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– ARTICLE –

Excavations at Kahukura (G47/128), Murihiku

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ABSTRACT

Archaeological data from coastal village sites are critical to our understanding of culture change in southern New Zealand. Here we report on excavations from Kahukura (G47/128), a sedentary coastal village occupied around the time of the cessation of moa-hunting. There are few recorded sites in southern New Zealand dating between the mid-fifteenth to mid-seventeenth centuries. The results of the Kahukura work enable us to situate the site within current models of culture change in this part of the country. The data presented here documents an attempt to continue the sedentary village way of life in an environment of increasing isolation from long-distance exchange networks: imported stone resources are scarce, and there is a trend away from terrestrial hunting towards a specialisation in intensive local exploitation strategies.

Keywords: Murihiku, transient village, Kahukura, culture change, New Zealand

INTRODUCTION, ARCHAEOLOGICAL AND ENVIRONMENTAL CONTEXT

Kahukura is a pre-contact Māori habitation site located on an eroding beach on the Catlins coast of Murihiku[4]. The site occupies the edge of a low sand dune at the northern end of Dummys Beach, southwest of Long Beach (Figure 1). In 1968, human remains were exposed at the site in eroding foredunes and in 1974 the location was added to the New Zealand Archaeological Association Site Recording Scheme (NZAA SRS) as a 'burial/cemetery' site (S183/5, now G47/2). In 2004, a team from the Southland Coastal Heritage Inventory Project (SCHIP)[5] reported a large shell and fishbone midden eroding over a 70 m beach frontage, with the site recorded as a 'midden/oven' (G47/128) (Figure 2) (Brooks *et al*. 2008). We consider G47/2 and G47/128 to be components of the same site at Kahukura. A review of historical photography and information from local informants suggested that considerable loss of site fabric had occurred over the last two decades (Brooks *et al*. 2008). Given the cultural and scientific value of the site, and the extreme risk it faced from coastal erosion, salvage excavation was recommended in reports to the SCHIP partners and was supported by the Kaitiaki Rūnaka o Murihiku, Oraka Aparima, and Te Ao Marama Inc. (Brooks *et al*. 2008; Egerton and Jacomb 2009). An archaeological authority (2009/151) was issued to the author (RW) by Heritage New Zealand Pouhere Taonga and an excavation took place in February 2009 as part of the annual University of Otago archaeological field school. The first observations about the site suggested that it might be contemporary with the larger 'moa hunter' settlements of the Catlins coast (Walter *et al*. 2008). Radiocarbon dating results from the 2009 investigation, however, indicate that it post-dates those sites. There are few recorded sites in southern New Zealand that date to the period following the predation of moa. In this paper, we discuss the results of the excavation at Kahukura in relation to current models of culture change in Murihiku.

The most influential model of settlement-subsistence systems in early Murihiku is Anderson and Smith's (1996) *transient village* model. The transient village way of life was seen as a response to the coarse-grained or 'clumpy' pattern of resource distribution that typified pre-fifteenth century Murihiku. It involved the establishment of sedentary population centres on major resource 'clumps' that were the residential nuclei of settlement-subsistence systems based on high return yields from moa hunting or sealing. These transient villages remained stable as long as those

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4 Murihiku is a widely used but poorly defined geographic term. Often used as a synonym for Southland, we use it here in a broader sense to refer to the region south of the Waitaki River, including Rakiura (Stewart Island) (e.g. Stevens 2011: 366).

5 This is a joint project between partner agencies Environment Southland, the Southland District Council, the Invercargill City Council, the Department of Conservation, Heritage New Zealand Pouhere Taonga, and Te Ao Marama Inc. with Southern Pacific Archaeological Research providing archaeological services.

resources were available. Examples include the Catlins 'moa hunter' sites Papatowai and Pounawea; Little Papanui, Warrington, Hinahina and Harwood on the Otago Peninsula; and Shag River Mouth north of Dunedin (Anderson and Smith 1996:360). The demise of moa and the retreat of seal colonies from the early fifteenth century resulted in the emergence of a much finer grained resource environment and the abandonment of the transient villages. The issue of what happened next has been debated, with alternative models proposed by Anderson and Smith (1996:368) and Jacomb *et al.* (2010). Both models saw the cessation of moa hunting and the transient village way of life precipitating fundamental and sudden changes in southern lifeways but neither model was well supported by archaeological field evidence from the relevant time period. As a rare example of a post-moa hunting village in Murihiku, Kahukura provides insight into the changes that occurred in settlement patterns, mobility and subsistence patterns immediately following moa extirpation and the abandonment of the transient villages.

Kahukura is located 19 km east and 4.5 km north of the southernmost point of the South Island mainland. Here the coastline is exposed to high frequencies of gale force winds and average daily temperatures range from around 16° C in summer to 4° C in winter (Macara 2013). The region lies hundreds of kilometres south of the limits for Māori horticulture which means that terrestrial productivity is much lower than in many other parts of the country. The marine zone is relatively productive, however, because of warmer waters generated by the Southland Current (Chiswell 1996:1). In addition to fish, the earliest Polynesian communities would have had access to various species of ground nesting marine bird (e.g. petrel, shag, penguin and shearwater) and sea mammals, including whales stranded on the sandy coasts (Anderson 2001; Hamel 1977; Jacomb *et al.* 2010).

The coastal geography of the Catlins is made up of high cliffs and headlands, estuaries and long stretches of sandy beach. Industrial stone sources are fairly scarce around the coast, but argillites and basalts occur in patches south of the Catlins; at Bluff Harbour, the New River estuary, Jacobs River estuary and the shores west of Riverton. Quarries and working floors in those places attest to widespread use of those resources from the early fourteenth century (Jennings 2009; Jennings *et al.* 2018; Leach and Leach 1980).

The Catlins area became the subject of archaeological interest in the mid-twentieth century, although sites had been fossicked prior to that (Hamel 1977; 1982). In the 1930s, at the behest of H.D. Skinner of the Otago Museum, David

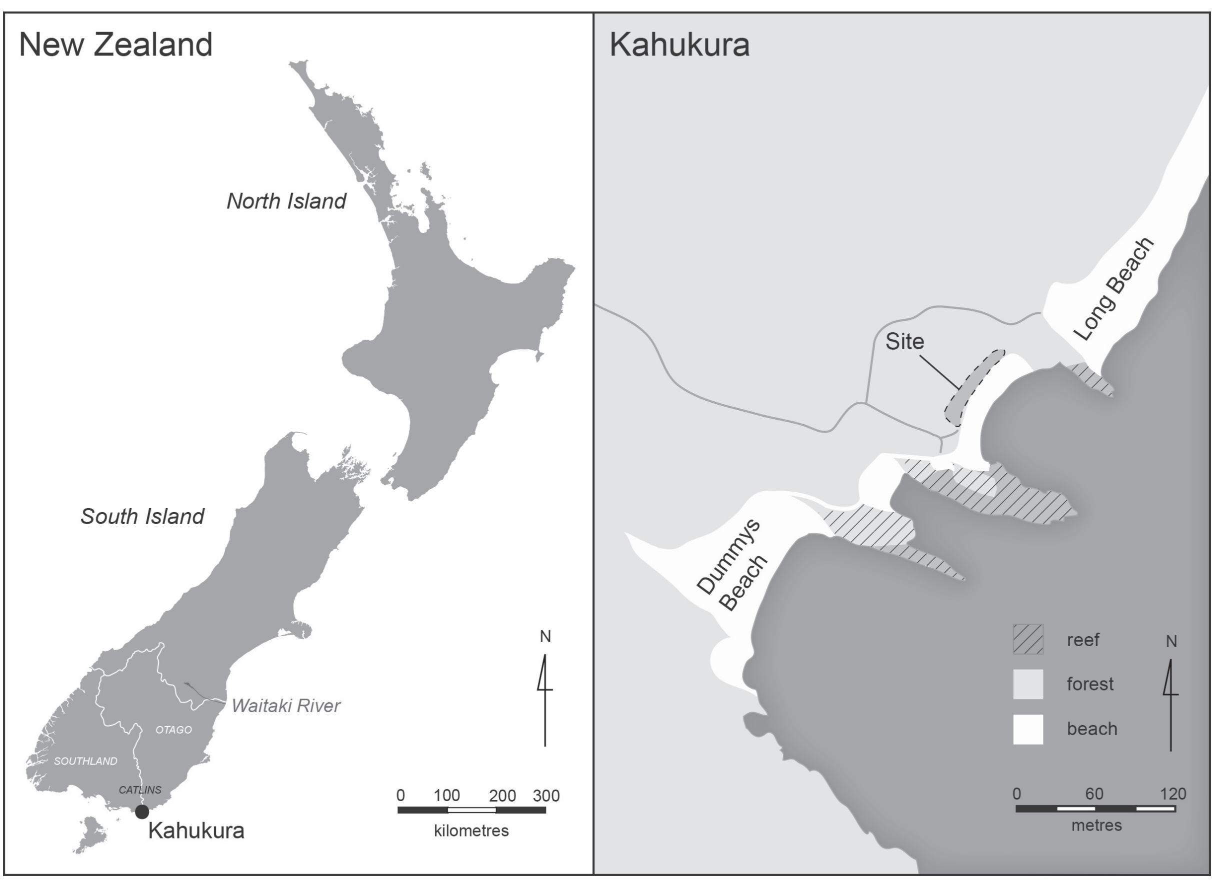

Figure 1. Location of the Kahukura site in the southern Catlins, Southland.

