Changing use of Lizard Island over the past 4000 years and implications for understanding Indigenous offshore island use on the Great Barrier Reef

Ariana B.J. Lambrides[a], Ian J. McNiven[b], Samantha J. Aird[c], Kelsey A. Lowe[d], Patrick Moss[e,f], Cassandra Rowe[g], Clair Harris[d], Cailey Maclaurin[a], Sarah A. Slater[a], Kylie Carroll[a], Malia H. Cedar[h], Fiona Petchey[i,a], Christian Reepmeyer[a], Matthew Harris[j], Johnny Charlie[k,†], Elaine McGreen[k], Phillip Baru[k] and Sean Ulm[a,*]

[a] ARC Centre of Excellence for Australian Biodiversity and Heritage, College of Arts, Society and Education, James Cook University, PO Box 6811, Cairns, QLD 4870, Australia; [b] ARC Centre of Excellence for Australian Biodiversity and Heritage, Monash Indigenous Studies Centre, Monash University, Clayton, VIC 3800, Australia; [c] ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia; [d] School of Social Science, The University of Queensland, Brisbane, QLD 4072, Australia; [e] School of Earth and Environmental Sciences, The University of Queensland, Brisbane, QLD 4072, Australia; [f] ARC Centre of Excellence for Australian Biodiversity and Heritage, Australian National University, Canberra, ACT 0200, Australia; [g] ARC Centre of Excellence for Australian Biodiversity and Heritage, College of Science and Engineering, James Cook University, PO Box 6811, Cairns, QLD 4870, Australia; [h] Anthropology Department, University of Colorado, Boulder, CO 80309, United States; [i] Radiocarbon Dating Laboratory, Division of Health, Engineering, Computing and Science, University of Waikato, Hamilton 3216, New Zealand; [j] Niche Environment and Heritage, Cairns, QLD 4870, Australia; [k] Dingaal Traditional Owner, C/- Hope Vale Post Office, QLD 4895, Australia

† Deceased

* Corresponding author sean.ulm@jcu.edu.au

Abstract

Archaeological records documenting the timing and use of northern Great Barrier Reef offshore islands by Aboriginal and Torres Strait Islander peoples throughout the Holocene are limited when compared to the central and southern extents of the region. Excavations on Lizard Island, located 33 km from Cape Flattery on the mainland, provide high resolution evidence for periodic, yet sustained offshore island use over the past 4000 years, with focused exploitation of diverse marine resources and manufacture of quartz artefacts. An increase in island use occurs from around 2250 years ago, at a time when a hiatus or reduction in offshore island occupation has been documented for other Great Barrier Reef islands, but concurrent with demographic expansion across Torres Strait to the north. Archaeological evidence from Lizard Island provides a previously undocumented occupation pattern associated with Great Barrier Reef Late Holocene island use. We suggest this trajectory of Lizard Island occupation was underwritten by its place within the Coral Sea Cultural Interaction Sphere, which may highlight its significance both locally and regionally across this vast seascape.

Introduction

There are limited archaeological records documenting the timing and use of Great Barrier Reef offshore islands throughout the Holocene, particularly when compared to available evidence from elsewhere along the Queensland coast (e.g. Barker 2004; Beaton 1978, 1985; Border 1999; Brady et al. 2013; Lentfer et al. 2013; McNiven et al. 2014; Mills 1992; Rowland 1980, 1984; Wright 2018). However, in the context of the broader social and cultural seascape, the Torres Strait Islands have been the most extensively investigated region, and provide an unparalleled record of island occupation in the region in terms of the development of specialised maritime societies (e.g. Ash et al. 2010; Barham 2000; Brady 2010; Brady and Ash 2018; Carter 2004; Crouch 2015; Crouch et al. 2007; David et al. 2005, 2009; David and Weisler 2006; Ghaleb 1990; McNiven 2006, 2015; McNiven et al. 2009, 2015; McNiven and Feldman 2003; Wright et al. 2013). The use of offshore islands by Aboriginal and Torres Strait Islander peoples throughout the Holocene in northeast Australia has been widely debated (e.g. Barker 2004; Beaton 1978; Border 1999; McNiven et al. 2014; Rowland 1996; Sim and Wallis 2008; Ulm 2013), particularly the timing of island use, the evidence for permanent or semi-permanent island-based marine economies, the associated extent of mainland connections and movement of people, and the wider social and cultural implications of the observed changes in island occupation during the Mid-to-Late Holocene.

Currently, the earliest evidence for offshore island use has been reported from the central and southern extents of the Great Barrier Reef region. Barker (2004) argued that records from the Whitsunday Islands indicate people were marine adapted prior to the time when Nara Inlet 1 (Hook Island) was cut off from the mainland (Figure 1), and adjusted to ~1500 years of changing coastlines and island development between ~9000 and 7400 cal BP, and continued to access and exploit marine resources until the recent past (see also Rowland 1996). In contrast, the Otterbourne Island 4 site (Shoalwater Bay Islands) was occupied at 5200 cal BP some 3000 years after island development. This time-lag between island formation and colonisation was attributed to the development of fringing reefs and associated expansion in turtle populations, a key socially important resource (McNiven et al. 2014). Use of these islands generally predates the earliest evidence for migration of ceramic-bearing New Guinea peoples into Torres Strait and Lapita expansion into Remote Oceania, and thus occupation of Great Barrier Reef offshore islands was not facilitated by the introduction of canoeing

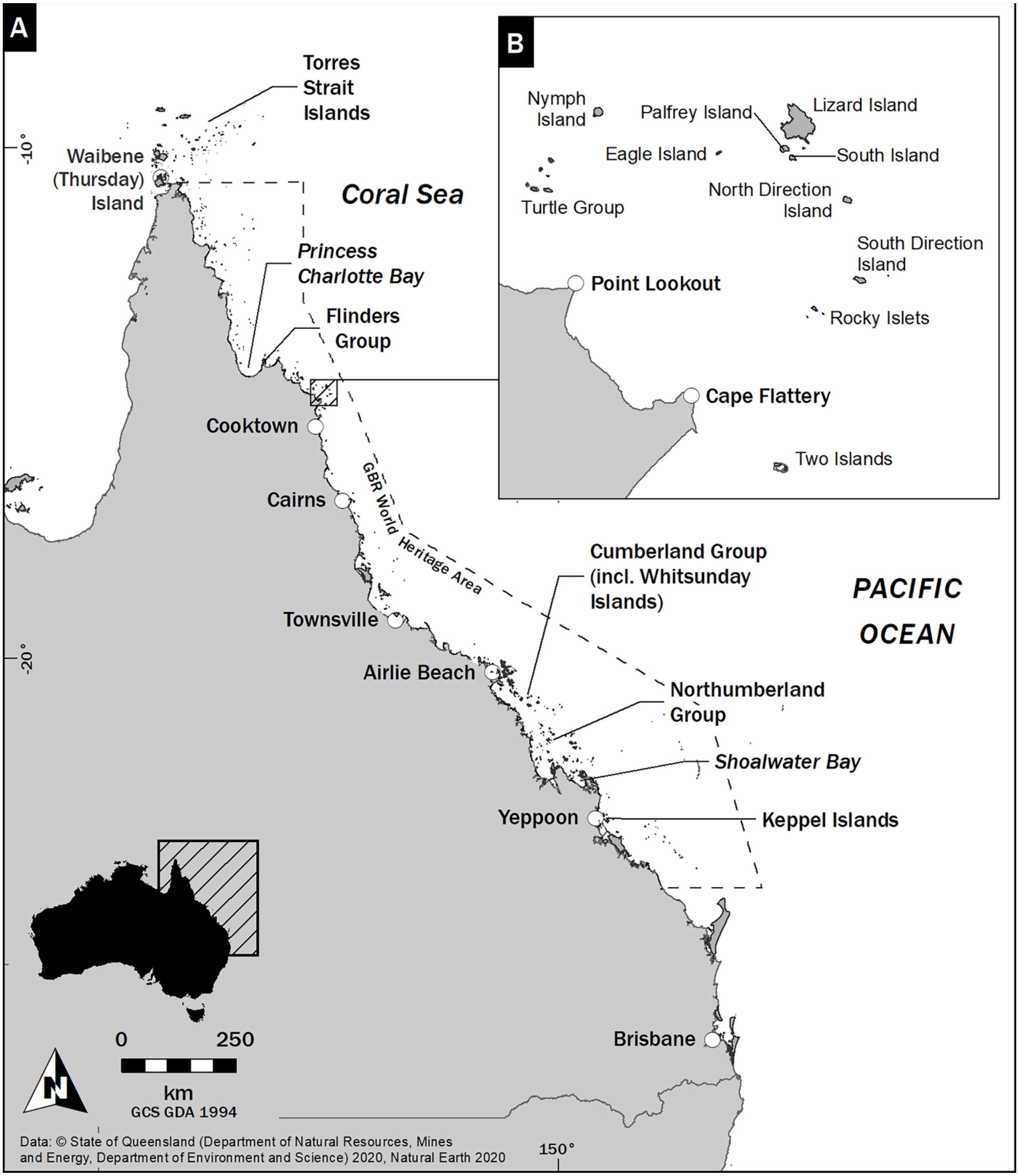

Figure 1. Australia, showing the location of Queensland, and (A) key places on the Great Barrier Reef mentioned in text, and (B) the islands between the mainland and Lizard Island Group. The dotted line shows the extent of the Great Barrier Reef World Heritage Area.

technologies from New Guinea (Denham et al. 2012; McNiven et al. 2006, 2011; Rowland 1996). Aboriginal people of the central and southern Queensland coast developed bark canoes and successfully voyaged offshore to access these islands throughout the Holocene (McNiven et al. 2014; Rowland 1984).

As characterised by McNiven et al. (2014) for the central and southern Great Barrier Reef region, the available archaeological evidence supports the occurrence of an island colonisation phase between ~5000 and 3000 years ago. A notable change in the use of these islands occurs from c.3000–3500 years ago, which has been inferred from increases in archaeological discard rates, changes in targeted resources, and the use of new technologies. This wider change in island occupation has been attributed to the expansion of coastal resources following sea-level stabilisation (Border 1999; Rowland 1999), or the restructuring of populations and inter-regional social systems, including controlled resource access (Barker 2004), yet all changes are argued to be underwritten by the emergence of permanent island-based economies (i.e. Cumberland Group, Northumberland Group, and North Keppel Island). Recent work on the Shoalwater Bay Islands (Northumberland Group) indicates there is no compelling evidence for permanent island-based economies (McNiven et al. 2014), unlike that documented for the Whitsunday and Keppel Islands (Barker 2004; Rowland 1999). The increased use of Shoalwater Bay Islands from 3000–3500 years ago was likely driven by demographic pressures on the mainland (e.g. increased demand on resources or a need to expand and/or acquire new territories), but these communities still had territory that extended to the mainland, and would likely visit these offshore islands periodically throughout the year (McNiven et al. 2014).

An absence or decrease in the use of islands from ~2000 to 1000 years ago was observed for sites in the Cumberland Group, Keppel Islands, and Northumberland Group (Barker 1996; Border 1999; Lamb and Barker 2001; McNiven et al. 2014; Rowland 1981, 1982, 1984, 1985, 1996). These occupation gaps have been linked to a corresponding period of high amplitude and low frequency ENSO events (~2500–1000 years ago), peaking at ~1300 years ago (Conroy et al. 2008; Gagan et al. 2004; Ulm 2011). Furthermore, Dechnik et al. (2017) documented a ~2300 year hiatus in lateral reef accretion between ~3900–3600 cal BP and ~1500–1300 cal BP along the Great Barrier Reef inner and mid-outer shelf reefs due to falling sea-levels, but excluding the reefs roughly between Cairns and Townsville, where no hiatus was observed likely due to increased subsidence for this region. Reef flat growth re-initiated ~2000 years ago, but was restricted to the slope and back reef lagoon (Perry and Smithers 2011). Most recently, evidence from the inshore southern Great Barrier Reef indicates that while hiatus or reef 'turn-off' events occurred during the past 5000 years, these were not regionally uniform events, unlike the evidence available for the northern extent of the region (Leonard et al. 2020). There is still a degree of uncertainty as to how these recent changes in the use of islands – from ~2000 to 1000 years ago – may relate to broader environmental change. Both intensified ENSO activity (e.g. Gagan et al. 2004) and – to a varying extent – a hiatus in reef flat accretion rates (e.g. Leonard et al. 2020) could have influenced reef flat communities and the predictability of accessing these resources. Furthermore, variations in coastal vegetation and movement of associated shorelines have been identified through the reconstruction of mangrove vegetation histories (Genever et al. 2003; Grindrod 1985). Ideally, sub-seasonal records at local scales of foraging and environmental change from these offshore island archaeological sites are required to disentangle these complex drivers of change. Nonetheless, following this ~1000-year hiatus or decrease in offshore island use, there is a notable increase in island use over the past 1000 years in the central and southern extents of the Great Barrier Reef region, as characterised by the relatively high discard rates and in some instances a change in the range of resources and technologies utilised (Barker 2004; Border 1999; McNiven et al. 2014; Rowland 1982, 1996).

There are limited records documenting variability in offshore island use for the northern Great Barrier Reef, with Flinders and Lizard Island Groups providing the most detailed evidence (Figure 1). It should be noted that work on Hinchinbrook Island by Campbell (1979, 1982a) does provide evidence of occupation from at least 2000 years ago at the Leefe Peak site, but the samples that provided these early dates were recovered from an exposed section of a midden, which had been cut by a seasonal creek, and are not associated with controlled stratigraphic excavations. Scraggy Point is the only excavated site on Hinchinbrook Island, and while dating inversions were reported, it appears the site was occupied in the past 400–500 years, with evidence for exploitation of molluscs, fish, and turtle (Campbell 1982b). Beaton (1985) initially investigated offshore island use on Stanley Island at Yindayin rockshelter, reporting the earliest evidence of site occupation at ~2500 cal BP, with cultural materials, including molluscs, fish, turtle, wallaby remains, and flaked shell (*Geloina coaxans*) (see Harris et al. 2017). The site was re-excavated in 2016 and generated a new basal date of 6286 cal BP (Wright 2018). Presently only detailed molluscan analyses are available, but evidence suggests an initial phase of low intensity site occupation, followed by a 3000 year hiatus in site use until 2938 cal BP, and occupation through to 2083 cal BP when the site was abandoned until the recent past (~0–172 cal BP). This period of site abandonment corresponds with occupation of the Princess Charlotte Bay chenier plain on the adjacent mainland, and the peak in *Tegillarca granosa* mound building at ~1000 cal BP (Beaton 1985). The most recent phase of site occupation at Yindayin rockshelter is associated with the highest concentration of cultural material discard, with a notable shift from hard substrate dwelling molluscan species (e.g. *Nerita* spp.) to mangrove species (*Terebralia* spp.) (Wright 2018). Similarly, Lizard Island has been a focus of archaeological interest since the initiation of island-focused research agendas in the wider Great Barrier Reef region during the mid-to-late 1970s (Beaton 1973; Specht 1978). Excavation efforts have primarily targeted Site 17 Freshwater Bay Midden (FBM, Lizard Island), and provided the earliest evidence for island use at 3656 cal BP, but with a notable increase in site use over the past 2000 years, particularly an expansion in the exploitation of marine resources (Lentfer et al. 2013; Mills 1992).

Significantly, the available archaeological evidence for the use of Lizard Island does not record an occupation hiatus between 2000 and 1000 cal BP, a regional trend that is well documented for the central and southern Great Barrier Reef, and most recently for the northern extent at Stanley Island (Barker 2004; Border 1999; Lentfer et al. 2013; McNiven et al. 2014; Mills 1992; Rowland 1996; Wright 2018). It is apparent that more records of Holocene Great Barrier Reef offshore island use are needed to facilitate both local and more nuanced regional models of change. Outcomes of previous Lizard Island archaeological investigations also suggested that further excavations were required to explore variability in the occupation history of the Lizard Island Group, particularly forager decision-making and landscape use through time. Here we present the outcomes of the Site 3 Mangrove Beach Headland Midden (MBHM), Lizard Island excavations, detailing the broader palaeoenvironmental context and variability in the Late Holocene occupation of the site. Results have implications for understanding the timing and use of offshore islands, increasing the limited records available from northeast Australia, and enhancing our ability to consider the dynamics of island occupation along the Great Barrier Reef during the Holocene.

Lizard Island Group

Environmental Context

There is variability in the width of the continental shelf along the length of the Great Barrier Reef, and as such, the impacts of Mid-to-Late Holocene sea-level changes were not consistent in this region. The timing and magnitude of these changes in sea-level between the inner/coastal reefs and the outer reefs are still widely debated, and further emphasise the need for locally specific sea-level curves to assess the influence of these changes on offshore island occupation and use (Chappell et al. 1983; Lewis et al. 2013; Nakada and Lambeck 1989). With Early Holocene rising sea-levels, Lizard is estimated to have become an island around 10,000 cal BP (Lewis et al. 2013; Williams et al. 2018), which is further supported by the Early-to-Mid-Holocene establishment of mangrove forests and contraction of near-coastal palm and grass-dominated vegetation documented during this period (Proske and Haberle 2012). The available sea-level indicator data derived from oyster and microatoll evidence from Lizard Island and the broader region suggests a 0.5 to 1.0 m high-stand between 6500 and 2300 cal BP (Chappell et al. 1983; Wright 2011; Zwartz 1995). The high-stand was potentially 0.5 m lower than has been recorded at coastal sites due to hydro-isostatic influences (Lambeck and Nakada 1990; Lewis et al. 2013). Rapid sea-level fall to modern levels along the northeast Australian coastline between 1200 and 800 cal BP were documented using modern and fossil oysters, but it is currently unknown as to whether this fall was stepped or smooth (Lewis et al. 2015).

Today the northern Great Barrier Reef is characterised by a continuous line of ribbon reefs that are situated on the shelf edge and enclose a narrow (~50 km) and shallow (<40 m in depth) continental shelf (Orme and Flood 1977; Rees et al. 2006). The region is unique in the wider Great Barrier Reef region due to the prominent north-south trending line of granite/continental islands (Lizard Island Group, North Direction Island, and South Direction Island). The islands are mapped as Finlayson Granite of Permian age (Lucas 1965), but more recent work has suggested that some of the granite may be of Triassic age (Tochilin et al. 2012).

The Lizard Island Group is situated 33 km off the coast of Cape Flattery, 93 km northeast of Cooktown, and only 16 km from the outer barrier reef and the edge of the continental shelf. The group comprises Lizard Island (highest elevation 395 m above present sea-level, ~10 km^2 in area), the largest island, and the adjacent Palfrey Island, South Island, Osprey Islet, and Bird Islets, all linked by an expansive fringing reef that encloses a deep lagoon (~10 m), which developed during the Holocene. At the northeast extent of the lagoon there is a 90 m-wide channel, which facilitates tidal flushing, with daily ranges from ~3 to 0.3 m (Kinsey 1979; Rees et al. 2006). Eagle Island is several kilometres to the west of Lizard Island and is an important seabird breeding habitat (Smith and Buckley 1986; Smith 1987). Southeast trade winds (~15–30 knots) predominantly blow through much of the year between March and September, and strongly influence the direction of water currents and benthic community structure.

The reef platform around Lizard Island is 16.7 km^2 in area, with many reefs in the lagoon rising steeply from ~20–30 m in depth to form a distinct reef crest, expansive reef flat, back reef, and subside back to an intra-reefal lagoon (Madin et al. 2006). The outer reef slope and crest are dominated by live coral, and this forms a continuous coral band along the outer margin of the barrier and fringing reef system (Hamylton et al. 2014; Saunders et al. 2015). Reef development is the most extensive on the windward margin in the southeast – from South Island across to Bird Islets and adjacent to Coconut Beach – in contrast, patch reefs dominate the western margin of the reef platform (e.g. Watson's Bay, Mermaid Cove). The reef flat adjacent to Mangrove and Trawler Beaches – in proximity to Site 3 MBHM – is characterised by low density seagrass (e.g. *Halodule uninervis* and *Thalassia hemprichii*), coral, and sparse rubble and algae on sand, and the lagoonal areas are predominantly sand, but with sparse coral patches, rubble, and algae (Hamylton et al. 2014; Saunders et al. 2015). These marine habitats support diverse faunal communities, including small reef fish such as damselfish (pomacentrids), wrasse (labrids), parrotfish (scarids), and sharks (e.g. black tip reef shark, *Carcharhinus melanopterus*) (Frisch et al. 2016; Goatley and Bellwood 2012; Leis 1986). Seagrasses provide important grazing habitats for green sea turtles (*Chelonia mydas*) and dugong (*Dugong dugon*). Infrequent nesting of turtles on Lizard Island has been observed (Goatley et al. 2012), and dugong feeding trails have been documented adjacent to Mangrove Beach (McKenzie et al. 1997). Dominant molluscan species include clams (e.g. *Hippopus hippopus* and *Tridacna* spp.), oyster (Ostreidae), cone snails (Conidae), conchs (Strombidae), and nerites (Neritidae) (Alder and Braley 1989; Robertson 1981).

Thirteen distinct vegetation communities have been characterised on Lizard Island. The landscape is dominated by *Themeda* grassland, and a complex of low vine forest and eucalypt woodland, dominated by *Eucalyptus tessellaris* (Byrnes et al. 1977; Lentfer et al. 2013). The region adjacent to Site 3 MBHM consists of a mosaic of plant communities. A small patch of mangrove trees (*Rhizophora stylosa*) has established around the rock headland between Mangrove and Trawler Beaches, grasslands cover the valleys and granitic hills (*T. australis* and *Arundinella nepalensis*) merging with shrub-dominated heathland (*Thryptomene oligandra* and *Acacia humifusa*). The southwest extent of Mangrove Beach is comprised of a woodland dominated by *Eucalyptus tessellaris* and *Acacia crassicarpa* (Byrnes et al. 1977).

No medium-to-large bodied mammals have been recorded on the island, but small mammals are the black flying fox (*Pteropus alecto*), dusky leaf-nosed bat (*Hipposideros ater*), and two rat species (*Hydromys chrysogaster* and *Melomys capensis*). It is believed that *H. chrysogaster* is a more recent introduction in the last decade, and *M. capensis* is a previously unrecorded native rat species (Bryant 2013; Reef et al. 2014). Reptiles (snakes and lizards), including the large yellow-spotted monitor (*Varanus panoptes*), are found on Lizard Island (Llewelyn et al. 2014). Birds (land and shore birds) include a variety of resident and visiting species that occupy diverse habitats (Smith 1987).

Permanent freshwater is available on Lizard Island, historically documented by Captain James Cook on the northern extent of Watson's Bay where water was collected from a creek (Beaglehole 1962). This, now brackish, water source flows into the sea at the southern end of the beach. Today freshwater is pumped from two bores situated in the pandanus swamp inland from Watson's Bay. Freshwater is also accessible from springs on the island interior and rim, including Mangrove Beach (Lentfer et al. 2013; Mills 1992).

Ethnographic and Archaeological Context

Lizard Island is known as *Jiigurru* or *Walmbaar* by the Dingaal traditional owners (Lentfer et al. 2013; Phillip Baru, Dingaal elder, pers. comm., 2020). Dingaal elder, Gordon Charlie, characterised Lizard Island as a highly significant place. The island was the site of initiations, intergroup gatherings, judicial deliberations, and a place for knowledge to be passed down from the 'clever men' to young males (Lentfer et al. 2013; Mills 1995a). When young males were initiated, these visits were usually for several months, indicating that in the recent past Lizard Island may not have been permanently occupied. Phillip Baru (pers. comm., 2020) described the Dingaal people travelling to Lizard not only for initiation, but also to access foods such as wild yam, shellfish, fish, and turtle. In 1770 and 1848, structures ('huts') were observed by early European explorers on Lizard Island, along with hearths, and scatters of shellfish, fish and turtle remains (Beaglehole 1962; Macgillivray 1852). Cook also observed canoes, and based on the description these were likely dugout canoes (Beaglehole 1962; Lentfer et al. 2013; Mills 1992). Macgillivray (1852) documented the expansiveness of the reef adjacent to Eagle Island, particularly noting the extensive shellfish populations, and describing evidence of what was believed to be 'turtle feasts'.

Ethnohistoric, ethnographic, and archaeological evidence supports the movement and interaction of Aboriginal people and Torres Strait Islanders along the northeast coast of Queensland as far south as Lizard Island. These interactions are thought to be part of an expansive seascape that linked communities from the Gulf of Papua and northern Queensland, termed by McNiven et al. (2004:284) the Coral Sea Cultural Interaction Sphere (see also Barham 2000; Haddon 1935; Laade 1969; McCarthy 1939; McNiven 2015, 2019; McNiven et al. 2004; Moore 2000; Rowland 1987). There have been reports of Torres Strait Islanders from Warraber and Poruma Islands (Central Islands) sailing some 600 km southeast to Lizard Island to source 'clubstone' for trade with Mer (Eastern Islands) (Laade 1969). Furthermore, pottery finds on the southern coast of Papua New Guinea dating ~2600–2900 years ago (David et al. 2011; McNiven et al. 2011), and in Torres Strait dating ~2500 years ago (McNiven et al. 2006), have led to the consideration of possible Melanesian cultural influences along the east coast of Australia (McNiven et al. 2011). The recovery of pottery sherds of possible Melanesian origin during multiple seasons of excavation (2009, 2010, and 2012) at the Mangrove Beach Intertidal Site on Lizard Island (Lentfer et al. 2013; Tochilin et al. 2012) potentially provides supporting evidence for these influences.

Archaeological research was first conducted on Lizard Island as part of broader survey efforts targeting islands and cays of the northern Great Barrier Reef. Beaton (1973) surveyed the central saddle region of Lizard Island and the south-facing dunes, all in the relative vicinity of the modern airstrip, most notably documenting a large midden deposit that contained numerous molluscan taxa and quartz artefacts. Specht (1978) conducted a more extensive survey of Lizard Island several years later to determine the viability of a dedicated archaeological study of the region, and recorded several additional middens and stone arrangements, including Site 3 MBHM and Site 17 FBM. Situated on the southern extent of the island, adjacent to Freshwater Beach, and on the access road to the Lizard Island Research Station, Site 17 FBM was excavated initially by Mills (1992) and most recently by Lentfer et al. (2013). Excavations of Site 17 FBM indicate Lizard Island was first occupied by 3656 cal BP, with an increase in the intensity of site use at ~1725 cal BP and through to the recent past, as evidenced by increased discard rates of quartz artefacts and marine faunal remains (molluscs, fish, turtle, and dugong) (Lentfer et al. 2013; Mills 1992). Additionally, Mills (1992, 1995a, 1995b) conducted comprehensive surveys of Lizard Island, recording 21 middens, four stone arrangements, and two art sites. One of these arts sites – Site 18 Gecko Shelter – situated at the southern extent of Cook's Look at the base of the ridge on a densely vegetated boulder slope was excavated, and returned limited cultural material, but Mills (1992) hypothesised this site may have been more recently utilised as a lookout to Watson's Bay to observe European activity in the region.

Since 2012, successive field seasons directed by Ulm and McNiven have been conducted in collaboration with Traditional Owners, and include extensive survey of Lizard, Palfrey, South, and North Direction Islands, recording of stone arrangements (Fitzpatrick et al. 2018) and art sites (Arnold 2020), and excavations on South Island and in the lagoon itself. This research program will be comprehensively reported elsewhere.

