quartz	Greasy	Small fraction flake	9.34	8.91	1.67	0						P	
L314	11	Quartz	Greasy	Small fraction flake	5.15	5.41	1.91	0						P	
L315	11	Flint		Small fraction flake	9.61	5.78	2.02	0						P	
L325	5/11	Quartz	Greasy	Small fraction flake	4.99	10.80	1.77	0						P	

L326	5/11	Quartz	Milky	Small fraction flake	8.40	6.38	2.06	0						P	
L327	5/11	Quartz	Greasy	Small fraction flake	8.29	8.70	1.72	0						P	
L329	17	Quartz	Greasy	Small fraction flake	8.94	11.08	3.32	0						P	
L330	17	Quartz	Greasy	Small fraction flake	5.97	6.21	2.20	0						P	
L332	6	Quartz	Greasy	Small fraction flake	9.29	6.85	1.75	<50						P	
L333	6	Quartz	Greasy (dark)	Small fraction flake	7.93	7.83	4.63	<50						P	
L335	6	Quartz	Milky-feldspar	Small fraction flake	8.47	7.94	4.06	>50						P	
L336	6	Quartz	Milky	Small fraction flake	5.65	8.56	3.40	0						P	

Table 77. Tràigh na Beirigh 2 chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
L25	3	Quartz	Greasy	Chunk	10.80	8.07	3.69	<50	P	
L78	11	Quartz	Greasy	Chunk	12.82	11.25	6.18	0	P	
L186	5	Quartz	Greasy	Chunk	13.72	11.77	5.21	<50	P	
L267	11	Quartz	Greasy	Chunk	12.77	6.13	6.32	<50	P	
L55	11	Quartz	Greasy	Small fraction chunk	5.52	5.21	5.29	0	P	

L134	19	Quartz	Greasy (dark)	Small fraction chunk	7.34	4.59	2.73	<50	P	
L149	21	Quartz	Greasy	Small fraction chunk	9.79	6.17	4.96	0	P	
L209	5	Quartz	Greasy	Small fraction chunk	7.10	6.26	2.31	0	P	
L210	5	Quartz	Greasy	Small fraction chunk	6.95	5.18	6.23	0	P	
L274	11	Quartz	Greasy	Small fraction chunk	8.88	8.03	4.55	<50	P	

Appendix 7 Tràigh na Beirigh 3 Lithic Catalogue

Table 78. Tràigh na Beirigh 3 flake

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
L1	1	Quartz	Greasy	Flake	10.30	7.80	2.02	0	Absent			1	Uni	P	

Appendix 8 Tràigh na Beirigh 4 Lithic Catalogue

Table 79. Tràigh na Beirigh 4 core

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
L18	1	Quartz	Greasy	Core	23.68	3.22	A	4	Multidirectional	Lost	Core rejuvenation scar evident, removing the original platform

Table 80. Tràigh na Beirigh 4 flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
SF1	1	Quartz	Fine grained	Flake	17.13	8.47	4.81	0	Plain	7.51	4.69	2	Uni	P	
SF3	1	Quartz	Fine grained-greasy	Flake	29.92	35.94	9.72	<50	Broken			5	Multi	A	Cortex smooth and flat
L3	1	Quartz	Greasy	Flake	12.18	6.42	3.26	0	Broken			1	Uni	P	
L12	1	Quartz	Greasy	Flake	12.50	8.23	1.70	<50	Absent			1	Uni	P	
L13	1	Quartz	Greasy	Flake	10.48	12.51	3.45	>50	Plain	8.25	3.34	1	Uni	P	Cortex smooth and slightly rounded
L15	1	Quartz	Greasy	Flake	18.91	20.02	3.91	100	Absent			N/A	N/A	P	Cortex flat break along fracture plane
L16	1	Quartz	Greasy	Flake	17.61	18.22	5.30	>50	Absent			1	Uni	P	Cortex flat break along fracture plane
L1	1	Quartz	Greasy	Small fraction flake	9.21	9.72	4.33	0						P	
L2	1	Quartz	Greasy	Small fraction flake	7.49	4.39	0.64	0						A	

L4	1	Quartz	Greasy	Small fraction flake	9.85	4.22	2.02	0						P	
L6	1	Quartz	Greasy	Small fraction flake	7.08	6.93	1.91	100						A	
L7	1	Quartz	Greasy	Small fraction flake	7.86	10.01	3.51	>50						P	
L8	1	Quartz	Greasy	Small fraction flake	6.65	4.83	2.30	0						P	
L9	1	Quartz	Greasy	Small fraction flake	9.01	6.65	3.01	>50						A	
L10	1	Quartz	Greasy	Small fraction flake	7.73	6.29	1.44	0						P	
L11	1	Quartz	Greasy	Small fraction flake	4.56	9.16	1.50	100						P	

Table 81. Tràigh na Beirigh 4 chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
L14	1	Quartz	Fine grained	Chunk	13.62	8.69	7.24	0	P	
L5	1	Quartz	Greasy	Small fraction chunk	6.96	6.72	1.15	<50	A	

Table 82. Tràigh na Beirigh 4 core secondary technology

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF2	1	Quartz	Greasy	Core/ Scraper	32.11	8.92	A	8	Bidirectional	Unprepared	Bipolar core that looks to have been used as a scraper evidenced by a small area of retouch and crushing at one end

Table 83. Tràigh na Beirigh 4 flake secondary technology

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
L17	1	Quartz	Greasy	Notch	15.77	19.11	4.95	0	Broken			1	Uni	P	

Table 84. Tràigh na Beirigh 4 detail of retouch

ID No.	Type	Extent	Orientation	Fineness	Morphology	Angle	Course	Notes
SF2	Edge	Sporadic	*	Fine	Sub-parallel	Abrupt-Very Abrupt	Convex	*Orientation could not be identified due to the fact this was originally a core
L17	Invasive	Sporadic	Normal	Very coarse	*		Notched	*Morphology could not be recorded as the retouch is only a single removal

Appendix 9 Tràigh na Beirigh 9 Lithic Catalogue

Table 85. Tràigh na Beirigh 9 coarse stone tools

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Notes
SF31	7	Quartz	Milky	Manuport	77.12	50.29	32.60	Sub-angular pebble
L54	5	Sandstone		Manuport	15.46	14.17	8.45	Rounded pebble, broken; not consistent with the background material in the sample
L255	7	Flowstone		Manuport	56.82	32.93	24.34	Probable hammerstone - rounded pebble with pitting along one face, likely percussion damage

Table 86. Tràigh na Beirigh 9 cores

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
SF29	6	Quartz	Greasy	Core	17.22	2.23	A	6	Multidirectional	Unprepared /Lost	
L3	4	Quartz	Milky	Core	9.92	0.58	P	1	Unidirectional	Unprepared	Cortex frosted and weathered - block/plate
L23	5	Quartz	Greasy (dark)	Core	16.48	1.38	P	5	Multidirectional	Unprepared /Lost	Cortex flat and frosted - block/plate
L78	5	Quartz	Greasy	Core	8.14	0.23	A	4	Multidirectional	Simple/lost	

Table 87. Tràigh na Beirigh 9 flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick -ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
SF1a	5	Quartz	Greasy	Flake	17.25	15.76	5.97	0	Broken			1	Uni	P	Broken edge used as a rejuvenated platform from which to detach another flake, prior to removal of this flake
SF1b	5	Quartz	Milky	Flake	18.58	19.12	6.23	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
SF3	6	Quartz	Milky	Flake	26.5	28.72	16	>50	Plain	10.58	4.32	2	Bi	P	Not bipolar; cortex is rounded - pebble
SF4	6	Quartz	Milky	Flake	17.84	23.23	10.55	0	Plain	23.23	10.55	3	Multi	A	
SF5	5	Quartz	Greasy	Flake	27.66	28.79	9.35	<50	Facetted	19.14	6.95	3	Multi	P	Further working appears to have been used to detach small, thin blades; not enough cortex to ascertain probable source
SF6	5	Quartz	Milky	Flake	18.27	28.47	6.87	>50	Plain	8.05	7.13	5	Multi	A	Cortex flat and frosted - block/plate
SF7	5	Quartz	Greasy	Flake	12.83	23.03	4.8	<50	Broken			3	Multi	A	Not enough cortex to ascertain probable source
SF8	5	Quartz	Greasy (dark)	Flake core	23.35	14.1	6.05	<50	Broken			2	Multi	P	Flake has broken perpendicular to the platform, creating an edge that has been used as a platform for a subsequent flake removal; not enough cortex to ascertain probable source

SF9	5	Quartz	Greasy	Flake	19.22	14.58	9.54	0	Broken			1	Uni	P	
SF10	5	Quartz	Greasy (dark)	Flake	16.10	22.57	7.47	0	Facetted	4.99	6.61	8	Multi	P	
SF11	5	Quartz	Greasy	Flake	20.47	27.67	5.41	0	Broken			1	Uni	P	
SF12	5	Quartz	Greasy	Flake	20.17	19.24	3.27	0	Absent			3	Multi	A	Yellow staining on two of the dorsal scars
SF13	5	Quartz	Greasy	Flake	15.75	17.58	5.17	<50	Broken/Cortical			2	Uni	P	Cortex rounded - pebble
SF15	5	Quartz	Greasy	Flake	14.75	11.79	6.36	0	Plain	10.71	6.36	3	Indet	P	
SF17	5	Quartz	Greasy	Flake	11.86	17.73	3.32	100	Crushed			N/A	N/A	A	Cortex flat and frosted - block/plate
SF21	5	Quartz	Greasy	Flake	13.06	9.03	3.29	>50	Broken			1	Uni	P	Cortex smooth and rounded - pebble
SF23	5	Quartz	Fine grained	Core rejuvenation flake	23.14	10.54	11.70	0	Plain	9.82	7.91	5	Multi	A	
SF24	5	Quartz	Fine grained	Flake	22.33	19.70	6.12	0	Broken			2	Indet	P	
SF26	5	Quartz	Greasy (dark)	Flake	10.00	7.24	13.21	>50	Crushed			1	Uni	P	Cortex rounded - pebble
SF27	5	Quartz	Milky	Flake	11.08	6.96	1.87	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
SF32	7	Quartz	Greasy (dark)	Flake	29.76	22.03	8.05	>50	Broken			2	Multi	P	Cortex flat and mixed raw material - outcrop?
SF33	6	Quartz	Greasy	Flake	20.16	18.94	5.08	0	Broken			3	Multi	P	
SF34	6	Quartz	Greasy	Flake core	14.71	19.96	5.54	0	Plain	15.63	4.89	4	Multi	P	
SF37	6	Quartz	Greasy (dark)	Flake	13.82	9.66	4.77	0	Crushed			1	Uni	P	
SF40	9	Quartz	Milky	Flake	17.93	14.34	3.71	0	Absent			5	Multi	A	

SF41	9	Quartz	Greasy (dark)	Flake	20.68	21.61	6.77	<50	Cortical	19.71	6.16	2	Uni	P	Cortex flat and smooth - pebble; percussion marks visible on the cortical face
L1	4	Quartz	Fine grained	Flake	13.10	17.38	4.14	>50	Crushed			1	Uni	A	Cortex rounded - pebble
L2	4	Quartz	Fine grained	Flake	12.04	18.18	9.57	>50	Cortical	12.28	9.67	2	Multi	A	Cortex smooth and rounded - pebble
L4	4	Quartz	Rock crystal	Flake	13.10	13.67	5.22	>50	Broken			1	Uni	P	Cortex flat, frosted and weathered - block/plate
L9	5	Quartz	Greasy	Flake	15.91	26.53	9.53	<50	Broken			4	Multi	P	Dorsal surface shattered by previous flaking attempt; cortex flat and frosted - block/plate
L12	5	Quartz	Greasy	Flake	17.32	19.96	4.68	0	Absent			1	Uni	P	
L14	5	Quartz	Milky	Flake	16.88	8.00	3.06	0	Broken			1	Uni	P	
L16	5	Quartz	Coarse grained	Flake	13.75	9.79	5.06	0	Broken			1	Uni	P	
L18	5	Quartz	Greasy (dark)	Flake	12.94	9.04	5.10	0	Crushed			3	Multi	A	
L26	5	Quartz	Fine grained	Flake	15.85	12.75	4.47	100	Cortical	6.20	3.91	N/A	N/A	P	Cortex is flat, frosted and mixed raw material - outcrop
L27	5	Quartz	Greasy	Flake	11.11	11.37	4.11	0	Crushed			1	Uni	P	
L35	5	Quartz	Greasy	Flake	10.26	5.93	3.89	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L38	5	Quartz	Greasy-fine grained	Flake	10.24	5.70	3.26	0	Broken			1	Uni	P	
L41	5	Quartz	Greasy	Flake	11.61	6.21	2.46	0	Crushed			1	Uni	P	
L48	5	Flint		Flake	10.49	7.07	2.85	<50	Absent			3	Multi	P	Exterior cortex absent
L50	5	Quartz	Milky	Flake	10.37	4.77	0.96	0	Absent			1	Uni	A	

L53	5	Granite		Flake	27.67	23.33	6.44	0	Broken			?	Indet	P	
L55	6	Quartz	Greasy (dark)	Flake	11.82	8.25	3.57	0	Broken			2	Indet	P	
L64	6	Quartz	Milky	Flake	16.82	9.10	4.85	100	Absent			N/A	N/A	P	Cortex flat and weathered - outcrop?
L65	5	Quartz	Greasy-fine grained	Flake	13.31	12.62	2.73	0	Absent			1	Uni	P	
L66	5	Quartz	Greasy (dark)	Flake	14.86	9.71	4.85	>50	Absent			N/A	N/A	P	Cortex flat and mixed raw material - outcrop
L67	5	Quartz	Greasy	Flake	10.86	15.46	3.40	0	Broken			1	Uni	P	
L68	5	Quartz	Greasy (dark)	Flake	10.09	12.49	2.82	0	Absent			3	Multi	P	
L70	5	Quartz	Greasy (dark)	Flake	13.38	12.27	5.60	<50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L105	5	Quartz	Milky	Flake	11.27	9.05	2.03	100	Broken			N/A	N/A	A	Cortex rounded - pebble
L106	5	Quartz	Milky	Flake	14.51	7.95	3.67	0	Broken			1	Uni	P	
L121	5	Quartz	Fine grained	Flake	10.99	4.93	2.45	0	Absent			1	Uni	P	
L125	5	Carbonate		Flake	12.86	9.90	2.18	0	Absent			3	Uni	P	
L126	5	Granite		Flake	11.56	19.78	4.96	100	Broken			N/A	N/A	P	Cortex weathered - outcrop?
L127	6	Quartz	Greasy	Flake	20.85	25.35	3.39	0	Absent			1	Uni	P	
L128	6	Quartz	Greasy	Flake core	18.30	19.05	7.58	0	Absent			2	Multi	P	Crushing on arris of dorsal face leading to removal of proximal end
L129	6	Quartz	Greasy (dark)	Flake	17.47	11.97	6.57	0	Broken			1	Uni	P	
L130	6	Quartz	Greasy	Flake	13.11	15.20	6.70	>50	Broken			1	Uni	P	Cortex flat and mixed raw material - outcrop

L131	6	Quartz	Greasy	Flake	19.72	15.45	13.16	<50	Absent			2	Multi	P	Cortex flat and smooth - pebble
L133	6	Quartz	Milky-greasy	Flake	10.47	14.22	5.48	0	Plain	10.35	5.48	1	Uni	A	
L137	6	Quartz	Greasy	Flake	13.01	12.52	2.03	0	Broken			3	Multi	P	
L138	6	Quartz	Greasy	Flake	10.32	13.30	2.84	0	Broken			2	Multi	P	
L140	6	Quartz	Greasy	Flake	13.83	8.58	2.95	<50	Absent			1	Uni	P	Cortex rounded - pebble
L145	6	Quartz	Greasy	Flake	12.75	9.63	2.32	0	Absent			2	Multi	P	
L150	6	Quartz	Greasy	Flake	10.07	9.38	2.19	100	Absent			N/A	N/A	A	Cortex flat and frosted - block/plate
L152	6	Quartz	Greasy	Flake	13.58	8.60	2.84	0	Absent			3	Multi	P	
L153	6	Quartz	Greasy (dark)-feldspar	Flake	18.90	10.13	4.47	0	Broken			1	Uni	P	
L156	6	Quartz	Milky	Flake	12.49	8.14	1.52	0	Absent			2	Multi	A	
L157	6	Quartz	Greasy	Flake	10.03	10.00	1.59	0	Absent			1	Uni	P	
L160	6	Quartz	Greasy - Milky	Flake	13.16	7.77	4.59	0	Broken			1	Uni	P	
L163	6	Quartz	Milky	Flake	10.95	5.77	3.01	0	Broken			2	Indet	A	
L166	6	Quartz	Greasy - Milky	Flake	12.69	3.66	1.51	0	Absent			1	Uni	P	
L167	6	Quartz	Greasy - Milky	Flake	11.69	3.44	2.42	0	Absent			3	Uni	P	Refits with L169; medial lateral snap, proximal end
L168	6	Quartz	Greasy - Milky	Flake	10.70	4.76	1.24	0	Absent			1	Uni	P	
L169	6	Quartz	Greasy - Milky	Flake	10.05	3.03	2.28	0	Absent			3	Uni	P	Refits with L167; medial lateral snap, distal end
L170	6	Quartz	Greasy	Flake	11.77	5.02	2.84	<50	Absent			1	Uni	P	Cortex flat and frosted - block/plate
L173	6	Quartz	Greasy (dark)	Flake	11.51	8.88	5.19	<50	Broken			1	Uni	P	Cortex flat and mixed raw material - outcrop

L174	6	Quartz	Milky	Flake	10.27	9.06	2.60	100	Absent			N/A	N/A	A	Cortex rounded - pebble
L177	6	Quartz	Greasy (dark)	Flake	16.98	8.92	3.94	100	Absent			N/A	N/A	P	Cortex flat and mixed raw material - outcrop
L178	6	Quartz	Greasy (dark)	Flake	12.17	5.79	2.94	>50	Absent			1	Uni	P	Cortex flat and mixed raw material - outcrop
L185	6	Quartz	Greasy	Flake	15.11	8.46	3.33	100	Absent			N/A	N/A	P	Cortex flat and frosted - block/plate
L191	6	Quartz	Milky	Flake	10.24	8.65	1.77	>50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L215	6	Quartz	Milky	Flake	11.60	6.41	1.35	<50	Broken			1	Uni	P	Cortex flat and frosted - block/plate
L235	6	Quartz	Greasy (dark)	Flake	13.84	8.51	5.02	<50	Absent			N/A	N/A	P	Cortex smooth and rounded - pebble
L238	6	Feldspar		Flake	10.90	10.20	2.35	0	Broken			1	Uni	P	
L240	6	Feldspar		Flake	11.58	11.09	3.28	0	Plain	10.98	3.28	1	Uni	A	
L241	6	Limestone		Flake	22.08	18.12	4.49	0	Broken			1	Uni	P	
L242	7	Quartz	Milky	Flake	17.22	11.36	4.98	0	Absent			1	Uni	P	
L243	7	Quartz	Milky	Flake	18.38	16.59	2.21	0	Absent			1	Uni	P	
L244	7	Quartz	Milky-rock crystal	Flake	13.45	12.82	2.12	0	Absent			1	Uni	P	
L245	7	Quartz	Milky-rock crystal	Flake	10.07	7.35	1.70	0	Absent			1	Uni	P	
L246	7	Quartz	Fine grained	Flake	11.24	9.36	2.82	0	Broken			1	Uni	P	
L248	7	Quartz	Greasy	Flake	13.23	10.60	3.02	0	Plain	6.41	2.18	1	Uni	P	
L249	7	Quartz	Milky	Flake	14.28	5.64	3.52	0	Absent			2	Multi	P	
L251	7	Quartz	Milky	Flake	10.90	7.19	3.69	0	Absent			1	Uni	P	
L254	7	Quartz	Milky/Quartzite	Flake	42.53	23.87	10.30	>50	Broken			1	Uni	A	Cortex flat and mixed raw material - outcrop
L256	9	Quartz	Milky	Flake	13.75	12.37	2.39	0	Broken			2	Uni	P	

L258	9	Quartz	Milky-rock crystal	Flake	10.15	12.14	2.62	0	Broken			1	Uni	P	
L270	9	Quartz	Fine grained	Flake	10.40	7.19	2.73	0	Broken			1	Uni	P	
L278	9	Basalt		Flake	11.72	10.48	4.19	0	Broken			2	Multi	A	
L279	11	Quartz	Milky	Flake	29.23	18.48	8.55	<50	Absent			1	Uni	P	Cortex rounded - pebble; characteristics of a 'split cobble core'
L280	11	Quartz	Milky	Flake	12.59	20.10	4.35	0	Broken			1	Uni	A	
SF16	5	Quartz	Milky	Small fraction flake	8.31	13.47	8.80	<50						A	
SF19	5	Quartz	Greasy	Small fraction flake	7.77	6.44	1.88	100						P	
SF28	6	Quartz	Greasy	Small fraction flake	8.19	10.27	2.23	<50						P	
L6	4	Quartz	Fine grained	Small fraction flake	6.99	8.58	1.68	100						P	
L7	4	Quartz	Fine grained	Small fraction flake	9.95	6.81	1.21	100						P	
L10	5	Quartz	Greasy (dark)	Small fraction flake	8.91	13.31	3.92	0						P	
L11	5	Quartz	Greasy	Small fraction flake	7.68	12.00	3.21	0						P	
L13	5	Quartz	Fine grained	Small fraction flake	9.01	11.53	2.87	0						P	
L15	5	Quartz	Greasy	Small fraction flake	7.66	11.16	2.72	0						P	

L19	5	Quartz	Greasy	Small fraction flake	7.76	10.57	3.81	0						P	
L20	5	Quartz	Greasy	Small fraction flake	8.19	9.81	2.86	0						A	
L22	5	Quartz	Fine grained	Small fraction flake	8.90	4.09	2.16	0						P	
L28	5	Quartz	Rock crystal	Small fraction flake	8.23	12.00	1.50	0						P	
L29	5	Quartz	Milky	Small fraction flake	8.82	8.78	3.36	0						P	
L30	5	Quartz	Greasy	Small fraction flake	5.61	6.75	2.15	0						P	
L31	5	Quartz	Milky	Small fraction flake	4.45	8.67	2.98	0						P	
L32	5	Quartz	Coarse grained	Small fraction flake	6.29	6.55	2.04	0						A	
L33	5	Quartz	Greasy	Small fraction flake	6.85	7.05	2.87	0						P	
L34	5	Quartz	Coarse grained	Small fraction flake	6.19	5.16	1.96	0						A	
L36	5	Quartz	Greasy	Small fraction flake	4.67	7.54	1.97	0						P	
L37	5	Quartz	Greasy	Small fraction flake	7.74	3.22	2.23	0						P	

L39	5	Quartz	Coarse grained	Small fraction flake	6.13	6.37	1.71	0						P	
L40	5	Quartz	Greasy	Small fraction flake	5.65	6.46	1.60	0						P	
L42	5	Quartz	Coarse grained	Small fraction flake	6.39	7.89	1.92	0						P	
L44	5	Quartz	Rock crystal	Small fraction flake	5.73	10.15	3.74	<50						A	
L45	5	Quartz	Greasy	Small fraction flake	4.94	8.89	3.10	100						P	
L46	5	Quartz	Greasy (dark)	Small fraction flake	6.48	5.12	2.31	<50						P	
L47	5	Quartz	Coarse grained	Small fraction flake	7.86	5.26	2.83	<50						P	
L49	5	Quartz	Milky	Small fraction flake	8.73	6.81	3.16	0						P	
L51	5	Quartz	Greasy	Small fraction flake	4.41	6.80	1.12	0						P	
L52	5	Quartz	Fine grained-coarse grained	Small fraction flake	6.18	9.69	2.14	0						P	
L56	6	Quartz	Greasy	Small fraction flake	7.33	13.55	4.45	>50						P	
L57	6	Quartz	Fine grained	Small fraction flake	6.31	9.27	2.40	0						P	

L58	6	Quartz	Coarse grained	Small fraction flake	6.01	7.16	1.50	100						A	
L59	6	Quartz	Greasy	Small fraction flake	9.14	4.23	2.46	0						P	
L60	6	Quartz	Fine grained	Small fraction flake	4.81	7.51	1.56	100						P	
L61	6	Quartz	Greasy (dark)	Small fraction flake	6.04	9.47	2.75	>50						P	
L63	6	Quartz	Greasy	Small fraction flake	4.40	7.79	2.63	<50						P	
L69	5	Quartz	Milky	Small fraction flake	8.58	15.70	3.21	0						P	
L73	5	Quartz	Milky	Small fraction flake	9.31	11.60	2.03	>50						P	
L74	5	Quartz	Greasy	Small fraction flake	9.02	11.25	6.52	<50						P	
L75	5	Quartz	Fine grained	Small fraction flake	7.63	11.90	1.94	0						P	
L76	5	Quartz	Greasy	Small fraction flake	5.83	7.84	3.04	0						A	
L77	5	Quartz	Greasy	Small fraction flake	5.97	8.62	2.02	0						P	
L79	5	Quartz	Greasy	Small fraction flake	5.36	8.38	1.83	0						P	

L80	5	Quartz	Coarse grained	Small fraction flake	9.84	10.48	2.75	0						P	Medial fragment
L81	5	Quartz	Coarse grained	Small fraction flake	9.63	6.80	2.13	0						P	
L82	5	Quartz	Milky	Small fraction flake	5.83	8.72	1.83	0						P	
L83	5	Quartz	Milky	Small fraction flake	9.31	10.87	2.96	0						P	
L84	5	Quartz	Greasy	Small fraction flake	7.33	12.14	1.73	0						P	
L85	5	Quartz	Greasy-fine grained	Small fraction flake	7.54	8.89	3.37	0						P	
L88	5	Quartz	Greasy-quartzite	Small fraction flake	6.71	9.01	1.74	<50						P	
L91	5	Quartz	Fine grained	Small fraction flake	6.26	6.83	1.04	0						P	
L92	5	Quartz	Coarse grained	Small fraction flake	6.52	7.30	1.58	0						P	
L94	5	Quartz	Greasy	Small fraction flake	6.04	9.46	2.51	0						A	
L96	5	Quartz	Fine grained	Small fraction flake	8.52	7.92	2.49	0						P	
L97	5	Quartz	Greasy	Small fraction flake	9.59	4.41	1.85	0						P	Possible blank for rod

L98	5	Quartz	Greasy	Small fraction flake	6.31	8.41	3.30	<50						P	
L99	5	Quartz	Greasy	Small fraction flake	9.77	3.67	2.73	0						P	
L101	5	Quartz	Greasy	Small fraction flake	4.77	6.85	2.09	0						P	
L102	5	Quartz	Coarse grained	Small fraction flake	5.89	5.01	1.99	0						P	Additional flake removed from same platform
L104	5	Quartz	Milky	Small fraction flake	9.01	5.76	2.64	0						P	
L107	5	Quartz	Fine grained	Small fraction flake	6.52	7.81	1.86	0						A	
L108	5	Quartz	Fine grained	Small fraction flake	6.28	7.74	2.27	0						P	
L109	5	Quartz	Fine grained	Small fraction flake	8.47	5.11	1.81	0						P	
L110	5	Quartz	Fine grained	Small fraction flake	4.29	6.37	2.99	100						P	
L111	5	Quartz	Fine grained	Small fraction flake	5.11	7.49	3.25	0						P	
L112	5	Quartz	Greasy	Small fraction flake	6.86	5.87	1.31	0						P	
L113	5	Quartz	Milky	Small fraction flake	8.60	3.73	3.82	100						P	

L114	5	Quartz	Milky	Small fraction flake	5.50	8.65	1.53	0						P	
L115	5	Quartz	Milky	Small fraction flake	5.58	7.24	1.29	0						P	
L116	5	Quartz	Milky	Small fraction flake	7.57	8.25	2.79	<50						P	
L117	5	Quartz	Greasy	Small fraction flake	6.12	7.48	4.29	100						P	
L118	5	Quartz	Fine grained	Small fraction flake	6.42	6.07	1.69	0						P	
L120	5	Quartz	Milky	Small fraction flake	4.79	7.93	2.61	100						P	
L122	5	Quartz	Greasy	Small fraction flake	4.27	6.91	5.49	<50						P	
L123	5	Quartz	Fine grained	Small fraction flake	7.23	4.79	1.70	0						P	
L135	6	Quartz	Milky-rock crystal	Small fraction flake	7.87	7.97	1.43	0						P	
L136	6	Quartz	Milky-rock crystal	Small fraction flake	8.44	9.39	1.53	0						A	
L141	6	Quartz	Milky	Small fraction flake	5.24	6.83	0.86	0						A	
L142	6	Quartz	Milky	Small fraction flake	9.59	7.61	0.95	0						A	

L143	6	Quartz	Milky	Small fraction flake	7.72	7.73	1.01	0						P	
L144	6	Quartz	Milky	Small fraction flake	8.78	8.76	2.80	0						P	
L146	6	Quartz	Milky	Small fraction flake	1.93	6.85	0.60	0						P	
L148	6	Quartz	Milky	Small fraction flake	9.87	9.17	2.42	0						P	
L149	6	Quartz	Milky	Small fraction flake	7.27	10.62	1.72	0						P	
L151	6	Quartz	Milky	Small fraction flake	9.20	6.74	2.22	0						P	
L155	6	Quartz	Milky	Small fraction flake	9.73	10.24	1.54	0						P	
L158	6	Quartz	Greasy – Feldspar	Small fraction flake	7.96	9.14	2.50	<50						P	
L161	6	Quartz	Greasy – Milky	Small fraction flake	9.75	8.22	2.10	0						P	
L162	6	Quartz	Milky	Small fraction flake	8.06	8.98	1.46	0						P	
L164	6	Quartz	Greasy – Milky	Small fraction flake	8.96	5.54	3.26	0						P	
L165	6	Quartz	Greasy	Small fraction flake	9.88	7.65	1.18	0						P	

L171	6	Quartz	Greasy – Milky	Small fraction flake	9.64	7.64	1.56	0						P	
L172	6	Quartz	Greasy (dark)	Small fraction flake	9.43	7.59	2.40	0						P	
L175	6	Quartz	Greasy	Small fraction flake	9.19	8.49	2.83	0						A	
L179	6	Quartz	Greasy	Small fraction flake	9.01	6.68	2.39	0						P	
L180	6	Quartz	Greasy	Small fraction flake	8.20	7.21	1.07	0						P	
L182	6	Quartz	Greasy	Small fraction flake	7.98	6.19	1.94	0						P	
L184	6	Quartz	Milky	Small fraction flake	7.57	6.91	2.26	0						P	
L186	6	Quartz	Greasy – Milky	Small fraction flake	7.75	7.42	1.23	0						P	
L188	6	Quartz	Milky	Small fraction flake	5.96	7.12	1.88	0						P	
L189	6	Quartz	Greasy	Small fraction flake	5.59	11.04	2.84	100						P	
L190	6	Quartz	Greasy	Small fraction flake	7.80	6.79	1.00	0						P	
L192	6	Quartz	Greasy	Small fraction flake	9.50	8.77	1.36	0						P	

L193	6	Quartz	Milky	Small fraction flake	8.31	7.14	1.19	0						P	
L194	6	Quartz	Milky	Small fraction flake	5.84	8.24	1.80	0						P	
L195	6	Quartz	Greasy	Small fraction flake	7.36	7.55	1.13	0						A	
L196	6	Quartz	Fine grained	Small fraction flake	9.72	8.39	1.93	0						A	Small flake became detached from ventral face during recording
L197	6	Quartz	Milky	Small fraction flake	7.30	6.43	1.88	0						P	
L198	6	Quartz	Milky	Small fraction flake	8.67	10.97	3.13	0						P	
L199	6	Quartz	Milky	Small fraction flake	5.27	6.39	1.76	0						P	
L202	6	Quartz	Greasy (dark)	Small fraction flake	7.89	9.01	2.52	>50						P	
L203	6	Quartz	Fine grained	Small fraction flake	8.59	4.38	3.09	0						P	
L204	6	Quartz	Greasy (dark)	Small fraction flake	8.55	6.69	2.30	<50						P	
L205	6	Quartz	Greasy	Small fraction flake	5.57	8.07	0.99	<50						A	
L206	6	Quartz	Milky	Small fraction flake	5.61	8.34	1.12	0						P	

L208	6	Quartz	Milky	Small fraction flake	6.82	4.78	4.68	100						A	
L209	6	Quartz	Greasy	Small fraction flake	6.59	8.17	1.69	0						P	
L210	6	Quartz	Milky	Small fraction flake	6.60	7.16	3.14	<50						P	
L211	6	Quartz	Fine grained	Small fraction flake	6.88	8.04	1.40	0						P	
L212	6	Quartz	Greasy	Small fraction flake	7.79	6.15	1.38	100						P	
L213	6	Quartz	Greasy	Small fraction flake	6.52	6.74	5.37	<50						P	
L214	6	Quartz	Milky	Small fraction flake	6.80	7.11	4.06	0						P	
L217	6	Quartz	Milky	Small fraction flake	7.25	7.66	0.89	<50						P	
L218	6	Quartz	Milky	Small fraction flake	6.99	3.71	2.92	0						P	
L219	6	Quartz	Milky	Small fraction flake	8.99	6.29	2.14	0						P	
L220	6	Quartz	Milky	Small fraction flake	5.38	7.01	1.65	0						P	
L221	6	Quartz	Milky	Small fraction flake	5.21	5.45	1.05	0						P	

L222	6	Quartz	Greasy	Small fraction flake	9.30	5.88	2.10	0						P	
L223	6	Quartz	Greasy	Small fraction flake	8.56	4.41	2.83	0						P	
L225	6	Quartz	Milky	Small fraction flake	7.02	6.91	2.81	<50						P	
L227	6	Quartz	Greasy	Small fraction flake	7.45	5.67	3.10	0						P	
L228	6	Quartz	Greasy	Small fraction flake	4.17	5.17	1.20	0						P	
L229	6	Quartz	Greasy	Small fraction flake	6.84	6.73	2.68	100						P	
L230	6	Quartz	Milky	Small fraction flake	5.78	6.42	1.93	<50						P	
L231	6	Quartz	Milky	Small fraction flake	6.84	5.54	1.80	0						P	
L232	6	Quartz	Greasy (dark)	Small fraction flake	7.67	8.13	2.18	0						P	
L233	6	Quartz	Fine grained	Small fraction flake	7.44	4.99	1.53	<50						P	
L234	6	Quartz	Coarse grained – Quartzite	Small fraction flake	5.96	10.77	2.76	0						P	
L239	6	Feldspar		Small fraction flake	6.78	6.40	2.61	0						P	

L247	7	Quartz	Milky	Small fraction flake	4.44	7.94	2.47	0						P	
L252	7	Quartz	Milky	Small fraction flake	8.97	6.59	1.18	0						P	
L253	7	Quartz	Quartzite	Small fraction flake	9.59	7.38	2.04	0						P	
L257	9	Quartz	Milky	Small fraction flake	9.85	9.15	5.79	>50						P	
L259	9	Quartz	Greasy - Fine grained	Small fraction flake	9.93	8.89	0.90	100						P	
L260	9	Quartz	Milky	Small fraction flake	9.56	6.55	2.94	0						P	
L261	9	Quartz	Fine grained	Small fraction flake	7.26	8.31	2.62	0						A	
L262	9	Quartz	Fine grained	Small fraction flake	7.83	6.50	3.24	0						P	
L263	9	Quartz	Fine grained	Small fraction flake	6.78	7.22	2.79	0						P	
L264	9	Quartz	Greasy	Small fraction flake	9.16	13.16	4.22	<50						P	
L265	9	Quartz	Greasy (dark)	Small fraction flake	6.28	7.76	2.23	0						P	
L266	9	Quartz	Milky	Small fraction flake	6.74	10.63	3.14	0						P	

L267	9	Quartz	Milky	Small fraction flake	6.09	8.24	5.02	<50						P	
L268	9	Quartz	Fine grained	Small fraction flake	9.07	7.30	3.39	0						P	
L271	9	Quartz	Milky	Small fraction flake	9.32	5.93	2.06	0						P	
L273	9	Quartz	Rock crystal	Small fraction flake	8.16	6.81	3.35	0						P	
L274	9	Quartz	Fine grained	Small fraction flake	8.07	6.66	2.40	0						P	
L281	11	Quartz	Fine grained	Small fraction flake	9.20	10.31	3.20	0						P	
L282	11	Quartz	Milky	Small fraction flake	7.12	4.45	3.36	>50						P	

Table 88. Tràigh na Beirigh 9 chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
SF30	7	Quartz	Milky	Chunk	15.17	7.37	6.68	0	P	
SF35	6	Quartz	Greasy (dark)	Chunk	10.33	14.14	4.80	0	P	
SF39	9	Quartz	Fine grained	Chunk	10.87	8.21	7.73	<50	A	
SF42	11	Quartz	Milky	Chunk	18.92	10.31	9.48	<50	P	
L21	5	Quartz	Fine grained	Chunk	17.00	10.15	6.43	>50	P	
L24	5	Quartz	Greasy	Chunk	10.87	4.02	4.27	0	P	
L25	5	Quartz	Greasy	Chunk	15.37	8.22	3.65	0	P	
L43	5	Quartz	Greasy	Chunk	10.29	6.50	3.32	0	P	

L71	5	Quartz	Milky-greasy	Chunk	12.24	10.59	6.38	0	P	
L72	5	Quartz	Greasy (dark) - quartzite	Chunk	22.78	11.27	5.92	>50	P	
L86	5	Quartz	Greasy	Chunk	10.65	6.84	2.55	0	A	
L90	5	Quartz	Greasy	Chunk	10.03	7.72	3.93	100	P	
L93	5	Quartz	Greasy	Chunk	10.87	6.57	3.63	0	P	
L95	5	Quartz	Greasy	Chunk	11.75	5.36	3.37	0	P	
L132	6	Quartz	Greasy	Chunk	11.91	13.75	5.15	<50	P	
L134	6	Quartz	Greasy (dark)	Chunk	17.39	14.59	6.21	>50	A	
L139	6	Quartz	Greasy (dark)	Chunk	15.02	11.49	3.86	0	P	
L154	6	Quartz	Greasy	Chunk	10.91	9.54	3.17	0	A	
L159	6	Quartz	Greasy - Fine grained	Chunk	14.37	7.80	6.72	>50	P	
L176	6	Quartz	Greasy (dark)	Chunk	13.24	6.02	5.34	<50	P	
L183	6	Quartz	Greasy	Chunk	11.73	5.50	3.80	0	P	
L250	7	Quartz	Milky	Chunk	10.07	8.00	3.42	0	P	
L277	9	Quartz	Coarse grained	Chunk	13.94	6.32	5.93	0	P	
SF18	5	Quartz	Greasy	Small fraction chunk	6.81	6.57	4.90	0	P	
L5	4	Quartz	Milky	Small fraction chunk	7.24	9.53	3.76	<50	A	
L17	5	Quartz	Greasy	Small fraction chunk	7.81	6.05	2.65	0	P	
L62	6	Quartz	Greasy	Small fraction chunk	9.96	3.37	3.28	0	P	
L100	5	Quartz	Greasy	Small fraction chunk	8.35	5.55	2.72	0	P	
L103	5	Quartz	Coarse grained	Small fraction chunk	7.69	6.52	2.12	<50	P	

L119	5	Quartz	Milky	Small fraction chunk	7.25	5.40	3.28	<50	P	
L124	5	Quartz	Milky	Small fraction chunk	6.39	4.72	2.29	0	P	
L147	6	Quartz	Milky	Small fraction chunk	8.84	8.41	2.65	0	P	
L181	6	Quartz	Milky	Small fraction chunk	7.73	5.60	2.16	*	P	*Cortex presence indeterminate due to yellow staining across piece
L187	6	Quartz	Milky	Small fraction chunk	5.72	5.00	2.33	0	P	
L200	6	Quartz	Greasy (dark)	Small fraction chunk	8.65	8.48	6.82	<50	P	
L201	6	Quartz	Greasy (dark)	Small fraction chunk	9.29	5.64	5.79	<50	P	
L207	6	Quartz	Milky	Small fraction chunk	6.56	6.37	3.71	0	P	
L216	6	Quartz	Greasy	Small fraction chunk	6.37	5.74	2.71	100	P	
L224	6	Quartz	Milky	Small fraction chunk	7.10	5.55	3.01	<50	A	
L226	6	Quartz	Milky	Small fraction chunk	6.07	5.58	3.28	0	P	
L236	6	Quartz	Greasy (dark)	Small fraction chunk	7.61	6.45	3.49	0	P	
L237	6	Quartz	Milky	Small fraction chunk	5.53	5.96	3.26	0	P	
L269	9	Quartz	Fine grained	Small fraction chunk	4.53	5.64	4.43	0	A	
L272	9	Quartz	Fine grained - Rock crystal	Small fraction chunk	6.41	5.56	1.56	0	P	
L275	9	Quartz	Greasy	Small fraction chunk	8.38	6.49	4.41	>50	P	
L276	9	Quartz	Milky - Fine grained	Small fraction chunk	8.85	11.59	6.91	0	P	

Table 89. Tràigh na Beirigh 9 secondary technology

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break-age	Notes
SF14	5	Quartz	Greasy	Oblique point	22.37	8.99	3.18	<50	Absent			1	Uni	P	Flake removed from a flake core as two ventral surfaces are present; cortex flat break along fracture plane
SF25	5	Quartz	Milky	Burin	14.05	15.78	5.11	0	Broken			1	Uni	A	Burin spall removed obliquely from proximal to right lateral with the facet perpendicular to the lower face
SF36	6	Quartz	Greasy (dark)	Notch	17.79	11.68	3.50	<50	Absent			1	Uni	P	Notch initiated from ventral side and situated on the right; cortex flat break along fracture plane
L89	5	Quartz	Milky	Burin	10.53	11.34	3.04	0	Crushed			3	Multi	A	Possible burin spall removed from distal to left lateral
L8	5	Quartz	Fine grained	Burin	16.41	13.83	3.41	0	Plain	7.88	2.36	2	Multi	P	Burin spall initiated from distal end to right lateral

Table 90. Tràigh na Beirigh 9 detail of retouch

ID No.	Type	Extent	Orientation	Fineness	Morphology	Angle	Course	Notes
SF14	Edge	Sporadic	From ridge (cortex)	Fine	Scaled	Abrupt	Straight	Unusual backing on arris - possible keying for hafting

Appendix 10 Pabaigh Mòr South Lithic Catalogue

Table 91. Pabaigh Mòr South cores

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Weight (g)	Cortex	Flake Removal Count	Flake Removal Sequence	Platform Preparation	Notes
L12	2	Flint		Core	13.97	1.78	P	9	Multidirectional	Unprepared /lost	Cortex smooth - pebble
L13	2	Quartz	Fine grained - greasy	Core/test piece	110.4	127.09	A	5	Unidirectional	Unprepared	Angular block; removals appear to have been done with the purpose of testing the block – removal on lateral edge, perpendicular to the rest indicates scar from blow used to detach the piece

Table 92. Pabaigh Mòr South flakes and small fraction flakes

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thick-ness (mm)	Cortex %	Platform Type	Platform Width (mm)	Platform Depth (mm)	Dorsal Flake Scar Count	Dorsal Flake Scar Pattern	Break -age	Notes
L1	1	Quartz	Greasy	Flake	19.30	12.03	4.47	<50	Plain	8.11	1.97	1	Uni	P	Cortex flat and frosted - block/plate
L2	1	Quartz	Greasy	Flake	18.42	9.19	4.92	100	Absent			N/A	N/A	P	Cortex flat and smooth - likely pebble
L7	2	Quartz	Milky	Flake	11.24	4.82	2.30	0	Broken			1	Uni	P	
L10	2	Quartz	Greasy	Flake	12.69	18.07	3.90	100	Broken			N/A	N/A	P	Cortex flat and frosted - block/plate

L11	2	Quartz	Greasy	Flake core	3.73	25.76	5.74	0	Broken			1	Uni	P	Breakage on left lateral edge due to knapping error resulted in an accidentally rejuvenated platform which was used for a removal on the dorsal side
L3	2	Quartz	Milky	Small fraction flake	6.22	5.47	2.06	0						A	
L5	2	Quartz	Milky	Small fraction flake	9.86	9.31	1.14	0						A	
L6	2	Quartz	Greasy	Small fraction flake	3.99	9.84	1.74	0						A	
L8	2	Quartz	Greasy	Small fraction flake	7.06	11.10	1.45	0						P	

Table 93. Pabaigh Mòr South chunks and small fraction chunks

ID No.	Context No.	Raw Material	Raw Material Variety	Typology	Length (mm)	Width (mm)	Thickness (mm)	Cortex %	Breakage	Notes
L4	2	Quartz	Greasy	Chunk	9.81	6.63	4.33	0	P	
L9	2	Quartz	Milky	Chunk	15.14	9.25	5.64	<50	P	

Appendix 11 Harris – Small Fraction Flakes, Chunks, and Small Fraction Chunks Results

11.1. Northton 2010

11.1.1. Small Fraction Flake Assemblage

The small fraction flake (<10mm) assemblage from Northton totals 311 pieces. There are 279 small fraction flakes in Phase 3 (C009; C014), and 32 small fraction flakes in Phase 4 (C016; C017).

11.1.1.1. Raw Material

Quartz makes up two-thirds of the total small fraction flake assemblage at Northton (Figure 274). A little less than a quarter of the small fraction flakes are flint, and there is a small proportion of mudstone. Two small fraction flakes of feldspar and an unknown igneous raw material comprise the remainder.

