UNIVERSITY OF GLASGOW

The Utilisation and Exploitation of Plants at Norse Age Sites in the North of Scotland

- A Study embracing sites in Caithness, Orkney and Shetland.

by

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This thesis is submitted in accordance with the requirements for the degree of Master of Science, Faculty of Science, Department of Archaeology, University of Glasgow.

SUMMARY

In this thesis, I will examine the utilisation and exploitation of cultivated and wild plants with particular reference to the subsistence economies and to the material culture in Caithness, Orkney and Shetland (Fig 1) during the Norse Period. In doing so, I would seek to present a case to suggest that in many instances it is possible that cultivated plants, other than just cereals, together with wild plant species were exploited intentionally as an important food, culinary, medicinal and material resource in the domestic economy.

The opportunity will be taken in Chapter 1 to look at the geology, soils and climatic information that is available. Consideration will also be given to the various pollen analytical investigations which have been published and which will provide an insight into the past ecology of these land masses. All this information will help to provide a picture of the past environment, the available plant resources and the conditions for plant production.

In Chapter 2 a range of written sources will include reference to the Orkneyinga Saga and will also take account of the available information that can be derived from the study of place-names and their distribution.

A wealth of ethnohistorical information will be taken account of in Chapter 3, with particular attention to the traditional lifestyle of the past communities living in the Northern latitudes. This information will allow, to a great extent, the reconstruction of earlier times to be made.

The role of Chapter 4 will be to briefly present details of the archaeological excavations at the sites that have been included in this study; and to provide the detailed evidence from the sites of the

domestic economies with particular reference to the crop plants and other plant remains that have been identified to date.

In Chapter 5 an analysis will be undertaken of the available evidence of both cultivated and wild plant resources with a view to assessing their role and importance in the economic strategies and sociopolitical needs of the Norse communities.

Past recorded uses will be taken into account in proposing the potential uses of many of the plant species discovered on the sites. Particular attention will be given to relating such information to the dietary/medicinal needs as well as the potential craft and industrial uses. The means by which plant material came to be carbonized will also be considered, and the likely availability and sources of tree species will be taken account of.

The intention of Chapter 6 will be to consider and compare the evidence of plant remains from other sites of comparable age in Britain, Ireland and Scandinavia, with particular attention to faecal deposits. Such undisputed evidence of dietary food sources will provide a useful comparison of plant species being consumed on these sites with those found on the sites within the study area.

In the final, Chapter 7, it is proposed to outline the main conclusions of the study and to indicate possible areas of future research.

TERMINOLOGY

In this thesis the term `Norse' has been applied as being representative of the settlers who came to the northern lands of Caithness, Orkney and Shetland and to the culture which they brought with them. It is, therefore, intended that the term "Norse" when used will be a general label representative of the combined `Viking Age' and the `Late Norse Period'. Where appropriate, though the term `Late Norse Period' will be used with particular reference to the period 1100-1500 AD as proposed by Bigelow (1984).

The term "Viking" has been avoided as it is felt to be inappropriate in relation to such farming communities. As Crawford states:

> "it was never used in contemporary sources of the pagan raiders around the Scottish coast" and "if the Viking pirate abandoned his raiding/trading occupation and settled down as a farmer, he was no longer a true Viking" (1987:1-2; Eldjarn, 1982:266).

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Any errors or misinterpretation of data is the responsibility entirely of the writer.

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CHAPTER ONE

1.0 THE ROLE OF ENVIRONMENTAL FACTORS

1.1 INTRODUCTION

It is the intention of this chapter to look at the main aspects of the environment, both past and present, so as to gain a better understanding of the conditions which would have undoubtedly influenced the subsistence resources available to the Norse settlers in the Northern latitudes. The varying geology, soils and topography, along with the climatic factors would have all interacted to significantly influence the local ecology. At the same time, the available palaeoecological data will also be taken account of in helping to provide a comprehensive picture of past conditions and economies.

1.2 GEOLOGY, SOILS AND CLIMATE

1.2.1 Caithness Geology and Soils

The landscape of the Caithness coastline has a most striking and spectacular character imparted in the main by the geology. Most of the outcropping rocks belong to the Middle Old Red Sandstone Age which dates back some 370 million years. The principal rock of which is the Caithness flagstone, which is grey in colour and finely laminated. It is seen at its most spectacular at such locations as Dunnet and Duncansby Heads. The other main rock type is the John O'Groats sandstone which is brick-red in colour and is not so coarse in texture, and presents a less exposed cliff line as can be seen at Freswick Bay (Omand, 1982:7-9; Omand, 1989:17; Omand in Batey et al, 1993:102).

In contrast, there are three main groups of coastal sand dunes and links that have been identified by Omand. They vary from those composed of long dunes which often run parallel to the coastline such as are evident at Dunnet and Keiss, to those which are of a more irregular distribution as occurs at Freswick Bay and at Reay. While the third group includes

the John O'Groats links which consist mostly of low fixed dunes formed from shell sand (Omand, 1982:16; Omand, 1989:23-4; Omand in Batey et al, 1993:108).

In Caithness Omand has recognised that the glacial activity was limited to the deposition of basically three main types of till. Inland from the coast the non-calcareous till which covers the south and west of Caithness is to a great extent covered by vast stretches of deep blanket bog or `flowes'. In some places it is up to 6 m deep in peat which is still presently a very common source of fuel for the domestic fire. This is without doubt the largest area of peatlands to be found in Britain today. The surface of which is dotted with considerable numbers of pools or `dubh-lochans' all of varying sizes and shapes. Such areas of peatland form a significant constraint to the development of agriculture in such locations (Sharpe and Saxon, 1972; Omand, 1972:49-54; Omand, 1982:II; Omand, 1989:21,24; Omand in Batey et al, 1993:106). The till in this area is formed from a mixture of schists, granites, sandstone and conglomerates of the Old Red Sandstone series. Thus, there is produced a reddish-brown coloured soil which is of a coarse texture and rather acid (Omand, 1972:48:52; Omand, 1982:20). The peaty podzols which develop are dominated by a vegetation of ling (Calluna vulgaris (L.) Hull.)(Plate 1).

In the central and eastern part of Caithness a soil has been developed on parent material consisting mostly of Caithness Flags. These soils, often a metre in thickness, are darker, fine textured and non-calcareous to a greater extent, and have contributed to the dominant agricultural and crofting lands of the lowland part of Caithness. A considerable amount of pasture and marginal land has over the years been reclaimed from the rough moorlands in this area (Omand, 1972, 52-3; Omand in Batey et al, 1993:106). The calcareous soils of the north east which are derived from the shelly sand deposits, are typical of those found at Dunnet, for example. They are usually quite free draining soils which give rise to pasture land dominated by the fescue grass (Festuca rubra L.). In these areas are also to be found many unstable dunes which in some cases do support a vegetation of marram grass (Ammophila arenaria (L.) Link.)(Omand, 1972:54).

1.2.1.1 Climate

As would be expected, the temperatures experienced in Caithness upon the land are influenced to a great extent by the ocean. Changes only vary from between 6°C and 12°C (Meteorological Office) over the year, thus preventing the extremes of both summer heat and winter cold. It is clearly, therefore, a maritime climate of cool summers and mild winters. It is only to be expected then that the growing season, which is when the temperature is above 5.5°C, takes place normally from early April to about mid November.

The sunniest months are generally May and June with up to 5.5 hours of sunshine per day. Annual figures for rainfall in Caithness show a range from 727 mm on the east coast to some 1100 mm on the west coast (Meteorological Office). It can rain on at least 250 days of the year, due to the unstable airstream coming down from the Artic.

With the exception of the Islands, Caithness can be said to have the most exposed and windy climate in Britain, with as many as 30 gales between the months of October to March per year. As would, therefore, be expected there can be considerable erosion of unstable land surfaces particularly along the coastal areas, and damage to crops and vegetation generally. In addition, the vegetation has to cope with the added problem of the salt laden winds. Of particular damage are the westerly gales which tend to be the most frequent.

1.2.2 Orkney: Geology and Soils

The greater part of the geology of Orkney is again of the Middle Red Sandstone Age, consisting of sedimentary and volcanic rocks which are known to form part of the Orcadian Series of flagstones and sandstones. As noted earlier, they do in fact continue south across the Pentland Firth to embrace considerable parts of Caithness. The only known younger rocks are to be found on Hoy, which are of the carboniferous group.

Much of Orkney consists of a flattish topography with the exception of western Hoy, and West Mainland, Rousay and Westray, where the hills do vary from some 170 m to 275 m in height (Mykura, 1975:1; Omand in Batey et al, 1993:108). The terrace slopes clearly reflect the alternating hard and soft layers in the Orcadian flagstones. It is the resistant sandstone which has given western Hoy its steep sided hill which in some cases are up to 477 m in height and equally give rise to the dramatic vertical cliff faces and stacks of both the western and south coasts of the Islands (Mykura, 1975:1; Omand in Batey et al, 1993:108).

The present day configuration of the Orkney Islands is dominated to a great extent by a number of south-east to east trending depressions which are occupied by the sea (Omand in Batey et al, 1993:108).

It is interesting to note that the coastline of Orkney measured at a scale of 1.30,000 covers some 800 km, which is much longer than the Caithness coastline which is only 150 km long, but equally is considerably shorter than Shetland, which measures 1,450 km (Flinn, 1974:13-21; Mather et al, 1975:10).

The Pleistocene ice sheet has smoothed off and in some instances almost removed the once significant terrace features of earlier times, while also covering the lower ground with a layer of till (Mykura, 1975:1). Of the post glacial deposits, the most significant is the brown sand, which covers at least one third of Sanday, as well as quite extensive areas of Westray and North Ronaldsay, and a much smaller area of the Mainland.

While the eastern hills of West Mainland and, to a considerable extent, of central Hoy are covered in peat, the blanker peat is up to 1 m in thickness and there are also limited areas of basin bog to be found. By far, the most widespread soils belong to the sub-groups consisting of a peaty nature and non-calcareous types very similar to those discussed earlier in relation to Caithness. (Macaulay Institute for Soil Research, 1969; Omand in Batey et al, 1993:106).

Fortunately for agriculture, a large proportion of Orkney does in fact lie at a most convenient slope - steep enough to give some natural drainage but not too steep for ploughing (Shearer et al, 1966:80).

Finally, in assuming that the vegetational and climatic environment has changed little since Neolithic times, Davidson would suggest that it is only reasonable to assume that there has been no significant change in soil types in Orkney (et al, 1976:356).

1.2.2.1 Climate

It has been said that the climate of Orkney is cool and equable, which reflects its location and exposure to the strong maritime influence (Senior and Swan, 1972). This is due to the fact that it is surrounded by the sea and is in the direct path of the warm waters of the North Atlantic Drift, thus the more severe aspects of such an exposed latitude are greatly reduced. At the same time, it is able to benefit from the longer day-lengths, particularly in the summer months.

Orkney does in fact have the same mid-winter temperature as the south coast of England, and for that matter Istanbul, at latitude 41° (Shearer et al, 1966:83). The annual range in temperatures for Kirkwall is 10.2°C, ie 13.8°C in July to 3.6°C in February (Meteorological Office).

The number of frosts are considerably fewer and less severe than is the case on the Scottish mainland. Due to the fact that Orkney lies in the track of the Atlantic depression, strong winds are a regular feature and in most years there is an average of at least 24 gales per annum (Bullard, 1975:19). Normally one would think of trees sheltering houses, but in Orkney houses shelter the trees, with the largest trees to be found in the centre of Kirkwall.

The annual rainfall is approximately 1070 mm per annum (Meteorological Office) which can be a particular problem during the harvesting time in the wet seasons. The growing season is reckoned to be the time between the first day in spring, when the temperature rises to 5.5°C, and the

first day in autumn, when the temperature fails to reach 5.5°C. Thus in Orkney this factor accounts for approximately 230 days per year and is a month shorter than in south-west Scotland (Shearer et al, 1966:94).

1.2.3 Shetland: Geology and Soils

The geology of the Shetland Islands is one of great variety and complexity. It consists of ancient metamorphic rocks which were themselves later affected by igneous intrusions of sedimentary and volcanic rocks of the Old Red Sandstone. Geologists have divided Shetland into basically two quite distinct parts, the west and the east, on account of the effects of a north-south Fault (Mykura, 1974:1).

It is interesting to note that this particular fault is in fact a continuation of the Great Glen Fault (Flinn, 1961:589-91). As would be expected, the geology of the East Shetland imparts a difference both in topography and scenery from that of the West. In the west the rocks are metamorphic, often foliating, almost vertically in some cases, while the Western part is built up to a great extent of Old Red Sandstone (Mykura, 1974:2).

The ice sheet which once covered the Shetland Islands left behind a landscape of many small lakes and areas of smoothed contours, while leaving a covering of boulder clay over the low lands (Mykura, 1974:2).

It is possible to categorise the Shetland coastline into two; an outer coast of bold, steep cliffs, and an inner coast of very much smaller cliffs and banks which extend long distances inland along the sides of `voes' (inlets of the sea) or amongst the numerous small islands (Scott and Palmer, 1987:3).

A considerable part of Shetland, including a large part of both central and western Mainland, are now covered by blanket bog type peats, which in turn supports an extensive area of ling (Calluna vulgaris) heath. The normal thickness of the blanket bogs is 1.5 m, though in some areas it can reach as much as 3 m and in valley areas it is known to be up to

6 m thick (Mykura, 1974:9). Though of little use for cultivation today, the land does provide a much needed and reliable source of fuel for many of the inhabitants.

In the past many of the areas of land now covered by the blanket peat would have been cultivated and grazed from very early times. The site of the prehistoric settlement at Scord of Brouster clearly shows evidence of early agricultural activity.

There is within the field system much evidence of lynchets having been formed along with a number of clearance cairns, stone walls and sparse stones, no doubt defining the field boundaries. In fact evidence of walls, banks and stone lines are extensive over a wide area north of the Scord of Brouster to the Loch of Grunnavoe in the south and in the north parallel with the Loch of Flatpunds (Whittle, 1986:54-8). Such evidence, now partly submerged in the blanket peat which followed the abandonment of the site, is clear testimony to the potential of the land at that period in time. The formation of the blanket peat did not take place immediately the occupation ceased, in fact the available data would suggest it was some 1000 years later, around 2250± BP when the base was laid (Whittle, 1986:109).

It is the sedimentary rocks of the Old Red Sandstone, which have provided the best agricultural land in the islands, while the metamorphic terrains of limestone outcrops, which when not covered by peats, can also provide fertile grass lands (Mykura, 1974:10). Cultivation in Shetland has over the centuries been a crofting tradition but several large farms do now exist. The cultivated land is confined to the mostly coastal lands and some of the valley bottoms.

1.2.3.1 Climate

The Shetland islands are the most northerly part of Britain and are only 340 km from the Norwegian coast. In Shetland the annual temperature range is 8.4°C, ie 11.7°C in July/August to 3.3°C in February

(Meteorological Office) resulting in cool summers and relatively mild winters. The Atlantic waters also moderate the climate similarly.

The altitude on Shetland plays a most important part for it has been calculated that the growing season at sea level on Shetland resemble that at an elevation of 350 metres in the Central Highlands of Scotland, while the summer temperatures at 305 metres on Shetland are equivalent to those at an elevation of 762 metres in the Highlands (Spence, 1979:12). It is of little surprise, therefore, to find that such differences have a marked effect upon the local ecology and agriculture of Shetland. As would be expected the growing season is considerably shorter than that on the mainland.

The total annual rainfall taken at Lerwick in an average year is 1080 mm (Meteorological Office). This may not be as high as one would imagine for this particular location. What is most noticeable is the nearly equal regularity of the rainfall over many months of the year, and the slow rate of evaporation due to the low temperatures (Bigelow, 1984:52). The snow falls on approximately 20 to 25 days per year. Both the winter and summer months are known to have foggy conditions, which can, particularly in summer, affect the growing season in certain locations.

It has been recorded that more salt falls on Shetland than on any other European location (Oddie, 1959:163-5), which is mostly carried by salt sprays. Such salt laden sprays have been identified as being a major factor responsible for the lack of tree growth in Shetland (O'Dell, 1939:52). More recently it has been suggested that grazing animals and wind are of more significance in this respect (Spence, 1979:86-88).

There can be little doubt that Shetland is one of the most exposed and therefore windy locations in Britain. This assumption is certainly confirmed by Irvine (1968:392-403) in the total number of days per year with gale force winds of 32 mph or over. To add to the difficulties the winds are known to constantly change direction and to increase considerably with altitude, as noted above. The prevailing winds throughout most of the year are either coming from the west or northwest.

1.3 CHANGING CLIMATES

1.3.1 Introduction

The climate has not remained constant throughout the present millennium but has changed and varied over long periods of time. It is, therefore, important to understand such changes in regard to the likely affect particularly on the more northern latitudes. Such changes were most likely to have had a great influence on the distribution of both natural plant communities, agricultural patterns and therefore man's economic base.

1.3.1.1 The Chronology of Climatic Change

It would appear that the initial Norse period of expansion took place during a warm period which is now referred to as the `Little Climatic Optimum' that took place during c1000-1250 AD. There were periods of frequent warm and dry, anticyclonic, summers in temperate Europe. It is suggested by Parry that in Britain the mean summer temperatures were probably more than 0.5°C higher than they are today, and more than 1.0°C higher than the temperatures in the seventeenth century. The winters would have been moist but mild and a little warmer than during the period 1900 to 1950 (Lamb, 1977:279, 436-7; Parry, 1978:65). Such warm conditions persisted into the mid thirteenth century when a gradual deterioration in the climate took place.

The progression was as follows:
A secondary climatic optimum (c.1000 - 1250 AD)
A cooling phase (c.1250 - 1450 AD)
A cold epoch (c.1550 - 1700 AD)
A warm phase (c.1700 - 1950 AD)
(Parry, 1978:97-8)

It would certainly appear that the warm epoch of c.1000 -1250 AD and the cool epoch of c.1550 - 1700 did in fact affect all parts of Europe to varying degrees (Parry, 1978:38).

The oxygen isotope analysis of new ice cores taken at the crest of the Greenland ice sheet have revealed climatic evidence for the past 1,420 years (Dansgaard et al, 1975:24). It would appear that while the climatic changes of medium frequencies are in phase with corresponding changes in Iceland and England, the long-term changes at mid Atlantic longitudes are out of phase with Europe and North America. Such differences would indicate that within the last millennium long term climatic changes have occurred, some 250 years later in West Europe than in Greenland (Dansgaard et al, 1975:26). The evidence has confirmed the well established fact that the twelfth and thirteenth centuries in England were extremely warm. But the time of the medieval warmth is more uncertain than the time of its termination which took place around 1300 AD, 100-150 years later than in Iceland at longitude 20°W, and 250-300 years later than in Crete, Central Greenland, at about 36°W. It is also worth noting that the cold period from 1450 to 1700 AD, referred to as "the little ice age", was in both Iceland and Crete not significantly cold (Dansgaard et al, 1975:26).

Bigelow has extended Lamb's reconstruction of climate change in Central England (1977:447) to Shetland and has suggested that the yearly average temperatures during the "little climatic optimum" were .7° - .8°C warmer than now. Such a difference could have increased the annual accumulated warmth in the archipelago, he would suggest, to as many as 1318 day-degrees. If this is correct, then it is certainly suggestive that grain harvests were reasonably predictable in the first half of the Late Norse Period (1984:205).

The subsequent deterioration brought with it cooler, and wetter summers, with colder but drier winters. In addition, there were more frequent storms during the period c.1250 to 1700 AD. During the time of the first phase of cooling c.1250 - 1450, Parry has suggested that average summer warmth fell by 175 day-degrees C and the end of summer PWS (potential water surplus) would have increased by about 70 mm (1978:98).

It has been recorded that in a number of locations there were particularly bad and wet summers in the years 1315 and 1316 (Parry, 1978:35). The cool period was temporarily interrupted by a number of very mild and wet winters, with dry warm summers during the period c.1450 - 1530 AD (Parry, 1978:66).

There then continued a cold epoch which lasted from about c.1530 to 1700 AD. From 1530 there were increased numbers of wet summers, with a 0.3C fall in mean `high' summer temperatures over the period c.1530 - 1600 AD (Parry, 1978:99). During the period c.1650 to 1700 AD, there was a significant increase in the number of wet autumns, and the nadir of the cold epoch. The 1690s were particularly bad for Scotland with many severe winters and cool, damp summers, which brought famine.
There was then a change towards higher summer temperatures in both summer and winter which resulted in increased rainfall in winter and less summer rainfall (Parry, 1978:66).

The deterioration in the weather noted above was particularly bad in Northern Britain between latitudes 56° - 62° North latitude (which embraces Caithness, Orkney and Shetland). Such conditions appear to have resulted in harvest failures in the late 1500s and the late 1600s. The most likely reason for these conditions is, according to Lamb, the southward shifts in the North Atlantic depression tracks resulting in increased wetness and storminess during the summers between 1586-1605 and 1688-1700 (1977:467; Parry, 1978:92, 98-9). It is during this period of cold climates that the most suitable locations for growing crops would have been those at lower elevations and on the better free-draining soils. Many acres of farm land at higher elevations were, during this period, abandoned in many parts of Scotland. Certainly many tracts of land would have become marginal due to the lower temperature and increased rainfall. Land that had been farmed may well have, under such conditions, reverted to moorland in the late Middle Ages (Parry, 1978:112, 117). It is certainly the view of Parry that the change of climate since the mid-thirteenth century has reduced the potential for successful cereal cultivation in many marginal areas (Parry, 1978:118). It is therefore more than likely that the domestic production of cereals

was to an extent hindered and was more unreliable in the more extreme situations.

1.4 CHANGES IN THE FLANDRIAN VEGETATION

1.4.1 Introduction

Environmental evidence in the form of charcoal, carbonised material and macrofossils, etc, have increased considerably over the last few years, due to the improved methods of excavating and retrieval, particularly relating to sieving techniques. As such evidence comes to light from Norse Age sites in the Northern latitudes, it is important to have some knowledge as to whether such material once identified was indigenous to the area. Items of wood, for example, that may be found on archaeological sites may be local to the area, or they may have been imported from some distance or they may have been washed up on the shore-line as drift wood. The latter instance applies directly, for example, to the record of spruce (Picea sp.) that was found at The Stone of Stenness (Dickson, and Dickson in Ritchie, 1976:43).

It is therefore the intention in this chapter to look at the vegetational changes that have taken place since the beginning of the Flandrian period in relation to Caithness, Orkney and Shetland. Such information will provide a better understanding as to the main vegetational types which were indigenous and some indication of their time scale and change.

1.4.1.1 Woodland Cover: Caithness

In looking at the areas of Caithness, Orkney and Shetland, the most striking aspect of the majority of the fossil assemblages that have been investigated is the almost total lack of tree-cover at any time since the last glaciation.

Similarities with the Flandrian pollen stratigraphy at sites in Caithness (Durno, 1958; Peglar, 1979; Robinson, 1987; Huntley, 1993) have also been revealed at sites in Orkney (Moar, 1969; Davidson et al 1976; Keatinge et al, 1979) and Shetland (Jôhansen, 1975).

The available pollen data from Loch Winless strongly suggest that no extensive woodlands were ever developed at any time in the Flandrian in Caithness. From the earliest times there was widespread expansion of `tall-herbs' and ferns which dominated communities with the occasional patches of willow (Salix) and hazel (Corylus) (Plate 1) scrub in sheltered sites (Peglar, 1979:245). Corylus/Myrica (Plate 5) values at the Loch of Winless, suggest a real expansion of either Hazel scrub or Bog myrtle or possibly both from about 8,700 BP. While the pollen from trees such as oak (Quercus), alder (Alnus glutinosa (L.) Gaertn) and elm (Ulmus) are consistently present in low amounts from about 9,400 BP. Such values are so low that they may well reflect either the very local occurrence of a few scattered trees in sheltered situations or, alternatively, they represent the long-distance pollen transported from further south and west where such tree species were known to exist (Peglar, 1979:259; Durno, 1958:127-35; Huntley, in Morris and Batey, forthcoming a). From around 7,500 BP there is a notable increase in birch (Betula) pollen values and direct evidence from seeds and wood fragments that occur. Within the peat of the flowe-bogs a number of fossil pine (Pinus) stumps have been noted (Lewis, 1906:335), although pine is definitely not a native species in Caithness today. The low pollen value found at Freswick Links are, it is suggested, representative of long distance transport of pollen (Huntley, in Morris and Batey, forthcoming a).

1.4.1.2 Woodland Cover: Orkney

Evidence from the earlier pollen diagrams (Moar, 1969; Davidson et al, 1976: Keatinge and Dickson, 1979) have suggested that Orkney was never, to any great extent, wooded.

On the Orkney mainland the early Flandrian vegetation was characterised by heathland composed of juniper (Juniperus)(Plate 1) followed by crowberry (Empetrum) and finally by the spread of birch (Betula) (Moar, 1969:207). In time the heathlands became dominated by birch (Betula) and hazel (Corylus avellana L.) scrub which appears to have developed especially in locally sheltered situations much as was the case in Caithness. The major vegetation type in the mid-Flandrian on the Orkneys appears to have been tall-herb communities with meadow sweet (Filipendula ulmaria(L.) Maxim.) (Plate 6), docks (Rumex spp.)(Plate 3), nettles (Urtica spp.) and ferns (Moar, 1969:205). It would appear by this evidence that from at least 4,000 BP that Orkney had a virtually treeless landscape (Davidson et al, 1976:346; 354). Interestingly there are two accounts from Orkney which relate to submerged forest. Firstly, Watt (1820:100) described c.1 acre (0.4 ha) of peat moss upon which were stems of small trees some 5 to 6 inches (5 cm) diameter and 10 feet (3 m) long, which were exposed at the Bay of Skaill by a gale in 1817. The other instance was recorded by Trail (1868:146) who stated that a gale in 1838 exposed some 50 acres (c.20 ha) of sand in Otterswick Bay, Sanday, revealing trees with diameters measuring up to 2 feet (60 cm). Both of these site records have in recent times been investigated, but no definite evidence of tree stems have come to light (Keatinge et al, 1979:587).

In 1977 on the Brough of Deerness a site north of Stove was selected for the purpose of taking a peat sample. A vertical section, some 180 cm in depth, was cut and block samples were collected for pollen analysis and radiocarbon dating (Donaldson, 1986b:5). The resulting evidence has indicated that a birch (Betula) woodland was established locally and the pollen spectrum was found to be very similar to that from the relict native woodland on Hoy (Keatinge and Dickson, 1979). It has been suggested, as noted above by the earlier pollen diagrams from Orkney, that the islands were never extensively covered by woodland, rather by birch and hazel scrub (Moar, 1969; Davidson et al 1976; Keatinge and Dickson, 1979). Clearly, from this new evidence, birch (Betula), willow (Salix) and hazel (Corylus) are native to Orkney, as is the honeysuckle (Lonicera) (Donaldson, 1986, b:11). The period represented includes the mid-Flandrian, when woodland cover would have been at it maximum extent.

Such evidence would clearly indicate that Orkney was not treeless when the first settlers set foot upon these lands. They would, no doubt, have found trees of suitable size for the basic needs in constructing buildings, etc and as a source of fuel (Donaldson, 1986, b:13). This evidence would therefore suggest that at this time the islands did support extensive localised woodlands, which may have been of denser cover in the east than those further west.

An important conclusion to arise from the pollen spectra for circa 4000 to 3000 b.p. in Orkney, was the broad similarity that was notable in the non-arboreal components to the contemporary flora of the Island group (Bullard, 1972; Davidson et al 1976:354).

1.4.1.3 Woodland Cover: Shetland

On Shetland mainland (Johansen, 1975:372) some birch (Betula) and hazel (Corylus) scrub developed locally with willow (Salix) and juniper (Juniperus) at about 9,000 BP, but again `tall-herb' vegetation with meadow sweet (Filipendula) and ferns dominate (Jôhansen, 1975:372). The amounts of pollen found clearly indicates that we cannot speak of any forest in Shetland at this time.

The presence of hazel (Corylus) does in fact give an indication of the temperatures. Andersson (1902:1) in his classical work on recent and fossil hazel in Sweden, found that the mean temperature for August and September should not be below 12°C if the plant was to grow normally. Thus, while the temperature for August was not necessarily higher than the average today, it would appear that September was at least 2°C warmer, and consequently the August temperature was also likely to be higher (Jôhansen, 1975:382).

It is not possible to state definitely from the pollen diagrams when all birch (Betula) became extinct in the Shetlands, but most probably, as noted above man and his grazing animals have, to a great extent, been an important factor, for the island has been inhabited for about 3,500 to 4,000 years (Calder, 1964:39).

In the case of hazel (Corylus)it has persisted for some time, undoubtedly growing on flushes and screes. There is no evidence to support alder (Alnus) growing in Shetland in postglacial times and it is therefore rather difficult to account for Lewis's (1911:801) statement that he found wood and catkins of alder on Shetland (Jôhansen, 1975:383). The pollen diagram from Murraster, Shetland, clearly shows pine (Pinus), though it is very much doubted that pine was ever a member of the Shetland postglacial flora. Its presence could simply reflect Pinus immigration to Shetland (Jôhansen, 1975:382). Juniperus in Shetland is very rare and occurs only amongst rocks in the main, therefore its abundance on the deep peats of a remote island is most noteworthy.

Its absence from similar habitats and community on a nearby island, accessible periodically to sheep but still having birch (Betula) and adders fern (Polypodium), suggest that land treatment has played a significant role in its elimination from the deep peats of the moors (Spence, 1960:87). It has been concluded that grazing and other effects of sheep have been of much less importance than burning in the reduction of Juniperus. It has been noted that after burning Juniperus is replaced by ling (Calluna) which in turn gives way to mat grass (Nardus stricta L) (Fenton, 937:426; Spence, 1960:87).

Just as in Caithness, there is no convincing palaeobotanical evidence to suggest that elm (Ulmus) or oak (Quercus) or alder (Alnus) ever grew on either Orkney or Shetland, although as emphasised by Moar, (1969:207) the former status of pine (Pinus) on Orkney is more problematical. Moar has clearly indicated the possibility that some of the arboreal pollen in the sequence he reports, especially Pinus, probably originated from the north Scottish mainland and the same is a possibility for the succeeding periods being discussed (Moar, 1969:207).

The scarcity of woodlands throughout the Flandrian in Caithness, Orkney and Shetland, is the result of a number of factors all of which would have played a significant role. Such factors include wind exposure, low temperatures in summer, low total sunshine, short growing season,

storms, gales and salt-laden sprays, all of which do restrict present day growth of trees (Peglar, 1979:262).

1.5 THE FLORA AND VEGETATION

1.5.1 Introduction

There can be little doubt that plant communities would have become a vital economic resource to the first Norse settlers when they arrived upon the Northern lands. Plants would have been used as we shall see in Chapter 3 as a source of food for humans, and for domesticated animals, also in the construction of dwellings and in the making of many essential items.

It is the intention in this Chapter to briefly look at the range of present day plant communities and to see to what extent they may have changed or may still reflect, in general terms, those that were flourishing when the first Norse settlers began to take an interest in these lands.

1.5.1.1 Caithness

The most comprehensive survey of the natural flora of Caithness was carried out by C.B. Crampton and was published in 1911 and is still of considerable relevance today. He identified four main distinct ecological areas in the County, they were:

Alpine and Sub-Alpine Plant Association.
Moorland Plant Associations.
Riverine Types.
Coastal Belt.

(Crampton, 1911; Butler, 1972, Map fig 10)

Butler has, in more recent times, broken the above four main groups into a number of sub-division and has provided lists of the plant species most common to each.

They are as follows:

Common Dune Links Plants - 4 different species.

Dune Link Stream Populations - 18 different species.

Plants of the Moorland Stream Banks - 24 different species.

Plants of the Lower Thuro River Banks - 39 different species.

Plants of the Rocky Valleys of East Caithness - 33 different species.

Commonly Occurring Plants - 62 different species.

(Butler, 1972:71-4)

Each of the above is quite distinct in their requirements and in the plant populations that are present, with the exception of the last group of plants which are found to be present in all the ecological zones. They include many plants classed as `weeds' which are normally spread by wind-born seeds. (Butler, 1972:63).

The present small woodland areas consist of hazel (Corylus avellana L.), birch (Betula pubescens Ehrh.), rowan (Sorbus aucuparia L.) and willow (Salix spp.) with a few bird cherry (Prunus padus L.) and aspen (Populus tremula L.). They are, to a great extent, restricted to sheltered locations in the south-east of Caithness, particularly in the river valleys and gorges.

The only extensive woodland starts at Langwell near the Caithness-Sutherland border and continues southwards consisting mostly of birch (Betula spp) (Peglar, 1979:246-7).

1.5.1.2 Orkney

Due to the fact that Orkney has a relatively fertile soil, the landscape is dominated by intensive agriculture and has been so for many centuries. Having said that, there are still today many areas of semi-natural vegetation that thrive for example, the wetlands within or adjacent to agricultural areas. Equally many coastal situations provide vast areas of semi-natural vegetation. The upland areas which are not

used for agriculture also provide extensive areas as well (Bullard and Goode, 1975:31).

The main features of semi-natural vegetation of Orkney can be divided into three main divisions as follows:

i) Coastal habitats.
ii) Habitats within the lowland agricultural zone.
iii) Montane habitats.

(Bullard and Goode, 1975:31)

An impression of the wide range of flora that exists upon Orkney can be appreciated by looking at the sub-divisions of those three divisions, each of which has its own often very characteristic flora.

Coastal habitats

i) Saltmarsh and intertidal flats.
ii) Beaches.
iii) Sand-dune and machair.
iv) Cliffs.

(Berry, 1985:53-64)

Habitats within lowland agricultural zone

i) Vergeside.
ii) Grassland and Heaths.
iii) Tall herbs and fern communities.
iv) Flushes and soligenous mires.
v) Fen vegetation.
vi) Rivers and Lochs.
vii) Islands.

(Berry, 1985:50-3, 73-6)

Montane habitats

i) Heath, grassland and fellfield vegetation.
ii) Woodland and scrub. (Berry, 1985:76-86)

Montane Woodland and scrub

The following are the only native tree species still growing on Orkney, which are to be found at Berriedale on Hoy:

Sorbus aucuparia L. (Rowan)(Plate 1)

occurs wild in Hoy where it is the most widely distributed native tree. Quite large and therefore old specimens occur naturally growing on the sea cliffs, burns and gullies in the hills. The most concentrated area is at Berriedale where some 100 trees have become established.

Betula pubescens Ehrh. (Brown Birch)

they only occur in the Segal Burn valley and in Berriedale where it is estimated there are some 100 No multi-stemmed specimens.

Corylus avellana L. (Hazel)(Plate 1)

two individual specimens are present at Berriedale.

Populus tremula L. (Aspen)

two stands are presently to be found at Berriedale. This species grows as scrub on cliffs and also forms trees in a few select locations such as Rysa, where it is almost on the shore.

Salix sp. (Willow)

scrub is quite common and large bushes of Salix cinerea ssp. oleifolia Macreight. occurs at Berriedale. Salix scrub is frequent with S. aurita L., S. phylicifolia L., and many hybrids. The rarest tree of all in Orkney is Salix myrtillus, one clump of which exists in the Glen of Greer.

(Bullard and Goode, 1975; Berry, 1985:71-2)

It is now accepted that Orkney would have been in a tree-less (see Changes in the Flandrian Vegetation) state long before the Norse settlers arrived and would only have supported scrub cover. It is the opinion of Bullard that:

> "even if it was little more than a scrub of Hazel, Birch and Willow by the time of the Norse invasions and settlement, this

reduction of cover must have been the biggest single factor in the development of the present "natural" environment" (1975:20-1).

That there have been changes in the composition of the flora on Orkney since the norse settlement is accepted, but to what extent is open to discussion.

The following is a list of those actions which Bullard (1975:20-27) would identify as having had an effect on the areas of natural flora in Orkney.

a) Burning of heath and scrub.
b) Intensive cropping land - resulting in erosion.
c) Introduction of grass and clover in the 1770s.
d) Enclosure of the communities.
e) Abolition of run-rig after 1830.
f) Extensive drainage programmes of 1845.
g) Use of artificial manures.
h) Increased number of stock.
j) The introduction of perennial variety of clover.
k) Reclamation of heathland.

Taking account of the timescale under discussion and noting all the above activities that have been implemented, it is interesting to note the comments of the following authorities.

Davidson (et al, 1976:354) with regard to his work on Orkney has made the important conclusion from the pollen spectra for circa 4000 to 3000 b.p. that there are broad similarities which are clearly noticeable in the non-arboreal components, with the contemporary flora of the island group prepared by Bullard (1972). It is also the view of Davidson (et al, 1976:355) as noted above, that many of the climatic features of modern Orkney must have persisted with little change from Neolithic times. Likewise Keatinge (et al, 1979:605) has also indicated that pasture vegetation, established under the influence of increased grazing pressure by the Neolithic occupation, resulted in a vegetation which would appear to have changed little since then, apart from certain areas of the hills.

Environmental evidence in the form of waterlogged plant remains from the Norse and Medieval settlement of Tuquoy, Orkney, are of considerable interest. For it is the view of Owen, based on her findings, that it may be possible to say that a similar patter of vegetation did in fact exist during the Norse period to that which presently exists (Owen, 1994, forthcoming).

1.5.1.3 Shetland

Such has been man's impact on Shetland that it has been suggested that only islands in lochs, ravines and crag sites presently give any true indication as to the composition of the vegetation before the introduction of sheep and man (Johnston, 1974:33). There can be little doubt that the cutting of peat for fuel, along with the numerous agricultural practices has had a significant effect on modifying the vegetation of a large part of Shetland.

Tree species like Sorbus aucuparia L. (Rowan) are now only found growing in a shrub like habit as at Loch of Clousta, where two small patches are some 60 cm high. Likewise, Betula pubescens Ehrh. (Downy birch) are now only found in two locations, one being near to Sandy Water, North Roe, where the bush like growth is some 75-100 cm tall, with prostrate trunks some 8 cm in diameter (Spence, 1960:74-77). Spence has clearly shown in his work on scrub growth in Shetland, that the effect of man has caused significant changes in the vegetation (1960).

In recent times various methods of drainage works, surface seeding, addition of shell sand, also liming operations, along with the ploughing of the better hill land has all had an effect in changing the composition of the natural vegetation. Fortunately, there has been only limited use of artificial fertilisers on arable land at this present point in time (Johnston, 1974:34).

A study of the species present in tall fen, grassland and scrub in Shetland has revealed that some 15 species of fern and shrub or small tree have been confined by the actions of grazing and burning to ledges,

islands and inaccessible fens. In the case of some 36 species of grass, woodrush and herbs they are almost totally restricted to ungrazed, lightly grazed or mown localities (Berry and Johnston, 1980:88).

The major habitat divisions that are to be found on Shetland, each of which contains a number of vegetative types within are as listed below:

i) Coastal Vegetation.
ii) Bog Vegetation.
iii) Grassland and Grass heaths.
iv) Montane Heath and Fell-field communities.
v) Scrub Vegetation.
vi) Soligenous mires.
vii) Freshwater marshes.

(Goode, 1974:65-70)

In the study of vascular plants of Shetland carried out by Palmer and Scott (1969) they produced a list of some 681 species, subspecies, hybrids and varieties, that they recorded as being present on Shetland. Of this number it was found that only 400 were in fact native to Shetland. To put this figure in perspective, it must be realised that there are a total of some 2,241 species which are native to Britain (Dandy, 1958).

There can be little doubt that the past combination of both human and animal activity has had a varying effect upon the plant communities in the three areas under discussion. The most severe results would appear to have taken place in Shetland which have resulted in the restriction of many species quite considerably, while in other instances encouraging certain species. The extent of grazing and burning on Shetland would seem to be the most significant factors influencing this situation.

It is the view of Berry and Johnston (1980:90) that some 36 species of shrub, tree, fern, herb and grasses owe their present scarcity to man's management of the land and not to the climatic conditions.

In the case of Caithness and Orkney, the vegetation is in both locations very similar in general terms. Again, it is only to be expected that

the various human influences over centuries has had an effect and therefore contributed to changes in the floral communities. But as indicated above, particularly in regard to Orkney, it is surprising that the changes would appear to have been much less dramatic in many instances than may have first been thought.

CHAPTER TWO

2.0 SOURCES OF STUDY IN THE MIDDLE AGES FOR NORTHERN SCOTLAND

2.1 INTRODUCTION

Most of our information of medieval Northern Scotland and the Islands has been derived from numerous sources of information including early written records, accounts, linguistical studies and archaeological findings. It is the intention of this Chapter to look at certain of the written records in a critical manner with a view to discussing the information that they might contain, with particular references to the domestic economies, material culture and to the husbandry of the land. One written source which would certainly be considered as a starting point in providing a broad and diverse canvas must be the Orkneyinga Saga.

2.2 ORKNEYINGA SAGA AND HISTORICAL SOURCES

The Orkneyinga Saga (Jarl's Saga) is the Saga of the Earls of Orkney. It embraces a considerable knowledge of the Northern Isles and Caithness in what is a unique historical document. The period covered includes the ninth century to the thirteenth and though it centres on Orkney it does relate to the history of other countries like Norway and Scotland. The detail involves much of the earldom's power struggles, killings and feastings it does nevertheless paint a most vivid picture of the twelfth century. It clearly involves the major Norse families in the earldom which is centred on Orkney particularly, and Caithness, involving to a much lesser extent, Shetland.

It is the view of Taylor that the author of the Orkneyinga Saga was an Icelander who between 1190 and 1210 made his way via Shetland and the Orkneys to Duncansby and thus much of his writing was from personal knowledge (Taylor, 1938:28). In more recent times Guðmundsson has expressed the view that the original version which commences with the rule of Rögnvaldr Maerajarl sons (in the present Ch4) and ending with

the killing of Sveinn Ásleifarson (Ch108) was written some time before 1190 (in Morris, et al, 1993:206). "It is evident that the author of Orkneyinga Saga is well informed about the Moddan family as we see in Ch53 and onwards" (Guðmundsson in Morris, et al, 1993:209). With regard to the last meeting between Earl Haraldr Maddaðarson with Svein Ásleifarson in Ch106, Guðmundsson comments that it "is so real that one would think that the earl told the story directly to the author". (in Morris, et al, 1993:209).

Though the Orkneyinga Saga, like other sagas may be viewed by many as being, to varying degrees, biased, distorted and selective, it may be that it is helpful in trying to reconstruct the life patterns of those times when it was written (Sawyer 1971:10). Indeed some authorities would suggest that the detail in respect of the material culture in the sagas may not necessarily be distorted with the retelling (Foot and Wilson, 1970:XXIV-V).

It is suggested here that, with careful reading of the Orkneyinga Saga, it is possible to bring together much useful information regarding the domestic lifestyle and economy; with particular attention to that of the farming communities which represent the greater population of the areas concerned. By taking account of the many individuals identified, it is possible to an extent to derive information on the possible settlement distribution of the time and to glean some insight into the farming practices generally.

It would appear that most of the occupants of the islands and the coast of Caithness were referred to as farmers, no doubt because of their primary involvement with the land. In the Orkneyinga Saga we clearly see that not all the farmers were wealthy for when Einar offered to pay the tax imposed by King Harold on the condition that he should hold all the estates in fee, we learn that the "farmers agreed since the wealthier ones hoped to redeem their estates later, while the poorer farmers were unable to pay the tribute anyway" (Pálsson and Edwards, OS CH8:32). The farmers appear, in many instances, to have acted as a body, that may well be because they had little or no alternative, though many farmers were in fact wealthy chieftains and Earls. Such collective

views are expressed in the Orkneyinga Saga after the death of Harold when "his brother Paul took over the entire earldom with the approval of every farmer in Orkney" (P/E OS Ch55:100). When again in the Orkneyinga Saga, Earl Rögnvaldr called the farmers to an assembly and offered them the chance to buy their estates and thus have no need to pay the fee "this they all agreed" (P/E OS Ch76:142). The farmers also appear to have been a reasonably influential body of people at times, for in one instance they are noted as trying to broker a peace pack between Svein Ásleifarson and Earl Erlend, "in the morning farmers who were friendly to both sides came up and tried to bring about a settlement" (P/E OS Ch92:187).

Many of the farmers are identified by their names and where they farmed, for instance "farming at Westness on Rousay was a man of distinguished lineage called Sigard" (P/E OS Ch56:101). Westness is mentioned no less than eight times in the Orkneyinga Saga as the home of Sigurd in the twelfth century. He was obviously a wealthy farmer and a close friend of Earl Paul Hakonarson (Ritchie, 1993:50). Norse activity has been found at Westness where evidence of a cemetery, farm buildings and a boat-noust have been discovered, though as yet they cannot be said to be contemporary, nor that the buildings were part of Sigurd's establishment (Kaland in Morris, et al 1933:308-317). We also learn that there was a farmer called Olaf Hrolfsson who was farming on Gairsay "though he had another estate at Duncansby in Caithness" (P/E OS Ch56:101).

Farming was not the domain of men only for we learn that "farming on North Ronaldsay was a distinguished woman called Ragna." At the same time we are informed of a rich and dependable farmer whose name was Helgi, who lived in a hamlet on Westray (P/E OS Ch56:102). Interestingly, information from a court case in Trondenes, Norway in 1738 makes reference to the fact that ploughing and sowing was performed by women (Lysaker, 1958:233; Bertelson and Lamb, in Batey et al, 1993:550). Bertelsen and Lamb have also drawn attention to the views of those (Bertelsen 1985, 105-6; Bratrein , 1976:22-4) who suggest that the farming of North Norwegian lands from the Iron Age up until modern times was most likely to be part of the household economy run by the women, while the men in these parts were employed in fishing (in Batey

et al, 1993:550). It is almost impossible to identify individual farms, though it has been suggested, for example, that the identification of a high-status late Norse site at Tuquoy on Westray could possibly be the farm belonging to Thorkell Flettir who is mentioned in the Orkneyinga Saga (P/E OS Ch56:102) as farming on Westray (Ritchie, 1993:117).

It is not only the location of the farmers' abodes that we are informed of for in a number of instances reference is made to the Earls, though many would be farmers themselves. We are informed that Earl Thorfinn "had his permanent residence at Birsay, where he built, and dedicated to Christ, a fine minster the seat of the first Bishop of Orkney" (P/E OS Ch31:75).

In time Birsay becomes, as Morris clearly states, "the political and ecclesiastical power base of the Earldom, embracing to the North, Shetland, and to the South, Caithness, and possibly even far wider at times" (in Batey et al, 1993:286). Though considerable archaeological evidence of Late Norse activity has been discovered at Birsay, no evidence has yet been found to link such findings with Thorfinn.

The settlement site at Skaill in Deerness has been suggested as the residence of Thorkell Amundssen, who spoke on behalf of the farmers against Earl Einar's harsh levies (P/E OS Ch14:40; Ritchie, 1993:60).

In Caithness the site of Freswick has revealed, over recent years, considerable archaeological evidence. There is reference to the fact that "Svein Ásleifarson was at Praswick in Caithness", at one point in time, looking after the estate of his stepsons (P/E OS Ch92:185). Praswick is now generally identified with Freswick (Taylor, 1938, footnote 3:397). A second reference to Freswick in connection with Anakol and Porsteinn Rognuson states "they hauled their skiff into a secret cove with a fortress above it, then made their way up near to the farmstead at Freswick where they hid themselves in a copse" (P/E OS Ch93:189). It has been suggested that this action took place at the northern end of the links according to Taylor (1938:311; footnote 4:398). Though Batey (1987:21) has suggested that it could equally have happened at the south end, especially if the Norse Hall lies below the

modern building of Freswick Castle. Another important site in Caithness to which reference is made in the Orkneyinga Saga is Duncansby, where we learn that "Earl Thorfinn stayed on in Caithness at Duncansby" (P/E OS Ch20:51). It may well be that the remains which have been found there recently could, it is suggested by Batey, be part of the settlement (1987a:23; 1987b:131-148).

An interesting reference to Caithness in the Orkneyinga Saga comes in relation to hunting "the Earls were in Thurso every summer hunting red deer and reindeer in the woods there" (P/E OS Ch102:209). For such animals to survive and breed the inference must be that there was sufficient good woodland cover in that area. It will also have been noted above that a copse was used to hide in, which again would indicate that at this date (circa 1153) there was sufficient tree and shrub canopy to provide such protection. It is though no doubt due to the lack of any extensive and significant tree growth in these northern-most lands that we note from the Saga that Earls and chieftains went to Norway for supplies of new boats (P/E OS Ch67:129; 85:156; 90:183). Ultimately, such ships would become a source of timber to the islanders.

There is written evidence relating to the trade of grain for timber with Norway in the Late Middle Ages (Crawford, 1987:135). The lack of wood must have been the spur to one Turf-Einar, who the Orkneyinga Saga informs us "was the first man to dig peat for fuel" in these northern lands (P/E OS Ch7:29). The explanation of the name is not accepted by Taylor (1938, footnote 1:354). One can only but wonder whether the Kalf Scurvy, who was killed by Turf-Einar, was so named because he suffered from the disease scurvy. (P/E OS Ch7:29; Buckland et al in Batey et al, 1993:518).

Some insight into the farming practices of the Norse period can be gleamed, for instance, there is a reference to a man whose name was Thord Dragon-Jaw a tenant of Bergfinn's in Shetland "he was threshing corn in a barley-shed on the eve of St. Magnus and St. Lucy." It was, we are informed, nearly sunset and the farmer Bergfinn entered the barn and told the man to stop work. "It's not often you think I'm working too late", said Thord. `St. Magnus Mass is tomorrow,' said Bergfinn,

`and we should observe it with all the respect we can'. It is said that he was punished by madness for his actions (P/E OS Ch57:105-6).

From the above, it may be deduced that barley/cereals were being grown on Shetland, and were being processed to remove the grain from the husks in the barley-shed on the threshing floor (Fenton, 1978:364). It would also appear that, as could well be imagined, the farm workers did indeed work long hours each day and continued to do so for many generations. Another most revealing account of farming practices in the mid-twelfth century is given in the account of how Sveinn used to live.

> "Winter he would spend home on Gairsay where he entertained some eighty men at his own expense. His drinking hall was so big, there was nothing in Orkney to compare with it. In spring he had more than enough to occupy him, with a great deal of seed to sow which he saw to carefully himself. Then when that job was done he would go off plundering in the Hebrides and in Ireland on what he called his `spring trip', then back home just after mid-summer where he stayed till the cornfields had been reaped and the grain was safely in. After that he would go off raiding again and never come back till the first month of winter was ended. This he used to call `his autumn trip'." (P/E OS Ch105:215).

It could be assumed from the above account that the area of land put down to corn was not insignificant and at the same time the crop would have been of considerable economic benefit to Sveinn. One can also infer that he supervised the preparation of the land direct and the sowing of "great deal of seed". He also returned well in advance of the reaping to again supervise the harvesting of his grain crop, which may have, particularly in a bad season needed to be harvested before it was fully ripe, so as to save the crop.

Such attention must point to the barley/cereal crop being of considerable economic importance to him, both for food and an essential ingredient to the making of alcoholic beverages.

There can be little doubt that the Orkney islands were trading in grain which would have been surplus to domestic needs, for the Saga mentions the sale of malt to a band of Norwegians spending a winter in Orkney (P/E OS Ch85:163). While again in the Orkneyinga Saga there is mention of Earl Rögnvaldr going to Papa Stronsay to fetch malt for the Christmas ale (P/E OS Ch29:70).

In the Egil's Saga we learn that Norway was receiving grain from England in the 10th century (Egil's Saga, Ch17; Kaland, 1982:91). There is also a thirteenth-century saga reference to an argument which took place in Iceland with regard to the price of flour that had been brought over in a ship from Orkney (Crawford, 1987:135).

Another important crop to the farmers was that of hay, for again we are given a glimpse in the Orkneyinga Saga of the farming practices relating to the gathering-in of the hay crop. The instance is the occasion when Earl Rögnvaldr and friends were riding up to Calder Dale, in Caithness when "as they approached the farmstead at Forsi, Hallvardr, the farmer there was standing on top of a haystack stacking the hay that his farmhands were carrying to him" (P/E OS Ch103:210). For him to be standing on the hayrick may well indicate that it was more likely to be a haystack (a large thatched hayrick). Such a crop would have been of great economic importance where cattle were being raised either for milk or beef and where they were being over wintered particularly in byres. The Saga appears to support that such was the case, for we read of Svein Âsleifarson's raid on Caithness, "As soon as they landed in Caithness they poured into the settlement and rounded up drones of cattle for slaughter on the beach, then loaded the carcases onto their ships" (P/E OS Ch94:194).

We can assume that the barley ricks were also of some size for the Orkneyinga Saga informs us in the Chapter on miracles that a farmer in Orkney called Thorkell fell from the top of his barley rick and injured himself. He evidently recovered after a visit to the shrine of the blessed Earl Magnus (P/E OS Ch57:105).