Site 3 Mangrove Beach Headland Midden

Site 3 MBHM is a large, stratified shell midden situated on the headland between Mangrove Beach (a sheltered lagoonal embayment) and Trawler Beach on the southern coast of Lizard Island (Figures 2-4). The site was approximately 2250 m^2 in area in 2013, which was significantly larger than originally recorded by Specht (1978) who documented an area of 75–100 m^2 and later by Mills (1992) who estimated the site to be ~300 m^2 in area. The expansion in recorded site size over the past several decades may be indicative of recent cyclonic activity and erosional processes increasingly exposing the subsurface deposit. The surface of the site is currently characterised by the shells of molluscs such as *Conomurex luhuanus*, *Tridacna* spp., *Lambis* spp., and Tegulidae (Appendix A), and by quartz artefacts, and granite cobbles (Figures 5-6).

Excavation of a single 1 m x 1 m unit (Square A) was undertaken between 5 and 26 May 2013. The square was oriented north and positioned on the area of highest density shell exposure at the top of the ridge overlooking Mangrove Beach. A local datum was established to facilitate mapping

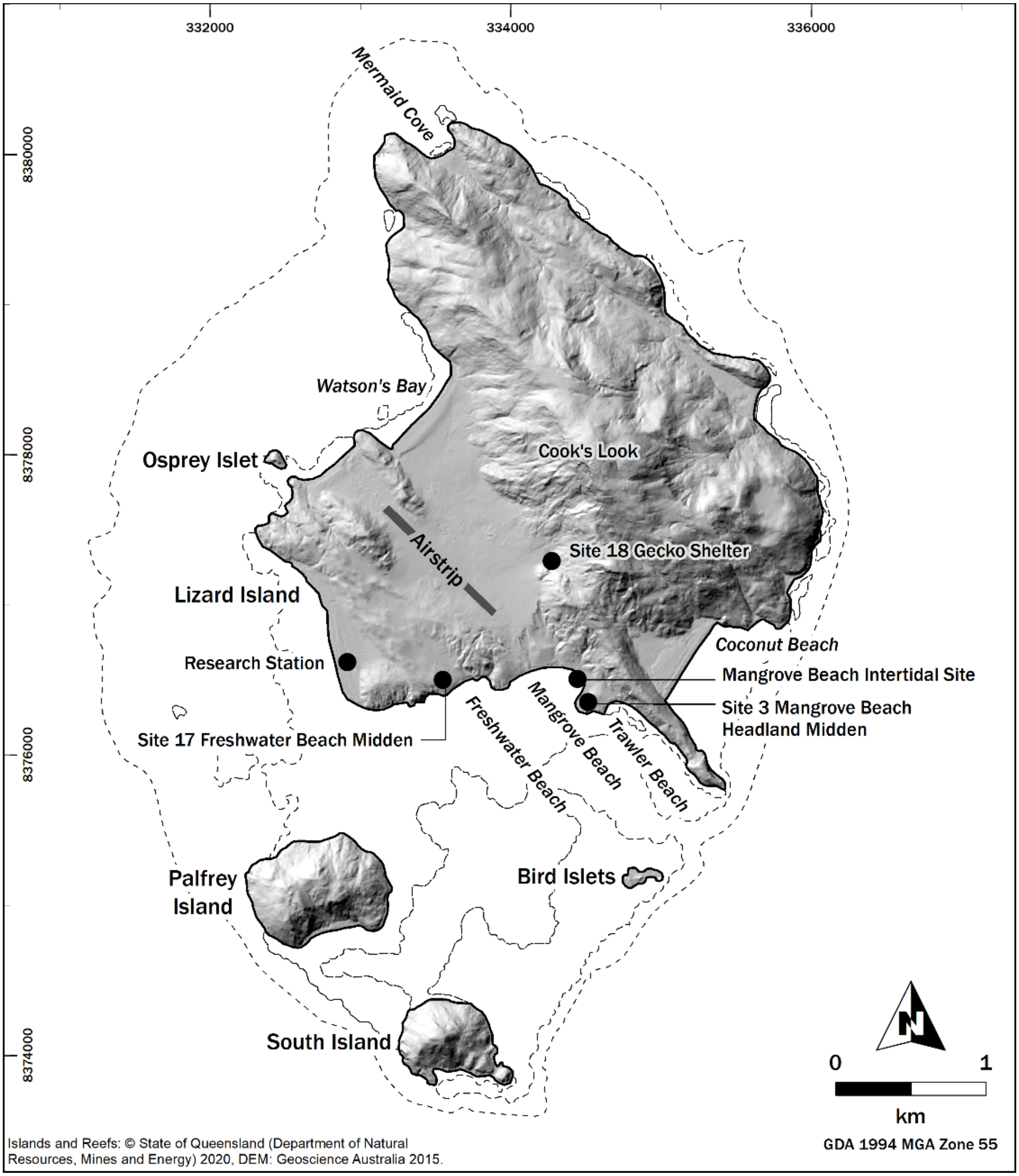

Figure 2. Lizard Island Group, showing the location of Site 3 Mangrove Beach Headland Midden (MBHM) and other archaeological sites and places mentioned in text. The dotted line shows the extent of the reef platform.

Figure 3. Topographic site map showing the location of Site 3 Mangrove Beach Headland Midden, Square A.

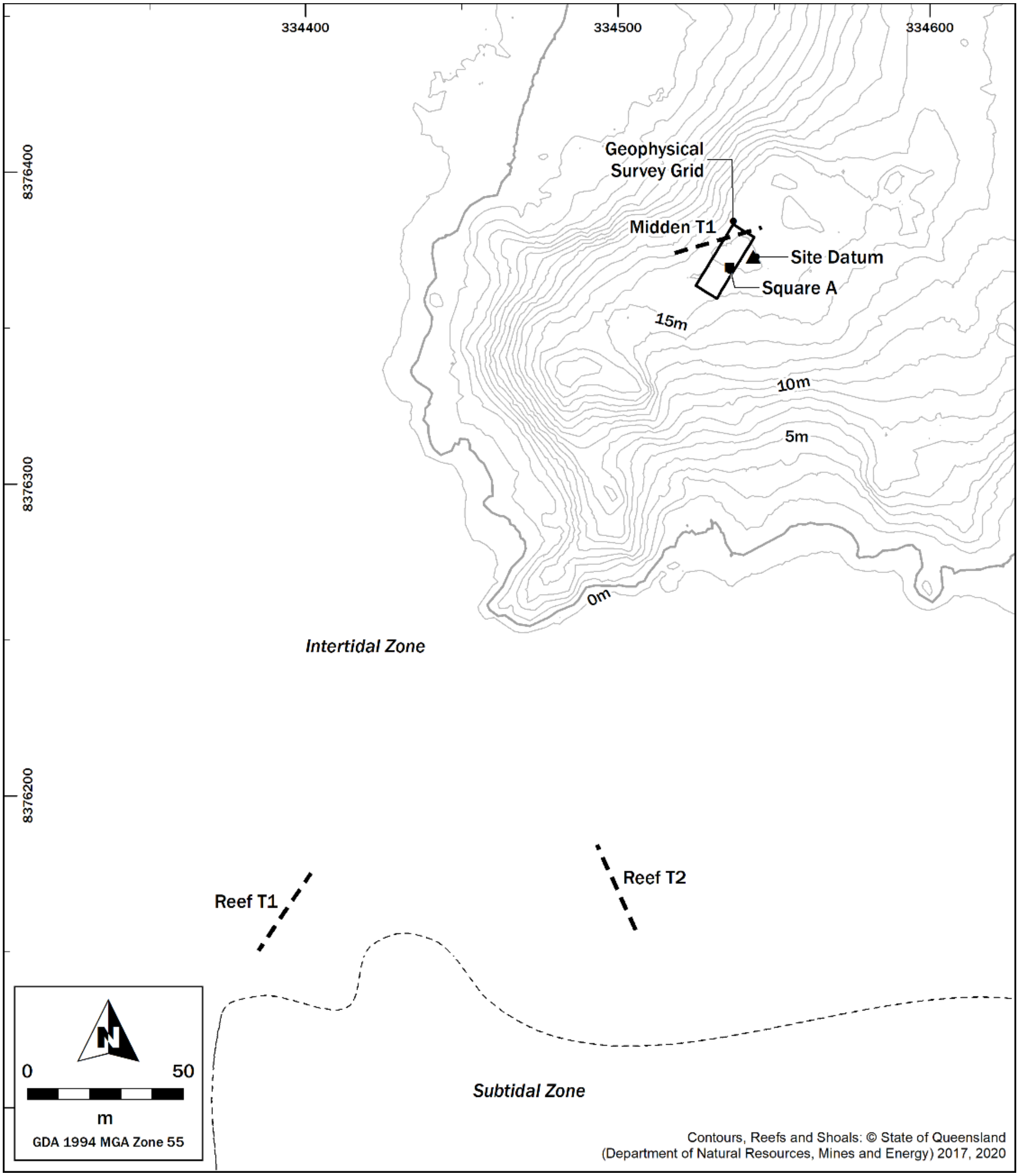

Figure 4. Topographic site map showing location of Site 3 Mangrove Beach Headland Midden, Square A in relation to the site datum, geophysical survey grid, and *T. maxima* transect surveys (Midden T1, Reef T1, and Reef T2). Transect Centrelines were used for the Midden T1, Reef T1, and T2 transects.

Figure 5. Site 3 Mangrove Beach Headland Midden (indicated by circle), looking towards the expansive reef and South Island (left) and Palfrey Island (right) in the background, facing southwest (Photograph: Sean Ulm, 2013).

Figure 6. Site 3 Mangrove Beach Headland Midden, looking towards Mangrove Beach, showing excavations in progress, end of XU1 (Square A in foreground), facing west-southwest (Photograph: Ian McNiven, 2013).

and to record elevations during excavation. Square A was excavated in 59 arbitrary excavation units (XUs), within stratigraphic units (SUs), avoiding mixing between SUs within the same XU where possible. The XUs averaged 2.53 cm in thickness, and excavations ceased at a maximum depth of 151.74 cm. Using an automatic level and stadia rod, elevations (four corners and centre-point) were recorded at the start and completion of each XU. Finds recovered in situ were recorded three-dimensionally and assigned both an object and field specimen number (see Appendix I). The weight (to the nearest 0.1 kg) and volume (to the nearest 0.5 L) of material recovered from each XU was measured. All excavated material was dry-sieved through 2.36 mm mesh in the field, and this retained material and a 100 g sieved sediment sample collected for each XU, were assigned individual field specimen numbers. Using dry sediments in the field, both pH readings and soil colour (classified using Munsell Soil Color® Charts) were recorded for each XU. Plan view photographs were captured at the completion of each XU. Excavated section walls were drawn and photographed when excavations were completed. A total of 2211.7 kg of material was excavated from Square A with a corresponding volume of 1897.9 L. Square A was backfilled with the sieved sediments from the spoil heap located 10 m northeast of Square A.

Stratigraphy, Cultural Deposit, and Preservation

The cultural deposit extended to approximately 100–110 cm below surface. Overall, the deposit was of low density consisting primarily of molluscs and artefactual stone, but also bone and charcoal (Figures 7-8). Square A comprised six SUs (Table 1; Figure 9), which generally consisted of loosely consolidated sands, with numerous roots, and a decreasing proportion of coarse-grained sediments with large visible quartz grains associated with the most recent deposits. The densest concentration of mollusc shell was recovered from the upper section of the deposit, down to a depth of ~30 cm below the surface (SUs 1–3), whereas artefactual stone was recovered throughout the sequence down to a depth of ~115 cm below the surface (SUs 1–5). The lowest 3D-plotted stone artefact was recovered from the top 5 cm of SU6, but the lowest artefact was recovered from 15 cm below the SU5/6 boundary. The SU5/6 boundary is diffuse, indicating that there was some movement of sediments from the lower part of SU5 to the top 15 cm of SU6. No cultural materials were observed in undisturbed SU6 sediments during excavation.

Aside from root growth, there was limited evidence of bioturbation documented during excavation (i.e. no indication of lizard burrows or extensive insect activity). There was good preservation of faunal remains in the top section of the deposit down to ~30 cm below the surface, particularly of mollusc shell, but small fish bones were also recovered, though they were highly fragmented. The increasingly acidic sediments with depth, particularly in SUs 5–6 (and the lower part of SU4), may account for the reduced representation of bone and mollusc shell in the earliest deposits, especially given stone artefacts were recovered well below the deepest faunal remains. Furthermore, pollen was only preserved in the top section of the deposit, specifically from sediments down to a depth of ~18 cm below surface (SUs 1–2). Evidence at the site for the most intensive stone artefact discard does correspond with the highest density of recovered mollusc shell and bone down to a depth of ~30 cm below surface (SUs 1–3).

These trends may indicate a combination of factors influenced discard and preservation of cultural materials through time at the site. For instance, poorer preservation of organics in the earliest occupation phases (SUs 4–5) may be due to comparatively more acidic sediments, which could indicate an underrepresentation of faunal remains associated with initial site use. Factors such as the presence of coarse sedimentary particles and the exposed nature of the site may also have influenced pollen preservation. Conversely, these observed changes in the deposition of cultural materials may relate to specific changes in site use and discard patterns through time, such as an increase in the intensity of occupation at the site. While poor preservation of faunal remains in the lower levels of Square A is a possibility, broader trends in the discard rates of cultural materials suggest these observed changes are probably a result of increased site use during the most recent phase of occupation.

Radiocarbon Dating and Chronology

Fourteen radiocarbon determinations were obtained using charcoal plotted in situ during excavation of the site (n = 8) and *Anadara antiquata* specimens (n = 6) collected from across the surface of the site (Table 2). The samples were processed at the University of Waikato Radiocarbon Dating Laboratory. Radiocarbon ages were calibrated using OxCal 4.1.3 (Bronk Ramsey 2009) and the IntCal13 calibration dataset for charcoal samples, and the Marine13 calibration dataset for marine shells (Reimer et al. 2013), using a ΔR of 12 ± 10 ^{14}C years (Ulm 2006). All calibrated ages are reported at the 95.4% probability distribution.

Dates for the surface of the site are tightly constrained, ranging from 580 to 530 cal BP. In Square A, dates range from 680 cal BP in XU3 to 4040 cal BP (charcoal) in XU44. The base of the cultural deposit is around the interface of SUs 5 and 6, with the stone artefact recovered from XU45 (upper half of SU6) the earliest evidence of cultural activity at the site, suggesting basal cultural material at the site dates to shortly before ~4000 cal BP. The site appears to not to have been used in the last 500 years, except for some metal fragments recovered near the surface that are attributed to recent tourist visitation. Age-depth relationships between and slightly beyond these radiocarbon ages were used to define 250-year analytical units between 0 and 5000 cal BP.

Analytical Methods

Geophysical Survey

A combination of ground-penetrating radar (GPR) and magnetic gradiometry were employed to conduct geophysical surveys at Site 3 MBHM in 2018. Magnetic gradiometry measures the strength or alteration of the Earth's magnetic field across a targeted area, and can locate iron-rich material below the ground surface, including burnt features, metal, and iron-rich soil (Aspinall et al. 2008; Clark 1996; Gaffney and Gater 2003; Witten 2006). GPR transmits electromagnetic energy in the form of radar waves into the ground, and when these waves encounter differences in the soil (e.g. air voids, stone, or a differential moisture content), a reflection occurs, which is received and recorded (Bevan 1998; Conyers 2009, 2012). GPR was selected as it provides both horizonal and vertical spatial information and facilitates the production of three-dimensional images of the subsurface. It was anticipated that GPR would potentially identify the depth of the buried shell deposits and the underlying bedrock.

Figure 7. Site 3 Mangrove Beach Headland Midden, Square A at end of excavation, plan view, facing north (Photograph: Ian McNiven, 2013).

Figure 8. Site 3 Mangrove Beach Headland Midden, Square A at end of excavation showing Stratigraphic Units (SUs), facing north (Photograph: Ian McNiven, 2013).

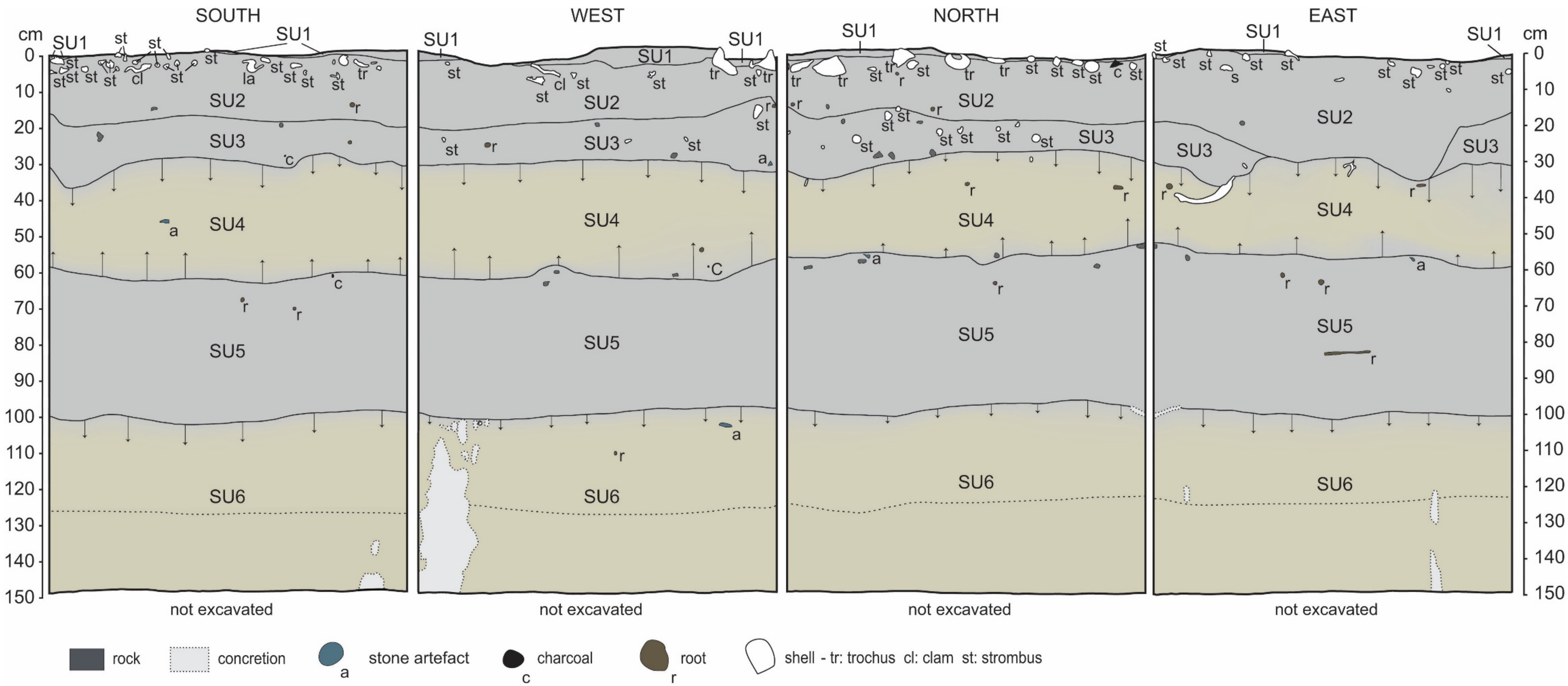

Figure 9. Section drawing of Site 3 Mangrove Beach Headland Midden, Square A, divided into six Stratigraphic Units (SUs) (Original section drawing by Ian McNiven and Sean Ulm, 2013).

Table 1. Stratigraphic Unit (SU) descriptions, Site 3 Mangrove Beach Headland Midden, Square A.

SU	Description
1	Loosely consolidated yellow-brown (10YR 4/6) fine sands, surface grasses and rootlets. Shellfish dominated by *R. nilotica* and *C. luhuanus*. SU1 is 0–4 cm below the surface and the interface with SU2 is abrupt and distinct. Sediments are alkaline (9.0 pH).
2	Partly consolidated brown (10YR 4/6-4/3) fine sands. Numerous fibrous rootlets and occasional larger roots up to 5 mm in diameter. High concentration of shell between 1 cm and 6 cm below the surface comprised of *Tridacna* spp., *R. nilotica,* and *C. luhuanus*. SU2 is 1–35 cm below the surface and the transition to SU3 ranges from distinct to diffuse. Towards the centre of the east section SU2 sediments appear to directly rest on the surface of SU4 sediments. Some mottling of grey sands. Sediments are neutral (6.0–7.5 pH).
3	Darker brown (10YR 4/3-4/4) partly consolidated fine sands. An increase in shell comprised predominantly of *C. luhuanus*. Fewer fibrous roots compared to SU2. Occasional larger roots up to 5 mm in diameter continue. SU3 is 12–37 cm below the surface and the transition to SU4 is reasonably distinct; however, some diffusion of SU3 sediments into the upper sections of SU4. Sediments are neutral-acidic (5.5–7.5 pH).
4	Lighter grey-brown (10YR 3/3-5/3). A little less consolidated than SU3. Fine sands, but with occasional coarse fraction with larger quartz grains visible. Scattered small roots, but some larger roots >1 cm in diameter. Interface with SU5 is reasonably distinct; however, there is some penetration of the darker sediments of SU5 into the lower part of SU4. The unit is 27–64 cm below the surface with only a few *R. nilotica* in section of SU4. Patches of light grey and yellow sand mottling. Sediments are neutral-acidic (5.5–6.0 pH).
5	Darker brown (10YR 4/3-5/3), but grades with depth to a slightly lighter coloured sediment. Scattered roots >1 cm in diameter. Fine sediments but with a coarse-grained fraction. The coarse fraction has a higher density in the lower 10 cm of the unit. No shellfish in section. Occasional nodules of degrading granite. SU5 is 52–103 cm below the surface and the interface with SU6 is diffuse. Sediments are neutral-acidic (5–6.5 pH).
6	Yellow-brown sands (10YR 5/3-6/6), but heavily mottled in the lower half with patches of yellow and fine, white sands. Some penetration of coarse-grained sediments from the basal part of SU5 into the top 5 cm of SU6. Partly consolidated orange sandstone/ironstone concretions common in lower half. Occasional roots >1 cm in diameter. Lowest plotted artefact in east section at the top of SU6, but in mixing interface zone with SU5. SU6 is c. 96–125 cm below the surface. No cultural materials were observed in undisturbed SU6 sediments during excavation. Sediments are acidic (4.5–5.5 pH).

Table 2. Radiocarbon determinations for Site 3 Mangrove Beach Headland Midden, Square A. Dates were calibrated using OxCal 4.1.3 (Bronk Ramsey 2009). For wood charcoal dates, the IntCal13 calibration dataset was used and for marine shell, the Marine13 calibration dataset (Reimer et al. 2013), with a ΔR of 12±10 ^{14}C years for marine samples (Ulm 2006). Calibrated ages are rounded to the nearest 10 years. Note the *A. antiquata* samples were collected from the surface of the site beyond Square A. AMS= Accelerator Mass Spectrometry. LSC=Liquid Scintillation Counting.

Lab. No.	SU	XU	Depth (cm)	Sample	Method	δ^{13}C (‰)	^{14}C Age (years BP)	Calibrated Age BP (95.4% Prob.)	Median Calibrated Age BP
Wk-37131	-	-	0	*A. antiquata*	AMS	1.7±0.1	948±25	490-610	530
Wk-37132	-	-	0	*A. antiquata*	LSC	1.7±0.1	965±27	500-620	550
Wk-37129	-	-	0	*A. antiquata*	AMS	1.7±0.1	981±25	510-620	560
Wk-37133	-	-	0	*A. antiquata*	LSC	1.8±0.1	985±30	510-630	570
Wk-37128	-	-	0	*A. antiquata*	LSC	0.6±0.1	1002±31	520-640	580
Wk-37130	-	-	0	*A. antiquata*	AMS	1.8±0.1	1008±25	530-640	580
Wk-38696	2	3	5.1-7.5	charcoal	AMS	-	747±21	670-720	680
Wk-38697	3	10	23.3	charcoal	AMS	-	1836±21	1710-1820	1770
Wk-38698	4	16	39.9	charcoal	AMS	-	3144±22	3270-3440	3370
Wk-38699	4	20	50.0	charcoal	AMS	-	3151±21	3280-3450	3380
Wk-38700	4	24	60.6	charcoal	AMS	-	3149±21	3270-3450	3380
Wk-38701	5	27	66.4	charcoal	AMS	-	3148±21	3270-3450	3380
Wk-38702	5	30	72.4	charcoal	AMS	-	3136±22	3260-3440	3370
Wk-38703	6	44	108.8	charcoal	AMS	-	3689±21	3930-4090	4040

The survey grid was 8 m x 20 m for the magnetic gradiometer and extended to 8 m x 23 m for the GPR (Figure 4). The magnetic gradiometer data were collected using a Bartington Instruments Fluxgate Grad601-2. This instrument utilises two pairs of magnetometers that are stacked vertically 1 m apart to provide a measure of the magnetic gradient at each measuring station. Gradiometers record very subtle (0.1 nT) fluctuations in the local magnetic field. The instrument was set up to record data eight times per metre with 0.5 m spaced survey transects (16 samples/m^2). Data were processed using TerraSurveyor version 3.0.25.1. Processing was limited to de-striping to remove abnormal high/low readings, high-pass filtering, and interpolation to equalise pixel size to 0.125 m by 0.125 m. The processed data were exported and imported into Surfer for cartography.

A Geophysical Survey Systems, Inc. (GSSI) SIR-3000, 400 MHz antenna and a model 620 survey wheel were used to collect the GPR data. Sixteen-bit data were collected with a 40 nS time window, 512 samples/scan, and with 25 scans/metre. Transects were spaced every 0.5 m. Using GPR-SLICE v7.0, data were processed (time zero correction, background removal and bandpass filter) and converted into amplitude slice-maps and reflection profiles. A constant velocity (m/nS) model was used in the hyperbola search menu. The hyperbola fitting function estimated the relative dielectric permittivity, which is calculated from the two-way travel time to depth, and this facilitated the production of time slices and provided an estimated depth of the data (Goodman and Piro 2013; Jacob and Urban 2015). These generated depth estimates were compared to the excavation data to create amplitude slice-maps. An overlay analysis computed in GPR-SLICE (see Goodman and Piro 2013) using depths from 28–59 cm was also created to highlight the anomalies across the site by depth. This supports interpretation of the reflection features as the amplitude slice levels are overlaid to show the strongest reflectors at specified depths.

Laboratory Protocols

Sediment samples were collected from each XU ($n = 59$) and sent to the University of Queensland for analysis of magnetic susceptibility, identification of pollen/spores, and assessment of micro-charcoal concentration throughout the sequence. All dry-sieved residues were transported to the James Cook University (JCU) Tropical Archaeology Research Laboratory (TARL) for analysis. Each XU was wet-sieved through 2.36 mm mesh, air-dried, and sorted into major categories – mollusc, bone, charcoal, coral, other organic (i.e. non-carbonised roots, litter, seeds, and insect remains), metal, pumice, non-artefactual stone, artefactual stone, and ochre. Specialist analysis was conducted on all recovered materials and sediments, and detailed analytical protocols are outlined below.