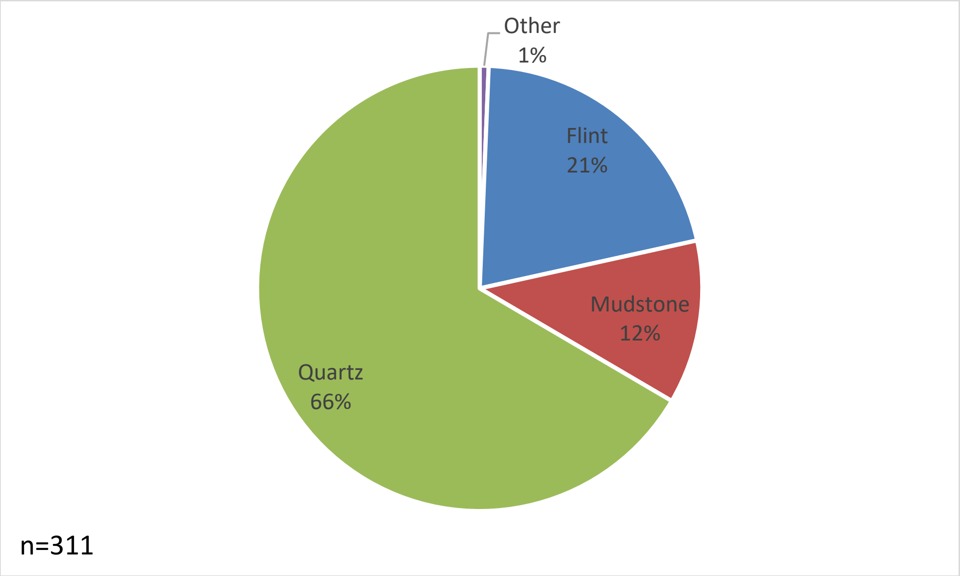


Figure 274. Northton 2010 total small fraction flake assemblage raw material composition

In Phase 3, quartz is the dominant raw material in the small fraction flake assemblage (Figure 275). Flint is represented more often than mudstone, and the small fraction flakes of feldspar and an unknown igneous rock are found in this phase.

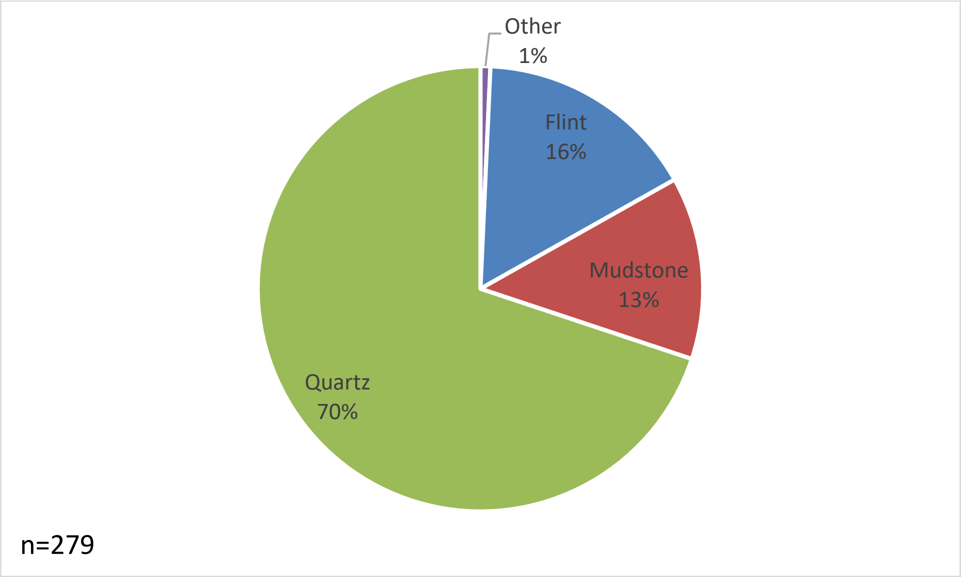


Figure 275. Northton 2010 Phase 3 small fraction flake raw material composition

Mixed quartz small fraction flakes are the most highly represented in the assemblage, with milky quartz also frequently occurring (Figure 276). There are smaller numbers of fine grained and greasy quartz present, and rare occurrences of rock crystal.

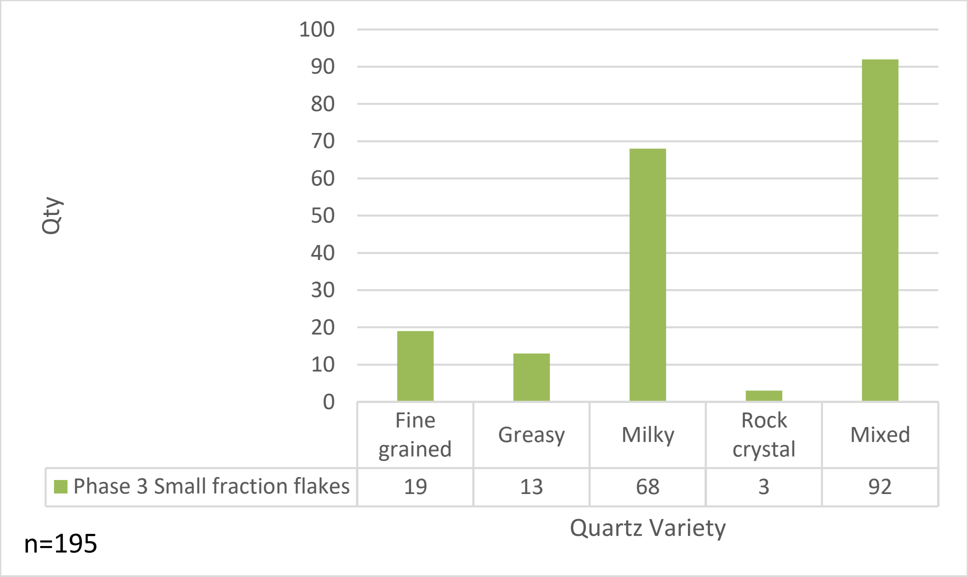


Figure 276. Northton 2010 Phase 3 small fraction flake quartz varieties

Flint is the most common raw material in the small fraction flake assemblage from Phase 4 (Figure 277). Fine grained and milky quartz varieties are equally represented, with two flakes mixed small fraction flakes of milky-rock crystal quartz also present (Figure 278).

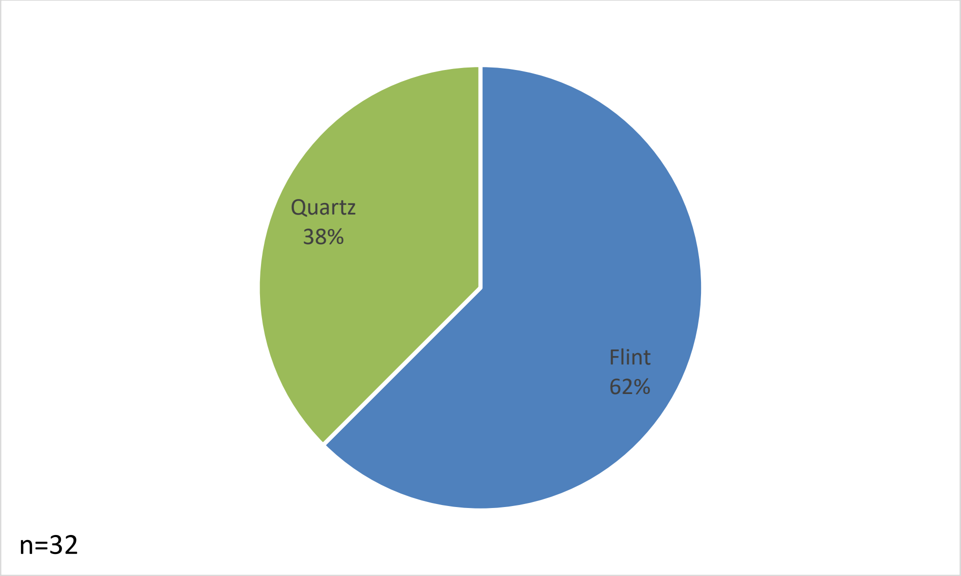


Figure 277. Northton 2010 Phase 4 small fraction flake raw material composition

Figure 278. Northton 2010 Phase 4 small fraction flake quartz varieties

11.1.1.2. Small Fraction Flake Dimensions

The summary statistics for the small fraction flake assemblage from Northton are presented in Table 94. The length of the small fraction flakes is constrained by the recording methodology; therefore none exceed 10mm in length. In Phase 3 the flint small fraction flakes are on average longer and wider than both the mudstone and quartz small fraction flakes. The quartz small fraction flakes are thicker on average. In Phase 4, the flint small fraction flakes are longer than those made from quartz, although the quartz small fraction flakes are both wider and thicker than flint.

Raw Material		Length (mm)		Width (mm)		Thickness (mm)	
		Phase 3	Phase 4	Phase 3	Phase 4	Phase 3	Phase 4
Flint	**Min**	4.10	4.80	4.70	4.20	0.50	0.50
	Max	9.90	9.90	16.60	12.30	5.50	4.90
	Mean	7.55	7.70	8.56	7.44	2.12	2.07
	SD	1.595226	1.572428	2.447584	1.707835	1.032285	1.178477
Mudstone	**Min**	3.60		3.90		0.70	
	Max	9.90		16.10		4.40	
	Mean	7.32		8.55		2.22	
	SD	1.673967		2.789873		0.978139	
Quartz	**Min**	3.80	4.60	4.30	4.70	0.90	1.20
	Max	9.90	8.90	17.20	11.30	22.60	6.20
	Mean	7.40	6.83	8.19	8.15	2.72	2.98
	SD	1.495542	1.410629	2.285823	2.189022	1.758615	1.541708

Table 94. Northton 2010 small fraction flake dimension summary statistics for Phase 3 and 4 primary raw materials. *Includes outlier. By removing the outlier, mean = 2.62, SD = 1.02505

11.1.1.2.1. Phase 3

There is a weak positive correlation between the length and width of the flint small fraction flakes in Phase 3. This contrasts with the baked mudstone small fraction flakes from this phase, which present no discernible relationship (Figure 279). The feldspar and igneous raw material small fraction flakes also follow a positive trend. The data points are constrained by the methodology employed, which classifies small fraction flakes as <10mm in length and the recovery method of material >4mm. The greatest concentration of small fraction flakes in flint, mudstone, feldspar and igneous raw material is more than 6mm in length and between 5mm-12mm in width. Single flint and mudstone small fraction flakes are more than 15mm in width each, and there is very little difference between the mean widths of these raw materials (Table 94 and Figure 279).

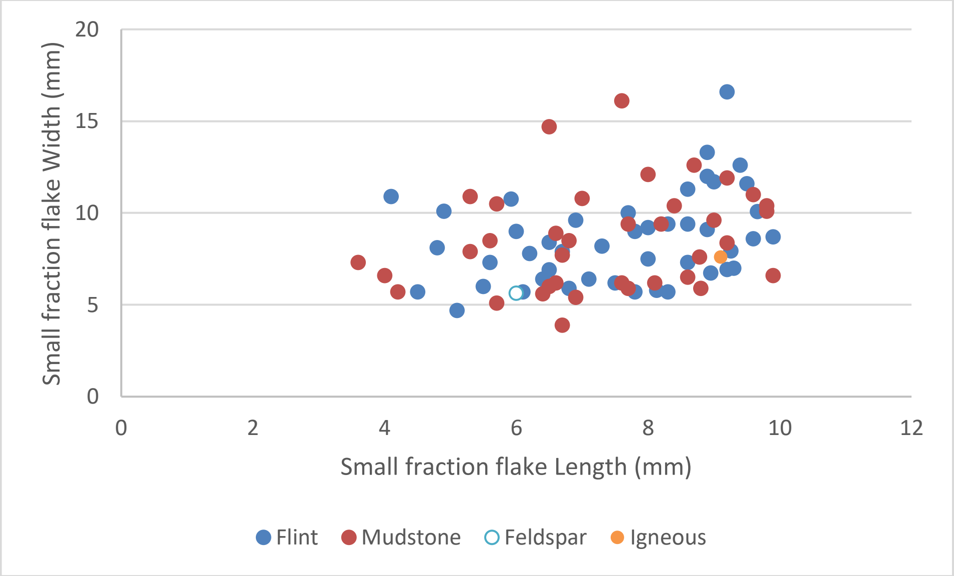


Figure 279. Northton 2010 Phase 3 small fraction flake dimensions length:width, quartz excluded

The majority of the quartz small fraction flakes fall within the same dense concentration as the other raw materials (Figure 280 and Figure 281). There are marginally more quartz small fraction flakes that exceed 15mm in width, with the mean width much greater than that of flint or mudstone small fraction flakes (Table 94). There is no observable relationship between the length and width of the quartz small fraction flakes in Phase 3.

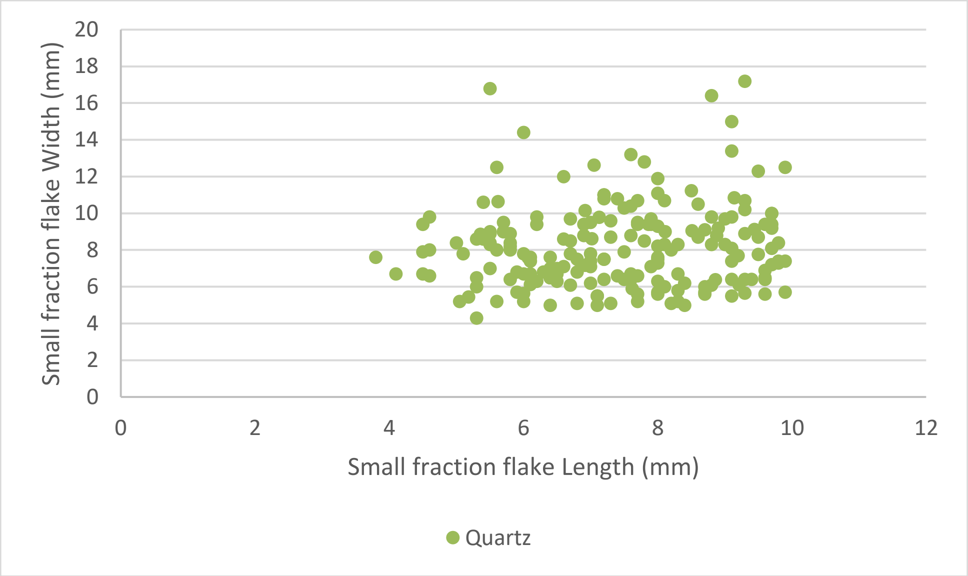


Figure 280. Northton 2010 Phase 3 quartz small fraction flake dimensions length:width

The minimum recorded length for mudstone and quartz small fraction flakes is marginally lower than that for flint. These raw materials are also shorter, but wider, on average than flint small fraction flakes (Table 94 and Figure 281).

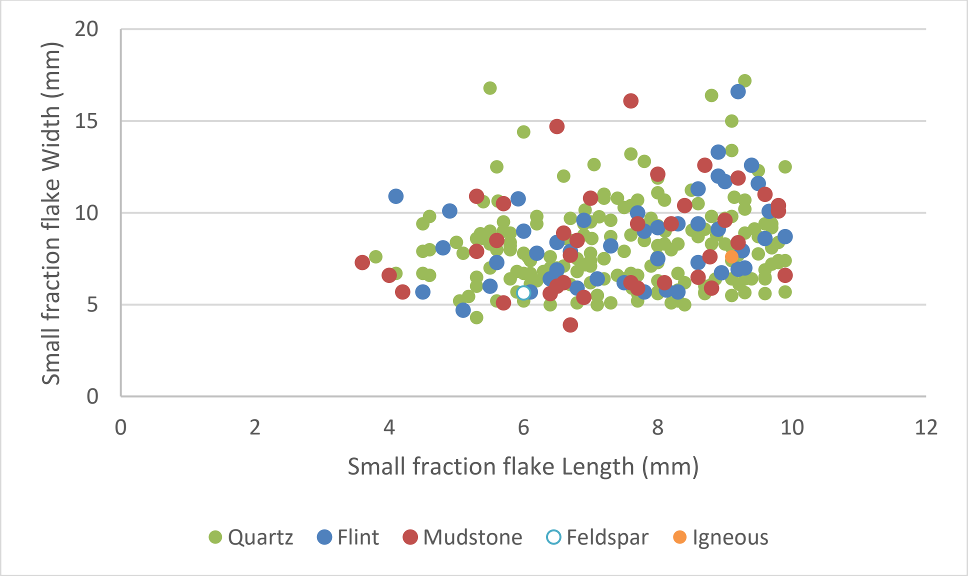


Figure 281. Northton 2010 Phase 3 small fraction flake dimensions length:width, quartz included

The relationship between length and thickness for the feldspar, igneous raw material and flint small fraction flakes in Phase 3 is positive, as observed above (Figure 282). However, this is not evident in the baked mudstone small fraction flakes. Most of the small fraction flakes in these raw materials group between 0.50mm-3.5mm in thickness. The maximum thickness for the flint small fraction flakes is greater than the mudstone flakes, which have a very small standard deviation from the mean (Table 94).

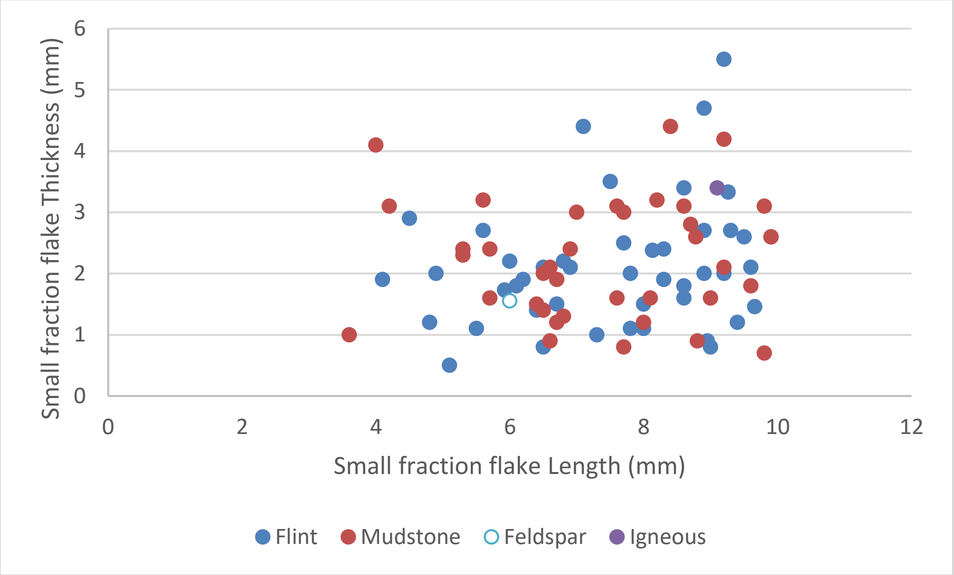


Figure 282. Northton 2010 Phase 3 small fraction flake dimensions length:thickness, quartz excluded

It is clear from Figure 283 and Figure 284 that there is a significant outlier in terms of the thickness of the quartz small fraction flake assemblage in Phase 3, which is unusually thick and obscures the remainder of the data. By removing the outlier (Figure 284) it is evident that the majority of the quartz small fraction flakes are less than 5mm in thickness, which compares well with the other raw materials in the assemblage (Figure 285 and Figure 286).

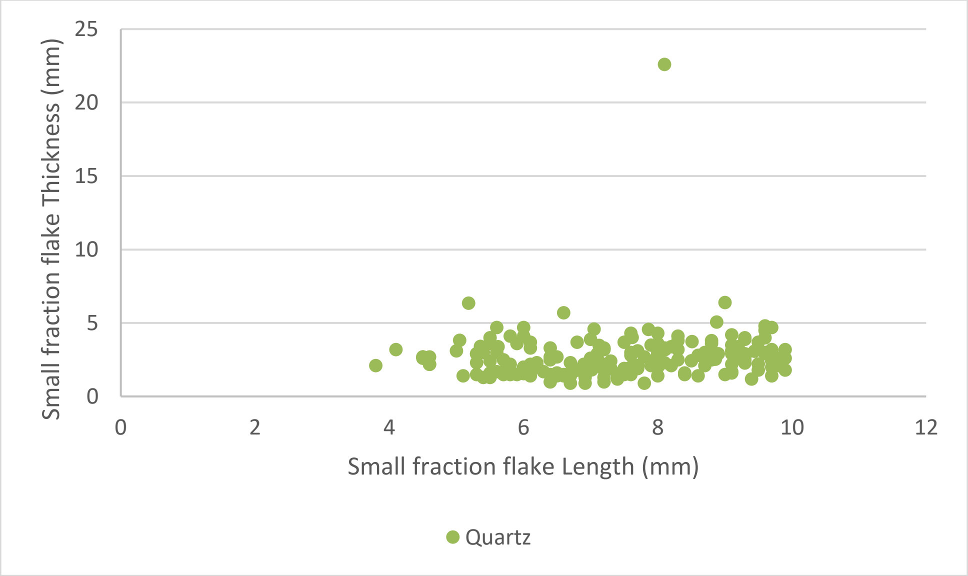


Figure 283. Northton 2010 Phase 3 quartz small fraction flake dimensions length:thickness

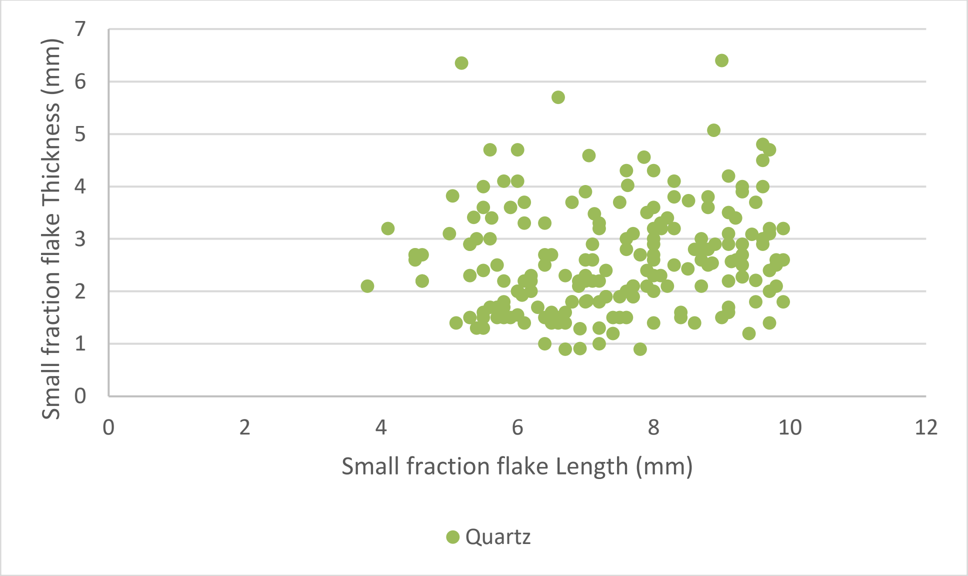


Figure 284. Northton 2010 Phase 3 quartz small fraction flake dimensions length:thickness, excluding significant outlier

Despite the excessive thickness of a single quartz small fraction flake, there is little difference between the standard deviation of the quartz and flint small fraction flakes. On average, the quartz small fraction flakes are only marginally thicker than the mudstone and flint small fraction flakes (Table 94).

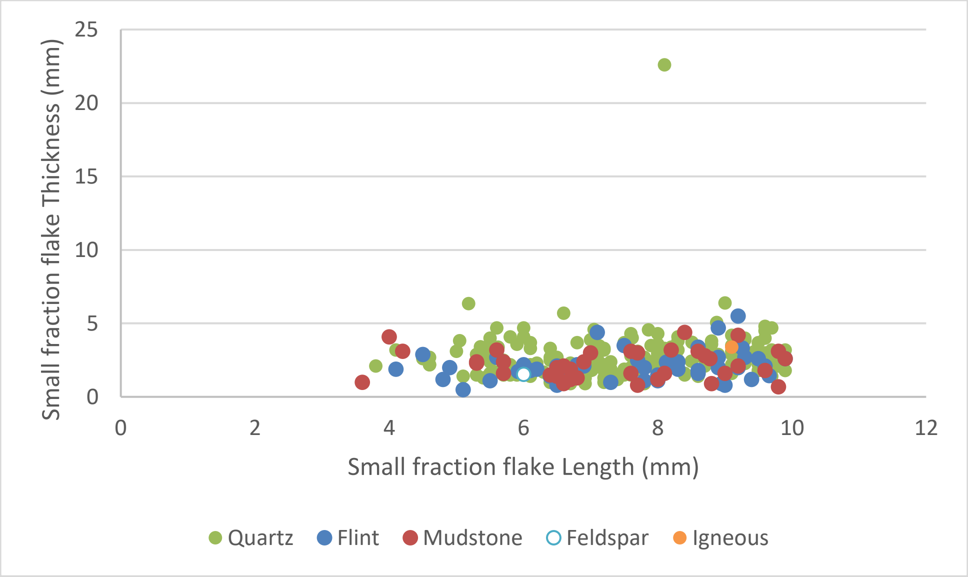


Figure 285. Northton 2010 Phase 3 small fraction flake dimensions length:thickness, quartz included

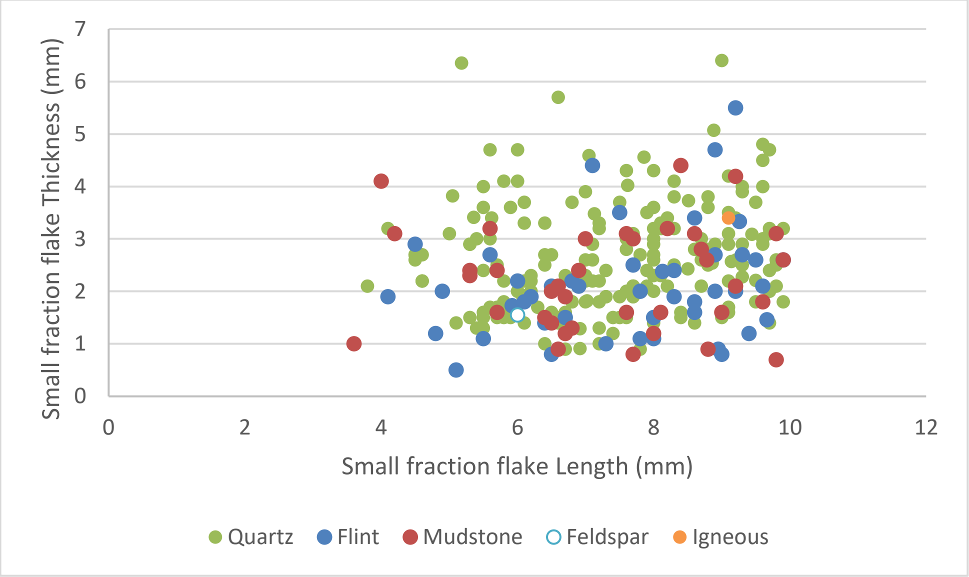


Figure 286. Northton 2010 Phase 3 small fraction flake dimensions length:thickness, quartz included, excluding significant outlier

The small fraction flake width and thickness are not constrained by the methodology or recovery technique; therefore any relationships between these dimensions are easily identifiable. The feldspar and igneous raw material small fraction flakes from Phase 3 clearly increase in both dimensions; however this is less apparent in the flint and mudstone small fraction flakes (Figure 287). The grouping between 5mm-12mm in width and 0.5mm-3.5mm in thickness is supported by this figure.

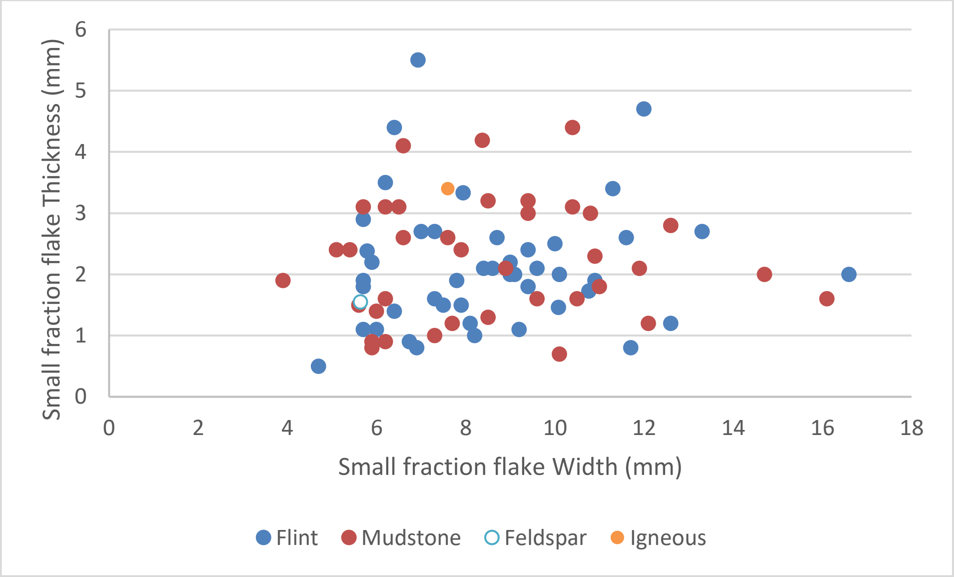


Figure 287. Northton 2010 Phase 3 small fraction flake dimensions with:thickness, quartz excluded

Figure 288 displays the quartz small fraction flake assemblage from Phase 3 as a whole, and Figure 289 shows the data following the removal of the outlier. The main cluster of points falls within 5mm-11mm in width, and 1mm-4mm in thickness as observed above, and there appears to be no significant relationship between the increases in these two dimensions.

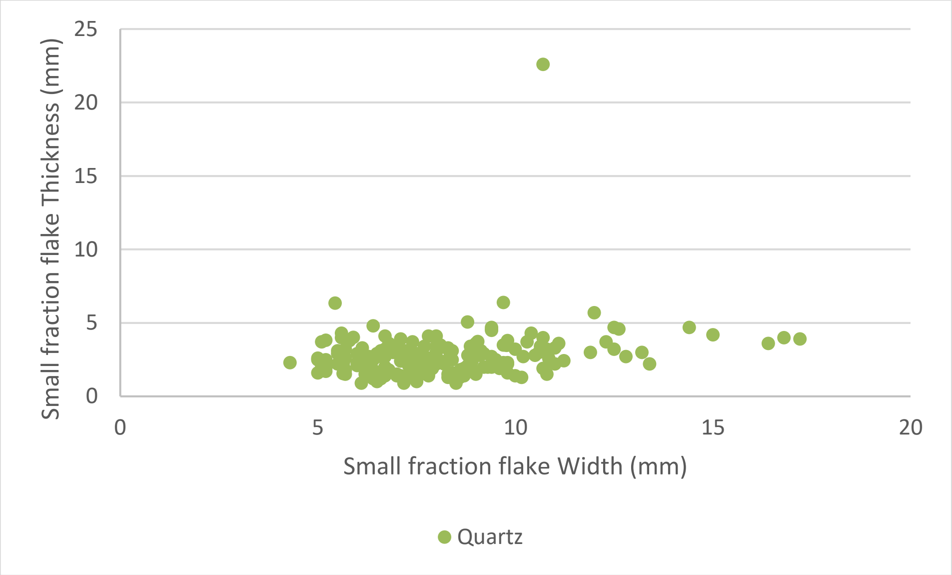


Figure 288. Northton 2010 Phase 3 quartz small fraction flake dimensions width:thickness

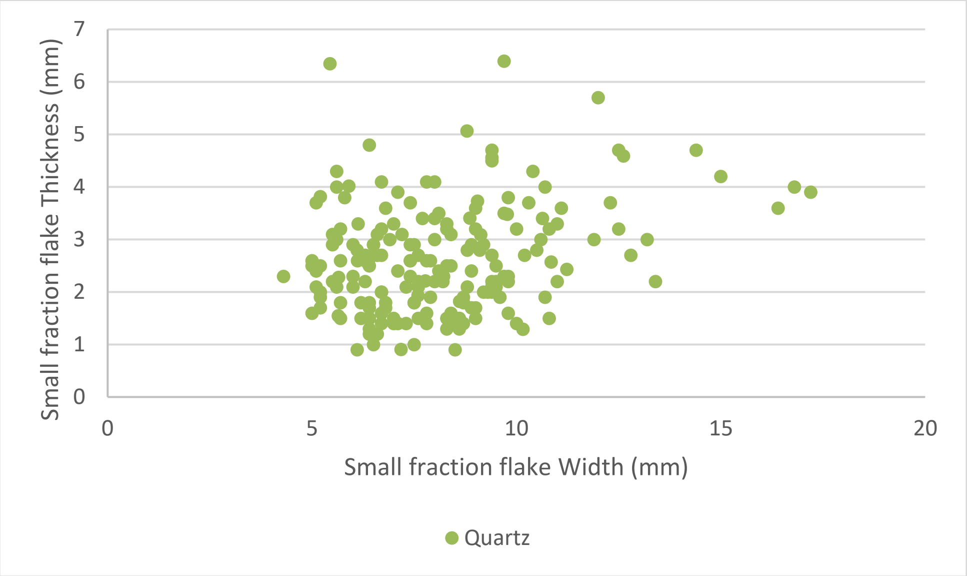


Figure 289. Northton 2010 Phase 3 quartz small fraction flake dimensions width:thickness, excluding significant outlier

By removing the outlier (contrast Figure 290 and Figure 291) the greater range in thickness of the flint and quartz small fraction flakes in comparison to the mudstone small fraction flakes is very clear (Figure 291). All of the raw materials display a similar range in width, which is clear from the comparable standard deviation figures for this dimension across the raw materials (Table 94).

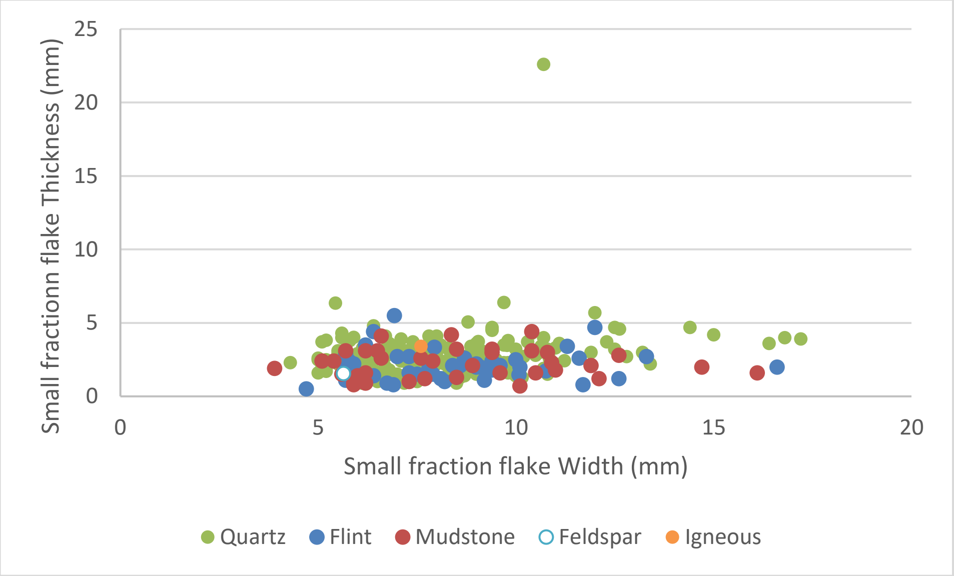


Figure 290. Northton 2010 Phase 3 small fraction flake dimensions width:thickness, quartz included

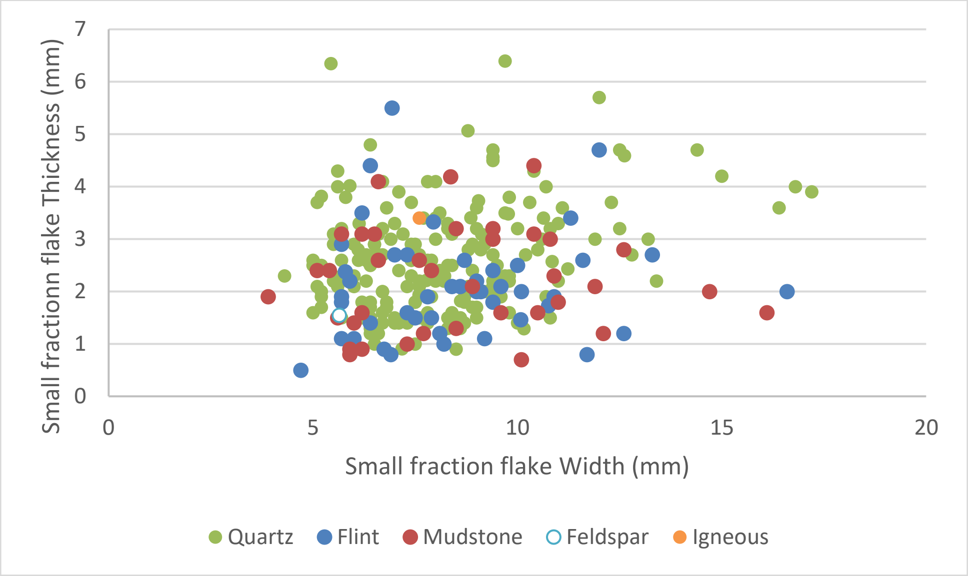


Figure 291. Northton 2010 Phase 3 small fraction flake dimensions width:thickness, quartz included - significant outlier removed

11.1.1.2.2. Phase 4

The majority of the flint and quartz small fraction flakes from Phase 4 exceed 5mm in length (Figure 292). There is a single flint outlier that is greater than 10mm in width, whereas there are three quartz small fraction flakes that exceed this measurement for width. There is a negative correlation between the flint small fraction flakes, which become narrower as they increase in length. This may be due to flake breakage. The quartz small fraction flakes in contrast have a positive relationship between the length and width. In Phase 4 the flint small fraction flakes have larger maximum and minimum length dimensions than those in quartz, with a greater mean flake length (Table 94).

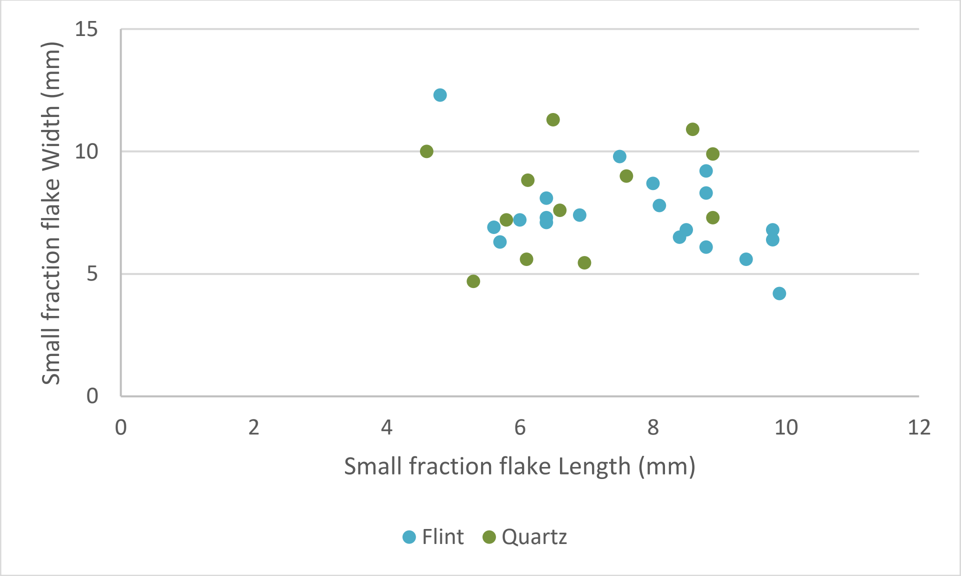


Figure 292. Northton 2010 Phase 4 small fraction flake dimensions length:width

The quartz small fraction flakes from Phase 4 average almost a whole millimetre thicker than the flint small fraction flakes in this phase (Table 94 and Figure 293). The flint small fraction flakes are almost exclusively thinner than 3mm, with only two pieces recorded at 4.9mm. This contrasts to the quartz small fraction flakes which have an equal number of pieces greater, and less than, 3mm in thickness.

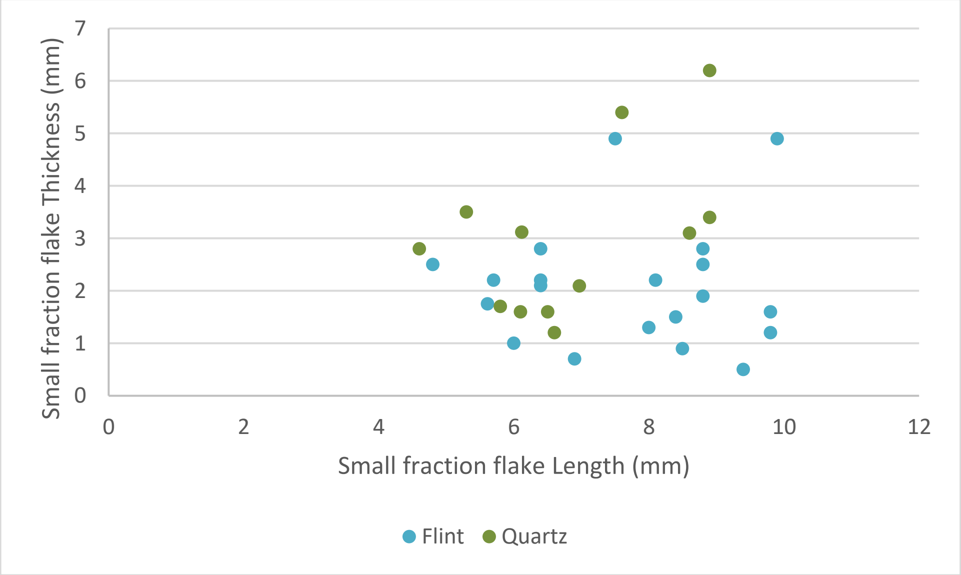


Figure 293. Northton 2010 Phase 4 small fraction flake dimensions length:thickness

Figure 294 demonstrates how the flint small fraction flakes from Phase 4 are much more densely clustered than the quartz small fraction flakes. There are four flint small fraction flakes that are outliers from this main group, which are thicker, thinner, or wider than the majority. The quartz small fraction flakes are more dispersed and follow a roughly linear correlation between width and thickness. Although the flint small fraction flakes have a wider maximum dimension than those of quartz, the quartz small fraction flakes are wider on average and with a higher standard deviation from the mean (Table 94).

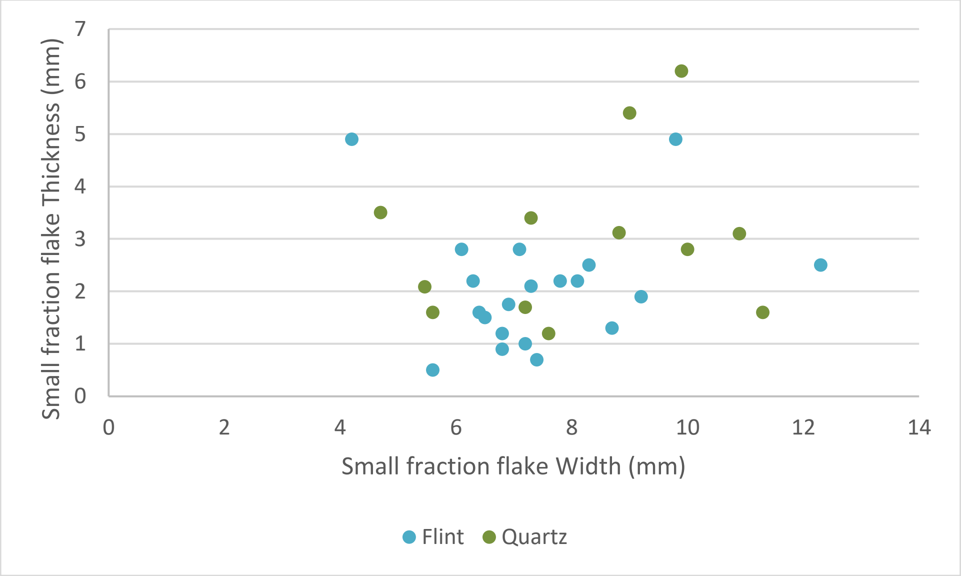


Figure 294. Northton 2010 Phase 4 small fraction flake dimensions width:thickness

11.1.1.2.3. Phases 3 and 4 Compared

The flint small fraction flakes from both phases are spread across the whole range of the length, although there are greater densities of flint small fraction flakes at the longer end of the spectrum from both phases (Figure 295). On average, the flint small fraction flakes from Phase 4 are very marginally longer than those from Phase 3, with the same standard deviation from the mean in both phases (Table 94). Phase 4 flint small fraction flakes occupy the narrower range of width than those from Phase 3, which has a greater number of small fraction flakes exceeding 10mm in this dimension. The Phase 3 flint small fraction flakes are on average much wider than those from Phase 4, with a greater maximum dimension and a higher standard deviation from the mean supporting the greater variation (Table 94).