Teviotdale carried out a reconnaissance of archaeological sites on the Catlins coast. This resulted in the identification of two sites: Papatowai and Pounawea, which were to become highly influential in documenting the early 'moa hunter' occupation and associated artefact assemblages of Murihiku. Teviotdale's work at Papatowai (Teviotdale 1937; 1938a; 1938b) drew the interest of Les Lockerbie, and their subsequent work there was notable for the use of stratigraphic principles (e.g., Lockerbie 1953). Lockerbie also included samples from the Catlins in his efforts to apply the then new radiocarbon dating technique to New Zealand archaeological research questions. In Golson's 1959 publication on culture change in New Zealand, Papatowai was one of the sites used to characterise the 'Archaic' in Murihiku (Golson 1959). The 1970s saw a change in focus from artefact-based approaches towards an interest in settlement patterns and ecology. Hamel's (1977) PhD research on the early human history of the Catlins coast included radiocarbon dating and the analysis of well-provenanced faunal assemblages. As part of this work, further excavations were undertaken at Papatowai and Pounawea (Hamel 1978; 1979b; 1980). The work at Pounawea was carried out as a rescue excavation, as the site was in the process of being washed away as the excavation proceeded. This highlights the vulnerability of sites in coastal Murihiku, including Kahukura, to destructive coastal processes.

Southeast of Kahukura lies Foveaux Strait which, despite being one of the most challenging environments encountered by Polynesians, was visited, explored and settled as early as any other part of the country (Jacomb *et al.* 2010:33). The NZAA SRS contains a record of at least 350 pre-contact sites along Foveaux Strait, attesting to the adaptability of these early communities. Most of the sites are small camp sites with single and multi-species middens, and many (about 20 per cent) contain stone flakes from local sources (Jacomb *et al.* 2010:37). There are few sites in Foveaux Strait that are candidates for permanent or repeated habitation, with the exception of the stone working sites in Bluff Harbour and Riverton (Jennings 2009) which were visited intermittently as long as the south coast was utilised by Māori communities.

During their 2004 site visit to Kahukura, the SCHIP team recorded bones of whale, dog and sea mammal in the coastal midden exposure, and a one-piece moa bone fish-hook was found on the beach. Team members continued to visit the site regularly over the next few years recording ongoing site damage, and in 2008 a third human skeleton was exposed and fully excavated later that year with representatives from Te Ao Marama (Walter *et al.* 2008). It was this increasing evidence of erosion and site loss that prompted the 2009 investigations.

EXCAVATION AND RECORDING METHODOLOGY

All excavation units were located on a grid aligned parallel to the coastline with the grid-north axis at 45° MN. Major

Figure 2. Bands of midden exposed along the eroding beach face at Kahukura, facing southwest (2008).

grid lines were laid out at 5 m intervals and columns (n–s) labelled with letters, and rows (e–w) by numbers. This created 5 × 5 m units within which each 1 × 1 m square was labelled by lower case letter. Six excavation units were laid out close to the edge of the beach terrace above the strip of exposed midden (Figure 3; Figure 4). Unit 3 was placed immediately north of the burial that was excavated in 2008 (Walter *et al.* 2008). All excavation was carried out by hand and by natural stratigraphic layer. Within each layer, excavation proceeded by 50 mm arbitrary levels (or spits). Excavated soils were sieved on site using 6.4 and 3.2 mm screens with the residues returned to the University of Otago Archaeology Laboratories (OAL) for further analysis. One un-sieved bulk sample of approximately 9.5 kg (one bucket) was retained from each level in each 1 × 1 m excavation unit. Plan and section drawings were made for each excavation unit, with supplementary photographs taken. All excavation units, features and artefact finds were recorded using a Leica TPS1200 robotic total station (NZGD 2000), and the data was managed in a geographic information system (GIS), projected in NZTM.

STRATIGRAPHY

The exposed beach face at Kahukura presents a complex stratigraphy of intercutting layers and lenses as is typical of dune sites. Over small distances this complexity is difficult to interpret (Figure 5) and in previous documents the site has been described as having up to four cultural layers (e.g., Brooks *et al.* 2010; Cunliffe and Brooks 2016; Lilley 2016). In preparing this report we re-examined the original site plans and field notes, and drew on the radiocarbon dates and faunal data to prepare a revised model of site stratigraphy. The stratigraphic complexity displayed over short distances can be conservatively resolved into a site-wide model involving two discrete cultural layers developing over a constantly mobile beach exposure (Figure 6; Table 1).

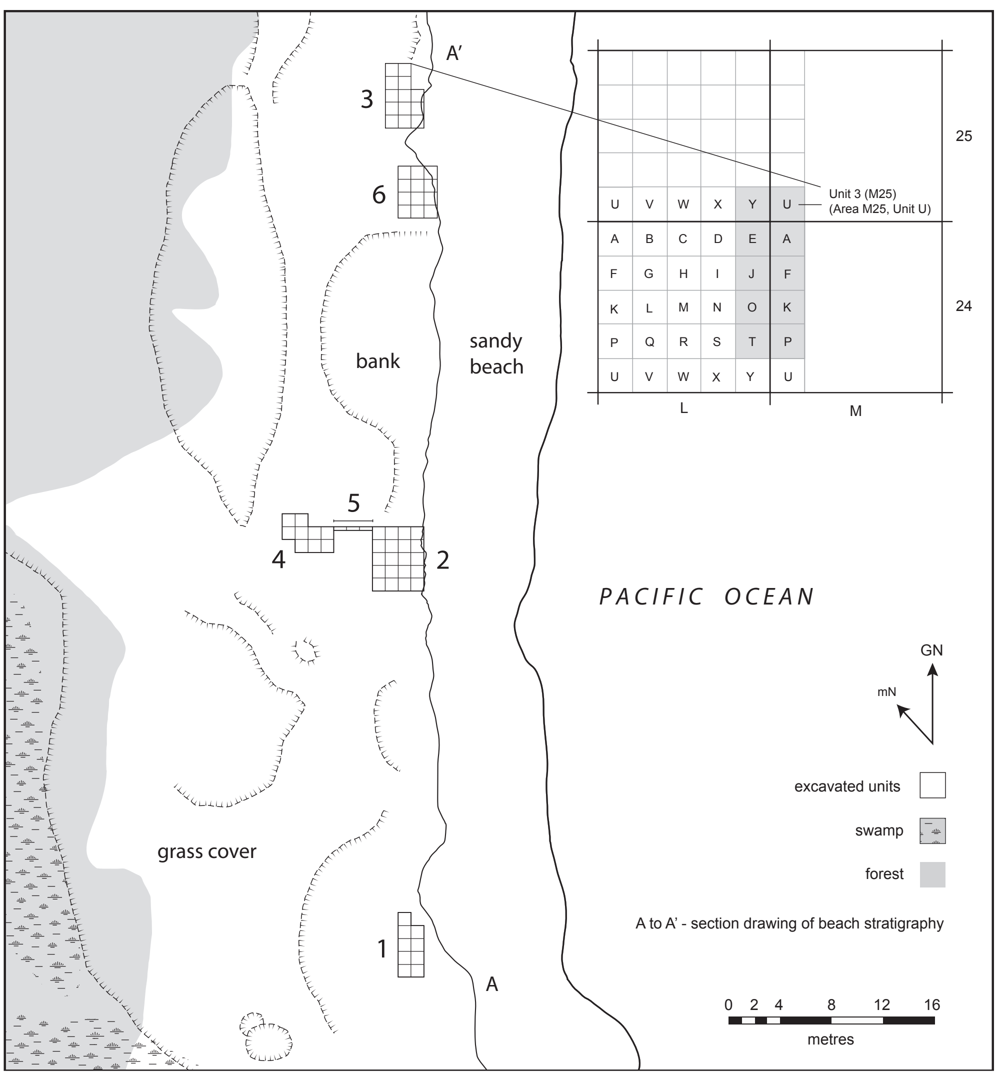

Figure 3. Location of the excavation units.

Figure 4. Excavations underway at Kahukura in February 2009. The most distant area of activity is Unit 1.

Figure 5. The exposed beach face at Kahukura showing the midden exposure facing northeast (2016). Scale divisions, 200 mm.

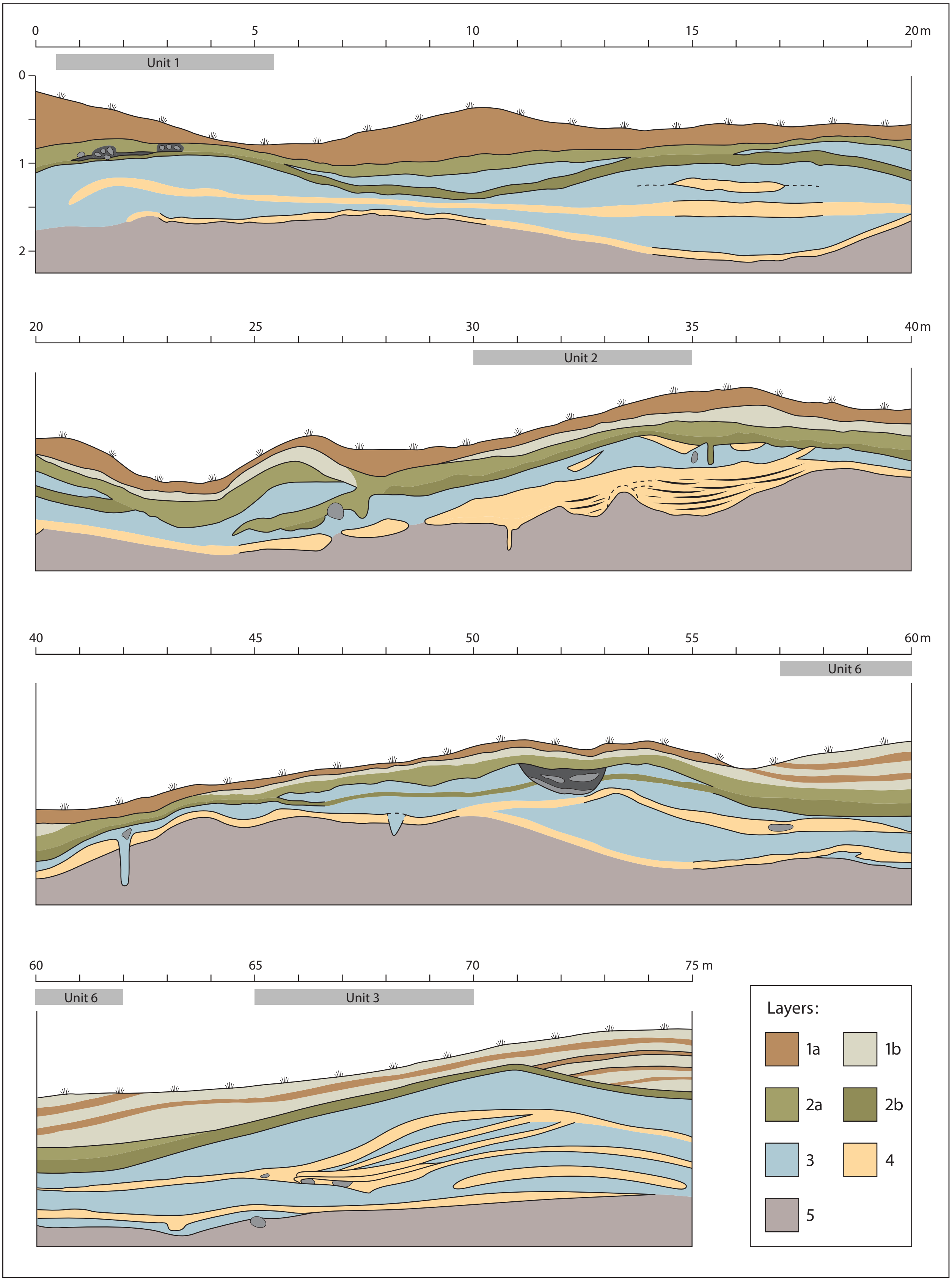

Figure 6. Full beach profile facing grid west, also showing the location of excavation units that connected with the beach section. Layers 1–5 described in Table 1.