It has been suggested that flax was grown by the Norse farmers from which linen was produced and used in the making of clothes. Archaeological evidence of seeds have been found on a number of sites which would appear to support such local cultivation and processing.

That such linen garments were worn is referred to in the Orkneyinga Saga in the `Death of Rögnvaldr' when a man, later suspected to have been Rögnvaldr, "came out into the doorway in linen clothes" (Taylor, 1938, Ch29:184). In `Svein on the run' we read that "Jon was only wearing a shirt and linen breeches" (P/E OS Ch95:202).

The fact that many farmers were in the Late Norse period actively involved in fishing has been revealed in the midden deposits of many sites which have been excavated in recent times. An insight into this fact is revealed in connection with the Orkneyinga Saga when Earl Rognvaldr who in disguise went fishing. "It happened one day (circa 1148), south of Shetland at Sumburgh Head, that a certain penniless farmer was still waiting for his mate to join" (P/E OS Ch85:158). It would appear that fish were an important or even vital resource to the farmer/fisherman of Norse Shetland, particularly in the mid twelfth century. The archaeological evidence would seem to support the intensification of fishing in the Late Norse period. It is the above reference to the Earl and fishing that Hamilton suggests might provide a brief glimpse of the settlement at Jarlshof, Shetland (1956:6).

There can be little doubt that the drinking of beverages or alcoholic drinks played an important role in the social life and cohesion of the Norse people. With reference to Earl Rögnvaldr the Orkneyinga Saga informs us that "just before Christmas he went with a large band of men over to Papa Stronsay to fetch malt for the Christmas ale" (P/E OS Ch29:70). This would seem to indicate that barley, or other grain, had been steeped in water until it germinated and then dried in a kiln was being collected for use in the brewing or distilling of alcohol back at Kirkwall. The Saga makes reference to the Earl's Paul and Harold, in respect of "a great drinking-hall at Orphir" with further details that "on the left as you came into the hall was a large stone slab, with a lot of big ale vats behind it" (P/E OS Ch66:125). It is possible that

the walls north of the surviving Round Church at Orphir which was built in circa 1172 and which were excavated some years ago may in fact be the remains of Earl Paul's drinking-hall (Ritchie, 1993:119).

The Orkneyinga Saga can be seen to be a source of useful information for the Late Norse period as well as providing some details of the previous centuries. It does also provide, if only glimpses, an image of the landscape, of some of the agricultural practices, the material culture, the trading opportunities, the relationship of the Northern islands with Norway, and to an extent the settlement patterns of the wealthy landowners, rather than alas those of the ordinary people.

There is ample justification for using such information from the Sagas for the purposes of archaeological and historical analysis - however biased it may seem to some. For it does, with careful reading, offer a valuable and important insight into the Norse lifestyle of the times, and at the same time provides a background from which to view and consider the archaeological evidence that has so far been recovered.

2.3 THE PLACE NAMES

In looking at the Scandinavian place-name distribution in Caithness, Orkney and Shetland, it is not without coincidence that the most significant place-name elements are intrinsically associated with the landscape, farms and settlements. The reason for this is that the incoming Norse settled in those areas where they could establish farms and thus undertake agricultural practices as an essential part of their subsistence strategy. The required conditions stated by Small were, easy access to the sea, a flat area to build upon, access to cultivable land with extensive pasture nearby and a fresh water supply (1967:149).

The major influx of settlers to Northern Scotland came from Norway with only a few exceptions, such as the Danes who settled at Danaberreg and Danhol in Shetland (Jakobsen, 1901:219; 1936:147-75). The early Norse settlers clearly rejected, in most instances, the existing place-names that they must have found being used and set about introducing their own

place-names. In the main they did not use place-names associated with places in their homelands. One possible exception to that rule is the now lost Upsala in Sandwick, Orkney, which was most likely named after Uppsala, in Sweden (Marwick, 1952:156-7).

The initial settlement areas within the islands were, in a number of cases, given topographical names as were many of the primary farms which were located in good situations on the Isles. There are 28 primary farms in the Orkney parishes of South Ronaldsay, Rousay, Harry and Deerness, of which no less than 14 have topographical names (Thuesen, 1978:94-5).

Place-names are capable of surviving for many centuries but they have no real ability by themselves of providing information suitable for absolute dating. It is not possible to state emphatically that settlements have always borne the name that they have. It could very well be that a certain topographical feature was applied to a settlement at a much later date. A relative chronological stratification constructed on the basis of suitable place-name material can only be put into a satisfactory absolute context with the assistance of a chronological framework derived from documentary or archaeological sources (Nicolaisen, 1982:75).

The great advantage of place-names comes to light when they are used for achieving a relative linguistic stratification by means of toponyms which for various reasons ceased to be used in the formation of place-names at certain points in time and consequently can indicate duration and ending. Much of the work in this area has been carried out by Marwick (1952) and in more recent times by Nicolaisen (1976) whose current distribution maps for Scandinavian settlement in Scotland include stadir (farm), setr (dwelling place) or saetr (shieling) and bolstadr (farm) as the most common habitative elements. To try and fix dates to such generics could be very misleading as they would be fraught with difficulties.

One which Marwick considered to be one of the earliest to be used in settlement names in Orkney was the West Norwegian baer, East Norwegian

and East Scandinavian bȳ(r). He considered that the element-boer was used particularly in the case of farms that were established at an early date, since in many cases the names are not recorded in the early rentals and some only survive as names of fields or of lost properties (Marwick, 1952:243-4). There is also no reference to -boer in the Orkneyinga Saga (Thomason, 1987:27). It may well be then that many -bȳr names have indeed disappeared due to the early division of the oldest established farms and that new names have now been given to the resulting farms (Crawford, 1987:112). Recent research in Scandinavia has suggested that -boer/-bȳr may well have been used as a secondary element itself in cases where the oldest primary name for a farm has been extended to identify a parish, for example (Fellows-Jensen, 1984; Crawford, 1987:112). It has been noted that at Levenwick in South Mainland, Shetland, that Everby (upper farm) and Netherby (lower farm) could very well imply a similar division (Crawford, 1987:12 therefore is that such names in Orkney may well indicate the division of early large -boer/-bȳr farms but that in Shetland the -boer/-bȳr names might very well have been used in the first instance when old coastal farms, which previously had topographical names, were then divided up, as for example, at Levenwick above (Crawford, 1987:112).

It has been noted that very few of the names in -boer/-bȳr in the Isles are found to contain personal names. The exceptions are possibly Trenaby, Yesnaby and Cattaby in Orkney (Fellows-Jensen, 1984:156). This lack of names containing personal names has been interpreted by Hellberg as possibly indicating that Orkney had undergone a much more gradual development and exploitation of its agricultural resources (1980:168). Fellow-Jensen on the other hand would suggest that it may well be the case that the fashion for place-names in which personal names are compounded with -by only developed after the period of the settlement of Orkney (Fellows-Jensen, 1984:157).

In the case of the generic -boer it is now suggested that it must be viewed as being unreliable as an indicator of the age of settlements in the Isles. While some of the boer names would appear to have been used in the names of older settlements, for example, Bae and Husabae, in

Orkney, these particular settlements almost certainly date from before the names (Fellows-Jensen, 1984:157).

There are again varying opinions in the case of the generic -staðir, as to whether or not it has had a habitative significance. Some scholars like Fellow-Jensen would suggest that the personal name in -staðir had always denoted settlements. On the other hand, Hellberg has argued that the staðir names in Orkney must originally have denoted fields in meadowlands, since in the west of the Orkney Mainland, such fields are in low-lying and often well watered areas (1967, 282-4).

Thomson would contend that a characteristic of staðir names is their inland location and were seldom on sites that would have been occupied by the very earliest settlers (1984:30). It would appear that the staðir names are in fact the earliest element for which a distribution pattern of any significance has emerged, which is of more than just local interest (Nicolaisen, 1976:86; 1982:80).

Many of the staðir names do contain personal names, and Fellow-Jensen would argue that there are more personal names as specific in this group than in most others. Indeed there are many examples in both Shetland, eg Grimista, Oddsta, Girsta, and Orkney, eg Hourston, Germinston and Tormiston (1984:159). It should be noted that though the generic -staðir is well represented in the place-names of Shetland and Orkney, as indicated above, it has been thought not to have occurred in Caithness or for that matter anywhere else on the Mainland. The reason for this, it is suggested, could be that the character of the landscape or the settlement configuration did not lend themselves to it. What is possibly much more likely is the fact that -staðir had ceased to be a place name generic when the Norse began to settle in Caithness. If this assumption is correct, then it would imply that the earliest Norse settlement in Caithness could have been some two generations later than the initial Scandinavian settlement in the Northern Isles. This is therefore suggestive that it was some time in the middle of the ninth century that Norse inhabitants first gave names to places in Caithness (Nicolaisen, 1979; 1982:80).

It is the view of Waugh, based on recent detailed research, that there is no reason to assume that settlement by the Norse in Caithness was significantly later than that in Orkney or Shetland. The place-name evidence would suggest that settlement was less intensive than in the northern isles, due to the fact that the habitative generics such as staðir, setr and bólstaðr, which refer to farming units, are less numerous in Caithness (Waugh, 1993:121). A few examples of staðir in Caithness have been identified by Waugh and they appear to be located on the edges of firmly established Norse communities, where often there is a concentration of Norse names indicative of increased farming activities (Waugh, 1993:122). The emphasis on these staðir names would appear to be connected with personal ownership and may well, it is suggested, have resulted from the time when the land was being appropriated to individuals within a farming community. Such examples suggested are Drumhollistan, Borrowston and Gerston (Waugh, 1993:122).

The distribution of -setr/-saetr names is particularly widespread in Shetland so much so that they cannot be plotted individually on the place-name maps. They also have a wide distribution in Caithness and Orkney (Nicolaisen, 1969:11-12, map 2; 1975:map 6b). It is apparent from looking at this wide distribution of -setr/saetr names that there must be some other influence in play other than just the gradual progression of Scandinavian settlements. The suggestion is that there is some evidence to support the case that the farms with such names are in fact of a secondary status. Invariably, they are to be found in the higher locations than is usually the case with primary farms and, correspondingly, they are often a greater distance from the coast (Fellows-Jensen, 1984:162). The view of Crawford is that the -setr names should indeed be seen as evidence of internal expansion into "peripheral, often inland, pastoral areas around earlier farms" and to which they are secondary (Crawford, 1987:110). A case can therefore be made for suggesting that in Shetland the -setr/saetr names define early secondary settlements which began as (shielings) pastorage farms, either in outfields or between the main tuns (Stewart, 1965:251). It may well be that the large number of -saetr names in Shetland corresponds to its extensive pasture lands which would have been of considerable economic importance to the farmers.

In Caithness three names containing setr have been identified which it has been suggested can be attributed, with some confidence, to the initial Norse phase of settlement. The early forms of the three names are Thusater (Thurso Parish), Reaster (Dunnet Parish) and Seater (Canisby Parish (Waugh, 1984:18). The apparent lack of setr/saetr names in Caithness may, it is suggested, be due to the presence of aergi which is a Norse borrowing of the Gaelic airigh, `a shieling' and may well be due to possible contact with Gaelic-speaking people (Waugh, 1993:123).

The most prolific habitative generic with the widest distribution within the Isles is -bólstaðr. It is also the one which varies the greatest. In Shetland it can occur as Bousta as a simplex name and as -bister in compounds. While in Orkney it occurs as Busta and Bousta as a simplex name and as -bister or -buster in compounds. There is documentary evidence in the case of Orkney to clearly show the further reduction of -bister/-buster to -bster and -ster is of sixteenth and seventeenth century date, for there are spellings indicated which are analogous to the forms surviving to the present day: Balbuster as late as 1671 for Bilbster, and Brabuster in 1644 for Brabster (Nicolaisen, 1982:82). In Caithness it occurs as -bster in compounds. It would appear that all the various forms do in fact represent an original Scandinavian -bólstaðr meaning `farm' rather than the apparently synonymous -bustaðr is suggested by those names which are recorded from old sources in forms in which l survives as, for example, in Scrabster, Caithness (Skarabolstad 1201) (Fellows-Jensen, 1984:159). The generic -bólstaðr is clearly the most important generic in the Norse settlement nomenclature of Caithness (Nicolaisen, 1976:92-4; 1982:81).

There are some 27 bólstaðr examples in Caithness which appear in marked concentrations on the western and eastern extremities of the parishes of Reay in the west and Wick and Canisbay to the east side. They account for some 22 of the names and their concentration may, it is suggested by Waugh, indicate a second stage of settlement in which the Norse appear to have moved both to the west and the south in their search for land (1984:19).

In Orkney the -bólstaðr farms were without doubt large and well established farms from an early period. The fact that they may be highly valued does not prevent them from having been a division of an original farm (Crawford, 1987:111). In Shetland it has been suggested that they are half the size of -staðir farms, which could very well suggest they are secondary to -staðir farms there (Stewart, 1965:251). In the Northern Isles the specific first element frequently indicates compass directions so as to clearly distinguish individual farms from neighbouring -bólstaðr farms. There can be little doubt that they are secondary divisions of (homefields), an earlier undivided farm. This can be clearly illustrated in the case of South Walls, Orkney, for there the conjunction of the two half-urislands Easter and Westerbister are clearly evidence of a much earlier, but undivided urisland settlement (Marwick, 1952:92, 184). It is most likely that the element -bólstaðr would have continued in use for a long period of time (Nicolaisen, 1982:82), and was probably being applied in many locations where appropriate and at any time (Morris and Batey, forthcoming a).

From one of the most common to one of the most limited in its geographic distribution are the generic names ending in -staðir, of which there are some 37 in Shetland and 25 in Orkney. While in Caithness there would appear to be only one, which, it is suggested, was probably settled from Orkney during a secondary phase of settlement (Crawford, 1987:105). This apparent lack of -staðir names in Caithness may, it is suggested, be due to the fact that it ceased to be a generic place-name by the time the Norse arrived in Caithness (Morris and Batey, forthcoming a). That they are in fact secondary in Orkney would seem to be indicated by the frequent combination of the generic with a personal name. It would appear that from a study of -staðir farms in relation to the brochs of Shetland that here they are primary Norse settlements (Crawford, 1987:105, 113-4).

A name typical of the hill-margin areas is quoy derived from ON Kvi referring to `a cattlefold or a place where the animals gather for milking'. Such locations were frequently later enclosed as small marginal farms due to the improved fertility of the land, a number of such farms have been identified in Caithness (Waugh in Batey et al,

1993:125). In Orkney, there are many such small quoy-farm which are frequently situated on the edge or outlying parts of a tunship, thus confirming the impression of their comparative late date (Wainwright, 1964:136).

At the site of Buckquoy, Birsay, both Pictish and Norse evidence has been found (Ritchie and Ritchie, 1978). The place-name Buckquoy itself was seen by Marwick as being derived from the ON bygg-kvi, indicating the growing of bere barley (Marwick, 1952:132; Marwick, 1970:60).

The element is not considered the most reliable indicator of expansion for it has been found to have been used long after the Norse influence had passed (Thomson, 1987:26-7, 31; Waugh, in Batey et al, 1993:125).

It can be seen from the above just how important place-names are as a source of evidence for Norse influence which even today is still, in many cases, both historically undocumented and archaeologically unrecognisable. The place-name evidence could point to there being little doubt that farming was the single most important subsistence activity being carried out upon the land. That the initial farming settlements flourished is apparent from the many secondary farms which developed; so much so that it has been suggested that the Isles became overpopulated during the ninth century and that some of the Norse settlers moved on from there to Iceland, the Faroes, England and Normandy (Smyth, 1975:82).

CHAPTER THREE

3.0 THE DIRECT HISTORICAL APPROACH : ETHNOHISTORIC RECORDS

3.1 INTRODUCTION

It is the intention of this chapter to adopt what Steward (1942:337-343) has called the "direct historical approach" to archaeological questions by reference to documented historical records. Such an approach can be a valuable aid to gaining an impression and possibly an understanding of the life-style of the past ancestral communities living in the Northern latitudes of Caithness, Orkney and Shetland. Many traits can become established quickly and go out of fashion quickly, but equally many such patterns of life-style can be seen to continue on from generation to generation, especially where one is comparing the same past socially ancestral line in a similar environment. It would seem to be logical and not unreasonable to accept that observations of descendant people does in fact possess a far greater probability than inference obtained from just any one group (Schiffer, 1978:232).

The ethnographical analogies which are to be used will help to present a `window of opportunity' to look at past cultures by reference to the available documented records. In most instances the ethnographical data that will be used concentrates on the earliest available data as generally being the closest to the past cultures and local economy. There are many aspects of cultural life-style recorded in the 17th century which had by that time become embedded in society and therefore can, to a degree, be viewed from the perspective of being a representation of a much earlier time. Note has to be taken of the certain political changes such as the transference of secular administration from Denmark to Scotland in 1469 of the Shetland Islands and the general impact of the Reformation (Crawford, 1968, 1969). The real fundamental changes in life-style in terms of demographic and economic aspects for the people of these Northern regions would have taken place in the eighteenth and nineteenth centuries which is clearly indicated by the commercial fishing activities and the introduction of the potato crop.

Little imagination is needed to appreciate that many of the ethnographic examples to be given would have been used for generations especially when one considers the limitations on the natural resources and the climatic conditions. For example, the methods of thatching, rope making and agricultural practices, etc, can be sighted as example of areas where little or no change would have occurred over many centuries. In some cases such changes did not occur until late into the twentieth century, if one looks at the use of the quern, the water-mills and the boat design.

Such an approach can therefore be used justifiably to provide a vivid picture of the life-style and the adaptability of these past people and their ingenuity in making use of what to many today would appear to be the least promising of natural resources.

The intention of the following pages is to call upon ethnographic and historical records of the seventeenth century to present a visual overlay of the domestic life-style of the farming communities and their economic subsistence. This will be achieved by looking at:

a) The Background to Land, Taxes and Rents.
b) Agricultural practices in relation to crop production.
c) The uses of indigenous plant material as a resource.

Reference will, where appropriate, be made back to this section when discussing the Analysis of Plant Remains in Chapter 5.

3.2 THE BACKGROUND TO LAND, TAXES AND RENTS

We are indeed very fortunate that a number of old medieval rental documents were saved and subsequently compiled by Alexander Peterkin for production in his volume `Rentals of Ancient Earldom and Bishoprick of Orkney', which was first printed in 1820. They contain a wealth of detailed and valuable information about the way of life in the Orkney Earldom from as early as circa 1500 AD up to 1739.

The picture presented would clearly support a strong dependency on agriculture as the major element of the subsistence economy for the greater part of both the Early and Late Norse period. That agriculture was of such paramount importance is clearly illustrated in its essential role as the necessary provider for meeting the demands of skat (taxes) and rents. The amount of land brought under cultivation is quite considerable and is clearly indicated in the documents, particularly with respect to the Orkney Islands.

3.2.1 Land, Taxes and Rents

At the time of the earliest rental records which exist for circa 1500 AD there would have been very little hard cash as such available and hence in circulation and, therefore, both skat and rentals were paid in farm `produce'. (Marwick, 1952:195). The actual units of weight were, marks, settings, lispunds and meils. The `settings' were associated with the weighing of grain products, while the `lispund' was used for butter, and the mark was used for both. Large quantities of butter were in circa 1500 AD charged by the barrel which was equal to 20 lispunds (Marwick, 1952:195).

The tax on the land must have been established centuries before the earliest present records of circa 1500 AD for they appear to have been well embedded by that date. Such taxes were made using what was known as urisland units, one of which comprised of eighteen pennylands and equally one pennyland was therefore an eighteenth part of a urisland (Thomson, 1987:166).

As noted above, the skats were paid by farm produce and clearly indicated just how important was such husbandry to the Norse settlers. One of the most important products was butter and it is recorded that the 1490 enquiry into the butter skat held in Sanday by Lord Henry Sinclair was informed that in the "auld tymes" butter skat had consisted of a half a lispund of butter from each newly calved cow (Thomson, 1987:19). The butter skat became even more onerous resulting in the murder of Bishop Adam in 1222 by the men of Caithness.At a later stage

it was converted from a tax on cows to one on land according to the amount of pennyland or urisland the farmer owned or tenanted (Thomson, 1987:18-9).

It is apparent from the records that it was often the case that the farmer could not produce the necessary quantities of butter, the remaining amount had to be paid in money or other kinds of produce (Marwick, 1952:196). Worthy of note is the fact that in the Northern Isles like Sanday and Papa Westray bere was used to pay the skat (Marwick, 1952:197). It was Harold Fairhair's son, Hakon the Good, who was credited with introducing the butter and malt skats (Sabiston, 1970:113). The malt skat seemingly originated in having to supply the earl's household with ale, but it subsequently came to be regarded as a tax on cultivated land (Thomson, 1987:120). In the case of the `Forcop' skat it was thought by Sabiston to be a contribution to the hire or wages of a levy or, alternatively, a skat on grassland (1970:117). Though there is in the 1500 rental of Sanday a reference to forcop as "girse mail" (grass rent),Thomson believes it was a charge on arable land which was remitted when out of cultivation (1987:120).

A skat, which appears to have changed little, was that of `wattle' which was a land skat paid by means of hospitality to a ruler while travelling about the country. There is at Birsay, Orkney, a farm-name Wattle which is derived from the ON veizla (Marwick, 1952:132; Marwick, 1970:59; Lamb, 1983:37; Morris et al, 1989:18). It was first applied by Harold Fairhair at the beginning of the tenth century (Sabiston, 1970:117).

It was only in the middle of the sixteenth century in Shetland that it was converted to money; up till then it had been paid by accommodation "for the maintenance of the schireff yeirly as he cam to do justice, meit for men and hors". While in Orkney the change came about by 1492 (Thomson, 1987:122).

One can easily imagine that in many cases the udal land owners would have found it difficult to pay the necessary skats that were placed upon them. Weather conditions were such that in many seasons it must have been difficult if there had been a bad spring or wet summer and the

crops had not been so productive. In such situations it may be that many were pressed into selling their rights to the ownership of the land. Consequently, not only did occupiers or tenants then have to pay land skat but also landmail (rent) as well. The payment of rent was by a system of valuation which was known as `markland' or fractions thereof.

In Orkney `markland' represented land which had the capital value or purchase price of a mark (Sabiston, 1970:112; Thomson, 1987:124). It is from Papa Stour, Shetland, in 1299 that the earliest use of marks is recorded, and it would appear to have been long-established by that date (Thomson, 1987:124). A document which has survived from 1329 AD indicates that a revaluation took place that year of land in South Ronaldsay which had been purchased by Katherin, the widowed Countess of Orkney (Marwick, 1952:201). It would appear that she intended to increase her income from her new land acquisitions.

In most instances the rents were like skat in that they were paid in kind, usually malt or cost (2/3 malt and 1/3 meal) or flesh (not detailed) (Marwick, 1952:201-2).

The situation in Shetland was somewhat different due to the fact that after the battle of Floruvoe in 1194, Shetland was detached from the Orkney Earldom by King Sverrir and subsequently administered from Norway. The skattable unit that was used in Shetland was the markland rather than the pennyland or urisland (Marwick, 1952:208).

The Orkney Earldom of 1595 must have witnessed considerable changes in the agricultural tenancies and economy since the first Norse settlers arrived. Clearly, the extent of land put under cultivation must have been greatly increased over the years for this is seen from the rental records which still survive. Certainly the numerous entries of unskatted quoylands, point to an increase that had taken place since skat was first imposed most likely in circa 900 AD (Marwick, 1952:218). There was an increase in skatted quoylands at this time as more land was put under cultivation. The question that is posed by this increase was, is it to meet the increased family needs or to meet the increased skat

and rents or was it, especially in the case of Orkney, to meet the export demands from other islands, England and Norway.

3.3 AGRICULTURAL PRACTICES IN RELATION TO CROP PRODUCTION

3.3.1 Dykes and Ditches

Such was the importance of the crops of oats and bere to the people of these northern latitudes that it is not difficult to appreciate how important it was to maintain the dykes and ditches so as to keep animals off the growing crops. Court books repeatedly show that a foud had given a `doom' or decision ordering people to repair their dykes or demolish illegal dykes. In 1602 the tenants of Caldbak in Unst were ordered to build up their dykes within eight days so that Alexander Forbes might be "skaithless of thair guidis" in his corn and `girse'; thus that his crops might be safe from their straying animals (Donaldson, 1958:39). An essential element associated with the dykes was the `pund' or enclosure for keeping animals in. In 1602 Erasmus Frangord, of Unst, was ordered to keep a lawful `pund' so that the corn and `girse' of the tenants of Mail and Colvidaill should be safe from his sheep (Donaldson, 1958:40).

3.3.2 Tilling the Land

It would appear that up to the seventeenth century the plough was used to a great extent to cultivate the land in the northern Isles. Records would indicate, for instance, that the Shetland plough was said to have `socks and culters slender and little', and as being drawn by four oxen, the man going before them backwards and the ploughman holding his plough by his side (Sibbald, 1845:18). The record would seem to indicate that there were reasonably large areas of land even on the Shetland Isles that could be ploughed.

It is interesting to note that Magnus Dickson of Samphrey was accused of `wrangous intromission' with a plough belonging to Effie Sutherland in

Copister (Donaldson, 1958:35). If Dickson wanted the plough for use on his won land, it would suggest that there was sufficient land suitable for ploughing on this small island, which is today no longer inhabited. It is also interesting to note the Rev John Brand's comments regarding ploughing in Orkney "their ploughs are little and light having only one stilt, and but little iron in them. At the end of the ridge, he who holds it lifts it up and carries it to the other side of his ridge, and if he please may carry it home on his shoulder" (Brand, 1701:28). It was only in the eighteenth and nineteenth centuries, with the subsequent subdivision of holdings that cultivation of the resulting small strips was carried out by using a spade (Donaldson, 1958:36).

3.3.3 Cereal Crops

A number of sixteenth century writers have noted that Caithness, Orkney and Shetland all produced oats (Avena) and bere (Hordeum vulgare L.) in varying amounts. It would seem that little or no wheat (Triticum) was grown. The oats and bere would have provided both bread and ale, though there would have been seasonal fluctuations depending on the amounts that grew and matured successfully in any given season. Quite often the people would have to go through the whole summer without any bread being available due to cereal stocks being low or non-existent.

In North Ronaldsay, the folk had barley bread available in the winter only in 1529, with fish and milk as the main substitute. This was often the state of affairs in Shetland, for in Unst the grain was only enough to maintain the inhabitant for four or five months of the year (Fenton, 1978:332). On Orkney good corn grew in several places according to the Rev John Brand for in 1701 he said "Sanda the pleasantest I think of the Orkney Isles - everywhere it is well furnished with Grass and much good Corn, said to be the best in Orkney" (Brand, 1701:46; 56). As for Caithness, the Rev Brand found the Country to be "pleasant and very Fertile abounding with Grass and Corn, hence Yearly there is a great quantity of Victual Exported as An.1695, there were 1600 Bolls Embarked and taken out", and even more revealing "intelligent Inhabitants observe that here is the cheapest Market in the World" (Brand, 1701:225).

One should also remember that servants got their wages partly in produce, such as bolls of bere into the 1700s. There would appear to be little doubt that bere was the most important crop for export and had most likely always been so, and this would therefore explain the emphasis on bere as being the main crop being produced. This was clearly the case in the Northern Isles and was the crop on which the best manure was always applied when available.

It is worth noting that the charge made against Adam Cromarty in Dunrossness, Shetland, was that he had "grippit Elspeth Rattray's muck" (Donaldson, 1958:36). Another not insignificant reason for the main production being bere, was that the lairds and Earls before them had always, from the earliest times, insisted on having a considerable proportion of their rent and taxes (skat) paid for in bere, oats were considerably less important (Fenton, 1978:335).

The greatest production was centred on the Orkney Isles where black oats (Avena strigosa Schreb.) and bere were either grown alternatively or in most cases, two crops of bere before one of oats, much depended on the availability of manure particularly on the sandy soils. Generally though the black oats was usually sown on the poorer outfield lands (Nicolson, 1978:54). The following extract from the 1794 Board of Agriculture Enquiry is quite clear:

"The Grains cultivated on these Island (Orkney) are almost universally Gray Oats and Big or Bear; and these in alternate crops without intermission, Bear has succeeded to Oats and Oats to Bear invariably on the same land for centuries."

(Marwick, 1952:223)

The importance of these crops to the people of these northern latitudes can be seen to be appreciated and upheld by the courts of law whenever there was any likelihood of crops being damaged or grain stolen. In 1603 the court of Walls approved a `doom' or decision of the foud that the swine of Papa Stour should be `snypit and ringit' (muzzled and ringed) in both summer and winter, so as not to damage the grass and corn crops. While in Dunrossness the foud had to order Magnus Bv to

make over a quantity of bere to John Scott in compensation for `swyne ruting' (Donaldson, 1958:29).

3.3.4 Harvesting

The crops of oats and bere were normally ready by about September, but sometimes when a storm was anticipated they would be cut when only partially ripe, otherwise the storm could easily flatten them by the rain and the wind would twist them, thus virtually destroying the whole crop (Nicolson, 1978:68).

Whenever possible, the grain crop was harvested with the intention of keeping the length of the straw as long as possible, so that it could after threshing be used for thatching or rope making, etc. So quite often the corn was plucked by hand particularly the black oats (Avena strigosa Schreb.) in the furrows and on the poorer soils where it was short in the stalk. The Rev John Brand writing in 1701 noted that "in some places they do not shear their corn, but pluck it up by the roots" (Brand, 1701:27). The corn heuks that were used in Caithness and Orkney were the traditional type with a toothed blade, whereas in Shetland the farmers had a more rounded form which was not toothed (Fenton, 1978:337).

In most instances the first bread of the season came from stalks picked up by the gleaners which had been dried and ground on the quern. Small stacks called scroos in Shetland were in most cases thatched using the common reed (Phragmites communis Trin.), whereas in Orkney the stacks were mostly roped down by means of straw simmens (Fenton, 1978:352). Flails for dehusking the crops were of various forms but basically consisted of a wooden handle, a souple or beater of wood, rope or rolled sealskin. Winnowing was usually carried out in a barn in the Northern Isles which generally had two open doors which were opposite and thus created a through draught. On those occasions when there was too much wind a mat or flackie made from marsh ragwort (Senecio jacobaea L.) or common dock (Rumex obtusifolius L.) was placed in the doorway (Fenton, 1978:372).

3.3.5 Corn Drying Kilns

In the Northern Isles it was not uncommon for the crop not to ripen properly due to the often short and moist season. A kiln was used to dry the grain which was also used to dry malt, thus stopping its growth once it had germinated and thus allowing it to be processed for the making of ale. But above all by drying the grain one facilitated the grinding of the grain. A reference to "raw eittis" or raw oats clearly suggest that the grain was dried or parched in a kiln after being harvested and before being taken to the mill for grinding (Donaldson, 1958:97). Other methods used for drying included using round-bottomed pots or rolling heated stones in the grain, this latter method was used both in Orkney and Shetland (Fenton, 1978:375).

Evidence would suggest that at the Norse settlement of Freswick, Caithness (building VII), a four-sided kiln there lasted until quite late into the thirteenth century, for here a building was found to contain such a structure (Curle, 1939:95; Fenton, 1978:379). Such kilns appear to be restricted in distribution to the smaller farms of the northern parts of Shetland, where they were placed inside or on the end of the barn. Circular kilns usually form the end structures in long houses or in barns that are free standing. The four-sided kiln has been named the `North Shetland' type, but this could very well be more to do with survival/discovery than with actual distribution patterns (Fenton, 1978:376-9).

Evidence of other corn drying kilns has come from a number of sites including Jarlshof (Hamilton, 1956:192) and Beachview, Birsay, `Studio Site' (Morris, 1983:143-5) see chapter 4.

3.3.6 Milling/Grinding Mills

In both Orkney and Shetland there is clear evidence of rotary querns being used well into the twentieth century. It has been recorded that in the August of 1625 the Sheriff or Orkney agreed to a request from a mill owner that the heritors, feuars, farmers, tenants and tackmen of

land in St. Andrews Parish should all have their querns taken from them and be retained at the mill as long as it was in production (Fenton, 1978:389).

The milling operations would have been mostly carried out during the winter months when streams would be in full flow or otherwise a millpond would have been created or a dam formed.

It is interesting to note that when Sir Walter Scott visited Shetland in 1814, there were well over 500 mills in operation (Nicolson, 1978:96). This fact alone must indicate that significant cereal crops were being grown in Shetland. The milling or grinding resulted in the oatmeal and beremeal being able to be used in a number of different ways so as to achieve variety in the diet. Even the sids or husks were not wasted, they were `set' with water and allowed to stand for a week to produce a sharp refreshing drink known as `swats'. The remaining solids after straining were cooked to make a delicious food known as `soins' (Nicolson, 1978:97). Recent excavations at the site of Earl's Bu, Orphir, Orkney, have revealed evidence of a Norse Horizontal Mill (Batey and Morris, 1991:45-49; 1992:33-41) see Chapter 4.

3.3.7 Brewing

Hector Boece in 1527 was recorded as being particularly taken by the virtue of Orkney ale "the people went in for excessive drinking and made the strongest ale in Albion because they had plenty of barley" (Fenton, 1978:332). It has been said that every farmer was his own master and thus the quern was used to grind malt as well as bustin or beremeal. It is worth noting that in many of the Northern Isles great quantities of ale would have been drank due to the fact that many of the cattle had insufficient food supplies to produce milk, especially during the winter months. In Shetland brewing must have flourished for in Dunrossness in 1604 there were some thirty-five persons engaged in brewing, and some three Acts of Court aimed at regulating this work. It is most likely that brewing centred on Dunrossness due to the availability of grain

there, whereas elsewhere it was needed to provide the basic bread supply with little left for malting and brewing (Donaldson, 1958:102).

3.3.8 Linen Production

Flax (Linum usitatissimum L.) like cereal crops has been grown in the Northern parts for a considerable time and more archaeological evidence is being discovered to support the historical texts. In Holm, flax is recorded as growing in the 1690s in sufficient quantities that it was able to supply the domestic needs as well as selling to the English buyers. It is recorded that in Kirkwall, in 1747 there were no less than 53 master weavers, while in Birsay and Harray there were upwards of 40-50 weavers mostly producing linen (Fenton, 1978:492).

3.3.9 Kailyards and Plantiecrues

It is very difficult to say what other plants were being grown on the farms in these Northern latitudes other than cereals and possibly flax, but it would be fair to assume that these were not the only ones being grown particularly during the Late Norse Period. There is every possibility that in the kailyard near the farmhouse and in the plantiecrue in the common grazing just outside the hill-dyke there could very well have been a variety of vegetables being grown on a small scale for domestic use.

Similarly, on the larger estates private gardens would have equally supplemented the diet by the production of an increasing variety of different vegetables. Kail (kale) has been recorded as growing in the fifteenth century and there is every possibility that it was being grown well before that date. It would have been of great assistance in the fight against the disease scurvy which was very common.

3.4 THE USE OF INDIGENOUS PLANT MATERIAL AS A RESOURCE

3.4.1 Plant Material - Roof Cover

In the Northern latitudes, which are presently under discussion, it was quite common for the roof timbers to be covered with poans or strips of green turf. Another popular method was to use flaws (Flais) which it would appear were often torn up by hand from the ground surface of the dry moss lands, and they were considered to be superior to poans (Fenton, 1978:175).

In Orkney a special method was adopted whereby straw simmens (ropes) were first laid as an underlay to support the turf and thatch. By this method a much brighter condition was provided internally to the dwelling (Fenton, 1978:184). While in Shetland lengths of hedder simmens - that is ropes twisted from heather - were chosen for their long-lasting qualities, as well as their roughness which helped to stop the layer of roofing material above from slipping (Nicolson, 1978:71).

Both in Caithness and Orkney bundles of straw called hallow or wisp hay were recorded in 1567-1623 as being used for roofing (Fenton, 1978:177). In Shetland also the upper covering of such roofs was done with straw thatch which was usually held down by simmens of straw stretched tightly from gable to gable and fastened to the poans with wooden pegs (Nicolson, 1978:72).

The thatch was replaced virtually every year so that the soot laiden thatch could be used as manure. Such was the value placed on the soot deposit as a manure, that it was often the case that no chimney or smoke-hole of any kind was provided in the roof. Often also the thin layers of turf between the rafters and the straw covering were not used, again for the purpose of maximising the soot deposits on the straw (Fenton, 1985:78).

3.4.2 Plant Material: For Making Baskets-Containers

A very functional object which was made from straw was that of the basket which were called cassies or kishies and took a variety of forms. In Orkney the name cubbie was often applied to baskets which were made for a variety of different uses, such as a winnowing cubbie, a sowing cubbie and even a horses cubbie which was used as a form of muzzle. The straw of black oats was preferred for the making of such cubbies. Once the straw bands were formed they were linked together by cords of bent-grass (Agrostis sp.). Quite often heather (Calluna vulgaris L.) was also used for making such cubbies (Fenton, 1978:260). A form of open-work nets called maishies, which were rectangular in shape, were also made of straw, though dried rushes (Juncus effusus L.) and bent-grass (Agrostis sp.) were also used. They were often used for the carrying of large peats on either side of a pony's back (Fenton, 1978:254). While the covers made for a pony's back called flackies, were made of parallel bunches of straw or bent grass simmens (Fenton, 1978:246).

Besides straw a number of other kinds of plants were used in the making of a variety of objects such as a Huvie which could be made from the shoots of mugwort (Artemisia vulgaris L.) or the stalks of the broad-leaved dock (Rumex obtusifolius L.). The kilpack was a small basket which had a handle and was either made from docks or from twigs. Small baskets which were carried on the back were called Toig or Toyack, they were used for carrying meal or corn and were most often made from tree roots (Fenton, 1978:263).

3.4.3 Plant Material: Rope Making

In these early times it was plants which provided the only available material for the making of ropes for a variety of tasks. Probably the most common ropes were those made from straw called simmens which were used extensively throughout Caithness, Orkney an Shetland, as noted above in the construction of roofs. In most cases it was the oat straw which was preferred for it was found to be more durable than the bere straw. But in addition there were several other plants which were also

used to a greater or lesser extent in rope making. Certainly the shoots of the native Crowberry (Empetrum nigrum L.) were also used in the process of roof thatching for they provided very strong ropes indeed. The shoots of various grasses were also used as was the roots of the marram grass (Ammophila arenaria L.). Other grasses from the sand-dunes such as the meadow soft-grass (Holcus lanatus L.) were often used for making tethers and bridle reins (Fenton, 1978:164). The tough stalks of the bent-grass (Agrostis sp.) were used in Shetland for making both baskets and ropes. In some cases its importance was such that it had to be shared out amongst the crofters in the district (Nicolson, 1978:89). Tethers for sheep were made from the shoots of the dog's tail grass (Cynosurus cristatus L.) and were often called pun tethers. Another very commonly used group of plants were the rushes or floss (Juncus spp.) which were cut in the autumn and then made into simmens which like the heather above were very strong (Fenton, 1978:264). Such was the demand for rushes that by the year 1623 it was recorded as being controlled. At this time an Act of Bailiary prohibited the cutting of bent or the pulling of floss before the first of Lammas each year, under a fine of ten shillings Scotch (Fenton, 1978:264). In Shetland an old Act stated that no-one must cut floss on the scattald before Lammas without due advertising his neighbours under pain of forty shillings Scotch (Nicolson, 1978:89).

3.4.4 Plant Material: Source of Fuel

Peat must have been one of the earliest plant materials used by man for burning in the Northern Isles, especially where trees were no longer indigenous. The traditional way of cutting peat was with a special peat spade which has been developed into different styles in different areas.

The Old Statistical Accounts, and the Agricultural Survey of the 1790s indicate quite clearly that in many parishes turf was used as a fuel, sometimes alongside peat and sometimes alone. Reference to the flauchter spade for cutting turf was first recorded in 1493. As the peats became scarcer in the islands turf came to be used more and more for fuel (Fenton, 1986:106).

Turf was also often used to supplement the fertility of the fields, being applied either directly or after burning or after being used as bedding in the byre. A good example of the extensive removal of peat from the moors to the infields comes from the Island of Papa Stour, in Shetland, where some two-thirds of the island area outside the hill dyke has been pared to the bare rock, with the resulting settlement third having a considerably increased depth of cultivated soil (Fenton, 1986:104).

3.4.5 Plant Material: A Source of Bedding-Manure

Nothing that could be used was ever discarded, rather it was recycled, if that was possible. The ash from the peat and turf fires was collected for spreading on the fields (providing potash), either directly or indirectly, when it was first used as bedding to help soak up the liquid manure in the byres (Fenton, 1978:283).

Both grass and short heath were cut and removed from the hills in August, and when dry were stacked outside the byre in the yard ready for subsequent use as bedding. Invariably, a mixture of grass or heath, dung, mould (decaying vegetable matter) and ash could be 4 to 5 ft (1.2-1.5 m) deep in the byre, at which point the heads of the cattle would be touching the roof (Fenton, 1978:281). Such manure was removed and applied to the land in the spring prior to the bere crop being sown. When there was sufficient supplies of such manure it was often the case that two crops of bere would be taken before one of oats was sown.

3.4.6 Plant Material: As Dyes

There are a number of plants for which there are records relating to their use as dyes and for which there can be little doubt that such uses would have existed long before they were first recorded. For the detailed discussion of such plants see Chapter 5.

3.5 SEAWEED: A VARIETY OF USES

Another group of plants which played an essential role particularly in the husbandry of the land was the various species of seaweed which could be gathered from the shore at low tide or after a heavy gale had washed quantities ashore.

Seaweed is known to contain nitrogen, potassium and some phosphorus, all of which are essential for the growth of crops. The seaweed was of particular importance to the sandy soils, since in most cases they were deficient in potassium (Fenton, 1986:48). Such was the value of seaweed, that from very early times it had been recognised and thus reflects a much older tradition. It was recorded that on 27 April 1509 the community of Toab should not have the right of taking seaweed from the shore at Sabay (Johnston, 1907:251-3; Fenton, 1978:275).

Sometimes the ground was manured two or three times a year with seaweed, for at Sandwick in Shetland and Stromness, Orkney, it was recorded as being applied to the fields in winter and also in spring when compost middens were spread (Fenton, 1978:275). It is also recorded from Caithness that in 1699 the cottars on the Mey estate, from 11-26 December, gathered in seaweed solely for the purpose of manuring the land with ware for spring sowing (Donaldson, 1938:122; 126). As Dickson (1770:431) points out, seaweed was unfavourable to weeds.

In Shetland a particular species of seaweed know as marlak (Zostera marina) was stuffed into mattresses used for bedding. Its special quality was that it was thought to be proof against fleas (Fenton, 1978:194).

On the Orkney Islands of Sanday and North Ronaldsay, there was no peat nor wood other than drift wood which could be used for fuel. It was noted that in 1524 the only local material that these islands had for use as fuel was seaweed or sandy turves, both of which gave very poor light. The better off inhabitants of Sanday were able in the sixteenth century to obtain peats from neighbouring islands (Fenton, 1978:206), while in 1770 the main fuel used on Sanday was cow dung baked with straw

and sea tangle (Laminaria spp.). Here the main winter job was to gather seaweed for fuel (Brand, 1701:24-5; Fenton, 1978:206).

Many seaweeds have been used as a source of food down the ages until this present day. It would therefore be very surprising if the inhabitants of the Northern Isles had not made use of such an easy food source. Most edible seaweeds are low in calories and rich in minerals, particularly iodides. The species laver (Porphyra umbilicalis)(Plate 7) was made into a puree called laverbread and was used with oatmeal (Mabey, 1972:155; 162). It was in common use as a vegetable in Scotland, Ireland and Iceland, as was `dabberlocks' (Alaria esculenta)(Plate 7) and dulse (Rhodymenia palmata)(Plate 7).

The sugar wrack (Laminaria saccharina) is a sweet brown algae due to the presence of mannitol (mannine), which is a sugar alcohol present in brown algae as a food storage material. In Scotland sugar wrack was used until the nineteenth century and its young st ipes were sold in the streets of Edinburgh as a vegetable (Brouk, 1975:49-54).

The making of kelp and other possible uses of burnt seaweed will be discussed later in Chapter 5. For a list of species of seaweed used primarily for manuring and those which are edible see Appendix A.

CHAPTER FOUR

4.0 THE ARCHAEOLOGICAL DATA AND EVIDENCE OF PLANT REMAINS

4.1 INTRODUCTION

Over the last few years an increasing number of Norse sites have been discovered and excavated, thus increasing our knowledge of the settlements types and their material culture. At the same time, improved recovery techniques and a much greater awareness of the role that environmental archaeology can play has meant that an enormous increase has taken place in the amount of such evidence. This has led to a much better understanding of the resources that were available to the Norse settlers and therefore to their subsistence economies.

The evidence for plant species both wild and cultivated has subsequently increased considerably and where such material has been identified and published it has provided a wealth of information. It is therefore the intention of this chapter to consider those sites (fig 1) in Caithness (2 No), Orkney (8 No) and Shetland (3 No) where details are available of plant species and to present that information for further consideration and analysis

4.2 CAITHNESS SITES

4.2.1 Freswick Links (Fig 2)

The site of the Norse settlement at Freswick Links is situated on the eastern coast of Caithness. This particular site has been known for some considerable time and was excavated at intervals during this present century by Curle and Childe in the 1930s and 1940s (Curle, 1939; Childe, 1943; Batey, 1982; 1987a; 1987b). An environmental survey was implemented in 1979 (Rackham, et al, 1984) as a pilot survey and an essential part of this study were two environmental column samples which

were taken through the sand dune deposits that also included midden layers. It was subsequently decided on the results from this survey to undertake an archaeological `rescue' project between 1980 and 1984, for the site had been recognised as being highly significant, but also subject to considerable erosion and thus loss of archaeological deposits (Batey, 1989; 1991).

The first part of the programme was the examination in Area 4 of a trench adjacent to Column Sample 2. This work continued into 1981 and 1982 with the excavation and bulk sampling of deposits in nine further trenches (4-8; 10-14; fig 2). The work involved the recovery of all material retained on a 1 mm mesh sieve from within a 4 m by 0.5 m column of deposit in each trench (Batey et al, 1981; 1983; AKG Jones et al, 1983; Jones 1991a; Morris and Rackham et al, 1992). The botanical results from the bulk sieving operations are present below under the heading Carbonized Plant Remains - Area Samples.

It was in 1982 that a number of further environmental Column Samples were taken from or adjacent to the above trenches, particularly to enable interim reports to be produced. The botanical finds from these Column Samples are present below under the heading Carbonized Plant Remains - Column Samples (Huntley, in Morris and Rackham et al, 1992:76-85).

4.2.1.1 Carbonized Plant Remains - Area Samples

The samples taken were after drying floated over 500 μ mesh and the material retained on the sieves was sorted to retain the potentially identifiable material. This material and the residual was sent to the Palaeoenvironmental Studies Services, University of Durham. It was noted that both barley and oats occurred in all cases in almost equal quantities suggesting to Huntley, that the two species formed the basis of the cereal economy at Freswick Links, and that it appears to have changed little over the time scale (Huntley in Morris and Batey, forthcoming a). The subsequent analysis revealed that all the identifiable barley was in fact hulled, and the ratio of twisted to

straight embryos has suggested to Huntley with 99% probability that the barley was in fact all six-rowed (Hordeum vulgare). It is interesting to note that there was little or no chaff found, this fact will be discussed further in Chapter 5.

No evidence of the wild oat (Avena fatua) was found from these samples. There were only floret bases of Avena sativa found and it was considered by Huntley that only the cultivated type was being grown. Interestingly, a few grains and chaff of wheat were found, the grain exhibited the characteristic broad, squat shape of bread wheat (Triticum aestivum). In addition to the above, there was also evidence found to support the possible cultivation of both flax (Linum usitatissimum), and the Celtic bean (Vicia faba) (Huntley in Morris and Batey, forthcoming a).

The seeds of wild species were generally found to be rather scarce (Huntley in Morris and Batey, forthcoming a).

4.2.1.2 Carbonized Plant Remains - Column Samples

In 1982 as mentioned above, nine Column Samples (4-12, fig 2) were taken in addition to the two taken in 1979 (1-2, fig 2) as part of the Environmental Survey (Rackham et al, 1984).

After each sample was processed (Morris and Rackham et al, 1992:49) the floats from the sieved material as well as the hand-picked material from the 3.35 and 1.7 mm sieves was all sent to the Palaeoenvironmental Studies Services at the University of Durham for macrofossil analysis.

On the basis of the analysis, there were found to be seven different groups of samples which could be recognised from the full botanical data. The conclusions which Huntley has been able to draw was that each column was different from the other, though a few were similar. There were no trends apparent from the botanical remains. Particular instances were for example:

Column 6

It was found that Vicia faba (Celtic bean) Coryllus avellana (Hazel) nuts were present. Possible indication of food crops other than cereals.

Column 8

Only a few cereal remains were noted, though a number of heathland species were present. Interpreted as a possible indication of `structural economy' (thatching).

Column 10

Rich samples with large amounts of cereal grains. Main area for arable indicators.

(Huntley in Morris and Rackham et al, 1992:77:84)

The fact that there were relatively few weed seeds present has prompted Huntley to suggest that the grain was imported rather than grown locally. It would appear that oats constituted the main cereal crop, though there were moderate amounts of barley present. In Column 10 it is interesting to note as Huntley points out that there were two grains considerably longer than any others, but it was not possible to distinguish between wild and cultivated oats (Huntley, in Morris and Rackham et al, 1992:83-5). The fact that both the cultivated oat (Avena sativa) and the wild oat (Avena fatua) were present was apparent from the presence of their characteristic floret bases. Considerable amounts of barley were found to be mostly hulled. As both straight and twisted grains were present, it can be assumed that some of the barley was in fact the six-rowed Hordeum vulgare (bere). There was very little evidence of wheat and the only other possible cultivated crop was that of the Celtic bean (Vicia faba). Practically all the samples had evidence of burnt peat, heath or moorland plants (Huntley, in Morris and Rackham et al, 1992:85).

It would appear that the results from the Column Samples and the Bulk Samples from the Areas show apparently only limited correlation, and Batey has made the point that it is the smaller samples like those from the Columns that are more generally taken and from which conclusions are

drawn. Equally, if even larger samples are taken than those from the Areas the results may differ again (1989:228).

Besides the evidence from carbonized material, there are many instances of impressions on the vegetal tempered pottery found at Freswick which clearly indicate the cultivation or at least the utilisation of barley and oats (Batey, 1989:227; 1987:133).

4.2.1.3 Burnt Material and Charcoal

All evidence of burnt and charcoal material was retrieved at Freswick Links, and was subsequently examined.

All areas produced evidence of lumps of burnt peat which had no doubt been used for fuel. The evidence for burnt seaweed was in the form of st ipe and bladder fragments. One such bladder recovered was later identified to the bladder wrack (Fucus vesiculosus) (Nye in Morris and Batey, forthcoming a). There were also frequent finds of charcoal which included twig pieces of heather (Calluna vulgaris), also regularly found was evidence of birch (Betula sp.) along with other tree and shrub species (Nye, in Morris and Batey, forthcoming a).

4.2.1.4 Pollen Analytical Investigations

The pollen monolith taken at the site of the Hill of Harley has been referred to above in regard to the local vegetational history. It was also taken with the view of helping to determine the type of farming practices implemented at Freswick which was some 1.5 Km away. Such information was viewed as being able to help determine whether the cereal evidence found at Freswick in the form of carbonized cereal grains, represented local grown crops or imported cereals.

It would appear that the results have been interpreted by Huntley as supporting continuous cereal cultivation during the `brock economy' and the Pictish period in Caithness (Hedges, 1987, 36,III; Fairhurst, 1984;

Batey, 1991; Gourlay, 1989). The evidence from the pollen diagram would though indicate that during the following Norse period there is little evidence of cereal cultivation around the Hill of Harley (Huntley in Morris and Batey, forthcoming a).

This evidence has lead Huntley to strongly suggest that the inhabitants of the Norse settlement at Freswick Links were most likely importing the cereals that they required. Huntley would also seek support from the Principal Components Analysis (PCA) and the level of the percentage of Plantago pollen present (Turner, 1964), in respect of the Freswick samples for this view (in Morris and Batey, forthcoming a).

For details of the plant species recovered from Freswick Links, see Table 1.

4.2.2 Robert's Haven (Fig 3)

The Robert's Haven site is situated in a small bay facing North West onto the Pentland Firth.

Present in the bank at the head of the bay are extensive midden deposits and structural remains which are slowly being eroded by constant wave action. Erosion has increased considerably since an initial survey was undertaken by Batey (1984) (Barrett, 1992:10). Thermoluminescence dates have been provided by Durham University (Batey, 1991:31-2) which would suggest that the middens are of the Late Norse period.

In 1992 an archaeological sampling project was undertaken consisting of a site survey and the excavation of three sample columns, the latter were intended to provide material for palaeoeconomic and environmental studies (Barrett, 1992:16). The soil samples were treated to wet sieving/flotation using a modified Siraf tank (Jones, 1983) fitted with 1 mm and 0.5 mm mesh (Barrett, 1992:19).