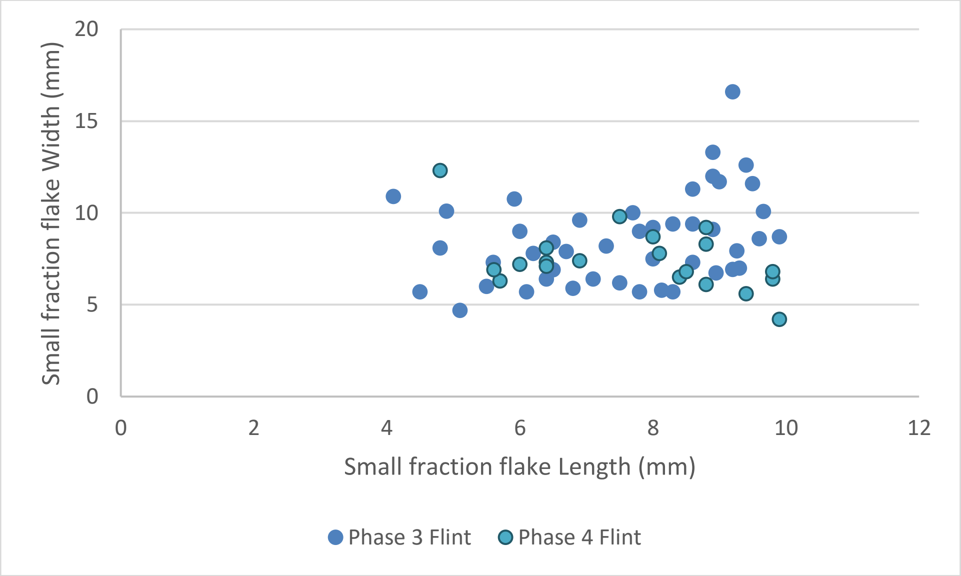


Figure 295. Northton 2010 comparison between Phase 3 and Phase 4 flint small fraction flake dimensions length:width

The majority of flint small fraction flakes from both phases fall below 3mm in thickness; however, a greater number from Phase 3 exceed this than those from Phase 4 (Figure 296). All of the flint small fraction flakes that are less than 7mm in length are also less than 3mm in thickness. Above this length, the flint small fraction flakes range much more widely in their thickness measurements. The Phase 3 flint small fraction flakes average marginally thicker than those from Phase 4, with a slightly higher maximum thickness recorded (Table 94).

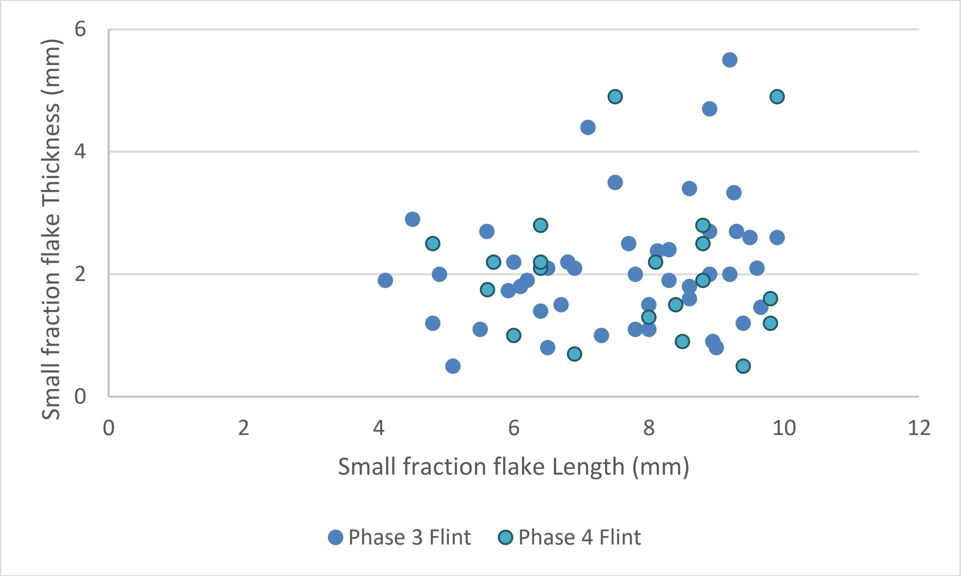


Figure 296. Northton 2010 comparison between Phase 3 and Phase 4 flint small fraction flake dimensions length:thickness

The densest concentration of flint small fraction flakes from both phases fall below 10mm in width and 3mm in thickness, as observed above (Figure 297). There are a larger number of flint small fraction flakes from Phase 3 that fall outside of this grouping than from Phase 4.

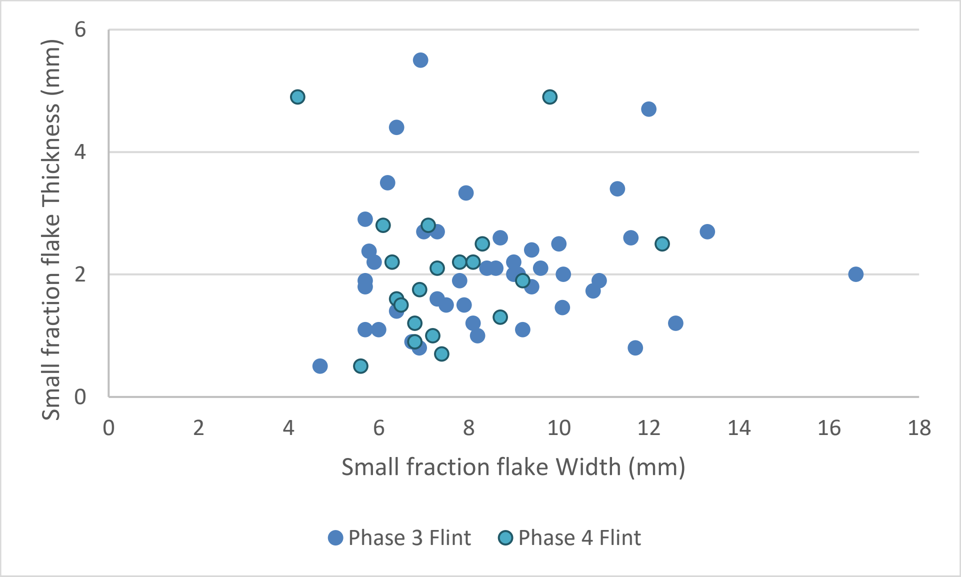


Figure 297. Northton 2010 comparison between Phase 3 and Phase 4 flint small fraction flake dimensions width:thickness

The quartz small fraction flakes from Phase 4 fall towards the shorter end of the length spectrum, whereas those from Phase 3 appear to be more evenly distributed between 4mm-10mm (Figure 298). This is reflected by the larger overall length of the Phase 3 quartz small fraction flakes (Table 94). There are a number of quartz small fraction flakes from Phase 3 that exceed 12mm in width in contrast to those from Phase 4, which all fall below this figure.

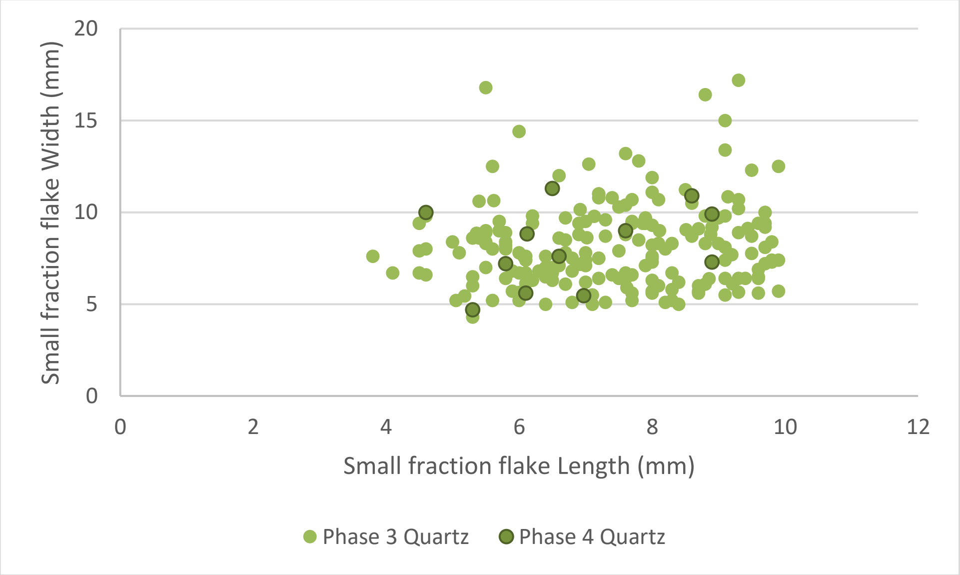


Figure 298. Northton 2010 comparison between Phase 3 and Phase 4 quartz small fraction flake dimensions length:width

Figure 299 displays the length and thickness dimensions for the total quartz small fraction flake assemblages from Phases 3 and 4. The outlier in Phase 3 evidently obscures any discernible patterns between the data. In Figure 300 the outlier has been removed.

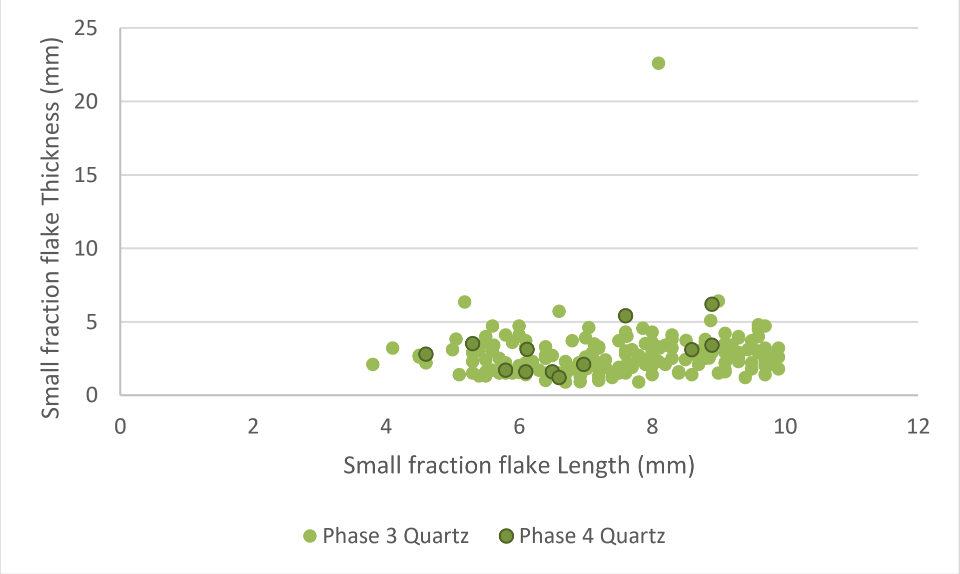


Figure 299. Northton 2010 comparison between Phase 3 and Phase 4 quartz small fraction flake dimensions length:thickness

Both Figure 300 and Figure 302 show that the majority of quartz small fraction flakes from each phase are less than 5mm in thickness and that the quartz small fraction flakes from Phase 4 cluster toward the shorter end of the spectrum. Figure 299 clearly shows the greater maximum and minimum dimensions for both length and thickness of the Phase 3 quartz small fraction flakes, in addition to the higher number from this phase that exceed 3.5mm in thickness. This contrasts to only two from Phase 4.

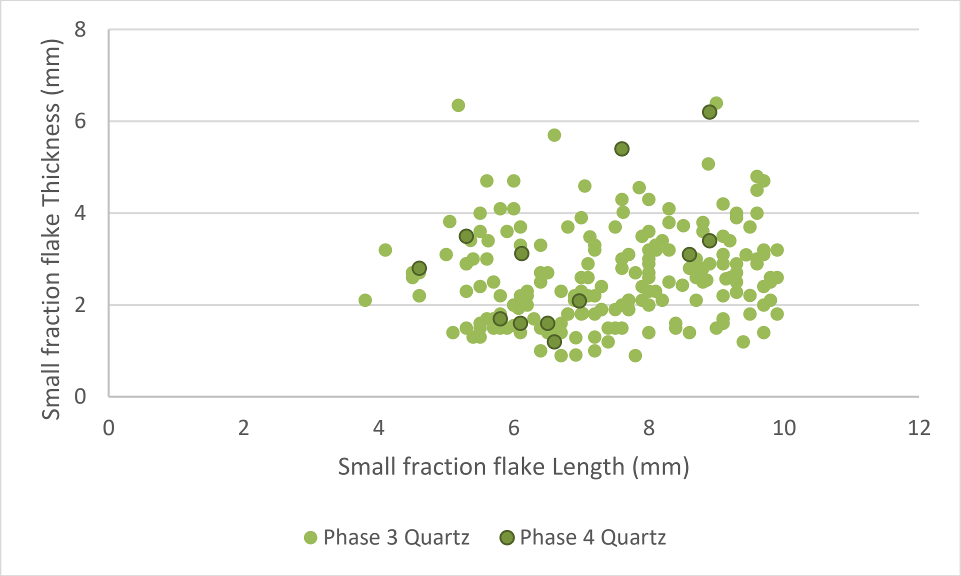


Figure 300. Northton 2010 comparison between Phase 3 and Phase 4 quartz small fraction flake dimensions length:thickness, excluding significant outlier

The cluster of points in both Figure 301 and Figure 302 emphasise how the majority of quartz small fraction flakes from both phases are less than 12mm in width and 4mm in thickness. Those from Phase 4 separate out into three different groups of thickness – c.1mm-2mm, c.2mm-3mm, and >5mm. However, there is little relationship between these increases in thickness and any increase in width. Beyond the main cluster of points the quartz small fraction flakes from Phase 3 are quite dispersed in terms of width and thickness, with greater maximum sizes in both dimensions than those in Phase 4. There is virtually no difference between the mean widths of the quartz small fraction flakes from both phases. Despite the presence of the outlier in the thickness measurements from Phase 3, the Phase 4 quartz small fraction flakes are thicker on average (Table 94).

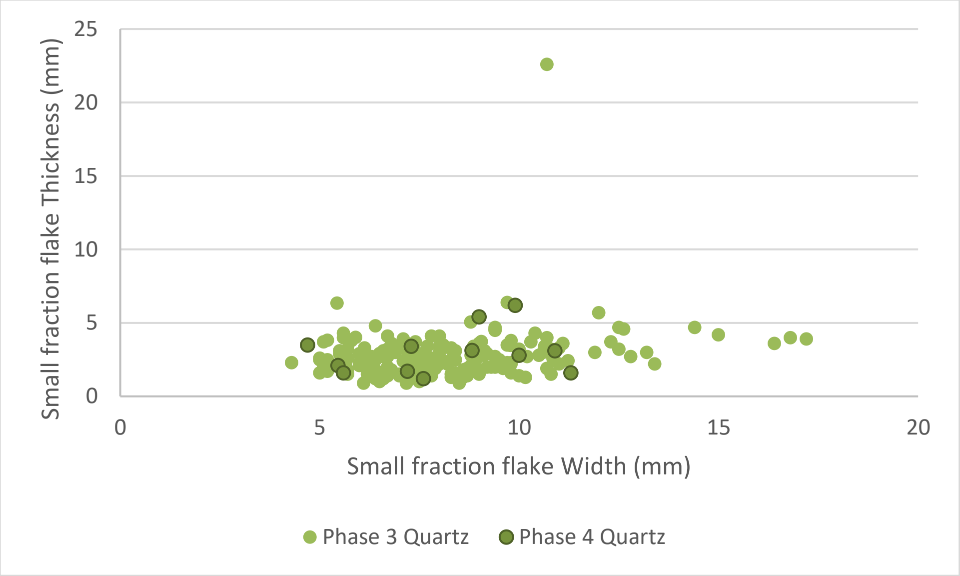


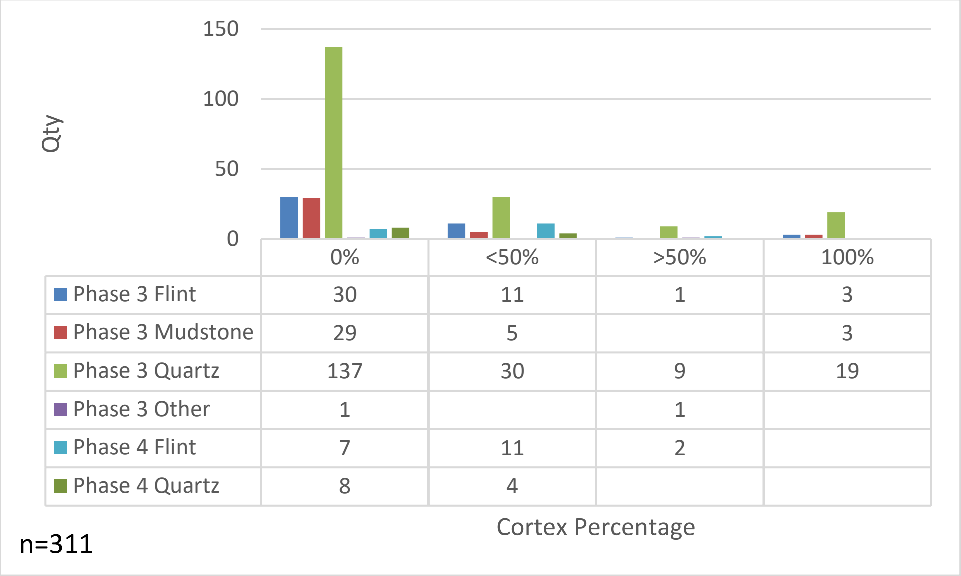
Figure 301. Northton 2010 comparison between Phase 3 and Phase 4 quartz small fraction flake dimensions width:thickness

Figure 302. Northton 2010 comparison between Phase 3 and Phase 4 quartz small fraction flake dimensions width:thickness, excluding significant outlier

11.1.1.3. Cortex

A small number of flint and mudstone small fraction flakes from Phase 3 retain 100% cortex; however no cortex is the most frequently represented category for both these raw materials. <50% cortex is the second most populated category for these raw materials in Phase 3, with a single flint small fraction flake displaying >50% cortex. The feldspar and igneous raw material small fraction flakes from this phase do not retain any cortex.

There are only two categories of cortex represented in the Phase 4 quartz small fraction flake assemblage - <50% and 0%, of which the latter is more frequently recorded (Figure 303). In the Phase 4 flint small fraction assemblage <50% cortex is most common, with only two flint small fraction flakes displaying >50% cortex. The remainder of the flint small fraction flakes from Phase 4 do not have any cortex present.

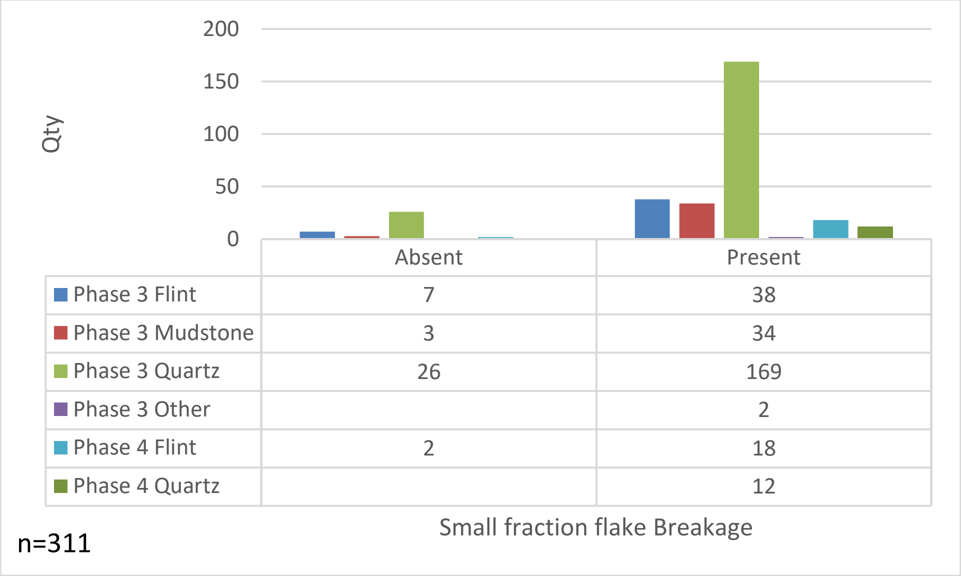


	0%	<50%	>50%	100%
🟦 Phase 3 Flint	30	11	1	3
🟥 Phase 3 Mudstone	29	5		3
🟩 Phase 3 Quartz	137	30	9	19
🟪 Phase 3 Other	1		1	
🟦 Phase 4 Flint	7	11	2	
🟩 Phase 4 Quartz	8	4		

Figure 303. Northton 2010 small fraction flake cortex percentage

11.1.1.4. Breakage

There is a higher presence of breakage in all of the raw materials in both phases (Figure 304).



	Absent	Present
🟦 Phase 3 Flint	7	38
🟥 Phase 3 Mudstone	3	34
🟩 Phase 3 Quartz	26	169
🟪 Phase 3 Other		2
🟦 Phase 4 Flint	2	18
🟩 Phase 4 Quartz		12

Figure 304. Northton 2010 small fraction flake breakage

11.1.2. Chunks and Small Fraction Chunks

Nineteen chunks and 26 small fraction chunks were recovered from Northton 2010, with 16 chunks and 18 small fraction chunks deriving from Phase 3. The remaining three chunks and eight small fraction chunks were recovered from Phase 4. As with the small fraction flakes, the results from the chunk and small fraction chunks analysis are presented on a phase-by-phase basis with a concluding comparison between the phases at the end of each section.

11.1.2.1. Raw Material

The raw material of the chunk assemblage at Northton is mostly comprised of quartz (Figure 305). Less than a quarter of the chunks are flint, and the remainder is composed of small quantities of mudstone and two feldspar chunks.

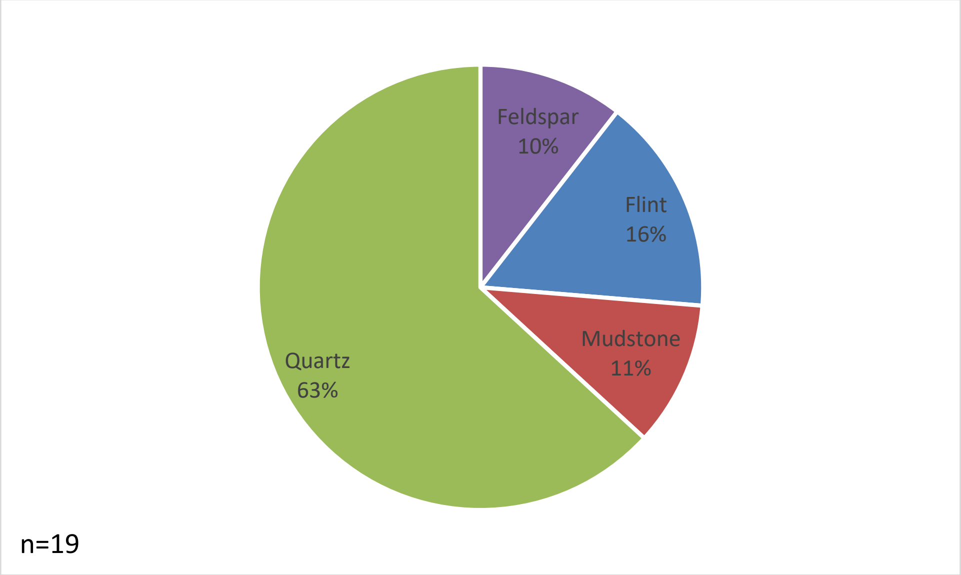


Figure 305. Northton 2010 total chunk raw material

The small fraction chunk assemblage is also dominated by quartz, in similar proportions to that of the chunk assemblage (Figure 306). Comparably with the chunk assemblage, flint also comprises less than a quarter of the small fraction chunks. Mudstone is the only other raw material represented in the small fraction chunk assemblage.

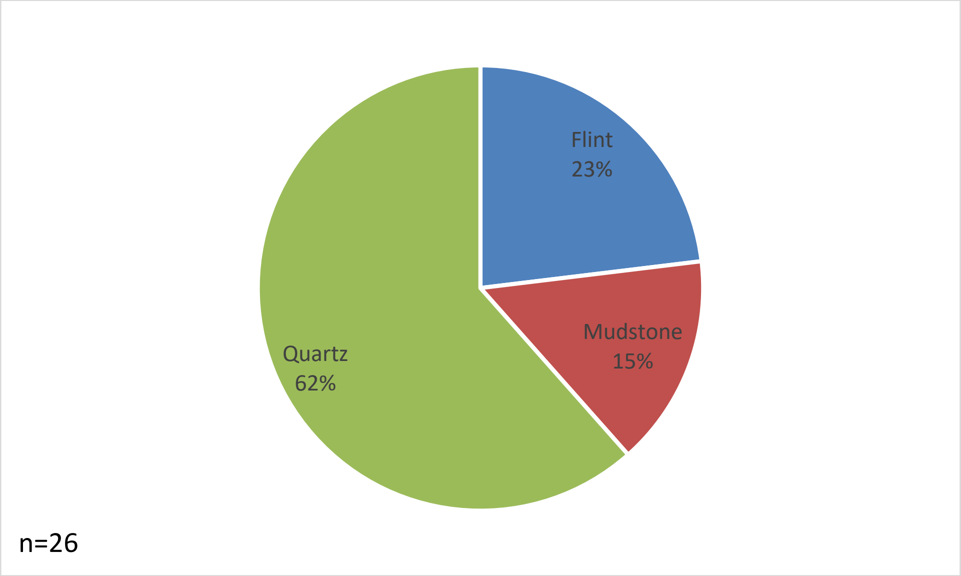


Figure 306. Northton 2010 total small fraction chunk raw material

In Phase 3, quartz represents over two thirds of the chunk raw material, with an equal number of feldspar and mudstone pieces present (Figure 307). A single chunk of flint makes up the remainder of the chunk assemblage from this phase.

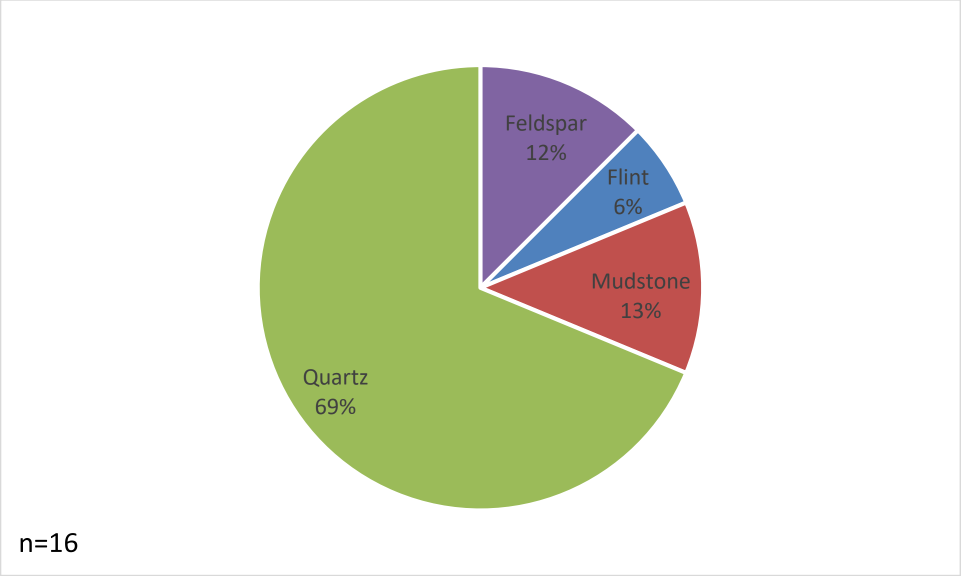


Figure 307. Northton 2010 Phase 3 chunk raw material

The small fraction chunk assemblage in Phase 3 is also dominated by quartz and mudstone accounts for a higher proportion of small fraction chunks in this phase than flint (Figure 308).

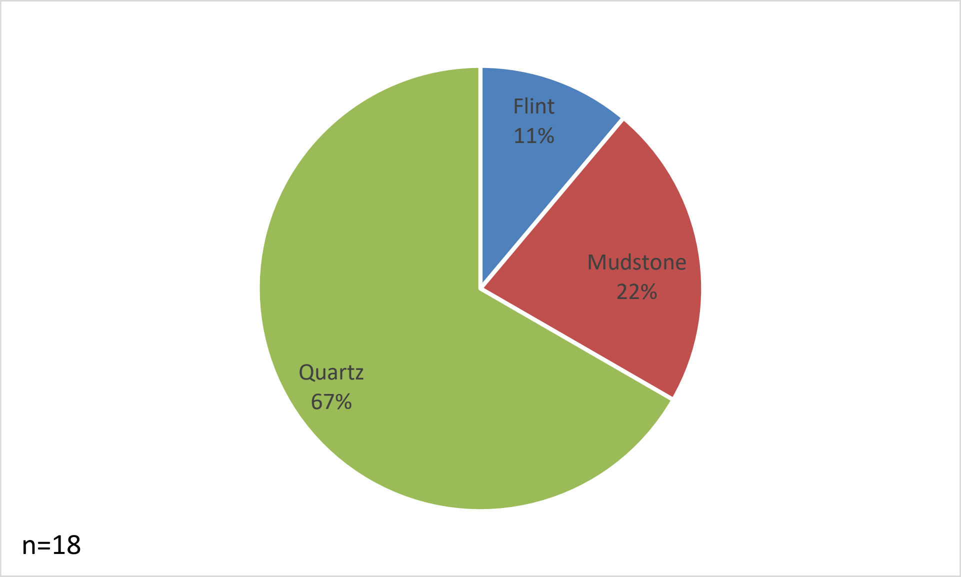
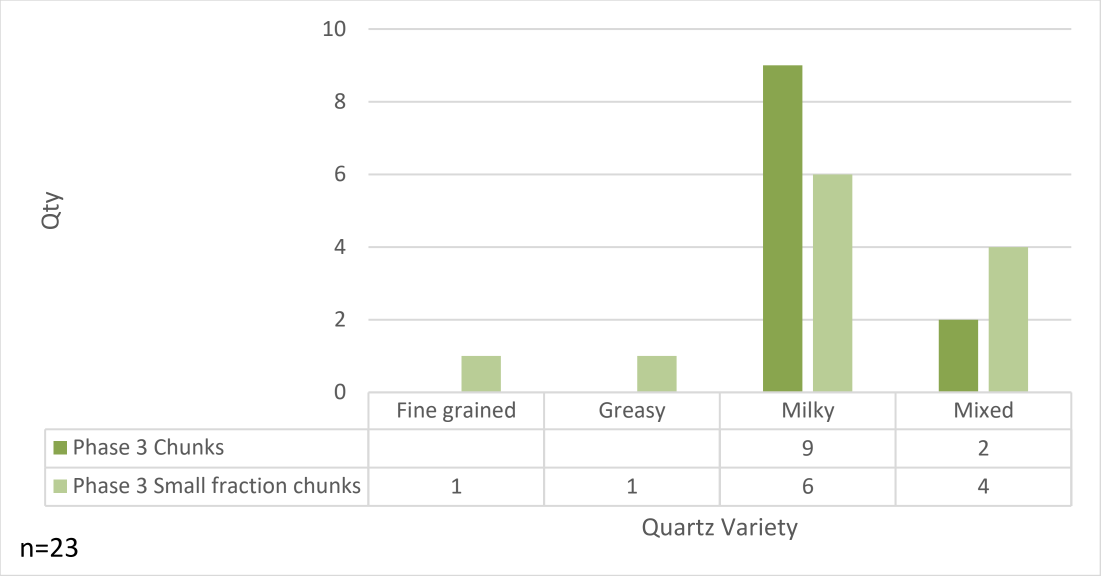


Figure 308. Northton 2010 Phase 3 small fraction chunk raw material

There is a very small number of quartz varieties present in the chunk assemblage from Phase 3 (Figure 309). The majority are milky, and the two mixed quartz chunks grade from greasy to fine grained quartz. A slightly wider variety of quartz is represented by the small fraction chunks. Single small fraction chunks were identified in fine grained and greasy quartz, with the majority also comprised of milky quartz. The mixed varieties grade between greasy to fine grained, fine grained to milky, and milky to rock crystal.



	Fine grained	Greasy	Milky	Mixed
🟩 Phase 3 Chunks			9	2
🟩 Phase 3 Small fraction chunks	1	1	6	4

Figure 309. Northton 2010 Phase 3 chunk quartz varieties

Two of the three chunks present in Phase 4 are flint (Figure 310). The other chunk is a single piece mixed between coarse grained quartz and quartzite (Figure 312), which contrasts to Phase 3.

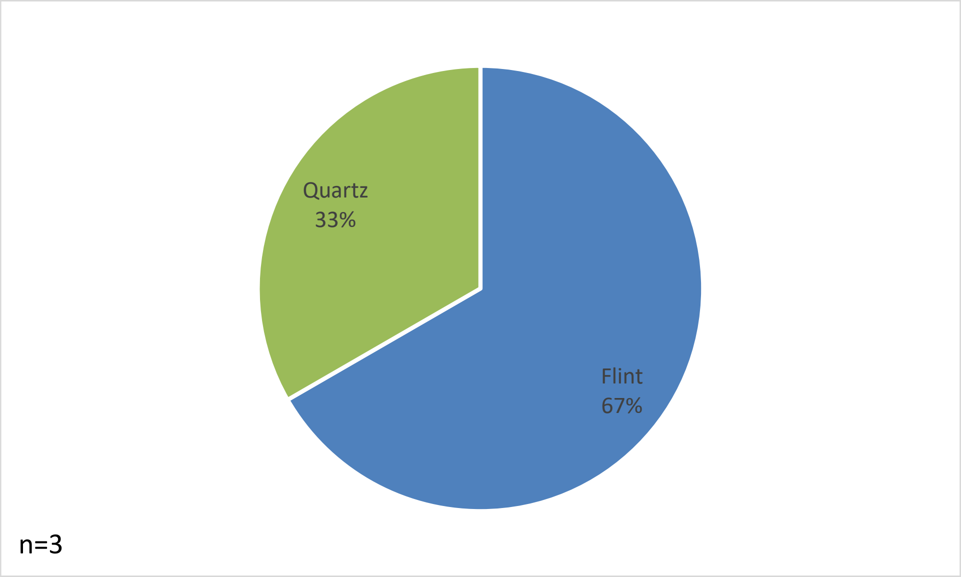


Figure 310. Northton 2010 Phase 4 chunk raw material

In the Phase 4 small fraction chunk assemblage flint and quartz are equally represented (Figure 310). Three of the quartz pieces are milky quartz and the other is a mix between milky quartz and rock crystal (Figure 312).

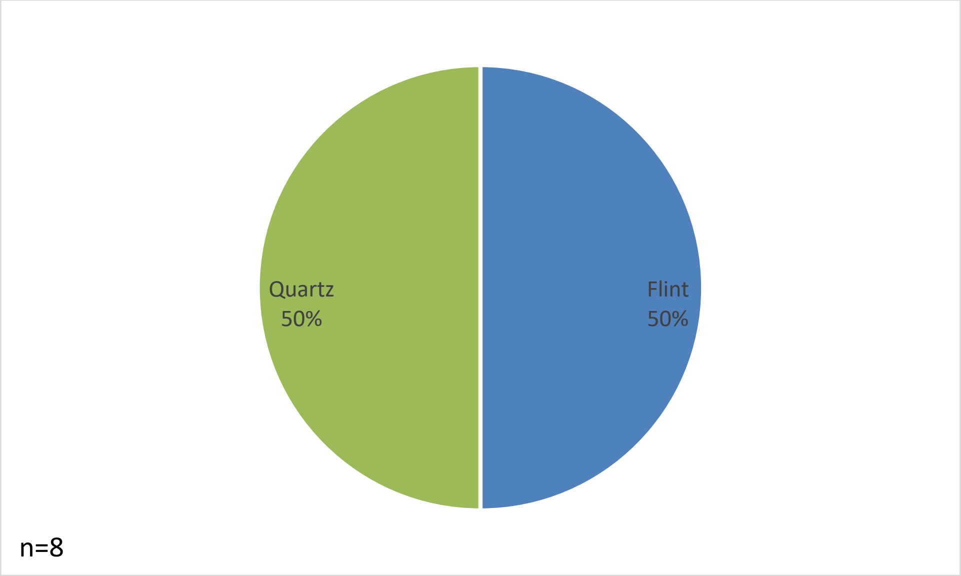


Figure 311. Northton 2010 Phase 4 small fraction chunk raw material

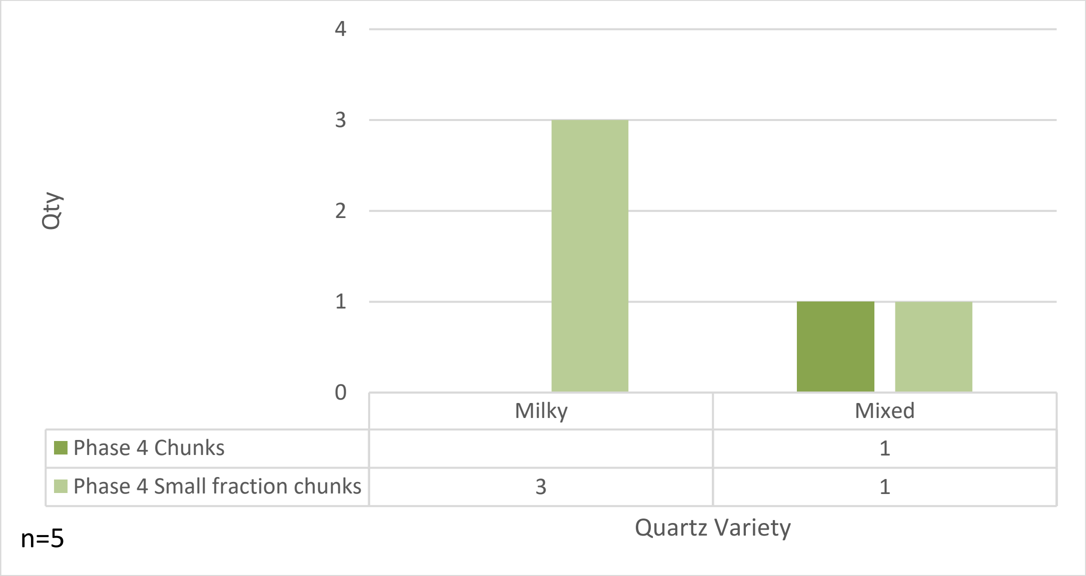


Figure 312. Northton 2010 Phase 4 chunk quartz varieties

11.1.2.2. Chunk Dimensions

11.1.2.2.1. Phase 3

There is a large range in the chunk dimensions from Phase 3, both within and between the raw materials. There are two groups of quartz chunks. In the smallest, the pieces do not exceed 16mm in length, and in the second all are in excess of 25mm in length. None of the quartz chunks are more than 20mm in width, in contrast to the other raw materials. Both flint and mudstone have pieces that are very large – exceeding 20mm in width (Figure 313). The flint chunk is almost 20mm in length, and the baked mudstone piece is almost 30mm in length. There are two much smaller pieces in each of these raw materials, which fall in with the smaller grouping of quartz chunks, as does the feldspar chunk.

The small fraction chunks in this phase are clearly constrained by the typological and recovery methodologies employed, as described previously. With the exception of a single quartz piece, none of the small fraction chunks exceed 10mm in width.

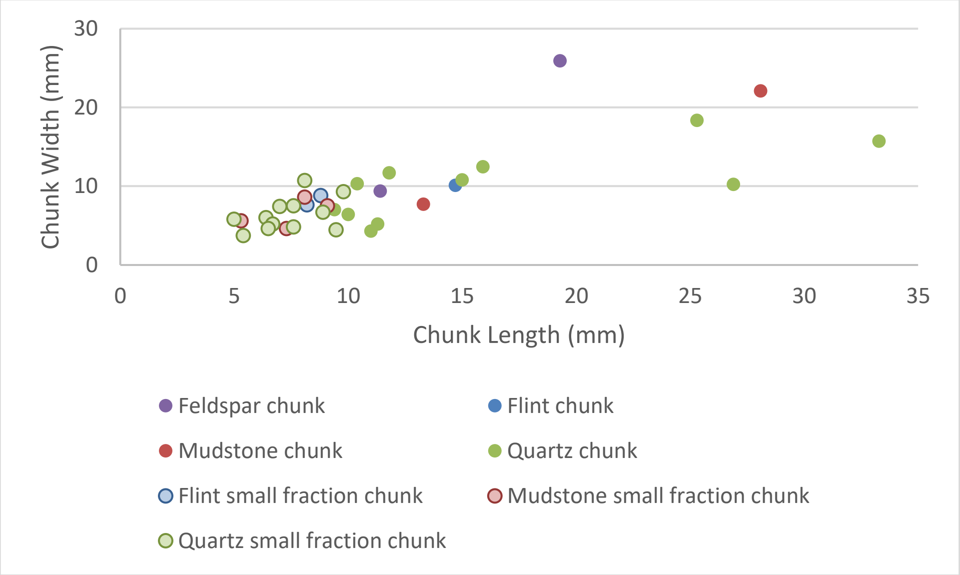


Figure 313. Northton 2010 Phase 3 chunk and small fraction chunk dimensions length:width

A similar pattern to the width is observed in the chunk thickness from Phase 3 (Figure 314). The two groups of quartz chunks are still clearly divided by length, and only a single piece from each group exceeds 10mm in thickness. The large and smaller chunks of mudstone and flint are also still separate in terms of width and thickness – each separated by over 5mm in the latter dimension. The feldspar chunk remains within the main cluster of smaller quartz, mudstone and flint chunks.

There are only two small fraction chunks that exceed 5mm in thickness – one mudstone and one quartz.

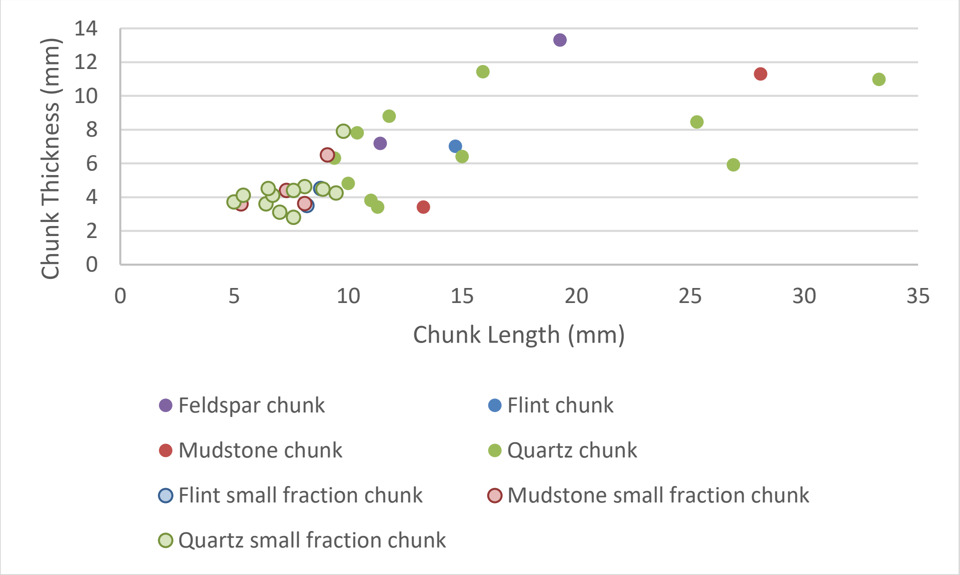


Figure 314. Northton 2010 Phase 3 chunk and small fraction chunk dimensions length:thickness

The largest grouping of both chunks and small fraction chunks from Phase 3 fall between c.3mm-11mm in width, and by thickness between c.3mm-8mm (Figure 315). The quartz chunks have the greatest range in width, as evidenced by a strong overlap with the small fraction chunks at the narrower end of the scale, and also the wider pieces which extend outside of the main cluster. The two large mudstone and flint chunks are also significant outliers in these dimensions, whereas the smaller pieces in these raw materials again fall within the main group.

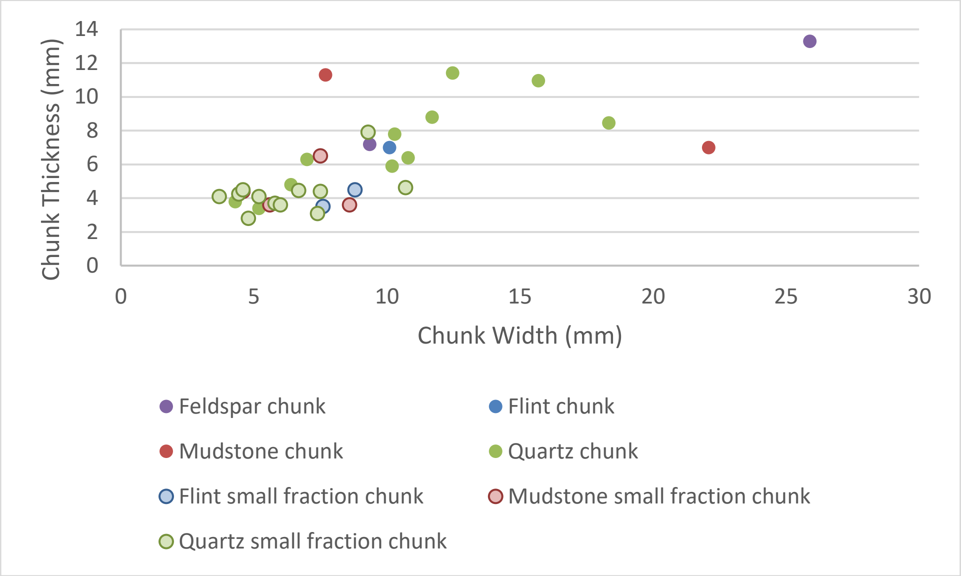


Figure 315. Northton 2010 Phase 3 chunk and small fraction chunk dimensions width:thickness

11.1.2.2.2. Phase 4

In Phase 4 the quartz chunk is longer than the flint chunks (Figure 316). One flint chunk is quite narrow in comparison with the other. The flint small fraction chunks have a greater range of width than the quartz small fraction chunks, with both greater extremes of widths displayed. Only a single flint chunk marginally exceeds 10mm in width.