Table 1. *Stratigraphy at Kahukura derived from beach section (Figure 6).*

Layer	Description
Layer 1a	A mid-grey beach sand with a poorly developed topsoil horizon.
Layer 1b	A fine white sand that is almost identical to Layer 3 but slightly darker, possibly through contact with Layer 2 soils. Like Layer 3 this material was probably wind deposited.
Layer 2	This is the second cultural horizon and comprises two distinct sub-layers. Layers 2a and 2b do not represent different occupation events. Instead, colour and texture differences are the result of natural taphonomic processes. Layer 2 is continuous across the site but is poorly defined in some places.
Layer 2a	A mid-grey sand that contains a low density of midden shell and bone.
Layer 2b	A dark grey sand that contains a higher density of midden shell and bone than Layer 2a. Layer 2b also contains several dense patches of midden, charcoal and fire-cracked rock.
Layer 3	A fine white sand probably deposited through wind action. It varies greatly in depth across the site but contains no evidence for the development of a top-soil horizon. In Figure 6, Layer 3 is shown in several places as a lens overlying portions of Layer 2b.
Layer 4	This is the first cultural horizon and comprises a matrix of dark to very dark grey sand with dense bands and lenses of midden (especially fishbone and crushed mussel shell).
Layer 5	This is the underlying natural layer at the site and consists of a white to orange-white marine sand.

The first occupation is represented by Layer 4 which developed over a marine deposited beach sediment (Layer 5). It is unclear whether the site was on exposed sand at the time of occupation or whether it was under a scrub cover as any topsoil that might have developed has become incorporated into the Layer 4 matrix. At the time of occupation, the site was experiencing regular inputs of sand deposition. This is represented by the Layer 3 material which covered and recovered sections of Layer 4 at various times (Figure 6). This banding of Layer 4 and sterile Layer 3 sand is unlikely to represent any great time depth and stratigraphically Layer 4 appears to represent a temporally discrete, but spatially discontinuous occupation; we interpret this below as a village living surface. The radiocarbon dates however, present a wide calibrated age range for the Layer (Table 2). These dates, and the banding in the soils, mean that we cannot dismiss the possibility that the site may have been visited for some time following the abandonment of the village.

The second occupation, Layer 2, is separated from Layer 4 by the same fine white Layer 3 sands that occur as lenses within Layer 4. It is continuous across the site and contains features that cut into Layer 4. Layer 2 comprises two distinct sub-layers. These sub-layers (Layers 2a and 2b) are distinguished by colour and texture differences but do not represent separate occupation events. Layer 2 is continuous across the site but is poorly defined in some places.

The stratigraphy suggests the time depth between occupations was short and this is supported by the radiocarbon dates (below). Following the abandonment of the Layer 2 occupation, there were periods of stability and topsoil development, punctuated by phases of new sand deposition.

DATING

Charcoal samples were recovered from six contexts. Five samples were excavated from the base of fire features in Layers 2 and 4 and the remaining sample was from a charcoal lens in Layer 4 (Table 2; Figure 7). The samples were sent to Rod Wallace at the University of Auckland for identification, and preferred short-lived species were selected for dating (Allen and Huebert 2014; McFadgen *et al.* 1994) (Table 2). Two marine shell samples previously recovered during the SCHIP fieldwork are also reported on below (Jacomb *et al.* 2010:39). These were *Mytilus* sp. valves excavated from the base of fire features in Layer 4 (Table 2). *Mytilus* sp. are suspension feeding shellfish dominant near dynamic coastal environments (e.g., open ocean and rocky shores). These environments are associated with strong tidal flushing, meaning associated taxa are less likely to have been in contact with older depleted carbon food sources, and are appropriate for dating. Local variability in the marine radiocarbon reservoir (delta-R) (ΔR) is recognised however (Petchey *et al.* 2008). In this instance, the current national New Zealand ΔR average (−7 ± 45) was recommended as a relatively accurate measure for calibrating radiocarbon dates on *Mytilus* sp (Waikato Radiocarbon Laboratory unpublished data). Both charcoal and marine samples were submitted to the Waikato Radiocarbon Dating Laboratory with the calibrated results shown in Table 2 and Figure 7.

Collectively, the calibrated Layer 4 ages span a period from 1399–1659 cal AD (95.4% CI). Wk-31372 (1399–1455 cal AD) provides the earliest date and tightest age range for Layer 4, while the remaining Layer 4 dates have wide probability distributions. At 95.4% CI, more than 50% of the distributions for four of these dates overlap in the sixteenth century. Conservatively, the Layer 4 dates suggest

Table 2. *Conventional radiocarbon age and calibrated ages AD from Kahukura. Southern Hemisphere Atmospheric data from Hogg* et al.*(2013); OxCal v4.3.2 (Bronk Ramsey 2017). Marine13 marine curve data from Reimer* et al. *(2013); Delta R –7 ± 45 (Waikato Radiocarbon Laboratory unpublished data); Oxcal v4.3.2 (Bronk Ramsey 2017).*

Lab. No.	Provenance Layer/Feature	Material	Taxa/Type	CRA BP	$\delta^{13}C$	Calibrated Year AD 68.2% CI	Calibrated Year AD 95.4% CI
Wk-31375	L2, Unit 2 F2.01 Fire Feature	Charcoal	*Coprosma* sp twig	215 ± 35	–25.6 ± 0.2	1661–1805	1648–1925…
Wk-31374	L2, Unit 2 F2.14 Fire Feature	Charcoal	*Coprosma* sp	335 ± 32	–26.7 ± 0.2	1510–1641	1497–1653
Wk-31371	L4, Unit 6 F6.01 Charcoal Lens	Charcoal	*Pittosporum* sp twig	317 ± 25	–24.9 ± 0.2	1513–1650	1505–1659
Wk-31376	L4, Unit 4 F4.09) Fire Feature	Charcoal	*Coprosma* sp	319 ± 35	–26.5 ± 0.2	1511–1651	1497–1667
Wk-31373	L4, Unit 1 F11.19 Fire Feature	Charcoal	*Pseudopanax arboretum*	432 ± 35	–25.2 ± 0.2	1450–1611	1440–1624
Wk-31372	L4, Unit 1 F11.23 Fire Feature	Charcoal	*Pseudopanax arboretum*	530 ± 36	–25.2 ± 0.2	1415–1445	1399–1455
Wk-23780	L4, SCHIP-4 Midden	Marine shell	*Mytilus* sp valve	796 ± 35	1.1 ± 0.2	1466–1540	1451–1619
Wk-23781	L4, SCHIP-5 Midden	Marine shell	*Mytilus* sp valve	804 ± 36	1.5 ± 0.2	1464–1532	1445–1616

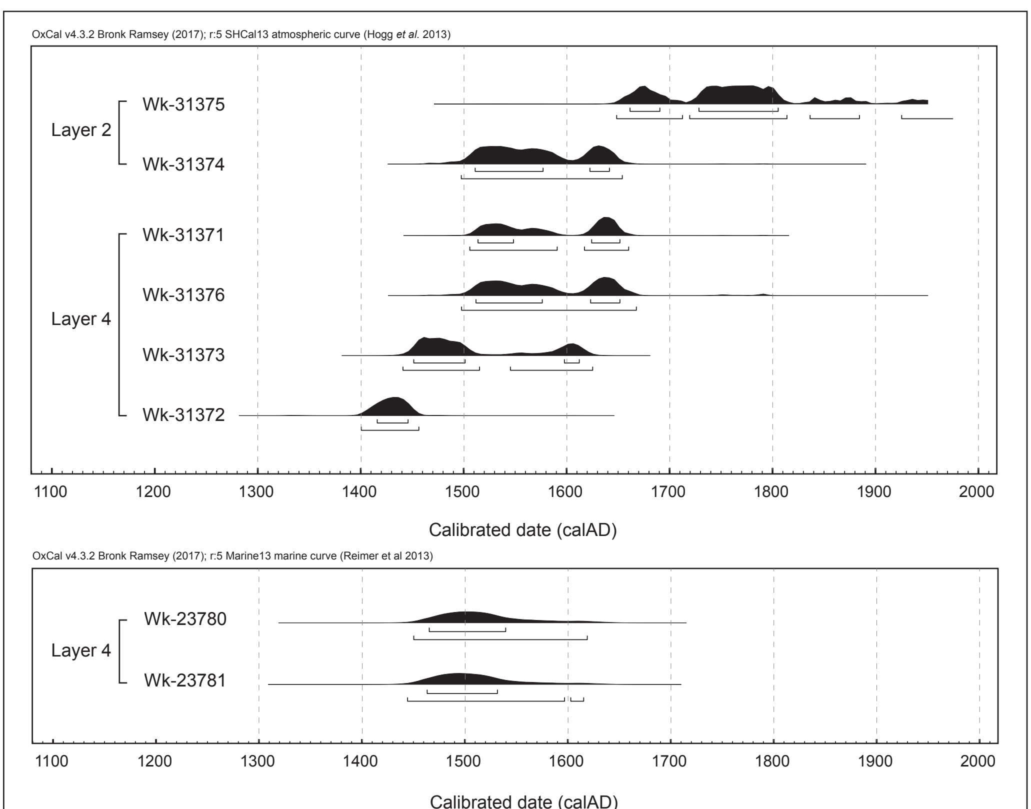

Figure 7. Probability distributions for Kahukura radiocarbon ages in OxCal v.4.3.2 (Bronk Ramsey 2017). Probability ranges are 68.2% and 95.4% CI. Southern Hemisphere Atmospheric calibration (SHCal13) from Hogg *et al*. (2013); Marine13 marine curve data from Reimer *et al*. (2013); Delta R –7 ± 45 (the New Zealand Delta R average as advised by Waikato Radiocarbon Dating Laboratory); Oxcal v4.3.2 (Bronk Ramsey 2017).

occupation occurred between the early fifteenth and the early seventeenth centuries. The wide probability distributions make it difficult to be more precise about either age or duration of occupation. However, industrial moa bone is rarely found in sites late into the sixteenth century, making a late-fifteenth to early-sixteenth century occupation more likely.