4.2.2.1 Carbonized Plant Remains

Some twenty samples have been processed and sorted for evidence of carbonized seeds, cereal grains and plant remains. Many of the seeds recovered are consistent with a maritime heath. The cereal grains included oats (Avena sp.) and barley, most likely thought to be the six-row barley (Hordeum vulgare), as the ratio of straight to twisted (47-25) grains was almost 2:1.

Chaff fragments were also present along with many typical crop weed seeds, which it is suggested by White would indicate that the cereals were being grown locally. Flax seeds (Linum usitatissimum) were found in five samples and it is suggested that it may also have been grown locally. (White and Barrett pers comm).

For details of the plan species recovered from Robert's Haven see Table 2.

4.3 ORKNEY SITES

4.3.1 Brough of Birsay (Fig 4)

The site is situated on the eastern face of the Brough of Birsay, which is a small island lying to the north-west of Mainland Orkney. Early excavation works in the 1930s were carried out mostly to assist in the visual display of the features (Curle, 1982), subsequently more detailed works were carried out after the war (Cruden, 1958, 1965; Radford, 1978). A report on the artifactual evidence from the earlier investigations has been published (Curle, 1982).

It was the threat of coastal erosion which was the spur to further investigations by Hunter and Morris which commenced in 1974 (Hunter and Morris, 1981; Hunter, 1983, 1986).

The three areas to be discussed here are the sites numbered VII, VIII and IX. They all revealed a number of phases of occupation, it is

though the Norse phases 2 and 3 which are central to this discussion (Hunter, 1986).

4.3.1.1 Phase 2 - The First Scandinavian Settlement (Viking Period)

In Phase 2 evidence was found of structures which represent the primary phase of Norse occupation on the respective sites. There were also numerous hearths, pits and associated refuse deposits, all of which were derived from domestic, farm and industrial activity taking place on the site (Hunter, 1986:69-103). It has been suggested by Hunter that settlement in phase 2 on all three sites had occurred during the 8th century, while the final dates for sites VII and VIII lay within the late eighth century or the early part of the ninth century. At about this time these structures give the impression of abandonment. In the case of site IX, it would appear that it continued to be used and there was no evidence of a break in continuity (Hunter, 986:103).

Calibrated radiocarbon dates have been provided for phase 2 with reference to each of the above mentioned sites (Hunter, 1986:104-5; 177). They have ranged from:

Site VII - 958±70 cal AD to 990±70 cal AD
Site VIII - 860±60 cal AD
Site IX - 950±60 cal AD to 994±60 cal AD

4.3.1.2 Phase 3 - Later Norse Settlement

It is the view of Hunter that the Phase 3 buildings were most probably erected by the first half of the eleventh century. There were six structural forms on sites VII and VIII, and it is the view of Hunter that they should be seen as a rebuilding phase of pre-existing structures which were broadly contemporary (1986:143).

Calibrated dates from phase 3 range from:

Site VII

1058±95cal AD to 958±65 cal AD

A silver penny of Aethelred II (AD 978-1016) was found in the wall core of structure 10, and has been given an estimated depositional date of c.AD 1009-1020, thus providing helpful evidence for the date of construction works. This appraisal date and those of the Radiocarbon assays would confirm the occupation as being of Late Norse Period, which it is suggested came to an end sometime during the middle of the twelfth century (Hunter, 1986:142-3).

4.3.1.3 Carbonized Grain and Seeds: Excavations 1974-1982

The macrobotanical remains were processed by the manual paraffin flotation technique. Samples were taken and processed from each major burnt contexts, which included burnt areas of house floors, hearths and waste or midden deposits (Donaldson, in Hunter, 1986:216). Material left in the sieve was washed and placed in sealed containers for sorting and identification in the laboratory (Donaldson, in Hunter, 1986:217).

The resulting evidence of plant species covers both cultivated cereal grains and the seeds of associated plants, as well as seeds, nutlets, fruitstones and shoots of other plants and shrubs (Donaldson, in Hunter, 1986:216-8). There would appear to be a close correlation between the plant species found on these sites and those in the Birsay Bay area (Donaldson et al 1981; Donaldson, in Hunter, 1986:219). The cereal evidence includes a large percentage of asymmetric grains which are referable to six-row barley (Hordeum vulgare) bere. The large proportion of oat (Avena sp.) grains found has prompted Donaldson to suggest that it is clear evidence that oats were being cultivated as a separate crop. It has also been suggested that the weed seeds present would support the crop having been grown locally and not imported from elsewhere (Donaldson, in Hunter, 1986:219). Both these points will be discussed further in Chapter 5.

4.3.1.4 Charcoal Evidence: Excavations 1974-1982

The charcoal remains have provided information regarding a number of tree and shrub species which were found to be present throughout the different phases in relatively the same proportions, but with no apparent trends showing (Donaldson, in Hunter, 1986:219-20).

4.3.1.5 Room 5

The excavation at this site was purely a sample investigation which was undertaken in the summer of 1974. The intention was to distinguish the major phases of occupation and to note the stratigraphical contexts to which recovered artifacts belonged, with the aim of helping to relate known artifacts from pre-war investigations found elsewhere on the site (Hunter and Morris, in Curle, 1982:124).

It is most probable that Norse occupation included phases 3a, 3b and 4, such an assumption is proposed based on a single calibrated radiocarbon date from phase 3a (995±80 cal AD) and on evidence of steatite cooking vessel fragments and a seatite spindle whirl found in phase 4 (Hunter and Morris, in Curle, 1982:129:131).

In each of the probable Norse phases (3a, 3b and 4) charcoal was collected and subsequently identified (Donaldson in Curle, 1982:138).

For details of the plant species recovered from the Brough of Birsay see Table 3.

4.3.2 Birsay Bay Project - Brough Road, Birsay (Fig 5)

The Bay of Birsay lies on the North West coast of Mainland Orkney and consists of two bays which are divided by a small promontory of land known as the point of Snusan or Snushan. It was James Farrer who in 1862 started to excavate in the area of Birsay Bay and he was followed

by other notable archaeologists, the details of which are given by Morris (et al, 1989:23-36; 71-8).

The works on the coastal sites in the N part of the Bay of Birsay, beside the Brough Road commenced in 1976. In the summer of 1978 the recovery of archaeological information continued while at the same time a strategy was introduced for the recovery of material which would be relevant to the economic and environmental interpretation of the sites as well as their C-14 potential (Rackham in Morris, et al, 1989:231). This work started in Areas 1 and 2 which lay on the cliff side of Birsay Bay just south of Red Craig (Morris et al, 1989:191-215). Present were cist graves and various structures along with substantial layers of midden deposits.

Subsequently a number of radiocarbon dates were processed for Area 1 and they ranged from, 720±55 cal AD to 958±60 cal AD, while in Area 2 the date range was found to be 828±65 cal AD to 955±110 cal AD (Morris et al, 1989:127; 141; 299). Support for the Viking period is also provided by two finds, firstly a hog-backed antler comb (RF 315) from a burial in Area 1 (Morris, et al, 1989:127) and secondly a steatite fragment (RF 337) found also in Area 1 (Batey in Morris et al, 1989, 199).

In Area 3 a figure of eight structure was discovered on the cliff-edge of Birsay Bay at Red Craig. The shape lent itself to the creation of two rooms, in which there was evidence of a hearth, two fire-pits and what is thought to be an oven (Emery in Morris, et al, 1989:143-74). Considerable remains were revealed from the various phases of this structure.

Three radiocarbon dates were obtained from the structure they ranged from 720±100 cal AD to 936±60 cal AD (Morris et al, 1989:299). It is the view of Morris that the structure was in use during the Late Pictish and the Early Norse period (et al 1989:169-71; 174; 287).

4.3.2.1 Carbonized Plant Remains

In Area 1 small selected sub-samples were sieved, while in Area 2 some were also sieved and others were sent to the laboratory at University of Durham where they were dry sieved and finally wet sieved. It was the residue caught on these latter sieves that when dried and sorted produced evidence of carbonized grain, seeds, seaweed and charcoal.

In Area 3 there were some 47 samples collected from 27 layers of which eight contained floor deposits and were processed for both their potential C-14 and environmental analysis (Rackham in Morris, et al, 1989:231-2).

In all cases the plant remains were carbonized and it is the view of Donaldson that their resulting carbonization and preservation should be seen as being accidental (in Morris et al, 1989:262). The Area 2 samples came from midden layers which were very homogeneous in character and probably represented discarded material such as peat ash, grain which got accidentally burnt along with a few associated weed seeds, discarded and burnt plant material such as food and bedding, etc (Donaldson and Nye in Morris et al, 1989:266).

In Area 3 the samples were quite different for they were largely derived from hearths or deposits adjacent to them. The botanical remains were dominated by cereal grains. It is suggested that they could have resulted from either a domestic accident of from parching of the grains prior to storage.

Evidence as to the type of crops being cultivated can clearly be visualised from the discovery of grains of mostly barley (Hordeum of vulgare), oats (Avena) and the sees of flax (Linum usitissimum). Plants associated with cultivated land and open habitats were also identified from their carbonized seeds. Carbonized seaweed was also found, some of which has been identified as the bladder wrack (Fucus vesiculosus)(Donaldson and Nye in Morris et al, 1989:263-4).

Quite large quantities of carbonized wood (charcoal) fragments were recovered, mostly from middens and hearth samples. On closer examination, it was revealed that a significant amount was derived from tree species not native to Orkney. The vast bulk of the charcoal had been produced from willow (Salix), also present as charcoal was evidence of heather (Calluna vulgaris)(Donaldson and Nye in Morris et al, 1989:262-3)

For details of the plant species recovered from Birsay Bay, Brough Road, see Table 4.

4.3.3 Beachview, Birsay (Fig 6)

The area known as Beachview is located on the south side of the Burn of Boardhouse, where it enters the Bay of Birsay on the North west extremity of Mainland Orkney.

It is the view of Morris that the Beachview area may well consist of one or two mound sites which are composed of archaeological deposits, formed from the remains of past buildings and discarded domestic waste (in Batey et al, 1993:304).

The `Studio site' which was excavated in 1978-80 has revealed substantial east-west rectangular structural remains which have been interpreted in part as a byre, with a possible corn-drying kiln at the north-west end of the main structure (Morris, 1983:143-4). It would appear that when the rectangular building went out of use it was then used as a midden dump.

The midden material was examined by Alison Donaldson, and was found to contain carbonized material which was identified as the cultivated oat (Avena sativa), barley (Hordeum), and the Scot's Pine (Pinus sylvestris). A radiocarbon determination on the above carbonized material gave a date of 1038±55 cal AD. Morris has stressed that this should only be regarded as provisional, pending further determination on non-coniferous material (1983:146). In 1979 Area `D' and `E' were

examined separately from the main area of the site. The few samples which were taken in these sub-areas did not follow any systematic pattern as was the case in Areas 2 and 3. Environmental evidence was only found in two or three of the resulting samples. The plant remains consisted of small pieces of charcoal, cereal grains and seeds (Rackham et al in Morris, forthcoming b).

4.3.3.1 Beachview: Burnside Area 2

This area was excavated in September 1979 to enable examination of the structural phases some of which had been revealed by the winter floods of 1977-8. There was evidence of extensive midden material being present in this area. A considerable amount of charcoal fragments and small twiggy pieces were found, most of which was probably of heather (Calluna sp). The larger pieces were representative of a number of tree species. There was also present seeds and grains all of which were carbonized. The seeds were found to be representative of a range of habitats. The cereal grains indicated the presence of the bristle pointed oats (Avena strigosa), the common cultivated oats (Avena sativa) and the lax-eared six-row hulled barley (Hodeum vulgare). Present also in many of the samples were the seeds of the flax plant (Linum usitatissimum) which most likely indicates that flax was being cultivated at this site (Nye in Morris, forthcoming b).

4.3.3.2 Burnside Cutting 3/Area 3 - Carbonized Plant Remains

Area 3 was excavated in 1979 after the winter flooding had exposed further areas of midden material and other archaeological features. Fragments of charcoal, burnt material and carbonized seeds were recovered from sieved samples taken from the layer immediately above the midden material (Nye in Morris, forthcoming b).

The charcoal evidence has consisted of twiggy pieces of heather (Calluna vulgaris) and a number of other tree species. There was also evidence of burnt seaweed in the form of stems and vegetative parts.

The macrofossil remains were of tree species notably birch (Betula sp.) and willow (Salix sp.) (Nye in Morris, forthcoming b). Numerous carbonized seeds of wild plant species were also recovered, though in some cases the species could not be identified. The evidence of cereal grains included oats (Avena sp.) and barley (Hordeum sp.), also present was flax (Linum usitatissimum) (Nye in Morris, forthcoming b).

For details of the plant species recovered from Beachview, Birsay, see Table 5.

4.3.4 Saevar Howe, Birsay (Fig 7)

The location of the site of Saevar Howe or Saverough, is located just above the high water mark on the very edge of an area of dunes to the south of the Village of `The Palace' in the Bay of Birsay (Hedges, 1983:73). The site was first excavated by Farrer in 1862 and again in 1867 (1862:601-4; 1868:104). Due to the coastal erosion threatening the site, it was decided to conduct a trial excavation in the summer of 1977.

The exploratory trenches revealed two periods of occupation, the second of which was found to have been Early Norse and to consist of three superimposed Norse hall-houses, each of which had had a period of abandonment. In the final (Phase 11c) period of occupation the structure was used as a disposal area, for a midden layer covered the whole of the internal area of the hall-house (Hedges, 1983:84-5).

Charcoal samples were obtained from the lowest (phase 11a) and the middle (phase 11b) buildings, but not from the top most structure where the faunal remains were considerably mixed. Three radiocarbon samples were ultimately processed and they were found to range from 600±80 cal AD to 760±105 cal AD (Stenhouse in Hedges, 1983:108-9; Morris in Renfrew, 1985:274). In both these cases the results must be considered problematic, as the earliest may have been affected by marine shells accumulating old carbon and in the latter case the spruce (Picea) would have been imported or arrived as driftwood.

A coin of Burgred of Mercia was found in a (phase 11c) drain, it was obvious from the perforation below the head that at some point in time it had become used as a pendant. It had been minted in AD 866-868 and therefore does provide an approximate guide to dating as a terminus post quem, for as Batey and Morris point out, its loss or depositon could have been some considerable time after the currency of the coin (in Hedges, 1983:93; 107). It was on the basis of the two charcoal radiocarbon dates that Hedges suggests that Saevar Howe was occupied by the Norse in the second (phase 11) period, which would have commenced in the ninth century, or as early as the late eighth century, and in either case occupation would have continued into the tenth century (Hedges, 1983:116).

4.3.4.1 Carbonized Plant Remains

Small fragments of charcoal were found in the second (phase 11) period which consisted mostly of tree and shrub species (Dickson in Hedges, 1983:114). In both phases 11b and 11c carbonized seeds of a number of plant species were recovered from the floor of the hall-houses. The evidence of oats (Avena sp.) was provided by the recovery of some 24 grains and one floret. Unfortunately, it was not possible to be precise as to which type of oats they belonged. The measurement of the grains would though indicate that they could be the grains of the wild oat (Avena fatua), cultivated oats (Avena sativa) or the black oats (Avena strigosa) (Jessen and Helbaek, 1944; Zeist, 1970). In the case of the barley, six-row barley (Hordeum vulgare) 36 battered grains were recovered, two of which were hulled. Some 27 rather poorly preserved cereal grains were identified as most probably barley (Dickson in Hedges, 1983:114).

Of considerable interest was the find in Phase 11c of the cultivated flax (Linum usitissimum) in the form of seeds and numerous fragments of capsules. Dickson has noted that after allowing for shrinkage due to carbonization the seeds are smaller than the present day flax seeds (in Hedges, 1983:114).

It has been suggested by Dickson that the evidence found for the crowberry (Empetrum nigrum) of four stones, of rowan (Sorbus acuparia), two seeds and of corn spurry (Spergula arvensis) fifty-three seeds, could well indicate that they had all been deliberately gathered as a food source. Other seeds found in small numbers included poppy (Papaver sp.) which it was thought could well represent chance inclusion with the cereals (Dickson, in Hedges, 1983:114).

For details of the plant species recovered from Saevar Howe, Birsay, see Table 6.

4.3.5 Earl's Bu, Orphir - Norse Horizontal Mill (Fig 8)

The site of Earl's Bu at Orphir is located on the south coast of the mainland looking onto Orphir Bay and Scapa Flow, to the south of the site are the remains of the Round Church and the nearby Norse `Hall'.

In 1978 the site was first inspected at the request of the local farmer who had uncovered a drystone tunnel-like construction, with slab lintels. It was not until 1988/89 excavation that deep midden banks were exposed to the west of the lintel slab tunnel, the middens were dated within the Late Norse period c.eleventh to twelfth century (Batey and Morris, in Morris and Rackham, 1992:33). Very soon it was realised that the chamber at the end of the stone passage was in fact the underhouse of a horizontal mill (Batey and Morris, 1991:45; Batey and Morris in Morris and Rackham, 1992:33-40).

Later excavations have revealed layers under the passage and chamber walls, thus predating them, which were found to contain significant amounts of sherds of steatite vessels as well as beads, worked bone and copper alloy fragments. These deposits were clearly not midden material as they were formed of a loose sandy deposit and therefore provided a base date of the Early Norse period for the complex (Batey and Morris, 1991:46). Subsequent dating of the steatite sherds has provided initial date of c.950-1050 (Batey pers comm; Batey and Morris, 1991:46). It is clearly the view of Batey and Morris that the mill was built in the

Early Norse period and it is without doubt the first Norse example of a type of mill referred to as a `Norse mill' (in Morris and Rackham, 1992:40).

4.3.5.1 Carbonized Plant Remains

Present within the midden material were sherds of steatite, a runic inscription on a piece of bone, and an iron key, these various artifacts have suggested a twelfth to thirteenth century date. The midden material has also been found to be very rich in faunal remains particularly of a marine nature. Included also is a significant amount of carbonized plant remains as well as vegetative parts and large quantities of heather wood, including leaves, shoots and flowers (Huntley, 1990; Batey and Morris, in Morris and Rackham, 1992:38). To date the identification of carbonized seeds has revealed the majority to be cereal grains with associated weed seeds.

It would appear that oats (Avena sp.) was the dominant cereal crop at this site, though the six-row barley (Hordeum vulgare) was also present, but there was little evidence of chaff. Of considerable interest were the finds of flax seeds (Linum usitissimum) in a number of contexts, which most likely means that flax was being cultivated at this site (Batey and Morris in Morris and Rackham, 1992:38).

For details of the plant species recovered from Earl's Bu, Orphir - (Norse Horizontal Mill), see Table 7.

4.3.6 Westness, Rousay (Fig 9)

The site of Westness is situated on the island of Rousay on the south-west coast facing out to the Bay of Swandro.

Possibly the first Norse evidence from this site came to light in 1826 with the discovery of a sword and shield loss by a local farmer (Ritchie, 1993:50). The first actual evidence of a Norse grave was

discovered in 1963 by the owner of Westness farm. This discovery prompted excavations at the site and the discovery of a farmstead at Westness, and to the east of which was discovered a cemetery. The farmstead consisted of two parallel longhouses, house I was a dwelling house along with two smaller houses II and III. The longhouse I had two large halls and a smaller room between (Kaland, in Batey et al, 1993:308). Within the building there has been revealed a number of artifacts, along with animal bones. It would appear that house II was a byre with room for some 18 cows, while building III functioned as a byre for sheep (Kaland, in Batey et al, 1993:310).

4.3.6.1 Carbonized Grain and Seeds

Westness has yielded evidence of cultivated plants in the form of carbonized cereal grains, mostly of barley (Hordeum sp.), with oats (Avena sp.), rye (Secale sp.), and flax (Linum usitissimum). Supporting evidence for the cultivation of these crops in nearby fields has been provided by pollen analysis (Kaland in Batey, 1993:311)

For details of the plant species recovered from Westness, Rousay, see Table 7.

4.3.7 Tuquoy, Westay (Fig 10)

The site of Tuquoy is situated on the northern Orkney island of Westray, on the south shore of the Ness of Tuquoy. It was first identified as being a Norse site of a major settlement by Dr Raymond Lamb in 1981.

It was the evidence of deposited and associated structures revealed in the eroding cliff face that prompted the subsequent survey and trial excavations to be carried out in 1982-3, and the large scale excavations which were later undertaken by Owen in 1988 (Owen in Batey et al, 1993:318).

Investigation of the site have revealed that it survives up to 50 m inland and is interrupted by a possible stream bed which Owen believes would have provided the water supply to the settlement (in Batey et al, 1993:324). To the west of the stream are numerous archaeological features, including masonry, middens and cultivated fields.

The initial assessment exercise has revealed a linear settlement site clearly located along the shore line which Owen has interpreted as moving westwards. There is little doubt that the nucleus of the twelfth century and Medieval site is present (in Batey et al, 1993:324-5).

The initial assessment work has included routine analysis of pH, phosphate, loss of ignition, particle size analysis, pollen and calcium carbonate content (in Batey et al 1993:326).

The remains of a rectilinear `hall' were uncovered, the interior of which had been paved at least three times. The monumental nature of the structure clearly points to its high status. The mortared, stone built hall exhibits an obvious departure from the native Scandinavian tradition of simple timber halls. There was evidence of blocked off buildings being filled with rich midden-site deposits dumped by the Medieval inhabitants (Owen in Batey et al, 1993:329).

A substantial pit was discovered in the east end of the cliff which contained waterlogged Viking deposits which in the normal Orcadian sandy soil, would not have survived. The material deposited appears to have consisted of a mixture of animal dung, straw and ash (Owen in Batey et al, 1993:330). It would appear that the final role of the pit was to be covered by some 1.4 m in depth of burnt stones and peat ash, which Owen has interpreted as representing the debris from water heating activities (Owen in Batey et al, 1993:335).

From the evidence discussed in detail below, it would appear that Tuquoy was occupied by a farming community, which survived on a mixed economy of arable and pasture. It is the view of Owen that the farm could well have been arranged into infields, outfields and pasture as described by Fenton (1978) for later Orkney farms (in Batey et al, 1993:334).

4.3.7.1 Evidence of Plant Material

The methodology employed involved standard bulk samples being collected from most soil contexts over the three seasons during 1982, 1983 and 1988.

4.3.7.2 Mineralised Seeds

A number of mineralised seeds were recovered from a few of the samples. As Nye and Boardman have stated mineralisation could have occurred at any time since the deposits were created and thus it is difficult to be precise in relating mineralisation of seeds to human activity (Owen, forthcoming).

4.3.7.3 Area `F': Charcoal, 1982-3

Most of the fragments found were very small measuring less than 1 cm. By far the most common species was heather (Calluna vulgaris) which was represented by stem fragments, shoot tips and flowers. The most abundant arboreal taxon was willow (Salix) which was followed by a number of different species. The overall representation of different taxa appear to have remained fairly constant throughout the main occupation phases (Owen, forthcoming).

4.3.7.4 Area `F': Charred Plant Remains, 1982-3

Some ninety seven contexts produced charred seeds and grains. The cereal grains were found to comprise more than 80% of finds in only eight samples, and greater than 60% of finds in seventeen samples.

The majority of barley grains had asymmetric dimensions indicating the six-row species (Hordeum vulgare). Cereal chaff was absent in samples from Area F. The dimensions of the oat grains were found to span the range of three species:

Avena sativa, A. strigosa and A. fatua.

It was found that both oat and barley grains were present in most samples from this site and that oats were found to dominate the cultivated plants in fifteen samples.

The seeds of flax (Linum usitissimum) were recovered from twenty contexts. It was noted that the dimension of 36 seeds compared well with those found at Saevar Howe, Birsay (Dickson in Hedges, 1983:114).

The wild plant species were poorly preserved and in many cases it was not possible to identify them beyond the genus or family. Those identified did clearly represent not only species to be found in cultivated fields and disturbed land, but also grassland, heath and moor, dune vegetation and seashore location (Owen, forthcoming). In four of the richest contexts it was found that wild plant species were dominant. The locations represented a possible floor, midden layers and a rubble rich layer. The most common wild taxa were found to be sedges (Carex spp.) Caryophyllaceae, goosefoot/orache (Chenopodium/Atriplex), curled dock (Rumex crispus) (Plate 3) and chickweed (Stellaria media) (Plate 6) (Owen, forthcoming).

Evidence of seaweed was found but it was mostly unidentifiable with the exception of flattened thallus fragments and bladders found in a stone lined box in Phase IX which have been identified to bladder wrack (Fucus vesiculosus) (Owen, forthcoming).

4.3.7.5 Waterlogged Pit Area `J' Plant Remains

The waterlogged conditions within the pit presented the ideal anaerobic conditions which arrested the process of decomposition by bacterial and fungal activity. The three lowest levels of the pit have produced evidence of an abundance of seeds of plants from a number of different habitats, along with flowers and leaves (Owen, forthcoming).

4.3.7.6 Pollen Evidence: Waterlogged Pit Area `J'

A sample of organic deposit was taken using a monolith tin. Some sixteen subsamples were taken from the monolith for pollen analysis, representing five of the twenty-two contexts (Tipping in Owen, forthcoming). Based on the detailed analysis it is thought that rye (Secale cereale) was not being grown and the common oat (Avena sativa) was in pollen percentage terms the most common cereal being grown at Tuquoy (in Owen, in Batey et al, 1993:334). It is also suggested that the other large pollen type is representative of either barley (Hordeum vulgare) or bristle oat (Avena strigosa) or indeed both. Based on initial observations, the following points have been suggested. The settlement at Tuquoy was a farming community, the inhabitants were growing the cereal crops there, and there was pasture land close by (Owen, forthcoming).

4.3.8 Pool, Sanday

The island of Sanday lies in the north-east of the Orkney group, and the site of Pool is located on its west coast. A detailed site monument survey was undertaken in the 1970s by Dr R Lamb (1980) of the island's archaeological interest, at which time it was noted that a large section of the Pool site was already being exposed by coastal erosion. The preliminary investigations of the settlement mound indicated the presence of structural elements which overlayed a series of almost tip-like deposits (Hunter et al 1991:131).

Excavation work commenced in 1983 and continued for six years. There is little doubt that the final phase of the multi-period occupation of this site belongs to the Norse settlement. Such occupation is therefore best seen as part of a process of continuity, rather than as an entity on its own (Hunter, et al, 1991:132). The earliest Norse settlers used the site of the part-abandoned Iron Age village to construct a sub-rectangular building taking advantage of the demolished stone-work on site, while to the north a much more formal timber-lined structure was erected (Hunter, et al, 1991:132). It is thought that the latest Norse

buildings to be constructed took place in the tenth or eleventh century and at that time the original roundhouse wall was used as a buttress. Sometime in the eleventh century it was finally demolished and levelled. This last Norse building was the largest and it was extended and subsequently sub-divided. Occupation of this site would appear to have ended in the twelfth or thirteenth century (Hunter, et al, 1991:132).

A considerable number of artifacts have been recovered including vessels in both steatite and grass tempered pottery, whorls and weights, etc (Hunter, et al, 1991:133).

4.3.8.1 Carbonized Grain and Seeds

The preliminary work on the subsistence economy has identified that flax (Linum usitissimum) was being cultivated during the `interface' period associated with the first Norse settlers. Hunter has commented on how good the soil and climate on Sanday would have been to such cultivation (Hunter et al, 1991:133).

The present evidence would indicate that more traditional farming practices were being pursued from the fourth century. During the Viking period cultivated oats (Avena sativa) vastly outnumbered the wild oats (Avena fatua) and there is also evidence of the bristle oat (Avena strigosa) being grown. The other main cereal crop being grown was the six-row hulled barley (Hordeum vulgare). Of particular note was the find of carbonized six-row barley (Hordeum vulgare) consisting, it is thought, of whole heads and stalks. There were in this instance some 126 barley grains, but only 6 weed seeds present, which it suggest is representative of some form of post-harvest preparation (Hunter et al in Batey et al, 1993:281). The non-crop species have been found to include docks (Rumex spp.) and chickweed (Stellaria media), both of which increased during the Norse occupation (Bond, 1993, pers comm).

4.4 SHETLAND SITES

4.4.1 Jarlshof (Fig 11)

The site of Jarlshof, Dunrossnes, Shetland, was first discovered in 1897 and is today probably the most important multi-period site in Britain which has also provided a wealth of cultural knowledge.

Excavation work was carried out by Curle from 1931 to 1935 (1934-5; 1935-6), followed by Child in 1937, and by Hamilton from 1949 to 1952 (1956).

The first Norse occupation began at Jarlshof in the early ninth century, when a single farmstead was first established on the shores of Sumburgh Bay. It consisted of a `hall-type' dwelling with associated outbuildings. During the following six centuries further dwellings were built. It was the structural alterations and additions, together with the apparent introduction of new diagnostic artefact types which Hamilton interpreted as reflecting a major change in the history of the settlement (1956:156-7). Such changes over the timescale have offered unique opportunities for detailed comparisons with other sites (Bigelow,1984:31).

4.4.1.1 Charcoal Evidence

During the excavations carried out by Hamilton (1956) a number of fragments of charcoal and charred wood were discovered mostly in the midden deposits. Evidence of numerous tree species came from a ninth century dated midden, along with evidence of charred wood of oak (Quercus sp.) and willow (Salix sp.), thought possibly to be pieces of constructional timbers. Other evidence came from the peat ash middens of the tenth century date (Hamilton, 1956:211).

4.4.2 The Biggings, Papa Stour (Fig 12)

The settlement known as The Biggings lies between Housa Voe and Kirk Sands, and is surrounded by agricultural land which looks east across the Sound of Papa to the Mainland of Shetland.

Crawford was prompted by an historical document which made reference to a royal farm into mounting a multi-disciplinary project with the object of locating the royal farm. The name of the farmhouse referred to in the document was uppi i husi (Uphouse) on Papa Stour, where such a croft was remembered at the central settlement of North Biggings (Crawford, 1990:38). The core settlement was located under an abandoned croft-house called "da Gorl".

The foundations of a Norse house were found underneath a building which had itself been demolished in 1846, to allow the construction of the "da Gorl" house. Excavation work revealed a substantial building which had had internal divisions thus dividing off a room which was later found to have a wooden floor and possible wooden panelling to the walls or wall benches. A very early date has been provided for the floor by Radiocarbon dating, which was calibrated to 1013-1156 cal AD (Stuiver and Pearson, 1986). This date has been confirmed from the estimates derived from two other sources (peat and heather charcoal and wood charcoal) which were found in contact with the floor (Crawford, 1990:40). A number of pits have also been discovered which appear to have been filled with carbonized seaweed. Crawford has suggested that the pits in trench `H' were associated with the hearth and could be semi-industrial or cooking pits (Crawford, 1985:149). The pits associated with trench `J' have been interpreted as storage pits related to domestic tasks such as a lye for various functions (Crawford, 1990:42) or as a mordant for dying of wool (Dickson pers comm).

4.4.2.1 Botanical Evidence

A steatite vessel was found containing a residue which has been interpreted as a kind of porridge or gruel, it was found to be composed

of seed husks of the corn spurrey (Spergula arvensis). It is known as the meal plant by Shetlanders and was recorded in historical accounts as being used as a food sources (Crawford, 1978:29).

4.4.2.2 Pollen Analysis

Four samples were taken from occupation layers and have been analysed. Dickson has suggested that they are all probably of Norse age (pers comm). It is unusual in Scotland to find pollen preserved in such layers, it is normally carbonized material that is found. The four samples were taken from contexts in which there were also macroscopic plant remains. Dickson has expressed the view that some of the pollen will be very local, mostly adhering to cereal grains, straw, etc, brought into the farmhouse. The regional pollen rains will have been recorded to a lesser extent, while long distance transport will be responsible for certain tree species (Dickson, pers comm). Evidence of cereals, cornfield and other weed seeds have also been recorded.

4.4.2.3 Macroscopic Plant Remains

In most instances the finds of cereal grains and arable weed seeds were unburnt and associated with other occupation debris and not with hearths. Such a sample taken from the contents of the farmhouse was found to consist of layers of plant tissues which had been interleaved with thin layers of find sand. Oat straw was clearly identified and numerous poorly preserved grains and seeds were also recovered. Found to be present were oats (Avena sp.) and the common spike rush (Eleocharis palustris) also barley (Hordeum sp.), the float-grass (Glyceria fluitans) and numerous embryos most probably of cornfield weeds. In building `K' a somewhat similar situation was found to exist, but here any straw that had been present would appear to have decayed leaving an assemblage which was much richer in seeds of arable weeds. The majority of the arable weeds identified have come from the above two contexts (Dickson, pers comm).

4.4.2.4 Wood and Bark

A considerable amount of wood was found in many different contexts relating in many cases to imported species. Two rather unusual tree types were found, one was a piece of bark belonging to the cork bark (Quercus suber), the other was a small piece of balsa wood (Ochroma lagopus) (Dickson, pers comm).

4.4.3 Sandwick, Unst (Fig 13)

The bay of Sand Wick is situated on the south-east coast of Unst, which is the most northerly of the Shetland Islands. The beach and immediate surrounding land at this location is known as Sandwick. To the south of the bay lies the site, it is composed of a rectilinear stone ruin with an associated stone enclosure (SWA) and a severely eroded sub-rectangular feature (SWB) (Bigelow, 1985:100). Archaeological investigations commenced in 1977 when an initial survey was carried out, and excavation work commenced the following summer. As a result of excavation on the SWA foundations a single longhouse was revealed (Bigelow, 1984:37). A programme of wet sieving was carried out on over 75% of the deposits, while the remaining soil was floated to recover seeds and other organic matter (Struever, 1968; Bigelow, 1984:135).

Excavations continued in 1979 of the outer rooms of the longhouse and the yard area. These excavations have revealed the final phases and the detailed stratigraphy of the midden deposit. A considerable number of artifacts and faunal samples were also recovered (Bigelow, 1985:103).

It is Bigelow's view based on the finds, that the site at Sandwick was occupied in the Late Norse Period which he has modified to extend from 1100 to 1500 (1984; 1985:104). This modification was based on artifactual finds and six radiocarbon dates taken from the house and midden at Sandwick. They have suggested that occupation started in the twelfth century, and continued into the thirteenth and fourteenth centuries (Bigelow, 1985:115; 126).

4.4.3.1 Carbonized Grain and Seeds

The evidence for the use of grain at Sandwick is two fold, firstly it can be seen in the finds of rotary quernstones, both full size and miniature scale, and secondly in the finds of carbonized grains of hulled six-row barley (Hordeum vulguare) also possibly two-row barley (Hordeum distichon), and oats (Avena sp.). A single flax (Linum usitissimum) seed was also discovered (Bigelow, 1984:135). It is the view of Bigelow that the evidence of charred cereal grains found in several contexts on the site "most likely represent local production, since long distance trade in green seed to be used for direct consumption and, therefore, requiring artificial drying, seems unlikely". (Bigelow, 1985:119).

Table A: Summary List of Plant Species found on Sites discussed in Chapter 4.

Trees and Shrubs	1. Freswick Links.	2. Robert's Haven.	Brough of Birsay.	3. Birsay Bay, Brough Road.	Beachview; Studio Site	4. Saevar Howe.	5. Earl's Bu, Orphir.	6. Westness, Rousay.	7. Tuquoy, Westray.	8. Pool, Sanday.	9. Jarlshof.	The Biggings, Papa Stour.	10. Sandwick, Unst.
	Caithness.					Orkney.						Shetland	
Picea sp.	+		●			●						⊘	
Picea abies (L.) Karst				●									
Pinus/Picea	●		●	●	●				+● ⊘				
Pinus sp.	+ ✓											+	
Pinus sylvestris L.			●								●	⊘ ✓	
Larix sp.									⊘				
Juniperus sp.						●						⊘	
Juniperus communis L.											●		
Acer sp.									⊘				
Crataegus sp.									+				
Sorbus aucuparia L.					✓	✓							
Betula sp.	+● ✓		●	●	●	●			+● ⊘		●	+ ⊘	
Betula pendula Roth.												⊘	
Alnus sp.					●	●			+●			+	
Alnus glutinosa (L.) Gaert	+ ●		●	●	●								
Corylus sp.	+● ✓				●						●	+ ⊘	
Corylus avellana L.	● ✓		●				✓		● ⊘		●		
Fagus sp.												+ ⊘	
Quercus sp.	+ ●		●	●	●				+● ⊘		●	+⊘ ✓	
Quercus suber L.												⊘	
Populus sp.			●										
Salix sp.	+●		●	●	●	●			● ⊘		●	⊘	
Salix repens L.							✓						
Calluna sp.	+ ✓											+	
Calluna vulgaris (L.) Hull.	●	✓	✓	● ✓	● ✓	●	✓		+● ⊘ ✓			⊘ ✓	
Erica sp.	+ ✓								⊘				
Erica tetralix L.	✓								⊘				

Key
- ✓ Carbonized Plant Remains
- ● Charcoal
- \+ Pollen
- ⊘ Unburnt/Macroscopic Plant Remains

	- Freswick Links.	- Robert's Haven.	- Brough of Birsay.	- Birsay Bay, Brough Road.	- Beachview, Studio Site	- Sacvar Howe.	- Earl's Pm. Orphir.	- Westness, Rousay.	- Taquoy, Westray.	- Pool, Sanday.	- Jarlshof.	The Ploatines, Papa Stour.	Sandwick, Up...
Erica cinerea L.									⌀			⌀	
Vaccinium myrtillus L.												⌀	
Empetrum nigrum L.	+ ✓	✓	✓	✓	✓	✓	✓		+ ✓			+ ⌀ ✓	
Fraxinus sp.	+				●				● ⌀			⌀	
Fraxinus excelsior L.			●										

Cereals

Triticum sp.	+ ✓						✓					+ ⌀	
Triticum aestivum L.	✓												
Secale sp.								+ ✓					
Hordeum - twisted	✓	✓					✓						
Hordeum - straight	✓	✓					✓						
Hordeum - hulled	✓	✓					✓						
Hordeum sp.	+ ✓				✓		✓	+ ✓	✓			+ ⌀	
Hordeum vulgare L.	✓	✓	✓	✓	✓	✓	✓			✓		⌀	✓
Hordeum distichon L.	✓												✓
Avena sp.	+ ✓	✓	✓	✓	✓	✓	✓	+ ✓	✓			+ ⌀	✓
Avena fatua L.	✓									✓			
Aven strigosa Schreb.			✓				✓			✓			
Avena sativa L.	✓						✓			✓			

General Flora

Caltha palustris L.					✓		✓		✓				
Trollius sp.									+				
Aconitum sp.									+				
Ranunculus sp.	+	✓										+	
Ranunculus acris L.			✓		✓				+ ⌀ ✓			⌀	
Ranunculus repens L.	✓						✓		+ ⌀			⌀	
Ranunculus bulbosus L.									+ ⌀				
Ranunculus flammula L.			✓		✓		✓		+ ⌀ ✓			⌀	
Thalictrum sp.									+				
Papaver sp.						✓			+ ⌀				
Fumaria sp.							✓		⌀				
Cruciferae	+			✓	✓				+ ✓			+ ⌀	
Brassica / Sinapis sp.				✓	✓				⌀ ✓				
Brassica sp.	✓						✓		⌀				
Sinapis arvensis L.							✓						

	Freswick Links	Robert's Haven	Brough of Birsay	Birsay Bay, Brough Road	Beachview: Studio Site	Saevar Howe	Earl's Bu, Orphir	Westness, Rousay	Tuquoy, Westray	Pool, Sanday	Jarlshof	The Biggings, Papa Stour	Sandwick
Diplotaxis muralis (L.) DC.									✓				
Raphanus raphanistrum L.	✓		✓	✓	✓		✓		⊘	✓			
Capsella bursa-pastoris (L.) Medic.									⊘				
Cochlearia sp.												⊘	
Cardamine sp.												⊘	
Erysimum cheiranthoides L.									✓				
Viola sp.					✓				+ ⊘ ✓			⊘	
Hypericum perforatum L.									+				
Frankenia sp.									+				
Caryophyllaceae	+ ✓				✓		✓		+ ✓			+ ⊘	
Silene dioica (L.) Clairv.									✓				
Agrostemma githago L.	✓												
Lychnis flos-cuculi L.									⊘				
Cerastium arvense L.	✓								⊘			+ ⊘	
Stellaria media (L.) Vill.	✓	✓	✓	✓	✓	✓	✓		⊘ ✓	✓		⊘	
Sagina procumbens L.			✓									+ ⊘	
Spergula arvensis L.	✓	✓	✓	✓	✓	✓	✓		⊘ ✓	✓		+ ⊘	
Scleranthus annuus L.	✓												
Montia fontana L.			✓						⊘ ✓	✓			
Montia fontana ssp chrondrospermum Frenzl S.M. Walters.				✓					✓				
ssp fontana			✓		✓				✓			⊘	
Chenopodiaceae	+ ✓	✓		✓			✓		+ ⊘ ✓			+	
Chenopodium sp.			✓		✓								
Chenopodum album L.	✓								⊘ ✓				
Chenopodium bonus-henricus L.	✓												
Atriplex sp.	✓			✓	✓				⊘ ✓			⊘	
Atriplex hastata/patula			✓										
Linum usitatissimum L.	✓	✓		✓	✓	✓	✓	+ ✓	✓	✓			✓
Linum catharticum L.									⊘				
Trifolium sp.	+ ✓				✓				⊘				
Trifolium repens L.												+	
Trifolium pratense L.									✓				
Lotus sp.									+				
Vicia sp.	+ ✓	✓							+				
Vicia faba L.	✓						✓						
Lathyrus sp.									+				
Rosaceae					✓							+	
Filipendula sp.									+			+	

	Freswick Links.	Robert's Haven.	Borough of Thurso.	Birsay Bay, Brough Road.	Beachview, Studio Site	Sacvar House.	Earl's Pie, Orphir.	Westness, Rousay.	Tuquoy, Westray.	Pool, Sanday.	Jarlshof.	The Pierowall, Papa Stour.	Sandwick, Unst.
Rubus fruticosa agg.	✓												
Potentilla sp.	+			✓	✓	✓			+⌀ ✓			+	
Potentilla anserina L.							✓						
Potentilla erecta L. Räuschel.			✓						⌀ ✓			⌀ ✓	
Fragaria vesca L.					✓								
Alchemilla sp.									+⌀				
Aphanes sp.					✓				✓			⌀	
Hydrocotyle vulgaris L.									⌀ ✓				
Umbelliferae									+ ✓			+	
Heracleum sp.												+	
Euphorbia helioscopia L.	✓				✓				⌀ ✓				
Polygonaceae	✓											⌀	
Polygonum sp.	✓	✓			✓								
Polygonum aviculare L.	✓			✓	✓	✓	✓		+⌀ ✓			+⌀	
Polygonum bistorta L.									+				
Polygonum persicaria L.	✓				✓		✓						
Polygonum hydropiper L.	✓												
Polygonum convolvulus L.	✓												
Rumex sp.			✓	✓	✓	✓			+⌀ ✓	✓		+⌀	
Rumex acetosella L.	+ ✓	✓		✓	✓		✓		⌀				
Rumex acetosa L.	+✓						✓					+	
Rumex longifolius D.C.												⌀	
Rumex crispus L.				✓	✓				⌀ ✓				
Rumex obtusifolius L.	✓	✓					✓		+				
Urtica urens L.									⌀	✓			
Urtica dioica L.									⌀ ✓			⌀	
Armeria sp.									+			+	
Glaux sp.									+				
Anchusa arvensis (L.) Bieb.												⌀	
Myosotis arvensis (L.) Hill.									⌀			⌀	
Hyoscyamus niger L.				✓	✓				✓				
Veronica arvensis L.				✓	✓				✓				
Veronica cf agrestis L.									✓				
Rhinanthus minor L.									+⌀				
Euphrasia sp.									⌀ ✓				
Odontites sp.									⌀				
Labiatae					✓				+				
Prunella vulgaris L.		✓											
Salvia sp.									⌀				

	Freswick Links.	Robert's Haven.	Dwarwick Haven.	Burgar Bay, Brough Road.	Beachview; Studio Site	Sæter Howe.	Earl's Bu, Orphir.	Westness, Rousay.	Tuquoy, Westray.	Pool, Sanday.	Jarlshof.	The Biggings, Papa Stour.	Sandwick, Unst.
Stachys sp.									+ ⊘				
Lamium purpureum L.							✓						
Galeopsis sp.									⊘			⊘	
Teucrium sp.									+				
Plantago major L.	+								+ ⊘ ✓			+ ⊘	
Plantago media L.	+				✓				+			+	
Plantago lanceolata L.	+ ✓	✓		✓	✓		✓		+ ✓			+	
Plantago maritima L.									+				
Plantago coronopus L.									+				
Littorella sp.					✓				✓			+	
Campanula sp.	✓												
Galium sp.					✓								
Galium aparine L.	✓				✓				✓				
Succisa sp.									+			+	
Compositae	+	✓			✓				+ ✓			⊘	
Bidens sp.									+				
Senecio aquaticus Hill.									⊘				
Anthemis sp.									+ ⊘				
Anthemis cotula L.	✓												
Tripleurospermum inodorum (L.) Hyl. ex Vaarama.									⊘			⊘	
Tripleurospermum maritimum (L.) Koch.				✓	✓				⊘ ✓			⊘	
Chrysanthemum sp.	✓												
Chrysanthemum segetum L.							✓						
Artemisia sp.	+											+	
Artemisia vulgaris L.									+ ⊘			+	
Carduus sp.									✓				
Cirsium sp.	+ ✓								✓				
Cirsium palustre (L.) Scop.			✓						+ ✓				
Centaurea sp.							✓		+				
Centaurea cyanus L.	✓												
Centaurea nigra L.	✓												
Serratula sp.									+				
Hypochoeris radiata L.	✓												
Leontodon sp.									⊘				
Sonchus asper L. (Hill)									⊘			⊘	
Juncus spp.	✓						✓		⊘			⊘	
Juncus squarrosus L.						✓						⊘	

CHAPTER FIVE

5.0 THE ANALYSIS OF PLANT REMAINS: UTILISATION AND EXPLOITATION

5.1 CULTIVATED CROPS : CEREALS

5.1.1 Caithness

The evidence from the `Area samples' at Freswick Links would support the presence of both oat (Avena) and barley (Hordeum) in almost equal proportions from the Pictish period through to the end of the Norse occupation.

With regard to the six-row barley (Hordeum vulgare) it is known that it produces two twisted to one straight embryo, while in the case of the two-row barley (Hordeum distichon) it produces all straight grains. The observed ratio from Freswick Links would suggest, with 99% probability, that the barley was all six-row (Huntley and Turner, in Morris and Batey, forthcoming a). The six-row variety is a traditional form also known as bere and is today mostly confined to being cultivated in the Orkney Islands.

In the case of oats, the evidence would point to them being primarily the cultivated form (Avena sativa) (Huntley and Turner in Morris and Batey, forthcoming a).

The results from the `Column samples' would suggest that oats were the most abundant cereal present, however, they would also appear to indicate the presence of both the cultivated oat (Avena sativa) and the wild oat (Avena fatua). The barley was mostly hulled. There were insufficient grains available to estimate the proportions of two to six-row barley (Huntley in Morris and Rackham, 1992:83). There was also evidence of a few broken rachis internodes of barley being present, while oat awn fragments were also recovered from some of the samples. Such evidence of these chaff fragments has prompted Huntley to suggest

that at least some of the grain present was being processed on the site and could, therefore, have been grown locally (in Morris and Rackham, 1992:83).

It is the view of Huntley that one would not necessarily expect to find the grain and chaff fragments together, for the grain could be processed in one location prior to storage in another location thus leaving the chaff behind. This did not happen in respect of the column samples 6, 10 and 12 where chaff fragments were present, but were lacking in the other samples while barley grains were present throughout. Such evidence has led Huntley to the view that this may be due to the small sample sizes or due to the fact that cereals were not being grown locally (in Morris and Rackham, 1992:84).

The lack of cereal chaff and the few arable weed seeds present in the `Area samples' would appear to support the above views of Huntley and have prompted Huntley and Turner to suggest that few of the cereals were being grown in the immediate vicinity. They would also cite the palynological evidence from the nearby Hill of Harley in support of this view (Huntley and Turner in Morris and Batey, forthcoming a). They have put forward the view that to obtain their cereals the occupants at Freswick would have either traded or formed part of a wider society, limited possibly to the northern area as only barley and oats were recovered in any quantity (Huntley and Turner in Morris and Batey, forthcoming a).

There was little evidence of bread wheat (Triticum aestivum) and what was present on the site could, it is suggested, be considered as stray grains in amongst the imported oats/barley or it might be seen as an attempt to grow some limited amounts of wheat (Huntley and Turner in Morris and Batey, forthcoming a).

The evidence from the Robert's Haven site would again suggest the presence of the six-row barley (Hordeum vulgare). It has not been possible to identify the oats to species in this instance. There is also at this site a lack of chaff fragments which White would suggest is due to the threshing operations not taking place at the source of the

middens. The presence of typical weeds of cultivation would suggest to White that it is unlikely, in this case, that the cereals were being imported (White in Barrett, forthcoming).

5.1.2 Orkney

The evidence from Orkney would suggest that both barley and oats were being grown and processed for human and animal consumption. Orkney generally and the Birsay region in particular, are known to have some of the most fertile soils in the Northern Islands. At Brough Road, Birsay Bay, the barley recovered was identified as six-row form (Hordeum cf vulgare). Oats were found to be present in many of the samples though never as great as barley, which would appear to be the dominant cereal.

Both the cultivated oat (Avena sativa) and the wild oat (Avena fatua) were present, though it is worth noting that the `wild' oat was an introduced species (Donaldson and Nye in Morris et al, 1989:266). The midden layers of Area 2 were very homogeneous in character, probably consisting of peat fuel thrown away with ashes, grain which got accidentally burnt, along with associated weed seeds, discarded and burnt plant matter such as food and bedding, etc.

In Area 3 the samples were quite different for they were derived from hearth or adjacent deposits and were found to have an abundance of cereal grain present which were again dominated by barley (Hordeum cf vulgare). It is the view of Rackham that the flotation techniques used on these samples could not have produced a bias against oats as the residues were also checked (Rackham in Morris et al, 1989:268). It should be remembered that the lack of oats from archaeological deposits may simply reflect the possibility that they were being used for animal fodder rather than for human consumption and, therefore, as Rackham has stated, there is a reduced chance of accidental carbonization in fires (Rackham in Morris et al, 1989:268). The considered view of Rackham is that the abundance of cereal grain found in association with the hearths in Area 3 is best viewed, not as resulting from accidental loss, but

resulting from bulk drying and parching of the grain, for it is unlikely that such action would have taken place in front of a small hearth fire.

Similarly, it is unlikely to have been a simple domestic accident. The chances are that it is more likely to be the result of small quantities of grain being pot-dried, as described by Fenton (1978:375), in front of the domestic fire. The presence of numerous grains which occur in more than one phase in the contexts in Area 3 could most likely therefore represent a number of possible small scale accidents occurring during such pot-drying operations, over an extended period of time (Rackham in Morris et al, 1989:268).

The site at Beachview, Burnside, Area 2, has produced evidence of charred oat and barley grains throughout the samples. The oats were thought to be a mixture including the cultivated oat (Avena sativa) and the bristle pointed oat (Avena strigosa) (Nye in Morris, forthcoming b). The barley was the six-row variety (Hordeum vulgare) which was more suited to the climate and ripened quicker than the other varieties (Fenton, 1978:336).

At the site of Saevar Howe, Birsay, there was also a greater number of grains belonging to the six-row barley (Hordeum vulgare) than of oats (Avena sp.). The latter grain sizes were found to span the ranges of the wild oat (Avena fatua), the bristle or black oat (A. strigosa) and the cultivated oat (A. sativa) (Dickson, in Hedges, 1983:114).

On the Brough of Birsay it has been noted that not barley but oats formed the larger proportion of the recorded grain. In a number of instances where the flower bases were present they could be identified as belonging to the bristle or black oat (A. strigosa). The barley grains were mostly asymmetric grains which were referable to the six-row (H. vulgare) (Donaldson in Hunter, 1986:219). The larger proportion of recorded oat grains at this site has prompted Donaldson to suggest that this may indicate that oats were being cultivated as a separate crop, rather than being weeds within the barley crop.

It is also suggested that the associated weed seeds present no evidence to importation from elsewhere (Donaldson,in Hunter, 1986:219). It is apparent that Rackham does not share the above views for he has suggested that the higher proportion of oats in this instance could have resulted from the use of paraffin flotation which could have been inefficient in recovering the heavier barley grains. Rackham sees no reason why the Brough should differ from the mainland sites, especially as Rackham does not accept that cereals were grown on the Brough (in Morris et al, 1989:268). Such use of paraffin may or may not have created a bias, but it should be noted that there are other sites where higher proportions of oats do occur and where paraffin flotation was not used.