Magnetic Susceptibility Analysis

Magnetic susceptibility is the degree to which magnetisation can be induced in a sample in the presence of a magnetic field (Dalan et al. 2017; Thompson and Oldfield 1986). Cultural and natural processes have the capacity to modify magnetic mineralogy, for example, the influence of fire, pedogenesis and chemical weathering (Dalan and Banerjee 1998; Ellwood et al. 1997; Herries and Fisher 2010; Linford et al. 2005). People tend to influence magnetic mineralogy through increased inputs of organic matter and the exposure of soils to high temperatures through burning events (Mullins 1974). In an archaeological context, soil magnetic susceptibilities tend to be enhanced and at the site-level as variability between site features and occupation layers can be observed; consequently, this technique is valuable for assessing changes in landscape use through time (Dalan et al. 2017; Tite and Mullins 1971).

All XU sediment samples ($n = 59$) from Square A were packed in small non-magnetic Althor P-15 boxes (5.28 cc volume). Magnetic susceptibility measurements were recorded using a Bartington MS2B dual frequency sensor. Repeat measurements were recorded for each sediment sample and averaged. Mass (χ) and volume (κ) low-field magnetic susceptibility measurements were recorded, as well as the frequency dependence of susceptibility (χ_{fd}) for each sample. Frequency dependence is the percent difference in susceptibility measured at 460 Hz (χ_{lf}) and 4600 Hz (χ_{hf}) frequencies, and is expressed as a relative loss of susceptibility ($\chi_{fd} = \chi_{lf} - \chi_{hf}$) or percentage loss of the low frequency value ($\chi_{fd}\% = 100\times[\chi_{lf} - \chi_{hf}/\chi_{lf}]$) (Dearing et al. 1996; Maher and Taylor 1988). Calculation of χ_{fd} and χ_{fd} (%) track the content of ultrafine or superparamagnetic (SP) grains (>0.03 μm), which are useful for documenting burned or well-developed soils (Dalan and Banerjee 1998; Dearing et al. 1996).

Pollen and Micro-Charcoal Analysis

Pollen, spore, and micro-charcoal samples from Square A comprised 1 g of sediment from the <2.36 mm fraction collected per XU.

Sample preparation followed techniques developed by van der Kaars (1991) and detailed in Moss et al. (2019). Chemical and sieving preparations were selected to disaggregate then progressively remove bulk sand/gravel, separate organic from inorganic (mineral) fine-fractions, and finally stain the pollen/spores (combining Sodium pyrophosphate, 180-μm and 8-μm screen mesh, heavy liquid treatment, and Acetolysis treatments). *Lycopodium* spike additions served relative concentration calculations of both pollen/spores and micro-charcoal. All samples were mounted in glycerol and examined at ×400 using a Leica compound light microscope. The pollen sum consisted of two completely counted slides, while the charcoal analysis involved counting all black angular fragments >5 μm along three evenly spaced transects across all XUs. The results of the palynological and charcoal analysis are presented graphically using the TGView software (Grimm 2004).

Faunal Identification and Quantification Protocols

Fish, turtle, and molluscan remains were identified to the lowest taxonomic level using comparative collections housed at the JCU TARL (see Tomkins et al. 2013, for a description of the fish reference collection, but note that additional specimens have since been added). Reference manuals were also used for molluscan (Carpenter and Niem 1998; Eichhorst 2016; Hinton 1972; Huber 2010; Jarrett 2011), fish (Bellwood 1994; Bellwood and Schultz 1988; Berkovitz and Shellis 2016), and turtle (Wyneken 2003) identifications. All bone and mollusc fragments were considered for taxonomic identification, with genus- and species-level identifications assigned conservatively to avoid over-identification (Harris et al. 2016; Wolverton 2013). All faunal remains were quantified using number of identified specimens (NISP), minimum number of individuals (MNI), and weight (g). For vertebrate remains, MNI values were calculated following standard zooarchaeological protocols (Grayson 1984; Lambrides and Weisler 2016; Lyman 2008; Reitz and Wing 2008) and for molluscs following Harris et al. (2015). An MNI of 1 was assigned in the absence of an NRE to indicate presence only when the specimen was taxonomically identifiable and the effects of aggregation could be avoided (e.g. Attenbrow 1992; Faulkner et al. 2019; Giovas 2009; Jerardino and Marean 2010). The adoption of these quantification methods allows direct comparison between vertebrate and invertebrate taxonomic abundance data as MNI values were consistently calculated using the most frequently occurring non-repetitive element (NRE) according to periodised 250-year time intervals.

For the mollusc assemblage taxonomic heterogeneity was measured using NTAXA, Shannon–Wiener index of diversity (*H*'), Shannon's evenness (E), Simpson's dominance ($1 - D$), and Fisher's α. All measures were calculated using MNI values and were determined using mutually exclusive taxonomic categories (or non-overlapping taxa) in accordance with standard quantitative zooarchaeology protocols (e.g. Giovas 2018; Lyman 2008). See Faith and Du (2017), Harris and Weisler (2018), Lambrides et al. (2018), Lyman (2008), Magurran (2004), and Smith and McNiven (2019) for definitions of terms and approaches for using these measures of taxonomic heterogeneity to analyse zooarchaeological assemblages. NTAXA values provide an assessment of taxonomic richness. High *H*' values broadly indicate greater species diversity and richness, with values generally falling below a theoretical maximum of 5. E and $1 - D$ values that are closer to 0 indicate an assemblage dominated by a single taxon, and rich and even assemblages will have values closer to 1 (Lyman 2008). Fisher's α provides an assessment of diversity that is independent of sample size by tracking taxa represented by single individuals, unlike NTAXA and Shannon's indices (Faith 2013; Hayek and Buzas 2010). Measures of taxonomic heterogeneity were not calculated for the fish and turtle assemblages due to insufficient sample sizes. All statistical analyses were completed using PAST, version 4.01 (Hammer et al. 2001).

Morphometric analysis of the dominant molluscan species was undertaken in a previous study, with lip thickness of *Conomurex luhuanus* ($n = 224$) and base diameter of *Rochia nilotica* ($n = 38$) measured to determine size-at-age habitat preferences (see Ulm et al. 2019 for a detailed description of the sample and analytical methods). The maximum shell length of *Tridacna maxima* specimens (left valve only) from both the archaeological deposit and a closely associated modern reef population were measured to provide a gross comparison of population age-structure of this species through time. See Chan et al. (2008:Figure 1) for an illustration of *Tridacna* spp. shell length landmarks. *T. maxima* specimens located on the surface of Site 3 MBHM and within a 30 m x 4 m transect (Midden T1) situated across the centre of the site were measured ($n = 74$) (Figure 4), as well as specimens recovered during the excavation of Square A ($n = 10$). During November, 2016, live *T. maxima* specimens ($n = 115$) located along the reef flat and situated near the southwest extent of the site were measured within two underwater transects (Reef T1 and T2) that were 30 m x 2 m in size. *T. maxima* sexual maturity can be indicated by a shell length of approximately 150 mm, however, in some instances maturity is reached when the individual is significantly smaller, and geography and local ecological factors have variable influences on maturation (e.g. Chambers 2007; Gilbert et al. 2006; Jameson 1976). Given most individuals will be sexually mature by 150 mm and larger, to be conservative, specimens with maximum lengths equal to or larger than 150 mm were categorised as adult, and those smaller than 150 mm categorised as juvenile. This approach facilitated a gross comparison between the representation of adult and juvenile *T. maxima* individuals in the sampled archaeological and modern reef populations.

Stone Artefact Analysis

All recovered stone artefacts were analysed. Attributes recorded – raw material, type (e.g. flake, core, etc.), fragment category (e.g. complete, left, right, distal, marginal, etc.) and flake dimensions (length, width, thickness, elongation, and angle) – were used to document changes in lithic discard rates and raw material usage through time at the site, following methods described by Clarkson (2007), McNiven et al. (2014), and O'Connor et al. (2014).

Results

Overall, 36.49 kg of material was retained in the 2.36 mm mesh sieve, which is 1.7% of the total recovered sediment and material excavated, broadly suggesting a low-density cultural deposit. See Appendix B for a summary of excavation data and retained materials. The assemblage was dominated by molluscan remains (55.1%, 20,101 g) and non-artefactual stone (43.1%, 15,719 g), with >2.0% of the deposit (673.47 g) comprising bone, charcoal, coral, other organic, metal, pumice, artefactual stone, and ochre. While the recovered stone artefacts weighed only 198.32 g, there were 333 individual artefacts identified, averaging 0.60 g each. The pumice (81.39 g) was examined for signs of cultural modification (e.g. grinding facets) and determined not to be culturally introduced into the site. Metal (3.47 g) was recovered from XUs 1 and 2 only (up to 5.1 cm below surface [cmbs], ~750–500 cal BP), suggesting some post-depositional disturbance at the surface of the site. This is consistent with the pollen and micro-charcoal records from the site, which indicate the possibility of missing sediments at the surface of the site. The entire assemblage was re-analysed for this study, and the results presented here supersede those in Aird (2014) and Ulm et al. (2019).

Geophysical Survey Outcomes

Gradiometer data revealed two magnetic anomaly types including a large positive (black) response in the northeast extent of the surveyed area, and a coupled positive and negative (white) response (Figure 10). The large positive anomaly was attributed to the metal star picket (site datum), which is located outside of the surveyed area, but still captured by the gradiometer. The coupled anomaly is a fragment of metal, and this is consistent with other metal fragments recovered from the site surface (XUs 1–2) during Square A excavation. The GPR data revealed several linear high-amplitude reflections throughout the survey area, most notably in those areas of the site that were topographically lower and towards the edges of the shell midden and surveyed area (Figure 10).

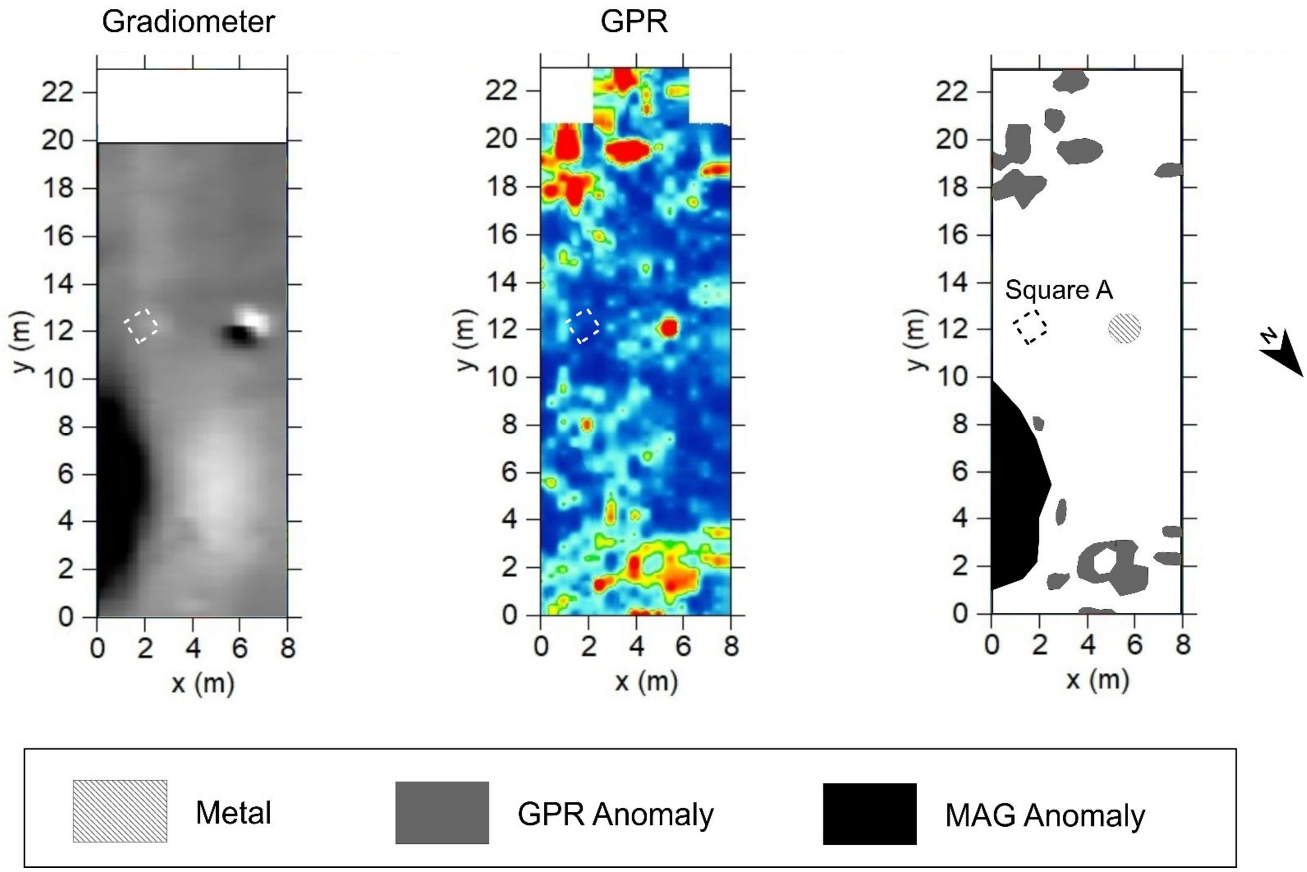

Figure 10. Magnetic gradiometer (left) and GPR (centre) datasets with the interpretations (right) for Site 3 Mangrove Beach Headland Midden. Note the square indicates the position of Square A, and for the GPR data that higher reflections are denoted by yellow and red, while weaker reflections are blue.

The GPR reflection profiles reveal several strong planar reflections within the area surveyed (Figure 11). Some anomalous reflections (red circles) may relate to bedrock deposits, subsurface boulders, or tree roots, and were mapped towards the southern extent of the study area from ~50–140 cmbs (Figure 11a,b,d). Note the location of Square A (Figure 11a). The shell midden was visible (yellow dashed line) in the GPR reflection and extends to ~60–80 cmbs. Figure 11c shows the same metal fragment described previously, visible as a strong and long hyperbola reflection (green circle). Below the shell midden and towards the southern extent of the survey area (where the shell midden starts to drop off), there is another subsurface layer denoted by a strong planar reflection (cyan line) around 200 cmbs. It is unknown what this feature may be but appears to be an old buried surface such as a sand ridge or dune that dips down towards the southern extent of the study area in the direction of the water (Figure 11c,d).

Magnetic Susceptibility Analysis

Magnetic susceptibility analysis reveals a strong correlation with stratigraphic units in the sedimentary sequence (Figure 12, see also Appendix C). The samples are weakly magnetic in the basal unit of SU6 and the lower section of SU5, with χ_{fd} (%) measurements of ~16%, but erroneous values in the lowest deposits were reported as sediments were too weakly magnetic to measure frequency dependence of susceptibility. The χ_{fd} (%) for all samples in SU1, SU2, SU3, SU4, and the upper section of SU5 range between approximately 4% and 15%, indicating a mix of magnetic grain sizes. Increases in both χ and χ_{fd} (%) occur in the upper section of SU5, which corresponds with documented increases in stone artefacts, macro-charcoal, and organics (Figure 12). Susceptibility values are highest in SU1, SU2, and SU3, and this is consistent with an increase in stone artefacts, macro-charcoal, organics, mollusc, and bone.

Increases in both χ and χfd (%) occur in the top sections of SU5, SU3, and SU2. However, in the lowest section of SU5 (below ~80 cm) an increase in χfd (%) and decrease in χ occurs, with a similar trend observed for SU4. Instances where an increase in both χ and χfd (%) was documented tend to be associated with the interfaces between SU1 and SU2, SU2 and SU3, and SU4 and SU5, which indicates change in the fine-grained component of magnetic grains at these successive depths. These changes may represent developed surfaces and/or anthropogenic inputs such as burning. The inverse change of high χfd (%) and χ values in SU4 are possible derivatives of sediment changes (i.e. increases in sands and silts). This also applies to the lower section of SU5 and SU6, as these basal sediments contain no cultural materials and are predominantly sand, with lower relative percentages of silt and clay (Figure 12).

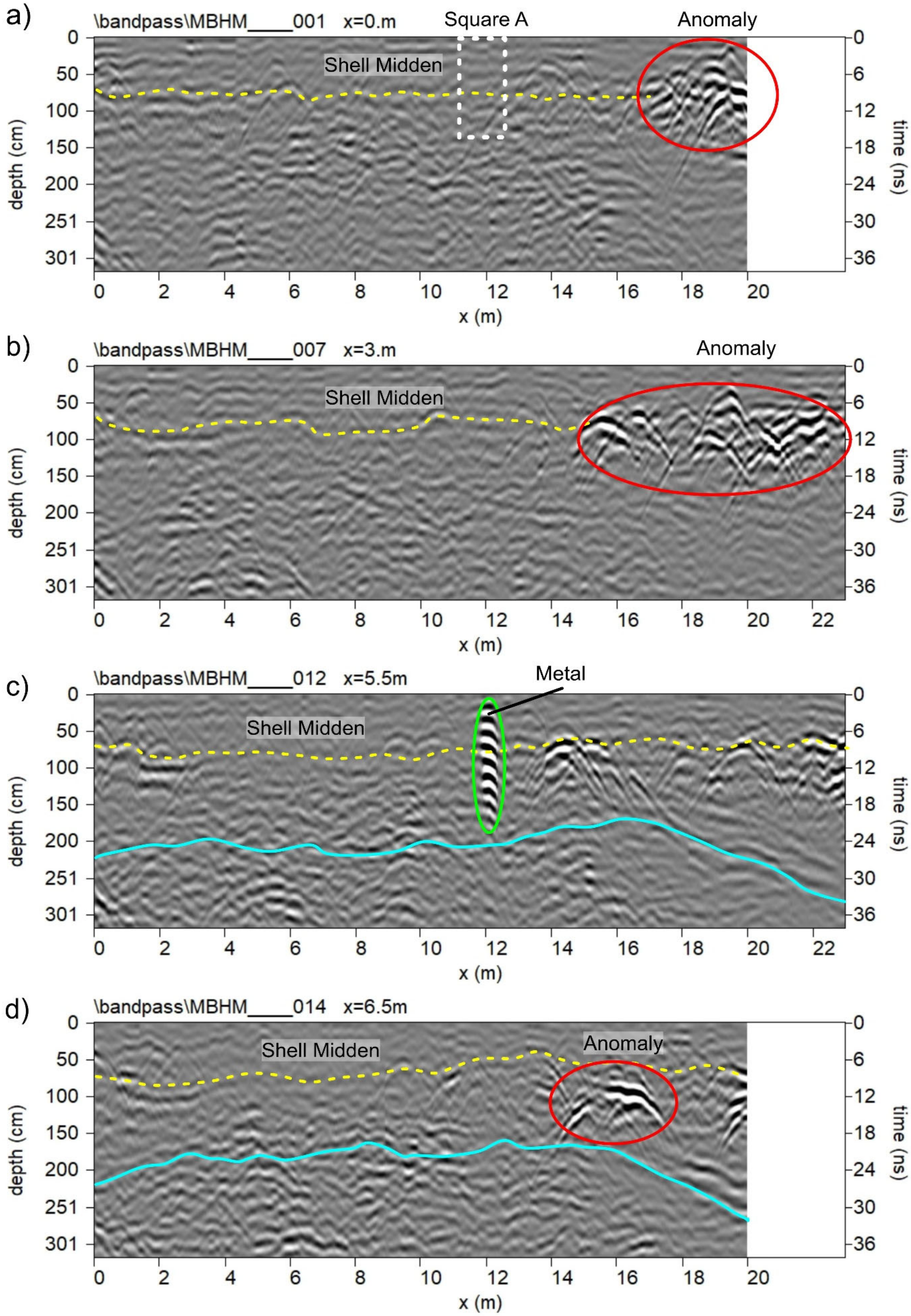

Figure 11. Reflection profiles (a) Profile 001, (b) Profile 007, (c) Profile 012, (d) Profile 014 showing the vertical distribution of the shell midden and the location of Site 3 Mangrove Beach Headland Midden, Square A.

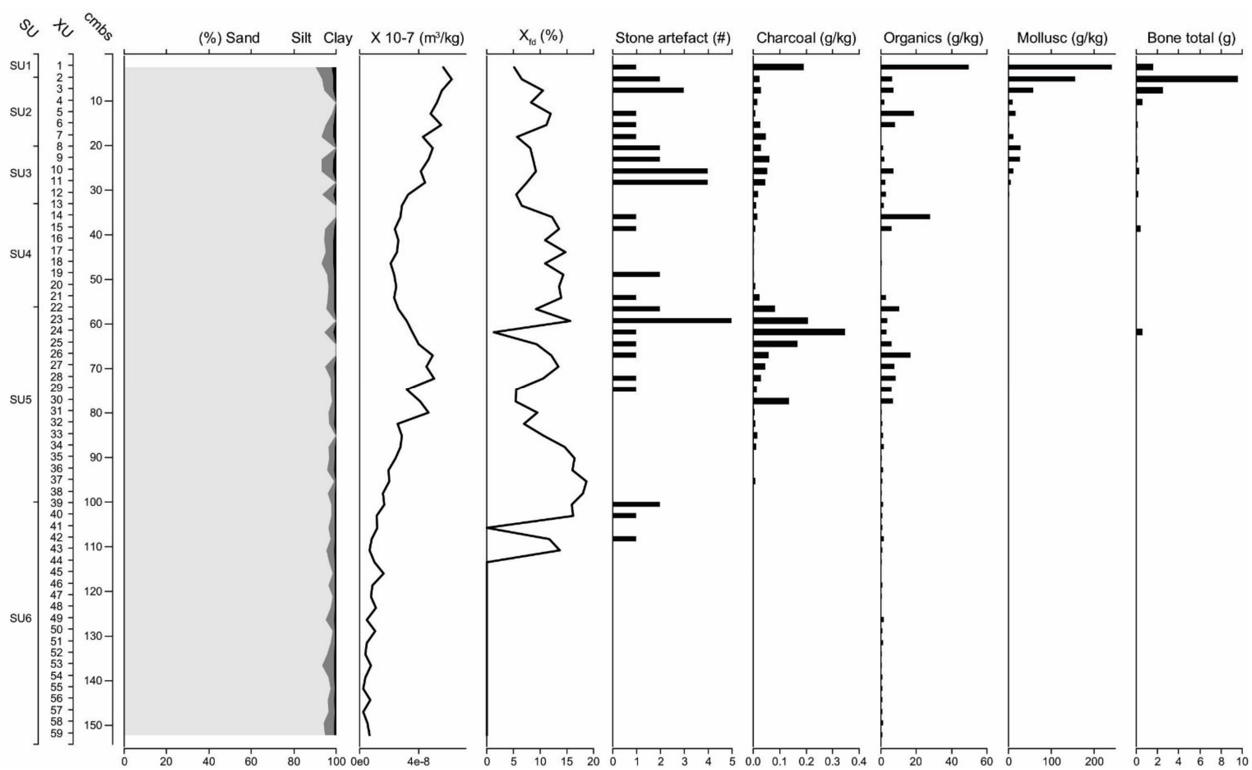

Figure 12. Changes in soil texture, low-field magnetic susceptibility (χ), frequency dependence of susceptibility χ_{fd} (%), and concentrations of stone artefacts, macro-charcoal, organics, mollusc, and bone with depth for Site 3 Mangrove Beach Headland Midden, Square A.

Pollen and Micro-Charcoal Results

Pollen-spore recovery decreased sharply with depth. Good grain preservation is limited to the upper seven XUs, corresponding to 1500–500 cal BP. Micro-charcoal particles did not appear to deteriorate with depth and a record was obtained for the entire sequence. Palynological results are presented in Figure 13 and micro-charcoal in Figure 14. See Appendix D for pollen percentage and micro-charcoal concentration values.

Twenty-eight pollen-spore types were identified representing a wide range of both localised and regional island taxa, divided into trees, grasses and herbs, pteridophytes (ferns), aquatic plants, and mangroves.

Over half the sequence is dominated by grasses; high Poaceae values (64–73% of the pollen sum) occur from XU7 and peak in XU4. Significant grass cover coincided with low tree-shrub abundance (majority values <20%, XUs 3–7) suggestive of an open woodland surrounding the site from at least 1500 cal BP until 750 cal BP. This open woodland included mixed tree composition; *Eucalyptus* and *Melaleuca* presence was near matched by taxa such as Casuarinaceae and *Callitris*, with more sporadic Araucariaceae, *Pandanus*, and Arecaceae. Grassy ground cover existed to the exclusion of most herbs, however greater occurrence and diversity of ferns and sedges (Cyperaceae) indicate relatively moist undergrowth conditions 1500–750 cal BP. Available moisture at this time is further supported by the record of *Pandanus*, *Leptospermum*, and Arecaceae.

From 750 cal BP (XU3), and notably from 500 cal BP (XU2), grasses declined (<20%). Tree abundance increased (to 60%) and site woodlands thickened. *Melaleuca* and *Eucalyptus* expanded to dominate the canopy, and with the loss of grasses, other herbs became more common. Herbs such as Asteraceae are dry-adapted (Moore 2005), with the onset of drier and potentially patchy undergrowth conditions further suggested by declines in all fern types and Cyperaceae up to the present day. The mixed nature woody composition also appears to have reduced with proportionally less secondary tree-shrub taxa.

Mangrove taxa do not reveal local palaeoecology but reflect longer-distance pollen transported into the site. Low values of *Rhizophora*, *Avicennia marina*, and *Ceriops*/*Brugueria* demonstrate the presence of an upper- and lower-tidal mangrove community within the broad vicinity, but not widespread growth, consistent with Proske and Haberle's (2012) findings of mangrove contraction at Watson's Bay, and possible progradation of shorelines within the past 2000 years.

Increased micro-charcoal deposition, incorporating progressively greater but fluctuating fire peaks, begins within the phase 4000–3750 cal BP (XU40), during 3750–3500 cal BP (XU35) and again through the early stages of 3500–3250 cal BP (from XU30). Micro-charcoal is most prominent between XU27 and XU22, corresponding to greatest burning through time centred on 3380 cal BP. By 3000–2750 cal BP (XU14) the micro-charcoal particles decrease to a near minimum before values rise slightly 1750–1500 cal BP (XUs 8–10). Burning at low levels continues through to the present day (reduced fires are reflected in the record of fire sensitive taxon *Callitris*, see Figure 13). Latest Holocene micro-charcoal is comparable to trends recorded Mid-Holocene prior to XU40 (>4000 cal BP). Concentrations of micro-charcoal notably decline >4500 cal BP (below XU51).

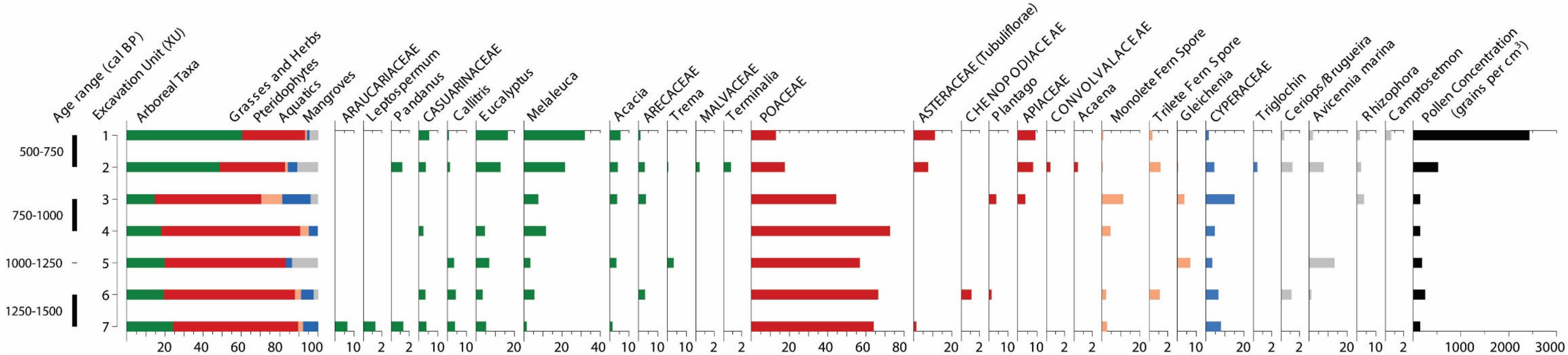

Figure 13. Site 3 Mangrove Beach Headland Midden, Square A, percentage pollen diagram plotted against XU and periodised 250-year time intervals developed using radiocarbon age determinations. All percentages derived from total pollen sum including spores.