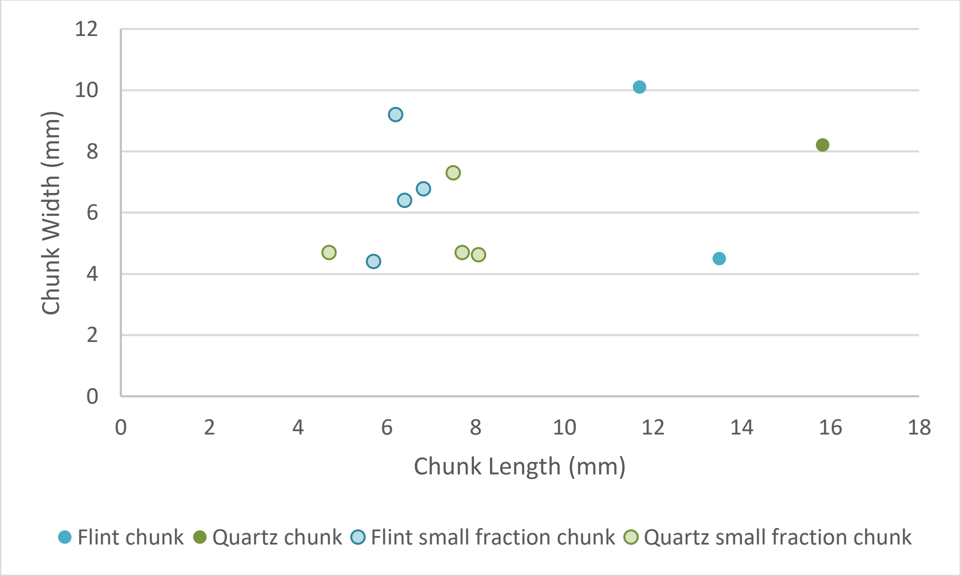


Figure 316. Northton 2010 Phase 4 chunk and small fraction chunk dimensions length:width

The quartz chunk from Phase 4 is significantly thicker than both of the flint chunks, and is the only piece from this Phase to exceed 8mm in thickness (Figure 317). The flint small fraction chunks display an even wider range in thickness when compared to the quartz small fraction chunks, than they did terms of length.

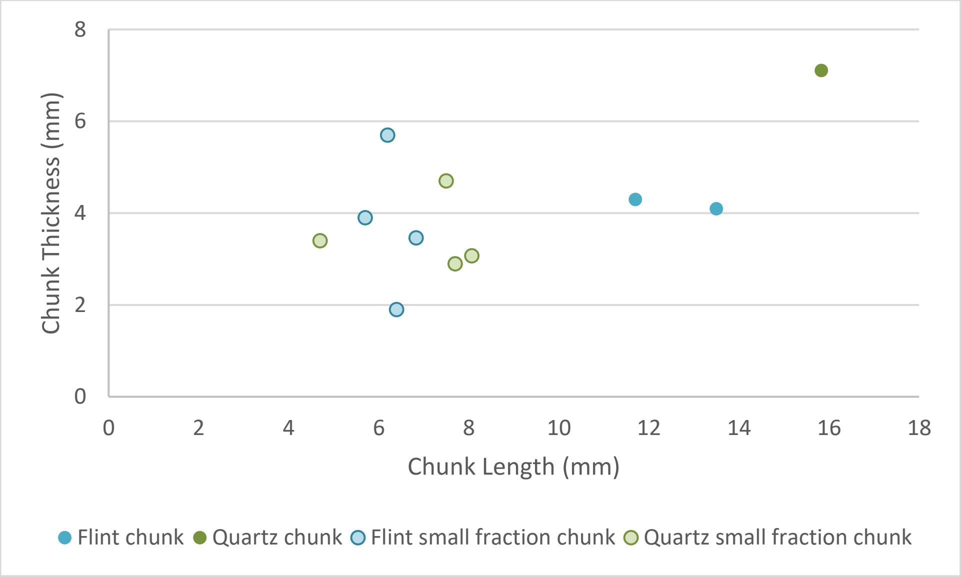


Figure 317. Northton 2010 Phase 4 chunk and small fraction chunk dimensions length:thickness

The flint chunks from Phase 4 are very comparable in terms of width and thickness to both the flint and quartz small fraction chunks. The quartz chunk is also similar in width to these pieces but is much thicker than either of the flint and quartz small fraction chunks, or the flint chunk (Figure 318).

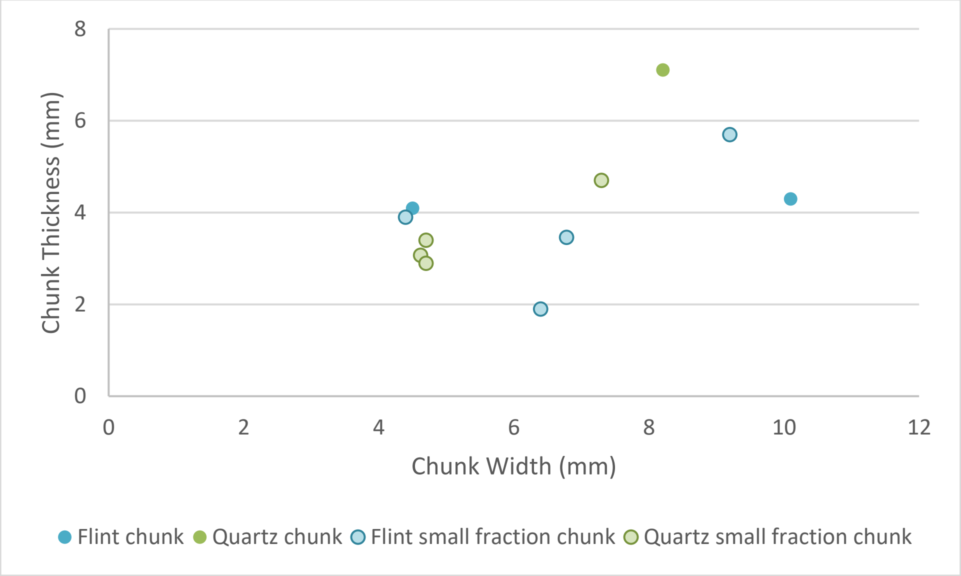


Figure 318. Northton 2010 Phase 4 chunk and small fraction chunk dimensions width:thickness

11.1.2.2.3. Flint and Quartz Chunks from Phase 3 and 4 Compared

The Phase 4 chunks in both raw materials cluster very closely in terms of length and width with the flint chunk and the majority of the quartz chunks from Phase 3 (Figure 319). The outliers are three quartz chunks from the Phase 3 which are longer.

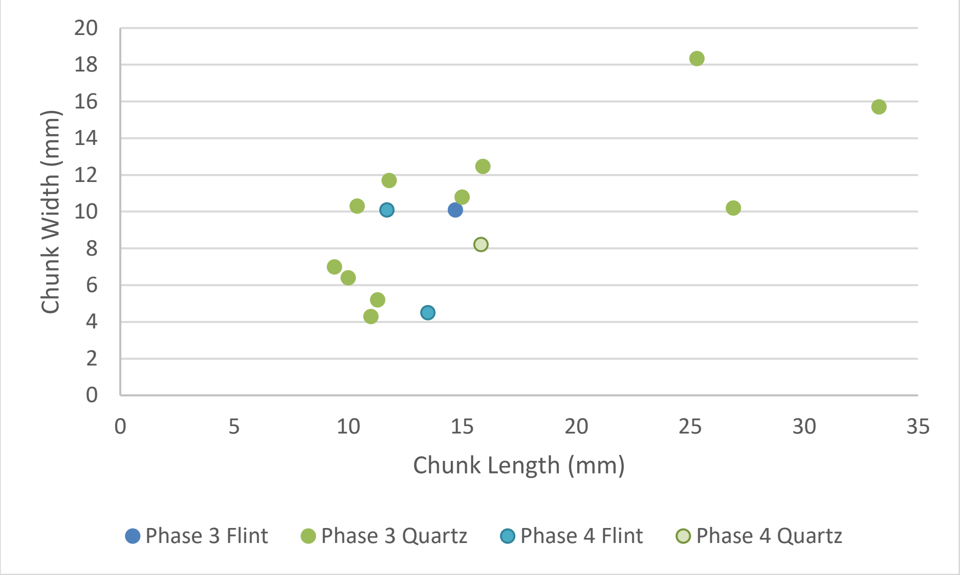


Figure 319. Northton 2010 Phase 3 and 4 chunk dimensions length:width

The Phase 4 flint chunks are much thinner than the flint chunk from Phase 3, although there is little difference in their length (Figure 320). The quartz chunk from Phase 4 falls in the middle of the range of Phase 3 quartz chunks in terms of thickness.

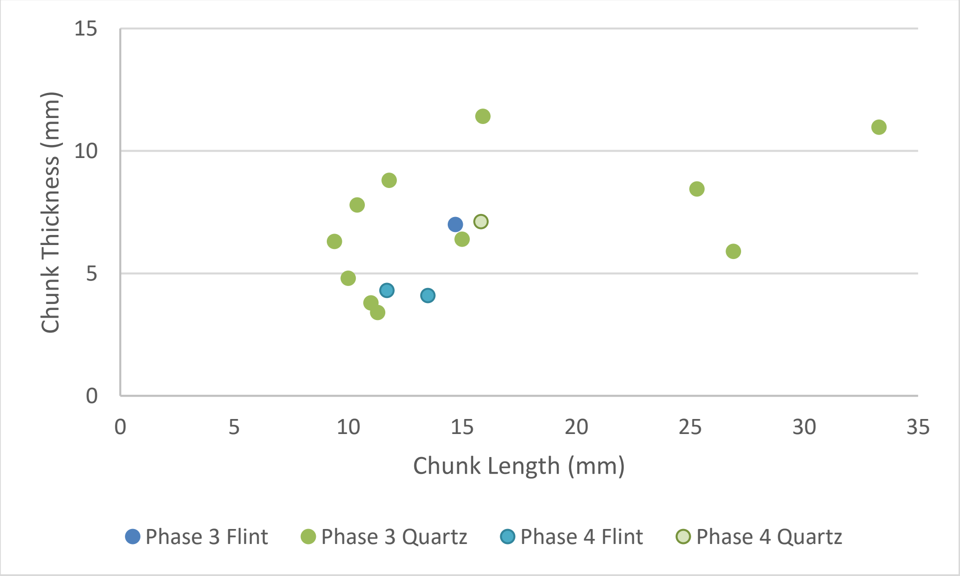


Figure 320. Northton 2010 Phase 3 and 4 chunk dimensions length:thickness

The flint chunks from Phase 4 fall at the smallest end of the scale in terms of width and thickness, whereas the one from Phase 3 occupies the middle range (Figure 321). There is a clear positive correlation between the width and thickness of the quartz chunks from Phase 3; the quartz chunk from Phase 4 falls in the centre of this.

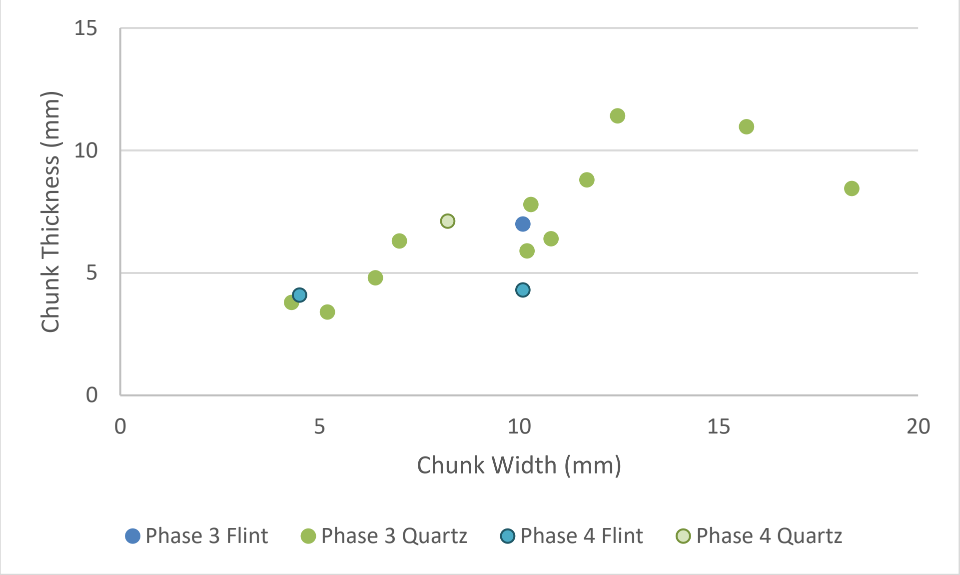


Figure 321. Northton 2010 Phase 3 and 4 chunk dimensions width:thickness

The flint small fraction chunks from Phase 3 are slightly longer than those from Phase 4, with a very narrow range in width; the Phase 4 flint small fraction chunks range very widely in width but less so in length (Figure 322). The majority of Phase 3 quartz small fraction chunks group quite closely in both dimensions with the quartz small fraction chunks from Phase 4, although there are some quartz small fraction chunks from Phase 3 which extend slightly longer and wider than those from Phase 4. On the whole the entire small fraction chunk assemblage ranges by less than 8mm in width.

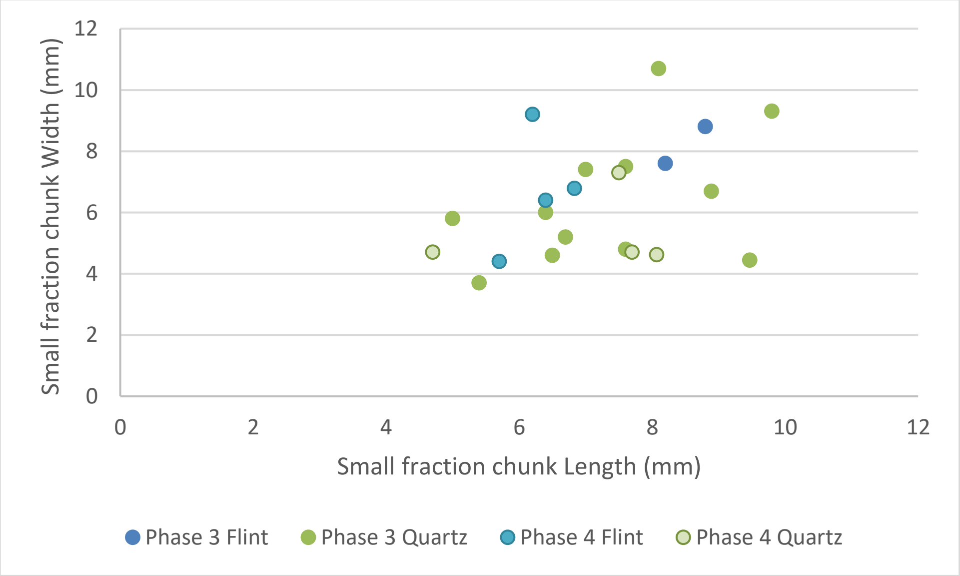


Figure 322. Northton 2010 Phase 3 and 4 small fraction chunk dimensions length:width

The range of thickness from the small fraction chunk assemblage is even less than that of the width. The vast majority of small fraction chunks in both raw materials, and from both phases, are clustered between 3mm-4mm; almost all points fall between 2mm-6mm and only a single quartz small fraction chunk from Phase 3 extends beyond this (Figure 323). In flint the Phase 4 small fraction chunks are most widely spread in terms of thickness.

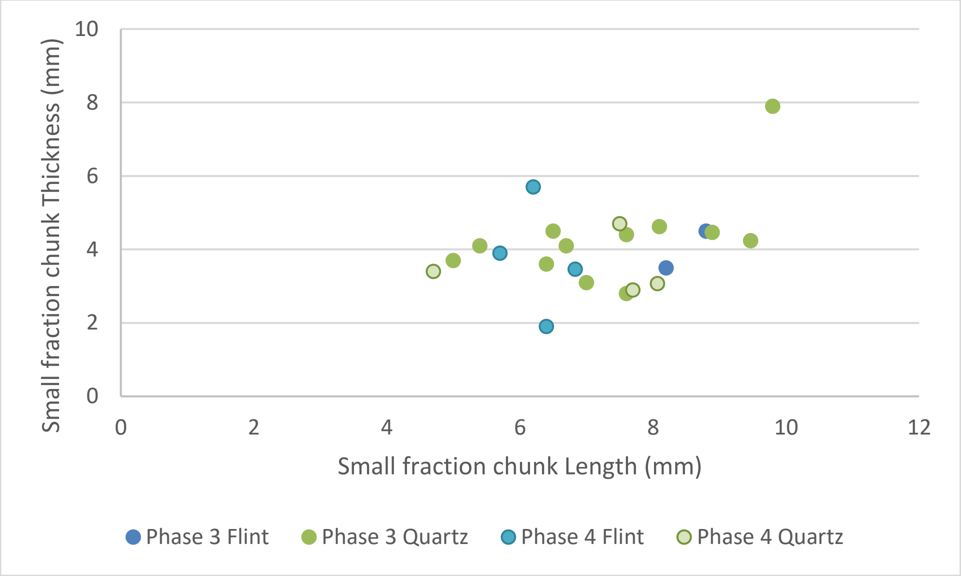


Figure 323. Northton 2010 Phase 3 and 4 small fraction chunk dimensions length:thickness

The low variation in width and thickness observed above is emphasised in Figure 324. With few exceptions, the small fraction chunks deviate very little in terms of thickness irrespective of width, raw material or phase.

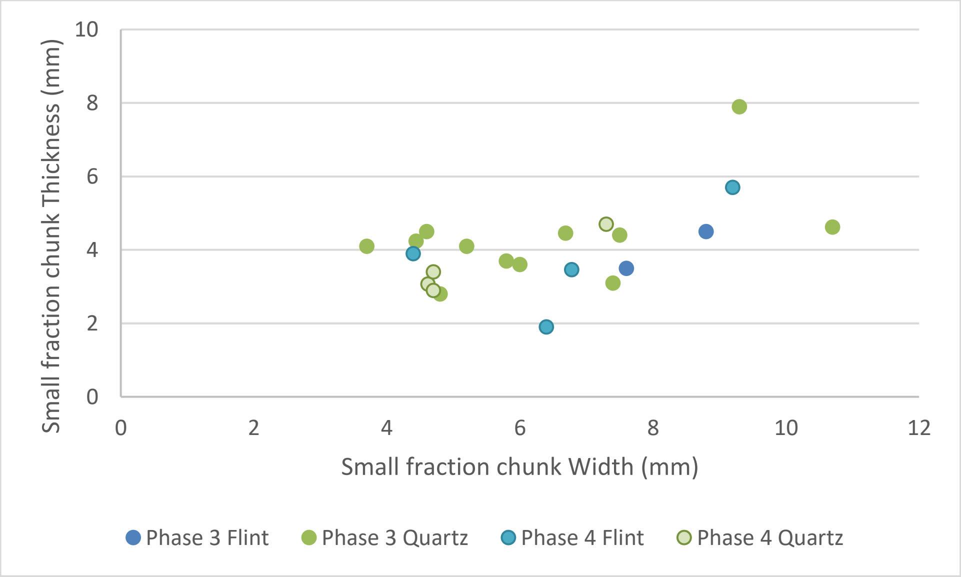
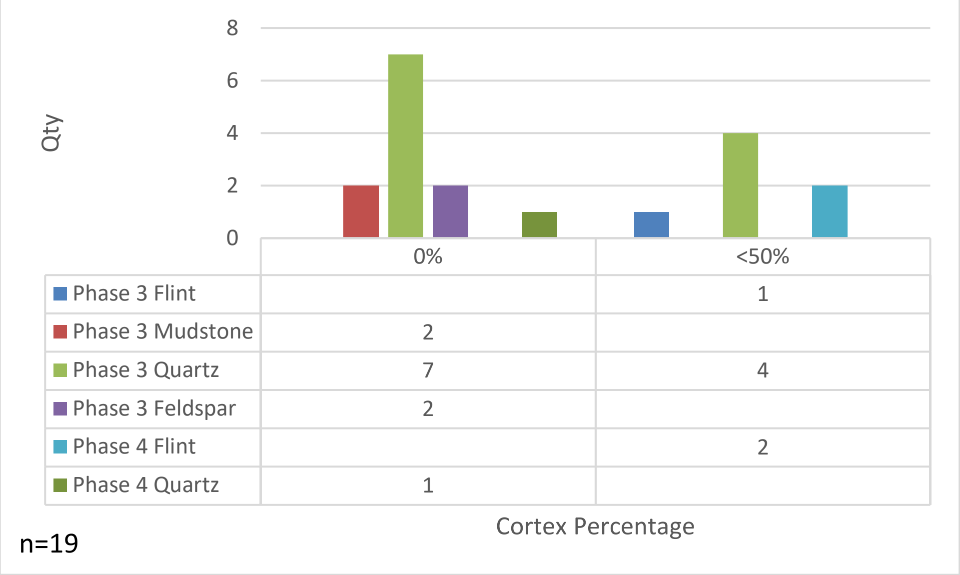


Figure 324. Northton 2010 Phase 3 and 4 small fraction chunk dimensions width:thickness

11.1.2.3. Cortex

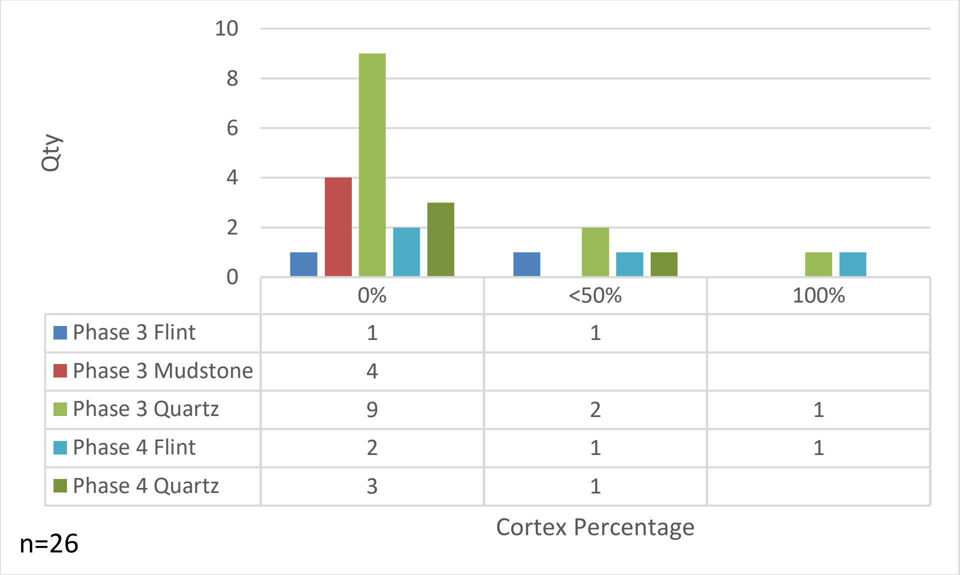
There is very little cortex present on any of the chunks from Northton. The flint chunk from Phase 3 and both flint chunks from Phase 4 retain <50% cortex, as do just over half of the quartz chunks from Phase 3 (Figure 325). The remainder of the chunk assemblage does not retain any cortex at all.



	0%	<50%
🟦 Phase 3 Flint		1
🟥 Phase 3 Mudstone	2	
🟩 Phase 3 Quartz	7	4
🟪 Phase 3 Feldspar	2	
🟦 Phase 4 Flint		2
🟩 Phase 4 Quartz	1	

Figure 325. Northton 2010 Phase 3 and 4 chunk cortex percentage

Only two small fraction chunks, one of quartz from Phase 3 and one of flint from Phase 4, display 100% cortex (Figure 326). A small number of flint and quartz small fraction chunks from both phases retain <50% cortex, and de-corticated small fraction chunks are the most common in all raw materials from both phases.



	0%	<50%	100%
🟦 Phase 3 Flint	1	1	
🟥 Phase 3 Mudstone	4		
🟩 Phase 3 Quartz	9	2	1
🟦 Phase 4 Flint	2	1	1
🟩 Phase 4 Quartz	3	1	

Figure 326. Northton 2010 Phase 3 and 4 small fraction chunk cortex percentage

11.1.2.4. Breakage

The only chunks not to display any evidence for breakage are a single mudstone chunk and two quartz chunks, both from Phase 3 (Figure 327). The remainder of the chunks in these raw materials from Phase 3 exhibit breakage, as do the flint and feldspar chunks in this phase. All of the flint and quartz chunks in Phase 4 are also broken.

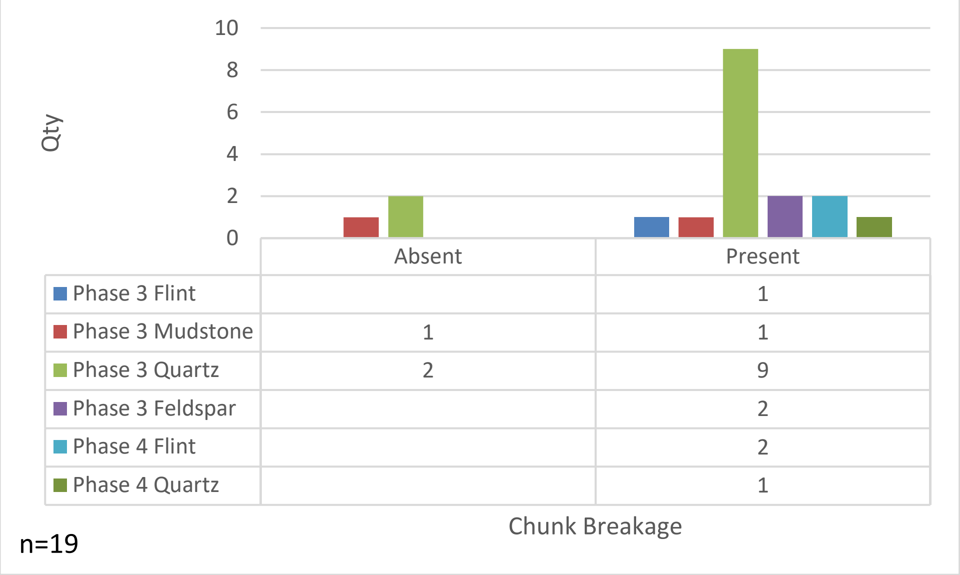


Figure 327. Northton 2010 Phase 3 and 4 chunk breakage

Almost all of the small fraction chunks from both phases, in each of the raw materials, show evidence of breakage. The only exception is a single mudstone small fraction chunk from Phase 3 (Figure 328).

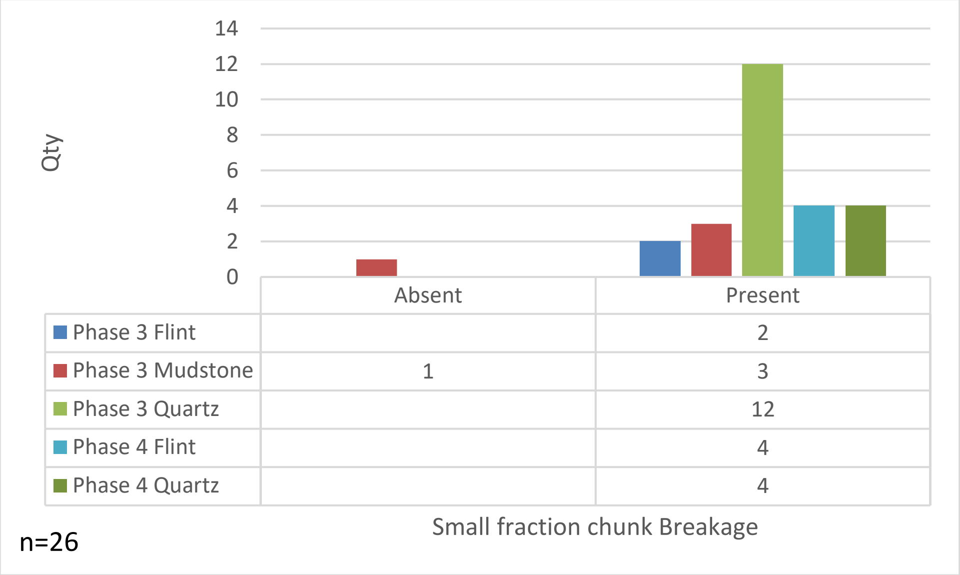


Figure 328. Northton 2010 Phase 3 and 4 small fraction chunk breakage

11.2. Northton 2011

11.2.1. Small Fraction Flakes

There are nine small fraction flakes (<10mm) in the assemblage from Northton 2011. These derive from both Phase 3 (C009) and from Phase 4 (C016/017; C018).

11.2.1.1. Raw Material

Flint and quartz are the only raw materials present in the small fraction flake assemblage from Northton 2011. In both phases, single small fraction flakes are flint, and the majority are quartz (Figure 329).

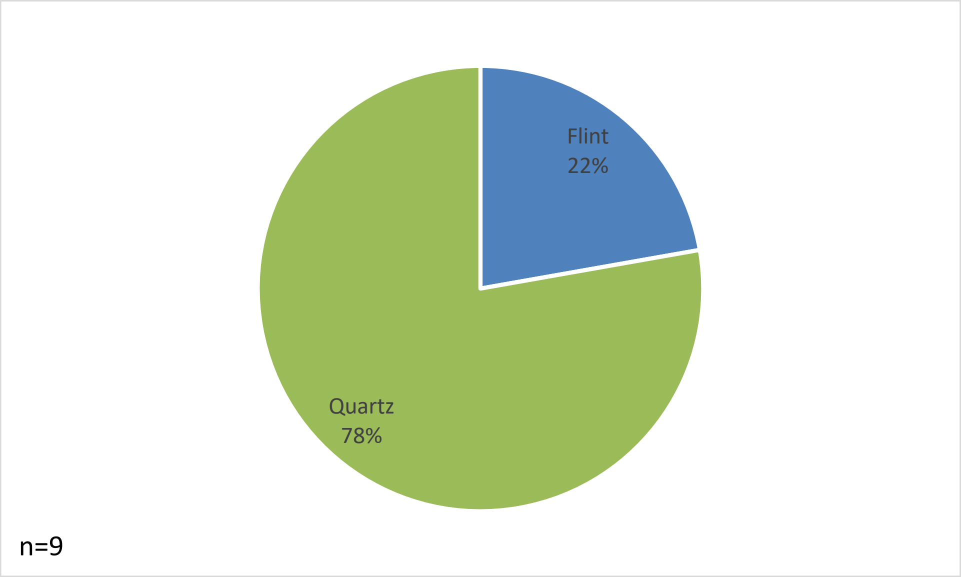


Figure 329. Northton 2011 total small fraction flake assemblage raw material composition

Half of the small fraction flakes in Phase 3 are mixed milky to fine grained quartz. One is simply milky quartz, and another is coarse grained (Figure 330). In Phase 4 the small fraction flakes are singly quartzite, fine grained, and rock crystal quartz varieties.

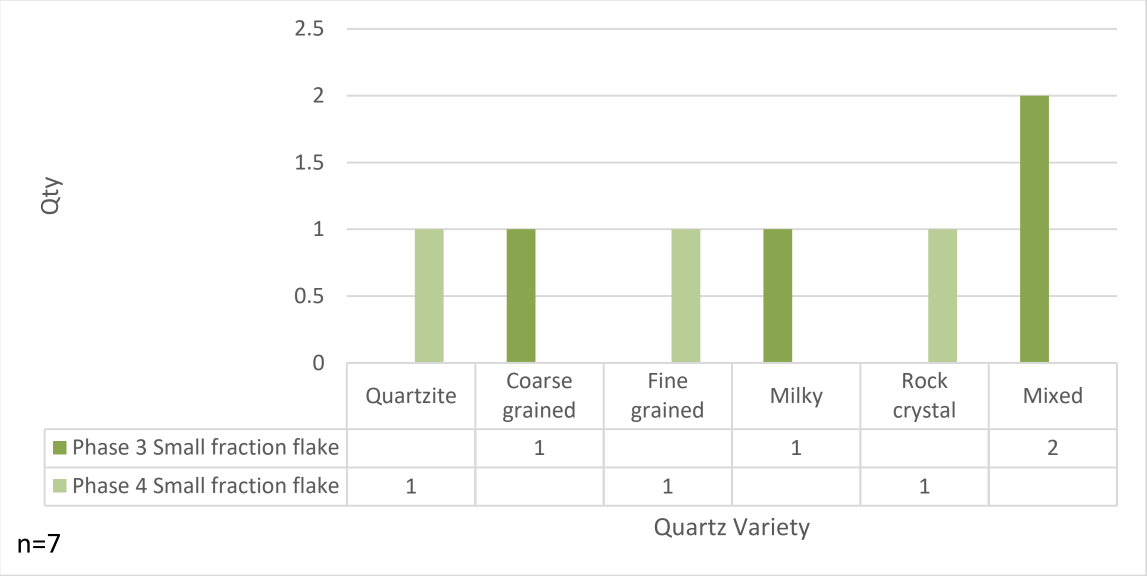


Figure 330 Northton 2011 Phase 3 and 4 small fraction flake quartz varieties

11.2.1.2. Small Fraction Flake Dimensions

The Phase 4 small fraction flakes are all on average shorter than those from Phase 3. In length, there is a wider range between the maximum and minimum dimensions in Phase 4, leading to a higher standard deviation value than in Phase 3, whereas in the other dimensions the range is narrower and consequently the standard deviation is less (Table 95).

Raw Material		**Length (mm)**		**Width (mm)**		**Thickness (mm)**	
		Phase 3	**Phase 4**	**Phase 3**	**Phase 4**	**Phase 3**	**Phase 4**
Quartz small fraction flake	**Min**	6.54	5.59	5.65	7.59	2.25	1.68
	Max	7.77	8.3	16.80	8.66	3.97	2.55
	Mean	7.12	6.99	10.15	8.02	2.71	2.00
	SD	0.504273	1.356921	4.923051	0.565066	0.838983	0.478435

Table 95. Northton 2011 small fraction flake dimension summary statistics

The flint small fraction flakes from both phases fall at the shorter end of the spectrum, with the Phase 3 flint small fraction flake much smaller than the one from Phase 4 (Figure 331). Both fall significantly short of the average values for the quartz small fraction flakes from each phase, despite appearing to be similar in length. There is a very gradual increase between the length and width of the quartz small fraction flakes from Phase 4, which contrasts to those from Phase 3, where the correlation is very strong. One quartz small fraction flake from Phase 3 is much wider than the rest of the assemblage, although it is not much longer.

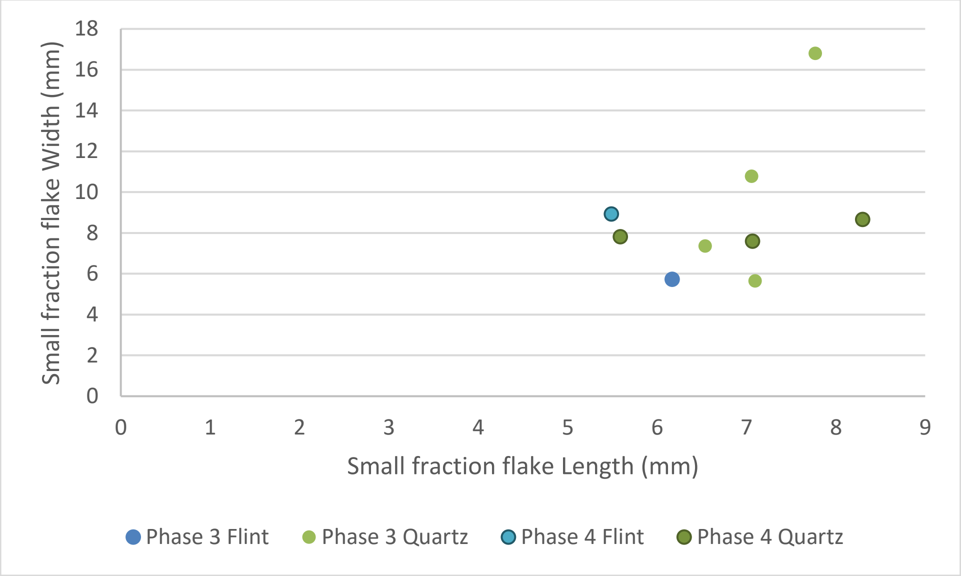


Figure 331. Northton 2011 small fraction flake dimensions length:width

There is also a strong, positive trend between the increase in length and thickness of the quartz small fraction flakes from Phase 3, whereas this is negligible in the same raw material from Phase 4 (Figure 332). The flint small fraction flakes are similar in thickness to those of quartz from their respective phases.

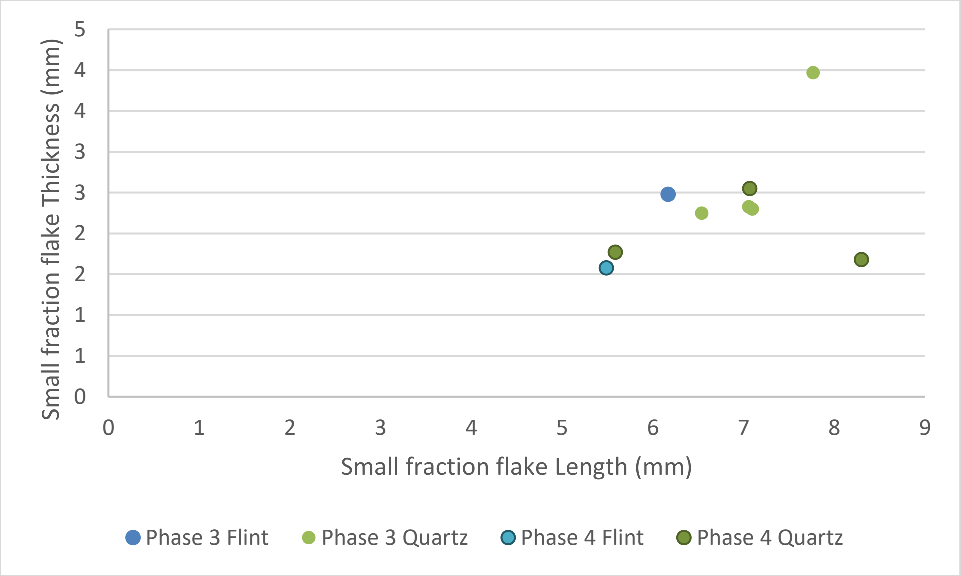


Figure 332. Northton 2011 small fraction flake dimensions length:thickness

The single quartz small fraction flake from Phase 3 that is much wider than the remainder of the assemblage, is also significantly thicker (Figure 333). A negative trend between the width and thickness of the Phase 4 quartz small fraction flakes is observed; there is no correlation between these dimensions for the Phase 3 quartz small fraction flakes, once the outlier is excluded. The Phase 4 flint small fraction flake is wider and thinner than the quartz from this phase, whereas the opposite occurs in Phase 3.

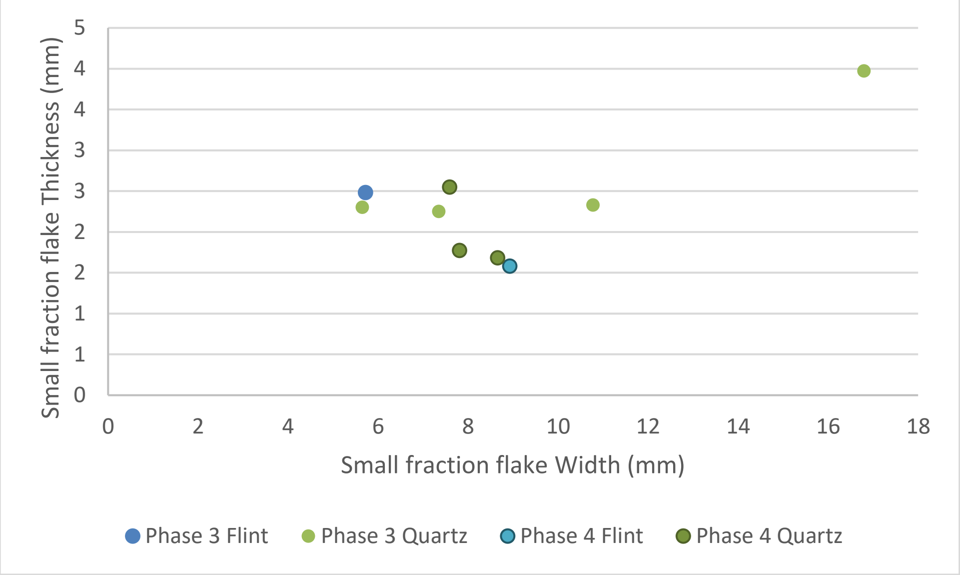
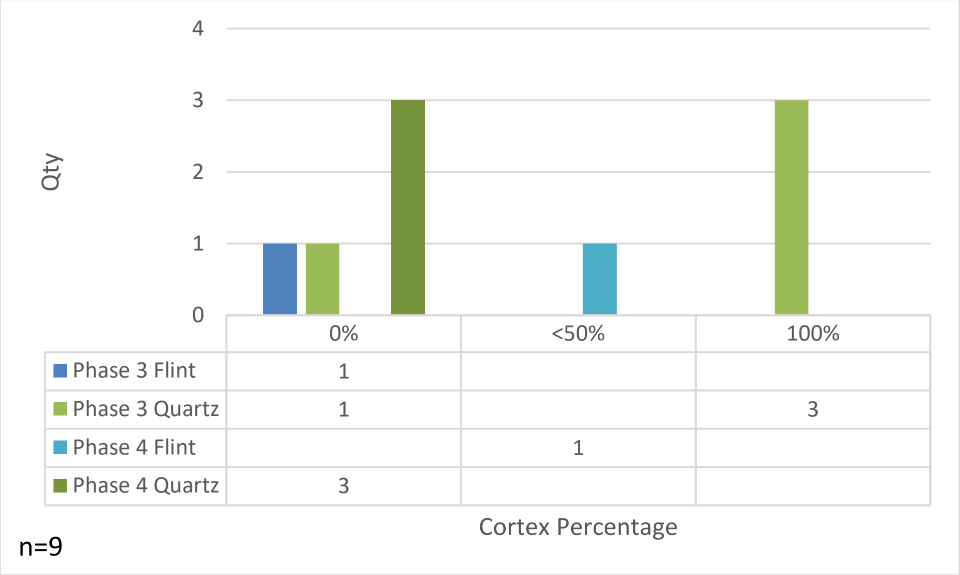


Figure 333. Northton 2011 small fraction flake dimensions width:thickness

11.2.1.3. Cortex and Breakage

The flint small fraction flake and a single quartz small fraction flake from Phase 3 are completely decorticated. The three other quartz small fraction flakes from this phase have 100% cortex present (Figure 334). None of the quartz small fraction flakes from Phase 4 have any cortex present, and the flint small fraction flake retains <50% cortex.



	0%	<50%	100%
■ Phase 3 Flint	1		
■ Phase 3 Quartz	1		3
■ Phase 4 Flint		1	
■ Phase 4 Quartz	3		

Figure 334. Northton 2011 small fraction flake cortex percentage

All of the small fraction flakes in Phase 3 and Phase 4 are broken.

11.3. Tràigh an Teampuill

11.3.1. Small Fraction Flakes

The small fraction flake assemblage from Tràigh an Teampuill totals 25 pieces. These were recovered from the old ground surface (C004; C005); an older relic ground surface (C008), and the earliest old ground surface of early- to mid-Holocene soil (C003).

11.3.1.1. Raw Material

The small fraction flakes only comprise two raw materials – flint and quartz (Figure 335). Flint is the most dominant raw material in this technological category. The majority of the quartz small fraction flakes are milky quartz (Figure 336). Greasy and rock crystal varieties are equally represented by a single small fraction flake each and two quartz small fraction flakes are of the fine grained variety.

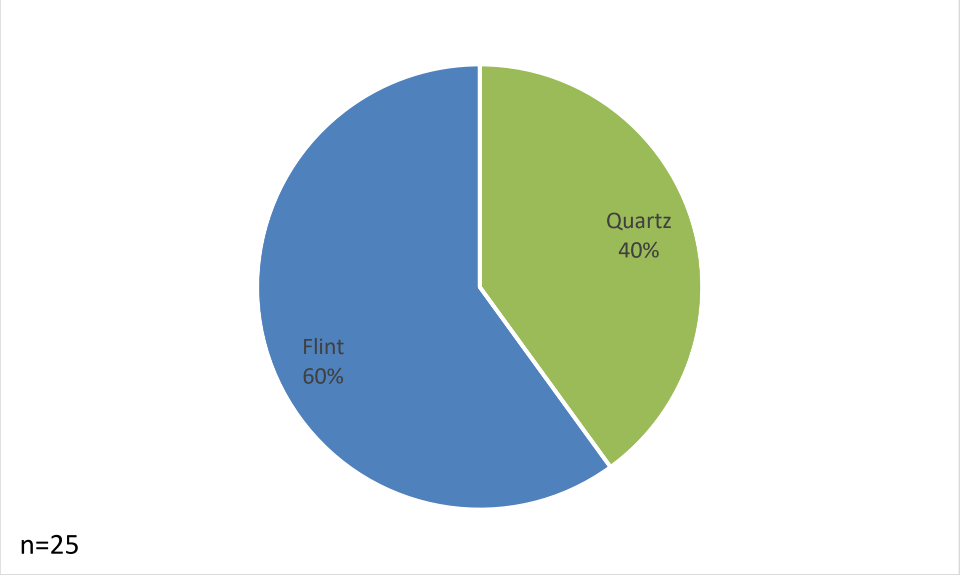


Figure 335. Tràigh an Teampuill small fraction flake raw material composition

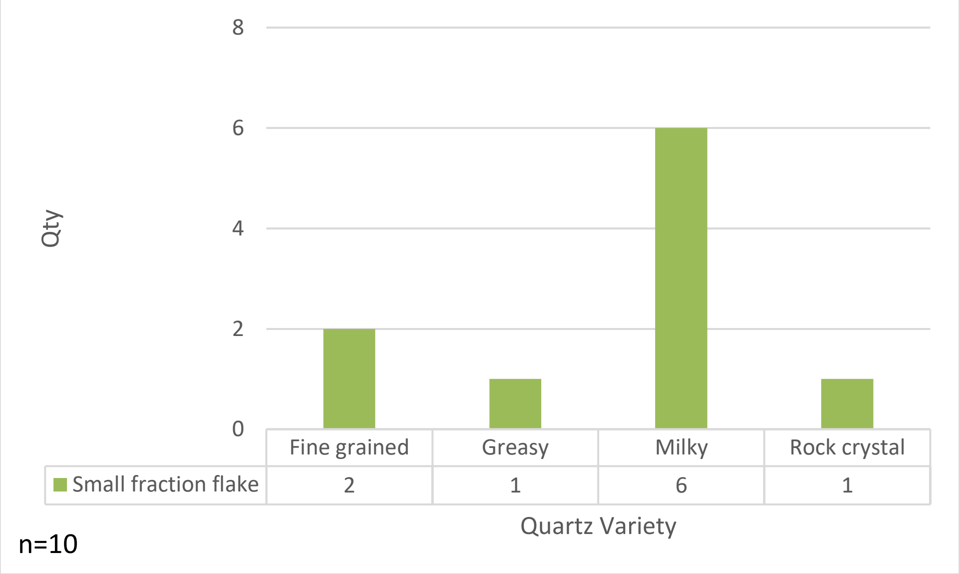


Figure 336. Tràigh an Teampuill small fraction flake quartz varieties

11.3.1.2. Small Fraction Flake Dimensions

The summary statistics for the small fraction flake assemblage from Tràigh an Teampuill is presented in Table 96. The flint small fraction flakes have a wider range between the maximum and minimum values recorded for each dimension than the quartz small fraction flakes. The mean length and thickness of flint small fraction flakes is less than that of quartz, but the flint is very slightly wider. The quartz small fraction flakes have a much lower standard deviation from the mean value than flint, which reflects the narrower range of measurements in each recorded dimension.