At the Earl's Bu, Orphir, site there was also found to be a domination of oats over the barley which was identified as the six-row hulled variety (H. vulgare) with little chaff present (Batey and Morris in Morris and Rackham, 1992:38). This site has also produced evidence of grains belonging to Brome (Bromus sp.), which it is noted from Denmark were collected up to this present century and ground to flour, as a famine food in years when crops failed (Jones, M, 1981:108-9).

At Tuquoy, Westry, the oats seem to be the dominant crop in the form of the cultivated oat (A. sativa), though the oat size does also embrace the wild oat (A. fatua) and the bristle or black oat (A. strigosa). The barley grains were hulled and a significant number had asymmetrical dimensions, which indicated that they were the six-row barley (H. vulgare) (Owen in Batey et al, 1993:334; Nye and Boardman in Owen, 1994, forthcoming). The pollen analysis from the `pit' at Tuquoy clearly indicates that cereal crops were being grown there including both barley and oats (Tippin in Owen, 1994, forthcoming).

The pollen analysis coming from Westness, Rousay, would indicate that barley (Hordeum sp.), oats (Avena sp.) and rye (Secale cereale) had all been cultivated locally (Kaland in Batey et al, 1993:311).

At Pool, Sandy, six-row barley (H. vulgare) and a cultivated form of oats were found (Hunter et al, 1991:133). It has been noted at this

site that cereal culm bases were strongly represented in the evidence. This may well, it is thought, suggest that the crops were being uprooted during the harvesting, no doubt due to the very loose sandy soil that was present. Also of particular note was the find of carbonized six-row barley (H. vulgare) representing whole heads and possibly the stalks as well. There were only 6 weed seeds present amongst some 126 barley grains. This has suggested to Hunter that some form of post-harvest processing was taking place (et al, in Batey et al, 1993:281). As noted above, the cultivated oat (A. sativa) or (A. strigosa) has been found to outnumber the wild oat (A. fatua) throughout the record at Pool (Bond, pers comm).

5.1.3 Shetland

To date the most detailed information on the cereal types that were grown on Shetland have come from The Biggings site (Dickson in Crawford 1994, forthcoming). The evidence would clearly support oats being grown, but the presence of wild oats (A.fatua) could not be ruled out in some of the samples for the grain character could not be distinguished.

The traditional oat grown in Scotland was the bristle or black oat (A. strigosa) which had been introduced during the Iron Age (Dickson, forthcoming a). Barley was recognised in naked form (H. vulgare var. nudum) and as the hulled six-row barley (H. vulgare var. vulgare). Dickson makes the point that in most of Britain the naked variety was largely replaced by the hulled type during the Iron Age. It has further been suggested by Dickson that it is quite possible that the Norse could have re-introduced the naked variety in seed corn which they may have brought over with them (in Crawford, 1994, forthcoming). Both the hulled six-row barley (H. vulgar var. vulgare) and the black oat (A. strigosa) continued to be the traditional main cereal crops grown until the eighteenth century when the common or cultivated oat (A. sativa) began to be introduced to Shetland.

The evidence from Sandwick, Unst, revealed carbonized grains in numerous locations consisting of both hulled six-row barley (H. vulgare) and possibly two-row barley (H. distichon) along with oats (Bigelow, 1984:135).

5.2 LOCAL PRODUCTION?

On the basis of there being little chaff and weed seeds present, it has been suggested that at Freswick Links cereals were generally being imported (Huntley in Morris and Rackham, 1992:84). The palynological evidence, taken from the nearby Hill of Harley, does lend support to this view (Huntley and Turner in Morris and Batey, forthcoming a).

It has been noted that wheat and barley are notorious for their poor pollen dispersal and that pollen remains associated with the bracts of cereal crops (Robinson and Hubbard, 1977:197-99). They have shown that cereal pollen can be transported on the bracts of hulled cereals. It must also therefore be accepted that cereal pollen, if present, does not necessarily indicate local production. It may well be that the mode of harvesting can equally affect the dispersal of cereal pollen.

The presence though of rachis internodes and straw of both wheat (Triticum sp.) and barley (Hordeum sp.) at Freswick Links, could, it is suggested by applying the criteria defined by Hillman (1981:142) indicate that the crops had in fact been grown and processed locally, based on the plant material evidence.

A similar situation would appear to apply to the oats (Avena sp.) for evidence of awns, floret bases and straw have all been found on site (Huntley in Morris and Rackham, 1992:76; Huntley and Turner in Morris and Batey, forthcoming a). The above evidence would suggest that Freswick Links site was producing some of its cereal crops, a view with which Huntley would support (Huntley in Morris and Rackham, 1992:83). At Robert's Haven, White would suggest, as noted above, that the evidence of seeds from native weeds of cultivation would also indicate that it is unlikely that the grain was being imported (in Barrett, forthcoming).

The suggestion that the evidence of lack of chaff could possibly imply that cereals were being imported, could be misleading. It is interesting to note that a Shetland farmer demonstrating winnowing of his crop of bristle oats (A.strigosa) in 1983 to Hinton, did so in the wind outside the barn, the oats being dropped in handfuls onto sacking (Hinton, 1991:51). It is also well known that chaff was used to kindle fire and therefore, in such circumstances, it is hardly surprising that significant amounts of chaff have not been found on sites.

It is interesting to note that at Pool, Sanday, Orkney, the weed seeds are accompanied by cereal culm bases which stand out in the evidence. This does suggest very much that the crop was quite possibly uprooted during the harvesting which would have been relatively simple in the light sandy soil present at this location (Hunter et al in Batey et al, 1993:281), and be suggestive of local production. The evidence of carbonized cereal grains at Sandwick, Unst, Shetland has prompted Bigelow to make a very pertinent observation which was that:

> "the charred seeds found in several locations around the site most likely represent local production, since long distance trade in green seed to be used for direct consumption and, therefore, requiring artificial drying, seems unlikely" (1985:119).

5.2.1 Barley V Oats

The wild oat (A.fatua) was in early times a weed of barley crops, but it is also recognised that oats were grown as a mixed crop with barley in what was a traditional way in Scotland. At the Brough of Birsay it has been suggested that oats may well have been cultivated as a separate crop at this time and are not just the weeds of the barley crop (Donaldson in Hunter, 1986:219). The evidence would suggest that at a few other sites mentioned above there was also a greater quantity of oat grains recovered than of barley grains. Clearly oats can be seen to have been an important crop and the fact that they lacked gluten, and therefore could not be made into bread, did not lessen their great importance in the making of oatcakes, flat griddle cakes and porridge;

while six-row barley or bere was used to make the essential bread of the family. It was also used as a component of soups or stews, as well as in the production of ale, and in feed for stock (Donaldson and Nye in Morris et al, 1989:265).

The historical evidence emphasises the importance of barley and oats in the Norse economy, for the records of taxation, trade and export confirm not only that such crops were being cultivated, but in the case of Orkney particularly, that surpluses were being produced. One reason for the greater quantities of oat grains to barley on the sites noted above may well be due to the fact that barley was favoured most strongly for the payment of taxes, tithes, etc. It would be all the more noticeable if such payments were to have been made and collected on the sheaves.

It would be no surprise that at Birsay Bay there was more barley recorded than oats for two reasons. Firstly, it is considered to be one of the most fertile areas on the Mainland and, secondly, as a residence of the earls of Orkney, it may well have received much of the taxes in barley which could have led to a supply of such grains in the Birsay region.

Where oats were used as a fodder crop they were hardly likely to be found in a carbonised form. Analysis of some 2000 extant testaments dated to the seventeenth century would appear to indicate that in Orkney barley and oats were being cultivated in almost equal quantities (Shaw, 1980:97). In the case of Shetland evidence from testaments indicated that rather more oats were being cultivated than bere. But on the Island of Papa Stour, the situation was reversed for in the year 1648 all extent testaments listed more bere than oats having been sown (Shaw, 1980:96). One of the main reasons for growing bere was the fact that it was more salt tolerant than other domestic grain crops (Fenton, 1978:333-5). In Orkney and Shetland, according to Shirreff, bere has succeeded to oats and oats to bere invariably on the same land for centuries (1814:60). Often the only grain the soil would nourish in Shetland was said to be black oats and bere (OAS, 1978:460). In Caithness it was noted that the main preoccupation of families was

agriculture and that it was a major grain exporting country (OAS, 1978:XVII, XIII).

5.3 FORM OF THE EVIDENCE

Practically all the evidence from the sites under consideration comes in the form of carbonized grain, seeds and plant material. Mineralised seeds have, to a very limited extent, been found at Tuquoy, Westray, Orkney, while also at Tuquoy and The Biggings, Shetland, evidence was found of unburnt plant material as noted above. The bulk of the carbonized material is most likely to represent hearth deposits from a direct situation or indirect from the midden deposits. Such evidence could give a very biased view of the waste material and preservation, which could result in an equally biased view of the activities taking place on the site (Green, 1982:40). As M. Jones (1978) has stated, there may also be a bias in favour of those plant remains that are able to resist, to a greater extent, the burning conditions that they were subjected to. Equally, weed seeds of plants may have become carbonized due to the burning of peat collected along with growing vegetation as a source of fuel.

It is fair to say that the evidence of carbonized plant material is, to a greater extent, biased in favour of those plants that require processing in the vicinity of a domestic fire, and thus are more likely to be preserved by accidental burning. Green has suggested that the carbonized plant remains may also include deliberately burnt material resulting from crop-cleaning processes or equally the burnt household waste (1982:43).

There is every possibility that much of the discarded material from crop-cleaning processes will have been too wet to burn or was likely to smoke or smell rather unpleasantly when burnt. It is therefore suggested that in reality very little plant material would have been deliberately burnt on a hearth fire.

On balance then, it is more than possible that the plant material, in many instances, may have come to be accidentally charred during the drying and parching operations prior to storage. The evidence of carbonized material from many of the sites looked at in this study would suggest that a significant amount could be interpreted as representing cereal crop contaminants; while other carbonized evidence could very well represent plants of the surrounding areas which, though atypical of part of the cultivated fields, can still become incorporated into the harvested crop (Hinton, 1991:49).

The carbonized plant material may thus best be viewed as representing the domestic refuse arising from accidental losses during food processing and preparation, along with material that was used as a source of fuel. In the case of Birsay Bay, Orkney, the Area 2 middens would appear to have been formed very much along these lines, for they were found to consist of ashes containing grain and crop weed seeds as well as discarded and burnt plant material, such as food and bedding.

In contrast, the samples in Area 3 appear to be derived from hearth situations and were dominated by cereal grains. As noted above, Rackham would view these deposits as a number of possible accidents during pot-drying of cereal grains, contributing to the accumulation of carbonized grain in these contexts in Area 3 (in Morris et al, 1989:268). At Saevar Howe, Orkney, there is also evidence which comes from a probable hearth area in the Norse phase IIc, which consists of carbonized barley and oat grains (Dickson, in Hedges, 1983:114). On the Brough of Birsay, Orkney, most of the evidence for cereals has come from burnt layers and hearths in structure 17 in the Norse phase of Area IX. Here the strategy was to recover samples from the major burnt contexts on all the sites that were excavated (Donaldson in Hunter, 1986:216-19; Rackham in Morris et al, 1989:267-8).

The evidence from Freswick Links, Caithness, of carbonized material has, to a major extent, come from the midden deposits. The most significant amounts were found to be associated with the middens in Area 6 and Column 10, east of Area 8. It would appear that they were composed of ashes either from a more typical domestic situation or the debris from a

hearth at which cereals would have been processed and dried (Rackham and Morris, 1992:97). The other Caithness site at Robert's Haven has also produced significant amounts of carbonized seeds, cereal grains and plant remains from midden situations (White in Barrett forthcoming).

The somewhat different situation occurs at The Biggings, Shetland, for at this site both burnt and unburnt material has been found associated with a complex of stone buildings of the Norse long-house type. In some instances the evidence would clearly suggest that the remains could have resulted from sieving of cereal grains to remove weed seeds or from the use of weedy straw for kindling or flooring (Dickson, in Crawford, 1994, forthcoming).

At the site of Tuquoy, Westray, Orkney, where the contextual information is available, it has been noted that densities of both cereal and non-cereal remains were the greatest in the midden deposits. However, some of the richest deposits of carbonized material was also found to be associated with masonry and rubble deposits (Nye and Boardman in Owen, 1994, forthcoming). Evidence of burnt and unburnt material was also found within a substantial waterlogged pit. It was found to contain cereal components throughout the samples which would suggest a close link with cultivated land. Some of the material is thought to represent spoilt grain and/or crop processing debris - its make-up is suggestive of redeposited byre-manure (Owen in Batey et al, 1993:332-5).

5.3.1 Crop Processing - Carbonized Weed Seeds

It is suggested that from very early times man has had the ability to clean the cereal crops by `winnowing', etc, to a very clean condition if he so wished. Dennel has taken samples of plant remains from ovens and storage jars in Bulgaria and Greece, which were most likely to contain crops in an advance state of preparation; and the least likely to be contaminated by plant material from other sources. The main conclusion to be drawn from these samples was that these people were able, by using very simple methods, to produce crops as free of weeds as those of much later periods (1974b:132-3).

It is, therefore, quite erroneous to assume that the Norse people would have had, in any way, to tolerate high degrees of crop impurities. It is suggested that it is much more likely that the degree to which many grain crops were cleaned of weed seeds at the time of harvesting and subsequently resulted from the quality and quantity of the grain produced from the harvested crop. Where there was a good crop resulting in sufficient grain it could well be that it was cleaned to produce prime grains of a very pure crop. But, alternatively, where the crop was poor then it would most likely be left with many weed seeds present to help bulk it up.

Considering the deteriorating climatic conditions of the times (see above 1.2) there must have been many years when crops in the areas under consideration were either destroyed completely or severely damaged by lack of sunshine, by rain and or wind, or by diseases, etc. A good picture of the conditions can be obtained from Sibbald, particularly in relation to Shetland, for he observed that:

> "Shetland affords little corn, and much of that often shaken by the violent winds or spoiled with the sea water blowen in upon it" (Sibbald, 1845:9).

It is not difficult to imagine that when the crop was cleaned of weed seeds, those with potential food value were possibly kept in order to supplement the grain supply (Drury, 1984:49).

In Anglo-Saxon England there are many recorded cases which mention `acorn (Quercus sp.) flour/powder' and sieved hazel (Corylus avellana) or Alder (Alnus sp.) all of which were used to bulk out cereal flour when supplies were short (Hagan, 1992:7). Weed contaminants are in many poor countries tolerated as long as they do not impair the overall palatability of the cereal crop. It would, therefore, be of no great surprise to find such contaminants in with primary cereal grains, particularly if there were shortages. Equally, it is also possible that even pure prime grain would have had weed seeds added to `bulk-up' in times of need. It is the view of Hillman that the last meal of both Tollund and Grauballe man consisted either of:

a) `fine clearings' from the grain crop with the possible addition of prime grain to make it more palatable, or,

b) sparse grain harvested from badly failed crops in which fine clearings were never removed (1984, 1986:102-3).

It is also known that along with weed seeds even runt grain and dense chaff sieved out of the previous year's prime grain were added at times of poor harvest (Maurizio, 1927). This mixture could then have been consumed as a form of porridge. In years of crop failure, one can imagine that everything that was harvested from the fields would have been processed only to the extent of winnowing and `coarse sieving', thus retaining most of the weed seeds along with the grain. As for the species of weed seeds associated with Tollund and Grauballe man, every one of them, according to Hillman (1986:102), turns out to be an archetypical weed of crops, with only one exception. Therefore, according to Hillman all the seeds present were most likely to have originated from weeds growing in the cereal crops themselves. The majority of such weed seeds have been found as carbonized material on the Norse sites presently under discussion. It is also a well known fact that in the eighteenth century in Scotland the daily fare consisted of a `morning piece' of half a bannock of bread made from bere mixed with seeds of all kinds of weeds (Handley, 1953:80).

The recent investigations of Hinton in Shetland clearly show how the cereal grains of the bristle oat (Avena strigosa) were found to be contaminated with seeds of typical arable weeds, but also with those not normally associated with cereal crops which came from atypical patches within the fields and from adjoining areas with different vegetative characteristics (1991, 49-54). It should, therefore, be no surprise that evidence is found of many carbonized weed seeds associated with cereal grains, and they should not automatically be viewed as either burnt waste from cereal processing, weed seeds coming in with material used as fuel, or as being blown in or walked in.

It is the view of Hillman that charred seeds of typically ruderal species appear to be found regularly in association with cereal grains (as is the case with the site under discussion) and they may be seen as

primarily contaminants of crop products and therefore are more likely to have arrived at the site by this means rather than any other (1984:21). Weed seeds, therefore, it is suggested, in this study should to a great extent be viewed as representing the accidental losses associated with cereal processing, for as is well known cereals were exposed to fire as grains were dried in household kilns or in small pots over a hearth (Fenton, 1978:375-87). In fact the traditional Orcadian dish, known as `Burstin' was made by roasting the whole grains until in some instances they were actually burnt (Fenton, 1978:375, 395). It is well documented that even in agrarian societies the seeds of many wild plants have continued to be gathered as a supplementary food supply until the most recent times (Schwantes, 1937:146-51) while at the same time there are numerous ethno-historical records which have been cited by Maurizio (1927).

5.4 CULTIVATED CROPS : FLAX

5.4.1 Caithness

There is evidence to suggest that flax (Linum usitatissimum) may have been cultivated at the Freswick Links site, for there were finds of carbonized seeds in a number of the Area samples. It is obviously impossible to say in what quantities they may have been used, but as Huntley and Turner point out they are less likely to have come into contact with fire than would be the case with grain (in Morris and Batey forthcoming a). At the Robert's Haven site White has identified carbonized seeds in 5 samples to date and again suggest they may have been cultivated locally (in Barrett, forthcoming).

5.4.2 Orkney

Finds of flax (Linum usitatissimum) seeds have been made at the following site on Orkney; Birsay Bay (Donaldson and Nye in Morris et al, 1989:266); Beachview, Burnside Area 2 (Nye in Morris, forthcoming b) and Beachview, Cutting 3/Area 3 (Nye in Morris forthcoming b).

Saevar Howe, Dickson, in Hedges, 1983:114). Earl's Bu, Orphir (Batey and Morris in Morris and Rackham, 1992:38), Westness, Rousay (Kaland in Batey et al, 1993:311), Tuquoy, Westray (Nye and Boardman in Owen, 1994, forthcoming), Pool, Sandy (Hunter et al, 1991:133; Hunter et al in Batey, et al, 1993:281; Bond, 1993 pers comm).

The largest single context was found at Saevar Howe, where some 101 carbonized seeds were discovered along with seeds of the corn spurrey (Spergula arvensis) which is a common weed associated with flax and would therefore suggest that this crop had been grown locally (Dickson, in Hedges, 1983:14). The evidence from Beachview, Burnside Area 2, has suggested to Nye that flax was being cultivated and used there, unfortunately it is not possible to say whether for oil, food or fibre (in Morris, forthcoming b Tables M30, M31).

At the Earl's Bu, Orphir, site, carbonized seeds were found in several contexts and again it has been suggested that they could have been grown locally (Batey and Morris in Morris and Rackham, 1992:38). At the site of Tuquoy, Westray, carbonized seeds were found in some 20 soil contexts in Area F. In general the size of the seeds was smaller than those used today for linseed oil production. They were similar in size to those found above at Saevar Howe, Birsay. (Nye and Boardman in Owen, 1994, forthcoming).

At Pool, Sanday, carbonized seeds were found in 18 samples from the 1983 season and in 14 from the 1984 season. There can be little doubt as to their Norse context as associated radiocarbon-dated material has provided the following dates - 975±50 bp, GU-1806; 1160±50 bp, GU-2006; 1270 ±50 bp, GU-1810 (Bond and Hunter, 1987:175).

In relation to the Pool site Hunter makes the valid point that the soil and climate there were particularly appropriate for the cultivation of flax, when taking into consideration the ethnographic parallels with Irish sources (Bradbury, 1925:23), for the pre-technical cultivation in the 1920s would appear to be analogous to Viking period Orkney (Hunter et al in Batey et al, 1993:281).

5.4.3 Shetland

The only site to reveal evidence of flax was Sandwick, Unst, where a single flax seed (Linum sp.) was found (Bigelow, 1984:135). The traditional view has been that flax was grown as a fibre crop, but at the site of Carigalla II, Co Limerick, Eire, a baked clot of seeds was found on a Norse Age site, and it has been suggested that they had been pressed to release their oil content (Jessen and Helbaek, 1944:55). Such evidence does indicate that they could be cultivated, not necessarily for their fibres alone, but also for their seeds which are known to be rich in fats and proteins. They were mixed with flour to make bread in Scandinavian countries (Jensen, 1979). Generally though, in the cool moist climates flax has been cultivated for its fibres rather than for linseed.

Hunter has made the point that flax plants can be grown to produce either linseed oil or fibre or indeed both at a much lower level of production (in Batey et al, 1993:281). In Ireland in the early twentieth century, when conditions were still as they had been for centuries past, Bradbury was well aware of the necessity for both fibre and seeds to be produced within the subsistence economy (1925:78). It was apparent, therefore, that they were sacrificing the finest quality linen and the optimum seed production so as to produce, from the same crop - fibre, linseed oil and next year's seed crop.

It has been suggested that some of the hammerstones found at Pool, Sandy, Orkney, may well have been used to break plant stems or bark and thus loosen the fibres (Bond and Hunter, 1987:178). There can be little doubt that some of the heckles discovered would have been used in preparing the flax; for an entry from the Holm parish, Mainland, Orkney in 1792 (OSA, 106) records that there was no lint mill and, therefore, amongst other items `coarse heckles' were used (Bond and Hunter, 1987:179).

5.5 OTHER CULTIVATED OR CARED FOR PLANTS

5.5.1 Introduction

It is very difficult to identify with real certainty the other plants, herbs and vegetables that may have been cultivated or cared for by the Norse inhabitants to help supplement their diet. Such plants, etc, by their very nature, would have been eaten either as roots or leaves which are generally harvested before the seeds have set and in many cases even before the flowers appear. The chances of seeds being preserved are therefore even more reduced than normally and one should not be surprised if only the occasional, often isolated, seeds are found in the archaeological record. If seeds have been collected for future crops or to be used as spices or oils, etc, they may possibly be found due to accidental loss or due to carbonization when drying near the hearth. In the case of seeds of the field/Celtic bean (Vicia faba), the pea (Pisum sativum) and wild vetch (Vicia spp.) species, they are well known to decay rapidly in the soil and this factor may well be why such evidence is so rare.

It is, therefore, impossible to state just how important legumes were in the economy, due to the nature of the processing and utilisation which by its very nature leaves less archaeological evidence than do cereals (Dennell, 1972:157).

It is more than likely that the Norse generally were familiar with crops other than cereal and flax for it is known that they did cultivate peas, hops and cabbages (Foote and Wilson, 1970:149). There is every probability that cabbages were introduced in the Norse period, for its name Kal is a loan-word from Frisian or Old English (Foote and Wilson, 1970:149). There were also, during this time, Norwegian laws which related specifically to angelica-cabbage and leek-gardens (Foote and Wilson, 1970:149).

It is interesting to note from Iceland that the pollen analysis studied by Thorarinsson (1944) indicated that not only were the Norse farmers cultivating cereals but that they were also cultivating two other plants

which have uses in brewing and medicine. They were bog myrtle (Myrica gale) and wormwood (Artemisia sp.) (Buckland et al, in Batey et al, 1993:509). To date no true cesspits or latrine deposits have been identified from Norse contexts on the sites under discussion. Where such evidence has come to light new techniques have enabled further detailed discoveries to be made relating to the vegetable plants that had been used in the diet. For example, the identification of Brassica spp. specific aphids has assisted in confirming that Brassica spp. had been consumed at York (Hall, et al, in Proudfoot, 1983:88). Equally important has been the identification of epicuticular leaf wax of Brassica spp. that have been absorbed into potsherds (Evershed, et al, 1991:540).

5.5.2 Caithness Sites

Evidence has been found at the Freswick Links site in both Area and Column samples of carbonized seeds of the Celtic bean (Vicia faba) which is the forerunner of the modern broad bean. It is the view of Huntley and Turner that it is almost certain that the Celtic bean was being grown locally (in Morris and Batey forthcoming, a). The site of Robert's haven has also provided evidence of Vicia sp. (White in Barrett, forthcoming).

With regard to peas and beans, they are known to have been cultivated in Scotland from at least 1299, for at that time the English soldiers besieging a castle in Lothian fed themselves on peas and beans from the surrounding fields (Hedrick, 1972:442). It is also known that James 1 introduced an Act in 1426 which related to the compulsory sowing of wheat, peas and beans (Symon, 1959:453). While at the XIVth parliament of James II on 6 March 1457, there was passed a law which was in fact a reaffirmation of the 1426 Act (Handley, 1953:54). While on the Island of Lismore there were convictions recorded in 1615 and 1618 for failure to grow peas (Shaw, 1980:95).

Seeds have also been found of Brassica sp. (p), at Freswick Links which could well belong to wild or improved forms of cabbage or Kale. It may

well be that certain wild species of plants were being cultivated or cared for at least, since there was found to be present on this site and, many others, evidence of pod fragments and seeds of the wild radish (Raphanus raphanistrum) as well as seeds of vetches/tares (Vicia sp.). There can be little doubt that many people would have grown vegetables in small plots associated with their farms or tenanted properties as an additional food source, for many cottars would have had his "Kail-yard" (Symon, 1959:106). In the statistical Accounts of Scotland for 1791-1799, it is recorded that at Reay, that "the gardens afford the common pot-herbs and flowers" (:154).

It was noted that in Wick the vegetable being grown there included, `cabbages, colewort, savoys, spinage, beets, turnips, carrots, parsnips, onions and all sorts of kitchen stuff, may be reared in abundance, as also pot, aromatic and medicinal herbs by due attention' (:258-9). Some indication of what may have been grown in the early garden plots or kail-yards can be glimpsed from the twelfth century Irish poem:

> `From the Vision of MacConglinne'
> A forest tall of real leeks,
> of onions and carrots, stood.
> Behind the house
> (Meyer, 1911:20-1).

5.5.3 Orkney Sites

The carbonized evidence from Brough Road, Birsay Bay Project, has identified a number of possible crop or garden vegetables which are represented by the seeds of Brassica/Sinapis. These particular seeds were unfortunately in a poor state of preservation and consequently it was not possible to provide specific identification. But as Donaldson and Nye have stated "they could be of cultivated, cabbage, kale, turnip or mustard, rather than the wild forms" (in Morris et al, 1989:266).

The site at Beachview, Birsay Bay, has also provided evidence of seed of Brassica/Sinapis from Area 2 (Nye in Morris forthcoming b, Table M30, M31). The Brough of Birsay, like most of the other Orkney sites being

discussed, produced evidence of the seed and or pod fragments belonging to the wild radish (Raphanus raphanistrum). If it was not being cultivated or cared for it would certainly seem to have been deliberately gathered for culinary uses. It is worth remembering that Brassica, Raphanus and Sinapis species are the progenitors of many modern day vegetables.

With regard to the site of Tuquoy, Owen makes the point that a number of the "arable `weed' may have been encouraged given their usefulness around the farm". Evidence from the late Norse site has certainly indicated to Nye that certain types of herbs and weeds were being used domestically (Owen in Batey et al, 1993:334). Again, poor preservation of many of the recovered seeds has prevented identification beyond the genus or family. Those noted include, Cruciferae, Brassica sp., mustard, rape cole; Brassica/Sinapis brassica/charlock. Such evidence, if specific, may well have indicated a range of vegetable plants being used on this site. Evidence of mineralised seeds were also discovered at this site. They included Brassica/Sinapis, brassica/charlock.

It is accepted that it is difficult to relate mineralised seeds positively to human activity (Nye and Boardman, in Owen, 1994, forthcoming), but it is worth noting that these seeds and the other species found would not create any surprised if they had been consumed.

It has been said that cabbages were scarcely known in Scotland until the soldiers of Cromwell introduced their planting and that up to that point in time (1649) they were to a great measure unknown (Barry, 1805:254; Hedrick, 1972:114). That may be the case with the true cabbage plant (Brassica oleracea capita), but it is more than likely that the wild cabbage (Brassica oleracea) and forms of it were being grown well before 1649. It is also possible, in a number of instances, that the word cabbage was used to refer to kale, kail or cole, etc (Brassica oleracea acephala).

There is little doubt that kail was known from at least the fifteenth century in Scotland (Fenton, 1978:101). There is little doubt too that it was firmly established in the Scottish island from an early date for

in July 1638, it is recorded that a tenant in Balygrundle, Lismore, brought an action against another tenant there for the purpose of recovering some three pounds of kail seed (Shaw, 1980:100).

Commenting on Orkney, the Rev John Brand in 1701 noted that:

> "Thou there be no trees and so no fruit for the table, yet there is no lack of good roots for the kitchen, as cabbages, carrots, parsnips, turnips, crummocks, artichokes, etc. All which useth to be bigger here then with us"

and he goes on to say:

> "Besides these they have likewise variety of herbs in the fields, very beneficial to such as understand their virtue and use" (1701:36).

Some indication of the numbers of houses with gardens is provided by the Statistical Accounts of Scotland for 1791-99, which indicate that within the parishes of Sandwick and Stromness, there were some "570 inhabited houses with gardens occupying 200 acres (:221).

A single seed of the Celtic bean (Vicia faba) was found at the Earl's Bu, Orphir, site (Huntley, 1990:2).

5.5.4 Shetland Sites

The only site to be excavated in Shetland, which is under consideration in this study, where there has been a significant recovery of plant remains is at The Biggings, Papa Stour. Unfortunately, the macroscopic plant remains have only been able to be identified to the genus or family due to their poor condition. Evidence was revealed for Cruciferae (Cabbage family), while the pollen analysis has revealed Cruciferae and Leguminosae (Dickson, in Crawford 1994, forthcoming).

The first reference to kail being grown in Shetland comes from a court case in 1615 where the offenders were charged with the theft of kail plants (Fenton, 1978:101). Gifford commenting on Shetland noted in 1733

that cabbage was the main vegetable grown there and was `much used by the inhabitants' (1879:21). While the statistical Accounts of Scotland for 1791-99 record that in Delting parish, cabbages thrive in every kail-yard and in North yell and Fetlar, "our turnips, cabbages, radish and cresses, grow better than any we import" (:402, 551).

The above information would seem to contradict G. Donaldson's statement, that "root crops were as yet unknown in Earl Patrick's day" (1958:34).

While the contention of Bigelow "that root crops were much less important in the seventeenth century than in later periods" (1984:144), does imply that they were available. Such would certainly seem to be the case in reference to the larger land owners as we have noted above. It needs little imagination to visualise that even the smallest farmer or tenant would have grown a steadily increasing number and variety of vegetables as they became more accessible within his kail-yard or plot in an endeavour to augment his economic subsistence in those days of limited resources. As most vegetables, by their very nature, are eaten before they flower, as noted above, it is not surprising that very little evidence has been found from excavation sites to support their cultivation.

5.6 DIETARY IMPLICATIONS

It has been proposed that the Viking Period subsistence economies would have been basically dependent on cattle and sheep husbandry, along with cereal cultivation. This would have thus resulted in a high energy food diet from c800 to c1100 AD (Bigelow 1984, 225).

In the latter eleventh century, it would appear that dairy production was intensified most likely as a result of the increased power of the Orkney Earldom. Their demands, through taxation of the available grain and butter, would have further reduced the resources of the household economies particularly in Shetland and Caithness. There can be little doubt that such actions would have resulted in the loss of dietary fats and carbohydrates, the latter in the form of cereal grain. The result

of such actions may have led to an increase in pastoral activity to help compensate for such losses (Bigelow, 1984:226, 1985:111-3). The carbohydrates are essential for helping to maintain body temperatures and to provide the energy that is so essential for enabling movement and for one to work. In the case of barley (Hordeum sp.) it provides 83.6 (g) of carbohydrates per 100 (g), while oats (Avena sp.) provides 72.8 (g) per 100 (g) (McCance and Widdowson, 1991).

It is further suggested that fishing would have assumed a much greater importance so as to help meet the families subsistence needs. Unfortunately neither cod, ling nor saith provide any carbohydrates, but do provide, as do other fish, a higher amount of proteins (McCance and Widdowson, 1991). Such a diet would therefore have resulted in an increasing nutritional imbalance of high protein - low energy food into the diet during the eleventh century. It is most likely that in the twelfth century such trends would have increased as the establishment of church tithes put yet further demands on the already depleted resources of butter and grain from the household economy, particularly in Shetland (Bigelow, 1984:226). It is, therefore, quite possible that the increased proportion of various fish in the Shetland diet would have created nutritional stresses, and have accelerated action to obtain high energy food supplies. Such needs would, it has been suggested by Bigelow and others, have been met by using the local fish resources to trade or exchange for cereals (Small, 1969:147, Fenton, 1978:6, 528,542, Bigelow 1985:122). This would have been essential as the dairying products were increasingly being siphoned off by various forms of taxation (Bigelow, 1984:226).

In Caithness the weight of fish bones discovered in the middens at the Freswick Links site has led to suggestions that some form of fish processing was also taking place here. Such evidence certainly draws parallels with the preliminary results from the Late Norse site at Sandwick, Unst, Shetland (Bigelow, 1984, 1985:Morris et al, 1992:97). On the North coast of Caithness at Robert's haven more recent excavation work on the middens there has also provided evidence for considerable quantities of fish being processed (Batey, 1989:226, Barrett, 1993:12).

There would appear to have been an increasing dependency on fish, particularly in Shetland and possibly Caithness, but to a lesser extent in Orkney where the conditions for agricultural production were that much better. In endeavouring to meet the needs of a balanced protein/carbohydrate diet in the Late Norse period, it is almost certain that there would have been a continuing, if not an increasing, loss to the diet of Vitamin C. Cereals produce no Vitamin C, while fish only produce the merest traces.

A diet without or lacking Vitamin C leads to attacks of the disease known as scurvy. Scurvy has been known from the time of Hippocrates (Father of medicine) to produce pains in the legs and gangrene of the gums which is associated with the loss of the teeth. It is also known to inhibit the healing of wounds and can ultimately cause death. In 1645 the Faculty of Medicine at Copenhagen published a "consilium" for the benefit of the poor, providing information on the causes, preventions and cure of this particular disease, which at the time was most prevalent amongst the Danish population and other northern nations (Hess, 1920:3).

It has been suggested above that the diet of the Norse settlers living on the various sites under consideration, would have consisted, to a great extent, of mostly fish/marine fauna, cereals and some meat products. Such a diet would provide no meaningful amounts of Vitamin C and could well have led to severe outbreaks of scurvy amongst the Norse inhabitants.

Though Vitamin C is present in relatively high proportions in raw meat and particularly in certain animal organs, it has been found that it is very quickly destroyed in cooking processes and in storage (Keene, 1985:184). The suggested daily intake of Vitamin C is in the region of from 30 to 45 mg per day and the fact that Vitamin C is water soluble has meant that little is stored by the body and, therefore, a regular daily supply is required (Keene, 1985:184).

In the winter months and early spring there would have been a shortage of fresh meat supplies and greens, and it is at this point, when many

people would have been in a pre-scorbutic state, and would have suffered from bleeding gums, ulcers and bloody dysentery (Gagan, 1992:106). Further nutritional analysis has also shown that bread, flour, oatmeal, porridge, butter, cheese and eggs, all of which would have been available to the Norse settlers, have negligible to zero amounts of ascorbic acid (Vitamin C) present (Carpenter, 1986:Table 10.1).

Brand records "that there was no sickness or disease this County is more subject unto then the scurvy, as in Orkney likewise, which is occasioned doubtless by their salt meats, fishes upon which many for the most part do live". He goes on to say that "sometimes this Scurvey degenerates into a kind of Leprosy, which they call a Bastard scurvy and is discerned by hairs falling from eyebrows, the nose falling in" (1701:108).

Evidence of people having scurvy has been found in a number of burials including those found at Birsay Bay, Orkney, in cist-graves cut into the midden deposits in both Area I and II. In Area I a male in his late 50s/early 60s was discovered. He had suffered severe infection of the mouth and periodontal diseases, both of which are clearly symptoms of scurvy. While in Area II a female, again in her late 50s, was found to have suffered from a badly infected mouth which had abscesses and severe tooth attrition (Morris in Batey et al, 1993:301). It is not known whether these people were of high or low status, but it is interesting to note that Kramer in 1737 informs us that the disease was almost always to be found in the common soldier, seldom in officers, for obviously the latter must have had sufficient access to fresh greens and vegetable foods (McCollum, 1957:253).

The benefits of antiscorbutic foodstuffs were appreciated from the very earliest times, since it is most probable that the potency of herbs and fruits was known to individuals and groups of people well before they were generally recognised (Hess, 1920:143). It would, therefore, have been soon appreciated that diets which did not contain such foodstuffs as fruits and greens resulted in scurvy. Not until more recent times was it realised that it was Vitamin C which was the vital ingredients. Evidence would suggest that cereals do develop antiscorbutic properties

when they have been allowed to germinate. It will, therefore, be appreciated that beer, alcoholic beverages and fermented liquors will have been helpful to those suffering from scurvy in the past (Lind, 1772).

The only antiscorbutic foodstuffs available then, to the Norse Settlers, would have been the alcoholic drinks, herbs, wild plants and a few available fruits. In such circumstances it is not surprising that it was noted in past times that cabbage, sorrel leaves (Rumex acetosa) and dandelion (Taraxacum officinale) were some of the many plants that were found to be best in helping to prevent attacks of scurvy (Hess, 1920:158). Others included the scurvy grass (Cochlearia officinalis), nettle (Urtica sp.) and elder (Sambucus sp.) (Hagan, 1992:106). The Chenopodium species are often referred to as being eaten in times of need or famine. They are known to contain ascorbic acid (Vitamin C - 100 mg per 100 gm) and other valuable vitamins (Hagan, 1992:105). Of the berries, cloudberries (Rubus chamaemorus) in certain parts of northern Europe were a prized antiscorbutic, as were the hips of roses (Rosa sp.) (Nordenskiöld, 1881:44, 480; Nicolay sen, 1980:303-5). There are recorded accounts of the common people gathering scurvy grass (fcurvy grafs), trefoil (Lotus sp.) and other plants that grow on Unst for their medicinal qualities (OSA, 1791-1799:501). It is also recorded from Sandness that "Cabbages were produced in great plenty and formed an essential part of the winter diet of the lower people", for they were considered to be a corrective of scorbutic habits (OSA, 1791-1799:527). The cabbage or kail was therefore a specific against scurvy and would be consumed as both kail brose and broth as a popular item of the diet (Symon, 1959:106).

In the writer's mind there can be little doubt that certain wild plants were being gathered and some cultivation of kail plants and possibly others would have taken place. Such plants would have been eaten as greens and roots, not in the knowledge that they were providing the essential Vitamin C, but in the simple knowledge that they were good for one.

5.7 HERBS: CULINARY : MEDICINAL PROPERTIES

From the earliest times there had been a knowledge of herbal plants both for medicinal and culinary uses. The Greek Hippocrates, was known as the Father of Medicine. It is known that St.Columba established a house on the Scottish Isle of Iona in 563 AD and it contained its own herbarium and a hospice (Ie Strange, 1977:XIV). While the Bishop of Winchester wrote to the Bishop of Mainz in 754 AD asking for medical books and adding "we have some medical books, but the foreign ingredients which we find prescribed in there are unknown to us and difficult to obtain" (Trease, 1964:37). Possibly the most famous original manuscript dating from the Saxon period is the Leech Book of Bald, dating from about c900 AD. The document contained the ancient herbal lore of Britain with prescriptions which had been sent from the East by the Patriach of Jerusalem to Alfred the Great (Ie Strange, 1977:XVI). At this time the medicinal use of plants was very much mixed up with myth and superstition, but, none the less, it has been estimated that, for example, the Saxons had names for some 500 different plants which they used (Ie Strange, 1977XVI).

Early spice merchants were known to have dealt in both drugs and prepared medicines as well as perfumes. There is a record relating to the household of Henry II, dated 1172 which merely refers to "spices and electuaries" (et in speciebus et electuariis) (Trease, 1964:43). While in York one "John le Especer aut apothecarius" was thus referred to in a grant to Fountain's Abbey in c1273 (Trease, 1964:55). In Scotland it was James I who introduced the first "poison law" in 1480 (Trease, 1964:70).

One of the earliest British herbals was The Grete Herball of 1526, which was soon followed by the famous Gerard's Herbal, which was first published in 1597. But possibly the most popular, though not the most scholarly, was Culpepper's Herbal which was published in 1653 under the title "The English Physician" (Stockwell, 1988:88).

There can be little doubt that our past ancestors would have been taught, as a matter of course from early childhood, of the many uses to

which plants could be put. It would be difficult to imagine that the incoming Scandinavians or the Pictish inhabitants before them were completely ignorant of such uses to which plants could be used, both in culinary and medicinal ways, in addition to the more obvious ones of providing material for shelter and animal fodder, etc. It is interesting to note the account of the burial by the Arab ambassador, Ibn Fadlan, on the River Volga in 922 AD, for he states that the mourners produced nabid, fruit, and aromatic plants which were placed around the body (Brøndsted, 1960:303).

There are many accounts of plants being used in the processing of dairy produce. The cinquefoil (Potentilla sp.) was known to have been used to curdle milk and to be used medicinally (Donaldson in Hunter, 1986:219). The flowers of the wild thistle (Cirsium sp.) and the lady's bedstraw, (Galium verum) it is suggested, were used to curdle milk in the preparation of cheese, while it is also thought that the butterwort (Pinguicula vulgaris) was used to help preserve butter (Hagan, 1992:20, 21). It is clearly recorded that the common people gathered scurvy grass (fcurvy grafs) (Cochlearia sp.) and trefoil (Lotus) and other wild plants that grew on Unst, for their medicinal qualities, (OSA, 1791-1799:501), while in Wick it is recorded that medicinal herbs were grown by due attention (OSA, 1791-99:258-9).

With reference to the plant assemblages from Brough Road sites and others in the Bay of Birsay, Rackham has stated that "some of the wild plants may have been part of the contemporary medicine or food chest (in Morris et al, 1989:268). In reference to Birsay Bay, Morris has also stated that "some species may represent wild plants deliberately collected for culinary usage (wild cabbage - Brassica oleracea, wild radish, Raphanus raphanistrum, and wild mustard Brassica/Sinapis) or medicinal (speedwell Veronica sp or henbane Hyoscyamus niger) (Morris et al, 1989:286). The speedwell plant was in the past known to be used as an astringent (Culpeper, 1652:345), while the henbane was a powerful poison and an effective anodyne and sedative (Wren, 1975:150, 287).

In Iceland, pollen analysis studied by Thôrarinsson (1944) indicated that Norse farmers were cultivating cereals but, in addition, they

appeared to be cultivating both bog myrtle (Myrica gale) and wormwood (Artemisia sp.), the former is used in brewing while the latter was used for its medicinal properties (Buckland et al in Batey et al, 1993:509).

In considering the actual plant species that have been frequently recovered from the sites presently under discussion, it would be of interest to note the recorded medical uses for which such plant species are known to have been used.

5.7.1 Antiscorbutic (were those plants used against scurvy, see page 110-114). They include the scurvy grass (Cochlearia officinalis) which is now known to contain a high percentage of Vitamin C. It was the leaves that were eaten as a salad, not for its flavour, which is decidedly bitter, but for its beneficial effects (Ranson, 1954:95). It was also used to make scurvy-grass ale which was a popular tonic drink (Grieve, 1931:725). Also used for curing scurvy was Chenopodium spp. for again they were rich in Vitamin C (Ie Strange, 1977:69, 70). The berries of the rowan (Sorbus acuparia) were also used to help cure scurvy (Grieve, 1931:70).

5.7.2 Aperients (produce a natural movement of the bowels - a laxative). One of the many plants used for this purpose was actually known as the purging flax (Linum catharicum) and was extolled by Gerard (1633:559-60). It is interesting to note that Hall was not aware, until 1980, that the seeds of flax/linseed (Linum usitatissimum) were used as a laxative when he discovered them being sold for that purpose in an Oslo supermarket (1987:20).

5.7.3 Astringents (They cause a contraction of the tissue). One of the most commonly used plants for such purposes was the ribwort plantain (Plantago lanceolata), the juices after being extracted from the leaves were applied to the wounds to help promote the healing (Ie Strange, 1977:205). Dioscorides wrote about plantain as a healing herb and it is still used today in Shetland on wounds, burns and sores

(Grigson, 1955:332). Also used for similar purposes were the alder (Alnus sp.) (Culpeper, 1652:23), the bur-marigold (Bidens sp.), sorrel (Rumex acetosa), curled dock (Rumex crispus) and the knotgrass (Polygonum aviculare) (Grieve, 1931:16, 259, 458).

5.7.4 Demulcents (they have a soothing or emollient effect on inflamed surfaces). Such plants include the common alder (Alnus glutinosa), the bark or leaves of which when young were applied externally to swellings and inflammations (Ie Strange, 1977:15). Other plants with similar properties included the redshank (Polygonum persicaria) (Culpeper, 1652:30-1) and chickweed (Stellaria media) (Grieve, 1931:196).

5.7.5 Diuretics (they increase the flow of urine, by acting on the kidneys). The marsh pennywort (Hydrocotyle vulgaris) was used for bladder and urine problems (Culpeper, 1652:267), as was the parsley piert (Aphanes arvensis) (Ie Strange, 1977:13) also cleavers (Galium aparine) and the great plantain (Plantago major) (Grieve, 1931:207, 641).

5.7.6 Haemostatics and Styptics (they help to control bleeding). The meadowsweet (Filipendula ulmaria) belongs to this group and was used against fluxes of blood (Grigson, 1955:144). While the shepherd's purse (Capsella-bursa-pastoris) was said to help all fluxes of blood caused by inward or outward wounds (Culpeper, 1652:332). In the case of sorrel (Rumex acetosa), it was the roots which were used to make an infusion against bleeding (Grieve, 1931:259).

5.7.7 Narcotics (they diminish the action of the nervous and vascular systems causing drowsiness, lethargy, stupor and insensibility). The common henbane (Hyoscyamus niger) can be used as a sedative and was used in the first anaesthetic `soporific sponge' of the middle Ages (Ranson, 1954:65). It also had a magic reputation in the

Middle Ages. The Stockholm Medical Manuscript (c1400) is quoted by Grigson as saying:

> "Amonis wommen if thou scholdist gon
> And bennebanne hawe the up-on
> This ilk cas schall be-falle,
> It schall hem make to lowe the all"
> (1955:291).

5.7.8 Dressings

The use of sphagnum moss (Sphagnum cymbifolium) as a dressing for wounds has been known, especially by country folk of Scotland, for hundreds of years (Ranson, 1954:97). There are records relating to how the Highlanders gathered `Bog Moss' to treat their wounds after the battle of Flodden (Ranson, 1954:97).

5.7.9 Snake Bites

The juices of the herb cleavers (Galium aparine) and its seeds was prescribed for those bitten by adders by helping to preserve the heart from the venom. Similarly, juniper (Juniperus sp.) was said to be excellent in such cases (Culpeper, 1652:94, 204).

It is clearly impossible to state that such plants found on the sites under discussion were used for culinary or medicinal purposes, but equally it is only reasonable to accept that the Norse dwellers would have suffered many of the above ailments and disorders. They would have taken action to relieve such symptoms and in doing so must have used wild plants/herbs for such purposes, if only for the simple reason that no other remedial substances were readily available to them. There is no reason why they should be less informed or knowledgeable of the properties of such plants than the Anglo-Saxons for whom there are many records relating to the use of wild plants.

5.8 WILD PLANTS : A SOURCE OF FOOD

In looking into the question as to the economic importance of wild plants as a food source, one must take into consideration the most notable recoveries of human bog-burials from the Iron Age. They have been of particular importance for it has been possible to examine the stomach content of probably the two most famous such bog-burials, ie Tollund and Grauballe man. In the case of Tollund man, his last meal was still contained in his stomach in the larger and smaller intestines. Their content was shown to consist of a mixture of finely reduced wild plant remains and particles of seeds. As well as the cultivated grain, it is worth noting the large amount of knotgrass (Polygonum aviculare) and pale persicaria (Polygonum lapathifolium) in the stomach. It has been suggested that these two species must have been gathered deliberately and other wild plants represented may well have been gathered along with them or have grown in the cereal crop. It has been suggested that the gruel made from this mixture of cultivated cereals and wild plants was most likely the normal diet when Tollund man was alive (Glob, 1971:30).

The last meal of Grauballe man was also removed from the digestive system and was found to have been eaten immediately before death (Glob, 1971:42). In addition to those species found in Tollund man, there were the following wild plant species:

Clover (Trifolium sp.)
Fat hen (Chenopodium album)
Buttercup (Ranunculus spp.)
Lady's Mantle (Alchemilla vulgaris)

Helbaek has suggested that the seeds of the wild plants represent the deliberate gathering of these seeds as a source of food. In support of this hypothesis, he was able to cite hoards of pure weed seeds from three different sites in Denmark; 1.7 litres of fat hen (Chenopodium album) from a charred wooden storage bin at Iron Age Norre Fljand; 1 litre of pure pale persicaria seeds (Polygonum lapathifolium) from a hearhside heap at first century AD Alrum, Jutland; and a remarkable 5.7 litres (5600 cc) of corn spurrey (Spergula arvensis) seeds identified by

Jessen (1933) at an Iron Age house in Ginderup on Jutland (Brandt, 1950; Helbaek, 1954, 1960).

It is though the view of Hillman that the last meal of both Tollund and Grauballe man consisted either of:

a) the `fine clearings' from the grain crops with the possible addition of prime grain to make it more palatable, or

b) spare grain harvested from badly failed crops in which fine clearings were never removed. (1986:102-3).

Hillman's views obviously differ from those of Helbaek as to the source of the wild seeds, but on balance the writer would suggest that the gruel was most likely to be representative of at least the rations in scarce times, if not of the normal gruel mixture of the less wealthy inhabitants. For evidence of faecal remains from Dublin, York and Bergen, see Chapter six.

The above tangible evidence does indicate the potential uses to which seeds of wild plants may be put to in normal times, or in times of scarcity. At Beachview, Burnside Area 2, Rackham has suggested that the evidence of carbonized seeds may well suggest that many were being deliberately collected (et al in Morris, forthcoming b, Table 9). There are many recorded accounts of the other uses to which wild plants/herbs may be put to, particularly relating to the leaves, stems and roots, etc. Such uses will now be considered in relation to those plants for which evidence has been found on the sites presently under consideration.

5.8.1 Spinach

The common sorrel (Rumex acetosa) is probably one of the first plants to produce fresh green leaves in the spring, in Gerard's time, and well before they were cooked and used as a vegetable like spinach (Mabey, 1972:49). It is known to have been used frequently for the table in Henry VIII's time (Grieve, 1931:753). The young shoots of nettles (Urtica sp.) were also gathered and eaten like spinach (Grigson,

1955:238). Another plant which was similarly used ws Good-King-Henry (Chenopodium bonus-henricus) for it was eaten as a spinach along with the shoots as well (Ie Strange, 1977:69). The fat hen (Chenopodium album), which was also eaten as a spinach, is now known to contain more iron and protein than either cabbage or true spinach, and more Vitamin B1 and calcium than raw cabbage (Mabey, 1972:54).

Chenopodium sp. are anemophilous (wind pollinated) plants and therefore produce abundant pollen. It is for this reason that it can be strongly represented in the pollen spectra, but in the case of Tuquoy it is not, even though there are a number of such seeds recorded. This may well point to the fact that Chenopodium sp. were being collected as a food source and brought onto the site. This may lend weight to the other instances where large numbers of the seeds of this plant have been recorded. A plant of wet areas is the marsh marigold (Caltha palustris), the young leaves of which were collected and after cooking were also eaten as a spinach (Grieve, 1931:519). Other plants which were eaten similarly included orache (Atriplex patula) (Hedrick, 1972:76) and cleavers (Galium aparine) which was gathered before the flower heads set seeds (Mabey, 1972:120).

5.8.2 Salads : Vegetables

Many wild plants were used as a salad. On the Island of Colonsay parsley piert (Aphanes arvensis) was known for generations to have been eaten raw or in a pickled form (McNeill, 1910). Culpeper remarked that it was "a good salad herb" and that the "gentry ought to pickle it up as they pickle samphire (Salicornia sp.) for their use all winter" (1652:259; 1669:215-6). The charlock (Sinapis arvensis) was once boiled before being eaten and continued to be used on the Island of Colonsay till more recent times (McNeill, 1910:177).

A once valued spring salad was the chickweed (Stellaria media), alternatively, it could be boiled and then used as a vegetable (Ranson, 1954:43). In the time of Gerard it was known to have been hawked around city streets by itinerant vegetable sellars (Mabey, 1972:60). The young

leaves of the sheeps' sorrel (Rumex acetosella) were often eaten in the spring as a beneficial salad (Culpeper, 1652:340). Another plant recommended by Culpeper as a salad was the lady's mantle (Alchemilla sp.) "it is a very good salad herb and it were well that the gentry would pick it up" (1669:168).