Two dates were obtained from Layer 2. One of these (Wk-31374) completely overlaps two of the Layer 4 dates (Wk-31371 and Wk-31376) and we consider the sample as possibly intrusive from Layer 4. Although the sample was obtained from a well-defined context (Feature 2.14 in Layer 2), consultation of the field books (23/02/09) reveals that part of Feature 2.14 was located on the eroding beach edge and it did cut into Layer 4. This makes mixing with Layer 4 material possible. Sample Wk-31375 provides a better age estimate for Layer 2, with maximum probability of an eighteenth century occupation, although again, it contains a wide probability distribution.

SITE FUNCTION AND SPATIAL ORGANISATION

Although the mobile sandy soils at Kahukura do not preserve features well, a number of postholes and fire features were recorded in both occupation layers (Table 3; Figure 8). A total of 42 post holes were encountered (L2 = 3, L4 = 39).

Table 3. *Postholes and fire features from Kahukura.*

	Postholes		Fire Features	
Unit	**Layer 2**	**Layer 4**	**Layer 2**	**Layer 4**
1	1	3	4	3
2	–	19	11	2
3	2	10	–	5
4	–	–	4	4
5	–	–	2	–
6	–	7	–	4
Total	**3**	**39**	**21**	**18**

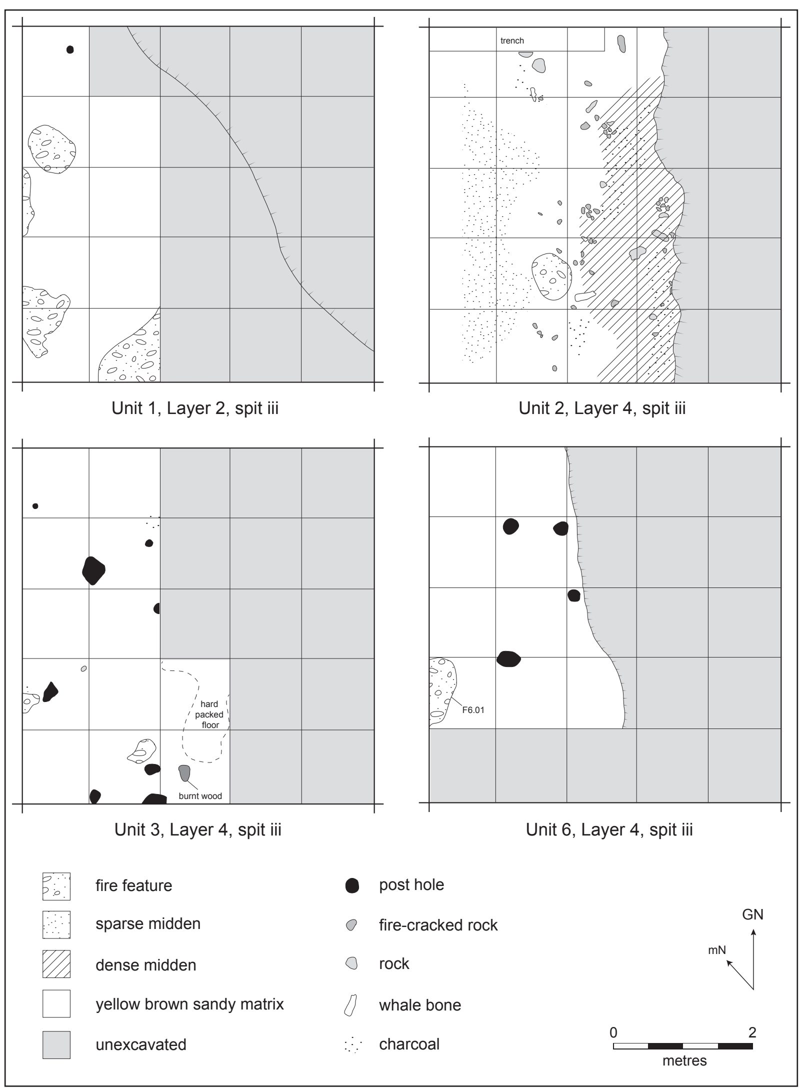

Figure 8. Plans of Units 1, 2, 3 and 6, Layers 2 and 4.

The post holes ranged in diameter from 5–55 cm, and in depth from 5–50 cm. The majority were to the middle of this size range, suggesting they had held medium-sized stakes that had been pushed into the ground only a short distance.

Unit 3 did not contain any features or artefacts that could be directly linked to the burial recorded in 2008 (excavated from the base of Layer 3), but it did contain several fire features, post holes, a hard-packed surface and a high density of lithics in Layer 4, which may be consistent with the presence of a structure and an associated flaking area.

WHALEBONE WORKING FLOOR

The only well-defined activity zone identified in the excavations was a whale bone working floor in Unit 2, Layer 4 (Cunliffe 2014; Cunliffe and Brooks 2016). This feature was represented by a scatter of 2,972 (12.56 kg) bone fragments around a large anvil stone measuring 400 × 300 mm (Figure 9).

Only four whale bone fragments had sufficient landmarks to identify to element; a proximal and distal rib fragment, the distal end of a vertebral spine, and a complete jugal bone (Cunliffe and Brooks 2016: 391). DNA sequencing was conducted on a small collection of pieces, confirming the presence of southern right whale (*Eubelena australis)* and possibly, pygmy sperm whale (*Kogia breviceps*) (Seersholm *et al.* 2018: 3, Figure 2).

The whalebone assemblage was analysed using a *chaîne opératoire* approach (Sellet 1993) and is fully reported in Cunliffe and Brooks (2016). The fragments of whale bone were divided into four categories based on their inferred position in a chain of production (Table 4).

The tool marks on the bone fragments were classified

Figure 9. The distribution of whalebone fragments and anvil defining a whalebone working floor (after Cunliffe and Brooks 2016: Figure 7).

Table 4. *Categories of bone within the production chain from the whale bone working floor (after Cunliffe and Brooks 2016).*

Bone Categories	Definition
Amorphous debitage	Bone fragments that lack evidence of deliberate shaping. Most examples were found in cancellous bone and probably represent discarded by-products from early stages of bone processing – the chopping and smashing up of the raw material.
Morphological flake debitage	Chips of cortical bone that appear to have been knocked off a larger piece. Like lithic flakes, these pieces often have a dorsal scar from earlier episodes of 'flaking'. They are generally oval in shape with the cortical bone running parallel to the long axis.
Cortical blanks	Bone pieces that have been deliberately shaped to form a blank or 'preform' for further controlled reduction. They were shaped by chipping, and through a sawing and snapping technique. Many show evidence of cortical bone removal through chiselling or abrading.
Artefacts	Bone pieces that have been worked from cortical blanks and display multiple tool marks. These 'artefacts' are probably not all finished tools, but they do represent the final phase in the chain of manufacture that occurred on the working floor.

Table 5. *Tool marks recorded on the whale bone fragments from the working floor (after Cunliffe and Brooks 2016).*

Tool marks	Definition
Chopping marks	Sheared surface or by 'v' shaped marks of direct impact.
Abrading marks	Flattening of the bone, often accompanied by the presence of criss-cross or linear abrasion marks.
Cutting marks	Linear 'v' shaped striations.
Sawing marks	Deep, wide cuts that displayed linear striations. The cross-sections of the tool marks were not as neatly 'v' shaped as in 'cutting marks' but were wider and more rounded in section.
Chipping marks	Rounded depression scars on the bone where pieces had been dislodged through some form of a blunt impact. On the outer surface of bone, these probably resulted in the production of many of the pieces labelled as 'morphological flakes'.

by Cunliffe (2014) and Cunliffe and Brooks (2016) following standard methodologies (e.g., Fisher 1995; Olsen and Shipman 1988; Shipman and Rose 1983) (Table 5; Figure 10). Table 6 shows the distribution of tool marks across the different categories of whale bone fragments.

Cunliffe and Brooks (2016: 391, Figure 8) interpret the whalebone working floor as a single event site where a small number of whale bones, principally ribs, were systematically worked down to create small blanks. They describe the reduction sequence as a '… longitudinal sequence, in which chips of bone are removed one after another down the length of the bone.' This produces fragments with the characteristic dorsal scarring that is found on the 'morphological flakes'. It is entirely unclear what the intended end point of this manufacturing might have been. No whalebone hooks were recovered from the site and the only worked piece that looked like a specific tool was probably intended as a ripi, or paua lever.