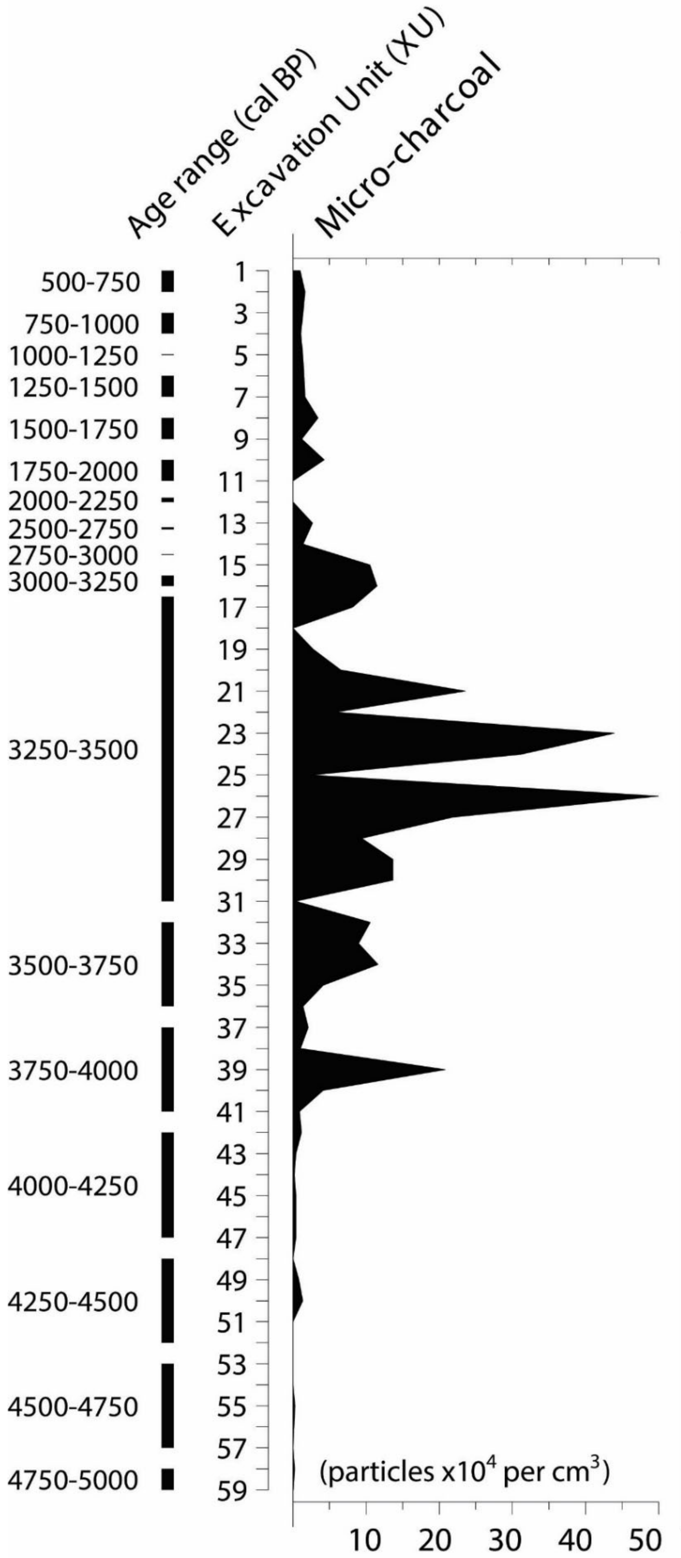

Figure 14. Site 3 Mangrove Beach Headland Midden, Square A, micro-charcoal (concentration) assemblage presented per XU and periodised 250-year time intervals developed using radiocarbon age determinations. Micro-charcoal has been defined as black angular fragments >5 µm.

Invertebrate Remains

A total of 11,127 mollusc shell fragments, weighing ~20.1 kg, were recovered from the site (see Table 3 and Appendix E). The molluscan assemblage was well preserved, with <1.0% of the sample affected by burning and corrosion (see Hammond 2014, for a description of the considered taphonomic variables and methods for identifying these agents). Breakage patterns and/or instances of deliberate impact were recorded. For *C. luhuanus* specimens, 27.6% (*n* = 477) of shell fragments had consistent breakage to the dorsal surface and 18.0% (*n* = 311) to the ventral surface. Similar fragmentation patterns were observed for *Lambis* sp., but with only 7.2% (*n* = 7) of shell fragments with breakage to the dorsal surface and 1.0% (*n* = 1) to the ventral surface. *C. luhuanus* and *Lambis* sp. were the only taxa with these observed breakage patterns, potentially indicating a consistent anthropogenic breakage pattern possibly associated with meat extraction, or similar taphonomic process operating on shell of a similar morphology (i.e. strombids). Overall, the shell fragmentation ratio was 3.92 (NISP:MNI, Faulkner 2010), which indicates that on average there were ~4 fragments per identified individual, suggesting a high proportion of diagnostic fragments and complete mollusc shells.

Mollusc shell was recovered from most XUs (1–24, 26, 28–31, 42, 50) with none reported from XUs 25, 27, 32–41 and 51–59. There was consistent evidence of mollusc exploitation from ~3500–500 cal BP. The indeterminate mollusc fragments (NISP = 5, weight = 0.03 g) recovered from XUs 42 and 50 were from the SU5/6 diffuse zone and SU6 respectively, and it is likely these either moved down the sediment profile or are natural inclusions. The identified assemblage comprised 26 taxonomic categories, eight to order/family, six to genus, and 12 to species, for a total MNI of 1356 (NISP = 5287). Gastropod taxa dominate the molluscan assemblage, accounting for 97.4% (MNI = 1321), dominated by *Conomurex luhuanus* (NISP = 1726, MNI = 1201, 88.6% MNI) and a smaller component of *Rochia nilotica* (NISP = 65, MNI = 46, 3.4% MNI). Bivalve taxa (2.1%, MNI = 28) and cephalopod taxa (0.1%, MNI = 2), were only minor components of the recovered assemblage. This was supported by measures of taxonomic heterogeneity, with low taxonomic richness and high dominance of a single taxon (*C. luhuanus*) reported (NTAXA = 15, *H'* = 0.435, E = 0.161, 1 – *D* = 0.161, Fisher's α = 2.363). Gross aggregated habitat assignments were established to facilitate broad categorisation of targeted zones and foraging methods (Beesley et al. 1998; Carpenter and Niem 1998; Wright 2018:Table 4.1). Identified mollusc species indicate that foraging efforts predominantly targeted intertidal benches, shallow subtidal reef flats, subtidal sandy substrates, and reef slopes (Table 3).

C. luhuanus was consistently the most commonly targeted species through time at the site, and *R. nilotica* the second most exploited during the majority of site occupation (Appendix E). Results indicate that a similar range of species were targeted, with no substantial shifts in their relative abundance through time. Morphometric analysis of these key molluscan species was undertaken and these results have previously been published (see Ulm et al. 2019). Lip thickness of *C. luhuanus* (*n* = 224) and base diameter of *R. nilotica* (*n* = 38) were measured to determine size-at-age habitat preferences and to facilitate high-resolution reconstructions of changes in foraging practices and targeted zones through time. Most specimens with measurable features occurred between ~2000 and 500 cal BP, with adolescent *C. luhuanus* and adult *R. nilotica* dominating the assemblage. The dominance overall of adolescent *C. luhuanus* at the site indicates foraging efforts were particularly focused on subtidal sandy substrates and rock and rubble substrates of the intertidal reef flat.

A small pilot study was conducted to compare maximum shell length of *T. maxima* specimens from the archaeological deposit (surface transect and Square A assemblage) and a closely associated modern reef population to provide a gross comparison of population age-structure of this species through time (see Appendix F). Results indicate that 86.9% (*n* = 73) of the archaeological population were juveniles (~1750–500 cal BP) and 13.1% adults (*n* = 11), in comparison to the modern reef population, with 47.8% (*n* = 55) juveniles and 52.2% adults (*n* = 60). Overall, sample size was insufficient to draw robust conclusions regarding population age-structure of this species through time, particularly given few measurable valves were recovered during excavation, and only limited sampling of the modern reef population was conducted. However, results provide some support for the conclusion that foraging efforts preferentially targeted juvenile *T. maxima* individuals situated along the shallow reef flat adjacent to the site.

Vertebrate Remains

Fish

A total of 238 fish bones, weighing 9.26 g, was recovered from the Site 3 MBHM (Table 4 and Appendix G). Fish bone was recovered from XUs 1–16, 22, 24–25, and 27–28, with none reported from XUs 17–21, 23, 26, and 29–59. The assemblage was highly fragmented, with the majority of fish bones recovered less than 10 mm in length or ~ 0.04 g per element. Accordingly a low portion – 13.0% overall – were identified to taxon. Fine mesh sieving directly facilitated the recovery of these highly fragmented fish remains from the site. Of the 31 fish bones identified to taxon and three to element only, ~9.6% (*n* = 3) were burnt, with no indication that any bones were altered by digestive processes (see Butler and Schroeder 1998). At the site level, teeth were the most commonly identified element (77.4%), followed by dentaries/premaxillae (16.1%), and then vertebrae (6.5%). Only ~1.0% of the total fish bone assemblage recovered (*n* = 3) could be identified to only element but not taxon.

A continuous presence of fish bone through time is evident (~3500–500 cal BP) though, compared to molluscs, the relative abundance of fish at the site is low. Overall, this small assemblage is dominated by parrotfish (Scaridae), a family that occupy diverse zones from the inshore reef flat to the deeper, oceanward portions of the reef, including the lagoon, shelves, and channels (Froese and Pauly 2018; Myers 1999; Randall et al. 1997). Parrotfish frequently inhabit coral reef and other hard bottom substrates as well as areas of sand and seagrass, and shallow water over reefs (Froese and Pauly 2018;

Table 3. Mollusc remains recovered from Site 3 Mangrove Beach Headland Midden, Square A. Note that MNI values were calculated according to periodised 250-year time intervals developed using radiocarbon age determinations, and only the site totals are presented. See Appendix E for detailed quantification data.

Taxon	Common Name	Habitat	NISP	%NISP	MNI	%MNI	Weight (g)
Marine Mollusca							
Indeterminate Mollusca			4631				179.92
Bivalvia							
Indeterminate Bivalvia			30				18.86
Cardiidae							
Hippopus hippopus	Horse's hoof clam	Reef flat	1	0.02	1	0.07	0.26
Tridacna crocea	Boring clam	Reef flat	4	0.08	4	0.29	558.72
Tridacna gigas	Giant clam	Reef flat	1	0.02	1	0.07	12.37
Tridacna maxima	Rugose giant clam	Reef flat	24	0.45	11	0.81	2405.43
Tridacna spp.		Reef flat	173	3.27	5	0.37	871.09
Ostreidae	Oyster		19	0.36	4	0.29	7.49
Veneridae							
Periglypta puerpera	Youthful venus	Intertidal – sand/mud	3	0.06	2	0.15	2.68
Cephalopoda							
Nautilidae							
Nautilus sp.	Nautilus	Reef slope	1	0.02	1	0.07	16.46
Sepiida	Cuttlefish	Reef slope	1	0.02	1	0.07	2.41
Gastropoda							
Indeterminate Gastropoda			1179				194.79
Conidae	Cone snails		1	0.02	1	0.07	7.23
Conus sp.		Varied	1	0.02	1	0.07	63.94
Muricidae	Murex snails		1	0.02	1	0.07	0.56
Thais sp.	Dog winkle	Intertidal-hard	2	0.04	1	0.07	2.39
Neritidae	Nerites						
Nerita costata		Intertidal-hard	1	0.02	1	0.07	0.76
Nerita polita		Intertidal-hard	8	0.15	5	0.37	8.91
Nerita spp.		Varied	9	0.17	4	0.29	4.30
Strombidae	True conchs		119	2.25	14	1.03	57.03
Conomurex luhuanus	Strawberry conch	Reef flat	1726	32.65	1201	88.57	7837.13
Lambis lambis	Spider conch	Reef flat	26	0.49	13	0.96	728.86
Lambis sp.		Reef flat	71	1.34	13	0.96	410.56
Tegulidae	Top shells		2946	55.72	13	0.96	767.91
Rochia nilotica		Reef flat	65	1.23	46	3.39	5931.05
Trochidae							
Monodonta labio	Toothed top shell	Intertidal-hard	14	0.26	3	0.22	7.04
Vermetidae	Worm snail	Reef flat	62	1.17	4	0.29	1.52
Polyplacophora							
Chitonidae							
Acanthopleura gemmata	Jewelled chiton	Intertidal-hard	1	0.02	1	0.07	0.41
Terrestrial Mollusca							
Gastropoda							
Rhytididae	Land snail	Terrestrial	7	0.13	4	0.29	0.43
Total identified			**5287**		**1356**		
Total Mollusca			**11127**				
Total weight (g)			**20100.51**				
% identified			**47.52**				

Table 4. Fish remains recovered from Site 3 Mangrove Beach Headland Midden, Square A. Note that MNI values were calculated according to periodised 250-year time intervals developed using radiocarbon age determinations, and only the site totals are presented. See Appendix G for detailed quantification data. P = piscivore; H = herbivore.

Taxon	Common Name	Feeding Behaviour	NISP	%NISP	MNI	%MNI	Weight (g)
Chondrichthyes							
Elasmobranchii	Sharks, skates, rays	P	2	6.45	2	13.33	0.02
Actinopterygii							
Indeterminate (element only)			3				0.19
Scaridae	parrotfish	H	27	87.10	11	73.33	1.68
Bolbometopon muricatum	green humphead parrotfish	H	2	6.45	2	13.33	0.12
Total identified (excl. indeterminate fish to element)			**31**		**15**		
Total bones			**238**				
Total weight (g)			**9.26**				
% identified			**13.03**				

Randall et al. 1997). Parrotfish can be found in small to large aggregations, which are often mixed-species. These schools can move across large areas of the reef in a day as they graze on benthic algae and coral (Marshall 1965; Randall et al. 1997). Here we report the first archaeological record of green humphead parrotfish (*Bolbometopon muricatum*) exploitation from a Queensland coastal archaeological site (see Lambrides et al. 2019). *B. muricatum* are the largest species of parrotfish growing to 130 cm (commonly 70 cm) in length, feeding in small aggregations on benthic algae and coral during the day, and sleeping at night in groups in caves or other sheltered areas. This group sheltering behaviour makes this species vulnerable to spearfishing (Froese and Pauly 2018; Myers 1999; Randall et al. 1997). While juveniles are frequently found in lagoons, adults tend to be associated with seaward reefs, particularly the outer-shelf reef crest and flat, such as surveyed Yonge, Day, and Hicks Reefs, approximately 20 km from Lizard Island (Froese and Pauly 2018; Hoey and Bellwood 2008). However, *B. muricatum* still does occur on the reefs in the vicinity of Lizard Island. Often described as the major coral predator on reefs, this species is a non-selective feeder that promotes coral diversity and can increase the resilience of corals to storm and wave dislodgement (Bellwood et al. 2003; Hoey and Bellwood 2008). In the Great Barrier Reef, green humphead parrotfish are the only species to perform this key role, and fundamentally contribute to long-term reef health in the region (Hoey and Bellwood 2008). There was also evidence for the exploitation of sharks, skates or rays (Elasmobranchii), however, this taxonomic grouping is too general to allow for habitat assignment.

Broadly, there is the potential for a wide range of habitats from the reef flat through to the deeper bank/shelf to have been exploited across millennia of site occupation, especially given the diverse reef zones parrotfish traverse daily and the variability in habitat preferences between species. It is probable that parrotfish would have been exploited using netting and spearfishing, however, no material culture was recovered to provide direct evidence of utilised capture techniques.

Turtle

Turtle remains (Cheloniidae) were recovered from XU1 (NISP = 1, weight = 0.47 g) and XU2 (NISP = 28, weight = 6.24 g), all fragments of carapace or plastron representing a minimum number of one adult or juvenile individual. There were no indications of burning or modification, and all remains were associated with the most recent phase of site occupation (~750–500 cal BP). Three species of turtle have been reported at Lizard Island, the logger-head turtle (*Carretta caretta*), green turtle (*Chelonia mydas*), and hawksbill turtle (*Eretmochelys imbricata*) (see the Lizard Island Field Guide: lifg.australianmuseum.net.au). Small green turtles (carapace length 40–50 cm) are the most common species at Lizard Island and are frequently observed feeding on seagrass beds in proximity to Site 3 MBHM, but with infrequent reports of nesting (Goatley et al. 2012).

Material Culture

Stone Artefacts

Flaked stone artefacts (*n* = 333, weight = 198.32 g) were recovered from XUs 1–30, 33, 39–40, 42, and 45, with none reported from XUs 31–32, 34–38, 41, 43–44 and 46–59 (see Appendix H). There was an initial peak in stone artefact discard between XUs 21 and 25 (*n* = 71, 3500–3250 cal BP), with the highest density of stone artefacts from XUs 1–12 (*n* = 213, 2250–500 cal BP), and low numbers occurring in the remainder of Square A (*n* = 49) (Figure 12). Seven fracture types were recovered from Square A, flakes (*n* = 294, 88.3%), flaked pieces (*n* = 21, 6.3%), bipolar flakes (*n* = 8, 2.4%), bipolar cores (*n* = 5, 1.5%), cores (*n* = 2, 0.6%), ground edge fragments (*n* = 2, 0.6%), and a microblade (*n* = 1, 0.3%). No indication of retouch of flaked stone artefacts was recorded at the site. The dominant raw materials throughout the deposit, accounting for 99.1% of flaked stone artefacts, were quartz (*n* = 312) and crystal quartz (*n* = 18), with the remainder manufactured from granite (*n* = 1), sedimentary (*n* = 1), and volcanic sources (*n* = 1). Quartz outcrops have been documented across Lizard Island and a local source for these Square A quartz artefacts is probable (Lentfer et al. 2013; Mills 1992, 1995a, 1995b). One ground edge-fragment, potentially from an axe, was made from volcanic stone, and is the only artefact that could have been produced from non-locally sourced raw material. This artefact may indicate movement of raw materials from the adjacent mainland, but at this stage, the source of this raw material is inconclusive.

The dominant recovered fracture type was flakes, and on average each complete flake (*n* = 132) weighed 0.7 g, had a mean length of 9.4 mm, width of 8.4 mm, elongation (length/width) of 1.2, and platform angle of ~65º, suggesting overall the flakes were very squat, with slightly contracting margins (after O'Connor et al. 2014). No notable differences in flake shape were observed between the initial peak in flake discard (*n* = 26, XUs 21–25, 3500–3250 cal BP, but no complete flakes were recovered from XU21) and the period of highest flake discard (*n* = 91, XUs 1–12, 2250–500 cal BP), with a low number of complete flakes (*n* = 15) recovered from the remainder of Square A (XUs 13–16, 19, 28–29, 39–40, 42, 45). On average flakes were consistently small, squat, and with slightly contracting margins as observed initially at 3500–3250 cal BP (weight = 0.7 g, length = 11.3 mm, width = 9.6 mm, elongation = 1.3, platform angle = ~67º) and through to the most recent phase of site occupation 2250–500 cal BP (weight = 0.7 g, length = 9.1 mm, width = 8.2 mm, elongation = 1.2, platform angle = ~64º).

The earliest evidence for bipolar reduction at the site was from XU23 (*n* = 1, 3500–3250 cal BP), but with the highest density of bipolar flakes (*n* = 8) and cores (*n* = 4) recovered from XUs 1–14 (3000–500 cal BP). Overall, only 3.9% of the flaked stone artefacts were reduced using bipolar techniques. On average each complete bipolar flake weighed 1.1 g, had a mean length of 16.0 mm, width of 9.7 mm, elongation of 1.7, and platform angle of ~72º. Relatively, the bipolar flakes were larger and more elongate, but would still be considered squat with slightly contracting margins.

Ochre

A low density of red ochre was reported, with six small fragments (XU23, weight = 3.10 g) dating to 3500–3250 cal BP recovered from the site (Appendix B). A ground facet was not explicitly identified on any of the recovered ochre fragments (after McNiven et al. 2014), and as such their attribution as cultural is tentative.

Discussion

Palaeoenvironmental analyses on Lizard Island undertaken on the southern (Site 3 MBHM and Site 17 FBM) and eastern (Watson's Bay) coasts record Late Holocene drying conditions and a rise in micro-charcoal concentration and fire frequency between 4000 and 3000 cal BP. This pattern suggests the occurrence of regional burning events spanning the Mid-to-Late Holocene that correspond with the earliest evidence for Aboriginal occupation of Lizard Island (Lentfer et al. 2013; Proske and Haberle 2012). Late Holocene vegetation succession following peaks in burning differs across Lizard Island, which indicates that although island burning was common, individual fire characteristics varied according to location, and ultimately influenced island vegetation communities differently. Lentfer et al. (2013) and Proske and Haberle (2012), for example, report trajectories of increasingly open vegetation communities following high frequencies of charcoal. At Site 3 MBHM, vegetation structure became more wooded through time. Lentfer et al. (2013) indicate that after frequent fire, there is initial recovery of myrtaceous plants and *Acacia* from at least 1725 cal BP, followed by a rise associated with a more disturbed and open environment during the recent past. At Watson's Bay, increasingly dominant grassland and sclerophyll vegetation incorporated more abundant Cyclosorus ferns, which suggested enhanced vegetation disturbance from ~1500 cal BP onwards (Proske and Haberle 2012). At Site 3 MBHM, there is also evidence for a rise in *Eucalyptus*, Melaleuca (Myrtacaeae taxa), and *Acacia* following the period of maximum micro-charcoal, but the same transition to higher grasses, most recently, as recorded for Site 17 FBM and Watson's Bay, is absent. Furthermore, ferns at Site 3 MBHM remain low between 750 and 500 cal BP rather than becoming more abundant as documented elsewhere on Lizard Island.

This discrepancy between the other reported palaeoenvironmental records from Lizard Island and Site 3 MBHM may indicate that sediments are missing from the surface of this site. This trend is further supported by the environmental disturbance reported at Site 17 FBM and Watson's Bay from 1500 years ago (Lentfer et al. 2013; Proske and Haberle 2012). An increase in the visible surface area of the study site has been recorded over the last several decades (~75–100 m^2 to 2250 m^2) (cf. Mills 1992; Specht 1978), and potentially indicates cyclonic activity and erosional processes may have successively removed the most recently accumulated deposits. However, given molluscs across the surface of the site were uniformly dated to ~500 cal BP, this may suggest that while sediment is potentially missing, a reduction or cessation of site use either occurred around this time, or cyclonic activity may have uniformly removed evidence for the past 500 years of cultural discard at the site.

Proske and Haberle (2012) also recorded increased fire frequencies from 1500 years ago, but this fire regime and pattern of site change is not seen at Site 3 MBHM. This trend further emphasises that individual fire characteristics varied according to location, and potentially the differential influences of natural fires and human activities across the landscape. At Watson's Bay, there was no evidence for the loss of dominant vegetation communities during the Late Holocene, but local extinction of *Sonneratia* (a component of mangrove forests) and *Ilex* (a component of rainforest patches) is followed by increases in micro-charcoal and may indicate increased disturbance over the past 2000 years (Proske and Haberle 2012). This also corresponds with an increase in the discard of cultural material at both Site 3 MBHM and Site 17 FBM. Specifically, at Site 3 MBHM magnetic susceptibility values are highest in the top section of the deposit down to ~30 cm below surface, and this is consistent with an increase in stone artefacts, macro-charcoal, organics, mollusc, and bone from ~2000 cal BP.

The GPR survey at Site 3 MBHM indicated the subsurface midden across the site extended 60 to 80 cm below the surface, consistent with the highest concentration of recovered mollusc remains from Square A. Subsistence remains at the site are dominated by molluscs, with evidence of mollusc exploitation between ~3500 and 500 cal BP demonstrating that a similar range of species was targeted through time, but most particularly *C. luhuanus* and *R. nilotica*. These taxa indicate foraging efforts were likely targeted towards intertidal benches, shallow subtidal reef flats, subtidal sandy substrates, and reef slopes. An increase in the discard of molluscs remains between ~2000 cal BP and

500 cal BP was documented, but presently there is no indication that anthropogenic and/or environmental factors altered the availability or population structure of these key exploited species (Ulm et al. 2019). Specifically, people were able to preferentially target adolescent and adult *C. luhuanus* and *R. nilotica* individuals, and juvenile *T. maxima* individuals (based on a small pilot study), throughout the occupation of the site. Fish bone abundances are low when compared to the representation of mollusc remains at Site 3 MBHM but were similarly exploited from 3500 to 500 cal BP, suggesting that fish were potentially a minor, but consistent component of subsistence regimes. Here we have reported the first evidence for the exploitation of green humphead parrotfish (*B. muricatum*) at a Great Barrier Reef archaeological site at ~2000–1750 cal BP. This species has recently suffered rapid population decline (Hoey and Bellwood 2008), and these deep time records help to clarify historic biogeographic ranges for this keystone species. There was limited evidence for the exploitation of turtle, with all recovered remains associated with the most recent phase of site occupation (~750–500 cal BP). Turtle may be underrepresented in sites owing to butchering and consumption on nearby beaches (Anderson and Robins 1988).

In terms of material culture, there was a dominance of quartz artefacts recovered from Site 3 MBHM, likely sourced locally given the well-documented quartz outcrops across Lizard Island. One ground edge-fragment, potentially from an axe, was made from volcanic stone, and may indicate the movement of raw materials from the adjacent mainland or elsewhere, but its source is not conclusive at this stage. Two peaks in stone artefact discard (3500–3250 and 2250–500 cal BP) were recorded, with evidence for increased use of bipolar techniques from ~2250 cal BP, a technique useful for fracturing small quartz cores and minimising flake fragmentation (e.g. Hiscock 1996; Tallavaara et al. 2010). There was no evidence that the quartz artefacts had been retouched, potentially due to the local availability of this resource; this may have minimised the need to extend the use life of the material through retouching. Finally, the use of red ochre has been documented at multiple art sites on Lizard Island (Arnold 2020; Mills 1992), but here we report the first evidence of the recovery of ochre from a stratified deposit.