According to Helbaek the leaves of the corn spurrey (Spergula arvensis) were gathered as greens to help supplement the cultivated crops (1960, Lucas, 1959:137-46).

5.8.3 Pottage : Soups : Stews

In the Western Highlands fat hen (Chenopodium album) was called praiseach fiadhain `wild pottage', for the leaves were boiled, then pounded and mixed with butter before being eaten (McNeill, 1910:29, 177). It is also recorded that the leaves were eaten as a nutritious pot-herb (Ie Strange, 1977:70). The young leaves of Good-King-Henry (Chenopodium bonus-henricus) were similarly used as either a broth or pot-herb (Grieve, 1931:189, 365). There are records which would indicate that the whole plant of Chenopodium sp. were used as an ingredient for soup by the poor of Fredericia in Denmark during the eighteenth century (Hatt, 1937:26-7). Two other plants used for making broths or soups were the nettles (Urtica sp.) (Grigson, 1955:238) and cleaver (Galium aparine) which was recommended by John Evelyn for use in spring soups (Mabey, 1972:120).

5.8.4 Roots

The bitter vetch (Lathyrus montanus) has been recorded as a vegetable from at least the middle ages and from very early times in the Hebrides and the North of Scotland. The tuberous rhizomes were dug up and eaten as a root crop. It is recorded that on Colonsay, they ate them either fresh and raw, or they tied them up in bundles to dry under the thatch (McNeill, 1910). In the Highlands and Islands of Scotland, according to Alexander Carmichael (Carmina Gadelica vol IV, 1941), the `brisgein' or silverweed (Potentilla anserina) was actually cultivated for its roots

until the time that potatoes became an established root crop. The roots were eaten raw or they were either boiled or roasted (Grigson, 1955:148). In Uist the silverweed was said to have been dug up by the poor from the arable fields in scarce times. Such actions had, it is recorded, to be prohibited in the eighteenth century for on the sandy soils it quickly led to erosion of the grassland (Buchanan, 1793:15). This practice continued into the nineteenth century and was quite widespread.

In Harris a large chest was noted in a house which was full of the roots which were being stored for winter use. When the ground was being tilled in Harris, it was often divided amongst the peasantry so that each could have a share of the edible roots (Campbell, 1958:50; Fenton, 1986:123). Rings were also placed in the snouts of pigs so as to stop them burrowing for the silverweed roots (Fenton, 1978:499).

5.8.5 Meal : Flour: Bread : Porridge : Gruel

The seeds of the corn spurrey (Spergula arvensis) were collected in Shetland and were ground into a meal (Jakobsen, 1932). Its common name on Shetland was Meldi, the meal plant (Grigson, 1955:92). The meal was used for a variety of tasks including the making of bread. On Orkney, the meal was used as a component in, Klino, a bread which was made from weed seeds (Fenton, 1978:438).

At the site of The Biggings, a steatite vessel was found to contain the residue of a porridge or gruel present in which were the seed-husks of the corn spurrey (Crawford, 1978:29). The dried roots of the silverweed (Potentilla anserina) were ground into a meal which was subsequently used for making bread and porridge (Grigson, 1955:148).

It has been suggested that fat hen (Chenopodium album) and various species of Polygonum, were in fact cultivated separately as a source of food-grain to provide gruel or coarse bread, particularly for the poorer classes (Mitchell, 1976:191). Reuthie bread was made from the seeds of the wild mustard (Brassica/Sinapis sp.), which were used to fill the gap

between the last of the old cereal crop and the appearance of the new grain (Handley, 1953:80).

It is recorded that the rhizomes of the bracken (Pteridium aquilinum) were in the past collected and ground to produce a nutritious and good tasting form of oatcake (Johnson, 1862). In Orkney, down almost to present times, the daily fare consisted of a `morning piece' of half a bannock of bread made from a mixture of bere and seeds of all kinds of wild plants (Handley, 1953:80). Similarly, the breakfast was often porridge made from the meal of the native black oats (Avena strigosa) and seeds of wild plants (Handley, 1953:80). On 25 February 1661, it is recorded that one Samuel Pepys enjoyed a nettle (Urtica sp.) `porridge', though there are no details provided (Mabey, 1972:46).

5.8.6 Fruits : Berries

The crowberry (Empetrum nigrum) which though scarcely palatable to our present day taste buds, were eaten in the distant past by Highlanders (Lightfoot, 1777; Fenton, 1978, 264). In the Hvamm-Sturla Saga there is also a reference to the use of crowberries as a source of food (Zutter, 1991). Berries from the rowan (Sorbus aucuparia) have been used in the past for making a jelly-like substance (McNeill, 1974), and the dried berries are still being used for food in different parts of Europe down to the present century (Brockmann-Jerosch, 1917:83-6). The berries are also eaten as a preserve and are known to have antiscorbutic and medicinal properties (Dickson, 1983, 114). There is no doubt that rowan berries were being consumed, for such evidence is clearly found in the samples taken from cess pits in medieval Aberdeen (Fraser, et al, 1973-81:243) and, similarly, in medieval Southampton (Dimbleby, 1975).

In several contexts at Birsay Bay Donaldson and Nye have found seeds of edible berries which has suggested that wild fruits were being gathered in the autumn, though they do suggest that they could have come in with the peat or fuel (in Morris et al, 1989:266).

5.8.7 Drinks

A number of plants have been used in the process of making and flavouring of drinks. The berries of juniper (Juniperus communis) have long been known as a source of flavouring of forms of gins, liquors and cordials (Masefield et al, 1969, 136). An ingredient of herbal beers is the meadowsweet (Filipendula ulmaria) (Ranson, 1954:77). Evidence for its use has come from a number of sources including one from a beaker found at Breyninge in Zealand, which had probably contained mead, for according to Dr Troels-Smith, the pollen was mostly meadowsweet (Filipendula ulmaria), with lime (Tilia sp.) and white clover (Trifolium repens) (Dickson, 1978:108-11).

In 1968 a beaker was found in a bronze age cist burial at Ashgrove, Fife. It was subsequently examined by Dr J Dickson and was found to contain pollen of the small leaved lime (Tilia sp.) and meadowsweet pollen (1978:111-2). He has accepted that such evidence must clearly point to the beaker having contained a honey or a honey containing drink.

The stinging nettle (Urtica dioica) has long been known as a plant used for the making of drinks down to the present day in the form of nettle beer and nettle tea (Ranson, 1954:84).

5.8.8 Drinks : Cereals

A number of alcoholic beverages can be made from cereals. The wheat (Tricitum sp.) was added to barley (Hordeum sp.) in small quantities for the production of beer (Brouk, 1975:357-9). Rye (Secale cereale) can be used either in the malted or in the unmalted state for beer production by being added to barley malt. It was chiefly used for distillations which were very popular, either in the pure form or flavoured. The rye gins were often flavoured with the "berries" of juniper (Juniperus communis) (Brouk, 1975:35-9). Barley was used in the production of ale, and oats (Avena sp.) were added to barley malt during the brewing of stout, occasionally. In Orkney, bere (Hordeum vulgare) was frequently

made in `home-brew' which was drunk by all members of the family, and replaced milk in the winter-time (Bailey, 1971:109)

5.9 WILD PLANTS : CRAFT AND INDUSTRIAL PROCESSES

In Chapter 3.4 (The Use of Indigenous Plant Material as a Resource), we have already noted the variety of uses to which many plants can be put in the material culture. In this section on wild plants a number of more specialised uses will be identified relating to plants which have been found on the sites presently under discussion.

5.9.1 Dyes

Many plants would have been gathered to be used as dyes for a variety of different colours could thus be achieved. The meadowsweet (Filipendula ulmaria) when mixed with copperas was used by many generations of Shetlanders to provide a black dye (Grigson, 1955:144). A black dye could also be obtained by using the berries of Crowberry (Empetrum nigrum) (Fenton, 1978:264). In the case of the blackberry, (Rubus fruticosus) it was the roots which were used in the highlands to provide an orange dye (Grigson, 1955, 145).

A bright red coloured dye could be obtained from the roots of the tormentil (Potentilla erecta) and was much used by Shetlanders (Grigson, 1955:151). The roots were also known to have been used in the tanning trade, both in Ireland and Scotland, where it was used at St. Kilda during the seventeenth century (Fenton, 1984:138). A species of the cinquefoil (Potentilla reptans) is also known as a source of red dye (Donaldson, in Hunter, 1986:219). The Shetlanders used the roots of persicaria (Polygonum persicaria) to provide a bright yellow dye (Grigson, 1955:232), while yet another shade of yellow could be obtained from the young bark and shoots of the common alder (Alnus glutinosa) (Grieve, 1931:17). Heather (Calluna vulgaris) was yet another source of yellow dye (Grigson, 1955:260). John Tudor, writing on the Orkney and Shetland Isles in 1881, described how a good yellow dye could be

produced from the roots of docks (Rumex spp.), while a quite different shade could be obtained by boiling yellowed grass with the garments to be dyed (Tudor, 1883). Other plants used as dyes included the blaeberry (Vaccinium myrtillus) and the bracken (Pteridium aquilinum) (Robinson in Holdsworth, 1987:206).

Relating to the Shetland Isle, Dr Hibbert mentions a purple that could be produced from the Lichen tartareus, and Lichen saxitilis or the `old man's beard' produced a yellow or, in some cases, a reddish brown colour, whereas Lichen parietinus, which was known as `scroita', produced an orange colour. Finally, a blackish or brownish purple could be produced from Lichen omphaloides (Hibbert, 1822; Nicolson, 1978:99).

5.9.2 Floor Covering

Rushes and sedges (Juncus spp. and Carex spp.) had many uses in the past (see Chapter 3.4), one of which was a floor covering. There are many documentary accounts of such uses, the practice of which continued in Ireland till very recently (Evans, 1957). While the stems of the soft rush (Juncus effusus) are used to the present day at Trinity House, Kingston-upon-Hull, to cover the floor of a large room, thus continuing a tradition from well before the fifteenth century (Hall et al, 1983:210). The common reed (Phragmites communis) was also extensively used as a flooring material. It would have been cleared out from time to time, as needed. Once again, it has been used until quite recently (Evans, 1957:86). It is also known that hay was used as a floor covering, where its sweet smell and its subsequent decomposition would no doubt have helped considerably to dissipate the possible stench of decaying matter upon the house floor (Buckland et al, in Batey, et al, 1993:518).

At `The Biggings' Dickson has identified the straw of oats (Avena sp.) barley (Hordeum sp.) and the float-grass (Glyceria fluitans) along with other vegetation which has been interpreted by Dickson as being used as litter on the floor of the house (Dickson, 1993 pers comm). It was also the view of Curle that the dwelling house floor of Group `B' building at

Freswick had most probably been covered with rushes or heather (Calluna vulgaris). Heather was often used to cover floors within the houses (Donaldson in Hunter, 1986:219).

Peat, beside its many other uses, was also often used to supplement hay on the floors of dwellings (Buckland et al, in Batey et al 1993:518).

The meadowsweet (Filipendula ulmaria) was very popular when floors were carpeted with rushes and other plants. According to Gerard `its leaves and flowers far excel all other strowing herbs, for to decke up houses, to stow in chambers, hals' (Grigson, 1955:144). Plants were also used in other locations to provide a refreshing smell as is the case in reference to chamomile (Chamaemelum nobile) in the wardrobe accounts of King Edward II (1307-27) (Ie Strange, 1977:26).

5.9.3 Nettle Cloth

The stinging nettle (Urtica dioica) has been used for many purposes in the past, but perhaps one of its oldest uses was as a fibre for making cloth and household linen. Nettle cloth was still being made in Scotland as late as the eighteenth century.

It is recorded that the Scottish poet, Thomas Campbell, (1777-1844), wrote of sleeping in nettle sheets in Scotland and of dining off a nettle table-cloth. Nettle cloth was also still being made in eighteenth century Denmark where the nettles were actually cultivated on the useless meadow land, and equally in Norway, where there is evidence of its cultivation in the place-names. There can be no doubt as to its use in prehistory for a nettle cloth was found in a Danish grave of the Late Bronze Age, where it was wrapped around the cremated bones (Grigson, 1955:238-9).

It is interesting to note that the common name for this plant is `nettle', which is derived from the Old English `noedl', meaning `needle', which could be a reference to its sting, or quite possibly to its use in the making of a thread which was commonly used throughout

western Europe in the weaving of different fabrics, before the introduction of flax and hemp (Ie Strange, 1977:251). While in Hans Anderson's fairy stories one will remember the princess who was set to weave coats of nettle fibre for the eleven swans (Ranson, 1954:84).

Associated with cloth making was the use of the seeds of the ribwort plantain (Plantago lanceolata) which were collected and soaked in hot water to produce a gelatinous substance which could be used to stiffen muslin and certain other fabrics (Ie Strange, 1977:205)

5.10 TREE AND SHRUB EVIDENCE

5.10.1 Caithness

The available pollen evidence (1.4.1.1, Woodland Cover : Caithness) would indicate that since the last Ice Age, trees have not formed a significant part of the available vegetation, particularly in the coastal areas of Caithness. It would appear that Birch-hazel (Betula sp. Corylus sp.) scrub had most likely developed in the sheltered sites and with some willow (Salix sp.) could have become quite widespread. They would have been replaced by blanket bog dominated by heather (Calluna vulgaris) from about 3000 BP as a result of climatic and man's activities (Peglar, 1979:245-6; Birks, 1975, 1977:129-30).

The evidence of charcoal recovered from the site at Freswick Links, was of native Scottish mainland species, consisting mostly of heather (Calluna vulgaris), together with birch (Betula spp.), willow (Salix spp.), pine (Pinus sp.), alder (Alnus glutinosa), some oak (Quercus sp.) and hazel (Corylus avellana) (Nye in Morris and Batey, forthcoming a). It is thought that the majority of this material would have been collected from the nearby birch-hazel woodland and willow scrub.

There is no evidence to suggest extensive closed forest of pine, oak and alder developed in Caithness (Birks, 1975), although they can be found today growing in sheltered ravines. It is, therefore, considered that the timber of some of these species, notably pine and oak, must have been imported from further south where such species grew readily or they

were collected locally as driftwood from the beaches (Nye in Morris and Batey, forthcoming a).

Such species would have been required as timber for the necessary building of ships and houses, as well as for fuel. There can be little doubt that the trees growing locally would have been affected by the exposed conditions and therefore would have been very stunted and gnarled in their growth habits. There was considerable evidence of pieces of twigs belonging to heather (Calluna vulgaris) which was noted in all the samples and was most likely resulting from this material having been collected for building purposes, and more particularly fuel (Nye in Morris and Batey, forthcoming a).

Similar evidence has been found at the site of Robert's Haven (White in Barrett, forthcoming). Most certainly heather, with other heaths (Erica spp.) and the crowberry (Empetrum nigrum), along with bryophytes, form peat which would most certainly have been used for fuel (Huntley, in Morris and Rackham, 1992:84). Seeds of the crowberry were found frequently at the Robert's Haven site and it has been suggested that they may have been gathered as a food source (White in Barrett, forthcoming).

Evidence of birch (Betula spp.) and willow (Salix spp.) was regularly found at Freswick. A few large pieces of coniferous charcoal were noted and would appear to be of pine (Pinus sp.) as would the remaining coniferous charcoal (Nye in Morris and Batey, forthcoming a). In the case of both oak (Quercus sp.) and hazel (Corylus avellana) they were identified in only a very few samples, but evidence of the latter in the form of nuts would most likely indicate their collection as a further source of food (Huntley, in Morris and Rackham, 1992:84).

5.10.2 Orkney

The evidence from sites on mainland Orkney would indicate that large forest trees most probably never grew in the islands, but they were not treeless when the first settlers came ashore for the native tree species

would have been the willow (Salix spp.), birch (Betula sp.) and the hazel (Corylus sp.) by virtue of their presence in the pollen records and as macroscopic remains in peat deposits, (Moar, 1969; Keatinge and Dickson, 1979; Donaldson, 1986b).

In most instances the bulk of the charcoal found was of willow, varying in size from fragments to small branches and twigs. There are some five species of willow which are thought to be native to Orkney (Bullard, 1979:11). Of these, only the creeping willow (Salix repens) is now common to the coastal habitats of cliffs and sand dunes. The large willow species, which were once more extensive, now only grow in certain lowland mires for they have been reduced considerably due to the pressure of grazing, trampling and manuring by domestic animals (Ratcliffe, 1964:434).

On Hoy, as noted above, a few large willow are to be found as a component of the relict native woodland there, which occurs in some sheltered hill valleys. Also present are rowan (Sorbus sp.), birch (Betula sp.), hazel (Corylus sp.) aspen (Populus sp.) and associated shrubs (Prentice and Prentice, 1975; Bullard and Goode, 1975:43).

On the Brough of Birsay, willow was again the most common type of charcoal to be found, followed by alder (Alnus sp.) which, though not native to the island, did occur throughout the phases of the site (Donaldson in Hunter, 1986:219-20). It is a possibility that alder was a native to Orkney and therefore cannot be rejected entirely. It is thought to be more likely that its appearance is due to the tides and currents washing up a steady supply of alder in the form of driftwood on these west coast locations (Jones, 1975).

The charcoal evidence clearly indicates the presence of pine (Pinus sylvestris) and another coniferous species which was identified as Norwegian spruce (Picea abies) from one quite large fragment. This particular species would appear to form a significant proportion of the total, especially during the later periods of the occupation (Donaldson in Hunter, 1986:220).

Both the above species are again best seen in the light of importations or as driftwood, as is also the case for the least represented species of oak (Quercus sp.) and ash (Fraxinus sp.) (Donaldson in Hunter, 1986:220). There is recorded evidence of the importation of timber into Orkney for in 1587 one Gilbert Irvine of Sabay brought a thousand deals from Norway to the island (Fenton, 1978:111). The charcoal evidence from below Room 5, clearly seen by twigs and fragments of native trees and shrubs, indicated that the local resources were to a great extent being exploited, and may very well have been responsible for influencing the initial pattern of settlement (Donaldson in Curle, 1982:138).

In the case of both willow (Salix sp.) and aspen (Populus sp.), Donaldson makes the point that it cannot be separated and that either is possible on ecological grounds (in Curle, 1982:138). Therefore, the bulk of the charcoal from this site is presented by willow/aspen, with birch, hazel, pine and oak occurring less frequently. The presence of the last two species, again pointing to importation or collection of driftwood, or even the snagging/cleaning of fishing nets. It is therefore likely that the main area of exploitation would have been the dwarf willow thickets in the dunes, with the possible existence of some limited birch dominated woodland (Donaldson in Curle, 1982:138).

At the sites beside the Brough Road, Birsay Bay, a large amount of charcoal fragments were recovered in the main from various middens and hearth samples. Certainly a high percentage was from trees which are not native to Orkney, such as the oak (Quercus sp.), pine (Pinus sp.) and alder (Alnus sp.) (Donaldson and Nye in Morris et al, 1989:262). Pollen analysis and macroscopic remains would, as noted above, indicate that they were components of the native woodland of the close-by mainland Scotland (Birks, 1977:129-30).

The evidence of spruce (Picea sp.) which is native only to North America and Scandinavia could have arrived as driftwood or have been imported conceivably originally in the form of boats. The Orkneyinga Saga does refer to the earls and chieftains going to Norway for new boats (Chapters 67, 85 and 90) (Kaland, 1982:92).

It is the view of Graham that if spruce was to arrive by natural means it was more than likely to have drifted from North America than the Continent (1952:135). It is now certain (see below) that a number of species, not native to these northern islands, would have been washed up on the shores. The ocean currents would have brought such material from the forests of mainland Britain and much further afield.

Another real possibility especially for spruce, pine and oak was that it was imported as timber for construction or it was the re-use of timber taken from wrecked ships (Donaldson and Nye in Morris et al, 1989:262). Heather (Calluna vulgaris) was again present as charcoal at Birsay Bay along with carbonized leafy shoots, in midden deposits and in other locations and most likely in these instances represented a variety of possible uses. Without doubt the vast bulk of the charcoal had been produced from willow (Salix sp.) which consisted of pieces 1-2 cm in diameter and smaller fragments of branches and twigs (Donaldson and Nye in Morris et al, 1989:262).

At the Beachview `Studio Site', Area 1, charcoal evidence has prompted Nye to suggest that willow (Salix sp.) was abundant or it was possibly being utilised for making baskets, skips, hurdles or in thatching. The evidence of hazel (Corylus sp.) might well indicate it was being managed (in Morris, forthcoming b, Tables M38, M39). Possible support for this view or at least for the collecting of hazel nuts has come in the form of hazel shell fragments found in Areas 1, 2 and 3 at this site. Also discovered were the seeds of rowan (Sorbus aucuparia) in Area 2 and of the crowberry (Empetrum nigrum) in Areas 2 and 3 (Nye in Morris forthcoming b, Tables M38, M30, M32 and 00).

At Saevar Howe, Birsay, the charcoal evidence was again very similar but with the addition of juniper (Juniperus sp.) and two seeds which have been tentatively identified as rowan (Sorbus aucuparia) (Dickson in Hedges, 1983:114).

Evidence from the Norse horizontal mill at Orphir, consisted of significant amounts of carbonized remains of heather (Calluna vulgaris) wood, leaves, shoots and flowers, which, it has been suggested, may well

represent bedding or roofing material (Batey and Morris in Morris and Rackham, 1992:38). Also at this site evidence has been found of hazel shell fragments and seeds of the Crowberry (Empetrum nigrum) which would again point to the former, if not the latter as well, both being collected as a possible food source (Huntley, 1990:1).

On the island of Westray, at Tuquoy, there was clear evidence from the remains of charred heather fragments that peat and turves had been collected and used for fuel. Further support for this view was provided by the thick bands of ash which were present across the excavation areas (Nye and Boardman in Owen, 1994:forthcoming). As mentioned above, the most likely existing vegetation in the Norse period would have been formed from local patches of willow scrub and some very limited areas of birch/hazel woodland. It was the willow that was represented by the highest percentage of charcoal in Area F and also by the waterlogged wood in Area J at Tuquoy (Nye and Boardman in Owen, 1994:forthcoming).

The non-native species found on this site conformed with other sites already discussed. In the case of both spruce (Picea sp.) and pine (Pinus sp.), an analysis of the waterlogged timbers by Dr Anne Crone has for the first time provided evidence that both sources (driftwood and imported) were being utilised (Crone forthcoming). In the case of ash (Fraxinus sp.) it was identified in only one sample, but was found to be present in the waterlogged Area J, whereas both alder (Alnus sp.) and hazel (Corylus sp.) were represented only by charcoal (Nye and Boardman in Owen, 1994:forthcoming). In Area F there was evidence of a number of tree and shrub species which included heather/heath/crowberry, willow, alder, pine/spruce, birch, hazel, oak and ash. It is the view of Nye and Boardman that this evidence of charcoal suggests that all these species had been used at some time as fuel (in Owen, 1994:forthcoming).

It is further suggested that in relation to the non-native species they were used as fuel once their other uses had ceased, or the cut offs and trimmings were burnt. It is noticeable that at Tuquoy, willow had been of sufficient size to enable certain pieces to be fashioned into a number of small domestic articles as well as being possibly used as a twine to hold down thatched roofs (Stummann Hansen, 1988). There was

also one piece of birch (Betula sp.) which had been carved into a handle, one end of which was burnt but had been covered originally by a crudely worked geometric pattern (Owen, 1988, 6, fig 4; in Batey et al, 1993:332). Another handle was made from maple (Acer sp.), it was of a good quality and it has been suggested that it may well be evidence of the importation of ready-made objects, perhaps via Pierowall (Owen in Batey et al, 1993:332).

There was also small amounts of spruce (Picea sp.) and recorded for the first time was larch (Larix sp.), both of these species would appear to have arrived as driftwood, as there was evidence of boreholes which could only have been made by a marine bivalve mollusc (J Sadler in Owen in batey et al, 1993:332). As both these species were represented by offcuts, it would seem to provide evidence that driftwood was in fact used for constructional purposes as well as fuel (Owen in Batey et al, 1993:332).

In the case of oak (Quercus sp.) and ash (Fraxinus sp.) only very small quantities were found and it is, therefore, suggested that they would have most likely been imported with particular uses in mind, ie oak for carpentry and ash for making handles, halts, shafts and bowls, etc. There can be little doubt that wood was being actively worked at this site, for a re-used fragment of oak, bearing possible runes cut with a knife, show evidence for the use of a plane with a blade of 1.8 cm wide (Owen in Batey et al, 1993:332).

5.10.3 Shetland

The native tree species of the Shetlands would have been similar to Orkney, though in fact they are extremely rare today (Spence, 1960, 1979). It is quite possible that they were more frequent in past times and would have been available for use by man. Due to the presence of sheep grazing, it is more than likely that by Norse times, the majority of the wood being used on the islands was either collected as driftwood or, by Late Norse times, was being traded from the Norwegian homeland

which was, in medieval times, Europe's greatest supplier of timber (Postan, 1973:203, 324-4).

It is recorded that in 1576 four men from Fetlar complained that the Laird, one Laurence Bruce, had taken from them a piece of sea-driven tree which measured some two fathoms long and was worth `nyne babies' (9 halfpennies) (Fenton, 1978:111). While in the parish of Walls and Sandness, it is recorded that in 1602 six long trees of fir were driven in about the Isle of Papa; four trees along with a piece of birch wood a fathom or two long came in at the Sand in Dale, also two trees of fir came in at Deepdale along with other timber, and a fir tree and a mast were found at Sandness (Donaldson, 1958:55). These records certainly give an impression as to how significant driftwood was in these locations.

At Jarlshof evidence was discovered from the upper slope midden of willow (Salix sp.) and oak (Quercus sp.) which, it is thought, represented the charred wood fragments of constructional timbers. In the same midden there was also evidence of the charcoal fragments of oak, willow and hazel (Corylus avellana). Also present was charcoal fragments of pine (Pinus sp.), juniper (Juniperus sp.), a small amount of ash (Fraxinus sp.) and some hardwood of ash.

It is interesting to note that in the Faroe Islands evidence has been found of Juniper having been used as a rope to hold down roofing stones and of wooden barrel staves having been held together by loops of juniper wickerwork (Larsen, 1990:54-9).

A wooden knife handle was found at the floor level in house 6 which had possibly been made from a piece of birch (Betula sp.) and two shafts made of oak (Quercus sp.) were also discovered on the same floor. Finally, a fourth example made, it is suggested, from pine and a hardwood was also found (Hamilton, 1956:211).

The more recent excavations at The Biggings has revealed that a significant amount of the wood discovered there in all periods was of pine (Pinus sylvestris), which it is thought may have been imported from

Norway (Dickson, in Crawford, 1994:forthcoming). Interestingly though, very little spruce (Picea sp.) was found on this site. It may well have been imported or just arrived on the shore as driftwood. The evidence for oak (Quercus sp.), which is not native of either Orkney or Shetland, is thought unlikely to have arrived as driftwood. It is native to southern Norway and therefore could easily have been imported from there or equally from mainland Scotland. An artifact made of beech (Fagus sp.) has been interpreted as an imported object since the beech is not a native Scottish tree. It is limited to the south-east of Norway with an isolated locality near Bergen.

In Southern Sweden though the beech is widespread as it is throughout north west Europe (Dickson, in Crawford, 1994:forthcoming). Other evidence included ash (Fraxinus sp.) and native trees and shrub species which can only now be found on the Shetland Isles in locations free from grazing sheep, as for example, juniper (Juniperus communis), a small piece of worked hazel (Corylus sp.) and wood fragments of birch (Scott and Palmer, 1987).

It is suggested that by the time the Norse settlers arrived, birch would not have been a common tree, though in fact three place names of Norse origins commemorate the birch. They are Birka Vird, near Enisfirth, Birka Water and Birka Lees, Whale Firth Yell (Scott and Palmer, 1987:108).

Dickson has drawn attention to the significant fact that no bark was found adhering to any of the wood and in only one instance was there evidence of coniferous rounded wood. These facts would clearly seem to support the proposition that both oak and Scot's pine (Pinus sylvestris) were imported debarked and with branches removed (Dickson, in Crawford, 1994:forthcoming).

As already noted above, Crone has provided evidence in respect of the site at Tuquoy for timber being imported to that site (in Owen, 1994:forthcoming).

At The Biggings site, evidence of birch bark has been found in more than twenty contexts covering all three periods of occupation. The bark resembles that of the silver birch (Betula pendula) which is not native to Orkney or Shetland and is a rare tree in northern Scotland, but is very common in southern Norway (Dickson, in Crawford, 1994:forthcoming). It would, therefore, seem most likely that this species had similarly been imported from Norway.

In Scandinavia, birch bark has been traditionally used as rectangular overlapping pieces under turf roofs as a form of waterproofing. It could quite possibly have been used for this very purpose at The Biggings, and if so, would be the first recorded use of birch bark in this manner in Scotland (Dickson, in Crawford, 1994:forthcoming).

In addition to the above, three pieces of rolled birch bark were also found; unfortunately only two were intact and each was tightly rolled. It is suggested by Dickson that they would have been torches for the birch bark is known to burn with a clear flame due to the high pitch content (Taylor, 1981:47). Similar pieces of rolled bark have been found in Anglo-Scandinavia York (Hall et al, 1983:179).

Of particular interest and curiosity was the finds of wood belonging to the cork oak (Quercus suber) and balsa wood (Ochroma lagopus). The former is native to the Mediterranean and Portugal and would therefore be best viewed as an incoming item of trade. In the case of the latter, it is native of tropical America, the West Indies and the Caribbean. It formed a small wedge within a birch artifact. The wood is particularly light and floats easily and, therefore, it could possibly have arrived via the gulf-stream as driftwood. Certainly tropical sea-beans have been recorded from Orkney and Shetland (Gunn and Dennis, 1976; Dickson, in Crawford, 1994:forthcoming).

5.11 SEAWEED

A number of sites have now provided evidence for carbonized seaweed in a number of different contexts. On the Brough of Birsay a probable Norse

context in Site S has been found to contain a considerable volume of fragments of carbonized seaweed, which in the main consisted of flattened fronds with no clear diagnostic features. There were, however, frond fragments of frond tips and an air bladder which were identified as belonging to the bladder wrack (Fucus vesiculosus). It was the excavator's view that all the material found there could best be referred to this species (Donaldson et al, in Brothwell and Dimbleby, 1981:78-9). In phase 4, evidence was found of circular or sub-circular shallow pits which are post AD1150. They have been interpreted as kelp pits and are therefore post medieval, though the excavator has noted certain features which do not fully accord with kelp-burning operations. Carbonized seaweed was present in some of the pits, but was not in others (Hunter, 1986:157). It was noted that steatite fragments had been used in the construction of some of the pits, and this has suggested that they do not post-date the abandonment of the Norse building by any great length of time (Hunter, 1986:152).

At the Brough Road, Birsay Bay, site a probable Norse midden was discovered in Area 2. It was found to contain frond fragments which were thought again to be referrable to the bladder wrack (Fucus vesiculosus) (Donaldson et al, in Brothwell and Dimbleby, 1981:79; in Hunter, 1986:219). Evidence from the site of Pool Sandy, would indicate the presence of the bladder wrack (Fucus vesiculosus), the serrated wrack (Fucus serratus) and the knotted wrack (Ascophyllum nodosum), all of which occur in relatively small fragments throughout the period of Norse occupation. Inside the doorway of one of the buildings and just below the bench line there was revealed a burnt lens composed of a frond, stem and holdfast fragment (Hunter et al, in Batey, et al, 1993:281).

A somewhat similar situation exists at Tuquoy, Westry, where charred seaweed was found to be present throughout the samples from `Area F'. To a great extent this material was mostly unidentifiable, though the flattened thallus fragments and bladders discovered in the stone lined box or compartment, (Phase IX) which had been constructed against the wall of a probable twelfth century Norse house, were attributed to the bladder wrack (Fucus vesiculosus) (Owen, 1983:8; Nye and Boardman in

Owen, 1994:forthcoming). As the structure was associated with an adjacent area of metal working, it is suggested by Spearman that it is connected with smithying operations (Crawford, 1990:42). Fragments of seaweed were also found within the waterlogged Pit in Area `J' (Nye and Boardman in Owen, 1994:forthcoming).

On the coast of Caithness, at Freswick Links, burnt seaweed has been found to be present in almost all `area samples', mainly as stipe and blade fragments, some measuring up to 1.2 X 1.5 cm in size. The identification of a bladder which was recovered has again indicated that the species concerned is the bladder wrack and much of the other evidence of fragments would likewise, most probably, belong to that species (Nye in Morris and Batey, forthcoming a). The bladder wrack (Fucus vesiculosus) was probably one of the most common seaweeds on the exposed shores of Caithness and the rocky foreshores of the northern islands, and still is today in many situations.

In the past it would have been a most important commodity in the economy of the Norse dwellers. Along with other species of seaweed, it would, as already noted, (3.5 Seaweed : A Variety of Uses) have been used as a valued manure for the fields, as well as being a source of food for humans in times of need. It was also a source of animal fodder. It has long been known that in south-west Ireland, boulders were especially placed in the sand in rows by the local people to help encourage the growth of Fucus and Ascophyllum (Cotton, 1912:153). It has long been known that the sheep of North Ronaldsay graze on seaweed the whole year round (Fenton, 1978:466).

Seaweed is seldom preserved in an archaeological context which might indicate that it had indeed been used for manuring. But it is interesting to note that at certain sites, including that of the Pictish and Viking age farmstead at Buckquoy, a number of seashore resources (bivalve molluscs, etc) have been identified which would clearly indicate that they had been brought onto the land along with the seaweed (Bell, 1981:121). Some of the seaweeds, because of their mucilaginous nature like the wracks, have in the past been used as glues and for caulking of boats, due to their hygroscopic properties which prevented

seams from drying out (Dimbleby, 1978; Donaldson et al, in Brothwell and Dimbleby, 1981:79). Carbonized seaweed, therefore, appears to be relatively common on most Norse sites which have been investigated and is invariably explained as either manure, fuel or fodder (Crawford, 1979:40; Donaldson et al, in Brothwell and Dimbleby, 1981:78; in Batey, et al, 1993:281).

Unfortunately, though, there are no instances above in relation to the Norse period in which the contexts can be definitely attributed to any of the above explanations and as Hunter rightly states in relation to Pool, Sanday "no satisfactory answer has been provided" (in Batey et al, 1993:282).

The evidence for burnt seaweed and pits can be ruled out as being related to kelp making in the Norse for it was only introduced in the late seventeenth/early eighteenth century. In Orkney it was first introduced in 1722 by James Flea of Stronsay. The initial reaction of the islanders was one of antagonism, and led ultimately to the so-called `kelp riots' of 1762 (Berry, 1985:184). It was thought that the burning of tang was in fact the cause of the poor crops for the last three years and for the cattle being sick due to the smoke, and `the poor people were deprived of part of their food' (Berry, 1985:184-5. A number of the pits, especially those next to hearths or in the main living space, could possibly have served in some cases to soak or store seaweed which was to be eaten as part of the diet, especially as noted above by the poor, or when harvest crops had failed and, therefore, in times of famine. It is also important to recognise that seaweed ash has been used for preserving wild-fowl, sea-meat, cheeses and other milk products over many centuries in the Western Isles and no doubt, therefore, in the Northern Isles (Martin, 1934:135; Clark, 1952:90). Salt was also made from burnt seaweed and used as a preservative (Brønsted, 1960:252).

Possibly the most interesting evidence for seaweed in a Norse context has been revealed at The Biggings site in Shetland (Crawford, 1990). There shallow pits, some 20-30 cm deep have been discovered dug into clean sand and bedrock in some cases. They appear to date from the Period 1, which predates the Norse house and Period 2, which post-dates

the earliest floor. They gave the appearance of possibly being storage pits for carbonized seaweed which could have been required for some domestic needs. There was, however, no evidence to suggest that metal working had taken place on the site (Crawford, 1990:42).

The view of Dickson is that the seaweed was being burnt for its ashes, no doubt due to the fact that local wood was not readily available and thus the dwellers had to resort to seaweed. The burnt seaweed was identified as the knotted wrack (Ascophyllum nodosum) and the flat wrack (Fucus spiralis) and possibly other fucoid algae along with peat (Dickson, in Crawford, 1994:forthcoming).

The important point has been made by Dickson that plant ashes were greatly used in medieval times for detergents and for the making of lye, soap and glass (Singer, et al, 1956). Water would have been percolated through the burnt seaware to produce a lye, which could then be used for cleaning and scouring. The lye would have also been used prior to the dyeing of wool. A caustic solution was produced by adding lime to water and ashes, it was then mixed with oil or fat to make the soap. The soap could then be used for fulling (cleaning and thickening) the cloth (Dickson in Crawford, 1994:forthcoming).

There is no definite evidence for such industrial processes having been carried out at The Biggings, but as Dickson mentions, the presence of both woven and knitted cloth some dyed does indicate that such operations could have taken place. In support of the above case, Dickson has noted that in the northwest of England shallow depressions have been found set into the hillside. They have been interpreted as potash pits which would have been directly associated with the local woollen trade which goes back into the twelfth and thirteenth centuries (Higham, 1988; Dickson in Crawford, 1994:forthcoming).

Though little definite evidence for smithying has been found, it is well known that the Norse extracted and smelted bog iron throughout the North Atlantic region, as there would have been a steady need to replace and produce new iron implements. Clear evidence of smithies have been found in Greenland, Iceland and elsewhere which date from the first period of

Norse settlement, and iron slag has also been recovered in such locations and in many others (Curle, 1939; Bigelow, 1984; Hunter and Morris, 1981). Such smelting operations do require a large volume of charcoal, which, under normal circumstances, would have been provided by burning wood. But where such material was at a premium, it is very likely that seaweed would have been used, especially as it was plentiful and any available finds of driftwood would have had many cells upon it. Therefore, the burning of seaweed should be considered as a possible provider of the essential charcoal required in the iron smelting operations. In many parts of England charcoal braziers/fires were used to heat rooms in the twelfth century (Holmes, 1953:86). Certainly with so much seaweed to hand and little, if any, wood, seaweed could have been a cheap and abundant source of heat during the winter months.

See Appendix A, for information on the species of seaweed used for manuring and those which are edible.

CHAPTER SIX

6.0 COMPARATIVE CASE STUDIES : FAECAL REMAINS

6.1 INTRODUCTION

It has been proposed in this study that many wild plants were an important resource for a variety of tasks, one of the most important of which would have been to provide a source of easily accessible and cheap food in the diet of the Norse inhabitants. Above all, they would have provided a source, in times of scarcity, when due to pressure of taxes, deteriorating weather and crop failures, etc, cereals may have been at a minimum or supplies may have been exhausted.

In bringing this study to a conclusion, it is considered that the strongest possible evidence to support such contentions which have been outlined, would be to look at the evidence of faecal remains from sites of comparative age. Such evidence is one source which to a great extent is uncontrovertible when available and, therefore, can provide a wealth of information as to precisely what was being consumed. It is, therefore, intended to look at the evidence of faecal remains from three locations, namely Norse Dublin, Anglo-Scandinavian York and Medieval Bryggen, Bergen, Norway (Fig 14).

The reason for choosing these urban or proto-urban examples is that there is no evidence presently available of cesspit finds rural sites. There can be little doubt that such situations would have had the closest interaction with the hinter land as is clearly seen in the evidence from cesspits of moss and certain seeds which must have been gathered.

The information will provide an indication of the economic base and an analysis of the diet in these three locations. It will also enable a site-by-site comparison to be made of the available evidence from these

three locations and from the three areas which compose this study namely, Caithness, Orkney and Shetland.

6.2 FAECAL REMAINS

6.2.1 Dublin

The excavations of Dublin commenced in High Street in 1962-3, which were followed by a second area in 1967-72. The main Wood Quarry site commenced in 1969 and embraced the blocks lying between Winetavern Street, Wood Quarry, Fishamble Street and Christchurch Place. These excavations of Norse Dublin covered a period of nearly twenty years and during that period of 1962 to 1981 they formed one of Europe's largest urban archaeological excavation programmes.

One of the most common wild species of plant to be found was that of fat-hen (Chenopodium album). It is known that in late medieval times this particular plant, along with various species of Polygonum, was cultivated as a source of food-grain and used in gruel or coarse bread eaten by the poorer people (Mitchell, 1976:191). Certain evidence that such species were being eaten was clearly identified in a faecal mass which contained the seeds of Chenopodium. It was found in an eleventh century house on the Fishamble Street site (Dickson and Dickson in Mitchell, 1987:23). While in High Street a possible faecal mass was located near to the pelvis of a skeleton of a young girl of similar date to the above. In this instance it was found to contain masses of crushed seeds of both persicaria (Polygonum sp.) and fat hen (Chenopodium album), along with seeds of chickweed (Stellaria media) (Dickson and Dickson in Mitchell, 1987:23).

Another faecal mass which was preserved amongst layers of moss also contained Chenopodium and Polygonum spp., but it was blackberry pips (Rubus fruticosus) that composed over 99% of the mass (Dickson and Dickson, in Mitchell, 1987:24).

At Winetavern Street a pit, which was thought to have been in use in the eleventh or twelfth century, was found containing a large amount of moss and faecal deposits. One of the faecal masses was found to contain numerous stones of the sloe (Prunus spinosa) along with numerous achenes of blackberry (Rubus fruticosus) and the wild strawberry (Fragaria vesca), while a second faecal mass was equally rich in remains of fat-hen (Chenopodium album) and common knotgrass (Polygonum aviculare).

Samples of the faeces were examined in detail and revealed that the evidence of plant species was in very small fragments, indicating that they had most probably been processed at a mill to be reduced to flour prior to use in the diet. Those plant species identified included:

Hordeum sp.	Barley
Triticum or Secale	Wheat or Rye
cf Pisum sativum	Pea
Chenopodium album	Fat-hen
Polygonum spp.	Persicaria
Brassica cf rapa	Rape
cf Raphanus sp.	Radish
Sisymbrium officinale	Hedge mustard
Galeopsis sp.	Hemp-nettle

Such a selection would indicate to Dickson and Dickson that it was likely to represent a meal of bread and gruel flavoured with pot-herbs (in Mitchell, 1987:29-30).

In the Winetavern Street pit there was found to be a large amount of moss remains in amongst the obvious human and canine faecal remains. The moss must have been gathered from sites at some distance from the town. Such evidence, therefore, clearly points to moss being used in the toilet activities of the townfolk. Other moss-rich pits which were also cess-pits have been discovered in medieval towns such as Durham, York, Perth and Aberdeen and also in Norway at Bergen (Dickson and Dickson in Mitchell, 1987:28-30).

6.2.2 York

At Coppergate a fill of an homogeneous nature had been found in an unlined pit which was provisionally dated to the tenth or eleventh century. The content was considered to be wholly organic with brittle concretions which were located around the edges of the pit. Also present were large fragments of grass-like plant material. During the detailed examination under a stereo microscope it was found that the bulk of the material was fragments of bran, together with whole or nearly whole cereal periderm sacs. There were, in addition, seeds of corncockle (Agrostemma githago). It is known that poisonous sapotaxins in the seeds of this plant can make the flour very dangerous to humans, though cooking may affect such properties. Also present were seeds of the stinking mayweed (Anthemis cotula), black bindweed (Polygonum convolvulus), and corn marigold (Chrysanthemum segetum), seeds of the spike-rush (Eleocharis palustris), marsh pennywort (Hydrocotyle vulgaris) and marsh marigold (Caltha palustris) were also found but thought to have been "consumed incidentally with the food" (Hall et al in Proudfoot, 1983:85-92, Table 1).

The large quantities of cereal bran in the York samples point clearly to the importance of cereals in the diet in the tenth and eleventh century. In the York case it would appear that grass could have been used as anal wipes for there was little evidence of moss or other suitable material present (Hall et al in Proudfoot, 1983:85-92, Table 1).

The above evidence would certainly suggest that the cereal grain was not being cleaned as well as it might, or that the tail ends were being added.

6.2.3 Bryggen, Bergen, Norway

Tradition has it that Bergen was declared a town in 1070, and as well as being a trading centre it was also a King residence. From 1300 the Hanseatic League became very powerful and influential with the Germans

remaining dominant in the town long after the league had lost its dominance in other parts of Europe.

The Botanical Institute of the University of Bergen has been involved in significant environmental archaeological excavations in Bergen since 1978. The main purpose of these excavations was to find out what plants were used by many and for what purposes in their everyday life (Krzywinski, et al, in Proudfoot,1983:145).

Evidence of cess pits/latrine deposits have been found to have survived from the eleventh century to the sixteenth century. One particular latrine deposit dated to around 1250 AD was found in an indoor situation, underlying a floor. The style of the latrine is traditional in old farming communities, consisting of a plant floor covering a cess pit', with a closed box serving as a seat over the cess pit. These deposits are still presently under investigation and only the preliminary findings have been made available.

Evidence clearly points to moss having been used in small proportions virtually throughout the deposits as a form of toilet paper. These deposits have been found to be associated with a warehouse and not living areas as such. This may well, it is thought, be the reason why no textile fragments (`possible sanitary towels') have been found associated with the moss. There can be little doubt that certainly from the eleventh to the sixteenth century there was a very strong tradition of collecting moss for such toilet use (Krzywinski et al, in Proudfoot, 1983:156).

It would appear that different plant species were collected at different times of the year with local berries obviously in great demand when available in late summer/autumn. The fruits and berries are mostly identified from the evidence of seeds, stones and pips. In the case of hazelnuts, it is the periderms and tiny fragments of nutshells that have been found in the latrines. It is a tradition in certain Norwegian fjord districts to eat sprouted hazel nuts which the children gather (Krzywinski et al, in Proudfoot, 1983:161). Evidence of macrofossils from the 1250 AD latrine has provided a long list of cultivated fruits

and wild plants which were obviously being used in the everyday diet of these people (Krzywinski et al, Figs 11 & 12).

A comparison of the plant species identified from faeces at Bergen, Dublin and York is provided below in tabular form (Table 14). Also listed are those same plant species which have been found on sites in Caithness, Orkney and Shetland.

CHAPTER SEVEN

7.0 CONCLUSIONS

7.1 ENVIRONMENTAL FACTORS

The evidence from the description of the environmental factors discussed in Chapter One would clearly indicate that the available economic options for human subsistence were restricted in these northern lands, to varying degrees, the further north one went. The geology and topography, together with the climatic conditions, especially the wet, cold and at times extreme winds, would together have made it difficult to regularly produce successful crops. Such conditions emphasise the need to adapt and to take advantage of all the available plant resources that nature provided, a challenge which it is argued the Norse people took on.

The soil appears in many locations to have been supportive of regular crop production, especially where manuring was a constant feature of the land management, while grassland in many locations consisted of a rich and often varied plant flora. There can then be little doubt that in general terms the most favourable conditions in respect of the study area were to be found on the Orkney Island sites, while the least favourable would have been in the Shetlands.

7.2 SOURCES OF STUDY

The study of the Orkneyinga Saga in Chapter Two clearly makes constant reference directly and indirectly to farming activities which gives an indication of its importance to the economic subsistence of the Norse inhabitants.

In the case of the survival of place-names from past times, they can be seen to provide a valuable source of information on the settlement

patterns and to an extent the sequence, though they are difficult to date with certainty. They also provide a valuable insight into the land uses which is equally important in understanding and appreciating the extent of land which was in agricultural usage during the greater part of the Norse period.

7.3 THE ETHNOHISTORIC RECORD

The available ethnohistoric evidence in Chapter Three clearly supports the importance of agriculture in the local economy to the Norse people in helping to pay `in kind' the taxes, rents and tithes, etc. At the same time, there is much evidence supporting the role of plant material in the construction of buildings, as noted in Section 3.4.1, and in the making of items of material use for a variety of purposes. Plant material, wherever possible, was never discarded, often it was recycled for such was its usefulness to the farmers.

Evidence would clearly support the important role of seaweed, as discussed in Section 3.5, the common species of which grows on the rocky shores of the islands and has traditionally been collected and used on the land, and for a variety of other uses.

7.4 ARCHAEOLOGICAL DATA AND EVIDENCE OF PLANT REMAINS

In looking at and comparing the evidence from the site of Jarlshof with the more recent sites, it is plain to see what great improvements have been made in the gathering of environmental information. The retrieval in the field of macrobotanical remains, which was initially pioneered at Cambridge in the early 1970s, has provided a wealth of evidence and subsequent information. This fact is clearly to be seen in the amount of available evidence from those sites discussed in this study, in Chapter Four, where these techniques have been successfully used.

It must though still be borne in mind that one is not always comparing like with like and that the scale of the project is likely to affect the

results. Equally, the method of flotation could make a difference, for example the paraffin method is likely to be inefficient for the recovery of the heavier barley grains and could therefore create a bias in favour of oats (Rackham in Morris et al, 1989:268). While over the years the use of the `Siraf' type tanks (Jones, 1983) have proved to be superior in the recovery of carbonised material.

Considerable evidence has been collected in respect of the potential domestic economy. This information, together with the ethnohistorical records, has helped greatly in the interpretation of the various archaeological records which are presented in the analysis of the evidence.

7.5 THE ANALYSIS OF PLANT REMAINS

In considering the available archaeological, documentary and environmental evidence for the period of Norse habitation of the sites within the study area, it would certainly appear that the human economic base in relation to plants revolved to its greatest extent around cereals. They were fundamental to helping meet the daily rations within the domestic economy. During the eleventh century the political endeavours of the Orkney Earldom would have put an added strain on such resources as payment of taxes and later still tithes, as discussed in Section 3.2.1, all of which were made to ensure the dwellers security of tenure.

Evidence would also seem to suggest, as noted in Sections 2.3 and 3.2.1, that the numbers of inhabitants increased, again putting pressure on the available resources. In time, many farmers would have had to turn increasingly to the sea for fish resources to help meet the domestic economies. Such pressures would no doubt have been even greater in Shetland and to an extent Caithness, rather than in Orkney where the conditions were much more favourable to cereal production. The diet would appear in time to have had an increasing dependency on fish, which could well have led to various nutritional imbalances in the diet.

Such problems, it is suggested, could well have prompted the farmers/fishermen to trade fish to enable them to buy in cereals. This trade is thought to have expanded in the thirteenth and fourteenth century due to the domestic cereal crops being affected by the climatic deterioration at that time.

Historical records and evidence from the sites studied would, however, support cereal crops still being produced in the homelands. It is suggested that during the ensuing period the pressures would have been such that other cultivated plants, wild plants and their seeds would have played a not insignificant role in the domestic economy.

7.5.1 Cultivated Cereal Crops

There can be little doubt from the available evidence, seen in Chapter Four, that the most commonly grown cereal crop was bere followed by oats, due to the fact that they were the most suitable for cultivation in the cool summer climate of these northern locations. It is, therefore, not surprising that little evidence was found for wheat and rye.

One must also remember, as noted in sections 2.2, 3.3.7 and 5.8.8, that barley in significant amounts would have been malted for beer, a process that requires the germination of the grain and hence leaves little or no evidence in the archaeological record.

In many instances the evidence of weed seeds, noted in Chapter Four and in the Tables, would seem to support local cereal cultivation, rather than their importation. The lack of chaff could, it is suggested, point to its many uses such as to kindle fires, as well as its use in the human diet, as noted in Section 3.3.6, especially in times of need, and equally for feeding to cattle. It should not be surprising, therefore, that such evidence is lacking, and this fact should not necessarily be used as an indicator of crop importation. Above all, nothing that could have the slightest use or re-use was ever discarded.

Bere and oats would have been important crops for not only did they supply food for humans in the form of bread and porridge, but food for the animals, malt for brewing, straw for thatching, rope and basket making, and for animal bedding, etc. Crops which met such a multiplicity of essential uses would have been persisted with, even if producing, from time to time, poor quantities of grain.

It would be right in most instances to assume that the carbonised grain found was derived from grain that was intended for domestic consumption and not brewing. There are two basic reasons for suggesting this firstly, the concentration of grain found associated with hearths and secondly the fact that grain intended for malting is required to germinate, a process which would be inhibited if the grain had been parched for the action of heating kills the cell tissue.

7.5.2 Crop Processing

In such northern locations, where many resources were minimal, there can be little doubt that no opportunity would have been missed to capitalise upon available local natural resources. The evidence of many wild seeds of plants, as noted in the Tables, must surely indicate that they were being gathered or utilised, rather than being discarded as weed seeds of the cereal crops.

In many instances the discarded material from the crop-cleaning processes would have been too wet to burn or was likely to create smoke and to smell within the buildings in which it was to be burnt. It is suggested, therefore, that many of the carbonized seeds found on the sites in this study could have resulted as the burnt remains from drying and parching of the cereal crops, prior to use or storage. Equally, many could have been selectively gathered and so treated as an additional food source.

It would be erroneous to assume that the Norse people would have had, in any way, to tolerate high degrees of crop impurities if they did not wish to. The degree to which many grain crops were cleaned of weed seeds at times of harvesting and subsequently would, it is suggested, have resulted directly from the quality and quantity of the grain produced from the harvested crop.