Raw Material		Length (mm)	Width (mm)	Thickness (mm)
Flint	**Min**	2.31	5.34	0.99
	Max	9.92	12.58	6.87
	Mean	7.32	7.99	2.56
	SD	2.111062	1.810477	1.539132
Quartz	**Min**	6.38	6.35	1.14
	Max	9.71	9.45	4.74
	Mean	8.19	7.81	3.12
	SD	1.16675	1.236078	1.237686

Table 96. Tràigh an Teampuill small fraction flake dimension summary statistics for primary raw materials

The quartz small fraction flakes clearly cluster tightly between 6mm-10mm in both length and width (Figure 337 and Table 96). This contrasts to the flint small fraction flakes which range much more widely, with little correlation between length and width. The shortest flint small fraction flake is anomalous in terms of length, given the whole small fraction flake assemblage are over 4.5mm in length. Almost all the remainder of the flint small fraction flakes are less than 10mm in width, and one small fraction flake is larger than this, with a width of 12.58mm.

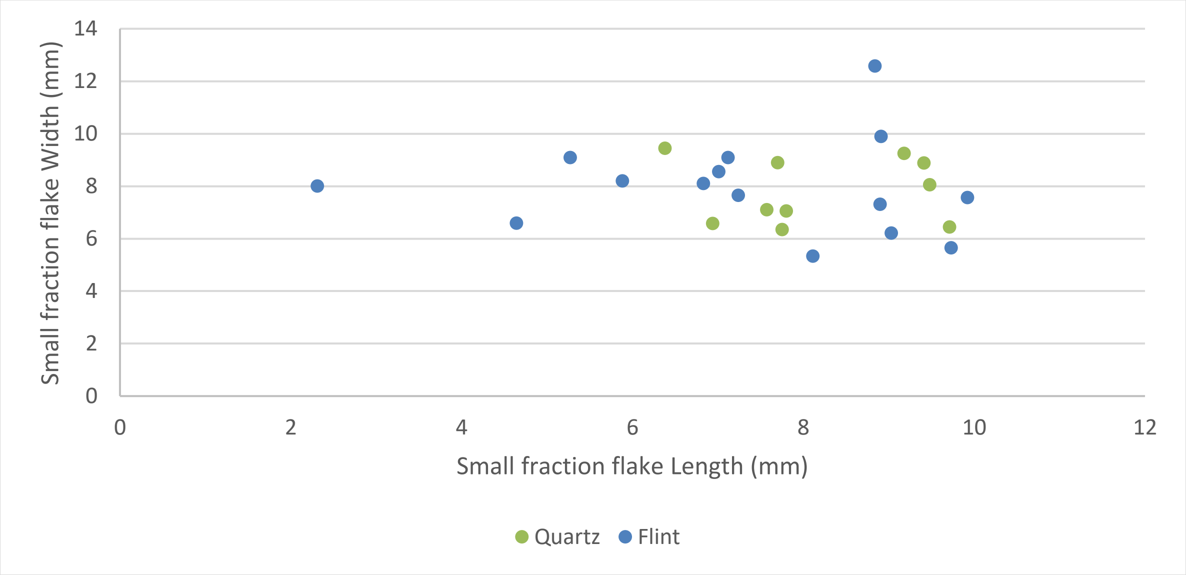


Figure 337. Tràigh an Teampuill small fraction flake dimensions length:width

The quartz small fraction flakes are also more tightly grouped in terms of length and thickness than those made from flint, which display greater variation in thickness (Figure 338). There is a negative correlation between the length and thickness of the small fraction flakes in both raw materials, which is most evident in the flint small fraction flakes – the shortest is also the thickest piece. The majority of the quartz small fraction flakes fall between 2.5-5mm in thickness, whereas the flint small fraction flakes are predominantly found between 1-3mm.

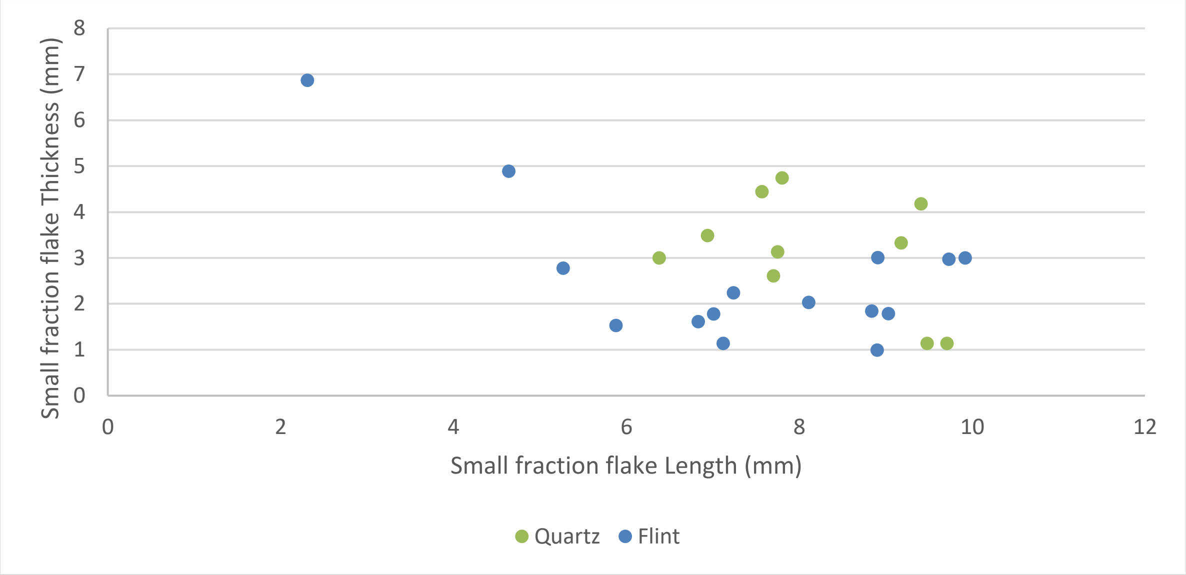


Figure 338. Tràigh an Teampuill small fraction flake dimensions length:thickness

There is no discernible relationship between the width and thickness of small fraction flakes in either raw material (Figure 339). There are two clear outliers, which have been identified previously and fall outside of the main group.

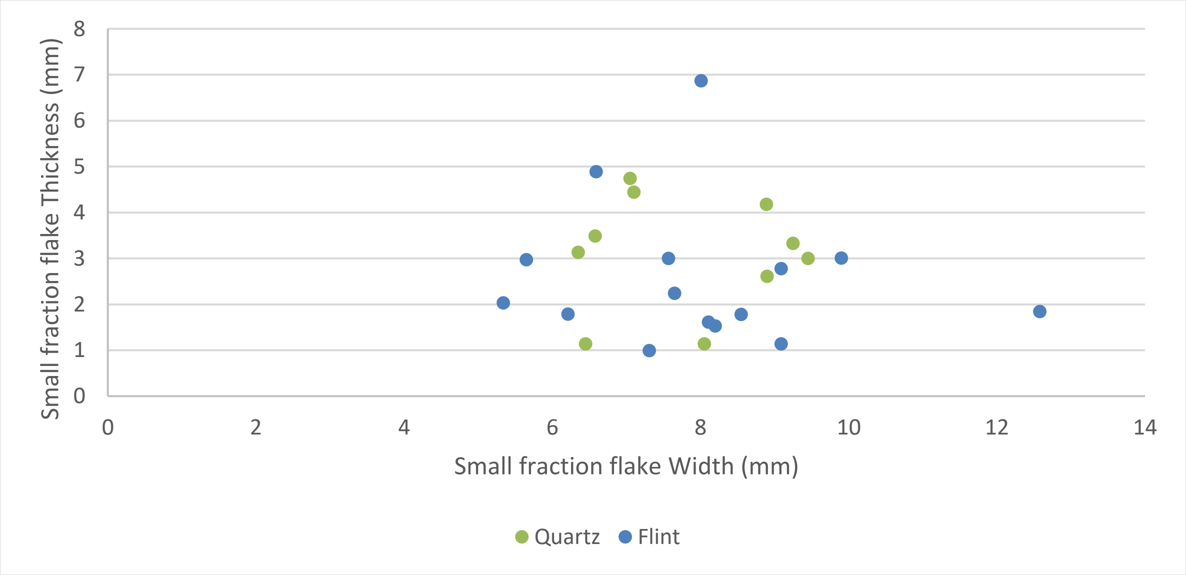
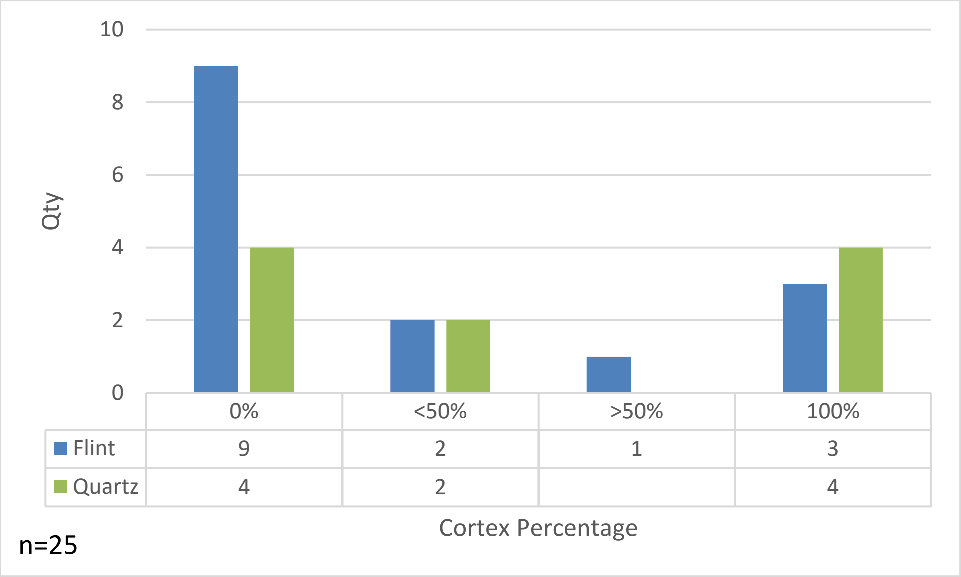


Figure 339. Tràigh an Teampuill small fraction flake dimensions width:thickness

11.3.1.3. Cortex

An equal number of quartz small fraction flakes exhibit either 0% or 100% cortex (Figure 340). The remainder of the quartz small fraction flakes retain <50% cortex. The majority of flint small fraction flakes do not have any cortex. Three flint small fraction flakes have 100% dorsal coverage of cortex, two have <50%, and only one displays >50% cortex.

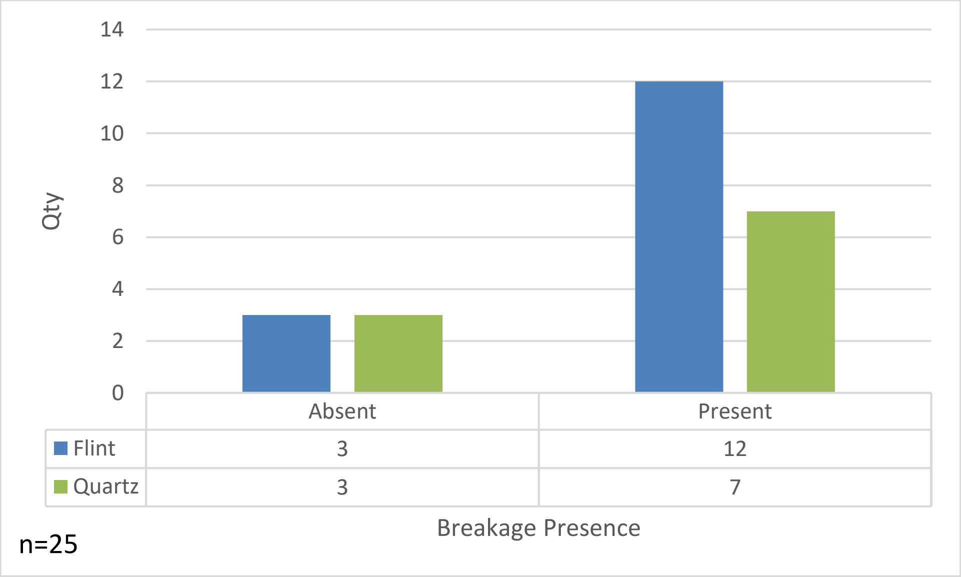


	0%	<50%	>50%	100%
Flint	9	2	1	3
Quartz	4	2		4

Figure 340. Tràigh an Teampuill small fraction flake cortex percentage

11.3.1.4. Breakage

An equal number of small fraction flakes are complete in both raw materials, whereas the majority of small fraction flakes were recorded as broken (Figure 341).



	Absent	Present
Flint	3	12
Quartz	3	7

Figure 341. Tràigh an Teampuill small fraction flake breakage

11.3.2. Chunks and Small Fraction Chunks

Three chunks (maximum dimension >10mm), and four small fraction chunks were recovered from the Tràigh an Teampuill lithic assemblage. One chunk was recovered from the basal clay-silt deposit

(C002), and two small fraction chunks came from the early to mid-Holocene ground surface that overlay this (C003). Two chunks and a small fraction chunk were identified in the main ground surface deposit (C004; C011), and a single small fraction chunk was revered from the ground surface that formed alongside the scoop fill deposits (C008). Due to the small number of pieces in this category the results of both the chunks and small fraction chunks are presented together.

11.3.2.1. Raw Material

There are two chunks of flint at Tràigh an Teampuill, and one of quartz. Quartz accounts for a higher proportion of small fraction chunks, with only a single piece in flint (Figure 342).

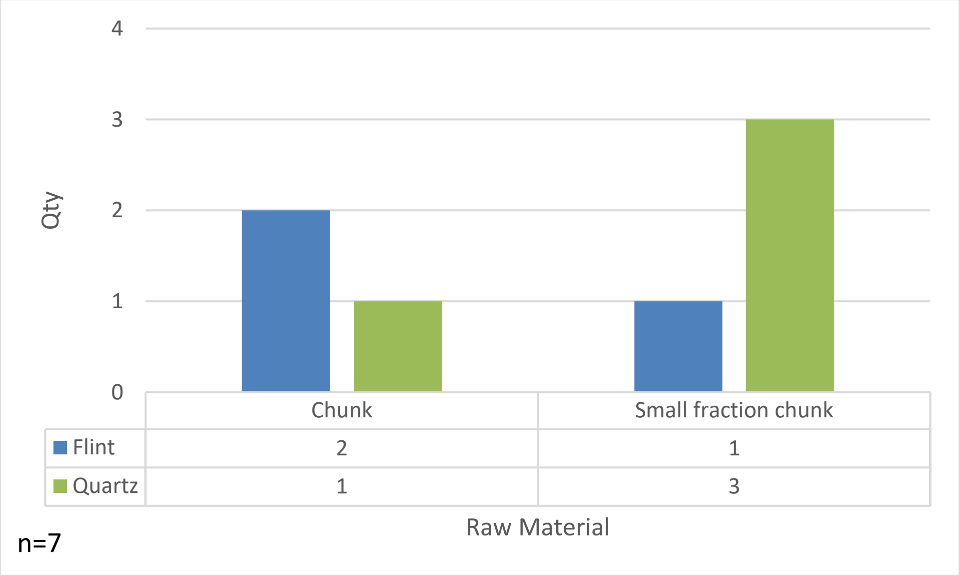


Figure 342. Tràigh an Teampuill chunk and small fraction chunk raw material

There are two varieties of quartz present in the chunk assemblage (Figure 343). The larger fraction chunk is milky quartz, as are two of the small fraction chunks. The remaining small fraction chunk is of the greasy (very fine grained) variety.

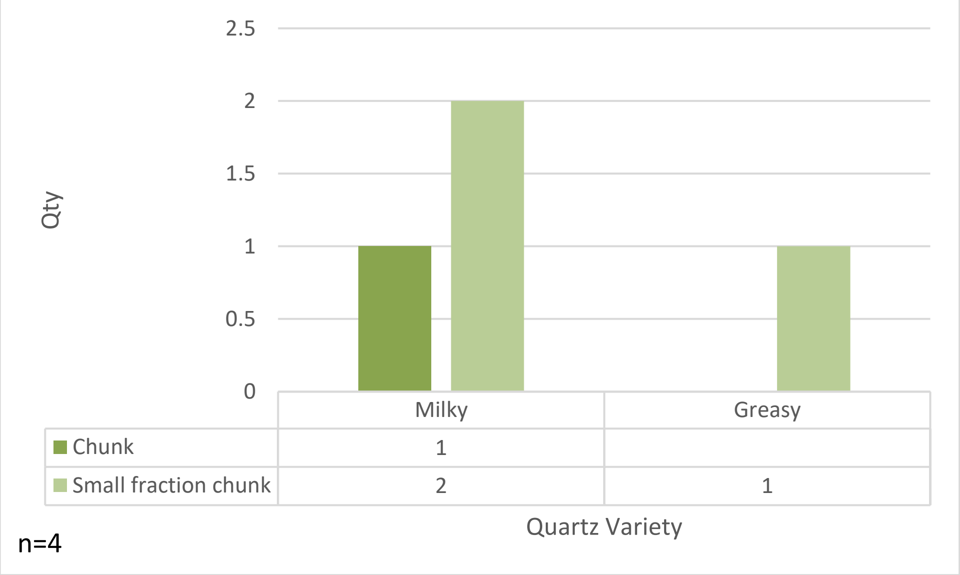


Figure 343. Tràigh an Teampuill chunk and small fraction chunk quartz varieties

11.3.2.2. Chunk Dimensions

Overall, there is a clear positive correlation between all dimensions of the flint chunk assemblage. This positive correlation is also observable in the quartz small fraction chunk assemblage.

The quartz chunk is substantially longer and wider than the flint chunks (Figure 344). This contrasts to the small fraction chunk assemblage, where the flint small fraction chunk is larger than those of quartz. The smallest flint chunk is very close in length and width to the flint small fraction chunk of the same raw material.

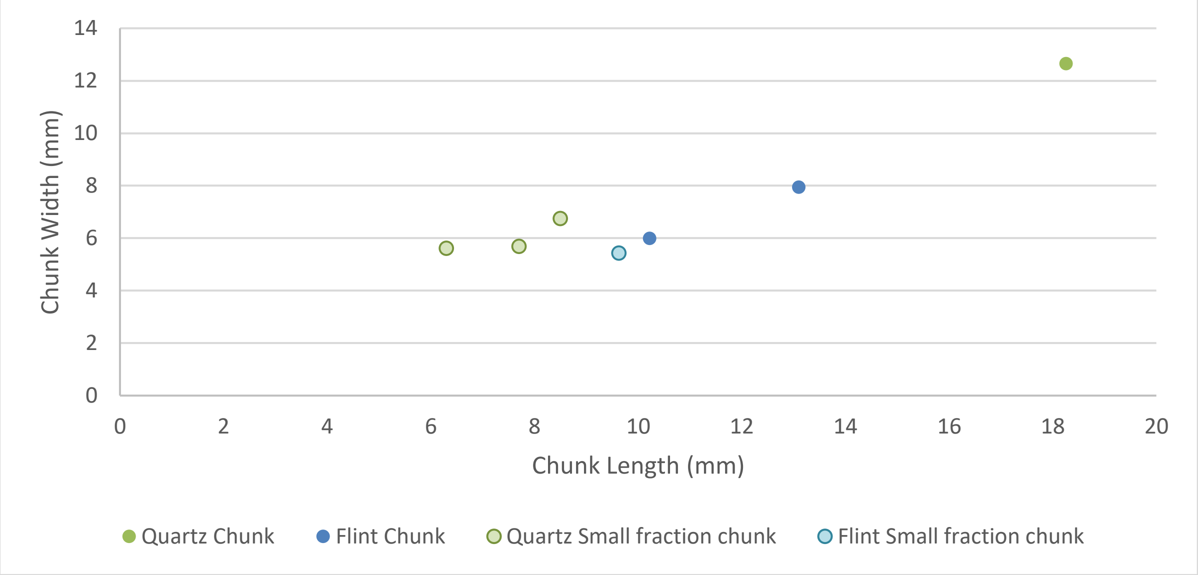


Figure 344. Tràigh an Teampuill chunk and small fraction chunk dimensions length:width

The quartz chunk is also thicker than the flint chunks (Figure 345). One quartz small fraction chunk and the flint small fraction chunk are thicker than one of the flint chunks in the assemblage. Quartz on the whole has a wider range of thickness and length than flint.

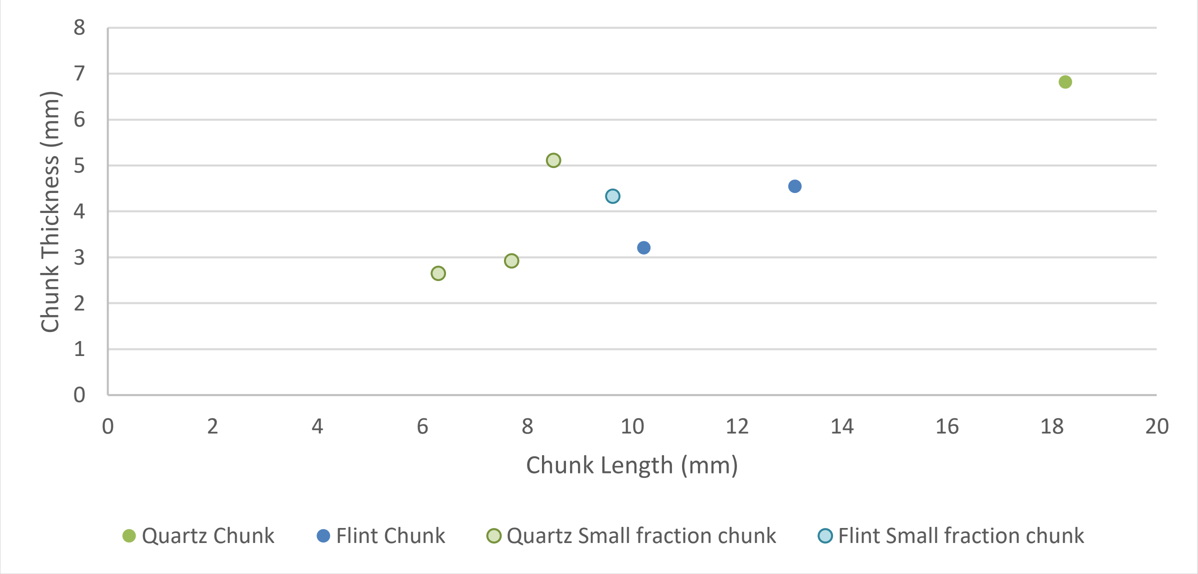


Figure 345. Tràigh an Teampuill chunk and small fraction chunk dimensions length:thickness

The flint small fraction chunk is the narrowest of the assemblage, but thicker than one of the larger fraction flint chunks. It is also thicker than two of the quartz small fraction (Figure 346). The quartz chunk and small fraction chunks range more widely than flint in terms of width, however this range is exaggerated by the quartz chunk, which is a clear outlier.

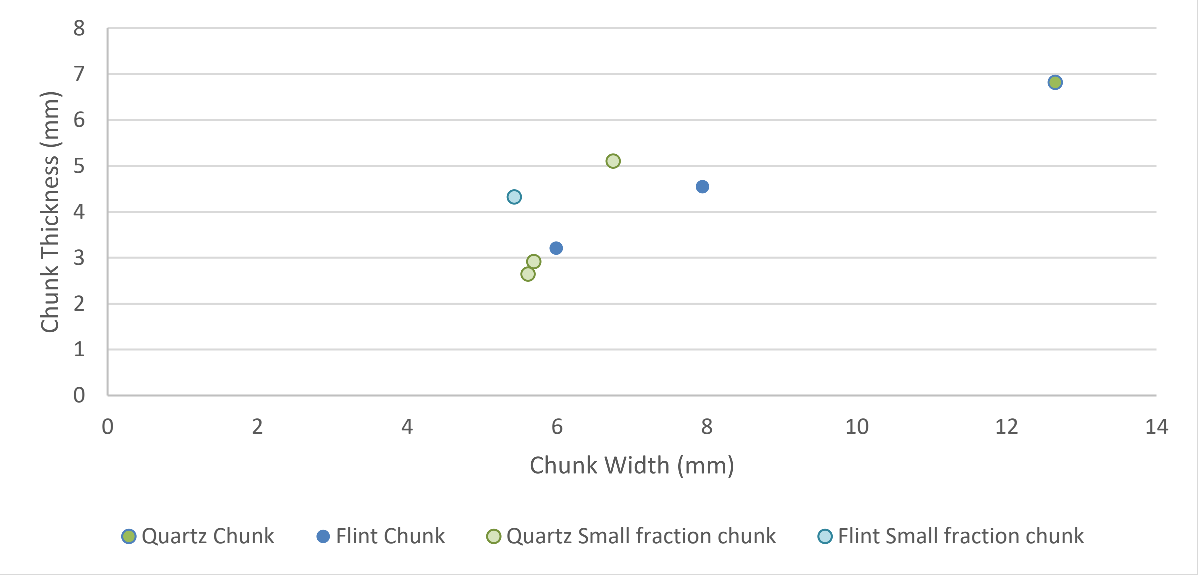
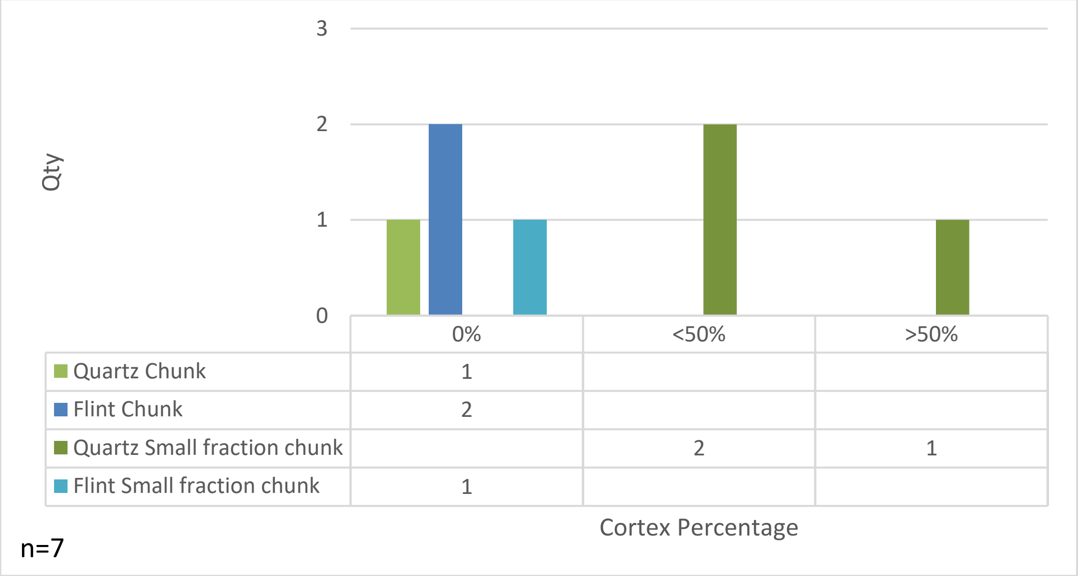


Figure 346. Tràigh an Teampuill chunk and small fraction chunk dimensions width:thickness

11.3.2.3. Cortex and Breakage

Only the quartz small fraction chunks retain any cortex – two display <50% and one >50% cortex (Figure 347).



	0%	<50%	>50%
Quartz Chunk	1		
Flint Chunk	2		
Quartz Small fraction chunk		2	1
Flint Small fraction chunk	1		

Figure 347. Tràigh an Teampuill chunk and small fraction chunk cortex percentage

All the chunks and small fraction chunks in both raw materials are broken.

Appendix 12 Lewis – Small Fraction Flakes, Chunks, and Small Fraction Chunks Results

12.1. Tràigh na Beirigh 1

12.1.1. Small Fraction Flakes

The small fraction (<10mm) flake assemblage from Tràigh na Beirigh 1 totals 143 pieces. The majority of the assemblage was recovered from the main body of the shell midden (C008; C009; C020), with a high proportion also found in the old ground surface deposits and soil/sand layers underlying the shell midden (C014; C015; C016; C017; C022; C032). A large number of small fraction flakes were identified in the interface deposits between the turf and the shell midden (C005; C014), and a single small fraction flake was found in the fill of a negative feature (C026) cut into the underlying ground surface.

12.1.1.1. Raw Material

The assemblage is almost exclusively comprised of quartz – only three flint small fraction flakes were recovered in addition to a single small fraction flake of feldspar (Figure 348).

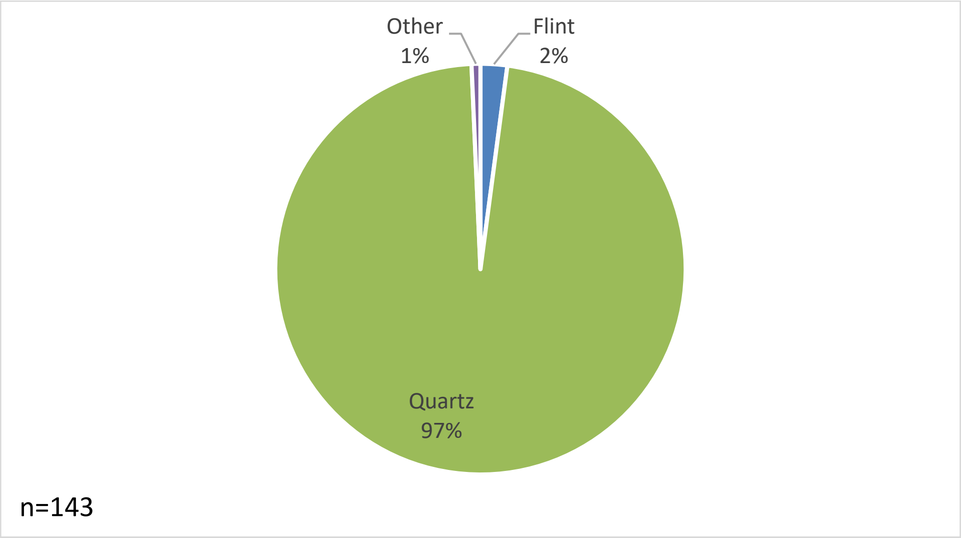


Figure 348. Tràigh na Beirigh 1 small fraction flake raw material composition

Greasy quartz dominates the small fraction flakes with milky quartz also represented in high quantities (Figure 349). There are small numbers of fine grained quartz and rock crystal present. The most common mixed quartz varieties grade from milky quartz to rock crystal, feldspar, and quartzite.

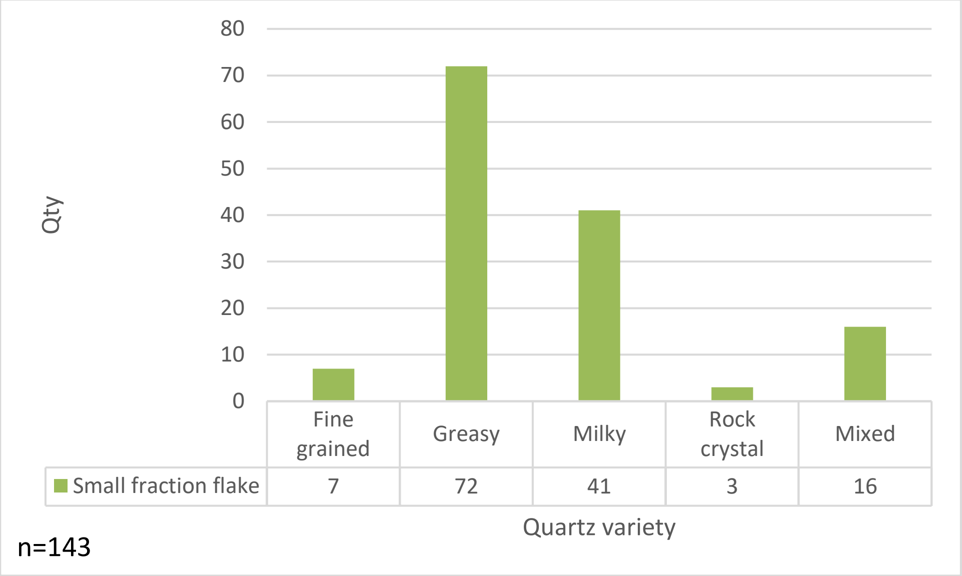


Figure 349. Tràigh na Beirigh 1 small fraction flake quartz varieties

12.1.1.2. Small Fraction Flake Dimensions

The summary statistics for the flint and quartz small fraction flakes are presented in Table 97. The flint small fraction flakes are on average slightly wider and thicker than the quartz, which is longer on average. The flint small fraction flakes have a very narrow range between the maximum and minimum values for each of the dimensions, when compared to the quartz small fraction flakes. Despite this, the standard deviation from the mean for both raw materials is very similar, if marginally greater for flint than quartz. This is likely to be because the flint small fraction flake assemblage only comprises three pieces, which are very different in size from each other.

Raw Material		Length (mm)	Width (mm)	Thickness (mm)
Flint	**Min**	5.12	6.40	1.75
	Max	8.66	11.27	4.61
	Mean	6.76	8.41	2.89
	SD	1.783545	2.543836	1.513748
Quartz	**Min**	3.80	4.50	0.94
	Max	9.95	17.92	11.25
	Mean	7.38	8.11	2.68
	SD	1.448289	2.48831	1.360286

Table 97. Tràigh na Beirigh 1 small fraction flake dimension summary statistics for primary raw materials

The maximum dimension of the small fraction flakes does not exceed 10mm due to the criteria of distinguishing between flakes and small fraction flakes. At least one of the recorded dimensions will also be a minimum of 4mm due to the recovery methodology employed. These limiting factors are clearly visible in Figure 350, with only a single quartz flake less than 4mm in length. All of the flakes, regardless of raw material, are wider than 4mm. In flint, the maximum width does not exceed 12mm, whereas quartz small fraction flakes are up to c.18mm in width. However, the majority of quartz small fraction flakes are also less than 12mm in width.

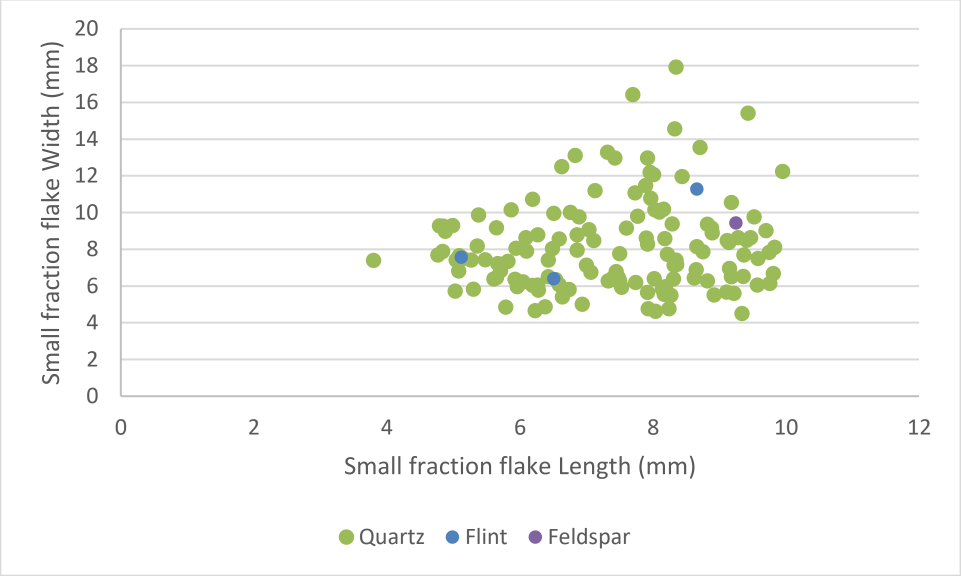


Figure 350. Tràigh na Beirigh 1 small fraction flake dimensions length:width

There is no obvious correlation between the length and thickness of the small fraction flakes (Figure 351). The vast majority of quartz small fraction flakes are less than 5mm in thickness, and only a very small number exceed this – up to a maximum of 11.25mm. These thicker small fraction flakes also tend to be longer. There is a negative correlation between the length and thickness of the flint small fraction flakes – the shortest is the thickest, and the longest the thinnest. The feldspar small fraction flake is very thin, but also long.

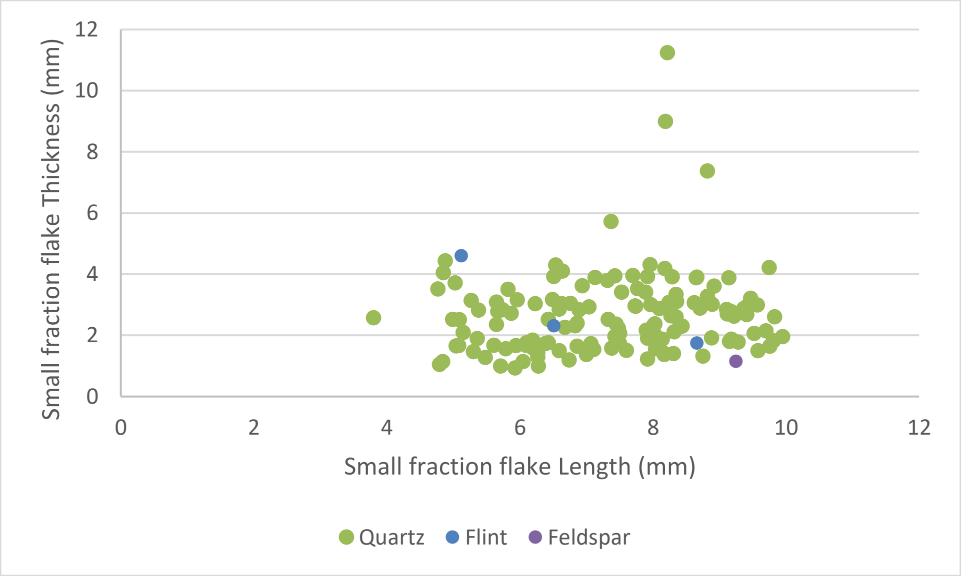


Figure 351. Tràigh na Beirigh 1 small fraction flake dimensions length:thickness

As discussed above the quartz small fraction flakes most densely cluster between 4-10mm in width, and up to 5mm in thickness, as seen in Figure 352. There is little correlation between the increases in these dimensions as the wider quartz flakes (10mm in width or greater) still fall under 5mm in thickness. The few quartz outliers in terms of thickness are clearly discernible, yet still fall within the same width range as the majority of the quartz small fraction flakes. There is also no correlation between width and thickness of the flint small fraction flakes.

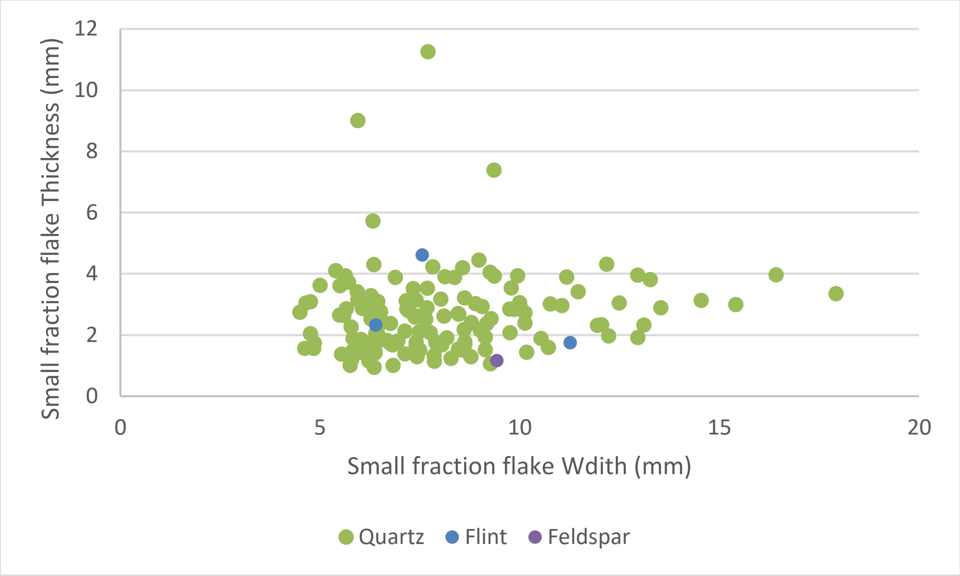
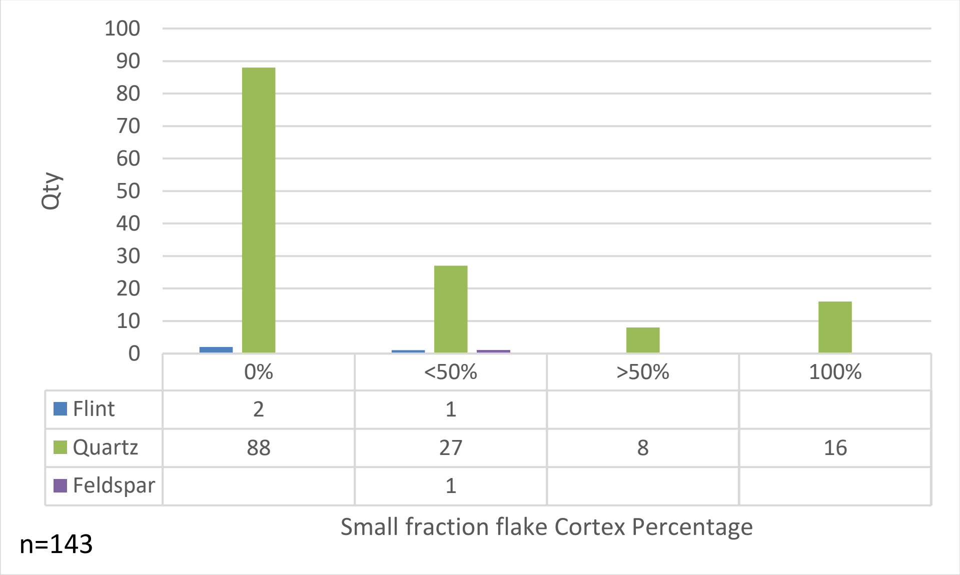


Figure 352. Tràigh na Beirigh 1 small fraction flake dimensions width:thickness

12.1.1.3. Cortex

A complete absence of cortex is observed on the majority of quartz small fraction flakes, with <50% cortex also frequently represented (Figure 353). Small fraction flakes with cortex between >50-100% are few in number. The flint small fraction flakes are mostly decorticated, however a single piece has <50% cortex present, as does the feldspar small fraction flake.



	0%	<50%	>50%	100%
🟦 Flint	2	1		
🟩 Quartz	88	27	8	16
🟪 Feldspar		1		

Figure 353. Tràigh na Beirigh 1 small fraction flake cortex percentage

12.1.1.4. Breakage

Twice as many flint small fraction flakes are complete than broken, and the only feldspar small fraction flake is damaged (Figure 354). Very few quartz small fraction flakes are complete.

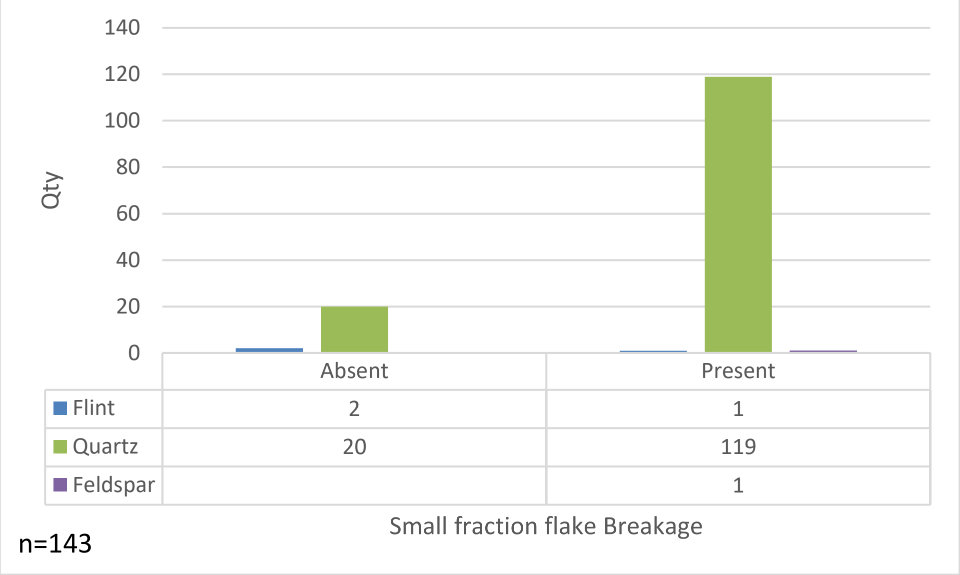


Figure 354. Tràigh na Beirigh 1 small fraction flake breakage

12.1.2. Chunks and Small Fraction Chunks

There are a total of nine chunks and eleven small fraction chunks from Tràigh na Beirigh 1, which were recovered from a variety of contexts including the interface deposits (C004; C005; C006), main body of the shell midden (C008), and underlying old ground surface/sand deposits (C014; C016; C017).