Table 6. *Counts of bone pieces and tool marks in the Kahukura whalebone working-floor assemblage (after Cunliffe and Brooks 2016:391).*

Reduction stage	NISP	Tool Marks				
		Chipping	Chopping	Cutting	Abrading	Sawing
Amorphous debitage	2294	2	9	0	0	0
Morphological flake debitage	668	662	33	13	3	4
Cortical blanks	6	2	3	0	1	1
Artefacts	4	2	0	2	3	2
Total	**2972**	**668**	**45**	**15**	**7**	**7**

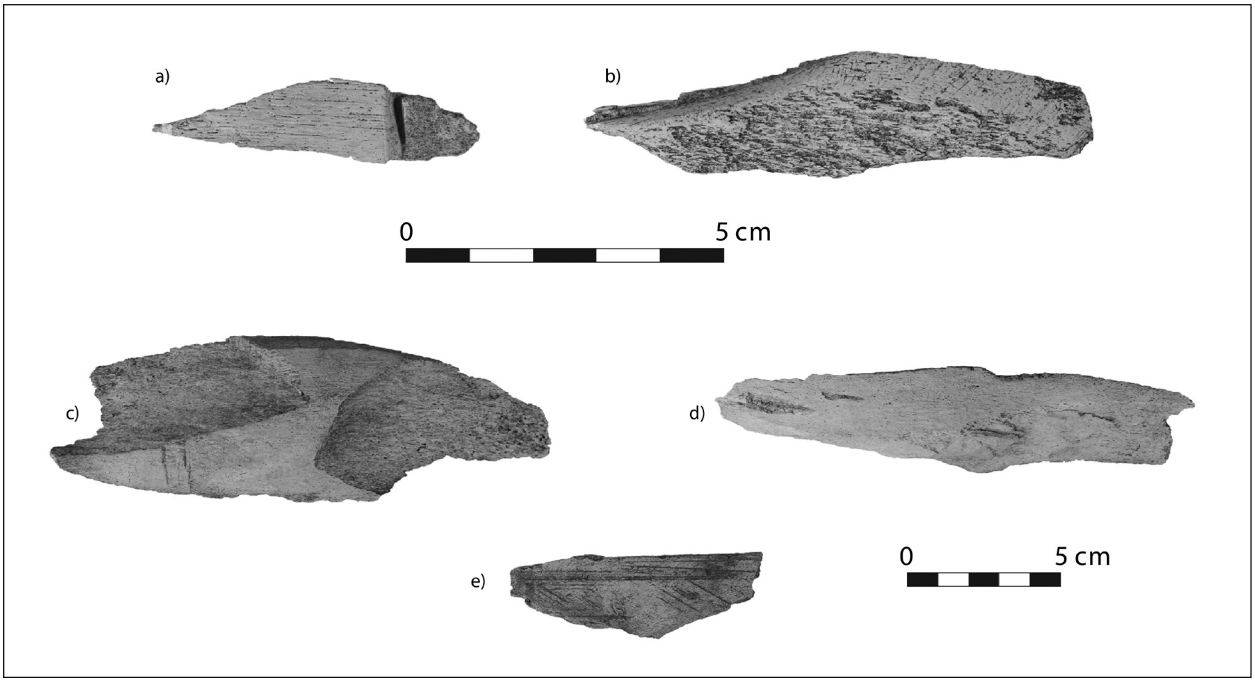

Figure 10. Examples of the different tool marks found in the whalebone assemblage from the working floor at Kahukura (Cunliffe 2014:80-88): a) saw mark, b) abrasion marks, c), outer chip marks d) chop marks, e) cut marks.

FAUNAL REMAINS

Unit 2 contained the greatest quantities of midden so an analytical sample was created by selecting 15% of the bags from the northwest quadrant of each of the 1 × 1 m squares in Unit 2. Layer 2 contained substantially less faunal material than Layer 4 (NISP = 19), thus the faunal analysis presented below focuses on the Layer 4 material.

The midden was washed, dried and sorted to primary faunal class and then to the lowest possible taxonomic level (with element, side and portion recorded) using the OAL reference collection. Quantification and analysis was carried out using standard archaeozoological measures of NISP (number of identified specimens present), MNE (minimum number of elements) and MNI (minimum number of individuals) (Grayson 1984; Reitz and Wing 2008). The Unit 2 midden analysis summarised below is reported in full in Lilley (2016).

Shellfish

The shellfish assemblage was highly fragmented and very few whole shells were recovered. Fragments were separated into bivalve and gastropod classes and specimens with quantifiable attributes (landmarks) were removed for further identification. For gastropods, this was the operculum, apex and aperture, and for bivalves, the hinge portion. In addition to the OAL reference collection, identification was facilitated by reference to Crowe (1999) and Powell (1976). The results of the identifications are shown in Table 7. Twenty-five unique species were identified in Layer 4, with mussels (Mytilidae) representing the most abundant taxa. This was followed by limpet (*Cellana* sp) which had an MNI of 397. Other gastropods also formed a significant component of the assemblage with spotted black top shell (*Diloma aethiops*) represented by an MNI of 234, and cat's eye (*Lunella smaragda*) an MNI of 190. As Table 7 shows, rocky shore species of the intertidal zones dominated, and these are taxa that would have been directly accessible from the site (Morley 2004; Powell 1976).

Bird

A total of 336 bird bones were identified from the Unit 2 sample, representing 0.9% (by NISP) of the total vertebrate assemblage. Of these, 242 bones were so fragmentary that it was not possible to identify them to element or species. Nineteen species were confidently identified, along with four genera and three families (Table 8). Species distribution and habitat information was taken from Robertson *et al.* (2015) and Scofield and Stephenson (2013). Of the sea birds, the common diving petrel (*Pelecanoides urinatrix*), banded dotterel (*Charadrius bicinctus*), Snares penguin (*Eudyptes robustus*) and spotted shag (*Stictocarbo punctatus*) had the greatest NISP and MNI counts. The relatively high abundance of *Charadrius bicinctus* is unusual; Worthy lists only three South Island sites with this taxa (Worthy 1999). Of the forest and scrubland birds, tui (*Prosthemadera novaeseelandiae*), bellbird (*Anthornis melanura*) and South Island robin (*Petroica australis*) were the most common.

Table 7. *Shellfish and crustacea identifications (NISP, MNE and MNI) from Unit 2, Layer 4.*

Taxon	Common name	Habitat	NISP	MNE	MNI
Mytilus edulis	Blue mussel	Rocky shore	5084	5084	2544
Mytilidae sp	–	Rocky shore	3705	3705	1854
Cellana sp	Limpet	Rocky shore	399	397	397
Perna canaliculus	NZ Green-lipped mussel	Rocky shore	477	476	240
Diloma aethiops	Spotted black topshell	Rocky shore	262	234	234
Lunella smaragda	Cat's eye	Rocky shore	314	261	190
Paphies australis	Pipi	Muddy/estuarine	298	279	141
Patelloidea sp	–	Rocky shore	95	94	94
Cellana denticulata	Denticulate limpet	Rocky shore	54	54	54
Haliotis iris	Blackfoot pāua	Rocky shore	77	19	19
Chitonidae sp	–	Rocky shore	126	–	18
Cellana ornata	Limpet	Rocky shore	14	14	14
Leukoma crassicosta	Ribbed venus clam	Soft shore	25	25	13
Aulacomya atra Māoriana	Ribbed mussel	Rocky shore	26	19	12
Haliotidae sp	Pāua	Rocky shore	34	10	10
Argalista crassicostata	Sea snail	Soft shore	8	8	8
Haliotis australis	Silver pāua	Rocky shore	14	7	7
Turritellidae sp	–	Mixed	6	6	6
Haustrum lacunosum	Rock snail	Rocky shore	5	5	5
Evichinus chloroticus	Kina	Rocky shore	43	4	4
Jasus edwardsii	Southern rock lobster	Rocky shore	5	3	3
Brachyura sp	–	Mixed	7	3	3
Ostreidae sp	–	Mixed	2	2	2
Cookia sulcata	Cook's turban	Rocky shore	2	2	2
Diloma nigerrima	Bluish top shell	Rocky shore	2	2	2
Haliotis virginea	Virgin pāua	Rocky shore	2	2	2
Muricidae sp	–	Rocky shore	2	2	2
Paratrophon patens	Rock snail	Rocky shore	2	2	2
Cellana strigilis	Limpet	Rocky shore	2	2	2
Scutus antipodes	Shield shell	Rocky shore	2	2	1
Irus elegans	Elephant venus shell	Rocky shore	1	1	1
Cominella glandiformis	Mud whelk	Muddy/estuarine	1	1	1
Austrovenus stutchburyi	NZ Tuangi cockle	Muddy/estuarine	1	1	1
Buccinidae sp	–	Mixed	1	1	1
Hiatellidae sp	–	Soft shore	1	1	1
Lepsiella scobina	Oyster borer	Rocky shore	1	1	1
Paphies subtriangulata	Tuatua	Soft shore	2	2	1
Gastropod sp	–	Mixed	20	20	–
Total			**11,122**	**10,751**	**5,882**

The remaining coastal and forest species were represented by only one individual. Overall, tui dominated the bird assemblage with a NISP of 17 and an MNI count of 7. Two fragments of moa bone (Dinornithiformes) were also identified although these may have been industrial specimens rather than food items.

Mammal

A total of 2,824 mammal bones were identified from Unit 2, representing 8.2% of the vertebrate assemblage (by NISP). Of these, 2,699 whale bone fragments and 87 other specimens were too fragmentary to identify to element or species. Table 9 presents a summary of the four taxa identified; Polynesian rat (*Rattus exulans*), fur seal (*Arctocephalus forsteri*), dog (*Canis familiaris*) and sea lion (*Phocarctos hookeri*).