Palatable weed seeds would have been saved to help supplement the cereal crops, particularly in the poor seasons. The `morning piece' of half a bannock of bread made from bere mixed with seeds of all types was still well established in the eighteenth century in Scotland and provides ample evidence of past basic dietary needs.

It is suggested that evidence of carbonized plant material should, to a great extent, be viewed in favour of those plants that were processed in the vicinity of a domestic fire due to having palatable qualities, and were therefore preserved by accidental burning.

7.5.3 Medicinal Qualities

The people who live in rural economies especially have a relationship with or an understanding of the land in the sense that the land supplied many of their material culture resources. This is a fact which it would be difficult to deny. To suppose that they totally ignored or were totally ignorant of the other uses of wild plants as a food source or as medicinal/herbal remedies is difficult to comprehend.

Recorded social histories have clearly shown how country people of whatever level of education had an amazing knowledge of the land, its plants and their many uses from an early age. Why the Norse inhabitants should be any different from many other people in this respect is difficult to understand.

Attention has been drawn to the many different medicinal cures, in Section 5.7, to which plants found on the sites could have been used. These plants would have played such a role is almost certainly the case, if only for the simple reason that no other remedial substances were available to these people.

7.5.4 Flax Cultivation

As the evidence now shows, flax seeds have been found on no less than ten sites within the study area. Such evidence does, in many instances, point to its local production for this quick growing plant enjoys cool summer climates which are ideal for its cultivation and which would have been readily available especially in the Orkney Islands. A number of weed seeds have also been identified which are commonly associated with flax and, therefore, seems to lend support to this view.

7.5.5 Other Cultivated or Cared for Plants

The chances of `finds' of plant material which was eaten as roots or leaf crops is, as noted in Section 5.5, very slim indeed, while evidence of legumes by the very nature of their processing and utilisation are just as unlikely to be found. Nonetheless, a number of sites have produced limited evidence of the brassica and leguminous species including the Celtic bean which should not be dismissed lightly. Such evidence, together with cases of brassica specific aphids being found in York and epicuticular leaf wax components of brassica spp. being found absorbed into potsherds is of great significance. It lends considerable weight to supporting the use of such plants as additional sources of green vegetables and therefore Vitamin C.

7.5.6 Dietary Implications

The fact that historical accounts have indicated that scurvy was present but not out of control, does in itself point to plants/greens having

been consumed whether from the wild or as early improved forms of wild species being cultivated or cared for. It would seem likely that the less well off suffered more from scurvy than the wealthy, due to a lack of resources. Many wild plants, discussed in Sections 5.6 and 5.7.1, have been noted and recorded as having beneficial affects against scurvy. Evidence of such plants has been found on a number of sites within the study area. These plants would have been consumed, it is suggested, as greens and roots purely in the simple knowledge that they were good for one.

7.5.7 Tree and Shrubs

The native tree and shrub resources would point to heather, willow, birch and hazel, while the evidence of spruce, oak, ash and other tree species clearly indicates that they arrived by other means. Most notable would have been tree species arriving as drift-wood from continental Europe, Scotland and North America, or as imports. Evidence of marine boring creatures would now certainly support the former, while the analysis of waterlogged timbers and the evidence from written sources would support both cases.

It may well also be the case, as discussed in Section 5.10, that a degree of basic scrub and woodland management/exploitation existed particularly in the case of willow and hazel. Certainly the abundance of charcoal evidence of the former may indicate such actions as it was an important species providing a valuable resource material for making a variety of baskets, containers, hurdles and for use in thatching. Its actual use for burning would have been limited for it is not the best wood for such use. The evidence of hazel nut shells from a number of sites may again support such limited management, especially as generally there is little charcoal evidence found and this fact may indicate that it was being protected for its crop of nuts.

7.6 FAECAL REMAINS

There can be no doubt, from the evidence discussed in Chapter Six and Table 14, that many of the seeds of plant species, which were being directly consumed in the diet at Bergen, Dublin and York were also found in a carbonized form at sites within the study area. Such carbonization may well, as suggested, have taken place during the process of drying and parching of the cereal crops prior to storage. What is quite definitely confirmed from the evidence is that the majority of those plants found in the faeces are being eaten not by chance but consciously, as suggested earlier, either by being left with the cereal grains and not removed or in some cases they may have been collected and subsequently added during food preparation or taken for medicinal purposes, etc. What we are not able to discover from this present information, some of which is only available from the initial reports, is how many more plants that have been suggested in this study as being edible, or of use for medicinal, or for herbal purposes, were actually being consumed.

Other evidence that has and is still coming to light from these sites would also confirm many of the already indicated uses of plants in the construction of dwellings or as floor coverings, etc, etc. The evidence from faecal deposits clearly then shows that wild plant resources were being utilised and not discarded. They show an understanding and appreciation of the benefits of such natural resources and how they are taken account of across a wide sphere of influence, ie Ireland to Britain to Norway. The Norse people living in Caithness, Orkney and Shetland were located on routes south to north and eastwards to Scandinavia. They had a strategic position both in trading goods, resources and of acquiring knowledge. It should, therefore, be of no surprise that many wild plants would have been used as a food source or for culinary or for medicinal use by these Norse people.

7.7 FUTURE RESEARCH

New avenues of research are continually increasing our knowledge of the environmental, economic, technological and social aspect of times past. The significant increase in both quantity and quality of environmental evidence over the last twenty years is a clear indication as to the importance of scientific endeavour to archaeology in helping to provide an improved data base. There are a number of areas of research which need to be given similar support for they can equally offer the opportunity in the future for significant advances to be achieved. Such research will be best directed as part of an integrated study. Such areas of research include:

7.8 THEMATIC APPROACH

A most helpful and rewarding area of further research will be to have a thematic approach which would look at the available data as well as possible new evidence relating to the economic subsistence of the Pictish people. Such a study would indicate if there were significant differences from the emerging evidence relating to the Norse Period. It has already been shown by Huntley, in respect of the Pollen Analytical Investigation at the Hill of Harley, Freswick, that the arable farming activities apparently decreased during the Norse period (in Morris and Batey, forthcoming a). Such a study would help to provide a picture of the development and possible changes through time with regard to the environment and the human subsistence economy.

7.9 ENTOMOLOGICAL STUDIES

The use of biological data gathered from archaeological sites is now beginning to provide an increasing amount of information on the differing habitats and probable activities which took place on various sites. It can also provide the opportunity for the reconstruction of past farming practices and the nature of individual settlements.

Already, it is possible to identify certain insects which feed on particular plants as, for example, the species of weevil which feed on docks or plantain, or those insects known to be associated with particular products or practices such as, for example in the tannery trade.

Identification of the species of aphid known to be associated with Brassica sp. has clearly indicated that such plants were present in Scandinavian York and clearly illustrates the future possibilities of achieving a much greater level of detailed knowledge in regard to the human diet and man's activities and life style generally (Hall, et al, in Proudfoot, 1983:88; Buckland et al, 1974:25-33). Sites in Iceland and Greenland have been particularly promising in this area of research, no doubt due to the climatic conditions which are likely to be more favourable to the preservation of such evidence (Buckland, et al, 1992:149-167; Buckland, et al in Batey, 1993:506-527). To date very little evidence has come to light from the sites within the study area, due no doubt to the less favourable conditions for such preservation.

7.10 EPICUTICULAR WAX COMPONENTS

One certain way of knowing what people ate is to be able to identify what was present within pots and other containers used in the past. By means of detecting the presence of preserved epicuticular leaf was components absorbed into potsherds, it is becoming possible to say what type of vegetable was present.

The ability to be able to carry out such research would be a significant step forward in identifying the make-up of past diets and their contents. At present, such research is showing promising possibilities in respect of Brassica crops. A database of chemical compositions of other potential foodstuffs needs to be researched as a means of progressing further this most promising of new advances (Evershed et al, 1991:540-44).

7.11 THE MATERIAL CULTURE EVIDENCE

It is suggested that research into the material culture evidence of both individual artifacts and structures relating to agriculture in the Norse period would be of considerable assistance in helping to testify to or, at least, supporting the increasing body of environmental evidence for the growing of cereals and other crops, as well as their processing. Such research could thus help identify the many different types of artifacts and structures that may have been utilised, and also provide details of the current information that is available regarding such finds.

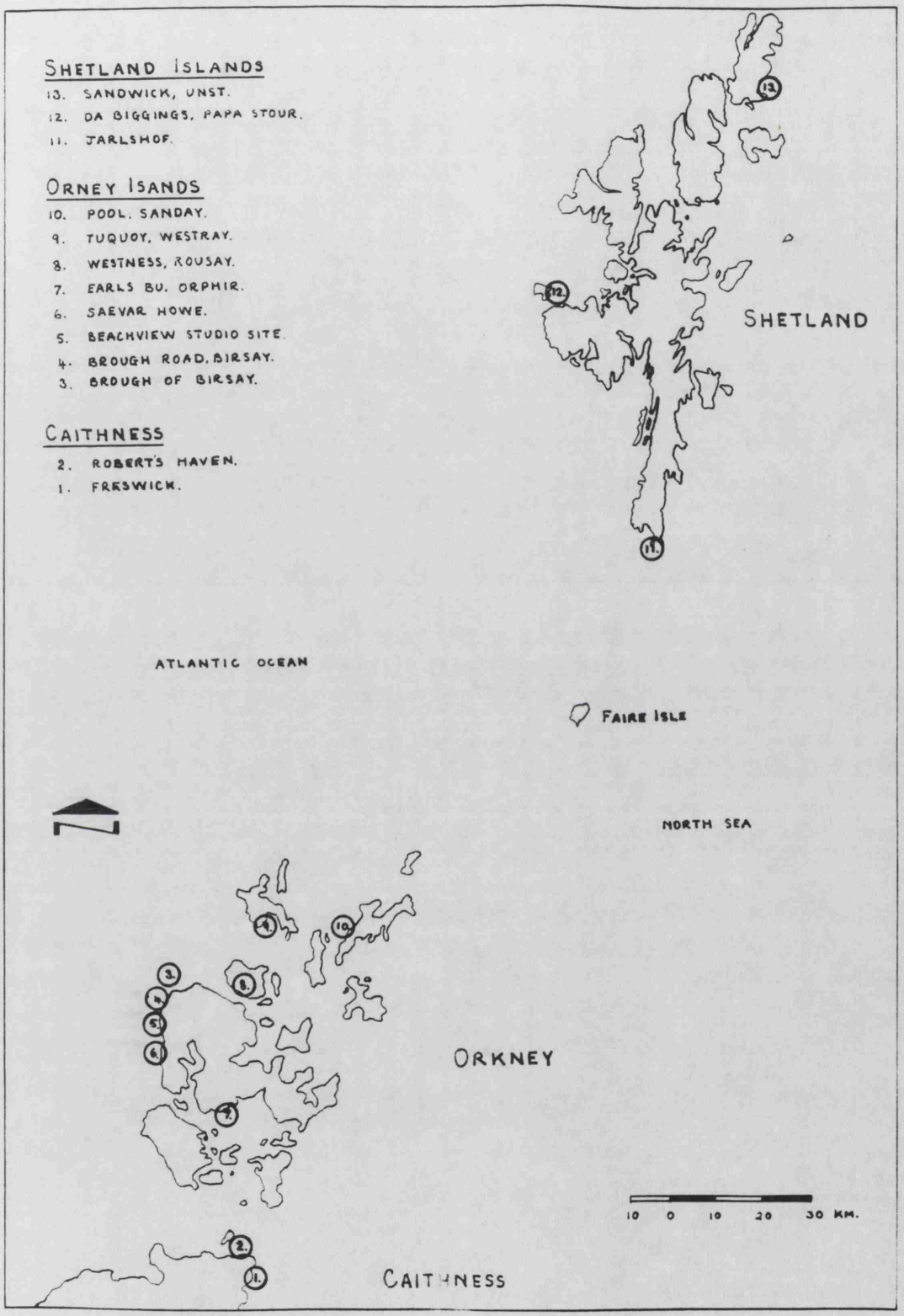


Fig. 1. Location of sites discussed in the study.

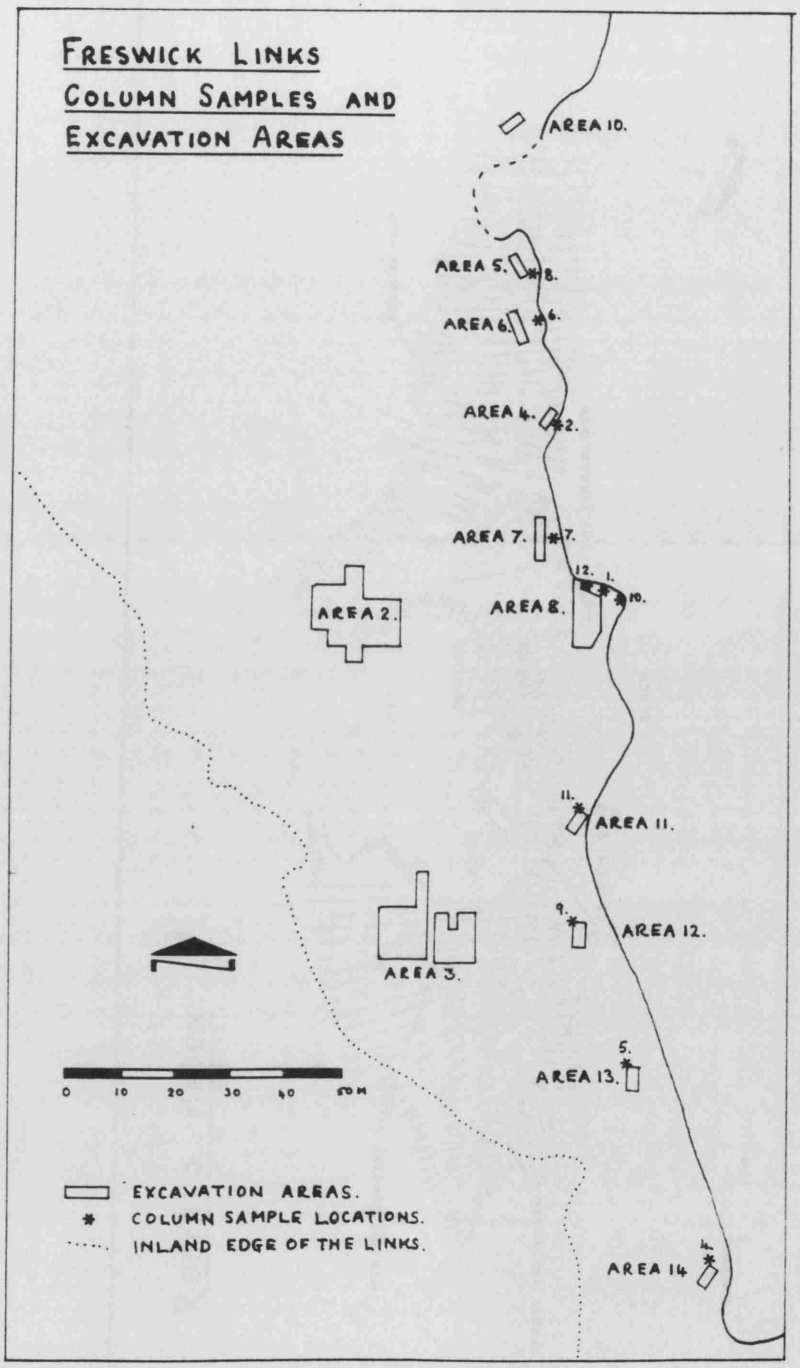


Fig. 2. Plan of Freswick Links: Location of Column Samples and Excavation Areas (After C.D. Morris/M.J. Rains).

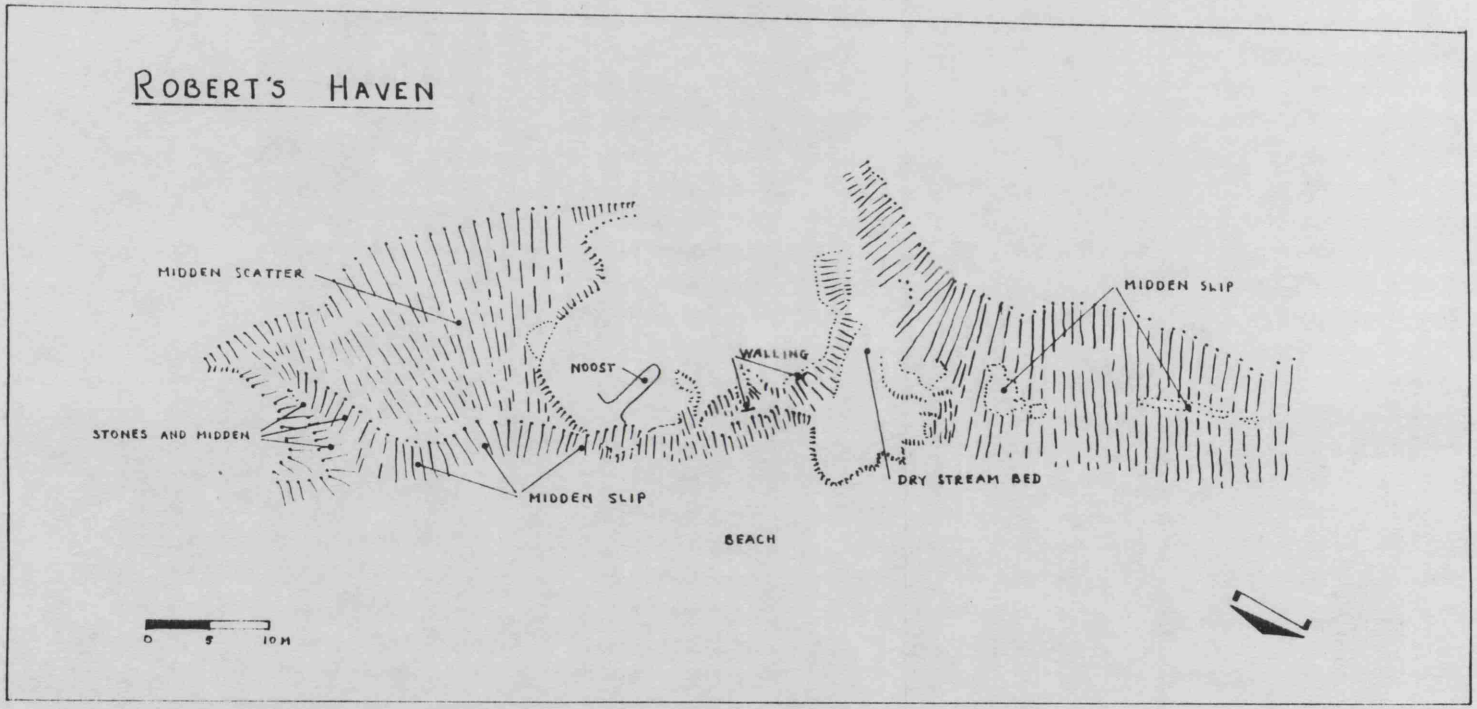


Fig.3. Robert's Haven: Plan (After N. Emery: Crown Copyright).

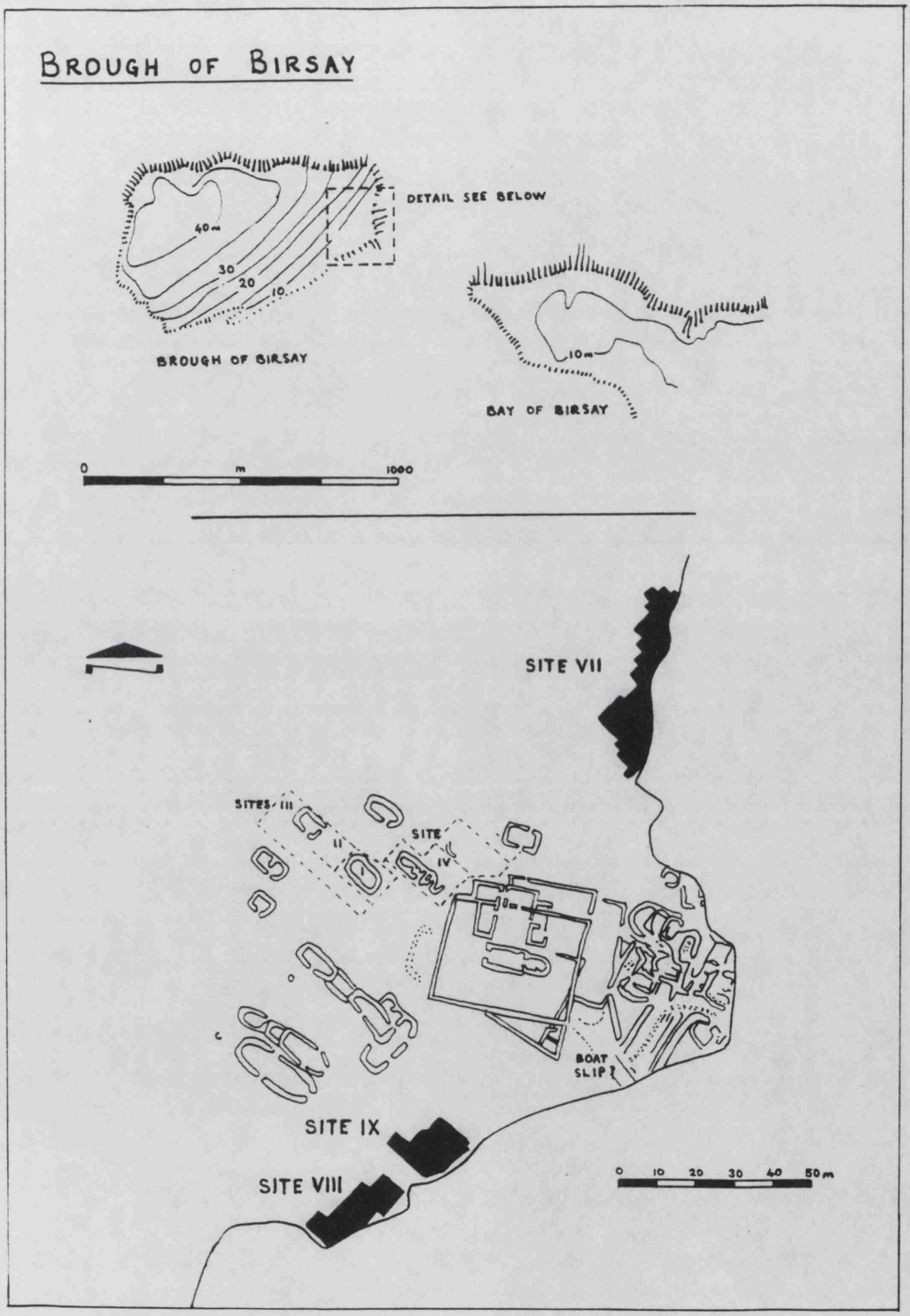


Fig. 4. Brough of Birsay: Location plan and location of sites (After J.R. Hunter).

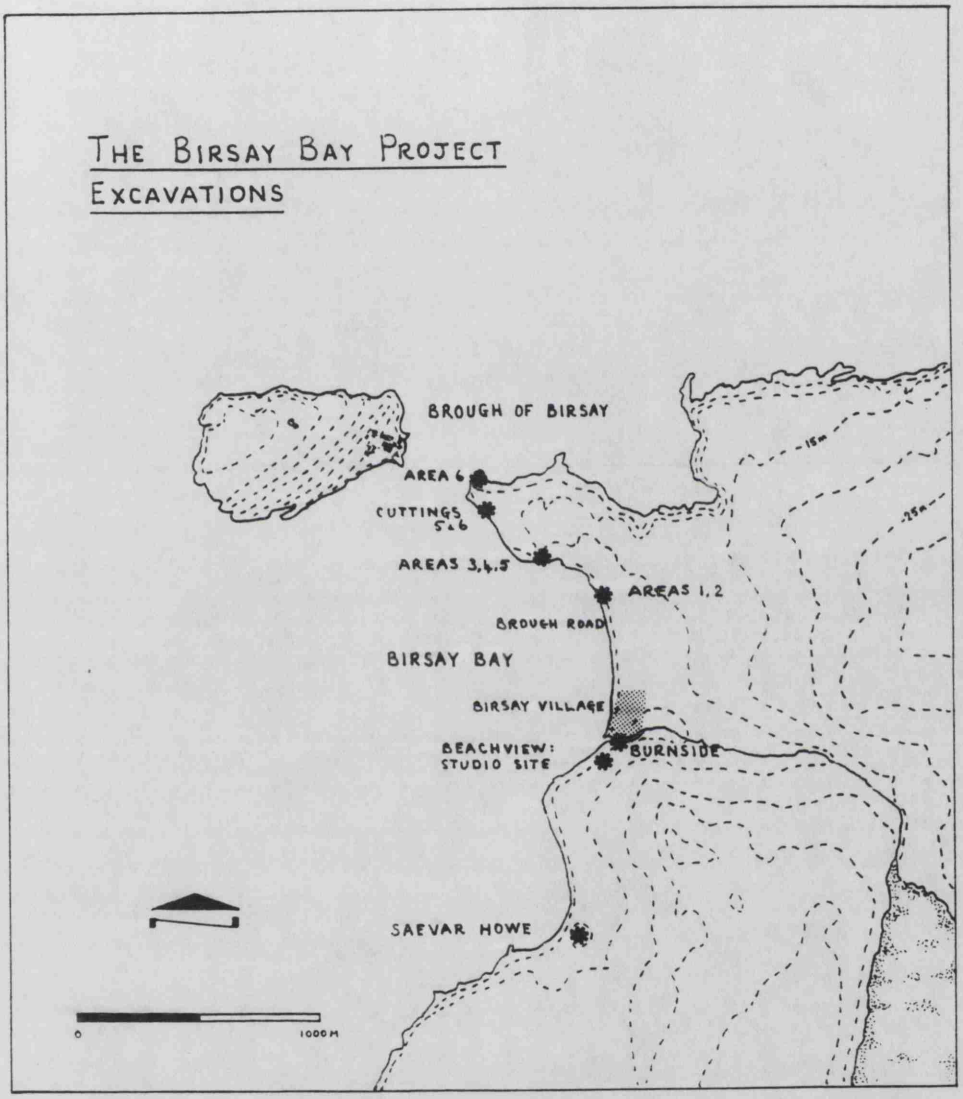


Fig. 5. Birsay Bay Project: Excavations (After N. Emery: Crown Copyright).

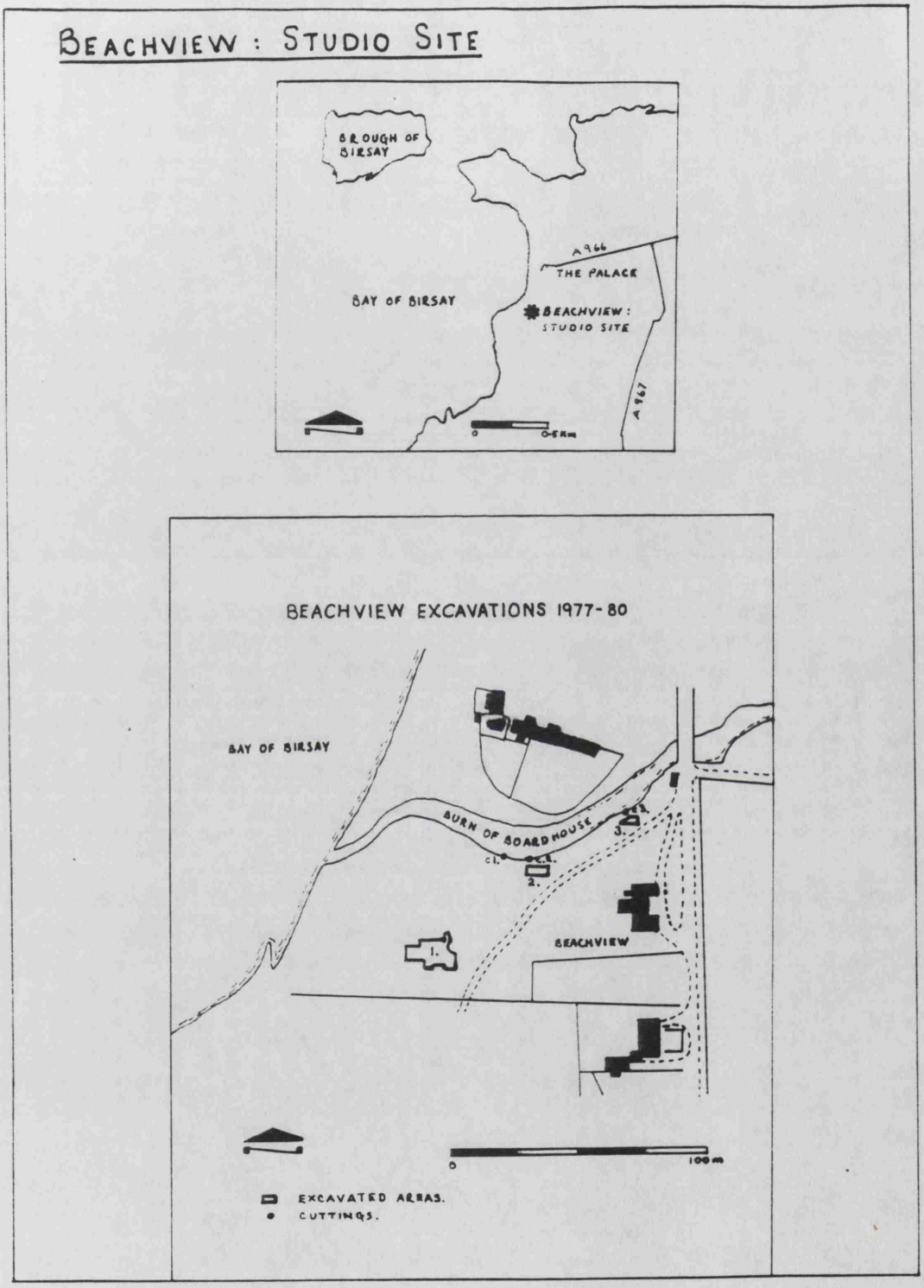


Fig. 6. Beachview: Studio site, plan of location and exavation sites (After N. Emery: Crown Copyright).

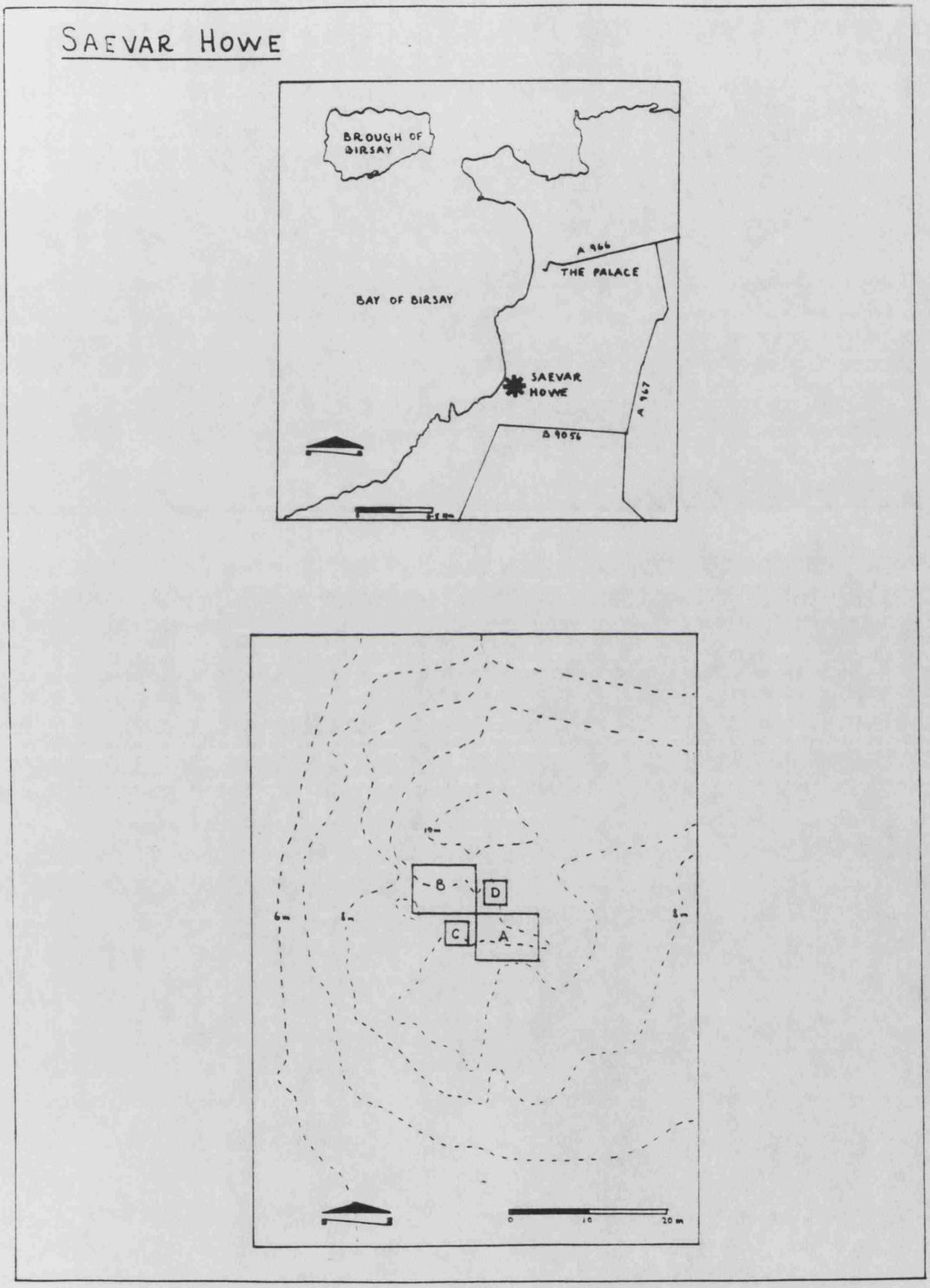


Fig. 7. Saevar Howe: Location and trench layout plan (After J.W. Hedges: Crown Copyright).

EARL'S BU, ORPHIR

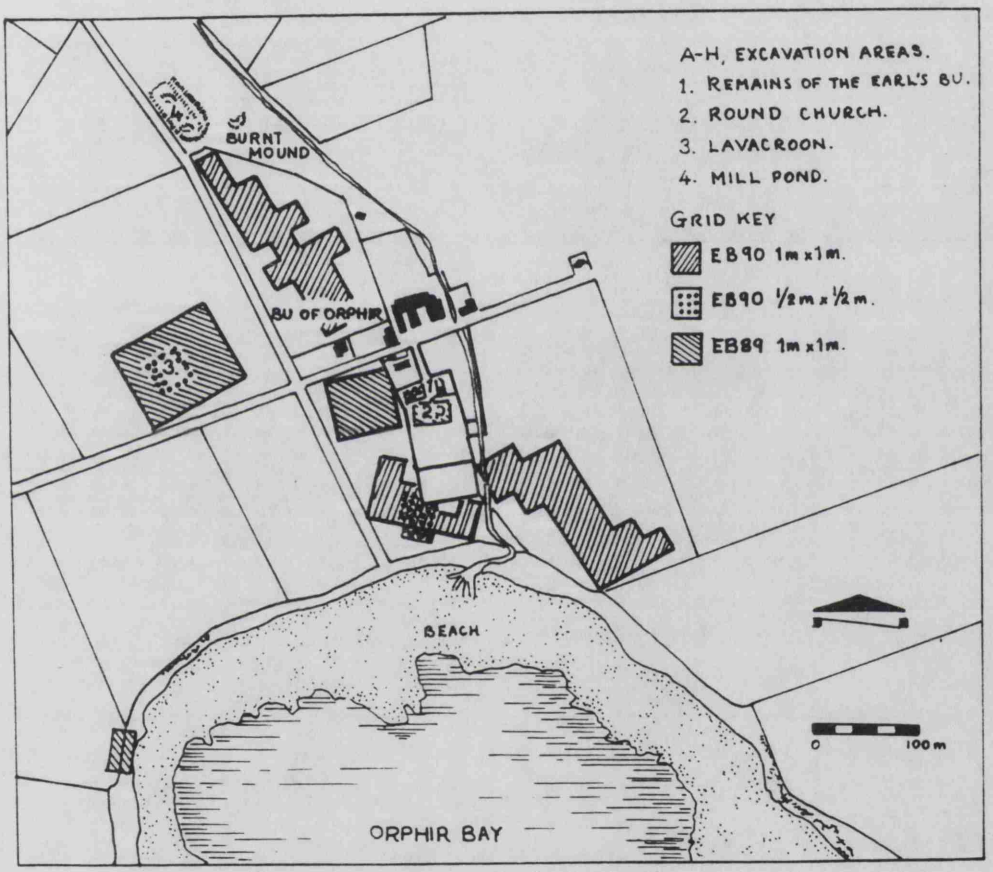


Fig. 8. Earl's Bu, Orphir: Location plan and areas of excavation (After C.E. Batey and P. Johnson).

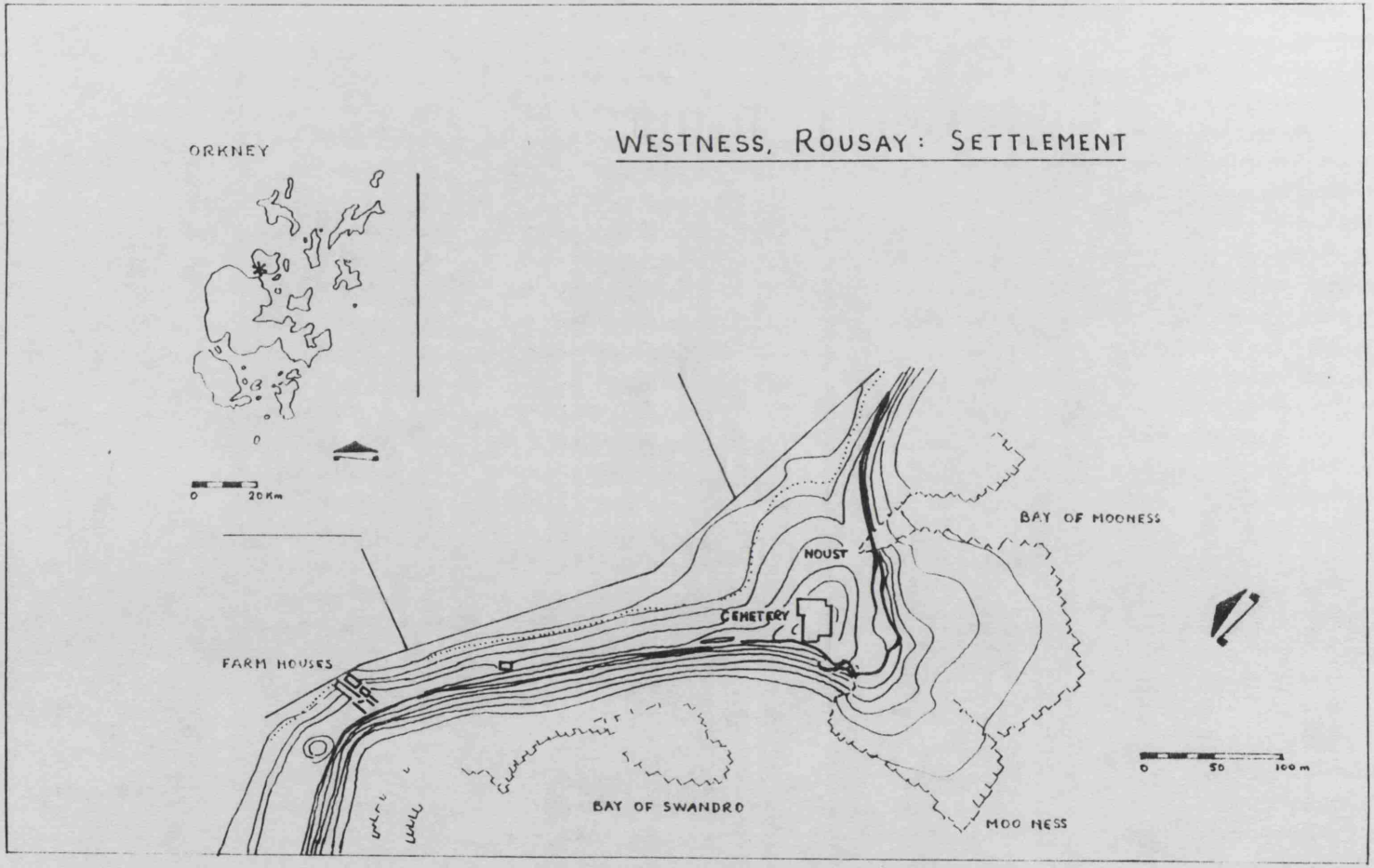


Fig. 9. Westness, Rousay: Location plan and excavation area (After S.H.H. Kaland).

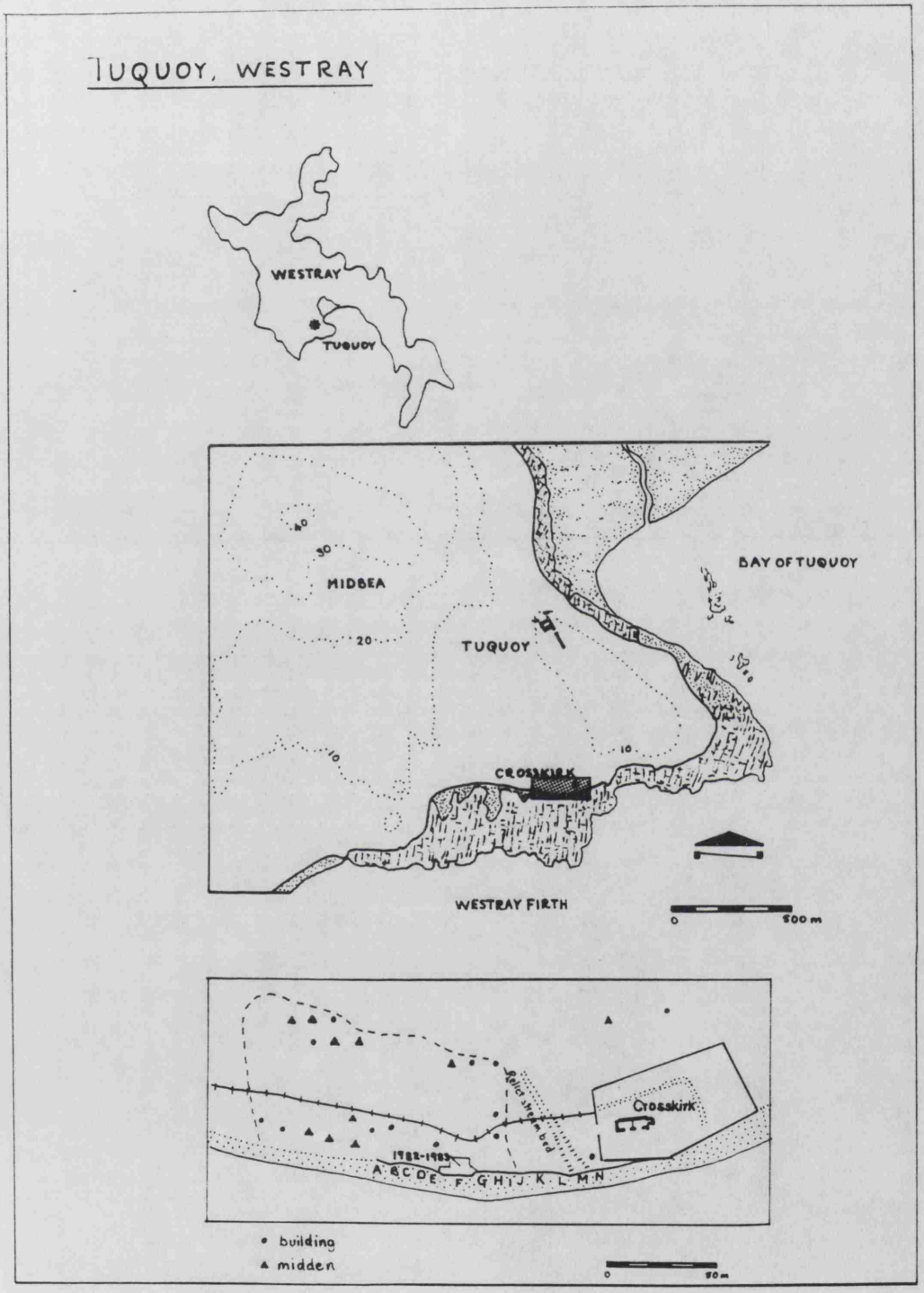


Fig. 10. Tuquoy, Westray: Location plan and context of the site (After C. Unwin).

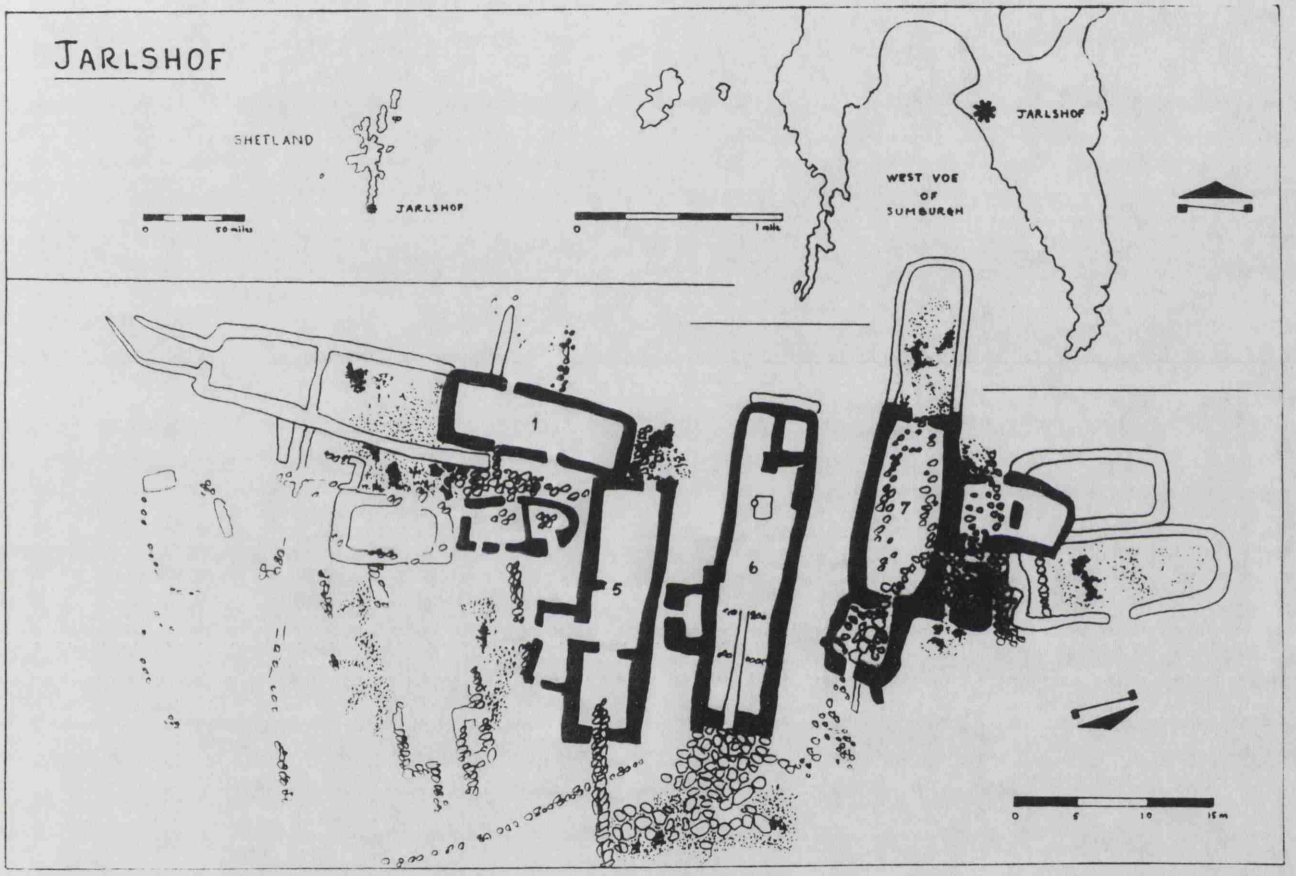


Fig. 11 Jarlshof: Location plan and Norse settlement plan (Phase VII - 13th Century) (After J.R.C. Hamilton).

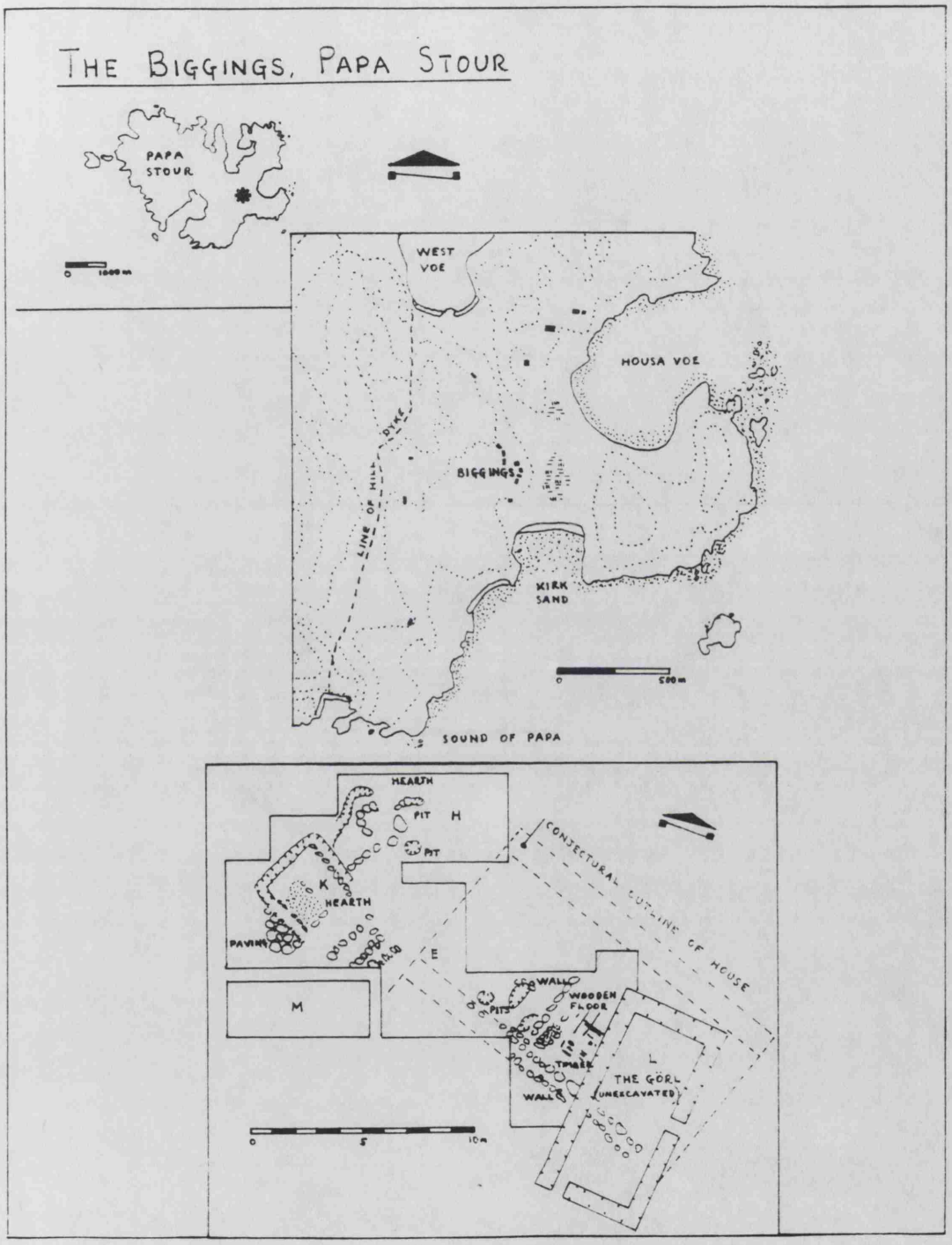


Fig. 12. The Biggings, Papa Stour: Location plan and structures uncovered - conjectural Late Norse house (After B. Crawford).