Lizard Island archaeological sites are dominated by small quartz artefacts and faunal remains (e.g. mollusc, fish, and turtle). An increase in the discard of quartz artefacts from ~2250 cal BP at Site 3 MBHM is largely consistent with trends documented at nearby Site 17 FBM, where the highest discard rates were reported from ~2500 cal BP from Trench 1 (Mills 1992) and ~1750 cal BP from the more recently excavated Trench 2 (Lentfer et al. 2013). Regional subsistence trends suggest a focus on marine resources, particularly molluscs, with limited evidence for the exploitation of vertebrate, and particularly terrestrial, fauna. Only a small quantity of bird and lizard remains were reported from Site 17 FBM (Mills 1992). A consistent increase in the discard of mollusc remains from ~2000 cal BP was reported at Site 3 MBHM and Site 17 FBM, with a similar range of species targeted between sites, including the preferential exploitation of *C. luhuanus* and *R. nilotica* individuals, and no significant alterations in the range of species exploited through time. A preference for small inshore reef taxa (e.g. scarids and labrids) and small, potentially juvenile, elasmobranchs is evident at Site 3 MBHM (~3500–500 cal BP) and Site 17 FBM (~2000–750 cal BP), but with low relative abundances reported at both sites (Lentfer et al. 2013; Mills 1992).

Interestingly, while only 6.7 g of turtle bone was recovered from Site 3 MBHM and associated with the most recent phase of site occupation (~750–500 cal BP), at Site 17 FBM a considerable amount of turtle bone (652.7 g) was excavated and dated to the past ~2250 years (Mills 1992). Ethnographic records suggest that turtles were an important resource accessed when voyaging to Lizard Island (Mills 1995a), but the archaeological record seems to suggest variability in the discard of turtle remains between sites. Currently there is limited evidence for the exploitation of dugong on Lizard Island, with no dugong remains recovered from Site 3 MBHM, and a minor quantity (20.8 g) recovered from Site 17 FBM dating to ~1500 cal BP (Mills 1992). However, Mills (1992:Figure 21) also documented a small dugong bone mound on the surface of Site 17 FBM. The low relative abundance of dugong bone recovered archaeologically may indicate restricted availability (due to limited seagrass food resources), culturally restricted exploitation, or inconsistent transport of dugong remains to the sites. The absence of dugong remains at Site 3 MBHM is consistent with the low relative quantity of turtle remains at the site when compared with Site 17 FBM. Of relevance here is McNiven and Feldman's (2003) discussion of Torres Strait hunting rituals and the use of dugong bones in ritual bone mounds, particularly the associated implications of differential discard of faunal remains between sites (see also McNiven and Wright 2008). Here, the relative absence and/or differential discard of dugong and turtle remains between sites on Lizard Island may relate to social and cultural distinctions in the treatment and discard of their remains across the landscape, though further clarification of this pattern is required.

Based on this available archaeological evidence, Lizard Island was first occupied at ~4040 cal BP, which post-dates island formation by at least 4000 years, but during the potentially sustained high-stand until ~2300 cal BP. Regionally, there is evidence for lower relative patterns of site use during the initial phases of occupation, and this initial occupation of Lizard Island corresponds to a well-documented regional burning event (Proske and Haberle 2012). Yet, there are notable increases in the discard of cultural materials from ~2250 cal BP (Site 3 MBHM and Site 17 FBM), and at the time when sea-levels began falling to modern levels along the northeast Australia coastline (Lewis et al. 2013, 2015). Lentfer et al. (2013) argued the absence of molluscs remains, for instance, from the earliest phases of site occupation, may be an issue of preservation, particularly due to the recovery of stone artefacts throughout the sequence. However, the recovery of fish bone and some mollusc shell from sediments associated with the earliest phases of site occupation at both Site 3 MBHM and Site 17 FBM, more likely indicates this documented increase in the relative abundance of cultural material is related to changes in site use and discard rates through time.

The available archaeological evidence also complements the ethnographic and ethnohistoric records for the use of Lizard Island. Specifically, the archaeological evidence supports periodic occupation of Lizard Island, likely short-term and perhaps seasonally by people with connections to the mainland or elsewhere. Such short-term use is similar to patterns of island use documented for the Shoalwater Bay region of the central Great Barrier Reef (McNiven et al. 2014) and preliminary results from the northern extent of the region for the Flinders Islands (Wright 2018), but unlike reports for the Whitsunday and Keppel Islands (Barker 2004; Rowland 1996).

The ethnographic, ethnohistorical, and archaeological records provide insight into the motivations for voyaging to Lizard Island, including targeted resource acquisition (e.g. molluscs and turtles), and furthermore, the social and cultural significance of the region as a place for gathering and ceremony, including the documented stone arrangements and art sites (Arnold 2020; Fitzpatrick et al. 2018; Mills 1992). However, it is apparent that the currently available archaeological evidence from Lizard Island may provide the first example of a previously undocumented occupation pattern associated with the Great Barrier Reef islands during the Late Holocene. Specifically, the Lizard Island archaeological evidence hints that an occupation hiatus does not occur between 2000 and 1000 years ago (see also Lentfer et al. 2013; Mills 1992), in contrast with equivalent high-resolution records available for other offshore islands along the length of the Great Barrier Reef (Barker 2004; Border 1999; McNiven et al. 2014; Rowland 1996; Wright 2018).

On Lizard Island, it appears that the frequency and/or length of visits increased during the past ~2,000 years of occupation, as documented by an increase in the discard of cultural material. We suggest the ongoing occupation of Lizard Island from 4040 cal BP could relate to several locally specific factors. Firstly, the social and cultural significance of Lizard Island as a place of ceremony and gathering, which is supported by well-documented stone arrangements, interpreted as material expressions of these socio-cultural practices (Fitzpatrick et al. 2018; see also Greer et al. 2015). Secondly, is the potential importance of the Lizard Island Group within the Coral Sea Cultural Interaction Sphere (McNiven et al. 2004). Fitzpatrick et al. (2018) have suggested that the Lizard Island stone arrangements do share attributes with those from Cape York Peninsula and Torres Strait Islands, and the recent pottery finds – from the lagoon excavations – also raise questions about cultural links with Melanesia (Lentfer et al. 2013; Tochilin et al. 2012). Furthermore, the increase in the discard of cultural material at Lizard Island archaeological sites (~2250 cal BP) roughly corresponds to the onset of the Torres Strait Cultural Complex (~2500 cal BP) (Barham 2000), which McNiven et al. (2006) link to demographic expansion and the immigration of pottery-making peoples from southern New Guinea to the eastern and western islands of Torres Strait. More detailed archaeological evidence is clearly required to explore the potential place of Lizard Island within the Coral Sea Cultural Interaction Sphere. However, here we demonstrate an ongoing record of Lizard Island occupation from initial settlement, which in combination with ethnographic records, documents both the socio-cultural significance of this region and its possible links (both direct and indirect) with peoples from Torres Strait and the southwest Pacific. Hence, this Lizard Island record provides a unique insight into an otherwise undocumented pattern of Late Holocene offshore island occupation on the Great Barrier Reef.

Conclusion

As new archaeological records of Great Barrier Reef offshore island occupation become available, an increasingly nuanced picture of the use of these islands by Aboriginal and Torres Strait Islander peoples during the Mid-to-Late Holocene is formed. These islands not only provided access to key resources, but were likely places of socio-cultural significance, and in the case of Lizard Island a place of ceremony and gathering. At Lizard Island we see an increase in island use from ~2000 years ago, at a time when a hiatus or reduction in offshore island occupation has been documented for other Great Barrier Reef islands, but concurrent with the onset of the Torres Strait Cultural Complex and associated demographic expansion. This association potentially demonstrates the complex interplay between the environmental, economic, social, and cultural factors that influenced and shaped island occupation in this region. More comprehensive records of landscape use across the entire Lizard Island Group are still required. Available evidence is constrained to Lizard Island, and broader work is needed on nearby islands to generate a more nuanced perspective on the frequency and intensity of island use. Within the broader Great Barrier Reef region, it is plausible that this unique pattern of site occupation documented for Lizard Island relates to its place within the Coral Sea Cultural Interaction Sphere and its significance both locally and regionally within a vast, networked seascape. Yet, future work is required to evaluate these themes, and importantly, to generate a comprehensive framework from which to consider offshore island use in northeast Australia more broadly, but also the dynamic history of Lizard Island occupation.

Acknowledgements

We acknowledge the Dingaal Aboriginal community as partners in this research. This research was supported by the Australian Research Council Centre of Excellence for Australian Biodiversity and Heritage (project number CE170100015), the Scarp Archaeology Richard Brookdale Scholarship to SA, and an Australian Research Council Future Fellowship to SU (project number FT120100656). We extend a special thanks to: Dr Anne Hoggett and Dr Lyle Vail for hosting us at the Australian Museum's Lizard Island Research Station; Kara Rasmanis (then Monash University) for preparing Figure 9; Javier Leon (University of the Sunshine Coast) for advice on mapping data; Jim Specht (Australian Museum) for advice and kindly supplying photographs. Adriana Basiaco, Simon Coxe, Alison Fitzpatrick, Shoshanna Grounds, Robyn Jenkins, Helene Peck, Tammy Purssell, and Ioana Zaharia assisted with the excavation of the site. Fieldwork on Lizard Island was conducted under Queensland Government Department of Environment and Heritage Protection Permit Number WITK12835313. Figure 3 contains data provided by the State of Queensland [2017]. In consideration of the State permitting use of this data we acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws. We thank the Editor, Mike Rowland, and three anonymous reviewers for their thoughtful comments on the manuscript.

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Citation: Lambrides, A.B.J., I.J. McNiven, S.J. Aird, K.A. Lowe, P. Moss, C. Rowe, C. Harris, C. Maclaurin, S.A. Slater, K. Carroll, M.H. Cedar, F. Petchey, C. Reepmeyer, M. Harris, J. Charlie, E. McGreen, P. Baru and S. Ulm 2020 Changing use of Lizard Island over the past 4000 years and implications for understanding Indigenous offshore island use on the Great Barrier Reef. *Queensland Archaeological Research* 23:43–109. https://doi.org/10.25120/qar.23.2020.3778

Appendix A. Measurements of Tegulidae, *Tridacna* spp., *Hippopus hippopus, Lambis* spp., *Periglypta puerpera*, Pteriidae, and *Anadara* spp. specimens located on the surface of Site 3 Mangrove Beach Headland Midden. Note *Conomurex luhuanus* was the only species excluded from this analysis due to the high concentration across the site surface and fieldwork time constraints.

		n		**Mean (mm)**		**Range ± s.d. (σ) (mm)**	
Taxon		**Width/ Height**	**Length/ Base Diameter**	**Width/ Height**	**Length/ Base Diameter**	**Width/ Height**	**Length/ Base Diameter**
Gastropoda	Strombidae						
	Lambis spp.	2	2	47.5	115.0	45.0-50.0±3.5	100.0-130.0±21.2
	Tegulidae	49	417	73.8	89.9	38.0-110.0±17.2	35.0-130.0±18.2
Bivalvia	Arcidae						
	Anadara spp.	21	21	48.6	71.1	38.0-60.0±5.6	50.0-90.0±9.2
	Cardiidae						
	Hippopus hippopus	4	4	78.9	110	70.0-100.0±14.4	100.0-130.0±14.1
	Tridacna spp.	350	352	70.6	125.1	40.0-120.0±14.7	70.0-230.0±25.7
	Pteriidae	1	1	80.0	95.0	-	-
	Veneridae						
	Periglypta puerpera	1	1	50.0	50.0	-	-

Appendix B. Summary excavation data and retained materials, Site 3 Mangrove Beach Headland Midden, Square A.

XU	cal BP	Depth Below Surface (cm)	Mean Thickness (cm)	Weight (kg)	Volume (L)	Area (cm^2)	Munsell Soil Color®	pH	Mollusc (g)	Bone (g)	Charcoal (g)	Coral (g)	Other Organic (g)	Metal (g)	Pumice (g)	Non-Artefactual Stone (g)	Artefactual Stone (g)	Ochre (g)	Retained Material (g)
1	500-750	2.02	2.02	28.1	21	1.0	10YR 4/6 dark yellowish brown	9.0	6934.87	1.50	5.44	2.63	50.14	3.33	7.92	646.14	18.37	0.00	7670.34
2		5.12	3.10	39.3	30	1.0	10YR 3/4 dark yellowish brown	9.0	6116.50	9.65	1.09	4.12	6.61	0.14	38.12	515.33	11.11	0.00	6702.67
3	750-1000	7.54	2.42	40.2	30	1.0	10YR 3/3 dark brown	6.0	2618.11	2.31	1.32	0.00	7.47	0.00	0.38	265.71	32.20	0.00	2927.50
4		9.66	2.12	36.3	30.5	1.0	10YR 4/3 brown	6.0	414.93	0.63	0.66	0.00	2.62	0.00	1.24	127.58	1.44	0.00	549.10
5	1000-1250	12.54	2.88	41.4	34.4	1.0	10YR 4/3 brown	6.0	769.83	0.03	0.46	0.00	19.16	0.00	1.06	141.26	1.40	0.00	933.20
6	1250-1500	14.96	2.42	37.9	35	1.0	10YR 3/3 dark brown	6.0	118.44	0.20	1.06	0.00	8.25	0.00	3.66	382.80	10.35	0.00	524.76
7		17.52	2.56	30.4	31	1.0	10YR 3/3 dark brown	6.0	402.74	0.13	1.54	0.14	0.05	0.00	1.94	517.34	1.24	0.00	925.12
8	1500-1750	19.98	2.46	35.8	28.5	1.0	10YR 4/3 brown	7.5	1071.28	0.14	1.10	0.24	1.40	0.00	3.58	706.20	4.36	0.00	1788.30
9		21.98	2.00	31.0	24	1.0	10YR 4/3 brown	6.5	705.58	0.15	2.00	0.08	2.31	0.00	2.41	730.09	10.97	0.00	1453.59
10	1750-2000	24.26	2.28	35.4	27	1.0	10YR 4/4 dark brown	6.0	470.91	0.32	2.01	0.00	7.83	0.00	4.15	715.70	23.12	0.00	1224.04
11		26.86	2.60	41.6	34	1.0	10YR 4/3 brown	5.5	284.57	0.03	1.95	39.35	2.63	0.00	1.22	647.96	6.88	0.00	984.59
12	2000-2250	29.98	3.12	41.3	37.5	1.0	10YR 3/3 dark brown	5.5	137.96	0.22	0.83	0.00	3.02	0.00	0.73	1205.09	6.01	0.00	1353.86
13	2500-2750	32.32	2.34	34.0	29.5	1.0	10YR 3/3 dark brown	7.5	27.40	0.03	0.44	0.00	2.14	0.00	0.40	330.19	0.04	0.00	360.64
14	2750-3000	34.94	2.62	41.9	36.5	1.0	10YR 4/4 dark brown	6.0	4.11	0.06	0.79	0.00	28.50	0.00	0.38	107.34	4.09	0.00	145.27
15	3000-3250	37.80	2.86	41.3	31.5	1.0	10YR 3/3 dark brown	6.0	2.94	0.30	0.43	0.00	6.86	0.00	0.35	81.81	0.14	0.00	92.83
16	3250-3500	40.46	2.66	38.7	34	1.0	10YR 4/3 brown	6.0	0.90	0.03	0.20	0.00	0.02	0.00	0.65	62.35	0.21	0.00	64.36
17		43.10	2.64	38.3	34	1.0	10YR 4/3 brown	5.5	1.54	0.00	0.25	0.00	0.05	0.00	0.94	41.82	0.01	0.00	44.61
18		45.64	2.54	36.1	31.5	1.0	10YR 4/3 brown	6.0	0.14	0.00	0.06	0.00	0.90	0.00	0.07	27.92	0.03	0.00	29.12
19		48.10	2.46	41.6	35.5	1.0	10YR 4/3 brown	5.5	0.84	0.00	0.17	0.00	0.32	0.00	0.19	38.46	0.30	0.00	40.28
20		54.30	6.20	39.5	30	1.0	10YR 5/4 dark yellowish brown	5.5	0.06	0.00	0.40	0.00	0.54	0.00	0.06	47.58	0.16	0.00	48.80
21		56.88	2.58	43.1	32.5	1.0	10YR 5/3 brown	5.5	0.08	0.00	1.10	0.00	3.13	0.00	0.32	136.47	1.23	0.00	142.33
22		59.22	2.34	33.0	27.5	1.0	10YR 5/3 brown	5.5	0.10	0.01	2.80	0.09	10.64	0.00	1.80	458.57	9.47	0.00	483.48

Appendix B. Summary excavation data and retained materials, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	cal BP	Depth Below Surface (cm)	Mean Thickness (cm)	Weight (kg)	Volume (L)	Area (cm²)	Munsell Soil Color®	pH	Mollusc (g)	Bone (g)	Charcoal (g)	Coral (g)	Other Organic (g)	Metal (g)	Pumice (g)	Non-Artefactual Stone (g)	Artefactual Stone (g)	Ochre (g)	Retained Material (g)
23	3250-3500	61.08	1.86	29.1	21.5	1.0	10YR 4/3 brown	6.0	0.06	0.00	6.09	0.00	3.79	0.00	2.94	1252.20	15.80	3.10	1283.98
24		63.84	2.76	36.7	29.5	1.0	10YR 4/3 brown	5.5	0.24	0.06	12.87	0.00	3.58	0.00	2.21	1532.08	8.09	0.00	1559.13
25		66.10	2.26	39.0	30.5	1.0	10YR 3/3 dark brown	6.5	0.00	0.08	6.60	0.00	6.41	0.00	0.40	1544.83	1.55	0.00	1559.87
26		68.76	2.66	34.6	31	1.0	10YR 3/3 dark brown	5.5	0.02	0.00	2.07	0.00	16.99	0.00	0.45	299.37	0.55	0.00	319.45
27		70.32	1.56	23.5	20	1.0	10YR 3/3 dark brown	5.5	0.00	0.02	1.12	0.00	8.02	0.00	0.01	123.29	0.04	0.00	132.50
28		72.42	2.10	34.0	31	1.0	10YR 4/3 brown	5.5	15.42	0.05	1.04	0.01	8.78	0.00	0.20	60.47	1.43	0.00	87.40
29		75.20	2.78	44.7	41	1.0	10YR 3/3 dark brown	5.5	0.26	0.00	0.66	0.00	6.43	0.00	1.82	210.06	0.73	0.00	219.96
30		77.98	2.78	39.1	32.5	1.0	10YR 3/3 dark brown	6.0	0.59	0.00	5.41	0.00	7.24	0.00	0.44	320.07	3.50	0.00	337.25
31		80.26	2.28	25.6	24.5	1.0	10YR 4/3 brown	6.0	0.06	0.00	0.23	0.00	0.86	0.00	0.11	69.28	0.00	0.00	70.54
32	3500-3750	81.82	1.56	30.4	26	1.0	10YR 4/3 brown	5.5	0.00	0.00	0.29	0.00	1.12	0.00	0.24	54.89	0.00	0.00	56.54
33		84.64	2.82	39.6	34	1.0	10YR 4/3 brown	5.5	0.00	0.00	0.70	0.00	1.47	0.00	0.01	66.76	3.52	0.00	72.46
34		87.36	2.72	39.3	35.5	1.0	10YR 4/3 brown	5.5	0.00	0.00	0.52	0.00	1.95	0.00	0.10	60.38	0.00	0.00	62.95
35		89.64	2.28	32.1	28.5	1.0	10YR 4/3 brown	5.5	0.00	0.00	0.04	0.00	0.73	0.00	0.21	44.59	0.00	0.00	45.57
36		92.48	2.84	42.7	40	1.0	10YR 4/3 brown	5.5	0.00	0.00	0.07	0.00	1.56	0.00	0.13	71.99	0.00	0.00	73.75
37	3750-4000	94.96	2.48	38.3	33.5	1.0	10YR 4/3 brown	5.5	0.00	0.00	0.36	0.00	1.24	0.00	0.00	81.40	0.00	0.00	83.00
38		97.40	2.44	34.7	30.5	1.0	10YR 5/3 brown	5.0	0.00	0.00	0.02	0.00	0.92	0.00	0.14	124.41	0.00	0.00	125.49
39		100.20	2.80	39.9	34.5	1.0	10YR 5/3 brown	5.5	0.00	0.00	0.05	0.00	1.44	0.00	0.13	269.76	4.50	0.00	275.88
40		102.80	2.60	36.7	31	1.0	10YR 5/3 brown	5.5	0.00	0.00	0.02	0.00	1.14	0.00	0.07	531.65	1.32	0.00	534.20
41		105.38	2.58	41.9	36	1.0	10YR 5/6 yellowish brown	5.5	0.00	0.00	0.16	0.00	1.25	0.00	0.21	428.34	0.00	0.00	429.96
42	4000-4250	108.70	3.32	49.8	43.5	1.0	10YR 5/4 dark yellowish brown	5.5	0.02	0.00	0.12	0.00	1.86	0.00	0.00	359.33	13.04	0.00	374.37
43		110.88	2.18	34.9	30.5	1.0	10YR 5/6 yellowish brown	5.0	0.00	0.00	0.10	0.00	1.05	0.00	0.00	65.08	0.00	0.00	66.23
44		113.58	2.70	37.8	33.5	1.0	10YR 5/6 yellowish brown	5.0	0.00	0.00	0.05	0.00	0.98	0.00	0.00	33.64	0.00	0.00	34.67
45		115.82	2.24	37.9	35	1.0	10YR 5/4 dark yellowish brown	5.5	0.00	0.00	0.57	0.00	0.00	0.00	0.00	19.53	1.12	0.00	21.22
46		118.18	2.36	33.2	29.5	1.0	10YR 5/4 dark yellowish brown	5.5	0.00	0.00	0.00	0.00	1.36	0.00	0.00	16.85	0.00	0.00	18.21
47		120.94	2.76	38.5	34.5	1.0	10YR 5/6 yellowish brown	5.5	0.00	0.00	0.07	0.00	0.77	0.00	0.00	12.30	0.00	0.00	13.14
48	4250-4500	123.74	2.80	46.2	40.5	1.0	10YR 5/6 yellowish brown	5.5	0.00	0.00	0.00	0.00	0.32	0.00	0.00	14.45	0.00	0.00	14.77
49		126.68	2.94	44.3	40	1.0	10YR 5/6 yellowish brown	5.0	0.00	0.00	0.00	0.00	1.81	0.00	0.00	15.86	0.00	0.00	17.67

Appendix B. Summary excavation data and retained materials, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	cal BP	Depth Below Surface (cm)	Mean Thickness (cm)	Weight (kg)	Volume (L)	Area (cm^2)	Munsell Soil Color®	pH	Mollusc (g)	Bone (g)	Charcoal (g)	Coral (g)	Other Organic (g)	Metal (g)	Pumice (g)	Non-Artefactual Stone (g)	Artefactual Stone (g)	Ochre (g)	Retained Material (g)
50	4250-4500	129.18	2.50	36.6	33	1.0	10YR 5/6 yellowish brown	5.5	0.01	0.00	0.00	0.00	1.14	0.00	0.00	11.29	0.00	0.00	12.44
51		131.74	2.56	40.6	36	1.0	10YR 5/6 yellowish brown	5.0	0.00	0.00	0.00	0.00	1.67	0.00	0.00	12.75	0.00	0.00	14.42
52		134.20	2.46	38.5	33	1.0	10YR 5/6 yellowish brown	5.0	0.00	0.00	0.00	0.00	0.97	0.00	0.00	7.99	0.00	0.00	8.96
53	4500-4750	136.82	2.62	38.8	34.5	1.0	10YR 6/6 brownish yellow	5.5	0.00	0.00	0.00	0.00	0.70	0.00	0.00	8.78	0.00	0.00	9.48
54		139.38	2.56	38.0	32.5	1.0	10YR 6/6 brownish yellow	4.5	0.00	0.00	0.02	0.00	1.08	0.00	0.00	7.21	0.00	0.00	8.31
55		141.96	2.58	41.2	37.5	1.0	10YR 6/6 brownish yellow	5.5	0.00	0.00	0.00	0.00	1.21	0.00	0.00	12.28	0.00	0.00	13.49
56		144.32	2.36	35.7	29	1.0	10YR 6/6 brownish yellow	5.0	0.00	0.00	0.00	0.00	1.18	0.00	0.00	7.84	0.00	0.00	9.02
57		146.64	2.32	37.4	32.5	1.0	10YR 6/6 brownish yellow	5.5	0.00	0.00	0.00	0.00	1.04	0.00	0.00	9.29	0.00	0.00	10.33
58	4750-5000	149.26	2.62	37.4	32	1.0	10YR 6/6 brownish yellow	5.0	0.00	0.00	0.00	0.00	1.51	0.00	0.00	13.43	0.00	0.00	14.94
59		151.74	2.48	36.8	34.5	1.0	10YR 6/6 brownish yellow	5.5	0.00	0.00	0.00	0.00	1.07	0.00	0.00	11.12	0.00	0.00	12.19
									20100.51	**15.95**	**65.35**	**46.66**	**259.23**	**3.47**	**81.39**	**15718.55**	**198.32**	**3.10**	**36492.53**

Appendix C. Magnetic susceptibility data, Site 3 Mangrove Beach Headland Midden, Square A.