12.1.2.1. Raw Material

All of the chunks and small fraction chunks are quartz. Both chunks and small fraction chunks are most commonly of the milky quartz variety, and a small number are greasy quartz (Figure 355). The mixed quartz varieties represented by small fraction chunks are almost exclusively milky quartz which grades into rock crystal.

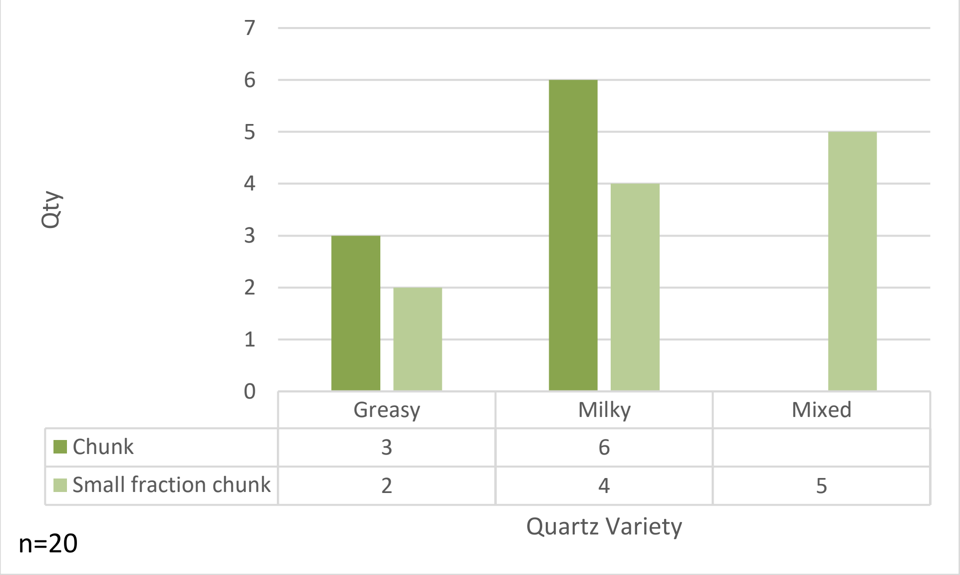


Figure 355. Tràigh na Beirigh 1 chunk and small fraction chunk quartz varieties

12.1.2.2. Chunk Dimensions

The small fraction chunks form a distinct, tight cluster between 5-10mm in length and 4-8mm in width (Figure 356). The chunks, in contrast range much more widely in their dimensions, with two clusters at c.13mm in length, and 17mm in length. These are spread between 5-15mm in width. A single chunk is significantly larger than the rest of the chunk assemblage in both length and width.

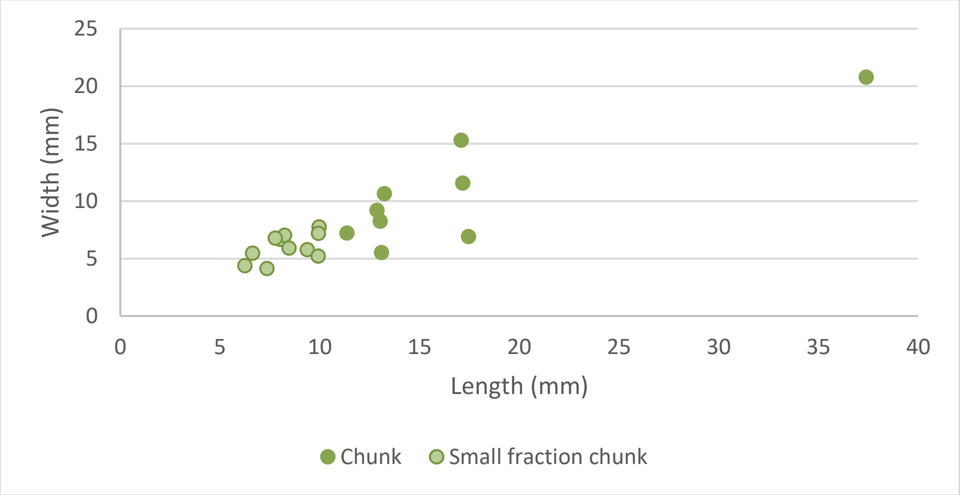


Figure 356. Tràigh na Beirigh 1 chunk and small fraction chunk dimensions length:width

The small fraction chunks are distributed between 2-7mm in thickness, with a clear positive correlation between this dimension and length (Figure 357). Overall the chunks and small fraction chunks are of a similar thickness, with the exception of the chunk which is longer than the other pieces in the assemblage and is also much thicker.

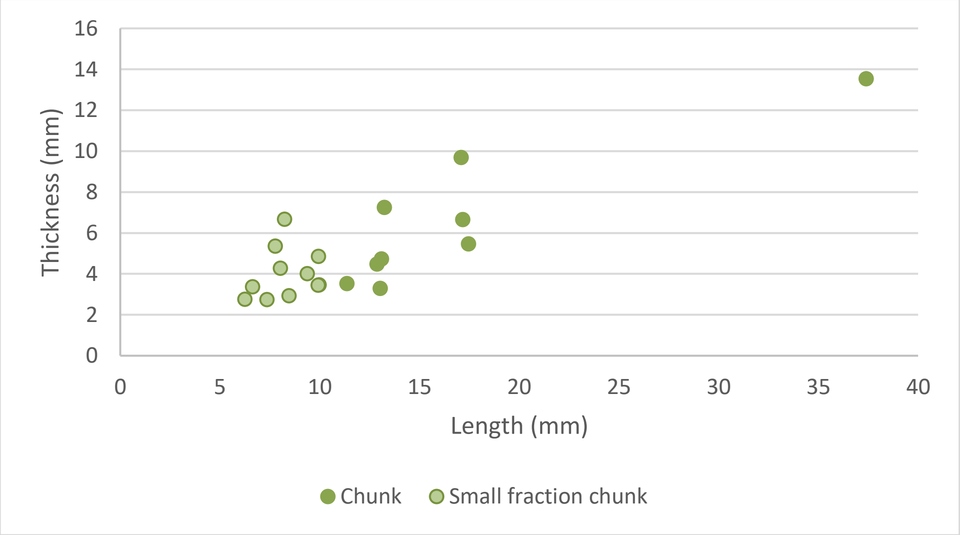


Figure 357. Tràigh na Beirigh 1 chunk and small fraction chunk dimensions length:thickness

There is a clear positive linear trend between the increasing width and thickness of the chunks (Figure 358). The small fraction chunks are very tightly clustered, in accordance with the constraints of the recovery and category methodology, however a positive correlation between the two dimensions is also observable.

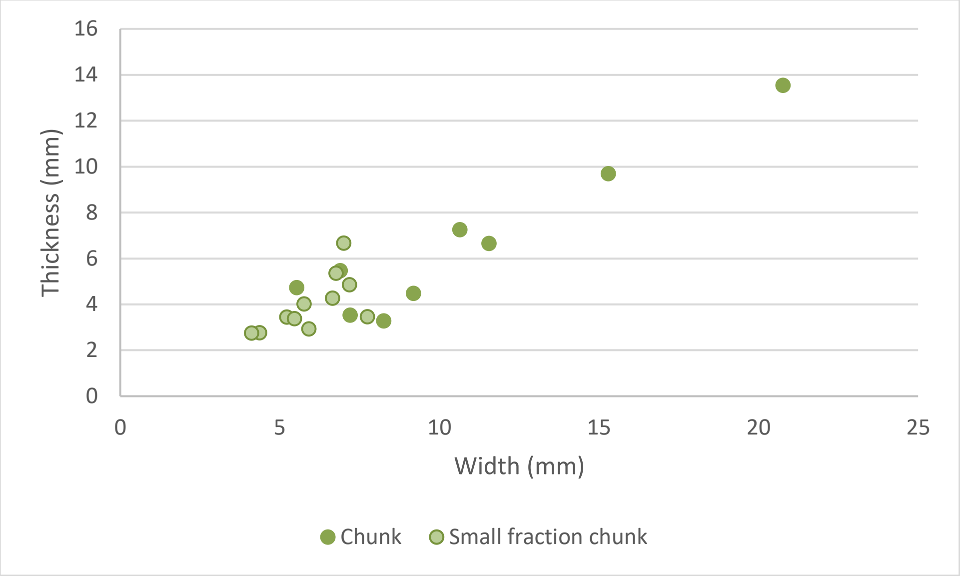
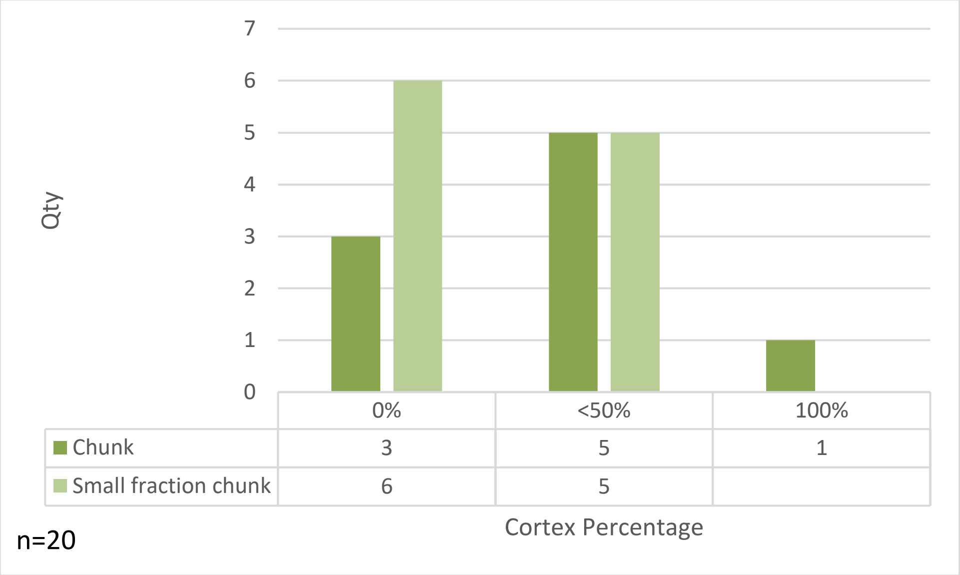


Figure 358. Tràigh na Beirigh 1 chunk and small fraction chunk dimensions width:thickness

12.1.2.3. Cortex

A single chunk has 100% dorsal cortex present, however the majority have <50% cortex. An equal number of small fraction chunks were recorded with a similar quantity of cortex, yet most of the small fraction chunks do not retain any cortex at all (Figure 359).



	0%	<50%	100%
Chunk	3	5	1
Small fraction chunk	6	5	

Figure 359. Tràigh na Beirigh 1 chunk and small fraction chunk cortex percentage

12.1.2.4. Breakage

Only a single chunk does not display any sign of breakage and almost all of the small fraction chunks are broken (Figure 360).

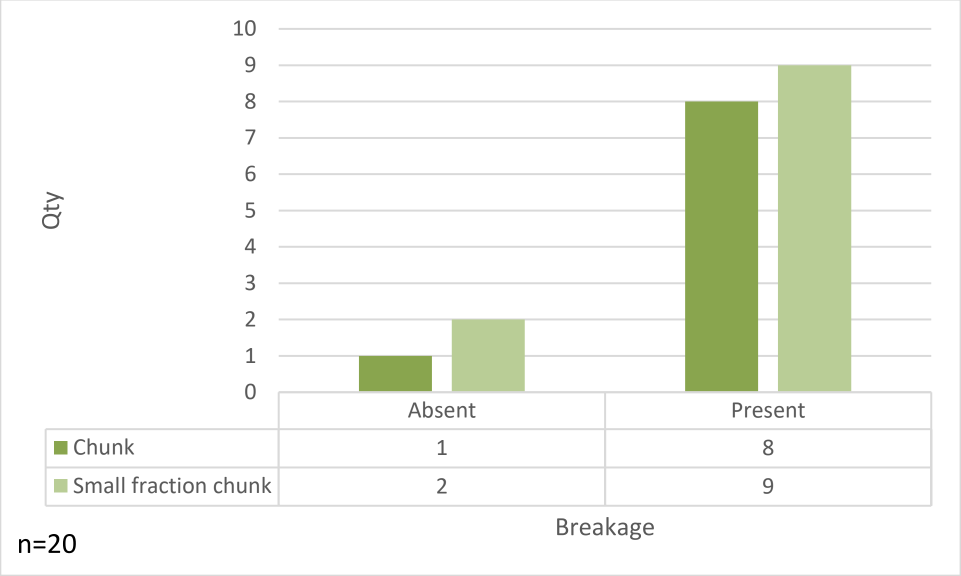


Figure 360. Tràigh na Beirigh 1 chunk and small fraction chunk breakage

12.2. Tràigh na Beirigh 2

12.2.1. Small Fraction Flakes

There are 162 small fraction flakes (<10mm) from Tràigh na Beirigh 2. The majority of small fraction flakes were recovered from the shell midden deposits (C005; C011; C014; C015; C018). A high proportion was also found in the overlying interface deposits of mixed machair and shell, predominantly in C003, but very small numbers of small fraction flakes also came from C009, C010, and C012. A small number of small fraction flakes were found in the upper old ground surface horizon (C006; C016; C017), and only a single context from the lower ground surface (C021) yielded pieces from this aspect of the assemblage.

12.2.1.1. Raw Material

The small fraction flake assemblage is almost exclusively quartz – only two pieces are flint (Figure 361). Greasy quartz is the most prevalent variety in the small fraction flake assemblage (Figure 362). This is followed by a small quantity made from milky quartz, some of which grade to quartzite or feldspar. A very small number of small fraction flakes are fine grained quartz; some of these are mixed with feldspar or grade into greasy quartz.

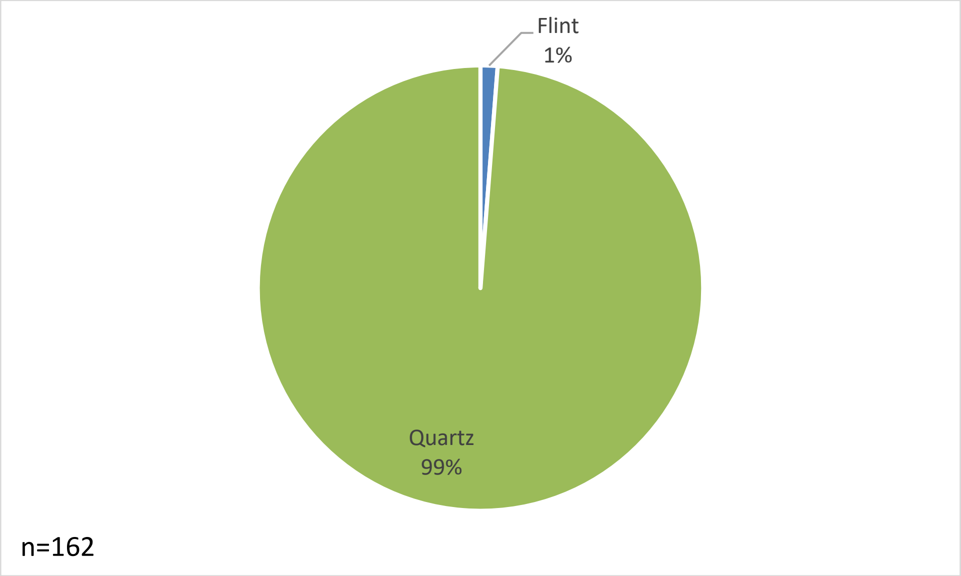


Figure 361. Tràigh na Beirigh 2 small fraction flake raw material

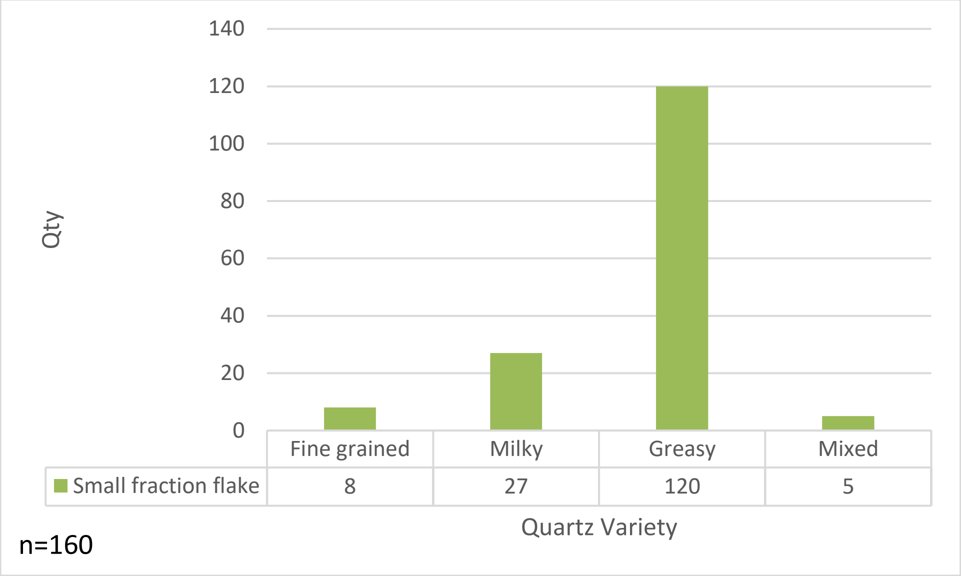


Figure 362. Tràigh na Beirigh 2 small fraction flake quartz varieties

12.2.1.2. Small Fraction Flake Dimensions

The small fraction flake summary statistics are presented in Table 98. The mean and standard deviation values have not been provided for the flint small fraction flakes as there are only two pieces present in the assemblage, which are the maximum and minimum values in the table. The width of the quartz small fraction flakes ranges widely between the maximum and minimum values, however the lower mean value suggests that the maximum figure is anomalous, as evident in Figure 363 and Figure 365. This is the probable cause for the higher standard deviation value of this dimension.

Raw Material		Length (mm)	Width (mm)	Thickness (mm)
Flint	**Min**	6.30	5.78	2.02
	Max	9.61	6.92	2.30
	Mean	N/A	N/A	N/A
	SD	N/A	N/A	N/A
Quartz	**Min**	4.10	2.63	0.62
	Max	9.88	19.41	7.04
	Mean	7.31	7.51	2.46
	SD	1.350974	2.556638	1.092048

Table 98. Tràigh na Beirigh 2 quartz small fraction flake dimension summary statistics

The small fraction flakes from Tràigh na Beirigh 2 range between 4-10mm in length, following the recovery and recording methodologies. There is a slightly denser concentration of quartz small fraction flakes between 8-9mm in length, however the quartz small fraction flakes are distributed throughout the length range (Figure 363). The majority of quartz small fraction flakes are less than 15mm in width, forming a weak correlation with length. Of the two flint small fraction flakes, the shortest is slightly wider than the longest thus forming a negative correlation; both fall at the narrower end of the range in terms of width.

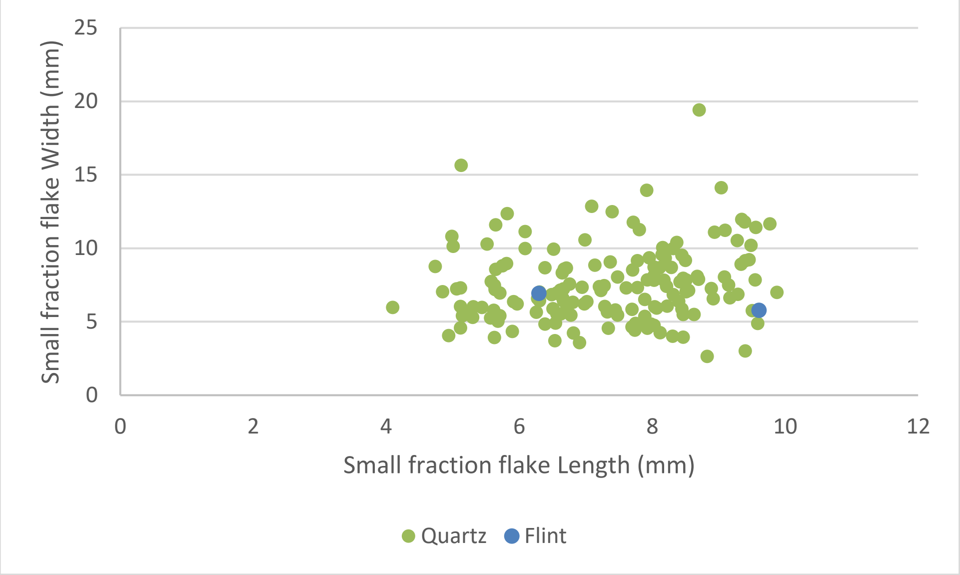


Figure 363. Tràigh na Beirigh 2 small fraction flake dimensions length:width

There is no relationship between the length and thickness of either the quartz or flint small fraction flakes (Figure 364). The majority of the quartz small fraction flakes are less than 5mm in thickness – only three are larger than this. As with width, the shortest flint small fraction flake is also thicker than the longest; both of these also fall towards the thinner end of the thickness scale.

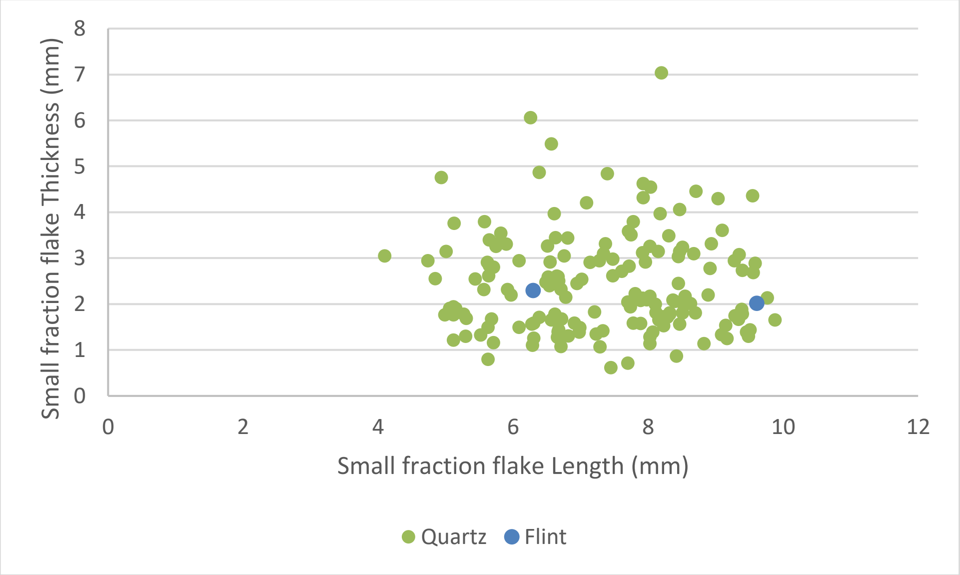


Figure 364. Tràigh na Beirigh 2 small fraction flake dimensions length:thickness

The densest concentration of quartz small fraction flakes falls between 4.5-7.5mm in width and 1-3.5mm in thickness (Figure 365). Beyond these ranges the points are more dispersed. There is a broadly positive correlation between the increase in width and thickness of the quartz small fraction flakes. This trend is also observed in the flint small fraction flakes; the flint small fraction flakes both lie within the densest cluster of quartz small fraction flakes.

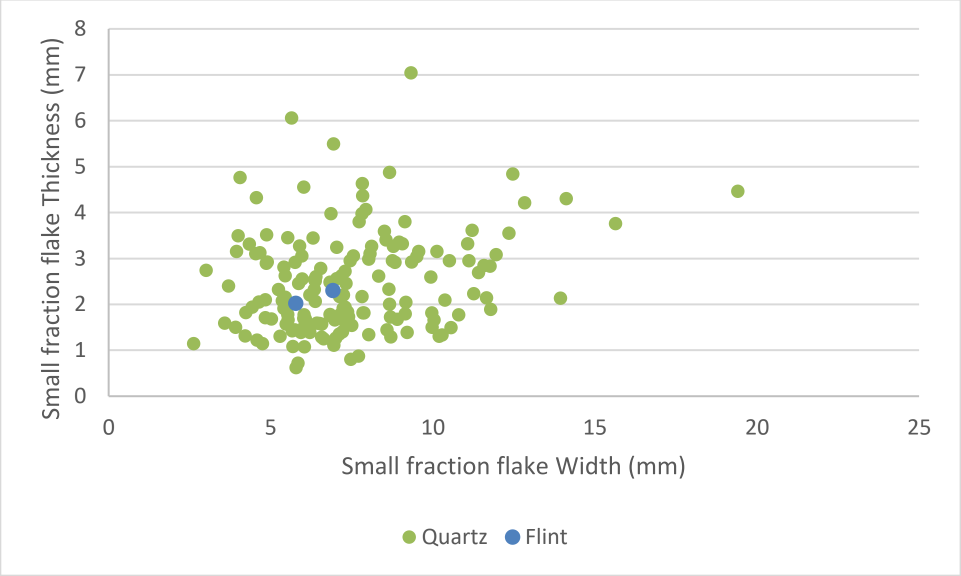
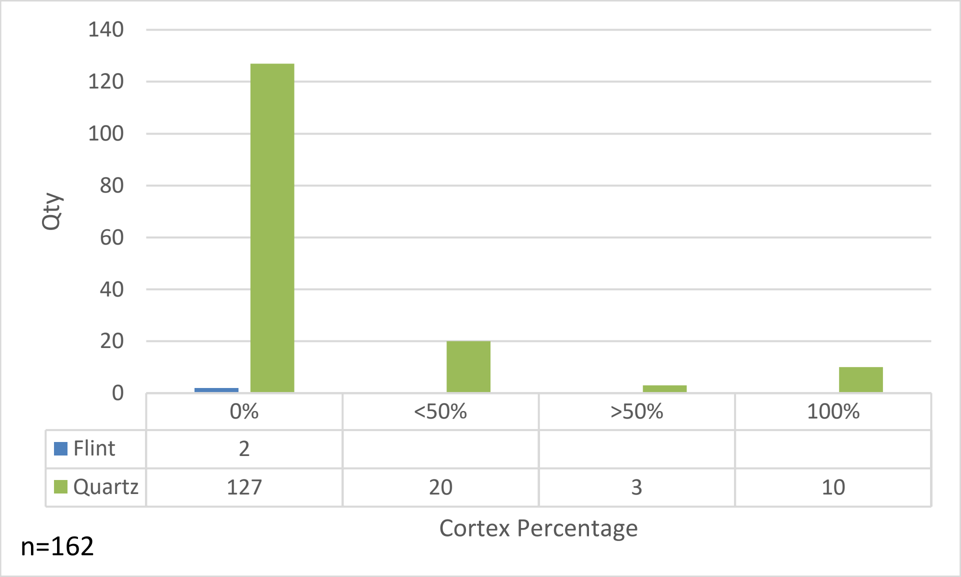


Figure 365. Tràigh na Beirigh 2 small fraction flake dimensions width:thickness

12.2.1.3. Cortex

The overwhelming majority of quartz small fraction flakes do not retain any cortex, nor do either of the flint small fraction flakes (Figure 366). Twice as many quartz small fraction flakes retain <50% than those with complete cortical coverage.



	0%	<50%	>50%	100%
Flint	2			
Quartz	127	20	3	10

Figure 366. Tràigh na Beirigh 2 small fraction flake cortex percentage

12.2.1.4. Breakage

Both of the flint small fraction flakes and the majority of those in quartz are broken (Figure 367).

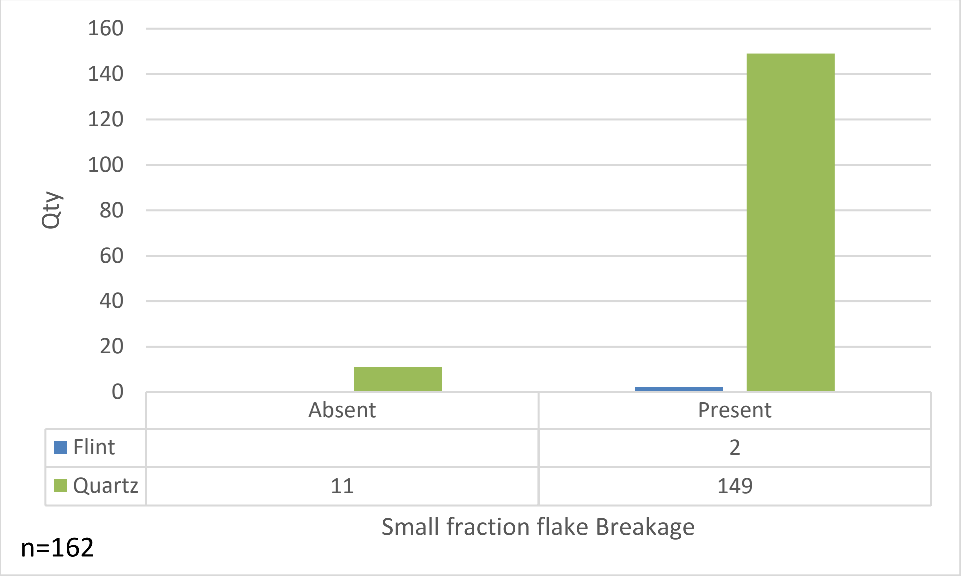


Figure 367. Tràigh na Beirigh 2 small fraction flake breakage

12.2.2. Chunks and Small Fraction Chunks

Four chunks and six small fraction chunks were recovered from Tràigh na Beirigh 2. The majority derived from shell midden contexts (C005 and C011). A single chunk came from the upper interface horizon (C003), and two small fraction chunks were recovered from the lower old ground surface deposits (C019 and C021).

12.2.2.1. Raw Material

All of the chunks and small fraction chunks found at Tràigh na Beirigh 2 are made from greasy quartz, and a single small fraction chunk is of the dark greasy quartz variety.

12.2.2.2. Chunk Dimensions

The chunks and small fraction chunks are separated at 10mm in length, as described in the methodology and observed in Figure 368. Both the chunks and small fraction chunks have a small range in length. None of the chunks exceed 14mm in length, and there is slightly over 4mm separating the shortest small fraction chunk from the longest. The two longest chunks are also the widest, which follows a strong positive trend in the increase of these dimensions. A single chunk is anomalous from this trend, however. The same correlation is also observed in the small fraction chunks, although it is weaker than for the chunks.

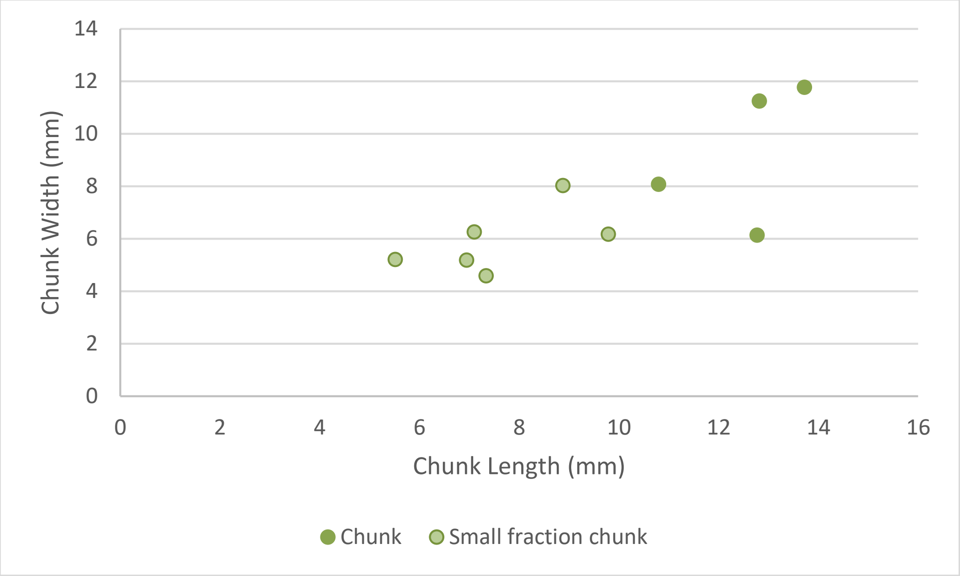


Figure 368. Tràigh na Beirigh 2 chunk and small fraction chunk dimensions length:width

There is no relationship between the length and the thickness of either the chunks or small fraction chunks (Figure 369). Both chunks and small fraction chunks fall into a similar range of thickness, primarily between c.3.5-6mm. Only two small fraction chunks are much thinner than this.

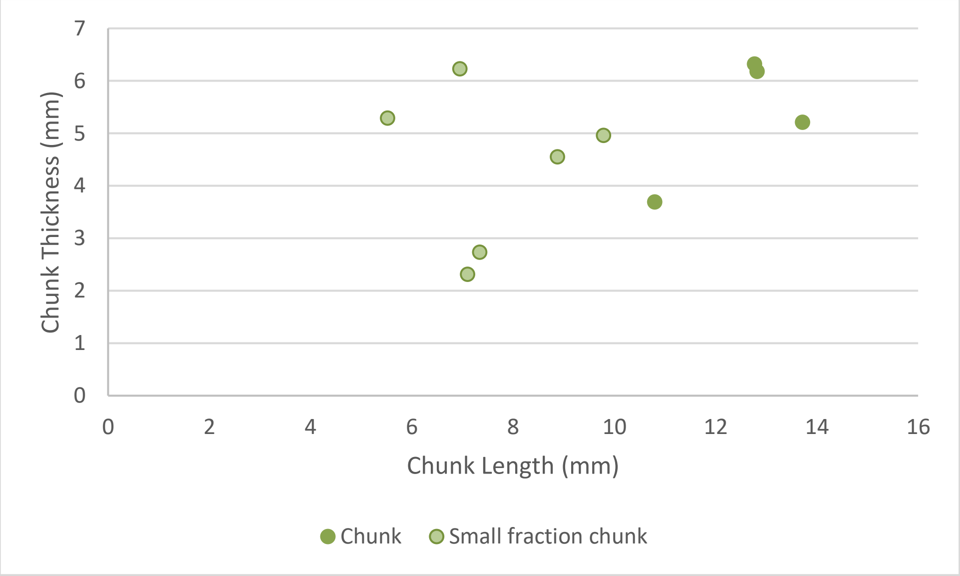


Figure 369. Tràigh na Beirigh 2 chunk and small fraction chunk dimensions length:thicknesss

The two narrower chunks fall into the same range of width measurements as the small fraction chunks (Figure 370). There is no observable relationship between the width and thickness of these pieces. The two widest chunks are thinner than small fraction chunks that measure half their width.

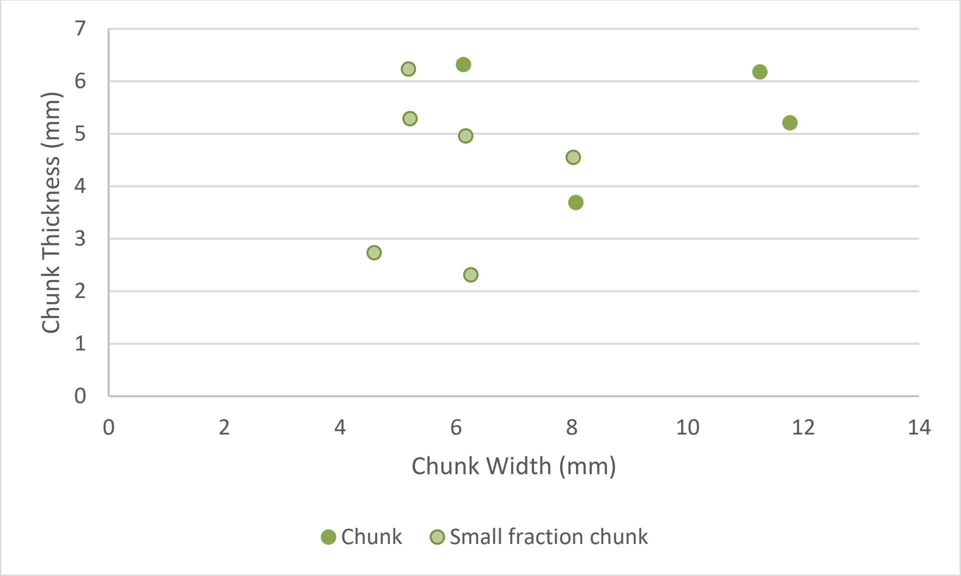


Figure 370. Tràigh na Beirigh 2 chunk and small fraction chunk dimensions width:thickness

12.2.2.3. Cortex and Breakage

Three quarters of the chunk assemblage from Tràigh na Beirigh 2 retain <50% cortex – only a single piece does not have any cortex present (Figure 371). In contrast, the small fraction chunks frequently do not retain any cortex and only two small fraction chunks have <50% cortex present.

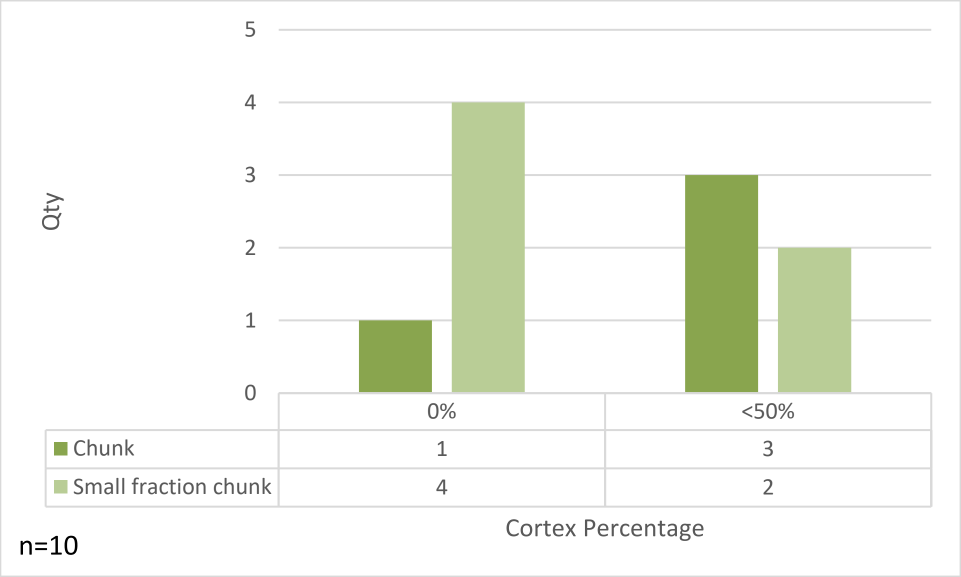


Figure 371. Tràigh na Beirigh 2 chunk and small fraction chunk cortex percentage

All of the chunks and small fraction chunks from this assemblage are broken.

12.3. Tràigh na Beirigh 4

12.3.1. Small Fraction Flakes

There are nine small fraction flakes from the single context (C001) at Tràigh na Beirigh 4**,** all of which are greasy quartz.

12.3.1.1. Small Fraction Flake Dimensions

The small fraction flakes are tightly clustered between 6-10mm, and are no more than 10mm in width. There a strong correlation between the length and width of the small fraction flakes, if the anomalous long, but narrow, piece is disregarded (Figure 372). There is also a strong correlation between the length and thickness of this category (Figure 373). A strong positive correlation is again seen between the width and thickness measurements of the small fraction flakes (Figure 374).

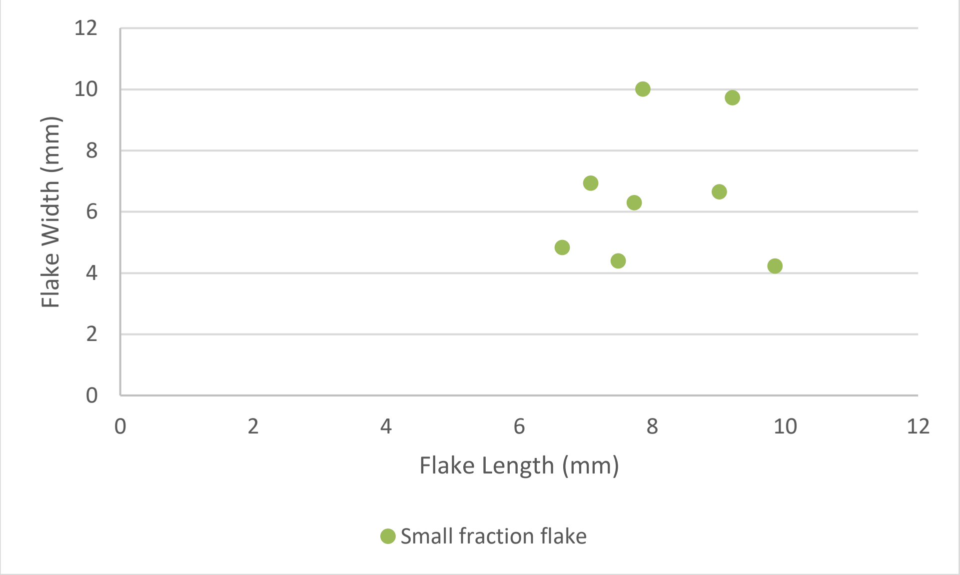


Figure 372. Tràigh na Beirigh 4 small fraction flake dimensions length:width

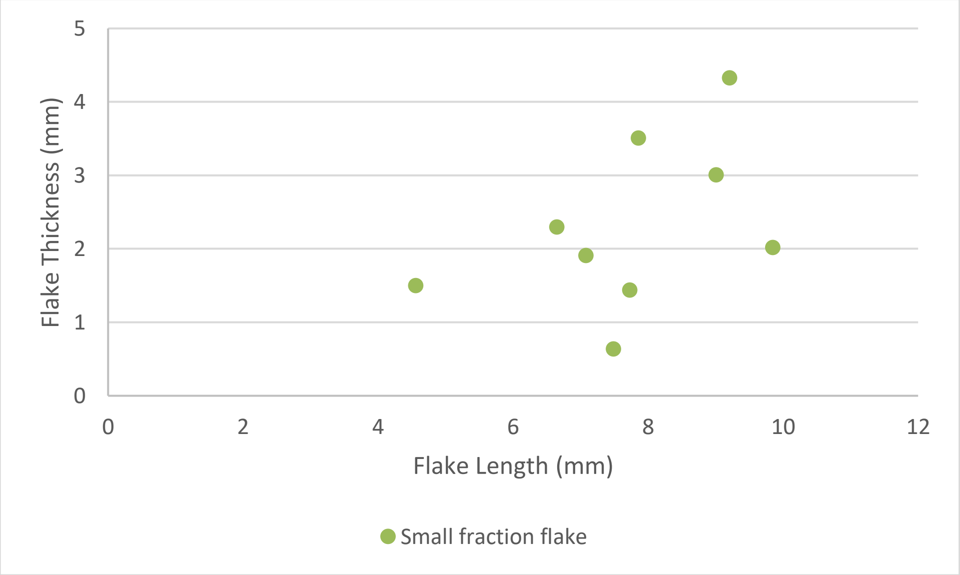


Figure 373. Tràigh na Beirigh 4 small fraction flake dimensions length:thickness

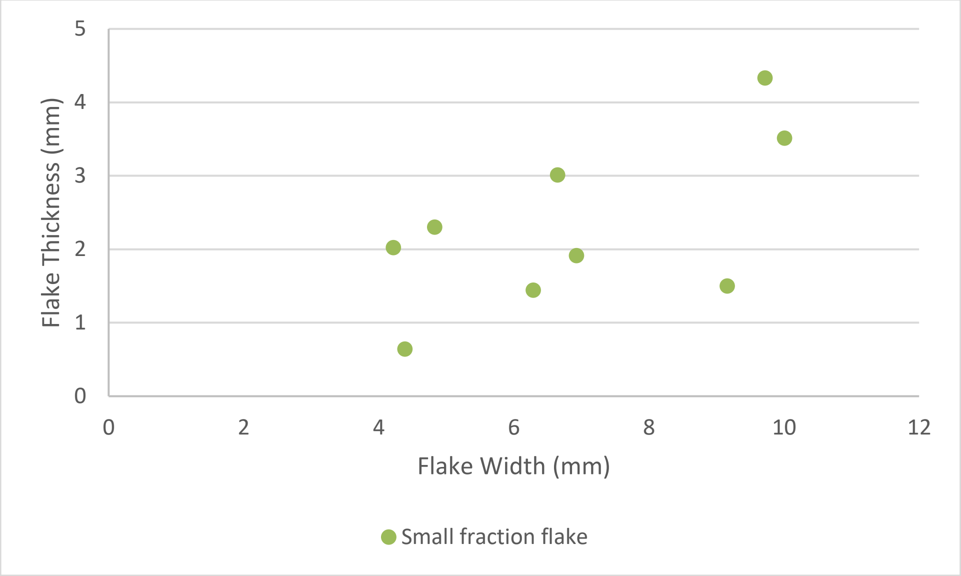


Figure 374. Tràigh na Beirigh 4 small fraction flake dimensions width:thickness

12.3.1.2. Cortex and Breakage

The majority of small fraction flakes do not have any cortex present. Equal numbers of the remaining four small fraction flakes retain >50% and 100% cortex respectively (Figure 375).