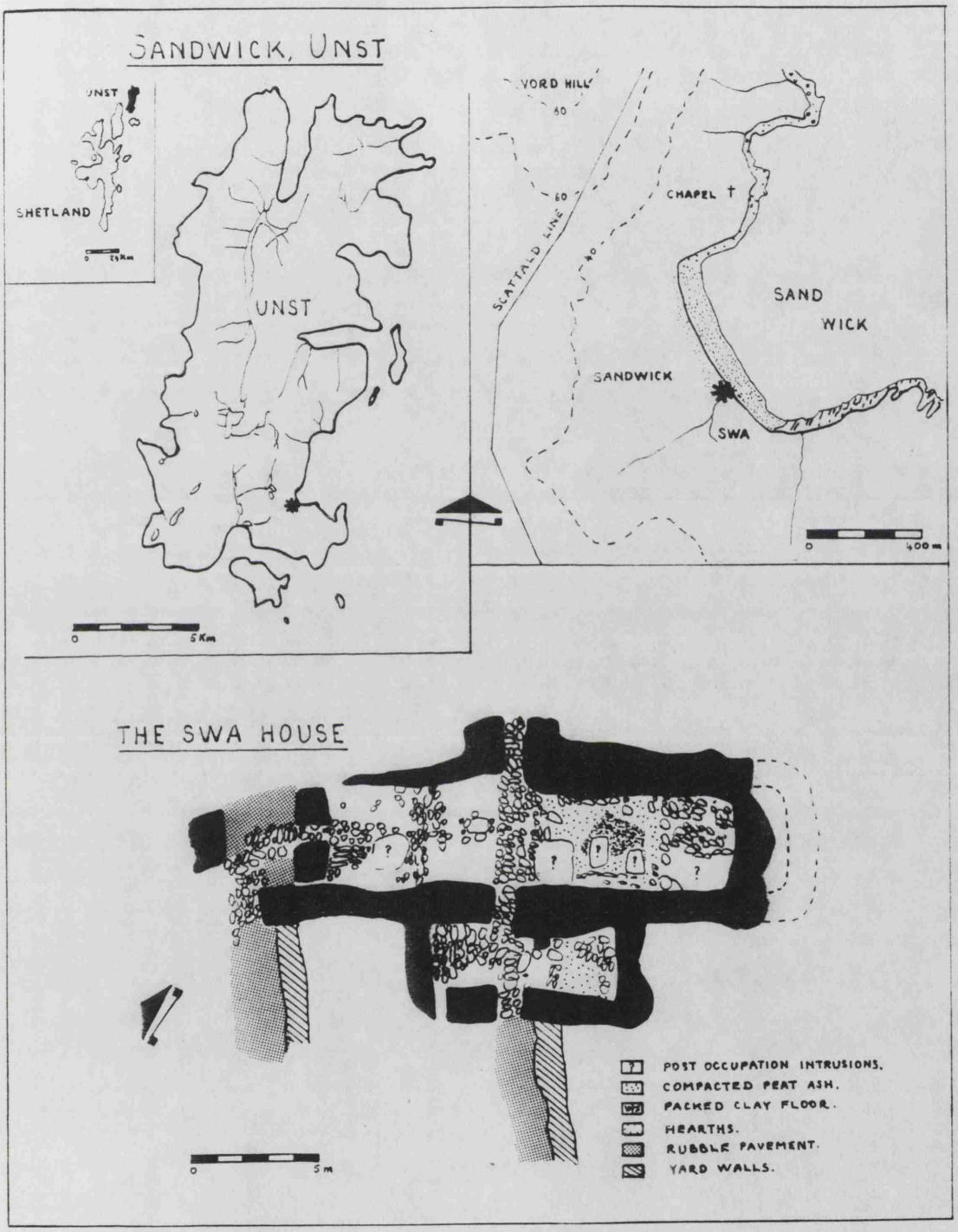


Fig. 13. Sandwick, Unst: Location plan and the SWA house plan (After G.F. Bigelow).

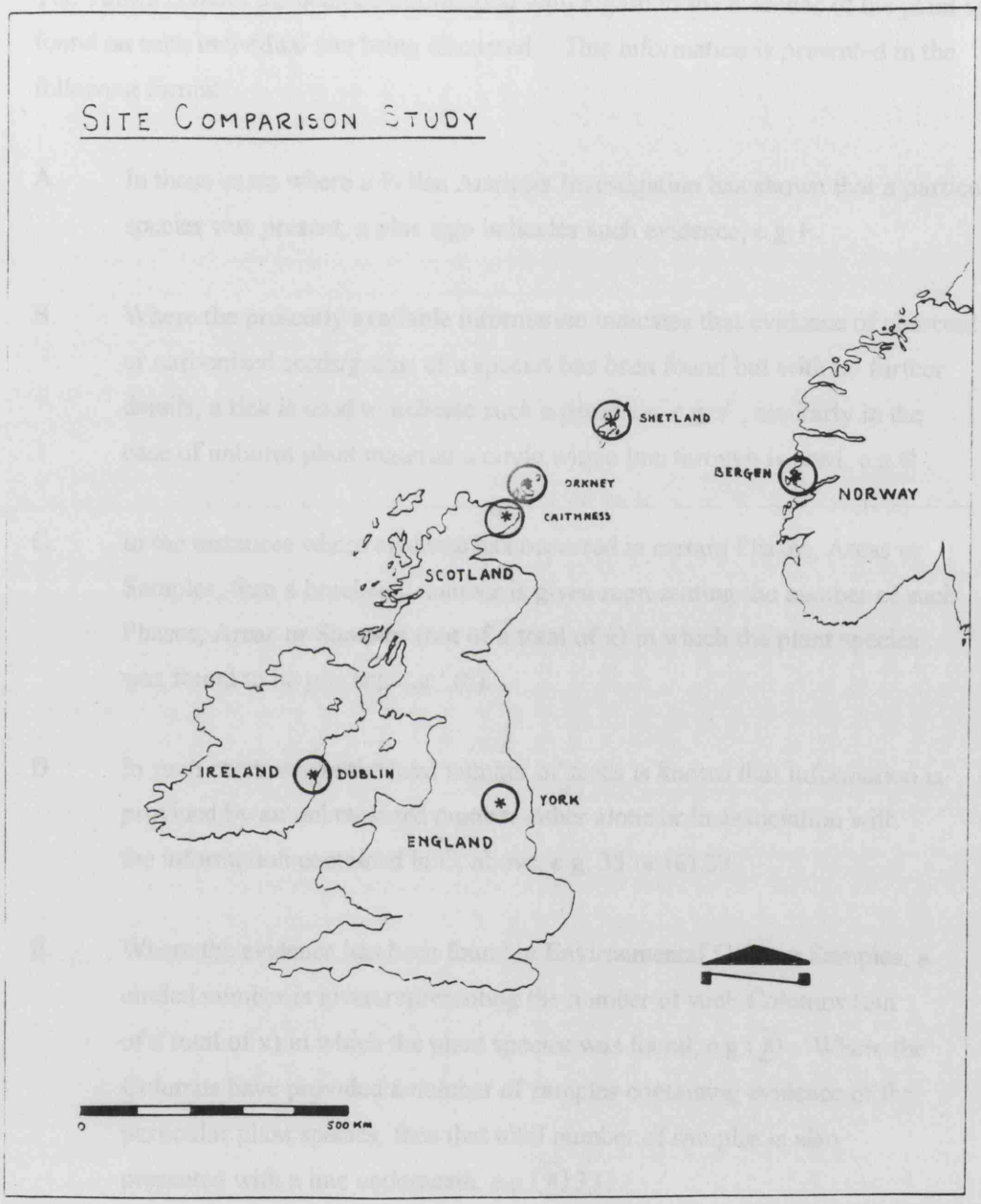


Fig. 14. Location of sites discussed in the Comparison Study.

Tables 1 - 15

Terminology and Nomenclature

The Tables contain the detailed information with regard to the evidence of the plant species found on each individual site being discussed. This information is presented in the following format:

A. In those cases where a Pollen Analysis Investigation has shown that a particular species was present, a plus sign indicates such evidence, e.g.+.

B. Where the presently available information indicates that evidence of charcoal or carbonized seeds/grains of a species has been found but with no further details, a tick is used to indicate such a presence, e.g. ✓, similarly in the case of unburnt plant material a circle with a line through is used, e.g.⊘.

C. In the instances where evidence has occurred in certain Phases, Areas or Samples, then a bracketed number is given representing the number of such Phases, Areas or Samples (out of a total of x) in which the plant species was found to be present, e.g. (6).

D. In such cases where the total number of seeds is known that information is provided by an unbracketed number either alone or in association with the information contained in C. above, e.g. 33 or (6) 33.

E. Where the evidence has been found in Environmental Column Samples, a circled number is given representing the number of such Columns (out of a total of x) in which the plant species was found, e.g.⑧ Where the Columns have provided a number of samples containing evidence of the particular plant species, then that total number of samples is also presented with a line underneath, e.g.⑧ 33.

F. Evidence of mineralised seeds having been found is indicated by an asterisk, e.g. *.

The word 'seed' is used in the colloquial sense of indicating achenes, buds, caryopsis, capsela, embryos, fruitstones and megaspores.

In general terms the Nomenclature follows that of Clapham et al, 1987.

For reference to the common names of the various plant species identified and some indication of the possible uses, see Table 15.

Table 1: Botanical Data - Freswick Links, Caithness.

Carbonized Plant Remains

Column/Samples: Area/Sample: Burnt Material and Charcoal

Pollen Analytical Investigations

	Pollen Analytical Invest.	Area's total - 14: Burnt Material and charcoal in	Area's total - 9: Present in	Column's total - 9: Present in
Picea	+			
Pinus/Picea		(7)		
Pinus sp.	+			② 7
Ulmus sp.	+			
Betula sp.	+	(11)		① 4
Betula/Corylus/Alnus	+			① 1
Alnus glutinosa (L.) Gaertn.	+	(6)		
Alnus/Betula		(6)		
Alnus/Corylus avellana (L.) Gaertn)(Plate 1)		(2)		
Corylus sp.	+			③ 4
Corylus avellana (L.) Gaertn. (Includ. nut fragments)		(4)	(5) 9	② 2
Quercus sp.	+	(6)		
Salix sp.	+	(9)		
Calluna sp.	+		(1) 1	⑨ 59
Calluna vulgaris (L.) Hull)(Plate1)		(13)		
Erica tetralix L.				⑤ 33
Fraxinus sp.	+			
Charcoal Indet		(12)		⑨121
Carbonised Seeds and Grains				
Erica sp.	+			① 2
Erica tetralix L.			(1) 32	① 1
Empetrum nigrum L.	+		(4) 6	① 1
Triticum aestivum L.			(1) 17	② 2
Triticum sp.	+		(4) 11	③ 8

Hordeum - twisted				① 1
Hordeum - straight				① 4
Hordeum - hulled				⑥ 21
Hordeum undiff.				⑦ 17
Hordeum sp.	+	(3)	(9)2462	
Avena fatua L.				② 2
Avena sativa L.			(4) 12	③ 3
Avena sp.	+	(3)	(9)2017	⑧ 56
Cerealia undiff.		(3)	(8) 698	⑨ 51
Ranunculaceae	+			
Ranunculus repens type			(2) 2	① 4
Cruciferae	+			
Brassica sp.			(2) 4	① 1
Raphanus raphanistrum L.			(1) 1	② 3
Caryophyllaceae undiff.	+		(4) 8	⑤ 16
Agrostemma githago L.			(2) 6	
Cerastium arvense L.				① 1
Stellaria media (L.) Vill (Plate 6)			(7) 287	⑥ 21
Spergula arvensis L.			(5) 18	③ 6
Scleranthus annuus L.				①
Chenopodiaceae undiff	+		(5) 136	⑤ 15
Chenopodium album L. (Plate 4)			(3) 23	① 1
Chenopodium bonus-henricus L.			(2) 4	① 1
Atriplex sp. (Plate 4)			(5) 66	④ 5
Linum usitatissimum L.			(4) 21	
Trifolium sp.	+			① 3
Vicia faba L.			(1) 2	① 1
Vicia type	+			
Legume < 4 mm			(5) 36	④ 5
Filipendula sp. (Plate 6)	+			
Rubus fruticosus agg. (Plate 2)			(1) 1	
Potentilla sp.	+			
Euphorbia helioscopia			(2) 5	
Polygonaceae undiff.			(2) 9	
Polygonum aviculare L.			(1) 5	① 1
Polygonum persicaria L. (Plate 3)			(2) 2	
Polygonum hydropiper L.			(1) 3	
Polygonum convolvulus L.				② 2

Polygonum undiff.				② 2
Rumex acetosella L.	+		(6) 287	④ 5
Rumex acetosa L. (Plate 3)	+		(2) 19	① 1
Rumex obtusifolius L.			(6) 269	① 1
Plantago lanceolata L.	+		(4) 5	③ 3
Plantago major/media	+			
Campanula sp.				① 1
Galium aparine L. (Plate 5)			(2) 127	
Compositae	+			
Anthemis cotula L.			(3) 24	② 6
cf Chrysanthemum sp.				① 1
Artemisia sp.	+			
Cirsium sp	+			② 2
Centaurea cyanus L.			(1) 6	
Centaurea nigra L.			(1) 2	
Hypochoeris radiata L.				② 2
Juncus sp.				① 1
Cyperaceae	+			
Carex (lenticular)			(2) 3	④ 7
Carex (trigonous)			(2) 26	④ 8
Gramineae spp.	+		(6) 107	⑥ 20
Sieglingia decumbens (L.) Bernh			(1) 15	④ 7
Bromus sp.			(5) 26	① 3
Bryophyte				⑤ 18
Equisetum	+		(2) 6	③ 5
Pteridium	+			
Polypodium	+			
Fucus sp.			(3) 33	
Kelp		(10)		
Peat		(14)		

(Huntley in Morris and Rackham, 1992: 76-85, Table 11; Huntley, Turner and Nye, in Morris and Batey (Forthcoming a.) Tables 76, 79.)

Table 2: Botanical Data - Robert's Haven, Caithness.

Carbonized Plant Remains

Cereal Grains and Fragments

	No. of grains/seeds etc.	No. of Samples out of 20
Hordeum vulgare L.	210	(20)
Hordeum - hulled	35	(14)
Hordeum - straight	25	(15)
Hordeum - twisted	47	(15)
Hordeum (fragments)	21	(12)
Avena sp.	273	(18)
Avena (fragments)	25	(12)
Cereal (grain fragments)	154	(16)
Cereal Chaff		
Hordeum - rachis internodes	28	(9)
Avena - grains and glumes	15	(9)
Avena -floret bases	20	(10)
Avena - awns	2	(1)
Other chaff	16	(2)
Carbonised seeds		
Calluna vulgaris (L.) Hull. - flowers	37	(17)
Calluna vulgaris (L.) Hull. - twigs	✓	(10)
Empetrum nigrum L.	72	(15)
Ranunculus sp.	24	(12)
Stellaria media (L.) Vill	393	(20)
Spergula arvensis L.	62	(10)
Chenopodiaceae	205	(14)
Linum usitatissimum L.	16	(5)
Vicia sp.	1	(1)
Polygonum sp.	3	(3)

Rumex acetosella L.	2	(2)
Rumex obtusifolius L.	11	(5)
Prunella vulgaris L.	1	(1)
Plantago lanceolata L.	4	(4)
Compositae	63	(16)
Eleocharis sp.	4	(3)
Carex sp. (lenticular type)	4	(2)
Carex sp. (trigonous type)	13	(8)
Gramineae spp.	328	(10)

(White and Barrett, pers. comm.)

Table 3: Botanical Data - Brough of Birsay, Orkney

	Excavations 1974-82 Phases: 2		Excavations Below Room 5 in Phases: 3	4
Charcoal				
Picea sp.	✓	✓		
Pinus/Picea	✓			
Pinus sylvestris L.	✓	✓	✓	✓
Hedera helix L.	✓	✓		
Betula sp.	✓	✓		✓
Alnus glutinosa (L.) Gaertn.	✓	✓		
Corylus avellana L.		✓		
Quercus sp.	✓	✓	✓	
Populus sp.			✓	✓
Salix sp.	✓	✓	✓	✓
Fraxinus excelsior L.	✓			

	Excavations 1974-82 Phases: 2	3
Carbonized Grains and Seeds		
Calluna vulgaris (L.) Hull	3	✓
Empetrum nigrum L.	3	2
Hordeum cf. vulgare L.	37	5
Avena sp.	120	18
Avena strigosa type	38	
Ranunculus acris L.	1	
Ranunculus flammula L.	2	3
Raphanus raphanistrum L.	1	
Stellaria media (L.) Vill	9	3
Sagina sp.	1	
Spergula arvensis L.	1	
Montia fontana L.	1	
Montia fontana ssp fontana	29	
Chenopodium sp.	2	
Atriplex hastata/patula L. (Plate 4)	1	1
Potentilla erecta (L.) Räusch.	3	

Rumex s.	9	14
Cirsium palustre (L.) Scop.		1
Carex sp.	2	5
Gramineae spp.	3	16
Peat (burnt)	✓	✓
Fucus sp.	✓	

(Donaldson in Curle et al 1982, 138; and Donaldson in Hunter, et al 1986, 216-20; M.E 1-13.)

Table 4: Botanical Data - Birsay Bay, Brough Road, Orkney

Samples of Burnt Material and Charcoal Taken on Site

Areas	1	2	3
Charcoal			
Picea abies (L.) Karst.		✓	
Pinus/Picea sp.		✓	✓
Betula sp.		✓	
Alnus glutinosa (L.) Gaertn.	✓		
Quercus sp.		✓	
Salix sp.	✓	✓	✓
Calluna vulgaris (L.) Hull.	✓	✓	✓
Indet.		✓	✓
Carbonized Seeds			
Hordeum cf vulgare L.	30	7	✓
Avena spp.		3	✓
Raphanus raphanistrum L.			✓
Rumex sp.	1		
Empetrum nigrum L.		1	
Luzula sp.	✓		
Carex sp.	1		
Kelp - incl. Fucus vesiculosus	✓	✓	✓

Soil Samples taken from Areas 2 and 3

Areas	2	3
Charcoal		
Salix sp.	✓	✓
Calluna vulgaris (L.) Hull.		✓
Indet.	✓	✓

Carbonized Seeds		
Calluna vulgaris (L.) Hull.		11
Empetrum nigrum L.	1	35
Hordeum cf vulgare L.	976	6072
Avena spp.	138	733
Cruciferae	1	1
Brassica/Sinapis sp.		7
Raphanus raphanistrum L.	2	6
Stellaria media (L.) Vill.	3	✓
Spergula arvensis L.	1	10
Montia fontana ssp. chrondrosperma Frenzl S.M. Walters.		1
Chenopodiaceae		1
Atriplex sp.		1
Linum usitatissimum L.	1	3
Potentilla sp.		21
Polygonum cf aviculare L.		2
Rumex acetosella L.		1
Rumex cf crispus L. (Plate 3)	1	21
Rumex sp./Carex sp.		4
Hyoscyamus niger L.		2
Veronica arvensis L.		✓
Plantago lanceolata L.		2
Tripleurospermum maritimum (L.) Koch.		✓
cf Luzula sp.		2
Cyperaceae	✓	4
Carex sp.	2	148
Gramineae spp.		39
Bryophyte indet.		✓
Kelp	✓	✓

(Donaldson and Nye in Morris et al 1989: 262-6, Tables 31; 32.)

Table 5: Botanical Data - Beachview: Studio Site Area 1, Sub-Areas 'D' and 'E'; Burnside Area 2 and Burnside Cutting/Area 3, Birsay, Orkney.

	Area 1: No. of layers with samples out of 39		Area 2: No. of samples out of 27		Area 3: No. of samples out of 5	
	No. of grains/seeds		No. of grains/seeds		No. of grains/seeds	
Charcoal						
Pinus/Picea sp.		(16)		(17)		(3)
Betula sp.		(5)		(14)		(3)
Alnus sp.				(8)		
Alnus glutinosa (L.)Gaertn.		(5)				
Corylus sp. (Nut fragments)		(1)		(3)		(2)
Quercus sp.						(1)
Salix sp.		(14)		(25)		(5)
cf. Salix sp.		(1)				
Calluna vulgaris (L.) Hull.		(2)		(25)		
Fraxinus sp.				(1)		
Kelp				(26)		(5)
Burnt peat/organic matter		(18)		(27)		(5)
Carbonized Grains & Seeds						
Sorbus aucuparia L. (Plate 1)			1	(1)		
Calluna vulgaris (L.) Hull.			5	(3)		
Empetrum nigrum L.			139	(25)	7	(2)
Hordeum sp.	5	(2)			178	(5)
Hordeum vulgare L.			1577	(27)		
Avena sp.	105	(2)	2955	(27)	206	(5)
Caltha palustris L.			6	(4)		
Ranunculus acris type			2	(2)		
Ranunculus flammula L.			9	(9)		

Cruciferae			4	(4)	3	(3)
Brassica /Sinapis (Plate 4)			6	(6)		
Raphanus raphanistrum L.			29	(15)	4	(2)
Viola sp.			2	(2)		
Caryophyllaceae cf Sm.			24	(10)	2	(2)
Stellaria media (L.) Vill.			117	(19)	3	(1)
Spergula arvensis L.			25	(10)	1	(1)
Montia fonatana spp fontana L.			1	(1)		
Chenopodium sp.			12	(8)		
Atriplex sp.			11	(9)		
Linum usitatissimum L.			43	(18)	5	(4)
cf Trifolium sp.			2	(2)	1	(1)
Rosaceae			1	(1)?		
Potentilla sp.			10	(7)		
Fragaria vesca L. (Plate 2)			1	(1)		
Aphanes sp.			1	(1)		
Euphorbia helioscopia L.			1	(1)		
Polygonum sp.			5	(4)		
Polygonum aviculare L.			8	(6)		
Polygonum persicaria L.	1	(1)			1	(1)
Rumex sp.						
Rumex acetosella L.			1	(1)		
Rumex crispus L.					2	(1)
Rumex cf. crispus L.	3	(1)	203	(22)	15	(3)
Rumex/Carex			77	(15)	5	(2)
Hyoscyamus niger L.			1	(1)		
Veronica arvensis L.			1	(1)		
Labiatae			3	(2)		
Plantago media L.			1	(1)		
Plantago lanceolata L.	1	(1)	19	(13)		
Littorella sp.			8	(5)		
Galium sp.			2	(2)		
Galium aparine L.			4	(2)		
Compositae			2	(2)	2	(2)
Tripleurospermum maritimum (L.) Koch			4	(2)		
Luzula cf sylvatica (Hudson) Gaudin.			57	(17)	4	(2)
Cyperaceae			10	(6)		
Cyperaceae cf Rhyn alb.			2	(2)		

Eriophorum sp.			2	(2)			
Eleocharis uniglumis (Link) Schult.			9	(6)			
Carex sp.			49	(16)	9	(3)	
Gramineae spp.			9	(6)			

(Rackham et al; Nye, in Morris, forthcoming b.)

Table 6: Botanical Data - Saevar Howe, Orkney.

Carbonized Plant Remains

Charcoal	Phases	IIa	IIb	IIc
Picea sp.			✓	✓
Juniperus sp. (Plate1)				✓
Betula sp.		✓		✓
Alnus sp.		✓		
Salix sp.		✓	✓	✓
Calluna vulgaris (L.) Hull.				✓

Carbonized Grains and Seeds

Sorbus aucuparia L.		1	1
Empetrum nigrum L.			4
Hordeum vulgare L.		4	32
cf. Hordeum vulgare L.			27
Avena sp.		2	23
Papaver sp.		4	
Stellaria media (L.) Vill.		1	
Spergula arvensis L.		53	
Linum usitatissimum L.		101	1
Potentilla sp.			5
Polygonum aviculare L.		1	
Rumex sp.			7
Juncus squarrosus L.			5
Carex spp.			10
Gramineae spp.		6	
Selaginella selaginoides (L.) Link.		1	
Bromus sp.		2	
Unidentified			6

(Dickson in Hedges, 1983: 114; Table 18, M92.)

Table 7: Botanical data - Earl's Bu, Orphir, Orkney.

Norse Horizontal Mill.

Carbonized Plant Remains

	Present in number of contexts out of 18	
	Number of grains/seeds	
Corylus avellana (L.) Gaertn.(nut fragments)	44	(5)
Salix repens L. (twigs)	4	(4)
Calluna vulgaris (L.) Hull. flowers	✓	(2)
Calluna vulgaris (L.) Hull. twigs	✓	(1)
Calluna vulgaris (L.) Hull. wood	✓	(15)
Empetrum nigrum L.	23	(6)
Triticum (hexaploid)	1	(1)
Hordeum hulled	587	(9)
Hordeum straight	25	(4)
Hordeum twisted	43	(3)
Hordeum indet.	31	(7)
Hordeum six-row rachis internodes	9	(5)
Hordeum rachis internodes	2	(2)
Avena grains	2421	(17)
Avena glumes	5	(2)
Avena sativa floret bases	2	(2)
Avena sativa/strigosa floret bases	3	(1)
Avena sp. floret bases	3	(2)
Cerealia undiff.	11	(3)
Culm nodes	5	(5)
Caltha palustris L.	6	(2)
Ranunculus repens-type	1	(1)
Ranunculus flammula L.	9	(6)
Fumaria sp.	1	(1)
Brassica sp.	1	(1)
Sinapis arvensis L.	1	(1)
Raphanus raphanistrum (pod fragments)	7	(6)
Caryophyllaceae undiff.	3	(1)
Stellaria media (L.) Vill.	140	(10)

Spergula arvensis L.	88	(7)
Chenopodiaceae undiff.	7	(3)
Linum usitatissimum L.	8	(4)
Vicia faba L.	1	(1)
Potentilla anserina L.	1	(1)
Polygonum aviculare L.	16	(2)
Polygonum persicaria L.	6	(2)
Rumex acetosella L.	24	(6)
Rumex acetosa L.	92	(8)
Rumex obtusifolius - type	46	(7)
Lamium cf purpureum L.	1	(1)
Plantago lanceolata L.	13	(6)
Chrysanthemum segetum L.	2	(2)
Centaurea sp.	1	(1)
Juncus sp. (capsule)	1	(1)
Luzula sp.	1	(1)
Eleocharis sp.	1	(1)
Eleocharis palustris (L.) Roem. Schult.	13	(3)
Isolepis setacea (L.) R. Br.	1	(1)
Carex (lenticular)	10	(5)
Carex (trigonous)	16	(7)
Gramineae < 2mm	1	(1)
Gramineae 2-4mm	4	(2)
Gramineae culm nodes	2	(2)
Sieglingia decumbens (L.) Bernh.	1	(1)
Bromus sp. grain	14	(3)
Fucus - thallus/fronds	✓	(12)

(Huntley, 1990; Batey and Morris in Morris and Rackham, 1992: 38.)

Table 8: Botanical Data - Westness, Rousay, Orkney.

Carbonized Grain and Seeds	
Secale sp.	✓
Hordeum sp.	✓
Avena sp.	✓
Linum usitatissimum L.	✓
Pollen Analysis Evidence	
Secale sp.	+
Hordeum sp.	+
Avena sp.	+
Linum usitatissimum L.	+

(Kaland in Batey et al, 1993:311; Ritchie, 1993:52.)

Table 9: Botanical Data - Tuquoy, Westray, Orkney.

	Area 'F' Charcoal in 81Samples: Present in	Waterlogged Pit area 'J' Plant Remains		
	Pollen Evidence: Waterlogged Pit			
Larix sp.		∅		
Pinus/Picea	+	∅		(41)
Acer sp.		∅		
Crataegus type (Plate 2)	+			
Betula sp.	+	∅		(4)
Alnus sp.	+			(24)
Corylus avellana L.				(2)
Quercus sp.	+	∅		(8)
Salix sp.		∅		(33)
Fraxinus sp.		∅		(1)
Calluna vulgaris (L.) Hull.				(61)
	Area 'F; Charred Plant Remains in 97 Samples: Present in			
Corylus avellana L.		1		
Andromeda/Arctostaphylos	+			
Calluna vulgaris (L.) Hull.	+	144	(35)	
Erica tetralix L.		51		
Erica cinerea L.		355		
Erica sp.		159		
Empetrum nigrum L.	+		(22)45	
Hordeum sp.			(90)1653	
Avena sp.			(88)1493	
Caltha palustris L.			(1) 2	
Aconitum/Trollius	+			
Ranunculus acris L.	+	9	(5) 5	
Ranunculus repens L.	+			
Ranunculus bulbosus L.	+			
Ranunculus flammula L.	+	15	(4) 6	
Thalictrum sp.	+			

Papaver sp.	+	3	
Fumaria sp.		1	
Cruciferae undiff.	+		(2) 2
Brassica sp.		1	
Brassica/Sinapis	*	7	(13) 18
cf Diplotaxis muralis (L.) DC.			(5) 6
Raphanus raphanistrum L.		15	
Capsella bursa-pastoris (L.) Medic.		17	
Erysimum cheiranthoides L.			(2) 5
Viola sp.	+	21	(3) 3
Hypericum perforatum type L.	+		
Frankenia sp.	+		
Caryophyllaceae indet.	+		(57)341
Silene dioica (L.) Clairv.			(10) 13
Lychnis flos-cuculi L.		2	
Cerastium sp.		141	
Stellaria media agg (L.) Vill.		625	(65)290
cf. Stellaria media			(1) 2
Spergula arvensis L.		103	(18) 30
Montia fontana L.		2	(2) 2
ssp chondrosperma (Fenzl) S.M. Walters,			(4) 8
ssp fontana			(4) 4
Chenopodiaceae indet.	+	33	(41) 72
Cheopodium album L.		3	(11) 16
Atriplex sp.		316	(11) 18
Linum catharticum L.	*	4	
Linum usitatissimum L.	*		(20) 77
Trifolium cf. pratense L.			(2) 2
Trifolium sp.		Ø	
Lotus type	+		
Vicia sp.	+		
Lathyrus/Vicia	+		
Filipendula type (Plate 6)	+		
Potentilla sp.	+ *	36	(2) 2
Potentilla cf erecta L. Rauschel.		53	(4) 6
Alchemilla sp.	+	33	
Aphanes arvensis L. (Plate 3)			(4) 4
Hydrocotyle vulgaris L.		6	(1) 1
Umbelliferae indet.	+		(3) 3

Euphorbia helioscopia L.		6	(1) 1
Polygonum aviculare L.	+ *	31	(10) 18
Polygonum bistorta type	+		
Rumex Indet.	+ *		
Rumex acetosella agg. L.		14	
Rumex crispus L.		1	(5) 16
Rumex cf. crispus L.			(69)558
Rumex obtusifolius	+		
Rumex spp.		73	(4) 5
Urtica urens L.		20	
Urtica dioica L.		8	(1) 4
Armeria sp.	+		
Glaux type	+		
Myosotis sp.	*	11	
Hyoscyamus niger L.			(2) 2
Veronica cf arvensis L.			(1) 1
Veronica cf. agrestis L.			(1) 1
Rhinanthus type			
Rhinanthus minor L.	+	17	
Euphrasia sp.			(1) 1
Odontites/Euphrasia sp.		148	
Labiateae indet.	+		
Salvia/Stachys spp.		2	
Stachys type	+		
Galeopsis sp.	*	2	
Teucrinum type	+		
Plantago major (Plate 6)		12	(2) 2
Plantago major/media	+		
Plantago lanceolata	+		(8) 8
Plantago maritima	+		
Plantago coronopus L.	+		
Littorella uniflora (L.) Ascherson.			(4) 4
Galium aparine L.			(16) 26
Succisa sp.	+		
Compositae Indet.	+		(7) 7
Bidens type	+		
Senecio cf aquaticus Hill.		2	
Anthemis type	+		
Anthemis arvensis L.		1	

Tripleurospermum inodorum (L.) Schultz Bip.		92		
Tripleurospermum maritimum (L.) Koch.		992	(6) 8	
Tripleurospermum sp.		401	(1) 1	
Artemisia vulgaris L.	+	155		
Carduus/Cirsium sp.			(2) 2	
Cirsium palustre (L.) Scop.	+		(1) 5	
Centaurea type	+			
Serratula type	+			
Leontodon sp.		37		
Sonchus asper.(L.) Hill.		99		
Potamogeton sp.		1		
Juncus spp.		4		
Luzula sylvatica (Hudson) Gaudin.			(3) 3	
cf Luzula sp.			(3) 3	
Cyperaceae Indet.	+	93	(6) 8	
Carex sp.			(40) 95	
Carex/Rumex			(16) 28	
Gramineae Indet.	*	76	(41)108	
Gramineae < 37μm	+			
Gramineae > 37μm	+			
Bryophyte			(14)	
Selaginella selaginoides (L.) Link.	+	∅		
Pteridium	+			
Polypodium vulgare	+			
Ophioglossum	+			
Kelp			(76)	

(Owen in Batey et al 1993: 329-335; Nye and Boardman: Tipping: Jones, in Owen, forthcoming)

Table 10: Botanical Data - Pool, Sanday, Orkney

Carbonized Grains and Seeds	
Hordeum vulgare L.	✓
Avena fatua L.	✓
Avena strigosa Schreb.	✓
Avena sativa L.	✓
Raphanus raphanistrum L.	✓
Stellaria media (L.) Vill.	✓
Spergula arvensis L.	✓
Montia fon tana L.	✓
Linum usitissi mum L.	✓
Rumex spp.	✓
Urtica urens L.	✓
Carbonized Seaweed	
Ascophyllum nodosum	✓
Fucus serratus	✓
Fucus vesiculosus	✓

(Hunter et al 1991: 133; Hunter et al in Batey et al 1993: 281; Bond, 1993 pers. comm.)

Table 11: Botanical Data - Jarlshof, Shetland

Charcoal Evidence

Charcoal Fragments (Upper slope midden: 9th century)	
Corylus avellana L.	✓
Quercus sp. (Root?)	✓
Salix sp.	✓
Charred Wood Fragments (Upper slope midden: 9th century)	
Juniperus communis L. (plate 1)	✓
Quercus sp.	✓
Salix sp.	✓
Charcoal (Peat ash midden below House 4: 9th - 10th century)	
Pinus sylvestris L.	✓
Betula sp.	✓
Corylus sp.	✓
Salix sp.	✓
Charcoal Fragments (Lower slope communal peat ash midden: 10th century)	
Pinus sylvestris L.	✓
Corylus avellana L. (Beneath House 5)	✓
Salix sp. (Beneath House 5)	✓
Charcoal Fragments (From floor of House 6: 13th - 14th century)	
Betula sp.	✓
Wooden Items (Probably 14th century)	
Wooden knife handle - Betula sp.	✓
Two similar hafts - Quercus sp.	✓
One other haft - Pinus sp.	✓

(Hamilton, 1956: 211)

Table 12: Botanical Data - The Biggings, Papa Stour, Shetland.

	Plant Remains from Pits	Macroscopic Plant Remains	Pollen Analysis/4 Samples: Present in
Picea sp.		∅	
Pinus sp.			(4)
Pinus sylvestris L.	✓	∅	
cf Juniperus sp.		∅	
Betula sp.		∅	(3)
Betula pendula Roth.		∅	
Alnus sp.			(3)
Coryloid			(3)
Corylus sp.		∅	
Fagus sp.		∅	(1)
Quercus sp.	✓	∅	(2)
Quercus suber L.		∅	
Salix sp.		∅	
Ericaceae			(3)
Calluna sp.			(4)
Calluna/Eriophorum			(3)
Calluna vulgaris (L.) Hull.	✓	∅	
Vaccinium sp. (plate 2)		∅	
Erica cinerea L.	∅	∅	
Empetrum nigrum L.	✓	∅	(4)
cf Fraxinus sp.		∅	
Ochroma lagopus SW.		∅	
Hordeum vulgare var. nudum		∅	
Hordeum vulgare var. vulgare		∅	
Hordeum group			(3)
Avena sp. or spp.		∅	
cf Avena sp. or spp. (Straw)		∅	
Avena/Triticum group			(4)
Ranunculus sp.			(4)
Ranunculus acris L.		✓	

Ranunculus repens L.		∅	
Ranunculus flammula L.		∅	
Cruciferae		∅	(1)
Cochlearia sp. (Plate 5)		∅	
cf Cardamine sp.		∅	
Viola sp.		∅	
Caryophyllaceae		∅	(1)
Cerastium type		∅	(4)
Stellaria media (L.) Vill.		∅	
Sagina sp			(1)
Sagina procumbens L.	∅	∅	
Spergula arvensis L.		∅	(4)
Montia fontana spp. fontana	∅	∅	
Chenopodiaceae			(3)
Atriplex sp.		∅	
Trifolium repens L.			(3)
Rosaceae			(1)
Filipendula sp.			(1)
Potentilla sp.			(4)
Potentilla erecta (L.) Räusch.	✓	∅	
Aphanes microcarpa (Boiss & Reut) Rothm.		∅	
Umbelliferae			(3)
Heracleum type			(2)
Polygonaceae		∅	
Polygonum aviculare agg.		∅	(4)
Rumex sp.		∅	(3)
Rumex acetosa type.			(1)
Rumex cf longifolius L.		∅	
Urtica dioica L.		∅	
Armeria sp.			(1)
Anchusa arvensis (L.) Bieb.		∅	
Mysotis arvensis (L.) Hill.		∅	
Rhinanthus sp.		∅	
Lamium section Lamiopsis		∅	
Galeopsis sp.		∅	
Plantago sp.			(2)
Plantago major L.		∅	
Plantago major/media			(4)
Plantago lanceolata L.			(4)

Littorella sp.			(2)
Rubiaceae			(2)
Succisa sp.			(4)
Compositae		∅	
Bellis type			(3)
Tripleurospermum type			(4)
Tripleurospermum inodorum (L.) Hyl. ex Vaarama.		∅	
Tripleurospermum maritimum (L.) Koch.		∅	
Artemisia sp.			(4)
Sonchus asper (L.) Hill.		∅	
Juncus spp.	∅		
Juncus articulatus L.type		∅	
Juncus bufonius L.	∅	∅	
Juncus conglomeratus or effusus		∅	
Juncus squarrosus L.		∅	
Eriophorum vaginatum		∅	
Eleocharis palustris (L.) Roem & Schult.		∅	
Cyperaceae			(1)
Carex spp.		∅	
Gramineae	✓	∅	(4)
Gramineae c. 40µm			(4)
Sieglingia decumbens (L.) Bernh.		∅	
Glyceria fluitans (L.) R.Br.		∅	
Poa annua L.	✓	∅	
Selaginella selaginoides	∅	∅	(2)
Polypodium sp.			(4)
Botrychium sp.			(1)
Ophioglossum sp.			(4)
Climacium dendroides		∅	
Hypnum cupressiforme		∅	
Plagiomnium sp.		∅	
Plagiothesium sp.		∅	
Racomitrium sp		∅	
Rhytidiadelphus triquetrus		∅	
Sphagnum palustre		∅	
Sphagnum sp. or spp.		∅	(3)

Ascophyllum nodosum	✓	∅	
Fucus spiralis	✓	∅	
cf Pelvetia sp.	✓	∅	
Fucoid alga	✓	∅	

(Dickson, pers. comm.)

Table 13: Botanical Data - Sandwick, Unst, Shetland.

Carbonized Grains and Seeds	
Hordeum vulgare L.	✓
Hordeum distichon L.	✓
Avena sp.	✓
Linum usitatissimum L.	✓

(Bigelow, 1984: 135; 1985: 119.)

Table 14: Plant Species: Faecal Remains: Study Area Evidence.

	Dublin	York	Bergen	Caithness	Orkney	Shetland
Caltha palustris L.		✓			✓	
Ranunculus sp.		✓		✓	✓	✓
Brassica sp.		✓	✓	✓	✓	
Brassica cf rapa	✓					
Sinapis sp.			✓		✓	
Raphanus raphanistrum L.	✓	✓	✓	✓	✓	
Agrostemma githago L.		✓		✓		
Stellaria media (L.) Vill.	✓		✓	✓	✓	✓
Spergula arvensis L.		✓		✓	✓	✓
Chenopodium album L.	✓	✓	✓	✓	✓	✓
Atriplex sp.		✓		✓	✓	✓
Linum usitatissimum L.	✓	✓	✓	✓	✓	✓
Oxalis acetosella L.		✓				
Papaver sominiferum L.		✓				
cf Pisum sativum L.	✓					
Rubus fruticosus agg.	✓	✓	✓	✓		
Fragaria vesca L.	✓		✓			
Prunus spinosa L.	✓					
Prunus domestica		✓				
Sorbus aucuparia L.			✓		✓	
Crataegus sp.						
Hydrocotyle vulgaris L.		✓			✓	
Aethusa cynapium L.		✓				
Malus sp.		✓	✓			
Polygonum sp.	✓			✓	✓	✓
Polygonum aviculare L.	✓		✓	✓	✓	✓
Polygonum persicaria L.			✓	✓		
Polygonum lapathifolium		✓	✓			
Polygonum convolvulus		✓	✓	✓		
Rumex sp.		✓		✓	✓	✓
Rumex acetosella agg.		✓	✓	✓	✓	
Rumex acetosa L.			✓	✓		✓
Urtica urens L.		✓			✓	
Corylus avellana L.			✓	✓	✓	✓

Arctostaphylos uva-ursi			✓		✓	
Vaccinium sp.			✓			✓
Empetrum nigrum L.			✓	✓	✓	✓
Centaurea sp.		✓		✓	✓	
Menyanthes trifoliata L.		✓				
Myosotis sp.		✓			✓	✓
Galeopsis sp.	✓		✓		✓	✓
cf Bellis perennis L.		✓				✓
Anthemis cotula L.		✓			✓	
Chrysanthemum segetum L.		✓		✓		
Sonchus asper (L.) Hill.		✓			✓	✓
Eleocharis palustris (L.) Roem & Schult.		✓		✓		✓
Carex spp.		✓		✓	✓	✓
Graminae		✓		✓	✓	✓
Triticum sp.	✓		✓	✓		✓
Secale cereale L.	✓		✓		✓	
Hordeum sp	✓			✓	✓	✓
Hordeum vulgare L.			✓	✓	✓	✓
Avena sativa L.			✓	✓	✓	✓

(Dickson and Dickson in Mitchell, 1987: 22-34, Tables 1 and 2.)

(Hall et al in Proudfoot, 1983: 85-104 Table 1)

(Krzywinski et al in Proudfoot, 1983: 145-169, Fig.11.)

T ble 15: List of Botanical - Common Plant Names and Possible Uses.

Trees and Shrubs	Dyes	Food	Fuel	Herbal Medic -inal
Picea sp. Spruce			•	
Picea abies (L.) Karst Norway Spruce			•	
Larix sp. Larch			•	
Pinus sp. Pine		•	•	
Pinus sylvestris L. Scots Pine		•	•	
Juniperus sp. Juniper		•		•
Juniperus communis L. Juniper (Plate 1)		•		•
Acer sp. Maple/Sycamore		•	•	
Crataegus sp. Hawthorn (Plate 2)		•	•	
Sorbus aucuparia L. Rowan (Plate 1)		•	•	•
Hedera helix L. Ivy				
Ulmus sp. Elm			•	
Myrica gale L. Bog Myrtle (Plate 5)		•		
Betula sp. Birch			•	
Betula pendula Roth. Silver Birch			•	
Betula pubescens Ehrh. Brown Birch			•	
Alnus sp. Alder	•		•	•
Alnus glutinosa (L.) Gaertn.Alder	•		•	•
Corylus sp. Hazel			•	
Corylus avellana L. Hazel (Plate 1)		•	•	
Fagus sp. Beech		•	•	
Quercus sp. Oak		•	•	
Quercus suber L. Cork Oak			•	
Populus sp. Aspen			•	
Salix sp. Willow			•	
Salix repens L. Creeping Willow			•	
Andromeda sp. Marsh Andromeda			•	
Arctostaphylos sp. Bear berry		•	•	
Calluna sp. Heather	•	•	•	
Calluna vulgaris (L.) Hull. Heather (Plate 1)	•	•	•	
Erica sp. Heath			•	
Erica tetralix L. Cross-leaved Heath			•	

	Dyes	Food	Fuel	Herbal Medic -inal
Erica cinera L. Bell-heather			•	
Vaccinium myrtillus L. Bilberry, Blaeberry (Plate 2)	•	•	•	
Empetrum nigrum L. Crowberry	•	•	•	
Fraxinus sp. Ash		•	•	
Fraxinus excelsior L. Ash		•	•	
Ochroma lagopus Sw. Balsa wood				
Cereals				
Triticum sp. Wheat		•		
Triticum aestivum L. Bread Wheat		•		
Secale sp. Rye		•		
Secale cereale L. Rye		•		
Hordeum sp. Barley		•		
Hordeum vulgare L. Six-row Barley		•		
Hordeum vulgare var. nudum Naked Six-row Barley		•		
Hordeum vulgare var. vulgare Hulled Six-row Barley		•		
Hordeum distichon L. Two-row Barley		•		
Avena sp. Oats		•		
Avena fatua L. Wild Oat		•		
Aven strigosa Schreb. Black Oat/Bristle Oat.		•		
Avena sativa L. Cultivated Oat.		•		
General Flora				
Caltha palustris L. Marsh Marigold		•		
Trollius sp. Globe Flower				
Aconitum sp. Monk's Hood				
Ranunculus sp. Buttercup.				
Ranunculus acris L. Common Meadow Buttercup				
Ranunculus repens L. CreepingButtercup		•		
Ranunculus bulbosus L. Bulbous Buttercup		•		
Ranunculus flammula L. Lesser Spearwort				
Thalictrum sp. Meadow Rue				
Papaver sp. Poppy		•		
Fumaria sp. Fumitory				

	Dyes	Food	Fuel	Herbal Medic -inal
Cruciferae Cabbage Family		•		
Brassica sp. Wild Cabbage/Rape/Cole/Turnip		•		
Sinapis sp. Mustard (Plate 4)		•		
Sinapis arvensis L. Charlock/Wild Mustard		•		
Diplotaxis muralis (L.) DC.Sand Rocket				
Raphanus raphanistrum L. Wild Radish		•		
Capsella bursa-pastoris (L.) Medic. Shepherd's Purse		•		•
Cochlearia sp. Scurvy-grass (Plate 5)		•		•
Cardamine sp. Bitter Cress		•		
Erysimum cheiranthoides L. Treacle Mustard		•		
Viola sp. Violet		•		
Hypericum perforatum L. Perforated St. John's Wort				
Frankenia sp. Sea Heath				
Caryophyllaceae Chickweed Family				
Silene dioica (L.) Clairv. Red Campion				
Agrostemma githago L. Corncockle				
Lychnis flos-cuculi L. Ragged Robin				
Cerastium arvense L. Field Mouse-ear				
Stellaria media (L.) Vill. Chickweed (Plate 6)		•		•
Sagina procumbens L. Common Pearlwort				
Spergula arvensis L. Corn Spurrey		•		
Scleranthus annuus L. Knawel				
Montia fontana L. Water Blinks				
Montia fontana ssp chrondrospermum Frenzl S.M. Walters. Water Blinks				
ssp fontana Water Blinks				
Chenopodiaceae Fat Hen Familly		•		•
Chenopodium bonus-henricus L. Good King Henry		•		•
Chenopodum album L. Fat Hen (Plate 4)		•		•
Atriplex hastata L. Hastata Orache		•		
Atriplex patula L. Common Orache (Plate 4)		•		
Linum usitatissimum L. Flax		•		•
Linum catharticum L. Purging Flax				•
Trifolium sp. Clover		•		
Trifolium repens L. White Clover		•		
Trifolium pratense L. Red Clover		•		

	Dyes	Food	Fuel	Herbal Medic -inal
Lotus sp. Birds Foot Trefoil				•
Vicia sp. Vetch		•		
Vicia faba L. Celtic Bean		•		
Lathyrus sp. Pea/Vetchling/Vetch		•		
Rosaceae Rose Family		•		
Filipendula ulmaria (L.) Maxim. Meadow Sweet (Plate 6)	•	•		•
Rubus fruticosa agg. Blackberry (Plate 2)	•	•		
Potentilla reptans L. Creeping Cinquefoil	•	•		
Potentilla anserina L. Silverweed (Plate 6)		•		
Potentilla erecta L. Räuschel. Common Cinquefoil/Tormentil	•	•		
Fragaria vesca L. Wild Strawberry (Plate 2)		•		
Alchemilla sp. Lady's Mantle		•		
Aphanes arvensis L. Parsley Piert. (Plate 3)		•		•
Aphanes microcarpa (Bioss & Reut) Rothm.				
Hydrocotyle vulgaris L. Marsh Pennywort				•
Umbelliferae				
Heracleum sp. Hogweed				
Euphorbia helioscopia L. Sun Spurge		•		
Polygonaceae Dock Family	•	•		
Polygonum sp. Knotgrass/Persicaria		•		
Polygonum aviculare L. Knotgrass		•		•
Polygonum bistorta L. Bistort		•		
Polygonum persicaria L. Redshank (Plate 3)	•	•		•
Polygonum lapathifolium L.		•		
Polygonum hydropiper L. Water Bistort				
Polygonum convolvulus L. Black Bindweed				
Rumex sp. Docks	•	•		
Rumex acetosella L. Sheep's Sorrel		•		
Rumex acetosa L. Common Sorrel (Plate 3)		•		•
Rumex longifolius D.C. Long-leaved Dock				
Rumex crispus L. Curled Dock (Plate 3)		•		•
Rumex obtusifolius L. Broad-leaved Dock				
Urtica urens L. Small Nettle				
Urtica dioica L. Stinging Nettle		•		

	Dyes	Food	Fuel	Herbal Medic -inal
Armeria sp. Sea Pink				
Glaux sp. Sea Milkwort				
Anchusa arvensis (L.) Bieb. Bugloss				
Myosotis arvensis (L.) Hill. Common Forget-me-not				
Hyoscyamus niger L. Henbane				•
Veronica arvensis L. Wall Speedwell				•
Veronica cf agrestis L. Field Speedwell				•
Rhinanthus minor L. Yellow Rattle				
Euphrasia sp. Eyebright				
Odontites sp. Bartsia				
Labiatae Nettle Family				
Prunella vulgaris L. Self-heal				
Salvia sp. Clary.				
Stachys sp. Woundwort				
Lamium purpureum L. Purple Dead Nettle		•		
Lamium album L. White Dead Nettle		•		
Galeopsis sp. Hemp-nettle				
Teucrium sp. Germander				
Plantago major L. Great Plantain (Plate 6)		•		•
Plantago media L. Hoary Plantain				
Plantago lanceolata L. Ribwort Plantain				•
Plantago maritima L. Sea Plantain		•		
Plantago coronopus L. Buck-horn Plantain		•		
Littorella uniflora (L.) Ascherson. Shore-weed				
Campanula sp. Bluebell				
Asperula sp.				
Galium aparine L. Cleavers (Plate 5)		•		•
Succisa sp. Devil's Bit Scabious				
Compositae Daisy Family				
Bidens sp.Bur-marigold				•
Senecio aquaticus Hill. Marsh Ragwort				
Bellis perennis L. Daisy				
Anthemis arvensis L. Corn Chamomile		•		
Anthemis cotula L. Stinking Chamomile				
Tripleurospermum inodorum (L.) Hyl. ex Vaarama. Scentless Mayweed				

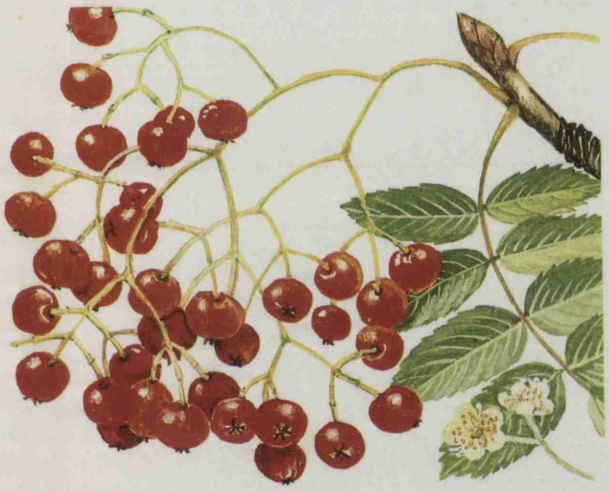
	Dyes	Food	Fuel	Herbal Medic -inal
Tripleurospermum maritimum (L.) Koch. Mayweed				
Chrysanthemum sp. Ox-eye Daisy		•		
Chrysanthemum segetum L. Corn Marigold		•		
Artemisia vulgaris L. Mugwort		•		•
Carduus sp. Thistle				
Cirsium sp.				•
Cirsium palustre (L.) Scop. Marsh Thistle		•		
Centaurea sp. Knapweed				
Centaurea cyanus L. Cornflower				
Centaurea nigra L. Knapweed		•		
Serratula sp. Saw-wort				
Hypochoeris radiata L. Common Cat's-ear		•		
Leontodon sp. Hawkbit		•		
Sonchus asper L. (Hill) Spiny Milk Thistle		•		
Hieracium sp. Hawkweed				
Potamogeton sp. Pondweed				
Juncus spp. Rush				
Juncus squarrosus L. Heath Rush				
Juncus bufonius L. Toad Rush				
Juncus effusus L. Soft Rush				
Juncus conglomeratus L. Rush				
Juncus articulatus L. Jointed Rush				
Luzula sp. Woodrush				
Luzula cf sylvatica (Huds) Gaud. Greater Woodrush				
Cyperaceae Rush Family				
Eriophorum vaginatum L. Cotton-grass				
Eleocharis palustris (L.) Roem & Schult. Common Spike-rush				
Eleocharis uniglumis (Link) Schult. Spike-rush				
Isolepis setacea (L.) R. Br. Bristle Scirpus.				
Carex sp. Sedges				
Carex (lenticular) Sedges				
Carex (trigonous) Sedges				
Gramineae spp. Grasses				
Sieglingia decumbens (L.) Bernh. Heath grass				

	Dyes	Food	Fuel	Herbal Medic -inal
Glyceria fluitans (L.) R.Br. Flote Grass		•		
Poa annua L. Annual Poa				
Bromus sp. Brome		•		
Mosses, Ferns etc.				
Bryophyte Liverworts and Mosses				
Climacium dendroides Bog Moss				
Hypnum cupressiforme Moss				
Plagiomnium sp. Moss				
Phlagiothesium sp. Bog Moss				
Racomitrium sp. Bog Moss				
Rhytidiadelphus triquetrus Bog Moss				
Sphabnum palustre Bog Moss				
Sphagnum sp. or spp. Bog Moss				•
Lycopodium sp. Clubmoss				
Selapinella selaginoides (L.) Link. Lesser Clubmoss				
Equisetum sp. Horsetail				
Pteridium sp. Bracken	•	•		
Polypodium sp. Polypody				
Botrychium sp. Moonwort				
Ophioglossum sp. Adder's tongue				
Seaweeds			•	
Ulva lactuca Sea Lettuce (Plate 7)		•		
Alaria esculenta Dabberlocks (Plate 7)		•		
Laminaria digitata Tangle		•		
Laminaria saccharina Sugar Wrack		•		
Fucus vesiculosus Bladderwrack		•		
Fucus serratus Serrated Wrack				
Fucus spiralis Flat Wrack				
Ascophyllum nodosum Knotted Wrack				
Pelvetia caniculata Channelled Wrack				

	Dyes	Food	Fuel	Herbal Medic -inal
Rhodymenia palmata Dulce (Plate 7)		•		
Porphyra umbilicis Laver (Plate 7)		•		
Chondras crispus Irish Moss (Plate 7)		•		

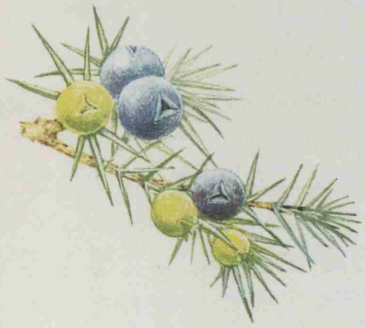
(Clapham et al, 1987; Hedrick, 1972; Mabey, 1972)
See Chapters 3 and 5, for discussion and other sources.