XU	Depth (cm)	Mass (g)	Mass Susceptibility (m^3/kg)	Volume Susceptibility (SI)	Frequency Dependence (%)	Xlf-Xhf (X 10-7 m3/kg)
1	2.02	6.97	6.35E-08	8.39E-06	5.1	1.95E-06
2	5.12	7.34	6.56E-08	9.12E-06	6.6	2.75E-06
3	7.54	7.06	6.47E-08	8.65E-06	10.5	4.12E-06
4	9.66	7.09	5.86E-08	7.87E-06	8.3	2.94E-06
5	12.54	6.63	5.86E-08	7.36E-06	12.0	3.94E-06
6	14.96	7.17	5.75E-08	7.81E-06	11.2	3.94E-06
7	17.52	6.87	5.16E-08	6.72E-06	5.7	1.67E-06
8	19.98	7.67	5.03E-08	7.30E-06	8.2	2.66E-06
9	21.98	7.29	5.57E-08	7.69E-06	8.7	3.00E-06
10	24.26	7.23	4.81E-08	6.59E-06	9.2	2.66E-06
11	26.86	7.42	4.96E-08	6.97E-06	7.5	2.31E-06
12	29.98	7.66	3.78E-08	5.49E-06	5.6	1.29E-06
13	32.32	7.21	3.69E-08	5.04E-06	6.5	1.36E-06
14	34.94	7.67	3.20E-08	4.66E-06	12.2	2.31E-06
15	37.8	7.42	3.08E-08	4.33E-06	13.6	2.34E-06
16	40.46	7.51	3.22E-08	4.59E-06	10.9	2.02E-06
17	43.1	7.73	3.04E-08	4.46E-06	14.7	2.63E-06
18	45.64	7.31	2.85E-08	3.94E-06	10.9	1.65E-06
19	48.1	7.33	2.98E-08	4.13E-06	14.4	2.33E-06
20	54.3	7.49	3.05E-08	4.33E-06	13.5	2.32E-06
21	56.88	7.47	2.97E-08	4.20E-06	13.9	2.30E-06
22	59.22	7.65	3.17E-08	4.59E-06	9.3	1.72E-06
23	61.08	7.61	3.81E-08	5.49E-06	15.7	3.64E-06
24	63.84	7.44	4.33E-08	6.10E-06	3.2	8.35E-07
25	66.1	7.48	4.60E-08	6.52E-06	9.3	2.65E-06
26	68.76	7.37	5.65E-08	7.88E-06	12.1	4.29E-06
27	70.32	7.68	4.97E-08	7.23E-06	13.4	4.29E-06
28	72.42	7.69	5.67E-08	8.26E-06	10.6	3.96E-06
29	75.2	7.64	3.84E-08	5.55E-06	5.5	1.29E-06
30	77.98	7.76	4.65E-08	6.84E-06	5.4	1.64E-06
31	80.26	7.72	5.30E-08	7.75E-06	9.5	3.31E-06
32	81.82	7.87	3.12E-08	4.65E-06	6.9	1.31E-06
33	84.64	7.82	3.49E-08	5.17E-06	10.7	2.30E-06
34	87.36	7.78	3.38E-08	4.98E-06	14.6	3.00E-06
35	89.64	7.73	3.04E-08	4.45E-06	16.5	2.94E-06
36	92.48	7.62	2.60E-08	3.75E-06	16.0	2.28E-06
37	94.96	7.84	2.52E-08	3.75E-06	18.7	2.66E-06
38	97.4	7.93	2.16E-08	3.24E-06	18.0	2.38E-06
39	100.2	7.86	2.26E-08	3.36E-06	16.0	1.95E-06
40	102.8	7.84	1.74E-08	2.59E-06	16.2	1.35E-06
41	105.38	7.84	1.79E-08	2.66E-06	18.0	2.98E-06
42	108.7	7.88	1.39E-08	2.07E-06	11.8	6.60E-07
43	110.88	7.71	1.29E-08	1.88E-06	13.7	6.35E-07
44	113.58	7.38	1.67E-08	2.33E-06	18.0	2.97E-06
45	115.82	7.74	2.16E-08	3.17E-06	16.0	6.64E-06
46	118.18	7.64	1.48E-08	2.14E-06	0.0	3.01E-06
47	120.94	7.75	1.37E-08	2.01E-06	0.0	2.30E-06
48	123.74	7.38	1.76E-08	2.46E-06	0.0	5.32E-06
49	126.68	7.88	1.05E-08	1.56E-06	0.0	1.01E-06
50	129.18	7.81	1.66E-08	2.46E-06	0.0	6.30E-06

Appendix C. Magnetic susceptibility data, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Depth (cm)	Mass (g)	Mass Susceptibility (m^3/kg)	Volume Susceptibility (SI)	Frequency Dependence (%)	Xlf-Xhf (X 10-7 m3/kg)
51	131.74	7.36	1.11E-08	1.55E-06	0.0	-
52	134.2	7.54	9.99E-09	1.43E-06	0.0	-
53	136.82	7.82	1.31E-08	1.94E-06	0.0	-
54	139.38	7.7	9.75E-09	1.42E-06	0.0	-
55	141.96	7.48	8.67E-09	1.23E-06	0.0	1.94E-06
56	144.32	7.5	1.32E-08	1.88E-06	0.0	-
57	146.64	7.26	8.97E-09	1.23E-06	0.0	-
58	149.26	7.65	1.12E-08	1.62E-06	0.0	2.67E-06
59	151.74	7.53	1.32E-08	1.88E-06	0.0	3.97E-06

Appendix D. Percentage values for identified pollen-spore types and micro-charcoal concentration, Site 3 Mangrove Beach Headland Midden, Square A.

XU	ARAUCARIACEAE	*Trema*	ARECACEAE	MALVACEAE	*Terminalia*	*Pandanus*	*Leptospermum*	*Melaleuca*	*Eucalyptus*	CASUARINACEAE	*Callitris*	*Acacia*	POACEAE	ASTERACEAE (Tubuliflorae)	*Plantago*	CHENOPODIACEAE	APIACEAE	CONVOLVALACEAE	*Acaena*	*Gleichenia*	Trilete Fern Spore	Monolete Fern Spore	*Triglochin*	CYPERACEAE	*Avicennia marina*	*Camptosetmon*	*Ceriops/Brugueira*	*Rhizophora*	Pollen Sum	Pollen Concentration (grains per cm^3)	Micro-Charcoal (particles per cm^3)
1	0	0	0.9	0	0	0	0	31.8	16.5	5.4	0.6	5.4	12.8	11.1	0	0	9.1	0	0	0	0.3	0.6	0	1.4	2	0.6	0.3	1.4	352	2429	9832
2	0	0.4	3.2	0.4	0.8	1.2	0	21.4	12.7	3.6	1.2	4	17.5	7.5	0	0	7.9	0.4	0.4	0.4	1.2	0.4	0.4	4.4	7.5	0	1.2	2	252	519	16722
3	0	0	3.7	0	0	0	0	7.4	0	0	0	3.7	44.4	0	3.7	0	3.7	0	0	3.7	0	11.1	0	14.8	0	0	0	3.7	27	143	14096
4	0	0	0	0	0	0	0	11.4	4.5	2.3	0	0	72.7	0	0	0	0	0	0	0	0	4.5	0	4.5	0	0	0	0	44	144	10672
5	0	3.3	0	0	0	0	0	3.3	6.7	0	3.3	3.3	56.7	0	0	0	0	0	0	6.7	0	0	0	3.3	13.3	0	0	0	30	180	13564
6	0	0	3.3	0	0	0	0	5.4	3.3	3.3	4.3	0	66.3	0	1.1	1.1	0	0	0	0	1.1	2.2	0	6.5	1.1	0	1.1	0	92	249	15054
7	6.4	0	0	0	0	1.3	1.3	1.3	5.1	3.8	3.8	1.3	64.1	1.3	0	0	0	0	0	0	0	2.6	0	7.7	0	0	0	0	78	142	16797
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34125
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12266
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42656
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26570
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13872
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105427
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115138
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81845
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27744
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65198
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	235824
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58262
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	439049
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	312120
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24970
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	499392
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	218484
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94330
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	136738

Appendix D. Percentage values for identified pollen-spore types and micro-charcoal concentration, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	ARAUCARIACEAE	*Trema*	ARECACEAE	MALVACEAE	*Terminalia*	*Pandanus*	*Leptospermum*	*Melaleuca*	*Eucalyptus*	CASUARINACEAE	*Callitris*	*Acacia*	POACEAE	ASTERACEAE (Tubuliflorae)	*Plantago*	CHENOPODIACEAE	APIACEAE	CONVOLVALACEAE	*Acaena*	*Gleichenia*	Trilete Fern Spore	Monolete Fern Spore	*Triglochin*	CYPERACEAE	*Avicennia marina*	*Camptosetmon*	*Ceriops/Brugueira*	*Rhizophora*	Pollen Sum	Pollen Concentration (grains per cm^3)	Micro-Charcoal (particles per cm^3)
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	136738
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3588
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105601
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89891
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116524
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41616
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13872
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20808
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10404
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	208080
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41616
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8989
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11890
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4162
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2081
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4162
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4162
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4162
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8323
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13317
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2732
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1355
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2270
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	740

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals.

											Gastropod NREs						Bivalve NREs			
XU	cal BP	Phylum	Class	Order/Family	Genus	Species	Side	NISP	MNI	Weight (g)	spire	anterior notch, canal, or columellar	posterior notch, canal, or columellar	outer lip	aperture	umbilicus	umbo/beak	anterior hinge	posterior hinge	posterior adductor muscle scar
1	500-750	Mollusca						1310		77.02										
1	500-750	Mollusca	Gastropoda					283		75.03										
1	500-750	Mollusca	Bivalvia					12		8.57										
1	500-750	Mollusca	Gastropoda	Strombidae				74	6	34.52	5									
1	500-750	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		610	771	4299.18	590	307	179	111	98					
1	500-750	Mollusca	Gastropoda	Strombidae	*Lambis*	*lambis*		11	12	247.1	3		4	4	2					
1	500-750	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		27	7	176.97		2			1					
1	500-750	Mollusca	Gastropoda	Tegulidae				1985	5	368.71						5				
1	500-750	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		13	25	641.89	1			1	1	8				
1	500-750	Mollusca	Gastropoda	Rhytididae				5	3	0.41	2			1	1	2				
1	500-750	Mollusca	Bivalvia	Ostreidae			indet.	1	1	0.05										
1	500-750	Mollusca	Gastropoda	Vermetidae				1	1	0.05										
1	500-750	Mollusca	Bivalvia	Cardiidae	*Hippopus*	*hippopus*	indet.	1	1	0.26										
1	500-750	Mollusca	Gastropoda	Trochidae	*Monodonta*	*labio*		7	1	3.15										
1	500-750	Mollusca	Gastropoda	Muricidae				1	1	0.56										
1	500-750	Mollusca	Gastropoda	Muricidae	*Thais*	sp.		2	1	2.39		1								
1	500-750	Mollusca	Gastropoda	Neritidae	*Nerita*	spp.		1	2	0.81		1		1						
1	500-750	Mollusca	Gastropoda	Neritidae	*Nerita*	*polita*		2	2	2.96	1									
1	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	spp.	1L	63	1	430.95									1	
1	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	5R	5	4	465.62							3	4	3	
1	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	2L	2									1	1	1	
1	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	indet.	3												
1	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*gigas*	1L	1	1	12.37							1	1	1	
1	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*crocea*	2L	2	3	86.3							2	2	2	
2	500-750	Mollusca						1315		36.25										
2	500-750	Mollusca	Gastropoda					135		39.75										

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals (cont.).

											Gastropod NREs						Bivalve NREs			
XU	**cal BP**	**Phylum**	**Class**	**Order/Family**	**Genus**	**Species**	**Side**	**NISP**	**MNI**	**Weight (g)**	**spire**	**anterior notch, canal, or columellar**	**posterior notch, canal, or columellar**	**outer lip**	**aperture**	**umbilicus**	**umbo/beak**	**anterior hinge**	**posterior hinge**	**posterior adductor muscle scar**
2	500-750	Mollusca	Gastropoda	Strombidae				20		8.01	1	3								
2	500-750	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		202		1663.59	181	62	81	54	50					
2	500-750	Mollusca	Gastropoda	Strombidae	*Lambis*	*lambis*		14		423.99	5	4	7	8	5					
2	500-750	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		18		50.72		5								
2	500-750	Mollusca	Gastropoda	Tegulidae				480		126.48										
2	500-750	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		29		2500.32	6			8	8	17				
2	500-750	Mollusca	Gastropoda	Rhytididae				1		0.01						1				
2	500-750	Mollusca	Bivalvia	Ostreidae			1R	1		2.82										1
2	500-750	Mollusca	Gastropoda	Vermetidae				23		0.38										
2	500-750	Mollusca	Gastropoda	Trochidae	*Monodonta*	*labio*		4		1.77										
2	500-750	Mollusca	Gastropoda	Neritidae	*Nerita*	spp.		5		1.7		1	1							
2	500-750	Mollusca	Gastropoda	Neritidae	*Nerita*	*polita*		2		3.56	1	2	1	1	1					
2	500-750	Mollusca	Gastropoda	Neritidae	*Nerita*	*costata*		1	1	0.76	1									
2	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	spp.	indet.	47		177.08										
2	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	3L	3		772.79							2	2	3	2
2	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1R	1											1	
2	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	indet.	2												
2	500-750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*crocea*	1L	1		306.52							1	1	1	1
3	750-1000	Mollusca						694		31.15										
3	750-1000	Mollusca	Gastropoda					21		17.93										
3	750-1000	Mollusca	Bivalvia					13		9.68										
3	750-1000	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		54	64	501.95	51	26	26	19	18					
3	750-1000	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		14	3	45.87		2								
3	750-1000	Mollusca	Gastropoda	Tegulidae				81	1	44.57										
3	750-1000	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		6	8	1224.53	4			4	4	6				
3	750-1000	Mollusca	Gastropoda	Vermetidae				7	1	0.24										
3	750-1000	Mollusca	Gastropoda	Trochidae	*Monodonta*	*labio*		1	1	0.95	1									

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals (cont.).

											Gastropod NREs						Bivalve NREs			
XU	**cal BP**	**Phylum**	**Class**	**Order/Family**	**Genus**	**Species**	**Side**	**NISP**	**MNI**	**Weight (g)**	**spire**	**anterior notch, canal, or columellar**	**posterior notch, canal, or columellar**	**outer lip**	**aperture**	**umbilicus**	**umbo/beak**	**anterior hinge**	**posterior hinge**	**posterior adductor muscle scar**
3	750-1000	Mollusca	Gastropoda	Neritidae	*Nerita*	sp.		2	1	1										
3	750-1000	Mollusca	Gastropoda	Neritidae	*Nerita*	*polita*		4	3	2.39	3	1	1	1	1					
3	750-1000	Mollusca	Cephalopoda	Sepiida				1	1	2.41										
3	750-1000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	spp.	indet.	17	1	81.32										
3	750-1000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1L	1	2	488.22									1	1
3	750-1000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1R	1									1	1	1	1
3	750-1000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*crocea*	1R	1	1	165.9							1	1	1	1
4	750-1000	Mollusca						183		7.16										
4	750-1000	Mollusca	Gastropoda					22		3.23										
4	750-1000	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		15		124.97	13	7	7	7	7					
4	750-1000	Mollusca	Gastropoda	Strombidae	*Lambis*	*lambis*		1	1	57.77	1	1	1	1	1					
4	750-1000	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		1		28.84	1	1	1							
4	750-1000	Mollusca	Gastropoda	Tegulidae				10		9.75						1				
4	750-1000	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		2		116.05	2			2	2	2				
4	750-1000	Mollusca	Bivalvia	Ostreidae			L	1	1	0.2										1
4	750-1000	Mollusca	Gastropoda	Trochidae	*Monodonta*	*labio*		1		0.81										
4	750-1000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	4		9										
4	750-1000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1L	1		57.15							1	1	1	
5	1000-1250	Mollusca						167		5.62										
5	1000-1250	Mollusca	Gastropoda					20		3.31										
5	1000-1250	Mollusca	Gastropoda	Strombidae				3	1	1.8										
5	1000-1250	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		7	7	47.34	7	3	3	3	3					
5	1000-1250	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		1	1	0.26										
5	1000-1250	Mollusca	Gastropoda	Tegulidae				58	1	3.67										
5	1000-1250	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		3	3	707.81	1			3	3	3				
5	1000-1250	Mollusca	Gastropoda	Vermetidae				1	1	0.01										
5	1000-1250	Mollusca	Gastropoda	Rhytididae				1	1	0.01	1									

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals (cont.).

											Gastropod NREs						Bivalve NREs			
XU	**cal BP**	**Phylum**	**Class**	**Order/Family**	**Genus**	**Species**	**Side**	**NISP**	**MNI**	**Weight (g)**	**spire**	**anterior notch, canal, or columellar**	**posterior notch, canal, or columellar**	**outer lip**	**aperture**	**umbilicus**	**umbo/beak**	**anterior hinge**	**posterior hinge**	**posterior adductor muscle scar**
6	1250-1500	Mollusca						31		1.95										
6	1250-1500	Mollusca	Gastropoda					125		6.68										
6	1250-1500	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		40	74	67.96	15	2	1							
6	1250-1500	Mollusca	Gastropoda	Tegulidae				3	1	14.13										
6	1250-1500	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	14	1	27.72										
7	1250-1500	Mollusca						145		4.1										
7	1250-1500	Mollusca	Gastropoda					77		8.55										
7	1250-1500	Mollusca	Bivalvia					3		0.08										
7	1250-1500	Mollusca	Gastropoda	Conidae	*Conus*	sp.		1	1	63.94	1	1								
7	1250-1500	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		140		171.26	59		1							
7	1250-1500	Mollusca	Gastropoda	Tegulidae				73		16.78										
7	1250-1500	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		2	2	9.74	2			1	1	1				
7	1250-1500	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	17		67.49										
7	1250-1500	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1L	1	1	43.07							1	1	1	
7	1250-1500	Mollusca	Gastropoda	Trochidae	*Monodonta*	*labio*		1	1	0.36										
7	1250-1500	Mollusca	Bivalvia	Veneridae	*Periglypta*	*puerpera*	indet.	1	1	0.91										
7	1250-1500	Mollusca	Cephalopoda	Nautilidae	*Nautilus*	sp.		1	1	16.46										
8	1500-1750	Mollusca						61		0.97										
8	1500-1750	Mollusca	Gastropoda					240		13.65										
8	1500-1750	Mollusca	Gastropoda	Conidae				1	1	7.23		1								
8	1500-1750	Mollusca	Gastropoda	Strombidae				13	5	6.18		4								
8	1500-1750	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		246	171	347.68	91	4	2							
8	1500-1750	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		2	1	5.87										
8	1500-1750	Mollusca	Gastropoda	Tegulidae				124	1	126.81										
8	1500-1750	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		4	4	497.05	3			1	1	4				
8	1500-1750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	2	1	2.99										
8	1500-1750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1L	1	3	60.91									1	

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals (cont.).

											Gastropod NREs						Bivalve NREs			
XU	cal BP	Phylum	Class	Order/Family	Genus	Species	Side	NISP	MNI	Weight (g)	spire	anterior notch, canal, or columellar	posterior notch, canal, or columellar	outer lip	aperture	umbilicus	umbo/beak	anterior hinge	posterior hinge	posterior adductor muscle scar
8	1500-1750	Mollusca	Bivalvia	Ostreidae			1R	5	1	1.36							1	1	1	
8	1500-1750	Mollusca	Gastropoda	Vermetidae				21	1	0.58										
9	1500-1750	Mollusca						146		3.45										
9	1500-1750	Mollusca	Gastropoda					72		6.74										
9	1500-1750	Mollusca	Gastropoda	Strombidae				3		3.63		1								
9	1500-1750	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		173		168.24	80	7	11							
9	1500-1750	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		5		24.18										
9	1500-1750	Mollusca	Gastropoda	Tegulidae				8		10.19										
9	1500-1750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	2		40.41										
9	1500-1750	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	2L	2		448.18							2	2	2	2
9	1500-1750	Mollusca	Bivalvia	Ostreidae			indet.	2		0.3										
9	1500-1750	Mollusca	Gastropoda	Vermetidae				9		0.26										
10	1750-2000	Mollusca						308		6.17										
10	1750-2000	Mollusca	Gastropoda					108		11.38										
10	1750-2000	Mollusca	Bivalvia					2		0.53										
10	1750-2000	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		120	87	265.39	66	1	5	1	1					
10	1750-2000	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		2	1	73.14				1	1					
10	1750-2000	Mollusca	Gastropoda	Tegulidae				13	1	22.87										
10	1750-2000	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		2	3	65.58	1					2				
10	1750-2000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	5	1	22.68										
10	1750-2000	Mollusca	Bivalvia	Ostreidae			indet.	9	1	2.76										
10	1750-2000	Mollusca	Polyplacophora	Chitonidae	*Acanthopleura*	*gemmata*		1	1	0.41										
11	1750-2000	Mollusca						133		2.74										
11	1750-2000	Mollusca	Gastropoda					18		1.52										
11	1750-2000	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		68		94.51	21	1								
11	1750-2000	Mollusca	Gastropoda	Strombidae	*Lambis*	sp.		1		4.71										
11	1750-2000	Mollusca	Gastropoda	Tegulidae				11		16.98										

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals (cont.).

											Gastropod NREs						Bivalve NREs			
XU	cal BP	Phylum	Class	Order/Family	Genus	Species	Side	NISP	MNI	Weight (g)	spire	anterior notch, canal, or columellar	posterior notch, canal, or columellar	outer lip	aperture	umbilicus	umbo/beak	anterior hinge	posterior hinge	posterior adductor muscle scar
11	1750-2000	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		1		152.66						1				
11	1750-2000	Mollusca	Bivalvia	Cardiidae	*Tridacna*	sp.	indet.	2		11.45										
12	2000-2250	Mollusca						56		0.8										
12	2000-2250	Mollusca	Gastropoda					22		3.95										
12	2000-2250	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		27	16	56.67	16									
12	2000-2250	Mollusca	Gastropoda	Tegulidae				90	1	5.28										
12	2000-2250	Mollusca	Bivalvia	Cardiidae	*Tridacna*	*maxima*	1R	1	1	69.49							1	1	1	1
12	2000-2250	Mollusca	Gastropoda	Veneridae	*Periglypta*	*puerpera*	indet.	2	1	1.77										
13	2500-2750	Mollusca	Gastropoda					12		0.99										
13	2500-2750	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		18	9	25.73	9									
13	2500-2750	Mollusca	Gastropoda	Tegulidae				3	1	0.68										
14	2750-3000	Mollusca						17		0.35										
14	2750-3000	Mollusca	Gastropoda					5		0.31										
14	2750-3000	Mollusca	Gastropoda	Strombidae	*Conomurex*	*luhuanus*		6	2	2.66	2	1								
14	2750-3000	Mollusca	Gastropoda	Neritidae	*Nerita*	sp.		1	1	0.79			1	1	1					
15	3000-3250	Mollusca						7		1.28										
15	3000-3250	Mollusca	Gastropoda					1		0.65										
15	3000-3250	Mollusca	Gastropoda	Tegulidae				7	1	1.01										
16	3250-3500	Mollusca						1		0.01										
16	3250-3500	Mollusca	Gastropoda	Strombidae				4	2	0.89										
17	3250-3500	Mollusca						14		0.11										
17	3250-3500	Mollusca	Gastropoda					2		0.21										
17	3250-3500	Mollusca	Gastropoda	Strombidae				1		1.22	1									
18	3250-3500	Mollusca	Gastropoda					3		0.14										
19	3250-3500	Mollusca						6		0.05										
19	3250-3500	Mollusca	Gastropoda					1		0.01										
19	3250-3500	Mollusca	Gastropoda	Strombidae				1		0.78	1									

Appendix E. Quantification of mollusc remains, Site 3 Mangrove Beach Headland Midden, Square A. Note NISP values are presented per XU and MNI values according to the periodised 250-year time intervals (cont.).

											Gastropod NREs						Bivalve NREs			
XU	**cal BP**	**Phylum**	**Class**	**Order/Family**	**Genus**	**Species**	**Side**	**NISP**	**MNI**	**Weight (g)**	**spire**	**anterior notch, canal, or columellar**	**posterior notch, canal, or columellar**	**outer lip**	**aperture**	**umbilicus**	**umbo/beak**	**anterior hinge**	**posterior hinge**	**posterior adductor muscle scar**
20	3250-3500	Mollusca						4		0.06										
21	3250-3500	Mollusca	Gastropoda					5		0.08										
22	3250-3500	Mollusca						8		0.1										
23	3250-3500	Mollusca						8		0.06										
24	3250-3500	Mollusca						7		0.15										
24	3250-3500	Mollusca	Gastropoda					6		0.09										
26	3250-3500	Mollusca						1		0.02										
28	3250-3500	Mollusca	Gastropoda	Tegulidae	*Rochia*	*nilotica*		3	1	15.42										
29	3250-3500	Mollusca						3		0.26										
30	3250-3500	Mollusca	Gastropoda					1		0.59										
31	3250-3500	Mollusca						1		0.06										
42	4000-4250	Mollusca						3		0.02										
50	4250-4500	Mollusca						2		0.01										
		Total						**11127**	**1356**	**20100.51**										

Appendix F. Maximum length measurements of *Tridacna maxima* specimens (left valves only), (a) located on the surface of Site 3 Mangrove Beach Headland Midden (30 m x 4 m transect) and modern reef populations (30 m x 2 m underwater transects) situated adjacent to the site, and (b) from Site 3 Mangrove Beach Headland Midden (Square A).

(a)

Sample	*n*	Mean (mm)	Range ± s.d. (σ) (mm)	% Juveniles	% Adults
Archaeological population (~500 cal BP)	74	120.96	76.32-176.23 ± 21.59	91	9
Reef population (modern)	115	152.97	8.00-360.00 ± 82.25	48	52

(b)

XU	cal BP	*n*	Mean (mm)	Range ± s.d. (σ) (mm)	% Juveniles	% Adults
1-2	500-750	5	143.47	87.47-179.41 ± 30.59	60	40
3	750-1000	1	174.16	-	0	100
7	1250-1500	1	112.05	-	100	0
8-9	1500-1750	3	119.67	96.21-165.13 ± 32.15	67	33

Appendix G: Quantification of fish remains, Site 3 Mangrove Beach Headland Midden, Square A.

XU	cal BP	Class	Family	Genus	Species	Element	NISP	MNI	Weight (g)
1	500-750	Actinopterygii	Scaridae			tooth	2	1	0.10
1	500-750	Actinopterygii	Scaridae			dentary or premaxilla	1	-	0.14
1	500-750	Actinopterygii				unknown (too fragmented)	29	-	0.78
2	500-750	Actinopterygii	Scaridae			dentary or premaxilla	1	-	0.84
2	500-750	Actinopterygii	Scaridae			tooth	1	-	0.02
2	500-750	Actinopterygii				unknown (too fragmented)	51	-	2.55
3	750-1000	Actinopterygii	Scaridae			tooth	1	1	0.04
3	750-1000	Actinopterygii				unknown (too fragmented)	61	-	2.27
4	750-1000	Actinopterygii	Scaridae			tooth	3	-	0.10
4	750-1000	Actinopterygii				unknown (too fragmented)	23	-	0.53
5	1000-1250	Actinopterygii				unknown (too fragmented)	1	-	0.02
5	1000-1250	Actinopterygii	Scaridae			tooth	1	1	0.02
6	1250-1500	Actinopterygii				unknown (too fragmented)	1	-	0.01
6	1250-1500	Actinopterygii				tooth	2	-	0.12
6	1250-1500	Actinopterygii				unknown (too fragmented)	6	-	0.06
7	1250-1500	Actinopterygii	Scaridae			dentary or premaxilla	1	1	0.02
7	1250-1500	Actinopterygii				unknown (too fragmented)	4	-	0.08
7	1250-1500	Actinopterygii	Scaridae	*Bolbometopon*	*muricatum*	tooth	1	1	0.01
7	1250-1500	Elasmobranchii				vertebra (unknown type)	1	1	0.02
8	1500-1750	Actinopterygii	Scaridae			tooth	1	1	0.01
8	1500-1750	Actinopterygii	Scaridae			tooth	1	-	0.03
8	1500-1750	Actinopterygii				tooth	1	-	0.07
8	1500-1750	Actinopterygii				unknown (too fragmented)	2	-	0.04
9	1500-1750	Actinopterygii				unknown (too fragmented)	7	-	0.15
10	1750-2000	Actinopterygii	Scaridae	*Bolbometopon*	*muricatum*	dentary or premaxilla	1	1	0.11
10	1750-2000	Actinopterygii	Scaridae			tooth	1	1	0.10
10	1750-2000	Actinopterygii				unknown (too fragmented)	4	-	0.11
10	1750-2000	Elasmobranchii				vertebra (unknown type)	1	1	0.00
11	1750-2000	Actinopterygii				unknown (too fragmented)	1	-	0.03
12	2000-2250	Actinopterygii	Scaridae			tooth	2	1	0.05
12	2000-2250	Actinopterygii				unknown (too fragmented)	5	-	0.18
13	2500-2750	Actinopterygii	Scaridae			tooth	2	1	0.02
13	2500-2750	Actinopterygii				unknown (too fragmented)	1	-	0.01
14	2750-3000	Actinopterygii	Scaridae			tooth	1	1	0.02
14	2750-3000	Actinopterygii	Scaridae			dentary or premaxilla	1	-	0.03
15	3000-3250	Actinopterygii	Scaridae			tooth	1	1	0.01
15	3000-3250	Actinopterygii				unknown (too fragmented)	2	-	0.30
16	3250-3500	Actinopterygii				unknown (too fragmented)	1	-	0.03
22	3250-3500	Actinopterygii	Scaridae			tooth	1	1	0.01
24	3250-3500	Actinopterygii	Scaridae			tooth	1	-	0.02
24	3250-3500	Actinopterygii				unknown (too fragmented)	3	-	0.05
25	3250-3500	Actinopterygii				unknown (too fragmented)	1	-	0.01
25	3250-3500	Actinopterygii	Scaridae			tooth	3	-	0.07
27	3250-3500	Actinopterygii				unknown (too fragmented)	1	-	0.02
28	3250-3500	Actinopterygii	Scaridae			tooth	1	-	0.05
		Total					**238**	**15**	**9.26**

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A.