Table 8. *Bird identifications (NISP, MNE and MNI) from Unit 2, Layer 4.*

Taxon	Common name	NISP	MNE	MNI
Prosthemadera novaeseelandiae	Tui	17	15	7
Pelecanoides urinatrix	Diving petrel	15	15	5
Charadrius bicinctus	Banded dotterel	8	7	3
Anthornis melanura	Bellbird	2	2	2
Eudyptes robustus	Snares penguin	2	2	2
Petroica australis	South island robin	2	2	2
Stictocarbo punctatus	Spotted shag	2	2	2
Dinornithiformes sp	Moa	2	–	1
Pachyptila turtur	Fairy prion	1	1	1
Cyanoramphus novaezelandiae	Red-crowned parakeet	1	1	1
Cyanoramphus sp	Parakeet	3	3	1
Eudyptula minor	Little penguin	4	3	1
Hemiphaga novaeseelandiae	New Zealand pigeon	2	2	1
Larus bulleri	Black-billed gull	1	1	1
Larus dominicanus	Kelp gull	1	1	1
Microcarbo melanoleucos	Little shag	2	2	1
Nestor meridionalis	Kākā	2	2	1
Pachyptila vittata	Broad-billed prion	2	2	1
Pterodroma cookii	Cook's petrel	2	2	1
Pterodroma sp	Petrel	2	2	1
Puffinus gavia	Fluttering shearwater	1	1	1
Puffinus tenuirostris	Short-tailed shearwater	1	1	1
Diomedeidae sp	Albatross	1	1	1
Eudyptes sp	Penguin	1	1	–
Larus sp	Gull	1	1	–
Passeriformes sp	–	1	1	–
Puffinus sp	Shearwater	1	1	–
Unidentified	–	256	14	–
Total		**336**	**88**	**39**

Table 9. *Mammal identifications (NISP, MNE and MNI) from Unit 2, Layer 4.*

Taxon	Taxa	NISP	MNE	MNI
Cetacean sp	Whale	2,699	–	1
Rattus exulans	Rat	16	8	3
Arctocephalus forsteri	Fur Seal	17	5	2
Canis familiaris	Dog	4	2	2
Phocarctos hookeri	Sea lion	1	–	1
Unidentified	–	87	–	–
Total		**2,824**	**15**	**9**

Fish

Fish bones accounted for 90.8% of the vertebrate sample by NISP. The fishbone assemblage was analysed in the OAL by Kate Lilley using the five paired mouth bones, distinctive 'special bones' (Leach 1997), plus additional paired and unpaired cranial bones (Lilley 2016) (Table 10). A second analysis was then carried out using only vertebrae with MNI values calculated by dividing NISP by the average number of vertebrae for that taxa (Harris *et al.* 2017). The results of these analyses are presented side by side in Table 11.

The fish assemblage was dominated by red cod (*Pseudophycis bachus*), barracouta (*Thyrsites atun*), and blue cod (*Parapercis colias*). Other species that were present in lesser frequencies included ling (*Genypterus blacodes*), shark or ray (Elasmobranchii sp.), spiny dogfish (*Squalas acanthias*), wrasse (*Notolabrus* sp), tarakihi (*Nemadactylus macropterus*) and groper (*Polyprion oxygeneios*). The two different analytical approaches produced different proportional values. Based on cranial bones alone, red cod accounted for ~50% of the fish assemblage with barracouta contributing ~30%. When only the vertebrae were analysed, the percentage of red cod increased to 73%, while barracouta decreased to 18.5%. The results of both analyses suggest that, of the red cod skeletal elements analysed, there is a higher ratio of post-cranial to cranial bones (Table 12). Barracouta vertebrae were under-represented in the midden, which

Table 10. *Elements used in the analysis of fishbone from Kahukura (after Harris* et al. *2017).*

Five paired mouth parts	Premaxilla, Maxilla, Dentary, Articular, Quadrate
Special bones	Superior pharyngeal clusters, Inferior pharyngeal clusters, Dorsal spines (Spiny Dogfish), Shark teeth, Elasmobranch vertebrae
Post-cranial bones (teleost)	Vertebrae
Additional paired cranial bones	Hyomandibular, Epihyal, Opercular, Preopercular, Palatine, Ceratohyal, Post-temporal, Cleithrum
Additional unpaired cranial bones	Vomer, Parasphenoid
Other	Otolith

may suggest the bodies were processed on site and stored for later consumption. This involves drying the whole fish on racks after removing the heads which were immediately consumed (Anderson 1981).

Table 12 near here

Stone artefacts

Stone artefacts were the most common artefact type excavated from the site, with 321 recovered. The assemblage consisted of adzes, chisels, hammer stones, cores, flakes, debitage and grinding stones (Table 13). Cores are defined here as nuclear pieces used as a source of flakes, and displaying one or more scars as evidence of flake removal. A flake is defined as a detached piece of stone generated by a discrete flaking event. A complete flake comprises a platform, termination, lateral margins and a bulb of per-

Table 11. *Fish identifications (NISP, MNI) from Unit 2, Layer 4 (after Harris* et al. *2017).*

		Cranial and special bones		Vertebrae	
Taxon		**NISP**	**MNI**	**NISP**	**MNI**
Pseudophycis bachus	Red cod	1870	120	4239	125
Thyrsites atun	Barracouta	1130	104	1078	34
Parapercis colias	Blue cod	297	29	192	19
Genypterus blacodes	Ling	128	9	238	8
Polyprion oxygeneios	Groper	11	5	5	1
Labridae sp	–	15	3	–	–
Latris lineata	Striped trumpeter	11	3	1	1
Nemadactylus macropterus	Tarakihi	12	3	–	–
Scombridae sp	–	4	3	–	–
Helicolenus percoides	Red gurnard perch	10	2	–	–
Latridopsis ciliaris	Blue moki	9	2	–	–
Chelidonichthys kumu	Red gurnard	1	1	1	1
Elasmobranchii sp	Shark/ray	1	1	90	1
Nototheniidae sp	–	2	1	–	
Selachimorpha sp	Shark	1	1	–	–
Squalas acanthias	Spiny dogfish	2	1	25	3
Trachurus sp.	Jack mackerel	2	1	–	–
Arripis trutta	Kahawai	–	–	1	1
Carcharhiniformes sp	Shark	–	–	11	1
Kathetostoma giganteum	Giant stargazer	–	–	8	–
Neophrynichthys latus	Dark toadfish	–	–	15	1
Notolabrus celidotus	Spotty wrasse	–	–	8	1
Notolabrus fucicola	Banded wrasse	–	–	45	2
Odax pullus	Butterfish	–	–	1	1
Pagrus auratus	Australasian snapper	–	–	3	1
Unidentified A*	–	143	30	279	–
Unidentified B**	–	21,450	–	–	–
Total (NISP)		**25,099**		**6,240**	
Total number of specimens identified to taxon		**3506**	**289**	**5961**	**197**

* Unidentified A, specimens that are not represented in the OAL reference collection
** Unidentified B, specimens with no apparent landmark features

Table 12. *Comparison of cranial to post-cranial bones in the two most abundant fish taxa identified at Kahukura, Unit 2, Layer 4 (from Harris* et al. *2017:Table 5).*

Measure	Element	Barracouta (*Thyrsites atun*)	Red cod (*Pseudophycis bachus*)
MNI	Cranial	104	120
	Post-cranial	34	125
	Ratio cranial to post-cranial bones	**0.33**	**1.04**
NISP	Cranial	1130	1870
	Post-cranial	1078	4239
	Ratio cranial to post-cranial bones	**0.95**	**2.27**

Table 13. *Stone artefacts from Kahukura.*

Artefact	Surface find	Layer 2	Layer 4	Total
Adze	1	–	10	11
Chisel (fragment)**	–	–	1	1
Core	–	1	14	15
Flake	–	–	–	–
Edge scarring	1	1	13	15
No edge scarring	1	9	83	93
Hammer dressing or polish*	1	2	20	23
Grindstone	2	–	9	11
Debitage	–	10	140	150
Hammer stone	–	–	2	2
Total count	**6**	**23**	**292**	**321**

* No flakes with hammer dressing or polish displayed edge scarring
** See Figure 11(a)

cussion although broken flakes may only display some of these landmarks. Debitage comprises angular stone fragments produced as the waste or by-product of a flaking event. It does not contain landmarks to distinguish it as a flake or core.

The stone material was identified using the New Zealand Rock Reference Collection in the OAL. The most common material was that used for the manufacture of casual cutting or scraping implements (e.g. porcellanite and chert). Most of these artefacts showed no signs of use-wear (Table 14). Twenty-three flakes with evidence of polish or hammer dressing attest to adze maintenance and repair but there is no evidence at the site for the manufacture of adzes, or the reduction of preforms. Twelve of these pieces were argillite, two of which in hand specimen appear to derive from northern South Island sources and ten from the south coast of Murihiku.

Ten adzes were recovered from Layer 4 and were assigned to type using Duff's (1956) adze classification, with Duff Type 2 adzes being the most common form (Table 15; Figure 11). An additional Duff Type 2 adze was also recovered from the beach which had probably eroded from Layer 4 (No. 6.63: Table 15).

Only six pieces of obsidian were excavated from Kahukura. Obsidian from the central North Island and the Bay of Plenty was traded throughout New Zealand from the earliest known period of colonisation, and is commonly found in fourteenth century sites in southern New Zealand (McCoy and Carpenter 2014; Seelenfreund-Hirsch 1985). However, its distribution declined with a contraction of communication networks from the early fifteenth century (Walter *et al.* 2010). The scarcity of obsidian at Kahukura and the small size of individual pieces (mean weight 0.99g, sd 1.178) suggests that Kahukura was not actively involved in long distance exchange systems and is indicative of the relatively late age of the site compared to the transient villages to the north.