HAZEL
Corylus avellana



ROWAN, MOUNTAIN ASH
Sorbus aucuparia

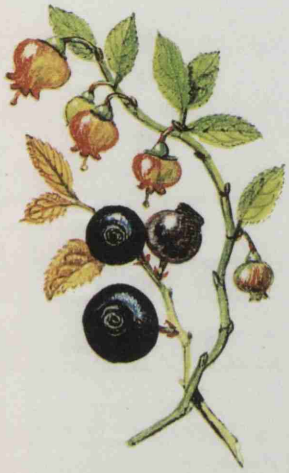
HEATHER
Calluna vulgaris



JUNIPER
Juniperus communis

Plate 1. Trees and shrubs: Nuts, berries and flowers.

BLACKBERRY, BRAMBLE
Rubus fruticosus



BILBERRY
Vaccinium myrtillus

HAWTHORN
Crataegus monogyna

WILD STRAWBERRY
Fragaria vesca

Plate 2. Shrubs with berries: Plants with fruits.

RED LEG
Polygonum persicaria

COMMON SORREL
Rumex acetosa

CURLED DOCK
Rumex crispus

PARSLEY PIERT
Aphanes arvensis

Plate 3. Seeds and foliage plants.

FAT-HEN
Chenopodium album

COMMON ORACHE
Atriplex patula

WHITE MUSTARD
Sinapis alba

Plate 4. Seeds and foliage plants.

COMMON SCURVY-GRASS
Cochlearia officinalis

SWEET GALE, BOG MYRTLE
Myrica gale

GOOSEGRASS, CLEAVERS
Galium aparine

Plate 5. Seeds and foliage plants.

MEADOWSWEET
Filipendula ulmaria

RAT'S-TAIL PLANTAIN
Plantago major

CHICKWEED
Stellaria media

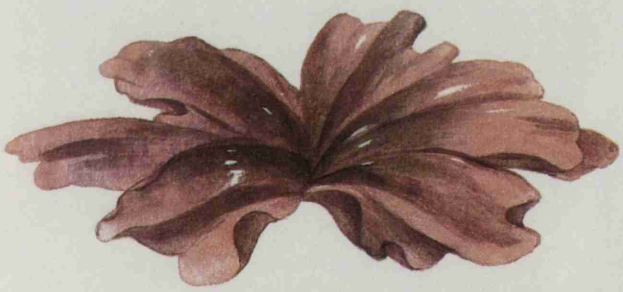
SILVERWEED
Potentilla anserina

Plate 6. Foliage and root plants.

SEA LETTUCE
Ulva lactuca

DULSE
Rhodymenia palmata

CARRAGHEEN, IRISH MOSS
Chondrus crispus



LAVER
Porphyra umbilicalis

DABBERLOCKS
Alaria esculenta

Plate 7. Seaweed

Appendix 'A'

Species of seaweeds used for manuring and those which are edible

The species of seaweed that were primarily used for manuring are as follows:

Fucaceae

Fucus vesiculosus

Ascophyllum nodosum

Pelvetia caniculata

Laminareae

Laminaria sp

L digitata

L saccharina

(Fenton, 1986:50)

The following species of seaweed have been used as an edible food source.

Ulva lactuca (Plate 7)

Alaria esculenta (Plate 7)

Laminaria digitata

L saccharina

Rhodymenia palmata (Plate 7)

Porphyra umbilicalis (Plate 7)

Chondras crispus (Plate 7)

Fucus vesiculosus

(Mabey, 1972:155-162)

Bibliography

Andersson, G. (1902) Hasseln: Sverige, Suer. geol Unders., Ser. Ca., 3, 1.

Bailey, P. (1971) Orkney, Newton Abbot.

Baillie, M.G.I. (1980) 'Dendrochronology - The Irish view', Current Archaeology 73, 61-3.

Barrett, J. (1992) Palaeoeconomic Investigations at Robert's Haven, Caithness, 1992. A Preliminary Report, Glasgow Uni. Dept. of Archaeology.

Barrett, J. (1993) 'Archaeological Sampling at Robert's Haven, A Preview', Glasgow Archaeological Society, Bulletin No. 31, 10-14.

Barrett, J. (Forthcoming) Ph.D. Degree, University of Glasgow.

Barry, Rev. G. (1805) The History of the Orkney Islands, London.

Batey, C.E. (1982) 'The Late Norse Site of Freswick', in Baldwin, J.R. (ed.) Caithness:A Cultural Crossroads. Edinburgh, 43-59.

Batey, C.E. (1984) Caithness Coastal Survey 1980-82; Dunnet Head to Ousdale Durham, Durham Uni. Dept. of Archaeology Occasional Paper No. 3.

Batey, C.E. (1987 a.) Freswick Links, Caithness. A Re-appraisal of the Late Norse Site in its Context, British Archaeological Reports, British Series 179, 2 Vols., Oxford.

Batey, C.E. (1987 b.) 'Viking and Late Norse Caithness: The Archaeological Evidence', in J.E. Knirk (ed.) Proceedings of the Tenth Viking Congress, Larkollen, Norway, 1985. Oslo, 131-148.

Batey, C.E. (1989) 'Recent work at Freswick Links, Caithness, Northern Scotland', Hikuin 15, 223-230.

Batey, C.E. (1991) 'Archaeological Aspects of Norse Settlement in Caithness, North Scotland, in Acta Archaeologica Vol. 61 - 1990, 29-35.

Batey, C.E., Jones, A.K.G., Morris, C.D. and Rackham, D.J. (1981) Freswick, Caithness. Excavations and Survey at Freswick Links and Freswick Castle, 1979-80, Durham.

Batey, C.E. and Morris, C.D. (1983) Part II: 'The Finds', in Hedges, J.W., 'Trial excavation on Pictish and Viking settlements at Saevar Howe, Orkney', 85-108, Glasgow Archaeological Journal. X. 73-124.

Batey, C.E. and Morris, C.D. (1991) 'Excavations at the Earl's Bu, Orphir, Orkney,' 1989-90, Durham Uni. Arch. Reports, 45-9.

Batey, C.E., and Morris, C.D. (1992) 'Earl's Bu, Orphir, Orkney: Excavation of a Norse Horizontal Mill'. in Morris, C.D. and Rackham, D.J. (eds.), Norse and Later Settlement and Subsistence in the North Atlantic, University of Glasgow, 33-41.

Batey, C.E., Jesch, J., and Morris, C.D. (eds.) (1993) The Viking Age in Caithness, Orkney and the North Atlantic. Proceedings of the Eleventh Viking Congress, Thurso and Kirkwall, 1989. Edinburgh Uni. Press.

Bell, M. (1981) 'Seaweed as a Prehistoric Resource' in Brothwell, D. and Dimbleby, G. (eds.) Environmental Aspects of Coasts and Islands, British Archaeological Reports, Oxford, 117-126.

Berry, R.J. (1985) The Natural History of Orkney, Collins, London.

Berry, R.J. and Johnston, J.L. (1980) The Natural History of Shetland, Collins, London.

Bertelsen, R. (1985), Lofoten og Vesterålens historie, Vol. 1, Svolvaer.

Bertelsen, R. and Lamb, R.G. (1993) 'Settlement mounds in the North Atlantic' in Batey, C.E., Jesch, J. and Morris, C.D., The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh University Press, 544-554.

Bigelow, G.F. (1984) Subsistence in Late Norse Shetland - An Investigation into a Northern Island Economy of the Middle Ages. Ph.D. dissertation, Cambridge.

Bigelow, G.F. (1985) 'Sandwick, Unst and the Late Norse Shetland Economy'. in Smith, B. (ed.) Shetland Archaeology. New Work in Shetland in the 1970's, Lerwick, 95-127.

Bigelow, G.F. (1989) 'Life in Medieval Shetland: an Archaeological Perspective'. Hikuin 15: 183-192.

Birks, H.J.B. (1975) Studies in the vegetational history of Scotland. Pine stumps in blanket peats, Philosophical Transactions of the Royal Society, B 270,181.

Birks, H.J.B. (1977) The Flandrian forest history of Scotland: a preliminary synthesis. In Shotton, F.W. (ed.) British Quaternary Studies, Recent Advances, Clarendon Press. Oxford, 119-35.

Bond, J.M., and Hunter, J.R. (1987) 'Flax-growing in Orkney from the Norse period to the 18th century'. In Proc. Soc. Antiq. Scot., 117, 175-181.

Bond, J.M. (1993) personal communications.

Bradbury, F. (1925) Flax Culture and Preparation, London.

Brand, Rev. J. (1701) A Brief Description of Orkney, Shetland, Pightland Firth and Caithness, Brown, Edinburgh.

Brandt, J. (1950) 'Plant remains in the body of an early Iron Age man from Borre Fen', Arboger for Nordisk Oldkyndighed og Historie, 348-350.

Bratrein, H.D. (1976) 'Det tradisjouelle Kjønnelle Kjønnsrollemønsteri Nord-Norge', in Drivandes Kvinnfolk. Om Kvinner, Iønn og arbeid, eds. Bratrein et al., Tromsø Oslo-Bergen 21-38.

Brockmann-Jerosch, H. (1917) 'Die altesten Nutz-und Kulturpflanzen, Vierteljahrsschrift', Naturforsch, 80-102.

Brøgger, A.W. (1929) Ancient Emigrants: a History of the Norse Settlement of Scotland, Oxford.

Brøgger, A.W. (1930) Den Norske Bosetningen på Shetland-Orknøyene. Studier og Resultater, Oslo.

Brøndsted, J. (1960) The Vikings, Penguin Books.

Brouk, B. (1975) Plants Consumed by Man, London.

Bryden J. (1845) In the New Statistical Accounts of Scotland, 15, Edinburgh.

Buchanan, J. L. (1793) Travels in the Western Hebrides, London.

Buckland, P.C., Greig, J.R.A, Denward, H.K. (1974) York; 'An Early Medieval Site', in Antiquity, XLVIII, 25-33.

Buckland, P.C., Sadler, J.P. and Sveinbjarnardóttir, G. (1992) 'Palaeoecological Investigations at Reykholt, Western Iceland', in Morris, C.D. and Rackham, D.J., Norse and Later Settlement and Subsistence in the North Atlantic, University of Glasgow, 149-167.

Buckland, P.C., Sadler, J.P. and Smith, D.N. (1993) 'An Insect's Eye-View of the Norse Farm', in Batey, C.E., Jesch, J. and Morris, C.D. (eds.) The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh University Press, 506-527.

Bullard, E.R. (1979) Orkney, A Checklist of Vascular Plants, Flowering Plants and Ferns, Stromness.

Bullard, E.R. (1975) 'Orkney Habitats an Outline Ecological Framework', in Goodier, R. (ed.) The Natural Environment of Orkney, Nat. Cons. Council, Edinburgh, 19-28.

Bullard, E.R., and Goode, D.A. (1975) 'The Vegetation of Orkney', in Goodier, R. (ed.) The Natural Environment of Orkney, Nat. Cons. Council, Edinburgh, 31-46.

Butler, J.K. (1972) 'The Vegetation of Caithness', in Omand, D. (ed.) The Caithness Book, Inverness Highland Printers, 61-74.

Calder, C.S.T. (1964) 'Neolithic Structures in Shetland' in The Northern Isles, Wainwright, F.T. (ed.), Nelson, London, 26-43.

Campbell, J.L. (ed.) (1958) Gaelic Words and Expressions from South Uist and Eriskay, collected by Rev. Fr. Allan McDonald, Dublin.

Carpenter, K.J., (1986) The History of Scurvy and Vitamin C, Cambridge Uni. Press.

Clapham, A.R., Tutin, T.G. and Moore, D.M. (1987) Flora of the British Isles, Cambridge.

Clark, J.G.D. (1952) Prehistoric Europe, The Economic Basis, Methuen, London.

Cotton, (1912) 'Marine Algae' Proc. Roy. Irish Acad., 31, 1-178.

Colley, S.M. (1983) Marine Resource Exploitation, in Hedges' 'Trial Excavations on Pictish and Viking Settlements at Saevar Howe, Birsay, Orkney,' Glasgow Arch. Journ. 10, 73-124.

Colley, S.M. (1983a) The Role of Fish Bone Studies in Economic Archaeology: With Special Reference to the Orkney Isles, Ph.D. dissertation, University of Southampton.

Crampton, C.B. (1911) The Vegetation of Caithness, Edinburgh.

Crawford, B.E. (1968) 'The Earldom of Orkney and the Lordship of Shetland; a reinterpretation of their pledging to Scotland in 1468-69', The Sagabook of the Viking Society, 17.

Crawford, B.E. (1969) The Pawning of Orkney and Shetland: a reconsideration of the events of 1460-9, in The Scottish Historical Review, XLVIII, 1. No. 145, 35-53.

Crawford, B.E. (1978) 'A progress report of the first season's excavation at 'Da Biggings', Papa Stour, Shetland', Northern Studies, No. 11, 25-29.

Crawford, B.E. (1985) 'The Biggings, Papa Stour', in Smith, B. (ed.) Shetland Archaeology, Lerwick, 125-158.

Crawford, B.E. (1987) Scandinavian Scotland, Leicester Uni. Press.

Crawford, B.E. (1990) 'Excavations at the Biggings, Papa Stour, Shetland,', in Acta Archaeologica Vol. 61, 36-43.

Crawford, B.E. (ed.) (1994) (Forthcoming) The Excavation Report, The Biggings, Papa Stour, Shetland.

Crone, A. in Owen, O.A. (1994) (Forthcoming) Tuquoy, Westry, Orkney: A Large Norse and medieval Farm Settlement.

Cruden, S. (1958) 'Earl Thorfinn the Mighty and the Brough of Birsay', in Eldjärn, K. (ed.) Third Viking Congress, 1956, Reykjavik, 156-162.

Cruden, S. (1965) 'Excavation at Birsay, Orkney', in Small, A. (ed.) The Fourth Viking Congress, 1961, Oliver and Boyd, Edinburgh, 22-31.

Culpeper, N. (1652) Complete Herbal, Foulshaw & Co. London.

Culpeper, N. (1669) The English Physitian, Enlarged, 1785 edition, London.

Curle, A.O. (1935) 'An account of the excavation of a dwelling of the Viking Period at "Jarlshof" Sumburgh, Shetland', Proceedings of the Society of Antiq. of Scotland 69, 265-321.

Curle, A.O. (1936) 'Excavation of further buildings of the Viking Period,' Proceedings of the Society of Antiq. of Scotland 70, 251-319.

Curle, A.O. (1939) 'The Viking settlement at Freswick, Caithness. Report on excavations carried out in 1937 and 1938', in Proceedings of the Society of Antiq. of Scotland LXXIII (1938-9), 71-110.

Curle, C.L. (1982) Pictish and Norse finds from the Brough of Birsay 1934-74, Proceedings of the Soc. of Antiq. of Scotland, Monograph Series no. 1, Edinburgh.

Dalland, M. (1992a) 'Scar, Sanday, Viking boat grave', in Discovery and Excavation in Scotland, Pub. Coun. for Scottish Arch. 81-2.

Calland, M. (1992b) 'Scar: A Viking Boat Burial', in Current Archaeology, No. 31, 475-77.

Dandy, J.E. (1958) List of British Vascular Plants, British Museum (Natural History), London.

Dansgaard, W., Johnsen, S.J., Rech, N., Gundestrup, N., Clausen, H.B. and Hammer, C.U. (1975) 'Climatic changes. Norsemen and modern man' in Nature Vol. 255 May, 24-28.

Davidson, D.A., Jones, R.L., Renfrew, C. (1976) 'Palaeoenvironmental Reconstruction and Evaluation: A Case Study from Orkney', in Transactions of the Inst. of Brit. Geographers 1, 346-361.

Dennell, R.W. (1974a) 'Botanical evidence for prehistoric crop processing activities'. Journal of Archaeological Science 1, 275-284.

Dennell, R.W. (1974b) 'The purity of prehistoric crops', Proc. of the Prehistoric Society, 40, 132-135.

Dickson, A. (1770) Treatise of Agriculture, Edinburgh.

Dickson, C.A. (1983) The Macroscopic Plant Remains, in Hedges, J.W., 'Trial excavations on Pictish and Viking settlements at Saevar Howe, Birsay, Orkney', Glasgow Archae. Journal Vol. 9, 114 and Microfiche 92.

Dickson, C.A. personal communications.

Dickson, C.A. in Crawford, B.E. (ed.) (1994) (Forthcoming) The Excavation Report, The Biggings, Papa Stow, Shetland.

Dickson, C.A. and Dickson, J.H. (1987) 'The Plant Remains', in Mitchell, G.F. Archaeology and Environment in Early Dublin, Medieval Dublin Excavations 1962-81, National Museum of Ireland, 22-36.

Dickson C.A. and Dickson J.H. (1976) in Ritchie, J.N.G. 'The Stones of Stenness; Orkney'. Proc. of the Soc. Antiq. Scotland, 107, (1975-6), 1-60.

Dickson, J.H. (1978)' Bronze Age Mead', Antiquity LII, 108-113.

Dimbleby, G.W. (1975) 'The Seeds', in Platt, C. and Coleman-Smith, R. (eds.) Excavations in Medieval Southampton 1953-1969, Leicester, 344-346.

Donaldson, A.M. (1982) 'Charcoal', in Curle, C.L. Pictish and Norse Finds from the Brough of Birsay 1934-74, Soc. of Antiq Scotland Mono. Series No. 1, Edinburgh, 138.

Donaldson, A.M. (1982) 'Carbonised Seeds and Grains with Identifications', in Hunter, J.R., Rescue Excavations on the Brough of Birsay 1974-82, Society of Antiq. of Scotland, Monograph Series No. 4, Edinburgh, 216-219.

Donaldson, A.M. (1986a) 'Charcoal Remains, with Identification', in Hunter, J.R., Rescue Excavation, on the Brough of Birsay 1974-82, Society of Antiq. of Scotland, Monograph Series No. 4, Edinburgh, 219-220.

Donaldson, A.M. (1986b) Pollen Analysis, in Morris, C.D. and Emery, N., 'The Setting for the Brough of Deerness, Orkney', in Northern Studies, No. 23, 1-30.

Donaldson, A.M., Morris, C.D., Rackham, D.J. (1981) 'The Birsay Bay Project': preliminary investigations into the past exploitation of the coastal environment at Birsay, Mainland, Orkney, in Brothwell, D.R. and Dimbleby, G.(eds.)

Environmental Aspects of Coasts and Islands, British Archaeological Reports, Intern. Series 94, Oxford, 65-85.

Donaldson, A.M., and Nye, S. (1989) 'The Botanical Remains', in Morris, C.D., Batey, C.E., Emery, N., Rackham, D.J. The Birsay Bay Project Vol. 1, University of Durham, Dept of Archae. Monograph Series No. 1, Durham, 262-267.

Donaldson, G. (1958) Shetland Life Under Earl Patrick, Oliver & Boyd, Edinburgh.

Donaldson, J.E. (1983) Caithness in the 18th Century, Edinburgh.

Drury, S.M. (1984) 'The use of wild plants as famine foods in eighteenth century Scotland and Ireland', in Vickery, R. (ed.) Plant-Lore Studies, Bot. Soc. Brit. Isles., Conference Rep. No. 18, London.

Durno, S.E. (1958) 'Pollen Analysis of Peat Deposits in Eastern Sutherland and Caithness', in Scottish Geographical Magazine, No. 74, 127-135.

Eldjarn, K. (1982) 'The Viking myth', in Farrell, R.T. (ed.) The Vikings, 262-73.

Evans, E.E. (1957) Irish Folk Ways, London.

Evershed, H. (1874) The Agriculture of the island of Shetland, Edinburgh.

Evershed, R.P., Heron C., and Goad, L.J. (1991) 'Epicuticular wax components preserved in potsherds as chemical indicators of leafy vegetables in ancient diets', Antiquity 65, 540-544.

Farrer, J. (1862) 'The Knowe of Saverough', in Gentleman's Magazine, 13, 601-4.

Farrer, J. (1868) 'Note respecting various articles in bronze and stone; found in Orkney, and now presented to the Museum', Proc. of the Society of Antiq. of Scotland 7 (1866-68), 103-5.

Fairhurst, H. (ed.) (1984) Excavations at Crosskirk Broch, Caithness, Proceedings of the Soc. of Antiq. of Scotland, Monograph Ser. No. 3, Edinburgh.

Fellows-Jensen, G. (1975) 'The Vikings in England: a review', in Anglo-Saxon England, IV, 181-206.

Fellows-Jensen, G. (1984) 'Viking settlement in the Northern and Western Isles; the place-name evidence as seen from Denmark and the Danelaw', in Fenton, A. and Pålsson, H. The Northern and Western Isles in the Viking World, 148-168.

Fenton, A. (1978) The Northern Isles: Orkney and Shetland, John Donald, Edinburgh.

Fenton, A. and Pålsson, H. (eds.) (1984) The Northern and Western Isles in the Viking World, Survival, Continuity and Change, Edinburgh.

Fenton, A. (1985) The Shape of the Past 1, Essays in Scottish Ethnology, Edinburgh.

Fenton, A. (1986) The Shape of the Past 2, Essays in Scottish Ethnology, Edinburgh.

Fenton, E.W. (1937) 'The influence of sheep on the vegetation of hill grazings in Scotland', Journal of Ecology, 25, 424.

Flinn, D. (1961) 'Continuation of the Great Glen Fault beyond the Moray Firth', Nature Lond., 191, 589-91.

Flinn, D. (1974) 'The Coastline of Shetland', in Goodier, R. (ed.) The Natural Environment of Shetland, Proceedings of the Nature Conservancy Council Symposium, 13-21.

Foot, P.G. and Wilson, D.M. (1970) The Viking Achievement, London.

Fraser, M. and Dickson, J.H. (1982) 'Plant Remains', in Murray, J.C. (ed.) Excavations in the Medieval Burgh of Aberdeen 1973-81, Soc. of Antiquaries of Scotland, Edinburgh 1982, Monograph Series No. 2, 239-243.

Gerard, J. (1633) The Herbal, Revised and enlarged by Thomas Johnson, 1633, Facsimile edition Dover, New York, 1975.

Gifford, T. (1879) Historical Description of the Zetland Islands in the Year 1733, Edinburgh.

Glob, P.V. (1971) The Bog People, Paladin.

Goode, D.A. (1974) 'The Flora and Vegetation of Shetland', in Goodier, R. The Natural Environment of Shetland, Nat. Cons. Council, Edinburgh, 50-72.

Graham, A. (1952) 'Spruce and Pine Timber in Two Scottish Prehistoric Buildings', Archaeological Newsletter 4, 133-7.

Graham-Campbell, J. (1980) The Viking World, Frances Lincoln Publishers, London.

Green, F.J. (1982) 'Problems of interpreting differentially preserved plant remains form excavations of medieval urban sites', in Hall, A.R. and Kenward, H.K. (eds.) Environmental Archaeology in Urban Context, Research Report No. 43, Council for British Archaeology, London, 40-46.

Grieg, S. (1940) 'Viking antiquities in Scotland', Viking Antiquities II, Oslo.

Grieve, M. (1931) A Modern Herbal, London.

Grigson, G. (1955) The Englishman's Flora, Phoenix, London.

Guðmundsson, F. (1993) On the writing of Orkneyinga Saga, in Batey, E.C., Jesch, J. and Morris C.D. The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh Univ. Press, 204-211.

Gunn, C.R. and Dennis, J.V. (1976) World guide to tropical drift seeds and fruits, New York.

Hagan, A. (1992) A Handbook of Anglo-Saxon Food Processing and Consumption, Anglo-Saxon Books.

Hall, A. (1987) 'Spices of Life' in Circaea Vol. 5, No. 1, 20.

Hall, A.R., Kenward, H.K., Williams, D. and Greig, J.R.A. (1983a) 'Environment and Living Conditions at Two Anglo-Scandinavian Sites', The Archaeology of York: The Past Environment of York 14/4, Pub. Council for British Archaeology, London.

Hall, A.R., Jones, A. K. G. and Kenward, H.D. (1983b) 'Cereal Bran and Human Faecal Remains From Archaeological Deposits - Some Preliminary Observations', in Proudfoot, B.(ed.) Site, Environment and Economy, Symp. of the Assoc. for Envir. Arch. No. 3, British Archaeological Reports, Inter. Series, 173, 1983, 85-104.

Hamilton, J.R.C. (1956) Excavation at Jarlshof, Shetland, Her Majesty's Stationery Office, Edinburgh.

Handley, J.E. (1953) Scottish Farming in the Eighteenth Century, London.

Hatt, G. (1937) Landbrug, Danmarks Oldtid, 26.

Hedges, J.W. (1983) 'Trial excavation on Pictish and Viking settlements at Saevar Howe, Birsay, Orkney', Glasgow Archaeological Journal X, 73-124 and Microfiche 40-102.

Hedges, J.W. (1987) Bu, Gurness and the Brochs of Orkney, Part II: Gurness British Archaeological Reports, British Series 164, 1987, Oxford, 163-5.

Hedrick, U.P. (ed.) (1972) Sturtevant's Edible Plants of the World, Dover Publications, New York.

Helbaek, H. (1954) 'Prehistoric Food Plants and Weeds' in Denmark, Danm. Geol. Unders., 11, 80-250.

Helbaek, H. (1960) 'Comment on Chenopodium as a Food Plant in Prehistory', Berichte der geobotanischen Forschunginstitute Rubert, Zürich (31) 16-19.

Hellberg, L. (1967) 'Kumlabygdens ortnamn och äldre bebyggelse', Kumlabygden III, 282-4.

Hellberg, L. (1980) Ortnamn och den Svenska bosëttningen på Aland. Ortnamn och samhalle 2.

Hess, A.F. (1920) Scurvy Past and Present, London.

Hibbert, S. (1822) A Description of the Shetland Islands, Edinburgh.

Higham, M.C. (1989) 'Some Evidence for 12th and 13th Century Linen and Woollen Textile Processing', Medieval Archaeology, Vol. 33, 38-52.

Hill, M.D. (1979) Two-way Indicator Species Analysis (TWINSPAN), Cornell University, Ithaca, New York.

Hillman, G.C. (1981) 'Reconstructing crop husbandry practices from charred remains of crops'. in Mercer, R. (ed.) Farming Practices in British Prehistory, Edinburgh Uni. Press, 123-162.

Hillman, G.C. (1984) 'Interpretation of archaeological plant remains: the application of ethnographic models from Turkey', in Zeist, W. Van. and Casparie, W.A. (eds.) Plants and Ancient Man, Studies in Palaeoethnobotany, Boston, 1984, 1-41.

Hillman, G.C. (1986) 'Plant foods in ancient diet', in Stead, I.M., Bourke, J.B. and Brothwell, D. Lindow Man, The Body in the Bog, British Museum Publications, London, 99-115.

Hinton, M.P. (1991) 'Weed associates of recently grown Avena strigosa Schreber from Shetland, Scotland', Circaea 8 (1), (1991 for 1990) 49-54.

Holmes, U.T. Jr. (1953) Daily Life in the Twelfth Century, Madison.

Hunter, J.R. (1983) 'Recent Excavations on the Brough of Birsay', Orkney Heritage 2, 152-170.

Hunter, J.R. (1986) Rescue Excavation on the Brough of Birsay 1974-82, Soc. Antiq. Scotland Monograph Series, No. 4, Edinburgh.

Hunter, J.R. (1991) 'The Multi-Period Landscape', in Hanson, W.S. and Slater, E.A., (ed.) Scottish Archaeology New Perceptions, Aberdeen Uni. Press, 178-195.

Hunter, J.R., Bond, J.M. and Smith, A.N. (1991) 'Excavations at Pool, Sanday, Orkney', Acta Archaeologica Vol. 62, Copenhagen, 131-3.

Hunter, J.R., Bond, J.M. and Smith, A.N. (1993) 'Some aspects of Early Viking Settlement in Orkney', in Batey, C.E., Jesch, J. and Morris, C.D. (eds.) The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh Uni. Press, 272-284.

Hunter, J.R. and Morris, C.D. (1981) 'Appendix: excavation of Room 5 clifftop settlement Brough of Birsay 1973-4', in Curle, C.L., Pictish and Norse Finds from the Brough of Birsay 1934-74, Soc. Antiq. Scotland Monograph Series No. 1, Edinburgh, 124-138.

Hunter, J.R. and Morris, C.D. (1982) Recent Excavations at the Brough of Birsay, Orkney', in Bekker-Nielson, H., Foote, P.G. and Olsen, O. (eds.) Proceedings of the Eighth Viking Congress, Århus 1977, Odense 245-58.

Huntley, J.P. (1990) Earl's Bu, Orphir, Orkney. Interim report upon carbonised plant remains from EB 79/80, 1-9.

Huntley, J.P. (1992) 'Carbonised Plant Remains', in Morris, C.D. and Rackham, D.J., Norse and Later Settlement and Subsistence in the North Atlantic, Glasgow University, 76-85.

Huntley, J.P. 'Pollen Analytical Investigations, Freswick Links', in Morris C.D. and Batey, C.E. (eds.) (Forthcoming a.) Excavations at Freswick Links, Caithness, 1979-84, Highland Region Monograph, No. 1.

Huntley, J.P. and Turner, J. 'Carbonised Plant Remains', in Morris C.D. and Batey, C.E. (eds.) (Forthcoming a.) Excavations at Freswick Links, Caithness, 1979-84, Highland Region Monograph, No. 1.

Ingstad, A.S. (1977) The Discovery of a Norse Settlement in America, Universitetsforlaget, Oslo.

Irvine, S.G. (1968) 'An outline of the climate of Shetland', Weather 23, 392-403.

Jakobsen, J. (1901) Shetlandsøernes stednavne, in Aarbøger for nordisk Oldkyndighed og Historie XVI.

Jakobsen, J. (1932) An etymological dictionary of the Norse language in Scotland Vol. 2.

Jakobsen, J. (1936) The Place-Names of Shetland, London.

Jensen, H.A. (1979) 'Seeds and other diaspores in medieval layers from Svendborg', The Archaeology of Svendborg, Denmark 2, Odense, 1-101.

Jessen, K. (1933) 'Planterester fra den aldre Jernalder Thy', Botanisk Tidsskrift, (42.3).

Jessen, K. and Helbaek, H. (1944) Cereals in Great Britain and Ireland in Prehistoric and Early Historic Times. Det Kongelige Danske Videnskabernes Selskab, Biologiske Skrifter, 3, Copenhagen, 1-68.

Jôhansen, J. (1975) 'Pollen Diagrams from the Shetland and Faroe Islands', in New Phytol. 75, 369-387.

Johnson, C.P. (1862) The Useful Plants of Great Britain.

Johnston, A.W. and Johnston, A. (1907) Diplomatarium Orcadense et Hialtlandense, London.

Johnston, J.L. (1974) 'Shetland Habitats, An Outline Ecological Framework', in Goodier, R. (ed.) The Natural Environment of Shetland, Nat. Cons. Council, Edinburgh, 33-49.

Jones, A.K.G. (1991a) 'Preliminary observations of fish remains from a late Norse settlement in Caithness', in Bigelow, G.F. (ed.) The Norse of the North Atlantic, Acta Archaeologica 61 (1990), Copenhagen, 220-227.

Jones, A.K.G. (1991b) Fish remains from excavations at Freswick links, Caithness, unpublished Ph.D. thesis, Dept. Biology, Uni. of York.

Jones, A.K.G., Batey, C.E., Morris, C.D., and Rackham D.J. (1983) 'Man and the environment at Freswick Links: preliminary observations from a Late Norse settlement in Caithness', in Jones, M. (ed.) Integrating the Subsistence Economy, British Archaeological Reports Intern. Series 181, Oxford, 163-176.

Jones, A.M. (1975) 'The Marine Environment of Orkney', in Goodier, R.(ed.) The Natural Environment of Orkney, Proc. Nat. Cons. Council Symp., Edinburgh, 85-94.

Jones, M. (1978) 'The Plant Remains', in Parrington, M. (ed.) The excavation of an Iron Age settlement, Bronze Age ring-ditches and Roman features at Ashville Trading Estate, Abingdon, Oxfordshire, 1974-76, Oxfordshire Archaeological Unit and the Council for British Archaeology, 1978, 93-110.

Jones, M. (1981) 'The Development of Crop Husbandry', in Jones, M. and Dimbleby, G. (eds.) The Environment of Man, British Archaeological Reports, British Series 87, 95-121.

Jones, M.(ed.) (1983) Integrating the Subsistence Economy, British Arch. Reports Inter. Ser. 181, Oxford.

Kaland, S.H.H. (1982) 'Some economic aspects of the Orkneys in the Viking period', Norwegian Archaeological Rev. XV, 8-95.

Kaland, S.H.H. (1993) 'The settlement of Westness, Rousay', in Batey, C.E., Jesch, J. and Morris, C.D., The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh Uni. Press, 308-317.

Keatinge, T.H. and Dickson, J.H. (1979) 'Mid-Flandrian Changes in Vegetation on Mainland Orkney', in New Phytology 82, 585-612.

Keene, A.S. (1985) 'Nutrition and Economy: Models for the Study of Prehistoric Diet', in Gilbert, R.I. and Mielke, J.H. (eds.) The Analysis of Prehistoric Diets, Academic Press, London, 155-190.

Krzywinski, K., Fjelldal, S. and Sôltvedt E.C. (1983) 'Recent Palaeoethnobotanical Work at the Medieval Excavation at Bryggen, Bergen, Norway', in Proudfoot, B. (ed.) Site Environment and Economy, Symp. of the Assoc. for Envir. Arch. No. 3 British Archaeological Reports, Inter. Ser. 173, 1983, 145-169.

Lamb, H.H. (1977) Climate: Past, Present and Future VII, Methuen, London.

Lamb, R.G. (1980) Sanday and North Ronaldsay, Orkney Island Area, The Archaeological Sites and Monuments of Scotland, R.C.A.H.M.S., Edinburgh.

Larsen, A.C. (1990) 'Norsemen's use of Juniper in Viking Age Faroe Islands', Acta Archaeologica Vol. 61, 54-9.

Laughlan, W.F. (ed.) (1982) Northern Lights: the Diary of Sir Walter Scott, Hawick.

Lewis, F.J. (1906) 'The Plant Remains in the Scottish Peat Mosses, II. The Scottish Highlands', Transactions of the Royal Soc. of Edinburgh, 45, 335.

Lewis, F.J. (1911) 'The Plant Remains in Scottish Peat Mosses', Transactions of the Royal Soc. of Edinburgh, 47, 793.

le Strange, R. (1977) A History of Herbal Plants, London.

Lightfoot, J. (1777) Flora Scotica, London.

Lind, J. (1772) Treatise on Scurvy, London.

Low G. (1879) A Tour Through the Islands of Orkney and Shetland, (1774) (1879 edition reprinted), Melven, Inverness.

Lucas, A.T. (1959) 'Nettles and Charlock as famine food', Breifne, 1 (2), 137-46.

Mabey, R. (1972) Food for Free, Harper Collins, London.

Martin, M. (1934) Description of the Western Islands of Scotland, Orig. Published London 1703.

Marwick, H. (1952) Orkney Farm Names, Kirkwall.

Marwick, H. (1970) The Place-Names of Birsay, Aberdeen Uni. Press.

Masefield, G.B., Wallis, M., Harrison, S.G., Nicholson, B.E., (1969) The Oxford Book of Food Plants, Oxford Univ. Press.

Mather, A.S., Ritchie, W. and Smith, J.S. (1974) Beaches of Orkney, Report for Countryside Comm. for Scotland, Dept. of Geography, Uni. of Aberdeen.

Maurizio, A. (1927) Die Geschichte unserer Pflanzennahrung von den Urzeiten bis zur Gegenwart, Berlin, Paul Parey.

McCane, R.A., and Widdowson, E.M. (1991 5th ed.) The Composition of Foods, Ministry of Agriculture, Fisheries and Food, London.

McCollum, E.V. (1957) History of Nutrition, The Riverside Press, U.S.A.

McNeill, M. (1910) Colonsay, its Plants, Climate, Geology etc., Douglas, Edinburgh.

McNeill, F.M. (1974) The Scots Kitchen: Its Lore and Recipes, London.

Meteorological Office, monthly weather reports.

Meyer, K. (1911) Ancient Irish Poetry, London.

Mitchell, F. (1976) The Irish Landscape, Collins, London.

Mitchell, G.F. (1987) Archaeology and Environment in Early Dublin, Medieval Dublin Excavations 1962-81, National Museum of Ireland, Dublin.

Moar, N.T. (1969) 'A Pollen Diagram from Mainland Orkney Islands', New Phytol. 68, 201-214.

Morris, C.D. (1983) 'Excavations Around the Bay of Birsay', in Orkney Heritage, Vol. 2, Birsay, 119-151.

Morris, C.D. (1993) 'The Birsay Bay Project: A Résumé', in Batey, C.E., Jesch, J. and Morris, C.D. The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh Uni. Press, 285-307.

Morris, C.D., Batey, C.E., Emery, N. and Rackham, D.J. (1989) The Birsay Bay Project, Vol. 1 Coastal sites beside the Brough Road, Birsay, Orkney Excavation 1976-1982, University of Durham, Dept. Archaeology Monograph Series No. 1, Durham.

Morris, C.D. and Rackham, D.J. (1992) Norse and Later Settlement and Subsistence in the North Atlantic, Glasgow University.

Morris, C.D., Rackham, D.J., Batey, C.E., Huntley, J.P., Jones, A.D.G., O'Connor, T.P. (1992) 'Excavations at Freswick Links, Caithness, 1980-82: Environmental Column Samples from the Cliff-side', in Morris C.D. and Rackham D.J. Norse and Later Settlement and Subsistence in the North Atlantic, Glasgow University, 43-102.

Morris, C.D. and Batey, C.E. (eds.) (Forthcoming a.) Excavations at Freswick Links, Caithness, 1979-84, Highland Regional Monograph No. 1.

Morris, C.D. (Forthcoming b.) The Birsay Bay Project, Vol. 2. Excavations and Survey in Birsay Village Orkney, Uni. Durham Dept. Arch. Monograph Series, Durham.

Mykura, W. (1974) 'The Geological Basis of the Shetland Environment,' in Goodier, R. (ed.) The Natural Environment of Shetland, Nature Cons. Council Edinburgh, 1-12.

Mykura, W. (1975) 'The Geological Basis of the Orkney Environment', in Goodier, R. (ed.) The Natural Environment of Orkney, Nature Cons. Council Edinburgh, 1-9.

Nicolaisen, W.F.H. (1969) 'Norse Settlement in the Northern and Western Isles' in Scottish Historical Rev., XLVIII, 14-23.

Nicolaisen, W.F.H. (1975) 'Scandinavian Place-Names' in MacNeill, P. and Nicolson, R., Historical Atlas of Scotland, 6-7.

Nicolaisen, W.F.H. (1976) Scottish Place-Names: Their Study and Significance, London.

Nicolaisen, W.F.H. (1976) 'Scandinavian place-names in Scotland as a source of knowledge', Northern Studies, 7/8, 14-23.

Nicolaisen, W.F.H. (1982) 'Scandinavians and Celts in Caithness: The Place-Name Evidence' in Baldwin, J.R. (ed.) Caithness: A Cultural Crossroads, Edina Press Ltd., Edinburgh, 75-85.

Nicolaysen, R. (1980) 'Arctic nutrition', Perspect. Biol. Med., 23, 295-310.

Nicolson, J. (1978) Traditional Life in Shetland, Hale, London.

Nordenskiöld, A.E. (1881) The Voyage of the Vega Around Asia and Europe, Macmillan, London.

Nye, S. 'Burnt Material and Charcoal' in Morris, C.D. and Batey, C.E., (Forthcoming a.) Excavating at Freswick Links, Caithness, 1979-84, Highland Region Monograph No. 1.

Nye, S. Botanical Report in Morris, C.D., (Forthcoming b.) The Birsay Bay Project, Vol. 2, Excavation and Survey in Birsay Village, Orkney, Uni. Durham Dept. Arch. Monograph Series, Durham.

Nye, S. and Boardman, S. 'Charred Plant Remains' in Owen, O.A. (Forthcoming) Tuquoy, Westray, Orkney: A Large Norse and Medieval Farm-settlement.

O'Dell, A.C. (1939) The Historical Geography of the Shetland Islands, Lerwick.

Oddie, B.C.V. (1959) 'The composition of precipitation at Lerwick, Shetland', Quarterly J. Royal Metrolog. Soc. 85, 163-165.

O.S.A., (1978) (ed.) The (Old) Statistical Account of Scotland 1791-1799, Vol. 19, Orkney and Shetland, Facsimile edition, Thomson, W.P.L. and Graham, J.J. (eds.) Wakefield.

Omand, D. (ed.) (1972) The Caithness Book, Inverness.

Omand, D. (1982) 'The Making of the Caithness Landscape', in Baldwin, J.R. (ed.) Caithness; A Cultural Crossroad, Edina Press Ltd, Edinburgh, 7-23.

Omand, D. (ed.) (1989) The New Caithness Book, Wick.

Omand, D. (1993) The Landscape of Caithness and Orkney, in Batey, C.E., Jesch, J. and Morris, C.D. The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh University Press, 102-110.

Owen, O.A. (1983) 'An Interim Report on the second season of the archaeological rescue project at Tuquoy, Westray, Orkney', in Universities of Durham and Newcastle-upon-Tyne Archaeological Reports for 1983, Durham, 49-53.

Owen, O.A. (1988) 'Tuquoy, Orkney 1988: Further Assessment and Tapestry Excavation of the Norse and Medieval Site', in Central Excavation Unit and Ancient Monuments Laboratory Annual Report 1988, Edinburgh, 5-8.

Owen, O.A. (1993) 'Tuquoy, Westray, Orkney: A challenge for the future?' in Batey, C.E., Jesch, J. and Morris, C.D. The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh University Press, 318-337.

Owen, O.A. (Forthcoming) Tuquoy, Westray, Orkney: A Large Norse and Medieval Farm-Settlement.

Palmer, R.C. and Scott, W. (1969) A Check-list of the Flowering Plants and Ferns of the Shetland Islands, Scalloway and Oxford.

Pálsson, H. and Edwards, P. (Trans.) (1978) Orkneyinga Saga, The History of the Earls of Orkney, Penguin Books.

Parry, M.L. (1978) Climate Change, Agriculture and Settlement, Folkestone.

Peglar, S. (1979) 'A Radiocarbon-dated Pollen Diagram from Loch of Winless, Caithness, North-East Scotland', in New Phytology 82, 245-263.

Petersen, Jan (1933) Gamle Gardsanlegg: Rogaland, Oslo, 1-11.

Postan, M.M. (1973) Medieval Trade and Finance, University Press, Cambridge.

Rackham, D.J. (1989) Discussion in Morris, C.D., Batey, C.E., Emery, N. The Birsay Bay Project Vol. 1, Brough Road, Excavations 1976-1982, University of Durham, Dept. of Archaeology, Monograph Series No. 1.

Rackham, D.J., Batey, C.., Jones, A. K. G. and Morris, C.D. (1984) 'Freswick Links, Caithness', Report on Environmental Survey 1979, Circaea 2 No. 1, York, 29-55.

Rackham, D. J., and others, Botanical Reports, in Morris, C.D., (Forthcoming b.) The Birsay Bay Project, Vol. 2, Excavations and Survey in Birsay Village, Orkney, University of Durham Dept. Arch. Monograph Series, Durham.

Radford, C.A.R. (1978) 'The Early Christian and Norse Settlements at Birsay, Orkney', Dept of the Environment Official Guide, Edinburgh, 2nd ed.

Ranson, F. (1954) British Herbs, Penguin Books.

Ratcliffe, D.A. (1964) 'Mires and bogs', in Burnett, J.H. (ed.), The Vegetation of Scotland, Edinburgh, 426-478.

Renfrew, C. and Buteux, S. (1985) 'Radiocarbon Dates from Orkney', in Renfrew, C. (ed.), The Prehistory of Orkney, 263-274.

Ritchie, A. (1993) Viking Scotland, Historic Scotland.

Ritchie, A. and Ritchie, G. (1978) The Ancient Monuments of Orkney, Historic Scotland, Edinburgh.

Robinson, D. (1987) 'Investigations into the Aukhorn Peat Mounds, Kleiss, Caithness: Pollen, Plant Macrofossil and Charcoal Analyses,' in New Phytology, 106, 185-200.

Robinson, D. (1987) 'Discussion: Plants Useful to Man', in Holdsworth, P. (ed.) Excavations in the Medieval Burgh of Perth, 1979-81, Soc. of Antiq. of Scotland, Monograph Series No. 5, Edinburgh, 205-209.

Robinson, M. and Hubbard, R.N.L.B. (1977) 'The Transport of Pollen in the Bracts of Hulled Cereals', Journal of Archaeological Science, 4, 197-199.

Roussell, A. (1934) Norse Building Customs in the Scottish Islands, Copenhagen.

Sabiston, W. (1970) 'An analysis of the A.D. 1595 Rentals of Birsay', in Marwick, H., The Place-Names of Birsay, Aberdeen Uni. Press, 99-117.

Saddler, J. (1993) in Owen, D.A. 'Tuquoy, Westray, Orkney', in Batey, C.E., Jesch, J. and Morris, C.D. The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh Univ. Press, 318-337.

Sawyer, P.H. (1971) The Age of the Vikings, 2nd ed., London.

Schiffer, M.B. (1978) Behavioural Archaeology, New York.

Scott, W. and Palmer, R. (1987) The Flowering Plants and Ferns of the Shetland Islands, Shetland Times.

Senior, W.H. and Swan, W.B. (1972) Survey of Agriculture in Caithness, Orkney and Shetland, Highlands and Islands Development Board, Special Report No. 8.

Shaw, F.J. (1980) The Northern and Western Islands of Scotland, Edinburgh.

Sharpe, R.M. and Saxon, J. (1972) 'Geology', in Omand, D. The Caithness Book, Highland Printers, Inverness, 3-16.

Shearer, J., Groundwater, W. and Mackay, J.D. (1966) The New Orkney Book, London.

Shetelig, H. (1940) 'An introduction to the Viking history of Western Europe', Viking Antiquities, 1, Oslo.

Shirreff, J. (1814) General View of the Agriculture of the Orkney Islands and Shetland Islands, Edinburgh.

Sibbald, Sir R. (1845) Description of the Isles of Orkney and Zetland, Edinburgh.

Singer, C., Holmyard, E.J., Hall, A.R. and Williams, T.I. (eds.) (1956) A History of Technology Vol. 2, Oxford.

Small, A. (1967) 'Excavations at Underhoull, Unst, Shetland', Pro. Soc. Antiq. Scotland, 103, 225-248.

Small, A. (1969) 'The distribution of settlements in Shetland and Faeroe in Viking times', Sagabook of the Viking Society 17, 145-55.

Smyth, A.P. (1975) Scandinavian York and Dublin (2 vols.) New Jersey and Dublin.

Spence, D.H.N. (1958) 'The Flora of Unst, Shetland, in relation to the Geology', Trans. Bot. Soc. Edinburgh, 37, 163-173.

Spence, D.H. N. (1960) 'Studies on the Vegetation of Shetland, III. Scrub in Shetland and in South Uist, Outer Hebrides', Journal of Ecology, 48, 73-95.

Spence, D.H.N. (1979) Shetland's Living landscape: A Study in Island Plant Ecology, Sandwick.

Steward, J. (1942) 'The direct historical approach to archaeology', American Antiquity 7, 337-343.

Stewart, J. (1965) 'Shetland farm names', in Fourth Viking Congress, 247-66.

Stockwell, C. (1988) Nature's Pharmacy, Century, London.

Struever, S. (1968) 'Flotation techniques for the recovery of small-scale archaeological remains', American Antiquity 33, 353-62.

Stuiver, M. and Pearson, G.W. (1986) 'Variation in the Curve of Radiocarbon Assay', Radiocarbon 28, 805-38.

Stummann Hansen, S. (1988) 'The Norse Landnam in the Faroe Islands in the Light of Recent Excavations at Toftanes, Leirvik' Northern Studies 25, 58-84.

Symon, J.A. (1950) Scottish Farming Past and Present, Edinburgh.

Taylor, A.B. (Trans.) (1938) The Orkneying Saga, Edinburgh.

Taylor, M. (1981) 'Wood in Archaeology', Shire Archaeology, No. 17, 47.

Thomson, W.P. L. (1987) History of Orkney, Edinburgh.

Thörarinsson, S. (1944) 'Tefrokronologiska Studier på Island, ' Geografiska Annalen 26, 1-217.

Tudor, J.R. (1883) The Orkneys and Shetland, London.

Thuesen, N.P. (1978) Norrøn Bosetning på Orknøyene, thesis, University of Oslo.

Tipping, R. 'Palynological and Sedimentological evidence for the provenance of material in, and function of, 'The Pit' at Tuquoy, Westray, Orkney,' in Owen, O.A. (Forthcoming) Tuquoy Westray, Orkney: A Large Norse and Medieval Farm-Settlement.

Traill, W. (1868) 'On Submarine Forests and the Remains of Indigenous Wood in Orkney', Transactions of the Botanical Society of Edinburgh 9, 146.

Trease, G.E. (1964) Pharmacy in History, London.

Tudor, R.J. (1883) The Orkneys and Shetland, London.

Wallace, J.A. (1883) Description of the Isles of Orkney, Edinburgh.

Watt, W.G. (1820) Article XVIII, Edinburgh Philosophical Journal 3, 100-102.

Waugh, D. (1993) 'Caithness: An Onomastic Frontier Zone', in Batey, C.E., Jesch, J. and Morris, C.D. (eds.) The Viking Age in Caithness, Orkney and the North Atlantic, Edinburgh University Press, 120-128.

White, S. in Barrett J., (Forthcoming) Ph.D. Degree, University of Glasgow.

Whittle, A., Keith-Lucas, M., Milles, A., Noddle, B., Rees, S. and Romans, J.C.C. (1986) Scord of Brouster, Oxford Uni. Committee for Archaeology, Monograph No. 9.

Wild, J.P. (1970) Textile Manufacture in the Northern Roman Provinces, Cambridge.

Wren, R.C. (1975) Potter's New Cyclopaedia of Botanical Drugs and Preparations, New Edition, London.

Zeist, W. van. (1970) 'Prehistoric and early historic food plants in the Netherlands', Palaeohistoria 14, 41-173.

Zutter, C.M. (1991) 'Murals of Icelandic Land-Use During the Freestate', Paper presented at the 24th Annual Meeting of the Canadian Archaeo. Ass., St. John's, Newfoundland.