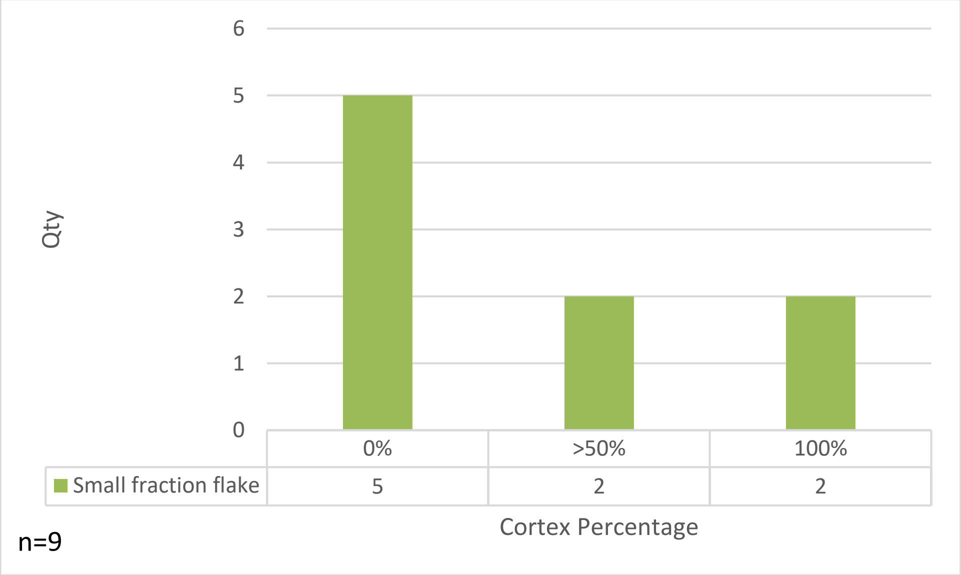


Figure 375. Tràigh na Beirigh 4 small fraction flake cortex percentage

Six of the small fraction flakes exhibit breakage, with a three pieces in the assemblage complete.

12.3.2. Chunks and Small Fraction Chunks

One chunk and one small fraction chunk were recorded from the Tràigh na Beirigh 4 assemblage. The chunk (L14) is of the fine grained quartz variety. It measures 13.62mm X 8.69mm X 7.24mm, does not have any cortex present and is broken. L5 is a small fraction chunk of greasy quartz, which measures 6.96mm X 6.72mm X 1.15mm, exhibits less than 50% cortex and is complete.

12.4. Tràigh na Beirigh 9

12.4.1. Small Fraction Flakes

168 small fraction flakes were recovered from Tràigh na Beirigh 9 throughout the archaeological sequence, including the overlying interface deposits (C004); mixed shell midden/old ground surface (C006); both the primary and secondary pit fill (C007; C005) and the lower soil horizons (C009; C011).

12.4.1.1. Raw Material

The small fraction flake (<10mm) component of the assemblage is almost exclusively quartz, with only a single small fraction flake of feldspar (Figure 376). The quartz varieties present range throughout the whole spectrum of grain sizes, with a single piece of quartzite at the coarsest end to three small fraction flakes of rock crystal at the finest (Figure 377). Greasy (very fine grained) and milky varieties are the most frequently represented.

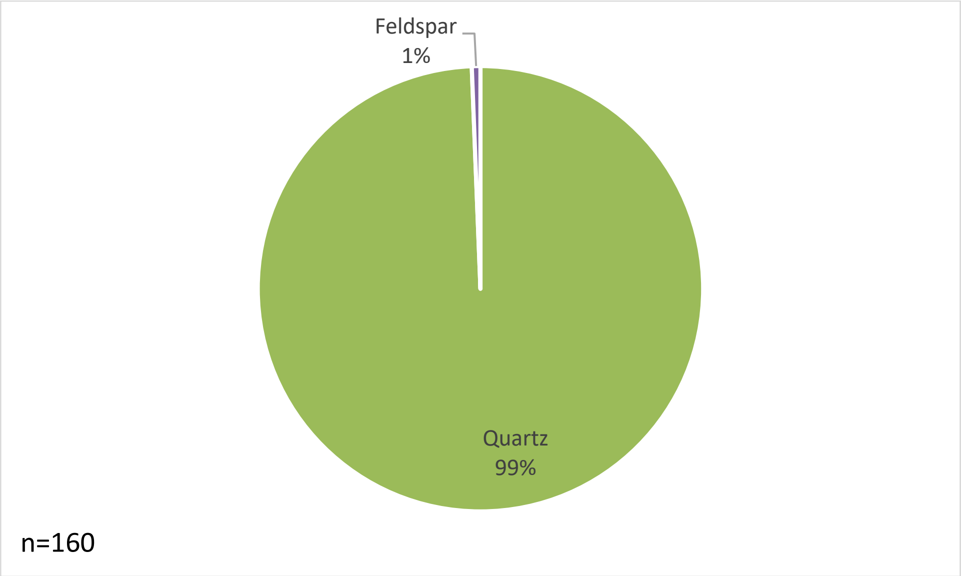
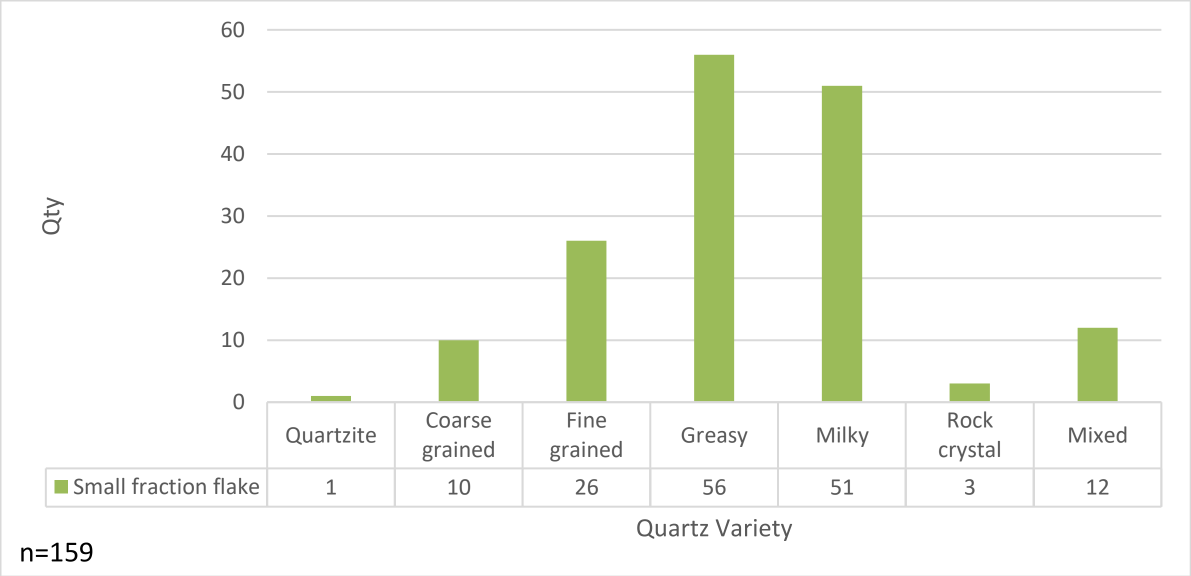


Figure 376. Tràigh na Beirigh 9 small fraction flake raw material composition



	Quartzite	Coarse grained	Fine grained	Greasy	Milky	Rock crystal	Mixed
🟩 Small fraction flake	1	10	26	56	51	3	12

Figure 377. Tràigh na Beirigh 9 small fraction flake quartz varieties

12.4.1.2. Small Fraction Flake Dimensions

The quartz small fraction flakes do not range widely in any of the dimensions recorded, which is likely to be due to the recovery and recording methodology. The range between maximum and minimum values is greatest for the width of these pieces, as reflected by the higher standard deviation value (Table 99).

Raw Material		Length (mm)	Width (mm)	Thickness (mm)
Quartz	**Min**	1.93	3.22	0.6
	Max	9.95	15.7	8.8
	Mean	7.34	7.79	2.41
	SD	1.611569	2.175489	1.133184

Table 99. Tràigh na Beirigh 9 quartz small fraction flake dimension summary statistics

There is little discernible correlation between the length and width of the quartz small fraction flakes (Figure 378). The clustering between 4mm and 10mm in length is representative of the recovery and classification methodologies implemented. The densest concentration of small fraction flakes fall between 6-10mm in width. The very short outlier was recovered due width of the piece, which exceeds 4mm. The feldspar small fraction flake is slightly shorter and narrower than the average quartz small fraction flake.

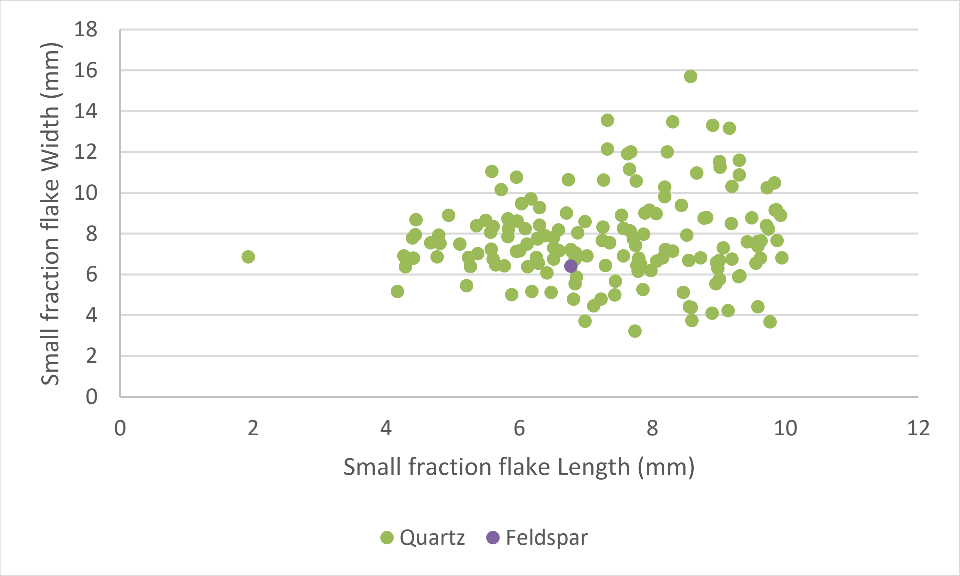


Figure 378. Tràigh na Beirigh 9 small fraction flake dimensions length:width

Again there is no trend between the dimensions of the quartz small fraction flakes in terms of length and thickness (Figure 379). The densest concentration of lithics is between 1-4mm in thickness, with several longer pieces that fall outside this band, and are thicker. The feldspar small fraction flake lies in the centre of this main group, and is slightly thicker than the average value for the quartz small fraction flakes.

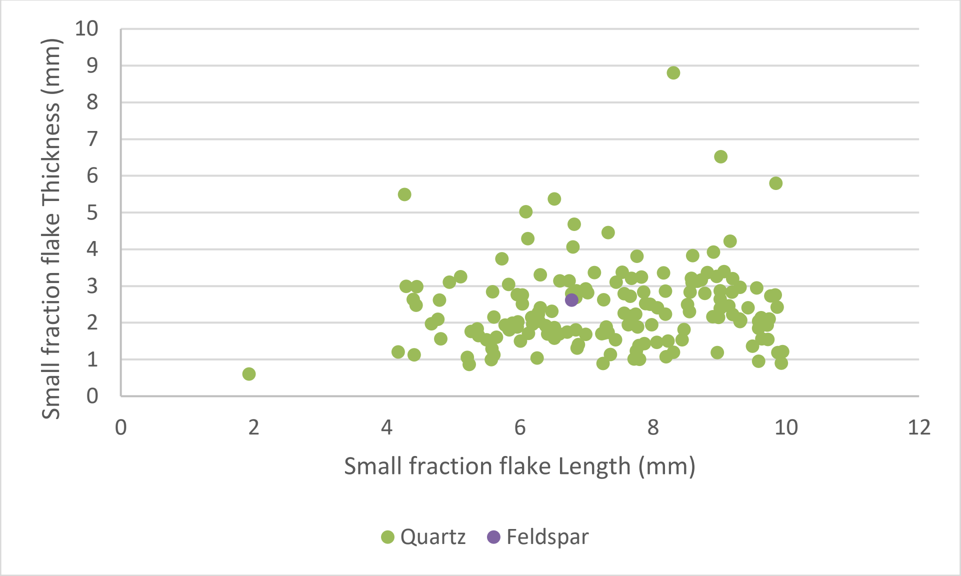


Figure 379. Tràigh na Beirigh 9 small fraction flake dimensions length:thickness

The relationship between small fraction width and thickness is not constrained by the flake classification methodology which is based on length, therefore if a correlation between these dimensions was to be evident, it would be represented by this relationship. Only a weak correlation is seen, as the vast majority of quartz small fraction flakes cluster tightly between 5-10mm in width, and 1-3.5mm in thickness (Figure 380). The thicker quartz small fraction flakes that fall outside the main group have a stronger correlation with width. The feldspar small fraction flake is contained within the main cluster.

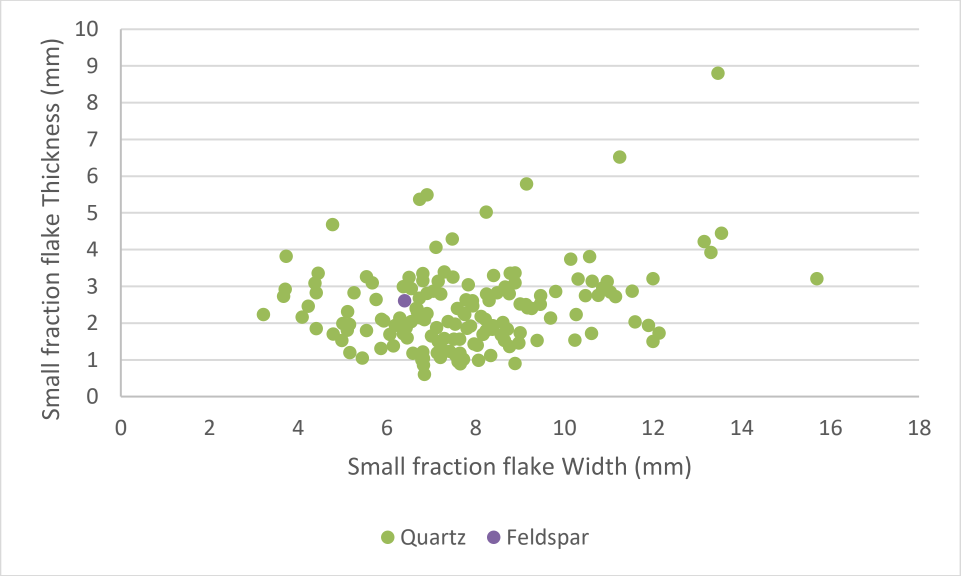


Figure 380. Tràigh na Beirigh 9 small fraction flake dimensions width:thickness

12.4.1.3. Cortex

The majority of the small fraction flake assemblage does not display any cortex (Figure 381). A considerably higher number of small fraction flakes retain <50%, in comparison with those displaying >50% cortex. A small quantity of small fraction flakes exhibit 100% cortex.

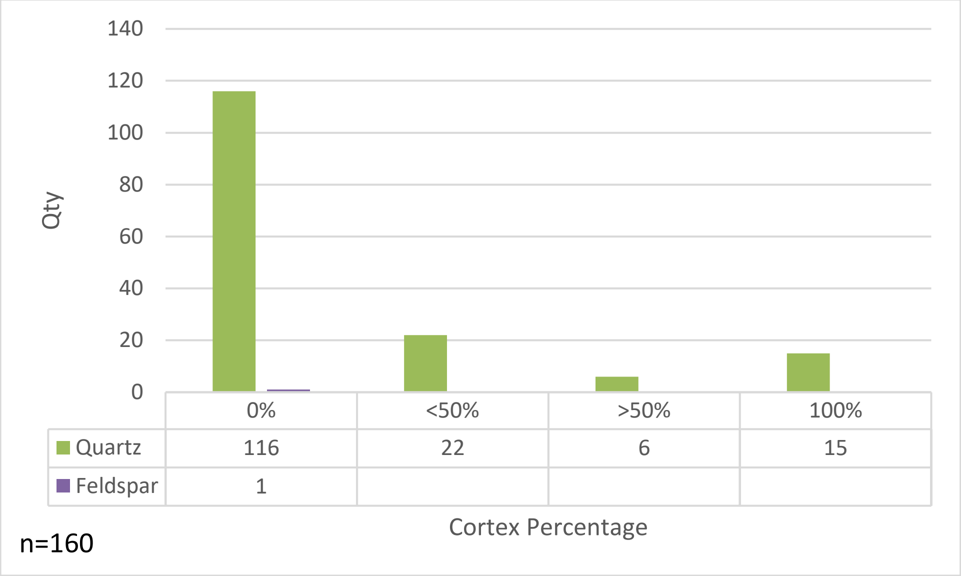


Figure 381. Tràigh na Beirigh 9 small fraction flake cortex percentage

12.4.1.4. Breakage

A significant proportion of the quartz small fraction flakes and the feldspar small fraction flakes are broken. There are comparatively very few that are complete (Figure 382).

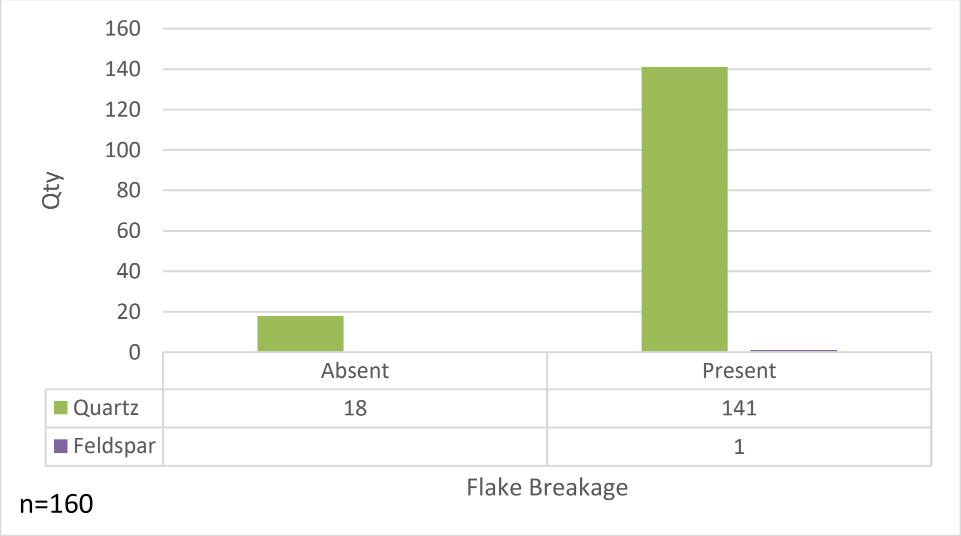


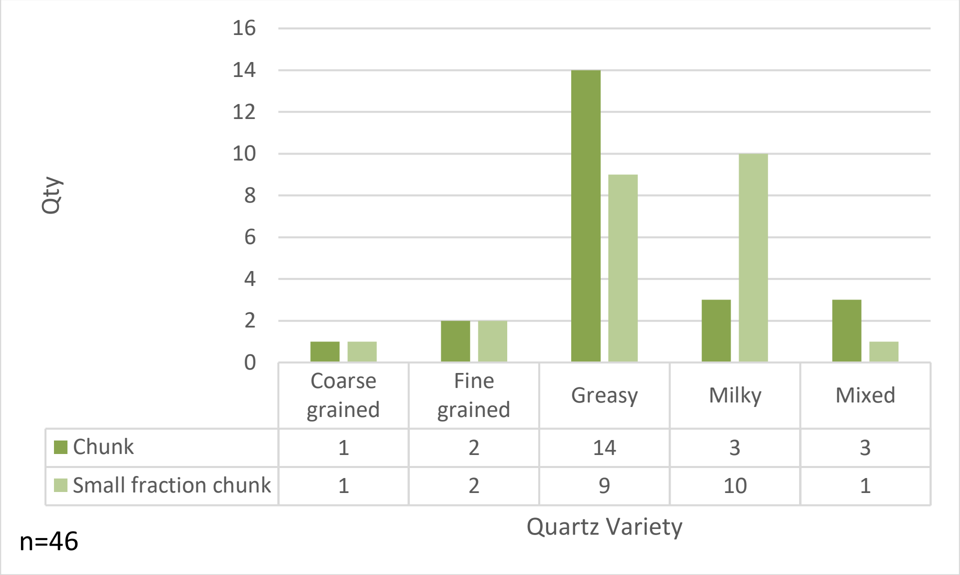
Figure 382. Tràigh na Beirigh 9 small fraction flake breakage

12.4.2. Chunks and Small Fraction Chunks

All chunks present in the Tràigh na Beirigh 9 assemblage are quartz. There are equal numbers of chunks and small fractions chunks (n=23), and the results are presented together. The majority of the chunks and small fraction chunks were recovered from the secondary pit fill deposit containing the skeleton (C005), and the underlying mixed shell midden/old ground surface (C006). Small numbers were also recovered from the mixed shell midden/old ground surface C009, which is similar to C006. A single small fraction chunk was found in the overlying interface deposits (C004), and a single chunk was recovered from the basal soil horizon (C011).

12.4.2.1. Raw Material

Coarse grained and fine grained quartz varieties are equally represented by both the chunks and small fraction chunks (Figure 383). The very fine grained (greasy) variety is more commonly represented by chunks, whereas greater quantities of small fraction chunks are made from milky quartz. Three chunks each are made from milky and mixed varieties of quartz respectively, whereas only a single small fraction chunk is of mixed quartz.



	Coarse grained	Fine grained	Greasy	Milky	Mixed
🟩 Chunk	1	2	14	3	3
🟩 Small fraction chunk	1	2	9	10	1

Figure 383. Tràigh na Beirigh 9 chunk and small fraction chunk quartz varieties

12.4.2.2. Chunk Dimensions

There is a broad spread and overall positive correlation between the length and width of the chunks from Tràigh na Beirigh 9. The small fraction chunks are more tightly clustered in terms of length, due to methodological constraints, and also in width – predominantly falling between 5-6.5mm in width (Figure 384).

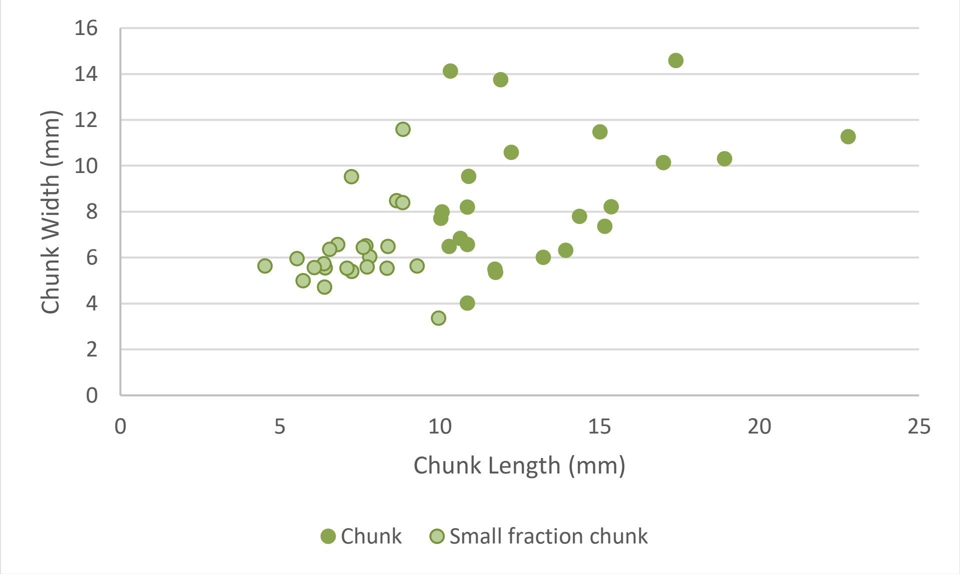


Figure 384. Tràigh na Beirigh 9 chunk and small fraction chunk dimensions length:width

The same pattern is echoed in the relationship between length and thickness, although there are a few clear outliers. The chunks broadly follow a positive correlation, whereas the small fraction chunks remain densely clustered between 2-4mm (Figure 385).

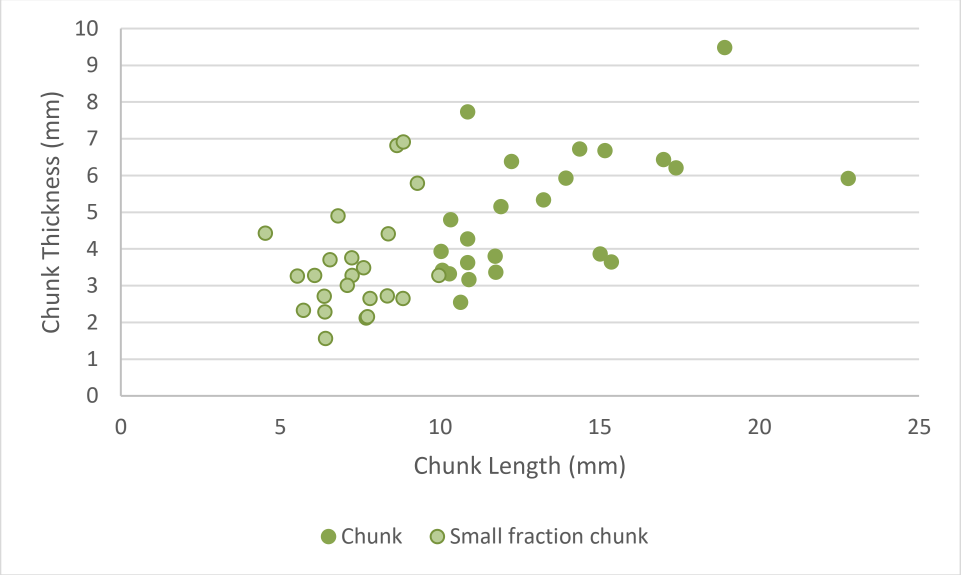


Figure 385. Tràigh na Beirigh 9 chunk and small fraction chunk dimensions length:thickness

There is no clear trend between the width and thickness of either the chunks or small fraction chunks, although the majority of the pieces are loosely grouped between 5-6.5mm in width, and 2-4.5mm in thickness (Figure 386).

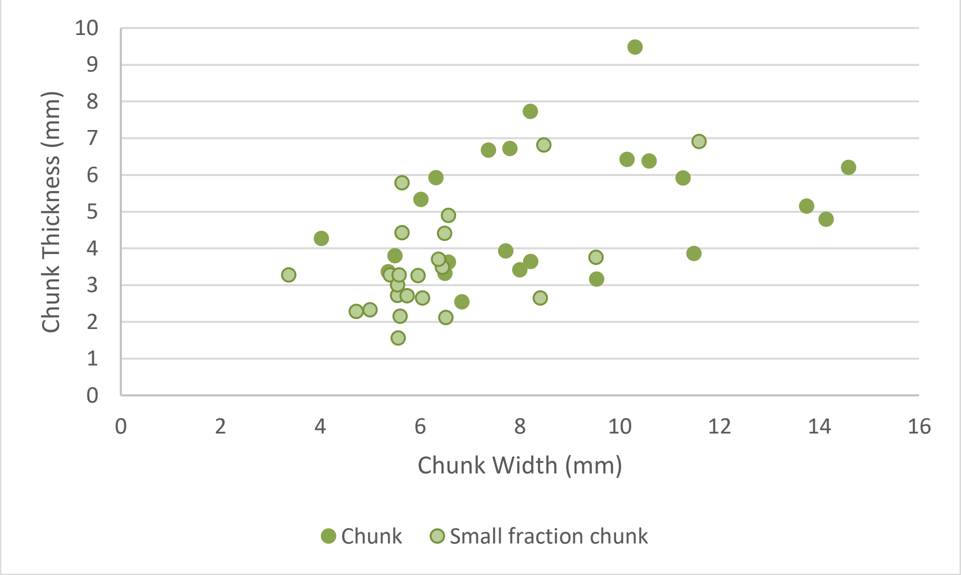


Figure 386. Tràigh na Beirigh 9 chunk and small fraction chunk dimensions width:thickness

12.4.2.3. Cortex

The number of chunks and small fraction chunks without any cortex are equally represented (Figure 387). This is also the case for the number of pieces from each fraction with 100% cortex. There are an equal number of chunks which exhibit both >50%, and <50% cortex; for small fraction chunks <50% cortex is more frequently represented.

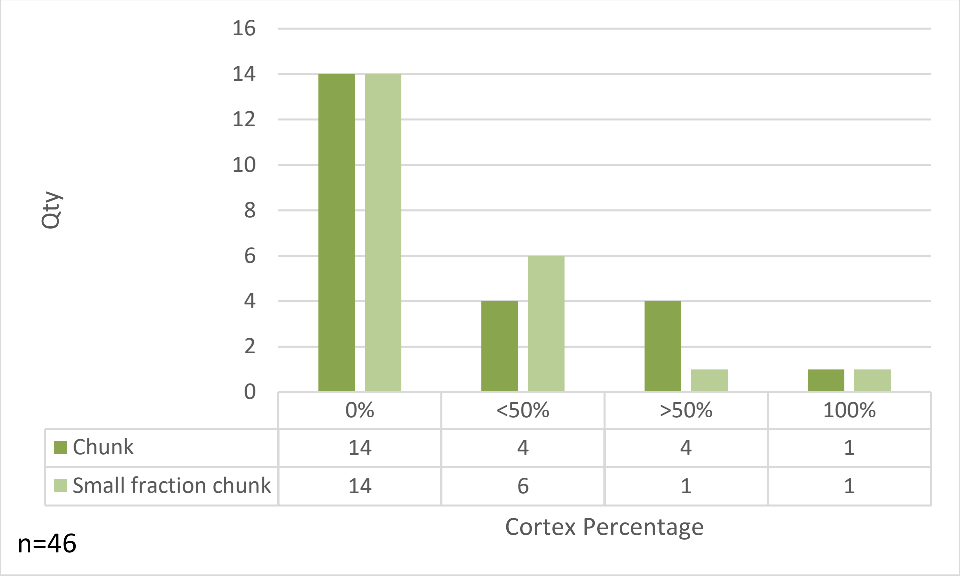


Figure 387. Tràigh na Beirigh 9 chunk and small fraction chunk cortex percentage

12.4.2.4. Breakage

The number of chunks and small fraction chunks are almost equally represented in terms of breakage; the disparity between the two is that there is one more chunk that is not broken (Figure 388).

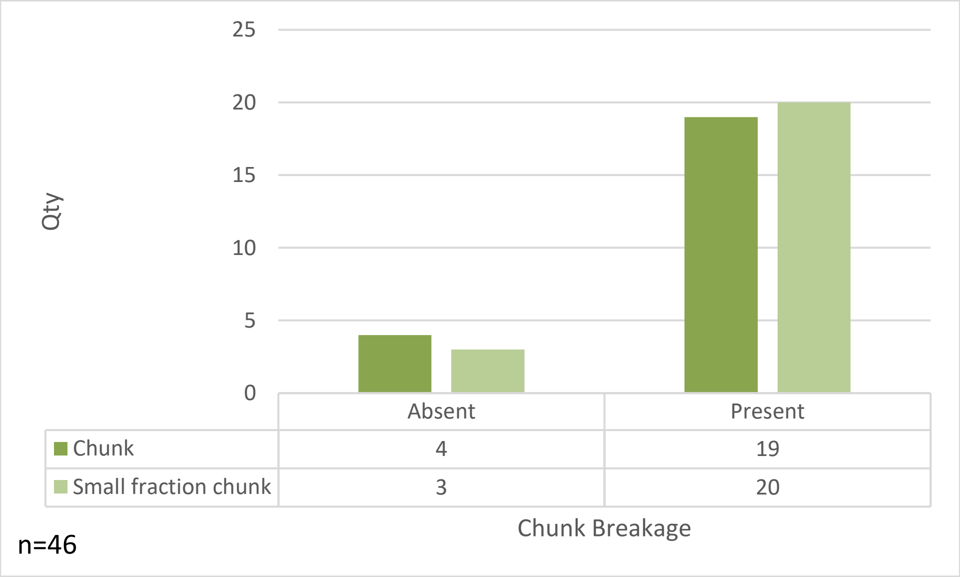


Figure 388. Tràigh na Beirigh 9 chunk and small fraction chunk breakage

12.4.3. A Comparison between C005 and C006

Before successful radiocarbon dates were obtained from the human skeleton at Tràigh na Beirigh 9 a comparison between the quartz flakes of C005 (the undated context in which the skeleton was found), and C006 (the securely dated Mesolithic context) was made. This was in an attempt to establish whether quartz had been treated in the same way between the two contexts. There were several possible outcomes: the quartz was markedly different between the two contexts, suggesting that it had been treated in a different manner, and therefore may be the result of later communities with different reduction techniques exploiting the raw material; the treatment of the quartz was not different between the two contexts, thus quartz was treated the same way over a significant period of time; or the treatment of the quartz was not different between the two contexts, representing a Mesolithic industry, and that the skeleton was potentially Mesolithic in date.

If there was no difference, then ascertaining which of the latter two scenarios as the most probable would was very difficult. Nevertheless, the results would have had interesting implications regardless. The equal sample size of the quartz assemblage from each context (n=35) was ideally suited to this investigation.

12.4.3.1. Raw Material

Only the quartz flakes from these contexts were used for the comparison. Very fine grained (greasy) quartz is the most frequently represented quartz variety in both contexts, which is followed by milky quartz. C006 has a higher number of flakes knapped from quartz which is of mixed varieties, whereas C005 has a larger spread of flakes between varieties with four flakes of fine grained quartz, only two of mixed, and a single flake of coarse grained quartz (Figure 389).

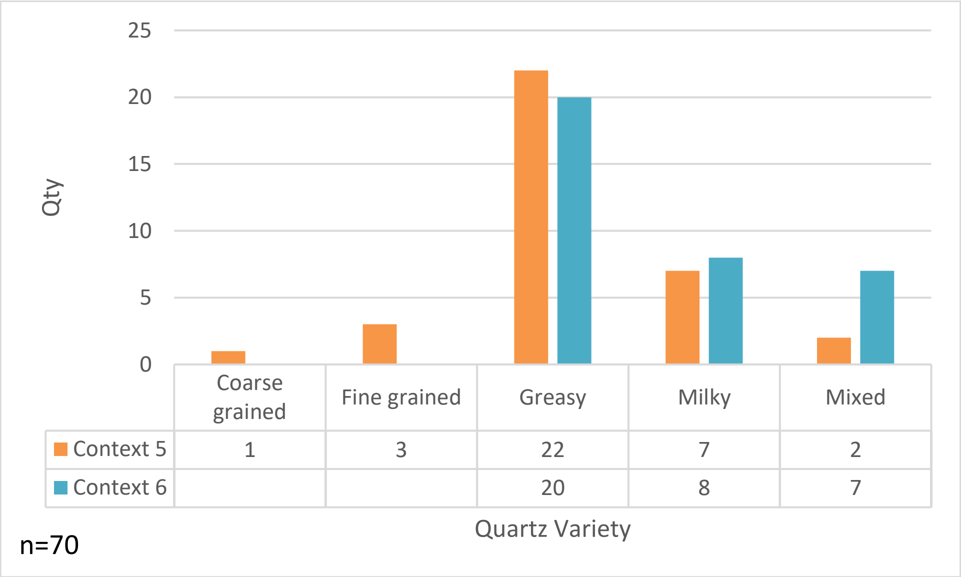


Figure 389. Tràigh na Beirigh 9 quartz varieties from C005 and C006

12.4.3.2. Flake Dimensions

The summary statistics for the flake dimensions are presented in Table 100. C005 has longer flakes on average with a higher standard deviation. The minimum values for width are very different between the two contexts, although the maximum width is very similar. The C005 flakes are substantially wider on average than those from C006, again with a higher standard deviation. The mean thickness for the flakes is very close between the two contexts, despite the different ranges between maximum and minimum values. C006 has a higher standard deviation in this case.

	Length (mm)		Width (mm)		Thickness (mm)	
	C005	C006	C005	C006	C005	C006
Min	10.00	10.03	4.77	3.03	0.96	1.24
Max	27.66	26.5	28.79	28.72	13.21	16.00
Mean	14.71	13.89	14.11	10.53	4.93	4.20
SD	4.062339	3.8426	7.155913	5.906472	2.561694	3.228817

Table 100. Tràigh na Beirigh 9 flake dimension summary statistics between C005 and C006

Both contexts show a clear positive correlation between all of the flake dimensions (Figure 390, Figure 391 and Figure 392).

Between length and thickness, there is a tight grouping between 10-15mm in length and 3-10mm in width, which is more densely populated by flakes from C006 (Figure 390). There are a higher number of flakes that range over a wider length and width, and is indicated by the higher standard deviation value. Single flakes from each context sit apart from the main group as they are very long and wide.

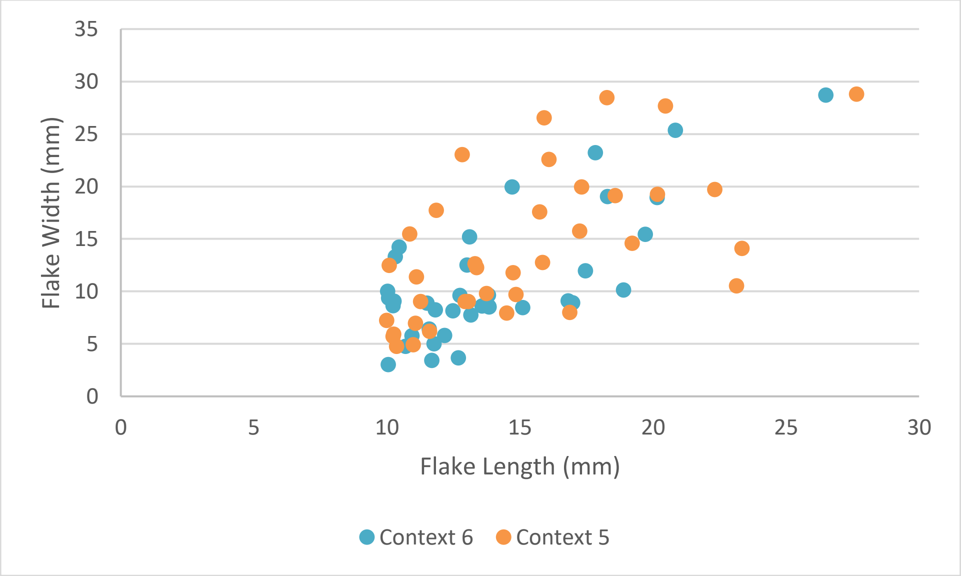


Figure 390. Tràigh na Beirigh 9 quartz flake length:width from C005 and C006

A similar pattern to the one described above is observed in Figure 391. The wider range of the length of C005 flakes is evident, as is the wider range of C006 thickness, which is again consistent with the standard deviation value. There is a tight grouping of C006 flakes between c.1-4mm, resulting in the lower mean value despite the higher standard deviation, whereas the C005 flakes are more dispersed. One flake from C005 is anomalously thick in relation to its length.

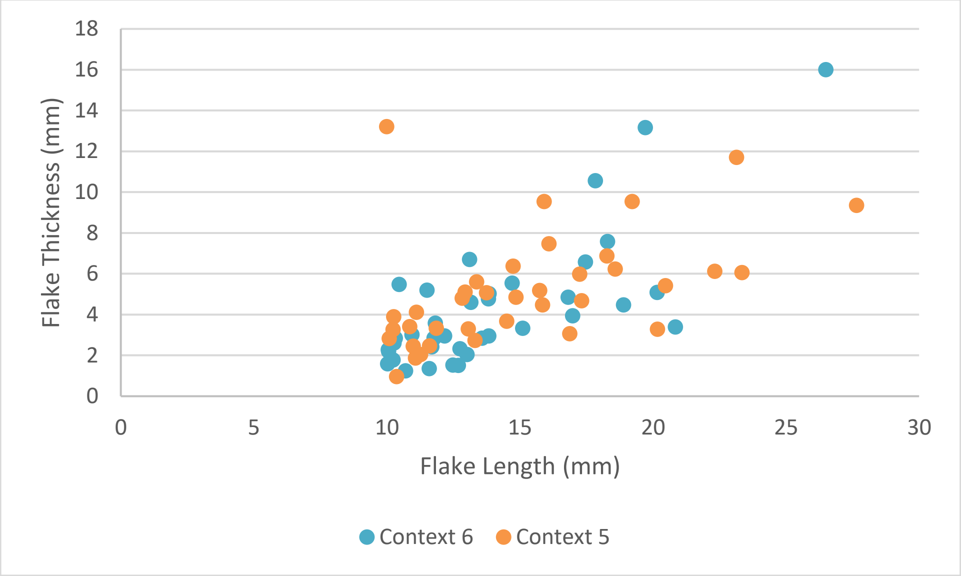


Figure 391. Tràigh na Beirigh 9 quartz flake length:thickness from C005 and C006

On the whole, the width and thickness of the flakes from both contexts are closely linked, however there are three flakes from each context that are notably thicker than other pieces in the assemblage of a similar width. (Figure 392). The majority of flakes are less than 8mm in thickness, and none exceed 30mm in width.

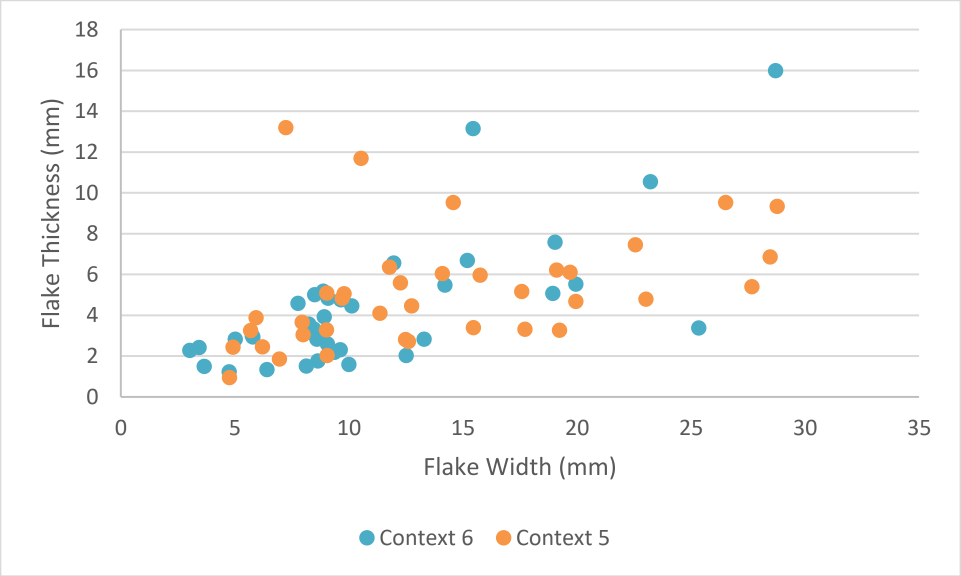


Figure 392. Tràigh na Beirigh 9 quartz flake width:thickness from C005 and C006

A MANOVA statistical test was conducted on the flake dimensions of the quartz flakes from C005 and C006 (Field 2013). Using Wilks's lambda, there was no significant difference between the quartz flake dimensions of C005 and C006:

$$\Lambda = .912, F(3,66) = 2.121, p = .106$$

To test the robustness a Mann-Whitney U test was also conducted on the quartz flakes, between the phases on the ranked values of each dimension (Table 101).

Dimensions (mm)	Mean Rank C005	Mean Rank C006	*U*	*z*	*p*	*r*
Length	37.79	33.21	532.5	-.940	.347	n/a
Width	40.83	30.17	426.0	-2.191	**.028**	-.2619
Thickness	40.44	30.56	439.5	-2.032	**.042**	-.2429

Table 101. Tràigh na Beirigh 9 Mann Whitney U test results on quartz flakes between C005 (n = 35) and C006 (n = 34)

There was no significant difference between the length of C005 flakes and the length of C006 flakes. There was, however a significant difference between the width and thickness of the flakes between these two contexts. The *r* value for both these dimensions indicates that the effect size is only small to medium (Field 2013). Overall, this supports the results of the MANOVA – there is no difference in the dimensions of the quartz flakes between the two contexts.

12.4.3.3. Cortex

The majority of flakes from both C005 and C006 do not exhibit any cortex. Equal numbers of flakes from C005 and C006 display <50%, with marginally more flakes from C005 retaining >50% cortex than those from C006. There are slightly more flakes with 100% cortex from C006 (Figure 393).

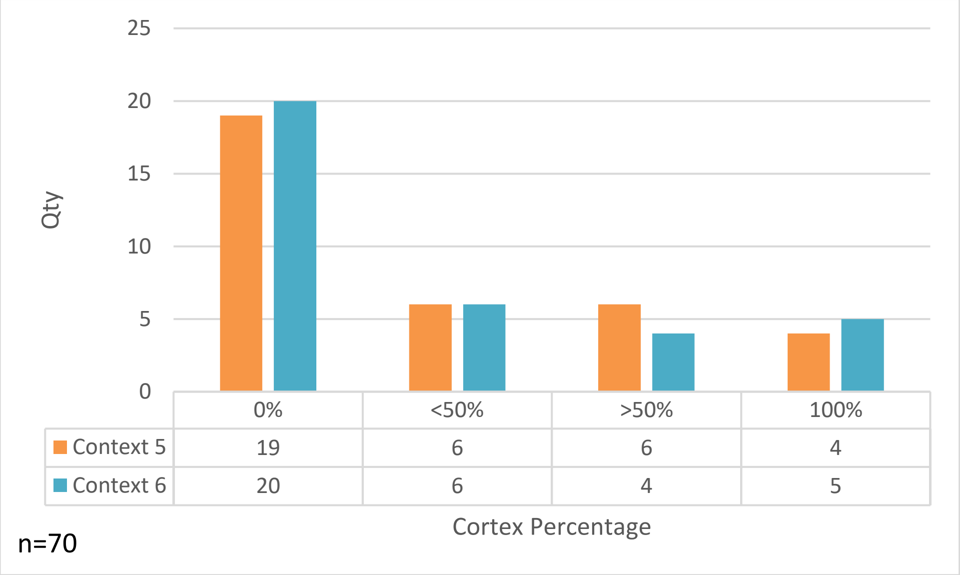


Figure 393. Tràigh na Beirigh 9 quartz flake cortex percentage from C005 and C006

12.4.3.4. Striking Platform – Type and Dimensions

The vast majority of platforms from C006 are absent, with broken/crushed platforms also represented in high numbers (Figure 394). Only three flakes from C006 exhibited plain platforms. For C005 the highest number of flakes had damaged platforms, followed by flakes where the platforms were absent. Of the flakes from this context where the platform could be recorded, a single platform still retained cortex, two had plain platforms, and two were facetted. One was completely indeterminate.