To identify the source of the obsidian samples they were analysed by X-Ray Fluorescence using a Bruker Tracer III-SD pXRF at the OAL. The machine was optimised to identify mid-Z trace elements (Mn, Fe, Zn, Th, Rb, Sr, Y, Zr, Nb) with green filter settings (40 kV per channel, filament ADC = 30μA, filter = 12milAl + 1milTi + 6milCu,

Table 14. *Flake and debitage artefacts, showing stone type and presence of use-wear.*

	Layer 2		Layer 4	
Stone type	No edge scars	Edge scars	No edge scars	Edge scars
Porcellanite	2	–	150	9
Chert	6	1	24	2
Argillite	2	–	17	2
Silcrete	–	–	16	1
Basalt*	2	–	8	–
Chalcedony	1	–	7	–
Quartz	3	–	6	–
Nephrite	2	–	6	–
Obsidian	2	–	4	–
Sandstone	–	–	2	–
Andesite	–	–	1	1
Schist?	–	–	1	–
Total count	20	1	242	15

* All basalt flakes displayed evidence of polish

Table 15. *Adzes recovered from Kahukura.*

Bag No.	Layer	Duff Type	Material	Max Length	Max Width	Max Thickness	Weight (g)	Figure 11
1.215	4	1A	Basalt	102.0	58.2	24.9	240.07	h
3.58	4	1D	Basalt	90.5	52.1	40.6	352.30	g
5.8	4	2	Argillite	98.9	50.0	25.0	203.79	f
6.118	4	2A	Basalt	121.8	49.9	21.8	292.14	j
6.135	4	2	Basalt	85.0	40.5	15.6	95.28	e
6.166	4	2A	Argillite	66.6	36.4	16.6	63.92	b
6.2	4	2	Nephrite	133.2	37.5	26.0	211.71	k
6.63	Surface Find	2	Argillite	112.1	45.2	10.7	93.10	i
6.8	4	2A	Basalt	144.6	64.5	25	455.79	l
24	4	2	Argillite	84.3	32.2	18.7	82.86	c
2.170	4	2	Basalt	87.5	22.0	22.8	47.42	d

Figure 11. Adzes and chisel fragment (a) recovered from Layer 4 (see Table 15).

runtime = 300 seconds). Five of the six obsidian artefacts were analysed with one omitted because it was considered too small[6]. The raw data was calibrated to parts per million (ppm) using the machine–specific quantification protocols for the Bruker Tracer III-SD #T3S2521, based on 40 known obsidian standards. A basalt standard (BHVO-2) was run at the beginning of the session as a quality control (Table 16). The archaeological material was then compared to geological reference sample spectra and values (McCoy and Carpenter 2014; Ward 1972).

Table 17 presents the results of the mid-z trace elements identified from the Kahukura obsidian samples. Five elements are considered the most useful and indicative when discriminating between obsidian sources (Rb, Sr, Y, Zr, and Nb) (McCoy and Carpenter 2014). The high relative standard deviation (RSD) in Rb is due to a known problem of high variance in quantitative data when concentrations are low. Through comparison of these element values with known values from geological reference samples (McCoy and Carpenter 2014; Ward 1972), two likely geological sources were positively identified. Mayor Island obsidian (MIO) was identified from two samples (M17-P-4-ii and M17-P-4-iii) and the remaining three samples were positively identified from the Taupo Volcanic Zone.

Ochre pieces (n = 524) were also excavated from Layer 4, with 94% (by weight) from Unit 3. Ochre is an earthy pigment procured from clays rich in iron and aluminium, ranging in colour from light yellow through to red (known as kokowai) (Table 18). During the contact period its use was documented for various purposes amongst Māori communities (Ledyard 1783: 14). To begin, the clay was dried, ground, and mixed with oil (usually fish oil). This produced paint that was used for decorating houses, canoes, ceremonial items, and sometimes for decorating the skin (Dieffenbach 1843: 159-160).

Fish hooks

One hundred and fifteen bone fish hooks and six fish hook blanks were excavated from Kahukura. The hooks consisted of three shanks from two-piece fish hooks (Figure 12-a), one fragment that may have been from a one-piece fish hook (Figure 12-b), 93 points from two-piece fish hooks

6 Only samples large enough to fit over the instrument window were used.

Table 16. *Basalt standard chemistry (ppm).*

	Mn	Fe	Zn	Ga	Th	Rb	Sr	Y	Zr	Nb
USGS recommended	1290	86300	103	22	1	10	389	26	172	18
OAL	1112	79076	211	27	1	14	334	22	150	17
SD	126	5108	76	4	0	3	39	3	15	1
RSD (%)	11	6	48	16	0	25	11	13	9	6

Table 17. *Concentration values for obsidian samples identified from Kahukura (ppm).*

Sample	Mn	Fe	Zn	Ga	Th	Rb	Sr	Y	Zr	Nb	Assigned source
K17-2-i	630	31027	285	26	14	136	1	118	987	85	Mayor Island
K17-E-2-i	623	31235	282	26	17	136	2	118	987	85	Mayor Island
M17-P-4-ii	724	17869	286	30	17	178	110	26	187	12	Taupo volcanic zone
M17-V-4-iii	554	16955	211	29	17	184	116	28	198	11	Taupo volcanic zone
M22-A-4-i	636	30262	264	26	16	131	3	115	960	83	Mayor Island

Table 18. *Count and weight of ochre recovered from Layer 4.*

Colour	Count	Weight (g)
Red-purple	322	170.2
Red-orange	192	54.6
Yellow	10	7.9.0
Total	524	232.7

Table 19. *Fish hooks identified within Hjarno's (1967) classification.*

Hjarno (1967) Type	Layer 2	Layer 4	Total
A.1	–	8	8
A.3	–	6	6
C.3a	3	31	34
C.5	–	3	3
C.4	–	1	1
Blank	–	6	6
Unidentified	3	60	63
Total	**6**	**115**	**121**

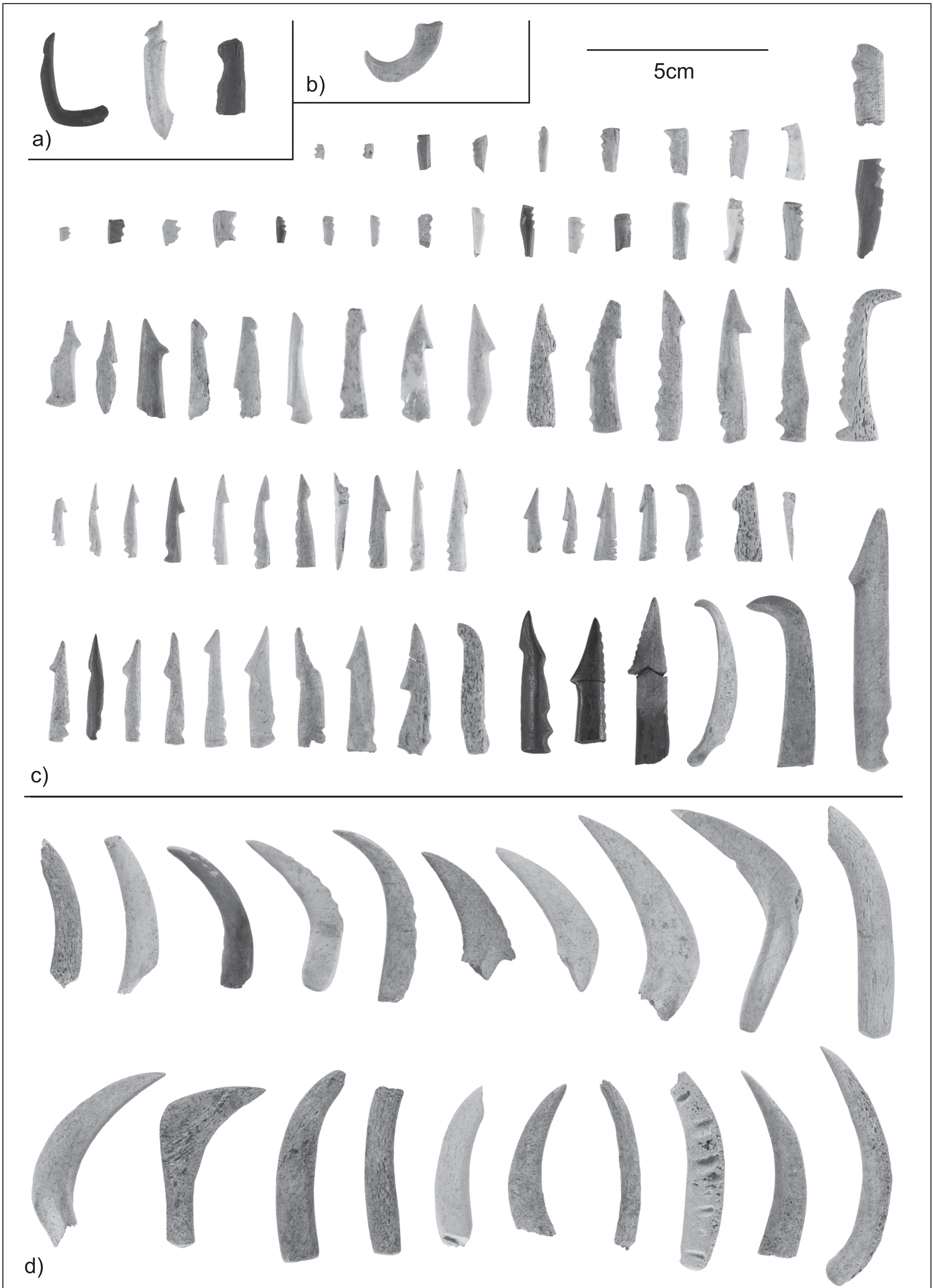

Figure 12. A selection of fish hooks excavated from Kahukura: a) shank examples of two piece hooks, b) possible fragment of one-piece hook, c) point examples of two piece hooks, d) point examples of lure hooks.

(Figure 12-c) and 22 points from lure hooks (Figure 12-d). Fifty two of the specimens retained landmark features enabling them to be classified according to Hjarno's (1967) classification of southern New Zealand hooks (Table 19). This classification uses a combination of morphological and, to a lesser extent, assumed functional attributes to organise fish hooks into three broad classes: one-piece (Type D), two-piece (Type C), and lures (point and shank) (Types A and B). These are further subdivided according to the presence or absence of notches or serrations, presence and location of barbs, and the overall shape of the hook.

Bone implements

Bone implements from the site include spear points (Figure 13-a), needle points (Figure 13-b), one possible harpoon point (Figure 13-c), one chisel (Figure 13-d) and two awls (Figure 13-e) (Table 20). Other examples of worked bone (n = 56) were also recorded but they were not modified into any recognisable form.