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
1	1	Quartz	Bipolar Core	Complete	5.06	23.28	22.00	6.49	1.06	-
1	-	Quartz	Flake	Complete	1.96	19.47	15.36	5.41	1.27	79
1	-	Quartz	Flaked Piece	-	2.27	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.58	15.44	9.92	2.54	1.56	43
1	-	Quartz	Flake	Complete	0.37	6.26	11.54	3.08	0.54	52
1	-	Quartz	Flake	Complete	0.62	15.24	11.05	2.83	1.38	59
1	-	Quartz	Flake	Proximal	0.02	-	-	-	-	-
1	-	Quartz	Flake	Complete	1.1	14.98	10.08	5.97	1.49	45
1	-	Quartz	Flake	Complete	0.97	8.20	13.63	5.87	0.60	56
1	-	Quartz	Flake	Complete	0.04	5.00	5.83	1.20	0.86	74
1	-	Quartz	Flake	Left	0.02	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.08	3.84	5.17	2.60	0.74	63
1	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.01	7.16	6.09	0.89	1.18	78
1	-	Quartz	Flake	Complete	0.04	7.09	3.31	1.68	2.14	51
1	-	Quartz	Flake	Marginal	0.04	-	-	-	-	-
1	-	Quartz	Flake	Distal	0.3	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.19	5.87	7.19	1.88	0.82	32
1	-	Quartz	Flake	Complete	0.11	5.29	5.82	1.41	0.91	72
1	-	Quartz	Flake	Complete	0.08	3.64	6.75	0.82	0.54	32
1	-	Crystal Quartz	Flake	Complete	0.03	6.37	1.84	0.89	3.46	53
1	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.03	3.27	4.80	0.99	0.68	40
1	-	Quartz	Flake	Complete	0.02	5.93	3.35	1.03	1.77	67
1	-	Quartz	Flake	Marginal	0.02	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.02	3.14	3.44	1.29	0.91	53
1	-	Quartz	Flake	Marginal	0.01	-	-	-	-	-
1	-	Quartz	Flake	Marginal	0.02	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.01	-	-	-	-	-
1	-	Quartz	Flake	Marginal	0.01	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.02	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.02	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.03	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.02	-	-	-	-	-
1	-	Quartz	Flake	Complete	0.04	6.37	5.64	2.31	1.13	70
1	-	Quartz	Flake	Proximal	0.17	-	-	-	-	-
1	-	Quartz	Flake	Medial	0.08	-	-	-	-	-
1	-	Quartz	Flake	Distal	0.33	-	-	-	-	-
1	-	Quartz	Flake	Right	0.02	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	3.35	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.18	-	-	-	-	-
1	-	Quartz	Flaked Piece	-	0.01	-	-	-	-	-
2	2	Quartz	Flake	Complete	7.66	38.63	15.93	11.95	2.42	77
2	3	Quartz	Bipolar Flake	Complete	0.56	17.77	10.98	3.30	1.62	70
2	-	Crystal Quartz	Flake	Complete	0.15	6.94	5.59	2.41	1.24	64
2	-	Quartz	Flake	Complete	0.86	17.58	9.23	5.56	1.90	66
2	-	Quartz	Flake	Complete	0.24	9.76	12.51	2.14	0.78	86
2	-	Quartz	Flake	Complete	0.07	6.28	6.83	1.22	0.92	73
2	-	Quartz	Flake	Distal	0.12	-	-	-	-	-
2	-	Quartz	Flake	Distal	0.09	-	-	-	-	-
2	-	Crystal Quartz	Flake	Left	0.06	-	-	-	-	-

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
2	-	Quartz	Flake	Proximal	0.04	-	-	-	-	-
2	-	Quartz	Flake	Left	0.04	-	-	-	-	-
2	-	Quartz	Flake	Marginal	0.02	-	-	-	-	-
2	-	Quartz	Flake	Marginal	0.03	-	-	-	-	-
2	-	Quartz	Bipolar Core	Complete	1.17	16.09	10.14	6.03	1.59	-
3	1	Quartz	Flake	Complete	9.83	28.55	18.54	10.59	1.54	82
3	2	Quartz	Flake	Complete	16.3	22.33	31.43	20.50	0.71	38
3	3	Quartz	Flake	Proximal	0.94	-	-	-	-	-
3	7	Quartz	Flake	Complete	3.51	21.24	21.92	6.70	0.97	78
3	-	Quartz	Flake	Complete	0.11	14.72	4.99	1.12	2.95	74
3	-	Quartz	Flake	Complete	0.04	9.47	2.14	1.44	4.43	75
3	-	Quartz	Flake	Complete	0.08	5.65	8.98	1.57	0.63	68
3	-	Quartz	Flake	Right	0.02	-	-	-	-	-
3	-	Quartz	Flake	Marginal	0.02	-	-	-	-	-
3	-	Quartz	Flake	Medial	0.04	-	-	-	-	-
3	-	Quartz	Flake	Medial	0.01	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.2	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.65	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.21	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.07	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.06	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.09	-	-	-	-	-
3	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
4	-	Quartz	Flake	Complete	0.11	6.89	7.09	1.89	0.97	70
4	-	Quartz	Flake	Complete	0.1	8.94	6.49	1.96	1.38	83
4	-	Quartz	Flake	Complete	0.08	10.32	4.56	1.68	2.26	76
4	-	Quartz	Flake	Medial	0.98	-	-	-	-	-
4	-	Quartz	Flake	Medial	0.02	-	-	-	-	-
4	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
4	-	Quartz	Flake	Distal	0.06	-	-	-	-	-
4	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
4	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
4	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
5	1	Quartz	Flake	Left	1.06	-	-	-	-	-
5	-	Quartz	Flake	Complete	0.09	6.13	9.79	1.27	0.63	43
5	-	Quartz	Flake	Complete	0.03	5.89	5.77	0.94	1.02	73
5	-	Quartz	Flake	Complete	0.03	5.14	4.36	1.05	1.18	75
5	-	Crystal Quartz	Flake	Marginal	0.02	-	-	-	-	-
5	-	Quartz	Flake	Left	0.16	-	-	-	-	-
5	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
6	1	Quartz	Flake	Complete	0.53	13.42	7.92	3.45	1.69	60
6	-	Quartz	Flake	Complete	3.39	26.76	15.05	6.37	1.78	105
6	-	Quartz	Flake	Complete	0.86	14.37	15.55	3.01	0.92	58
6	-	Quartz	Flake	Complete	0.18	10.79	7.74	1.74	1.39	67
6	-	Quartz	Flake	Complete	0.23	7.55	9.88	2.33	0.76	74
6	-	Quartz	Flake	Complete	0.09	12.46	4.83	1.05	2.58	74
6	-	Quartz	Flake	Complete	0.04	4.42	5.51	1.36	0.80	62
6	-	Quartz	Flake	Complete	0.05	5.33	4.31	1.46	1.24	56
6	-	Quartz	Flake	Complete	0.07	6.49	5.55	1.79	1.17	70
6	-	Quartz	Flake	Complete	0.03	4.67	5.75	0.98	0.81	60
6	-	Quartz	Flake	Marginal	0.06	-	-	-	-	-

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
6	-	Quartz	Flake	Distal	0.12	-	-	-	-	-
6	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
6	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
6	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
6	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
6	-	Quartz	Flaked Piece	-	4.3	-	-	-	-	-
6	-	Quartz	Flake	Complete	0.3	8.93	8.61	3.04	1.04	72
6	-	Quartz	Flake	Complete	0.05	2.50	10.08	1.08	0.25	69
7	1	Quartz	Flake	Distal	0.06	-	-	-	-	-
7	9	Quartz	Flake	Complete	0.13	3.82	8.37	2.23	0.46	47
7	-	Quartz	Flake	Complete	0.21	8.03	7.04	2.69	1.14	55
7	-	Quartz	Flake	Complete	0.05	4.31	5.49	1.21	0.79	49
7	-	Quartz	Flake	Complete	0.01	4.05	2.53	0.72	1.60	69
7	-	Quartz	Flake	Complete	0.02	3.59	3.92	1.15	0.92	60
7	-	Quartz	Flake	Complete	0.03	4.84	2.98	1.51	1.62	68
7	-	Quartz	Flake	Complete	0.01	2.67	4.14	0.75	0.64	70
7	-	Quartz	Flake	Marginal	0.02	-	-	-	-	-
7	-	Quartz	Flake	Medial	0.36	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.05	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.06	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.16	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
7	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
8	1	Quartz	Bipolar Flake	Complete	1.23	18.43	9.64	5.35	1.91	92
8	2	Quartz	Bipolar Flake	Complete	0.11	6.60	5.20	2.18	1.27	75
8	6	Quartz	Flake	Complete	0.52	9.86	11.43	3.91	0.86	69
8	-	Quartz	Flake	Complete	0.45	7.23	12.23	3.63	0.59	56
8	-	Quartz	Bipolar Flake	Complete	0.32	14.09	7.30	2.68	1.93	69
8	-	Quartz	Flake	Complete	0.07	5.11	7.61	0.82	0.67	57
8	-	Quartz	Flake	Complete	0.09	6.92	4.81	1.79	1.44	79
8	-	Quartz	Flake	Complete	0.09	7.94	5.68	1.75	1.40	76
8	-	Quartz	Flake	Complete	0.03	5.21	3.28	1.23	1.59	49
8	-	Quartz	Flake	Complete	0.02	4.49	4.12	0.71	1.09	28
8	-	Quartz	Flake	Marginal	0.02	-	-	-	-	-
8	-	Quartz	Flake	Complete	0.36	11.84	7.65	3.92	1.55	75
8	-	Quartz	Flake	Medial	0.37	-	-	-	-	-
8	-	Quartz	Flake	Medial	0.4	-	-	-	-	-
8	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
8	-	Quartz	Flake	Distal	0.13	-	-	-	-	-
8	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
8	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
8	-	Quartz	Flake	Distal	0.06	-	-	-	-	-
8	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
9	2	Quartz	Bipolar Flake	Complete	3.26	16.46	17.78	8.05	0.93	54
9	5	Quartz	Microblade	Complete	0.22	13.65	4.75	2.13	2.87	57
9	12	Quartz	Flake	Complete	2.35	11.10	17.04	10.29	0.65	40
9	14	Quartz	Flake	Distal	3.23	-	-	-	-	-
9	16	Quartz	Flake	Complete	0.08	6.12	5.57	1.42	1.10	69

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
9	-	Quartz	Flake	Complete	0.48	11.56	12.27	3.50	0.94	67
9	-	Quartz	Flake	Complete	0.35	6.30	11.42	2.52	0.55	30
9	-	Quartz	Flake	Complete	0.06	5.89	5.74	1.61	1.03	75
9	-	Quartz	Flake	Complete	0.02	6.46	4.97	0.80	1.30	73
9	-	Quartz	Flake	Complete	0.04	6.55	5.12	0.73	1.28	78
9	-	Quartz	Flake	Complete	0.01	3.63	4.42	0.66	0.82	84
9	-	Quartz	Flake	Right	0.6	-	-	-	-	-
9	-	Quartz	Flake	Marginal	0.05	-	-	-	-	-
9	-	Quartz	Flake	Proximal	0.12	-	-	-	-	-
9	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
9	-	Quartz	Flake	Right	0.06	-	-	-	-	-
10	3	Quartz	Flake	Complete	1.3	16.75	14.12	4.98	1.19	67
10	4	Quartz	Flake	Complete	0.78	11.36	9.37	3.05	1.21	68
10	5	Quartz	Flake	Proximal	1.14	-	-	-	-	-
10	6	Quartz	Flake	Proximal	0.5	-	-	-	-	-
10	9	Quartz	Bipolar Core	Complete	11.15	29.86	22.03	15.06	1.36	-
10	10	Quartz	Flaked Piece	-	4.88	-	-	-	-	-
10	-	Quartz	Flake	Complete	0.62	11.90	10.36	2.99	1.15	71
10	-	Quartz	Flake	Complete	0.4	13.27	12.61	3.06	1.05	68
10	-	Quartz	Flake	Complete	0.2	9.78	9.33	1.75	1.05	64
10	-	Quartz	Flake	Complete	0.23	8.98	7.08	2.52	1.27	91
10	-	Quartz	Flake	Complete	0.19	7.98	10.10	1.83	0.79	87
10	-	Quartz	Flake	Complete	0.01	5.29	5.08	0.46	1.04	72
10	-	Quartz	Flake	Proximal	0.06	-	-	-	-	-
10	-	Quartz	Flake	Left	0.29	-	-	-	-	-
10	-	Quartz	Flake	Distal	0.05	-	-	-	-	-
10	-	Quartz	Flake	Medial	0.3	-	-	-	-	-
10	-	Quartz	Flake	Distal	0.19	-	-	-	-	-
10	-	Quartz	Flake	Complete	0.27	4.40	9.65	2.81	0.46	51
10	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
10	-	Quartz	Bipolar Flake	Complete	0.21	7.24	9.98	2.00	0.73	74
10	-	Quartz	Flake	Complete	0.13	5.17	9.77	1.83	0.53	71
10	-	Quartz	Flake	Complete	0.07	3.33	6.11	2.16	0.55	48
10	-	Quartz	Flake	Complete	0.05	6.28	4.36	1.45	1.44	43
10	-	Quartz	Flake	Complete	0.01	4.19	3.88	0.97	1.08	79
10	-	Quartz	Flake	Marginal	0.03	-	-	-	-	-
10	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
11	1	Quartz	Flake	Complete	2.62	22.53	14.94	4.86	1.51	46
11	2	Quartz	Bipolar Flake	Complete	0.48	15.47	7.31	2.74	2.12	68
11	3	Quartz	Flake	Distal	0.13	-	-	-	-	-
11	4	Quartz	Flaked Piece	-	1.02	-	-	-	-	-
11	13	Quartz	Flaked Piece	-	1.7	-	-	-	-	-
11	16	Quartz	Flake	Distal	0.05	-	-	-	-	-
11	-	Crystal Quartz	Flake	Complete	0.4	14.79	9.15	2.02	1.62	64
11	-	Quartz	Flake	Complete	0.16	9.56	8.09	2.08	1.18	74
11	-	Quartz	Flake	Complete	0.07	8.05	5.92	1.20	1.36	73
11	-	Quartz	Flake	Complete	0.06	5.49	6.11	1.26	0.90	71
11	-	Quartz	Flake	Proximal	0.1	-	-	-	-	-
11	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
11	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
11	-	Quartz	Flake	Distal	0.03	-	-	-	-	-

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
12	-	Quartz	Bipolar Flake	Complete	2.35	32.14	9.76	4.49	3.29	74
12	-	Quartz	Core	Complete	1.58	9.18	23.29	5.93	0.39	-
12	-	Crystal Quartz	Flake	Complete	0.16	9.73	7.41	1.68	1.31	77
12	-	Quartz	Flake	Complete	0.2	7.79	8.93	2.87	0.87	54
12	-	Quartz	Flake	Proximal	1.03	-	-	-	-	-
12	-	Quartz	Flake	Distal	0.07	-	-	-	-	-
12	-	Quartz	Flake	Distal	0.13	-	-	-	-	-
12	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
12	-	Quartz	Flake	Complete	0.48	8.17	8.74	6.13	0.93	58
13	-	Quartz	Flake	Complete	0.04	5.60	4.74	1.44	1.18	77
14	1	Quartz	Bipolar Core	Complete	3.78	27.74	14.96	8.68	1.85	-
14	-	Quartz	Flake	Right	0.22	-	-	-	-	-
14	-	Quartz	Flake	Complete	0.09	6.99	4.05	2.33	1.73	60
15	2	Quartz	Flake	Complete	0.09	7.73	6.51	1.37	1.19	74
15	-	Crystal Quartz	Flake	Complete	0.02	5.68	3.04	0.88	1.87	74
15	-	Crystal Quartz	Flake	Marginal	0.01	-	-	-	-	-
15	-	Crystal Quartz	Flake	Distal	0.01	-	-	-	-	-
15	-	Crystal Quartz	Flake	Distal	0.01	-	-	-	-	-
16	-	Crystal Quartz	Flake	Complete	0.01	4.97	3.81	0.90	1.30	58
16	-	Quartz	Flake	Complete	0.02	6.28	5.05	0.68	1.24	68
16	-	Quartz	Flake	Proximal	0.17	-	-	-	-	-
16	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
17	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
18	-	Quartz	Flake	Medial	0.03	-	-	-	-	-
19	8	Quartz	Flake	Medial	0.02	-	-	-	-	-
19	-	Quartz	Flake	Complete	0.07	6.54	4.68	2.23	1.40	55
19	-	Quartz	Flake	Complete	0.12	6.61	6.21	1.90	1.06	58
19	-	Quartz	Flake	Distal	0.06	-	-	-	-	-
19	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
19	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
20	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
20	-	Quartz	Flake	Distal	0.1	-	-	-	-	-
20	-	Crystal Quartz	Flake	Distal	0.02	-	-	-	-	-
21	-	Quartz	Flake	Proximal	0.05	-	-	-	-	-
21	-	Quartz	Flake	Medial	0.08	-	-	-	-	-
21	-	Quartz	Flake	Distal	0.64	-	-	-	-	-
21	-	Quartz	Flake	Distal	0.16	-	-	-	-	-
21	-	Quartz	Flake	Distal	0.26	-	-	-	-	-
21	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
21	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
22	10	Quartz	Flake	Distal	0.24	-	-	-	-	-
22	11	Quartz	Flake	Left	0.13	-	-	-	-	-
22	15	Crystal Quartz	Flake	Complete	0.58	11.72	11.95	2.96	0.98	74
22	-	Quartz	Flake	Complete	0.04	8.57	4.50	1.19	1.90	76
22	-	Quartz	Flake	Complete	0.03	8.93	4.80	0.78	1.86	73
22	-	Quartz	Flake	Left	1.39	-	-	-	-	-
22	-	Quartz	Flake	Right	4.38	-	-	-	-	-
22	-	Quartz	Flake	Distal	2.36	-	-	-	-	-
22	-	Quartz	Flake	Distal	0.22	-	-	-	-	-
22	-	Quartz	Flake	Distal	0.04	-	-	-	-	-
22	-	Quartz	Flake	Distal	0.01	-	-	-	-	-

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
22	-	Quartz	Flake	Proximal	0.04	-	-	-	-	-
22	-	Quartz	Flaked Piece	-	0.01	-	-	-	-	-
23	1	Quartz	Flake	Complete	4.44	21.03	29.85	5.43	0.70	50
23	20	Quartz	Flake	Complete	1.31	21.95	8.70	4.62	2.52	61
23	23	Quartz	Flake	Complete	2.63	13.91	23.77	3.09	0.59	76
23	32	Quartz	Flake	Left	0.47	-	-	-	-	-
23	33	Sedimentary	Flake	Proximal	2.37	-	-	-	-	-
23	41	Quartz	Flake	Complete	0.47	19.82	11.10	1.67	1.79	62
23	-	Quartz	Bipolar Core	Complete	1.91	22.66	5.42	10.06	4.18	-
23	-	Crystal Quartz	Flake	Complete	0.27	17.24	6.23	1.95	2.77	79
23	-	Quartz	Flake	Complete	0.66	22.60	4.97	5.80	4.55	89
23	-	Quartz	Flake	Complete	0.03	3.65	6.35	1.30	0.57	79
23	-	Quartz	Flake	Complete	0.03	5.00	5.07	1.49	0.99	67
23	-	Quartz	Flake	Proximal	0.02	-	-	-	-	-
23	-	Quartz	Flake	Left	0.1	-	-	-	-	-
23	-	Crystal Quartz	Flake	Right	0.25	-	-	-	-	-
23	-	Quartz	Flake	Distal	0.19	-	-	-	-	-
23	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
23	-	Quartz	Flake	Medial	0.01	-	-	-	-	-
23	-	Quartz	Flaked Piece	-	0.03	-	-	-	-	-
23	-	Granite	Flake	Medial	0.58	-	-	-	-	-
24	5	Quartz	Flake	Complete	0.16	9.22	7.11	1.98	1.30	88
24	13	Quartz	Flaked Piece	-	0.04	-	-	-	-	-
24	14	Quartz	Flake	Complete	1.42	14.49	14.27	5.48	1.02	83
24	15	Quartz	Flake	Right	0.27	-	-	-	-	-
24	57	Quartz	Flake	Complete	3.72	32.92	21.40	4.12	1.54	70
24	-	Quartz	Flake	Complete	0.48	8.90	16.12	2.52	0.55	49
24	-	Quartz	Flake	Complete	0.26	7.08	8.97	2.20	0.79	54
24	-	Quartz	Flake	Complete	0.08	6.93	5.83	1.21	1.19	75
24	-	Quartz	Flake	Complete	0.13	6.12	7.26	2.29	0.84	61
24	-	Quartz	Flake	Complete	0.06	4.35	8.90	1.22	0.49	49
24	-	Quartz	Flake	Complete	0.03	5.89	4.48	1.02	1.31	67
24	-	Quartz	Flake	Complete	0.08	4.32	6.90	1.69	0.63	43
24	-	Quartz	Flake	Complete	0.04	4.73	5.29	1.43	0.89	43
24	-	Quartz	Flake	Complete	0.01	4.46	3.28	0.59	1.36	48
24	-	Quartz	Flake	Proximal	0.09	-	-	-	-	-
24	-	Quartz	Flake	Proximal	0.07	-	-	-	-	-
24	-	Quartz	Flake	Proximal	0.03	-	-	-	-	-
24	-	Quartz	Flake	Distal	0.07	-	-	-	-	-
24	-	Quartz	Flake	Distal	0.46	-	-	-	-	-
24	-	Quartz	Flake	Distal	0.22	-	-	-	-	-
24	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
24	-	Quartz	Flaked Piece	-	0.36	-	-	-	-	-
25	13	Quartz	Flake	Complete	0.99	18.83	9.42	3.75	2.00	66
25	-	Quartz	Flake	Complete	0.11	5.86	6.52	2.03	0.90	73
25	-	Quartz	Flake	Complete	0.1	5.19	7.24	2.06	0.72	75
25	-	Quartz	Flake	Proximal	0.17	-	-	-	-	-
25	-	Quartz	Flake	Medial	0.01	-	-	-	-	-
25	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
25	-	Quartz	Flake	Distal	0.02	-	-	-	-	-

Appendix H. Stone artefact analysis, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

XU	Object #	Raw Material	Fracture Type	Fragment Category	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Elongation (mm)	Angle (°)
25	-	Quartz	Ground Edge Fragment	-	0.09	-	-	-	-	-
25	-	Quartz	Flaked Piece	-	0.02	-	-	-	-	-
25	-	Quartz	Flaked Piece	-	0.01	-	-	-	-	-
26	13	Quartz	Flake	Distal	0.49	-	-	-	-	-
26	-	Quartz	Flake	Proximal	0.03	-	-	-	-	-
26	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
26	-	Quartz	Flake	Medial	0.01	-	-	-	-	-
27	-	Quartz	Flake	Left	0.03	-	-	-	-	-
27	-	Quartz	Flake	Distal	0.01	-	-	-	-	-
28	3	Quartz	Flake	Complete	1.38	10.72	14.18	7.10	0.76	68
28	-	Quartz	Flake	Complete	0.04	4.73	5.52	1.19	0.86	79
28	-	Quartz	Flake	Marginal	0.01	-	-	-	-	-
29	8	Quartz	Flake	Complete	0.66	8.19	13.13	3.03	0.62	59
29	-	Quartz	Flake	Proximal	0.01	-	-	-	-	-
29	-	Quartz	Flake	Distal	0.02	-	-	-	-	-
29	-	Quartz	Flake	Distal	0.03	-	-	-	-	-
29	-	Quartz	Flake	Marginal	0.01	-	-	-	-	-
30	6	Quartz	Flaked Piece	-	3.49	-	-	-	-	-
30	-	Crystal Quartz	Flake	Marginal	0.01	-	-	-	-	-
33	4	Volcanic	Ground Edge Fragment	Broken	3.52	-	-	-	-	-
39	2	Quartz	Flake	Right	1.96	-	-	-	-	-
39	3	Quartz	Flaked Piece	-	2.01	-	-	-	-	-
39	-	Quartz	Flake	Complete	0.52	8.29	9.33	3.00	0.89	55
39	-	Crystal Quartz	Flake	Marginal	0.01	-	-	-	-	-
40	1	Quartz	Flake	Complete	1.32	8.02	16.02	6.10	0.50	53
42	4	Quartz	Core	Complete	13.03	28.16	35.83	7.13	0.79	-
42	-	Crystal Quartz	Flake	Complete	0.01	6.31	2.23	0.71	2.83	71
45	-	Quartz	Flake	Complete	1.12	18.13	8.68	5.35	2.09	58

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A.