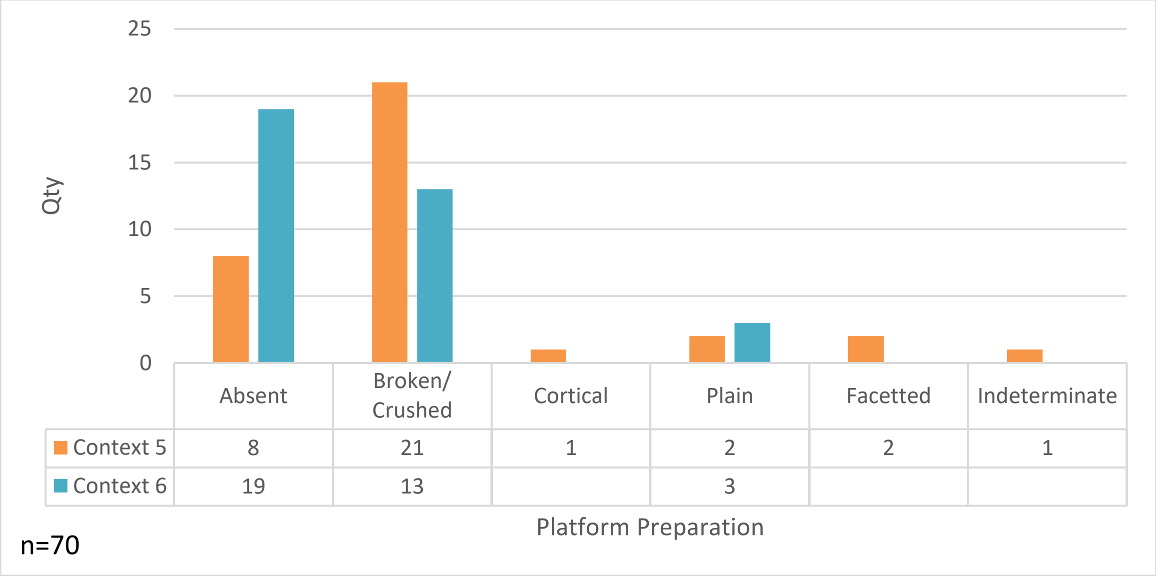


Figure 394. Tràigh na Beirigh 9 quartz flake platform type from C005 and C006

The width of the platforms ranges widely for both of the contexts (c.5-25mm) with a comparatively narrow range of platform depth (c. 4-8mm; Figure 395). The main cluster sits between c.5-10cm in length. One of the flakes from each context stands apart from the rest of the group in terms of greater width and/or thickness.

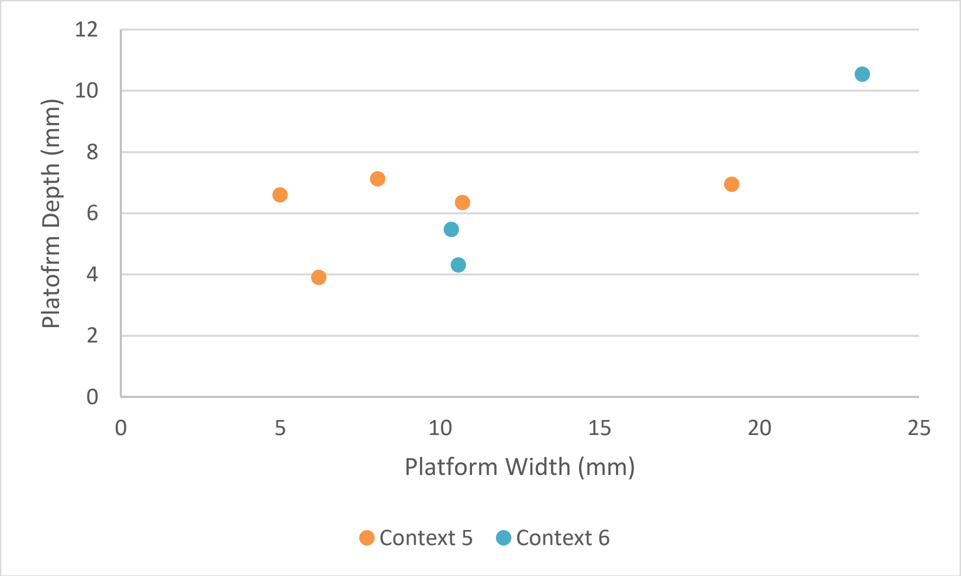


Figure 395. Tràigh na Beirigh 9 quartz flake platform dimensions from C005 and C006

12.4.3.5. Dorsal Flake Scars – Count and Pattern

Single dorsal flakes scars are most frequently recorded on flakes from both contexts (Figure 396). In C006, there are more flakes with two dorsal flakes scars than three, whereas in C005 the opposite is true. Only C005 has flakes that display four or more dorsal flakes scars.

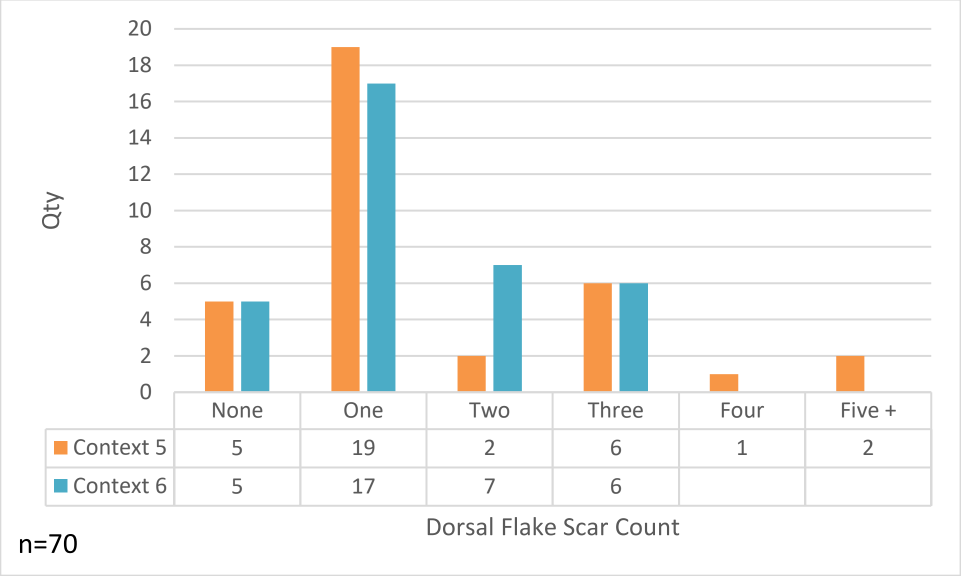


Figure 396. Tràigh na Beirigh 9 quartz flake dorsal scar count from C005 and C006

Equal numbers of flakes from both contexts display multidirectional dorsal flake scar patterns, although this is not the most commonly observed pattern – a unidirectional pattern is dominant (Figure 397). A small number of flakes have indeterminate removal patterns and a single flake from C006 shows a bidirectional removals. This is not evidence of bipolar technology, but of an alternating reduction sequence.

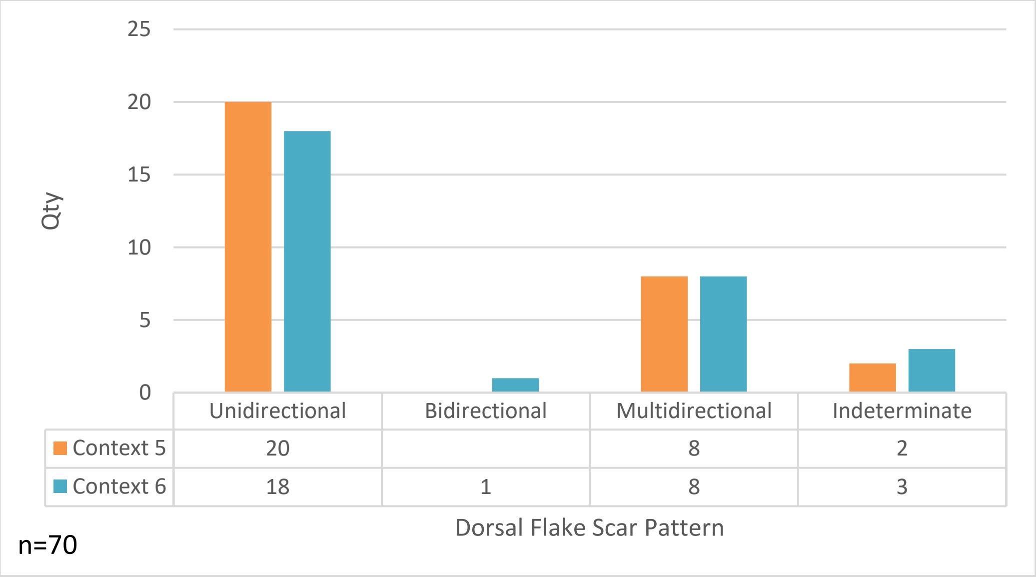


Figure 397. Tràigh na Beirigh 9 quartz flake platform dorsal scar pattern from C005 and C006

12.4.3.6. Breakage

Flake breakage is highly prevalent in both contexts, with flakes from each context represented almost equally in each category (Figure 398).

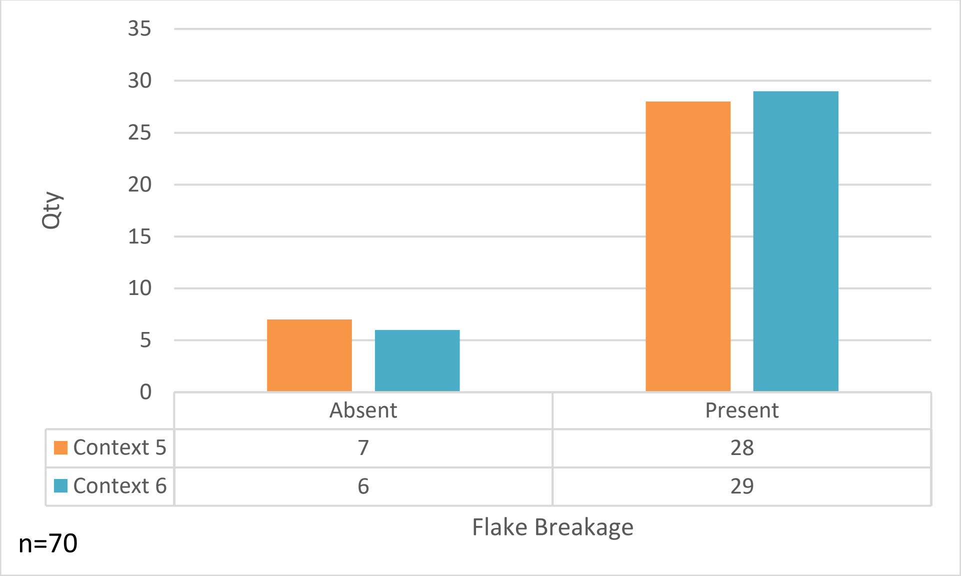


Figure 398. Tràigh na Beirigh 9 quartz flake breakage from C005 and C006

12.4.3.7. Concluding Remarks

The quartz flakes that were from C005 and C006 at Tràigh na Beirigh 9 have been treated in an identical manner throughout, suggesting that either the skeleton was Mesolithic in date, or that the reduction of quartz had not changed significantly over a long period of time. Following the successful radiocarbon dating of a tooth from the skeleton, it was evident that the material surrounding it was Mesolithic in date. Consideration of the site formation processes indicates that the quartz lithics present in C006 are likely to have been redeposited, as the material from the underlying midden, into which the grave had been cut, was subsequently used to fill the grave.

12.5. Pabaigh Mòr South

12.5.1. Small Fraction Flakes

Four small fraction (<10mm) flakes were recovered from Pabaigh Mòr South in C002. Two of them are milky quartz and two are greasy quartz. Their dimensions are presented in Table 102. None of the small fraction flakes have any cortex present and three of the small fraction flakes are complete.

Catalogue No.	Quartz Variety	Length (mm)	Width (mm)	Thickness (mm)
L3	Milky	6.22	5.47	2.06
L5	Milky	9.86	9.31	1.14
L6	Greasy	3.99	9.84	1.74
L8	Greasy	7.06	11.10	1.45

Table 102. Pabaigh Mòr South small fraction flake dimensions

12.5.2. Chunks

There were two chunks recovered from Pabaigh Mòr South, both from the main body of the shell midden (C002). L4 is a chunk of greasy quartz which is broken and did not retain any cortex. L9, a milky quartz chunk, is also broken but exhibited less than 50% cortex. The dimensions of the chunks are presented in Table 103.

Catalogue No.	Quartz Variety	Length (mm)	Width (mm)	Thickness (mm)
L4	Greasy	9.81	6.63	4.33
L9	Milky	15.14	9.25	5.64

Table 103. Pabaigh Mòr South chunk dimensions

Appendix 13 Thin Section Analysis of Baked Mudstone

13.1. Introduction

In Chapter Five, it was established that determining the lithological differences between two raw materials – mylonite and baked mudstone – could not be definitively ascertained based on visual inspection alone. In order for the composition of these raw materials to be better understood, thin sections were made using standard petrographic techniques (Goldberg & Macphail 2008). The thin sections were examined under increasing magnifications using a high-powered binocular microscope, using both cross-polarising (XPL) and plain polarising (PPL) light.

This study simply aimed to gain a quantitative understanding of the lithological differences between these raw materials: *are these raw materials mylonite or baked mudstone?* As such, only basic descriptions of the lithological components of each thin section have been undertaken. Two samples were taken from Northton and one sample from Tràigh an Teampuill. The thin section descriptions were then compared to two previously examined thin sections held within the British Geological Survey (BGS) minerology and petrology collection database (British Geological Survey 2016b). The first reference sample is of mylonite (S73582) taken from “S shore of Toe Head, 32 m at 112 deg from Chapel (ruin)”. This sample has erroneously been recorded as taken from North Uist, as is clear from the grid reference, which places it slightly beyond the site of Tràigh an Teampuill (Collins & British Geological Survey 2016b). The other reference sample is a baked shale (S72034), which was used in the initial thin section study of the Beaker-age flake from Northton by Phillips (2006b). This piece is derived from the cliff exposure at An Corran, at the south end of Staffin Bay (Collins & British Geological Survey 2016a).

13.2. Thin Section Descriptions: Archaeological Samples

13.2.1. Northton L50

This sample has a poorly-sorted, matrix-supported texture with no apparent preferred orientations of clasts, and a large range of grain sizes. The coarse, sand-sized fraction predominantly comprises angular to sub-angular quartz, with a minor feldspar component. There is also a small proportion of very-fine sand to silt sized, dark, opaque mineral clasts, which are much smaller in size than the quartz and feldspar fractions. The fine fraction is mainly clay, variously stained by both organic material and iron oxides, with some quartz silt (Figure 399 and Figure 400).

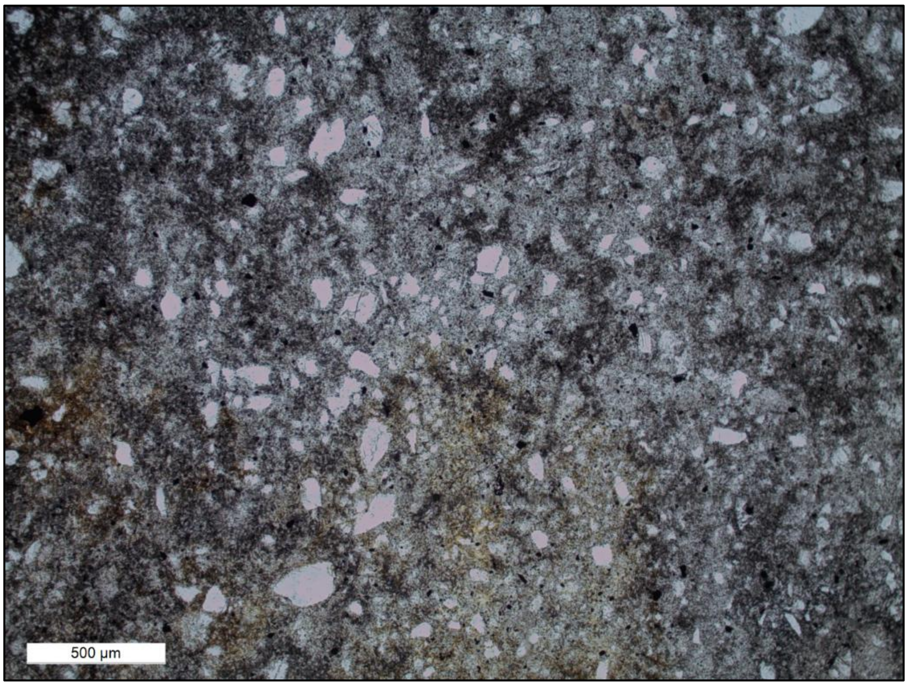


Figure 399. Northton L50 thin section under PPL

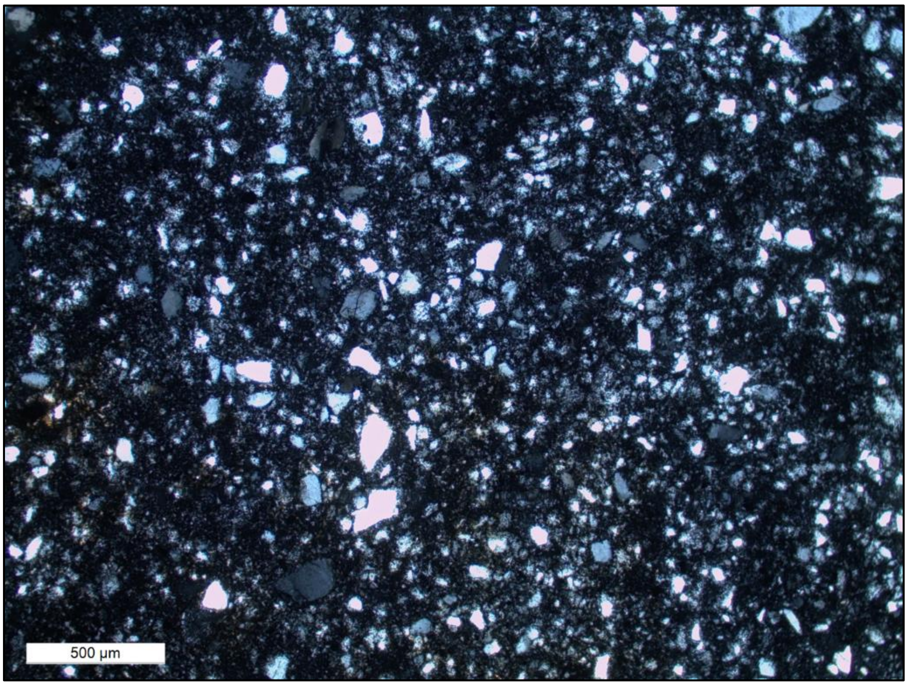


Figure 400. Northton L50 thin section under XPL

13.2.2. Northton SF96

The texture of this thin section is also matrix-supported. The grain sizes range from fine sand to clay, which is considerably less than that of sample L50, discussed above. A definite preferred orientation of fine-sand sized quartz clasts are observed in this sample, oriented in bands from top-right to bottom-left (Figure 401). This banding is clearer under XPL than PPL (Figure 402). There are possible secondary calcite coatings along the preferred orientation plane, or preferential orientation of the clay particles as a result of metamorphosis.

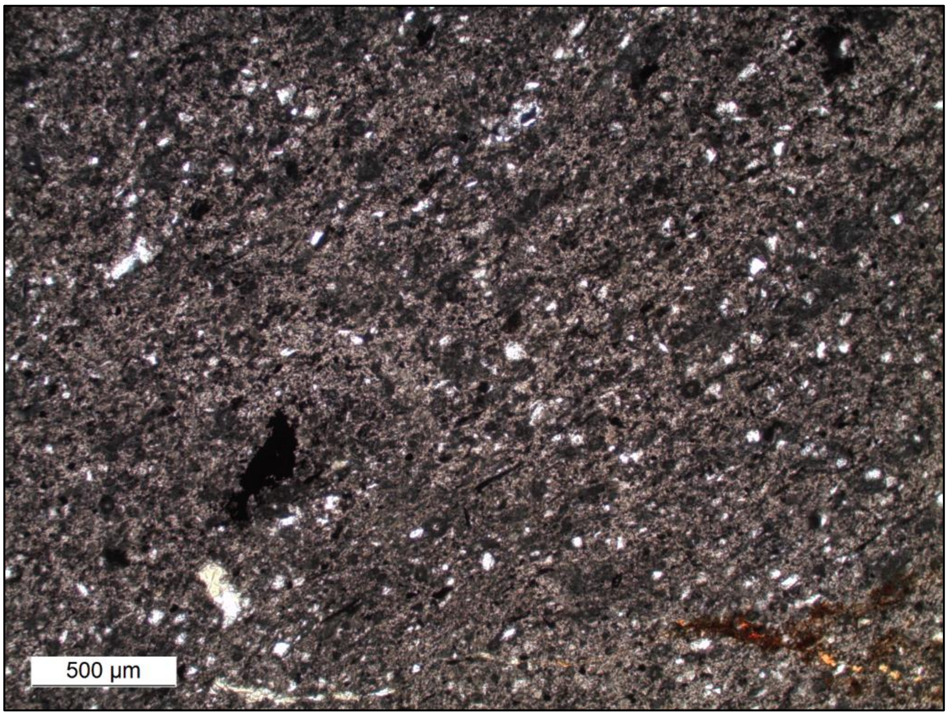


Figure 401. Northton SF96 thin section under PPL

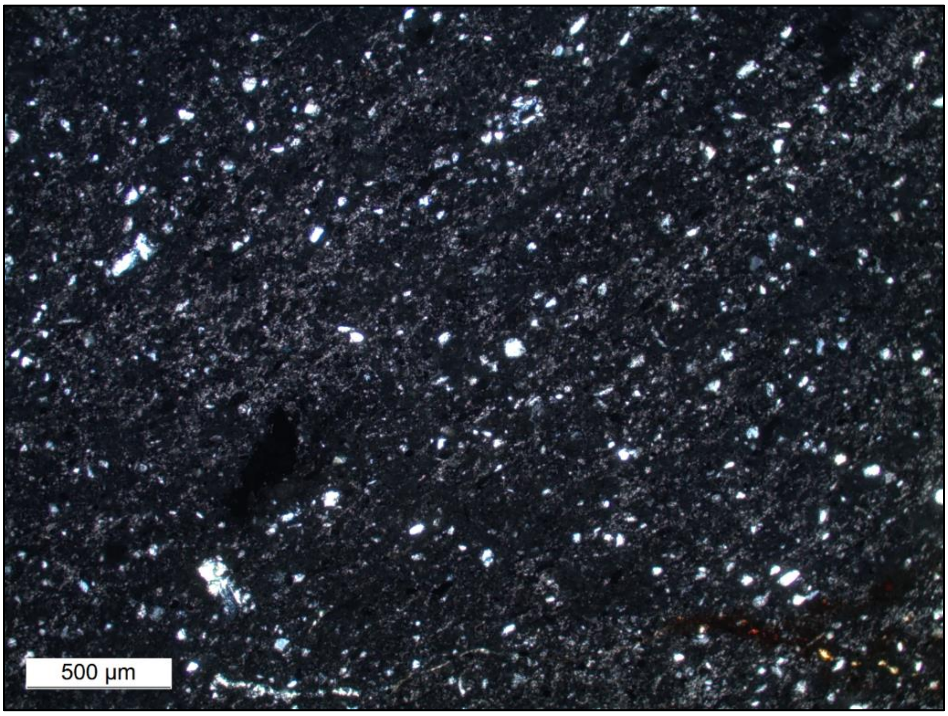


Figure 402. Northton SF96 thin section under XPL

13.2.3. Tràigh an Teampuill L37

This thin section also displays a poorly-sorted, matrix-supported texture with no preferred orientation of clasts. The range of grain sizes is similar to that of Northton L50, comprising sand to clay-sized particles, although there is a lower abundance of larger clasts. The sand-sized fraction is dominated by angular to sub-angular quartz, and the fine fraction is mainly comprised of quartz silts with a minor component of clays (Figure 403 and Figure 404).

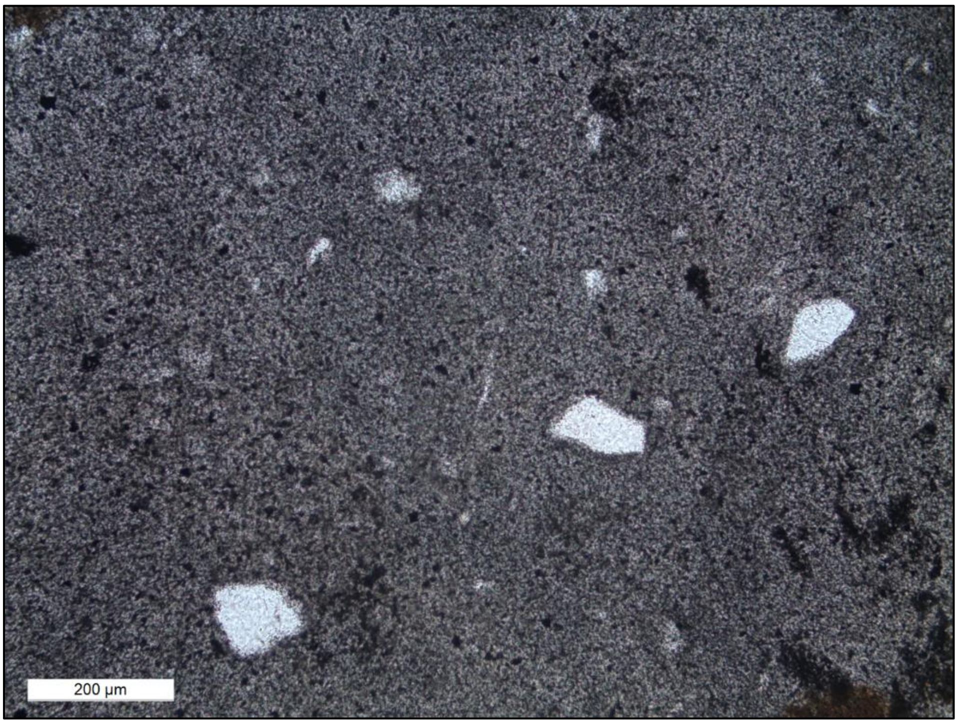


Figure 403. Tràigh an Teampuill L37 thin section under PPL

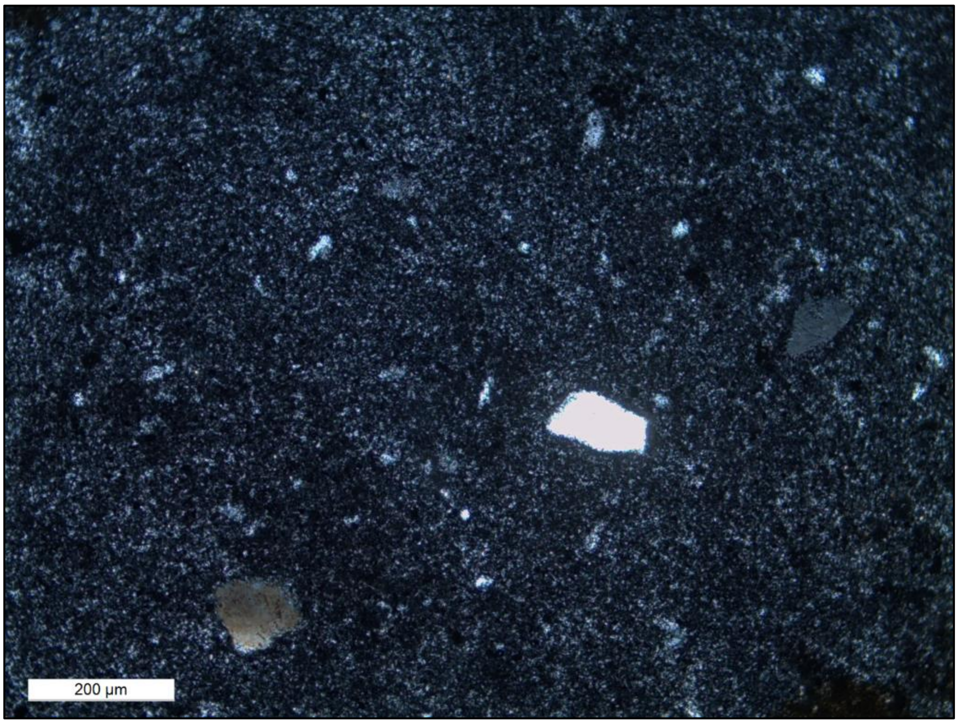


Figure 404. Tràigh an Teampuill L37 thin section under XPL

13.3. Thin Section Descriptions: Reference Samples

13.3.1. Mylonite: S73582

This thin section exhibits a highly crystalline texture entirely comprising inter-grown quartz and feldspar grains, with very few void spaces. It shows marked foliation and a strongly preferred orientation in the bimodal distribution of crystal sizes, which results in a banded appearance. Some of the void spaces have been secondarily infilled, possibly with chlorite, which also align with the preferred orientation of the sample (Figure 405 and Figure 406).

Figure 405. Mylonite (S73582) thin section under PPL. Contains British Geological Survey materials © NERC 2016. No scale available

Figure 406. Mylonite (S73582) thin section under XPL. Contains British Geological Survey materials © NERC 2016. No scale available

13.3.2. Baked Shale: S72034

Due to the low magnification available for this sample, only a very broad description can be made regarding its lithology. The sample displays distinctive foliation of coarse and fine-grained clasts. The coarse fraction appears to be dominated by rounded to sub-rounded quartz grains, with some feldspar inclusions also likely. It is probable that the fine-grained fraction comprises quartz silts or clays, however it is difficult to be certain. There is moderate sorting of grains within each of the foliated bands; however, over the entire face of this thin section, sorting is poor (Figure 407 and Figure 408).

Figure 407. Baked shale (S72034) thin section under PPL. Contains British Geological Survey materials © NERC 2016. No scale available

Figure 408. Baked shale (S72034) thin section under XPL. Contains British Geological Survey materials © NERC 2016. No scale available

13.4. Interpretation and Conclusions

It is clear that the three raw material samples, recovered from the Mesolithic sites on Harris and analysed here, differ considerably from the mylonite sample found within the BGS reference collection. Given the mylonite was sampled within the immediate vicinity of the sites, this is significant in terms of determining whether this locally available material was utilised during the Mesolithic occupation of the Toe Head Peninsula.

The high degree of crystallinity in the mylonite sample, which is a high-grade metamorphic rock, is not evidenced in any of the archaeological samples (Haldar 2013:220). Instead, the thin section analyses indicate that these samples are pelitic sedimentary rocks (Haldar 2013:159-162). The presence of calcite infillings in SF96, suggest this is a pelitic sedimentary rock that has been slightly metamorphosed. As such, the samples analysed are characteristic of the argillaceous lithologies found within the Staffin Shale Formation, specifically sandy siltstones (Survey 2016a; Trewin 2002:349). The Staffin Shale Formation was deposited during the Jurassic period, therefore it is possible that these lithologies have been slightly metamorphosed due to the extensive regional igneous activity that occurred during this period (Trewin 2002:349). In this instance, these lithologies could be colloquially termed ‘baked mudstones’.

Appendix 14 Gleann Mor Barabhais Survey Records

Table 104. Catalogue of sites recorded during the survey of Gleann Mor Barabhais

Site No.	NGR (centred)	Site Type	Previously Recorded?	SMR No.	NMR No.	Photo No.	Eroded	Estimated Date	Description/Interpretation
1	NB3505149392	Structure and lazy beds	No	N/A	N/A	DP51-55	No	Medieval-Modern	A rectangular structure oriented N-S with a possible entrance to the N although this is indistinct. Exterior dimensions 23.5x11.3m, interior dimensions 18.5x8.2m. The W wall appears to have been robbed out to construct a modern wall immediately behind. Only a single course of very large (>50cm) sub-rounded stones (0.8m high) is visible at ground level on the S wall and in the lower coursing of the modern wall. Sixteen lazy beds orientated E-W are associated with the structure.
2	NB3535049165	Lazy beds	No	N/A	N/A	DP56-63 DP67-68	Yes	Medieval-Modern	A large area of lazy beds c.500x120m running in several directions. Several of the beds are truncated by the river and the eroded section was observed from Site 4 where the original ground surface was visible below the beds.
3	NB3548549077	Structures and lazy beds	No	N/A	N/A	DP66 DP69-87	Yes	Medieval-Modern?	Area of lazy beds extending over an area c.100m², some truncated by the river. A series of 11 sub-rectangular structures were also identified associated with the lazy beds. The ridges of the beds have been used as E and W walls of the structures, with entrances to the N and S. There is minimal evidence of stone coursing (only a single stone identified in the complex); turf walling appears to have been added to the tops of the ridges to create additional height and to create entrances. Structure 1 3.4x4.2m; Structure 2 3.9x3.8m; Structure 3 5.2x4.6m; Structure 4 4.9x3.9m; Structure 5 4.5x5.6m; Structure 6 6.2x5.5m; Structure 7 9.5x5.5m; Structure 8 9.2x5.3m; Structure 9 6x5.5m; Structure 10 17.5x6.2m; Structure 11 5.8x6.4m. Age and function unknown.
4	NB3527849332	Lazy beds	No	N/A	N/A	DP88	Yes	Medieval-Modern	Lazy beds running in several directions over c.150m. Several beds were truncated by the river and investigation of the eroded sections revealed sandy deposits with little organic content and no cultural material was visible. Agricultural.
5	NB3508749464	Lazy beds	No	N/A	N/A	-	No	Medieval-Modern	Five lazy beds orientated NW-SE over an area c.10x20m. Agricultural.
6	NB3561148770	Lazy beds	No	N/A	N/A	-	No	Medieval-Modern	Two, possibly three lazy beds orientated NE-SW over a c.10m² area. Agricultural.
7	NB3608148183	Wall	No	N/A	N/A	DP89-90	No	Modern	A wall 13.5x1m oriented N-S almost along the bank of the river, comprised of a single course of large (>20cm) sub-rounded stones visible at ground level, however a maximum of three courses were visible in the bank section above water level at a height of 1m. Likely function as bank stabilisation.

8	NB3634847995	Wall	No	N/A	N/A	DP91-94	Yes	Modern	Two linear walls oriented NW-SE comprising large (>20cm) to sub angular stones with a maximum of two courses visible (varying height of 0.3-0.6m). The landward wall extends for 17.8m before a 90° return towards the SW, which extends for 3m, followed by an indeterminate change of course to the original orientation. The second wall, closer to the river extends for c.17m. Both walls are c.0.54m in width and although there has been some animal erosion and scatter of stones there is clear facing of both walls on their NE side. Likely function as bank stabilisation.
9	NB3627048031	Wall	No	N/A	N/A	DP99	No	Modern	A stretch of wall 10.4mx0.6m built into the bank close to the river, oriented E-W. A maximum of three courses of large (>20cm) sub-angular stones were visible (0.5m high). Likely function as bank stabilisation.
10	NB3653647841	Wall	No	N/A	N/A	DP100	No	Modern	A small stretch of wall c.5x0.5m running E-W comprising large (>20cm) sub-angular stones. A single course is visible (c.0.3m in height) at ground level at the western extend for c.2m before becoming more indeterminate for the remainder of the extent towards the east. Likely function as bank stabilisation.
11	NB3666347622	Lazy beds	No	N/A	N/A	-	No	Medieval-Modern	Five lazy beds orientated NW-SE and running parallel to the river for c.200m. Agricultural.
12a	NB3699047113	Wall	No	N/A	N/A	-	Yes	Modern	A wall 10.9x1.3m orientated NW-SE comprising large (>20cm) sub-angular stones with a maximum of three courses (c.0.5m high) visible. The wall may have originally been higher as there was a significant amount of tumbled stones in front of the NW face indicating collapse. Likely function for bank stabilisation.
12b	NB3673547498	Wall	No	N/A	N/A	DP101-102	No	Modern	A substantial extent of wall 25x2.8m comprising a single visible course of large (>20cm) sub-angular stones (0.2m high) oriented NW-SE. A possible earlier phase was noted to the NE face with facing stones set well into the ground. The single course of facing stones set back from this indicates a later phase of maintenance. It is probable that this wall is still being reinforced as the N, S, and E extent were very well defined with no grass coverage or tumble. Likely function as bank stabilisation.

13	NB3703146894	Structures and lazy beds	Yes	3189	131382	DP107-111	Yes	Medieval-Modern	Two structures in association with a system of lazy beds. Structure 1 exterior dimensions 11.3x7.7m, interior dimensions 8.9x4.4m is the smaller of the two structures. The structure is visible as earthworks c.0.6m in height with a few large (>20cm) stones visible which may attest to stone-walling. A possible entrance is situated in the S facing wall. Structure 2 comprises much more substantial earthworks, although still only 0.8m in height. The external dimensions measure 17.7x8.9m and the internal dimensions 12.8x3.8m - this large discrepancy in measurements indicates a high degree of collapse. As with structure 1 there are a few large (>20cm) sub-angular stones visible attesting to stone walling. There is a N facing entrance which is contained by a small semi-circular stone (medium, >10cm) walled feature which measures 4.2x4.2m. This 'annexe' has a possible W facing entrance. The structures confirm the NMR record. Some lazy beds truncated by the river and adjoining head dyke system. Situated directly opposite Site 16 and may possibly be associated with the same phase of settlement.
14	NB3731746652	Wall	No	N/A	N/A	-	No	Modern	A wall c.6x1m running N-S comprising large (>20cm) sub-angular stones with a maximum of three courses (c.0.5m high). Likely function as bank stabilisation.
15	NB3744546572	Lazy beds	No	N/A	N/A	-	Yes	Medieval-Modern	Eight lazy beds orientated N-S covering an area of c.100m². Two were truncated by the river and it was possible to see the relic ground surface below the beds, although no cultural material was identified. Agricultural.
16	NB3710946940	Lazy beds	No	N/A	N/A	-	No	Medieval-Modern	Four, possibly five lazy beds c.50m in length orientated NW-SE. These were situated directly opposite Site 13 and may possibly be associated with the same settlement phase. Agricultural.
17	NB3704847115	Lazy beds	No	N/A	N/A	-	Yes	Medieval-Modern	Four lazy beds c.50m in length orientated NW-SE, two of which were truncated by the river at their southern extent. Agricultural.
18	NB3672547573	Wall	No	N/A	N/A	DP112-113	No	Modern	A stretch of wall 18.6x0.4m forming part of the river bank comprising very large (>50cm) sub-angular stones. A maximum of four courses were visible above the water level (c.0.8m high). River bank revetment.

19	NB3753746661	Structures and lazy beds	Yes	3191	131384	DP114-121	Yes	Medieval-Modern	Four structures associated with a system of lazy beds extending over an area c.200x50m. Structure 1 comprises earthworks, sub-circular in plan and measuring 6.9x7.3m. A few large (.20cm) sub-angular stones are also visible which may suggest stone walling. A possible semi-circular annexe is present to the NW although this, and any entrance is indeterminate. Structure 2 is positioned to the S of Structure 1 and comprises very indeterminate sub-circular earthworks measuring 5x3.4m. Both these structures are situated on the E bank of a stream/head dyke that bisects the site, with Structures 3 and 4 on the east bank. Structure 3 is visible by irregularly shaped earthworks, with no stonework visible. It may have been rectilinear in plan with a curved south wall and measures 14.4x9.2m. Structure 4 is also only visible as earthworks with an elevated circular area to the N with a lower, rectilinear 'annexe' to the S - the whole structure measures 14.7x7.6m. Some lazy beds to the E truncated by the stream, no cultural material was visible in the section. Majority of the lazy beds are orientated N-S. The survey has confirmed that there are four structures still visible of the original possible ten unroofed shieling huts that were identified on the 1st Edition OS map, but were not present on the current 1:10000 map (1974).
20	NB3843645375	Structures	Yes	3197	131390	DP126-135	No	Medieval-Modern?	A series of four structures, two of which (Structures 1 and 2) were situated on the top of a steep bank, whereas the other two (Structures 3 and 4) were situated by the river, directly below Structures 1 and 2. Structure 1 comprised circular earthworks with very indeterminate edges, therefore the dimensions of 7.3x7m are very approximate. There was no stonework visible for this structure. Structure 2, to the S of structure 1, also comprised indeterminate sub-circular earthworks with approximate dimensions of 5.3x4.4m. Some large (>20cm) stones were intermittently visible. Structure 3, to the E of structure 1, comprised large earthworks (15.1x12.5m) of substantial height (c.2m) and was ovoid in plan with an irregularly shaped 'annexe' (6.2x7.6m) to the N. A single stone was visible in the centre of the structure and may represent collapsed stone walling. Structure 4, to the E of structure 2 comprised ovoid earthworks 7.3x6.8m and no stonework was visible. This survey indicates that there are more structures remaining than the single unroofed building reported as present on the current 1:10000 (1974) OS map, of the original six roofed shieling huts that were visible on the 1st Edition.
21	NB3864844997	Shieling	Yes	3218	131411	DP136-138	No	Medieval-Modern	A single structure comprising roughly ovoid earthworks and standing stonework 5.8x5.1m. At the NE extent a maximum of four courses of large (>20cm) sub-angular stones are visible forming a D-shaped 'alcove' with a very large (>30cm) flat lintel-like slab which had partially slumped by the collapse of some of the supporting stonework within the interior of the structure. Confirms the current CANMORE entry.

22	NB3895544345	Shieling	No	N/A	N/A	DP139-140	No	Medieval-Modern?	A small stone rectilinear structure measuring 3.5x3.1m likely to be a shieling orientated N-S. The large (>20cm) to medium (>10cm) sub-angular stone walling stands to a maximum of four courses (0.5m high). A possible entrance is situated in the W wall.
23	NB3810046139	Lazy beds	No	N/A	N/A	-	Yes	Medieval-Modern	Ten lazy beds covering an area c.100x50m orientated NE-SW. The southern extent of the lazy beds were truncated by the river and two beds were eroded down the centre by a small tributary stream. Agricultural.
24	NB3790246095	Lazy beds	No	N/A	N/A	-	No	Medieval-Modern	Fifteen lazy beds covering an area c.100x50m running in several directions. Agricultural.
25	NB3752246499	Lazy beds	No	N/A	N/A	-	No	Medieval-Modern	Fourteen lazy beds orientated N-S and six beds orientated E-W covering an area c.100m². These are situated directly opposite Site 19 and may be part of the same settlement phase. Agricultural.
26	NB3888944252	Structures	Yes	12156	136372	DP141-144	No	Medieval-Modern?	Two structures identified. The first is a small sub-circular earthwork 3.7x4.2 with no stonework visible and a small linear feature extending from the southern extent towards Structure 2. This structure was sub-rectangular in plan comprising a maximum of seven courses of large (>20cm) sub-angular stones and a turf bank supporting the exterior. The exterior measures 5.9x4.8m and the interior 3.4x1.9m. A single alcove was built into the eastern wall in the interior, directly opposite the entrance in the western wall. The structure is listed in the NMR a possible shieling hut that can be seen on both the 1st Edition (1852) and current 1:10000 (1972) maps. The association and function of the earthworks to the N is unknown.
27	NB3841843585	Earthworks	No	N/A	N/A	DP145-146	No	Unknown	Ovoid earthwork with a possible entrance facing NW, measuring 5x6.3m. Indeterminate linear earthwork to the W. Situated directly opposite Site 28. Form and function unknown.
28	NB3838443592	Structure	Yes	12153	136323	DP147-152	No	Medieval-Modern	A structure ovoid in plan that may have been a beehive shaped building from the shape of the walls (clearly NOT slumping). The structure is oriented E-W with entrances in the N and S walls, with four alcoves built into the W wall. There are a maximum of seven courses of large (>20cm) sub-angular stones 1m in height. The external dimensions measure 5.3x4.4m and the internal dimensions measure 2.8x1.9m. It is situated directly opposite Site 27, although any association cannot be determined. This was the only structure identified of a possible five unroofed structures depicted on the current 1:10000 (1972) map, which remained of four roofed and thirteen unroofed possible shieling huts that were present on the 1st Edition OS map (1852).

29	NB3872844227	Structure	Yes	12155	136325	DP153-155	Yes	Medieval-Modern	A sub-rectangular structure oriented N-S with two entrances in the E and W walls which are biased towards the S end of the structure. Four alcoves in a two-by-two arrangement were built into the N wall, which has slumped considerably. There are two alcoves built into the E wall to the N of the entrance. The exterior dimensions measure 4x4.9m and the interior dimensions measure 3x1.9m. The walling survives to a height of 0.9m with maximum of five courses of large (>20cm) sub-angular stone visible. This is most likely to be the single structure present on the current 1:10000 map, which is all that remains of four unroofed structures depicted on the 1st Edition OS map (1852).
30	NB3746546484	Possible OGS	No	N/A	N/A	DP122-125 DP156-162	Yes	Holocene?	A dark-brown/black organic layer overlying a thin layer of grey clay and glacial till and underlying orange-brown alluvium, extending for c.5m in an eroding section of the river bank and sheep scrape. This may be a possible Holocene ground surface based on the stratigraphy and possible anthropogenic activity is attested by the presence of charcoal flacks in the deposit. A 0.95m stretch was bulk sampled for RST and two soil-micromorphology samples were taken.

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