FS#	Square	XU	Object #	Description	Date	# of Bags
1	A	1	-	2.3 mm sieve residue	7/05/2013	3
2	A	1	-	sediment sample	7/05/2013	1
3	A	1	1	quartz artefact	7/05/2013	1
4	A	1	2	charcoal	7/05/2013	1
5	A	1	3	charcoal	7/05/2013	1
6	A	1	4	charcoal	7/05/2013	1
7	A	1	5	charcoal	7/05/2013	1
8	A	1	6	charcoal	7/05/2013	1
9	A	1	7	turtle bone	7/05/2013	1
10	A	2	-	quartz artefact	7/05/2013	3
11	A	2	-	quartz artefact	7/05/2013	1
12	A	2	1	turtle bone	7/05/2013	1
13	A	2	2	quartz artefact	7/05/2013	1
14	A	3	3	quartz artefact	7/05/2013	1
15	A	3	-	2.3 mm sieve residue	7/05/2013	2
16	A	3	-	sediment sample	7/05/2013	1
17	A	3	1	quartz artefact	7/05/2013	1
18	A	3	2	quartz artefact	7/05/2013	1
19	A	3	3	quartz artefact	7/05/2013	1
20	A	3	4	charcoal	7/05/2013	1
21	A	3	5	charcoal	7/05/2013	1
22	A	3	6	charcoal	7/05/2013	1
23	A	3	7	quartz artefact	7/05/2013	1
24	A	3	8	charcoal	7/05/2013	1
25	A	3	9	charcoal	7/05/2013	1
26	A	4	-	2.3 mm sieve residue	7/05/2013	1
27	A	4	-	sediment sample	7/05/2013	1
28	A	5	-	2.3 mm sieve residue	8/05/2013	1
29	A	5	-	sediment sample	8/05/2013	1
30	A	5	1	quartz artefact	8/05/2013	1
31	A	6	-	2.3 mm sieve residue	8/05/2013	1
32	A	6	-	sediment sample	8/05/2013	1
33	A	6	1	quartz artefact	8/05/2013	1
34	A	7	-	2.3 mm sieve residue	8/05/2013	1
35	A	7	-	sediment sample	8/05/2013	1
36	A	7	1	quartz artefact	8/05/2013	1
37	A	7	2	charcoal	8/05/2013	1
38	A	7	3	charcoal	8/05/2013	1
39	A	7	4	charcoal	8/05/2013	1
40	A	7	5	charcoal	8/05/2013	1
41	A	7	6	charcoal	8/05/2013	1
42	A	7	7	*Conus* sp. fragment	8/05/2013	1
43	A	7	8	charcoal	8/05/2013	1
44	A	7	9	quartz artefact	8/05/2013	1
45	A	7	10	charcoal	8/05/2013	1
46	A	7	11	charcoal	8/05/2013	1
47	A	7	12	charcoal	8/05/2013	1
48	A	7	13	charcoal	8/05/2013	1
49	A	7	14	charcoal	8/05/2013	1
50	A	7	15	charcoal	8/05/2013	1
51	A	7	16	charcoal	8/05/2013	1
52	A	8	-	2.3 mm sieve residue	8/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
53	A	8	-	sediment sample	8/05/2013	1
54	A	8	1	quartz artefact	8/05/2013	1
55	A	8	2	quartz artefact	8/05/2013	1
56	A	8	3	charcoal	8/05/2013	1
57	A	8	4	charcoal	8/05/2013	1
58	A	8	5	charcoal	8/05/2013	1
59	A	8	6	quartz artefact	8/05/2013	1
60	A	8	7	rock	8/05/2013	1
61	A	9	-	2.3 mm sieve residue	8/05/2013	1
62	A	9	-	sediment sample	8/05/2013	1
63	A	9	1	quartz artefact	8/05/2013	1
64	A	9	2	quartz artefact	8/05/2013	1
65	A	9	3	charcoal	8/05/2013	1
66	A	9	4	charcoal	8/05/2013	1
67	A	9	5	quartz artefact	8/05/2013	1
68	A	9	6	charcoal	8/05/2013	1
69	A	9	7	charcoal	8/05/2013	1
70	A	9	8	charcoal	8/05/2013	1
71	A	9	9	charcoal	8/05/2013	1
72	A	9	10	charcoal	8/05/2013	1
73	A	9	11	charcoal	8/05/2013	1
74	A	9	12	quartz artefact	8/05/2013	1
75	A	9	13	charcoal	8/05/2013	1
76	A	9	14	quartz artefact	8/05/2013	1
77	A	9	15	charcoal	8/05/2013	1
78	A	9	16	quartz artefact	8/05/2013	1
79	A	9	17	charcoal	8/05/2013	1
80	A	9	18	charcoal	8/05/2013	1
81	A	9	19	charcoal	8/05/2013	1
82	A	10	-	2.3 mm sieve residue	8/05/2013	1
83	A	10	-	sediment sample	8/05/2013	1
84	A	10	1	charcoal	8/05/2013	1
85	A	10	2	charcoal	8/05/2013	1
86	A	10	3	quartz artefact	8/05/2013	1
87	A	10	4	quartz artefact	8/05/2013	1
88	A	10	5	quartz artefact	8/05/2013	1
89	A	10	6	quartz artefact	8/05/2013	1
90	A	10	7	charcoal	8/05/2013	1
91	A	10	8	charcoal	8/05/2013	1
92	A	10	9	quartz artefact	8/05/2013	1
93	A	10	10	quartz artefact	8/05/2013	1
94	A	10	11	charcoal	8/05/2013	1
95	A	11	-	2.3 mm sieve residue	9/05/2013	1
96	A	11	-	sediment sample	9/05/2013	1
97	A	11	1	quartz artefact	9/05/2013	1
98	A	11	2	quartz artefact	9/05/2013	1
99	A	11	3	quartz artefact	9/05/2013	1
100	A	11	4	quartz artefact	9/05/2013	1
101	A	11	5	charcoal	9/05/2013	1
102	A	11	6	discarded sample (rock)	9/05/2013	1
103	A	11	7	charcoal	9/05/2013	1
104	A	11	8	pumice	9/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
105	A	11	9	charcoal	9/05/2013	1
106	A	11	10	charcoal	9/05/2013	1
107	A	11	11	charcoal	9/05/2013	1
108	A	11	12	charcoal	9/05/2013	1
109	A	11	13	quartz artefact	9/05/2013	1
110	A	11	14	charcoal	9/05/2013	1
111	A	11	15	charcoal	9/05/2013	1
112	A	11	16	quartz artefact	9/05/2013	1
113	A	11	17	charcoal	9/05/2013	1
114	A	11	18	charcoal	9/05/2013	1
115	A	11	19	charcoal	9/05/2013	1
116	A	11	20	charcoal	9/05/2013	1
117	A	12	-	2.3 mm sieve residue	9/05/2013	1
118	A	12	-	sediment sample	9/05/2013	1
119	A	13	-	2.3 mm sieve residue	9/05/2013	1
120	A	13	-	sediment sample	9/05/2013	1
121	A	14	-	2.3 mm sieve residue	9/05/2013	1
122	A	14	-	sediment sample	9/05/2013	1
123	A	14	1	quartz artefact	9/05/2013	1
124	A	14	2	charcoal	9/05/2013	1
125	A	14	3	charcoal	9/05/2013	1
126	A	14	4	charcoal	9/05/2013	1
127	A	14	5	charcoal	9/05/2013	1
128	A	15	-	2.3 mm sieve residue	9/05/2013	1
129	A	15	-	sediment sample	9/05/2013	1
130	A	15	1	manuport	9/05/2013	1
131	A	15	2	quartz artefact	9/05/2013	1
132	A	16	-	2.3 mm sieve residue	9/05/2013	1
133	A	16	-	sediment sample	9/05/2013	1
134	A	16	1	charcoal	9/05/2013	1
135	A	16	2	charcoal	9/05/2013	1
136	A	17	-	2.3 mm sieve residue	10/05/2013	1
137	A	17	-	sediment sample	10/05/2013	1
138	A	17	1	charcoal	10/05/2013	1
139	A	17	2	charcoal	10/05/2013	1
140	A	17	3	charcoal	10/05/2013	1
141	A	17	4	charcoal	10/05/2013	1
142	A	18	-	2.3 mm sieve residue	10/05/2013	1
143	A	18	-	sediment sample	10/05/2013	1
144	A	18	1	sediment collected in situ	10/05/2013	1
145	A	18	2	sediment collected in situ	10/05/2013	1
146	A	19	-	2.3 mm sieve residue	10/05/2013	1
147	A	19	-	sediment sample	10/05/2013	1
148	A	19	1	charcoal	10/05/2013	1
149	A	19	2	quartz artefact	10/05/2013	1
150	A	19	3	charcoal	10/05/2013	1
151	A	19	4	charcoal	10/05/2013	1
152	A	19	5	charcoal	10/05/2013	1
153	A	19	6	charcoal	10/05/2013	1
154	A	19	7	charcoal	10/05/2013	1
155	A	19	8	quartz artefact	10/05/2013	1
156	A	19	9	charcoal	10/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
157	A	20	-	2.3 mm sieve residue	10/05/2013	1
158	A	20	-	sediment sample	10/05/2013	1
159	A	20	1	charcoal	10/05/2013	1
160	A	20	2	charcoal	10/05/2013	1
161	A	20	3	charcoal	10/05/2013	1
162	A	20	4	charcoal	10/05/2013	1
163	A	20	5	charcoal	10/05/2013	1
164	A	20	6	charcoal	10/05/2013	1
165	A	20	7	charcoal	10/05/2013	1
166	A	20	8	charcoal	10/05/2013	1
167	A	20	9	charcoal	10/05/2013	1
168	A	20	10	charcoal	10/05/2013	1
169	A	20	11	charcoal	10/05/2013	1
170	A	20	12	charcoal	10/05/2013	1
171	A	20	13	charcoal	10/05/2013	1
172	A	20	14	charcoal	10/05/2013	1
173	A	20	15	charcoal	10/05/2013	1
174	A	20	16	charcoal	10/05/2013	1
175	A	20	17	charcoal	10/05/2013	1
176	A	20	18	charcoal	10/05/2013	1
177	A	21	-	2.3 mm sieve residue	10/05/2013	1
178	A	21	-	sediment sample	10/05/2013	1
179	A	21	1	rock	10/05/2013	1
180	A	21	2	charcoal	10/05/2013	1
181	A	22	-	2.3 mm sieve residue	11/05/2013	1
182	A	22	-	sediment sample	11/05/2013	1
183	A	22	1	charcoal	11/05/2013	1
184	A	22	2	charcoal	11/05/2013	1
185	A	22	3	charcoal	11/05/2013	1
186	A	22	4	charcoal	11/05/2013	1
187	A	22	5	charcoal	11/05/2013	1
188	A	22	6	charcoal	11/05/2013	1
189	A	22	7	charcoal	11/05/2013	1
190	A	22	8	charcoal	11/05/2013	1
191	A	22	9	charcoal	11/05/2013	1
192	A	22	10	quartz artefact	11/05/2013	1
193	A	22	11	quartz artefact	11/05/2013	1
194	A	22	12	charcoal	11/05/2013	1
195	A	22	13	charcoal	11/05/2013	1
196	A	22	14	charcoal	11/05/2013	1
197	A	22	15	charcoal	11/05/2013	1
198	A	22	16	charcoal	11/05/2013	1
199	A	22	17	charcoal	11/05/2013	1
200	A	22	18	charcoal	11/05/2013	1
201	A	22	19	charcoal	11/05/2013	1
202	A	22	20	charcoal	11/05/2013	1
203	A	22	21	charcoal	11/05/2013	1
204	A	22	22	charcoal	11/05/2013	1
205	A	22	23	manuport	11/05/2013	1
206	A	22	24	charcoal	11/05/2013	1
207	A	23	-	2.3 mm sieve residue	11/05/2013	1
208	A	23	-	sediment sample	11/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
209	A	23	1	quartz artefact	11/05/2013	1
210	A	23	2	red ochre	11/05/2013	1
211	A	23	3	charcoal	11/05/2013	1
212	A	23	4	charcoal	11/05/2013	1
213	A	23	5	charcoal	11/05/2013	1
214	A	23	6	charcoal	11/05/2013	1
215	A	23	7	charcoal	11/05/2013	1
216	A	23	8	charcoal	11/05/2013	1
217	A	23	9	charcoal	11/05/2013	1
218	A	23	10	charcoal	11/05/2013	1
219	A	23	11	charcoal	11/05/2013	1
220	A	23	12	charcoal	11/05/2013	1
221	A	23	13	charcoal	11/05/2013	1
222	A	23	14	red ochre	11/05/2013	1
223	A	23	15	mollusc fragment	11/05/2013	1
224	A	23	16	charcoal	11/05/2013	1
225	A	23	17	charcoal	11/05/2013	1
226	A	23	18	charcoal	11/05/2013	1
227	A	23	19	quartz artefact	11/05/2013	1
228	A	23	20	quartz artefact	11/05/2013	1
229	A	23	21	charcoal	11/05/2013	1
230	A	23	22	red ochre	11/05/2013	1
231	A	23	23	charcoal	11/05/2013	1
232	A	23	24	charcoal	11/05/2013	1
233	A	23	25	charcoal	11/05/2013	1
234	A	23	26	charcoal	11/05/2013	1
235	A	23	27	charcoal	11/05/2013	1
236	A	23	28	charcoal	11/05/2013	1
237	A	23	29	charcoal	11/05/2013	1
238	A	23	30	charcoal	11/05/2013	1
239	A	23	31	charcoal	11/05/2013	1
240	A	23	32	quartz artefact	11/05/2013	1
241	A	23	33	sedimentary artefact	11/05/2013	1
242	A	23	34	charcoal	11/05/2013	1
243	A	23	35	mollusc fragment	11/05/2013	1
244	A	23	36	charcoal	11/05/2013	1
245	A	23	37	charcoal	11/05/2013	1
246	A	23	38	charcoal	11/05/2013	1
247	A	23	39	heat retainer?	11/05/2013	1
248	A	23	40	charcoal	11/05/2013	1
249	A	23	41	quartz artefact	11/05/2013	1
250	A	23	42	heat retainer?	11/05/2013	1
251	A	23	43	heat retainer?	11/05/2013	1
252	A	23	44	charcoal	11/05/2013	1
253	A	23	45	charcoal	11/05/2013	1
254	A	24	-	2.3 mm sieve residue	13/05/2013	1
255	A	24	-	sediment sample	13/05/2013	1
256	A	24	1	heat retainer?	13/05/2013	1
257	A	24	2	charcoal	13/05/2013	1
258	A	24	3	charcoal	13/05/2013	1
259	A	24	4	charcoal	13/05/2013	1
260	A	24	5	quartz artefact	13/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
261	A	24	6	charcoal	13/05/2013	1
262	A	24	7	charcoal	13/05/2013	1
263	A	24	8	charcoal	13/05/2013	1
264	A	24	9	charcoal	13/05/2013	1
265	A	24	10	charcoal	13/05/2013	1
266	A	24	11	charcoal	13/05/2013	1
267	A	24	12	charcoal	13/05/2013	1
268	A	24	13	quartz artefact	13/05/2013	1
269	A	24	14	quartz artefact	13/05/2013	1
270	A	24	15	quartz artefact	13/05/2013	1
271	A	24	16	charcoal	13/05/2013	1
272	A	24	17	charcoal	13/05/2013	1
273	A	24	18	charcoal	13/05/2013	1
274	A	24	19	charcoal	13/05/2013	1
275	A	24	20	charcoal	13/05/2013	1
276	A	24	21	charcoal	13/05/2013	1
277	A	24	22	charcoal	13/05/2013	1
278	A	24	23	charcoal	13/05/2013	1
279	A	24	24	charcoal	13/05/2013	1
280	A	24	25	charcoal	13/05/2013	1
281	A	24	26	charcoal	13/05/2013	1
282	A	24	27	charcoal	13/05/2013	1
283	A	24	28	charcoal	13/05/2013	1
284	A	24	29	charcoal	13/05/2013	1
285	A	24	30	charcoal	13/05/2013	1
286	A	24	31	charcoal	13/05/2013	1
287	A	24	32	charcoal	13/05/2013	1
288	A	24	33	charcoal	13/05/2013	1
289	A	24	34	charcoal	13/05/2013	1
290	A	24	35	charcoal	13/05/2013	1
291	A	24	36	charcoal	13/05/2013	1
292	A	24	37	charcoal	13/05/2013	1
293	A	24	38	charcoal	13/05/2013	1
294	A	24	39	charcoal	13/05/2013	1
295	A	24	40	charcoal	13/05/2013	1
296	A	24	41	charcoal	13/05/2013	1
297	A	24	42	charcoal	13/05/2013	1
298	A	24	43	charcoal	13/05/2013	1
299	A	24	44	charcoal	13/05/2013	1
300	A	24	45	charcoal	13/05/2013	1
301	A	24	46	charcoal	13/05/2013	1
302	A	24	47	charcoal	13/05/2013	1
303	A	24	48	charcoal	13/05/2013	1
304	A	24	49	charcoal	13/05/2013	1
305	A	24	50	charcoal	13/05/2013	1
306	A	24	51	charcoal	13/05/2013	1
307	A	24	52	charcoal	13/05/2013	1
308	A	24	53	charcoal	13/05/2013	1
309	A	24	54	charcoal	13/05/2013	1
310	A	24	55	charcoal	13/05/2013	1
311	A	24	56	charcoal	13/05/2013	1
312	A	24	57	quartz artefact	13/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
313	A	24	58	charcoal	13/05/2013	1
314	A	24	59	charcoal	13/05/2013	1
315	A	24	60	charcoal	13/05/2013	1
316	A	24	61	charcoal	13/05/2013	1
317	A	24	62	charcoal	13/05/2013	1
318	A	24	63	fish tooth	13/05/2013	1
319	A	24	64	charcoal	13/05/2013	1
320	A	24	65	charcoal	13/05/2013	1
321	A	24	66	charcoal	13/05/2013	1
322	A	25	1	charcoal	14/05/2013	1
323	A	25	2	charcoal	14/05/2013	1
324	A	25	3	charcoal	14/05/2013	1
325	A	25	4	charcoal	14/05/2013	1
326	A	25	5	charcoal	14/05/2013	1
327	A	25	6	charcoal	14/05/2013	1
328	A	25	7	charcoal	14/05/2013	1
329	A	25	8	charcoal	14/05/2013	1
330	A	25	9	charcoal	14/05/2013	1
331	A	25	10	heat retainer?	14/05/2013	1
332	A	25	11	charcoal	14/05/2013	1
333	A	25	-	2.3 mm sieve residue	14/05/2013	1
334	A	25	-	sediment sample	14/05/2013	1
335	A	25	12	charcoal	14/05/2013	1
336	A	25	13	quartz artefact	14/05/2013	1
337	A	26	-	2.3 mm sieve residue	14/05/2013	1
338	A	26	-	sediment sample	14/05/2013	1
339	A	26	1	charcoal	14/05/2013	1
340	A	26	2	charcoal	14/05/2013	1
341	A	26	3	charcoal	14/05/2013	1
342	A	26	4	charcoal	14/05/2013	1
343	A	26	5	charcoal	14/05/2013	1
344	A	26	6	charcoal	14/05/2013	1
345	A	26	7	charcoal	14/05/2013	1
346	A	26	8	charcoal	14/05/2013	1
347	A	26	9	charcoal	14/05/2013	1
348	A	26	10	charcoal	14/05/2013	1
349	A	26	11	charcoal	14/05/2013	1
350	A	26	12	charcoal	14/05/2013	1
351	A	26	13	quartz artefact	14/05/2013	1
352	A	26	14	charcoal	14/05/2013	1
353	A	26	15	charcoal	14/05/2013	1
354	A	26	16	charcoal	14/05/2013	1
355	A	26	17	charcoal	14/05/2013	1
356	A	26	18	charcoal	14/05/2013	1
357	A	26	19	charcoal	14/05/2013	1
358	A	26	20	charcoal	14/05/2013	1
359	A	27	-	2.3 mm sieve residue	14/05/2013	1
360	A	27	-	sediment sample	14/05/2013	1
361	A	27	1	charcoal	14/05/2013	1
362	A	27	2	charcoal	14/05/2013	1
363	A	28	-	2.3 mm sieve residue	15/05/2013	1
364	A	28	-	sediment sample	15/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
365	A	28	1	charcoal	15/05/2013	1
366	A	28	2	charcoal	15/05/2013	1
367	A	28	3	quartz artefact	15/05/2013	1
368	A	28	4	charcoal	15/05/2013	1
369	A	28	5	charcoal	15/05/2013	1
370	A	28	6	mollusc fragment	15/05/2013	1
371	A	28	7	charcoal	15/05/2013	1
372	A	29	-	2.3 mm sieve residue	15/05/2013	1
373	A	29	-	sediment sample	15/05/2013	1
374	A	29	1	charcoal	15/05/2013	1
375	A	29	2	charcoal	15/05/2013	1
376	A	29	3	charcoal	15/05/2013	1
377	A	29	4	charcoal	15/05/2013	1
378	A	29	5	charcoal	15/05/2013	1
379	A	29	6	charcoal	15/05/2013	1
380	A	29	7	charcoal	15/05/2013	1
381	A	29	8	quartz artefact	15/05/2013	1
382	A	30	-	2.3 mm sieve residue	15/05/2013	1
383	A	30	-	sediment sample	15/05/2013	1
384	A	30	1	charcoal	15/05/2013	1
385	A	30	2	charcoal	15/05/2013	1
386	A	30	3	charcoal	15/05/2013	1
387	A	30	4	mollusc fragment	15/05/2013	1
388	A	30	5	charcoal	15/05/2013	1
389	A	30	6	quartz artefact	15/05/2013	1
390	A	30	7	charcoal	15/05/2013	1
391	A	30	8	charcoal	15/05/2013	1
392	A	30	9	charcoal	15/05/2013	1
393	A	30	10	charcoal	15/05/2013	1
394	A	30	11	charcoal	15/05/2013	1
395	A	31	-	2.3 mm sieve residue	16/05/2013	1
396	A	31	-	sediment sample	16/05/2013	1
397	A	31	1	charcoal	16/05/2013	1
398	A	31	2	charcoal	16/05/2013	1
399	A	31	3	charcoal	16/05/2013	1
400	A	31	4	charcoal	16/05/2013	1
401	A	31	5	charcoal	16/05/2013	1
402	A	32	-	2.3 mm sieve residue	16/05/2013	1
403	A	32	-	sediment sample	16/05/2013	1
404	A	32	1	charcoal	16/05/2013	1
405	A	32	2	charcoal	16/05/2013	1
406	A	32	3	charcoal	16/05/2013	1
407	A	32	4	charcoal	16/05/2013	1
408	A	32	5	charcoal	16/05/2013	1
409	A	32	6	charcoal	16/05/2013	1
410	A	32	7	charcoal	16/05/2013	1
411	A	32	8	charcoal	16/05/2013	1
412	A	32	9	charcoal	16/05/2013	1
413	A	32	10	charcoal	16/05/2013	1
414	A	32	11	charcoal	16/05/2013	1
415	A	32	12	charcoal	16/05/2013	1
416	A	32	13	charcoal	16/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
417	A	33	-	2.3 mm sieve residue	16/05/2013	1
418	A	33	-	sediment sample	16/05/2013	1
419	A	33	1	charcoal	16/05/2013	1
420	A	33	2	charcoal	16/05/2013	1
421	A	33	3	charcoal	16/05/2013	1
422	A	33	4	ground edge fragment	16/05/2013	1
423	A	33	5	charcoal	16/05/2013	1
424	A	33	6	charcoal	16/05/2013	1
425	A	33	7	charcoal	16/05/2013	1
426	A	33	8	charcoal	16/05/2013	1
427	A	33	9	charcoal	16/05/2013	1
428	A	34	-	2.3 mm sieve residue	16/05/2013	1
429	A	34	-	sediment sample	16/05/2013	1
430	A	34	1	charcoal	17/05/2013	1
431	A	34	2	charcoal	17/05/2013	1
432	A	34	3	charcoal	17/05/2013	1
433	A	34	4	charcoal	17/05/2013	1
434	A	34	5	charcoal	17/05/2013	1
435	A	34	6	charcoal	17/05/2013	1
436	A	34	7	charcoal	17/05/2013	1
437	A	34	8	charcoal	17/05/2013	1
438	A	34	9	charcoal	17/05/2013	1
439	A	34	10	charcoal	17/05/2013	1
440	A	35	-	2.3 mm sieve residue	17/05/2013	1
441	A	35	-	sediment sample	17/05/2013	1
442	A	35	1	charcoal	17/05/2013	1
443	A	35	2	charcoal	17/05/2013	1
444	A	35	3	charcoal	17/05/2013	1
445	A	35	4	charcoal	17/05/2013	1
446	A	35	5	charcoal	17/05/2013	1
447	A	35	6	charcoal	17/05/2013	1
448	A	35	7	charcoal	17/05/2013	1
449	A	36	-	2.3 mm sieve residue	17/05/2013	1
450	A	36	-	sediment sample	17/05/2013	1
451	A	36	1	charcoal	17/05/2013	1
452	A	36	2	charcoal	17/05/2013	1
453	A	36	3	charcoal	17/05/2013	1
454	A	37	-	2.3 mm sieve residue	18/05/2013	1
455	A	37	-	sediment sample	18/05/2013	1
456	A	38	-	2.3 mm sieve residue	18/05/2013	1
457	A	38	-	sediment sample	18/05/2013	1
458	A	38	1	charcoal	18/05/2013	1
459	A	38	2	charcoal	18/05/2013	1
460	A	39	-	2.3 mm sieve residue	18/05/2013	1
461	A	39	-	sediment sample	18/05/2013	1
462	A	39	1	charcoal	18/05/2013	1
463	A	39	2	quartz artefact	18/05/2013	1
464	A	39	3	quartz artefact	18/05/2013	1
465	A	40	-	2.3 mm sieve residue	18/05/2013	1
466	A	40	-	sediment sample	18/05/2013	1
467	A	40	1	quartz artefact	18/05/2013	1
468	-	-	-	*Anadara antiquata* (^{14}C sample)	20/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
469	-	-	-	*Anadara antiquata* (^{14}C sample)	20/05/2013	1
470	-	-	-	*Anadara antiquata* (^{14}C sample)	20/05/2013	1
471	-	-	-	*Anadara antiquata* (^{14}C sample)	20/05/2013	1
472	-	-	-	*Anadara antiquata* (^{14}C sample)	20/05/2013	1
473	-	-	-	*Anadara antiquata* (^{14}C sample)	20/05/2013	1
474	A	41	-	2.3 mm sieve residue	20/05/2013	1
475	A	41	-	sediment sample	20/05/2013	1
476	A	41	1	charcoal	20/05/2013	1
477	A	41	2	charcoal	20/05/2013	1
478	A	42	-	2.3 mm sieve residue	20/05/2013	1
479	A	42	-	sediment sample	20/05/2013	1
480	A	42	1	charcoal	20/05/2013	1
481	A	42	2	charcoal	20/05/2013	1
482	A	42	3	charcoal	20/05/2013	1
483	A	42	4	quartz artefact	20/05/2013	1
484	A	42	5	charcoal	20/05/2013	1
485	A	43	-	2.3 mm sieve residue	20/05/2013	1
486	A	43	-	sediment sample	20/05/2013	1
487	A	43	1	charcoal	20/05/2013	1
488	A	43	2	charcoal	20/05/2013	1
489	A	43	3	charcoal	20/05/2013	1
490	A	44	-	2.3 mm sieve residue	21/05/2013	1
491	A	44	-	sediment sample	21/05/2013	1
492	A	44	1	charcoal	21/05/2013	1
493	A	45	-	2.3 mm sieve residue	21/05/2013	1
494	A	45	-	sediment sample	21/05/2013	1
495	A	46	-	2.3 mm sieve residue	21/05/2013	1
496	A	46	-	sediment sample	21/05/2013	1
497	A	47	-	2.3 mm sieve residue	21/05/2013	1
498	A	47	-	sediment sample	21/05/2013	1
499	A	48	-	2.3 mm sieve residue	21/05/2013	1
500	A	48	-	sediment sample	21/05/2013	1
501	A	41	3	charcoal	20/05/2013	1
502	A	49	-	2.3 mm sieve residue	22/05/2013	1
503	A	49	-	sediment sample	22/05/2013	1
504	A	50	-	2.3 mm sieve residue	22/05/2013	1
505	A	50	-	sediment sample	22/05/2013	1
506	A	51	-	2.3 mm sieve residue	22/05/2013	1
507	A	51	-	sediment sample	22/05/2013	1
508	A	52	-	2.3 mm sieve residue	22/05/2013	1
509	A	52	-	sediment sample	22/05/2013	1
510	A	53	-	2.3 mm sieve residue	22/05/2013	1
511	A	53	-	sediment sample	22/05/2013	1
512	A	54	-	2.3 mm sieve residue	23/05/2013	1
513	A	54	-	sediment sample	23/05/2013	1
514	A	55	-	2.3 mm sieve residue	23/05/2013	1
515	A	55	-	sediment sample	23/05/2013	1
516	A	56	-	2.3 mm sieve residue	23/05/2013	1
517	A	56	-	sediment sample	23/05/2013	1
518	A	57	-	2.3 mm sieve residue	23/05/2013	1
519	A	57	-	sediment sample	23/05/2013	1
520	A	58	-	2.3 mm sieve residue	23/05/2013	1

Appendix I. Field specimen log, Site 3 Mangrove Beach Headland Midden, Square A (cont.).

FS#	Square	XU	Object #	Description	Date	# of Bags
521	A	58	-	sediment sample	23/05/2013	1
522	A	59	-	2.3 mm sieve residue	23/05/2013	1
523	A	59	-	sediment sample	23/05/2013	1