Table 20. *Bone implements from Kahukura.*

Bone implement	Surface find	Layer 2	Layer 4	Total
Awl	1	-	1	2
Needle point?	1	1	4	6
Chisel	-	-	1	1
Harpoon point?	-	-	1	1
Spear point	1	-	5	6
Worked bone	-	2	54	56
Total count	**3**	**3**	**66**	**72**

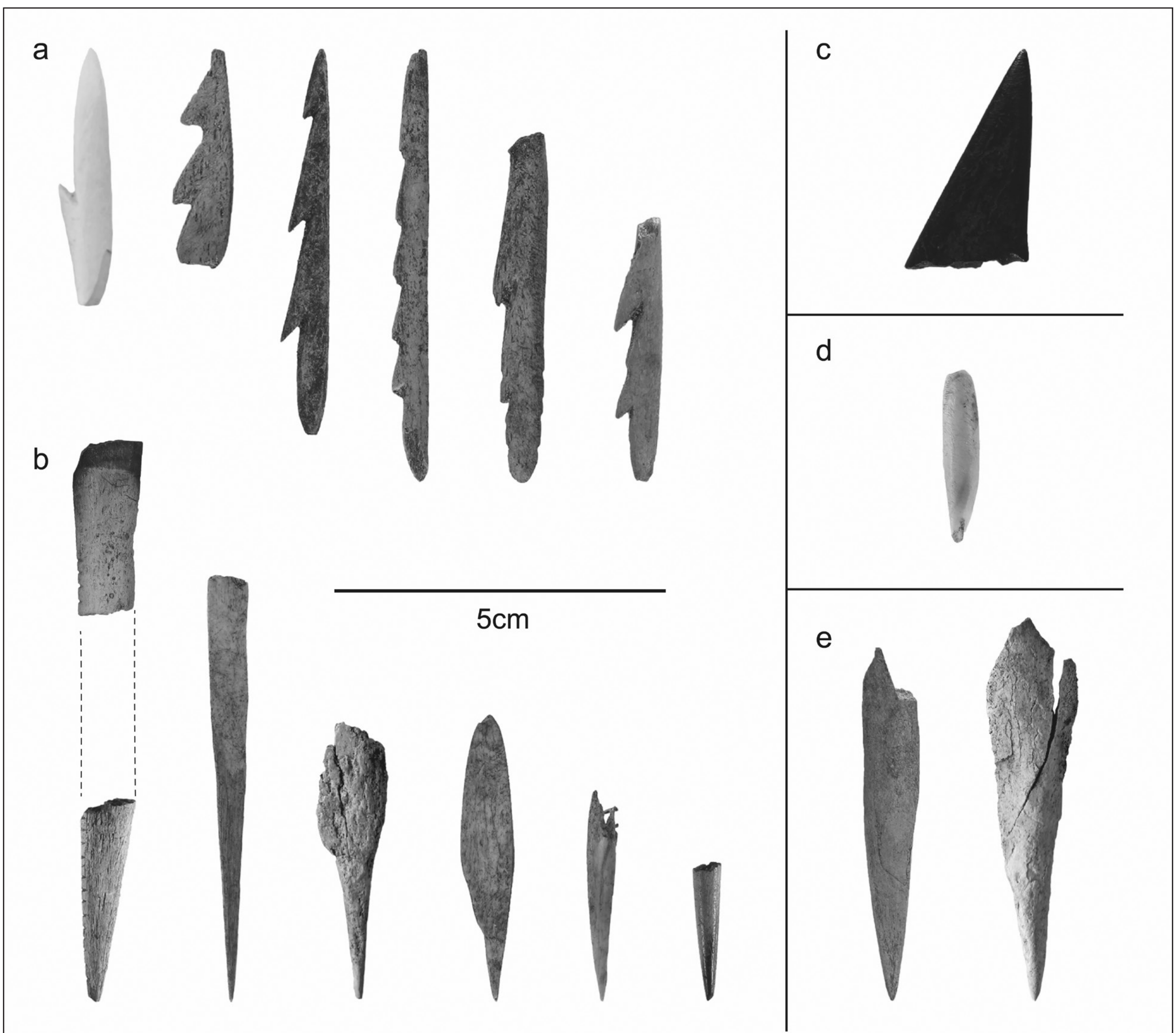

Figure 13. Bone implements recovered from Kahukura: a) bone spear points, b) bone needle points, c) burnt bone harpoon point, d) bone chisel, e) bone awls.

Ornaments

Excavated ornamental artefacts include one pendant made from petrified wood (Figure 14-a), the proximal end of what appears to be a drilled ornament (Figure 14-b), seven small *Dentalium* beads (Figure 14-c) and the teeth of two bone combs (Figure 14-d) (Table 21). The most significant artefact is a fragment of a chevroned amulet (Figure 15). This enigmatic artefact form (Mead 1975; Skinner 1934) is predominantly associated with the 'Archaic' but has not before been recovered from a well-provenanced and dated context. Although they are found in very small numbers in a variety of forms in both the North and South Island, they are strongly associated with southern New Zealand and the mid-Otago coast, and at least some appear to have been recovered from southern transient village sites (Little Papanui, Waikouaiti) (Skinner 1934). Although the Kahukura piece is only a small fragment, it is very similar in form to an amulet from Wickliffe Bay (Figure 16).

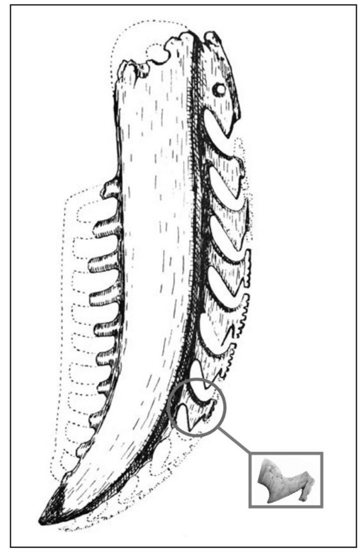

Figure 16. Chevroned amulet from Wickliffe Bay considered with the fragment from Kahukura (Skinner 1934:207).

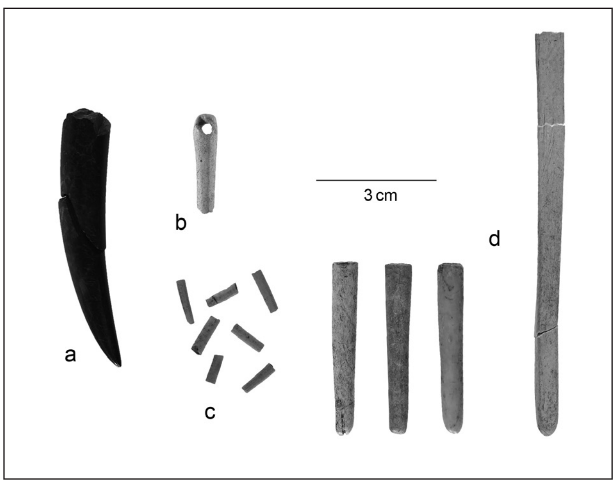

Figure 14. Ornaments identified from Kahukura Layer 4: a) burnt petrified wood pendant, b) drilled bone ornament, c) *Dentalium* beads, d) teeth from two bone combs.

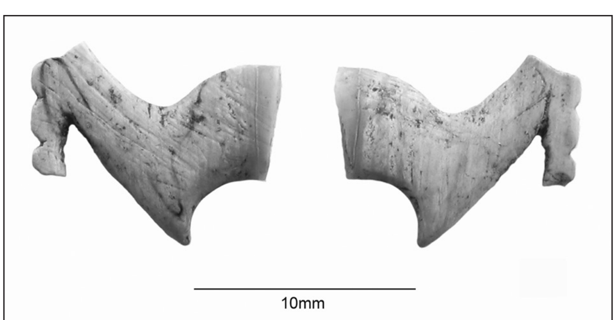

Figure 15. Chevroned amulet fragment from Kahukura.

Table 21. *Ornaments from Kahukura, Layer 4.*

Artefact	Quantity
Pendant	1
Drilled ornament?	1
Comb (teeth)	4
Bead (*Dentalium*)	7
Chevron amulet	1
Total	**15**

DISCUSSION

In their 1996 paper on the 'transient village' Anderson and Smith (1996:360) set out specific defining criteria for villages. The distinguishing attributes include: "…relatively large size (2–5 ha), existence of burials and remains of dwellings, abundant and varied material culture and extensive middens…". Today, Kahukura occupies only about 0.5 ha but it has lost a great deal of fabric through coastal erosion. Whether it ever reached 2 ha in size is uncertain, but it meets Anderson and Smith's (1996) definition of a village in every other respect. Kahukura also contains evidence for a diverse range of domestic and industrial activities which we consider additional and essential criteria for identifying a site as a village. These activities include cooking, food preparation, working of whalebone and the maintenance of stone tools. Despite the chronological inadequacies of the calibrated radiocarbon age ranges, Kahukura appears to have been occupied soon after the abandonment of the transient villages of the Catlins coast. At this time moa hunting had ceased, but moa bone was still available for use in tool making. Village sites within this period are rare in Murihiku and provide important insights into post-moa hunting culture change in the south.

In northern New Zealand early settlement patterns seem to have included the occupation of dispersed hamlets (with some regional clustering) whose inhabitants supplemented kumara horticulture with fishing, shell fishing and low intensity hunting. This gave way, by 1500 AD, to a landscape of defensive earthwork constructions or pa, with outlying open settlements scattered over extensive garden lands. Fishing continued, but the economic significance of shellfish may have increased relative to other protein sources in many parts of the country. In southern New Zealand early occupation was characterised by large, rich nucleated settlements located on isolated, coastal resource nodes. The economic focus was on terrestrial and strandline hunting and foraging. Smaller, short-duration settlements, possibly associated with single-function activities, were located in both coastal and inland locations. This model of settlement was followed by a period of population dispersal, and localised abandonment (e.g., Jacomb *et al.* 2010), that was a consequence of resource depression exacerbated by climatic changes. Two models have been proposed to describe what happened following moa extinction and the collapse of the transient villages. Anderson and Smith (1996) have suggested that there was a transition to more mobile, smaller-scale economic systems while Jacomb *et al.* (2010) argued that much of the region was simply abandoned. Both models were hampered by a chronological gap in the record that Kahukura now partly fills. The evidence from Kahukura suggests that the collapse of moa hunting did not necessarily lead directly to abandonment, nor to a sudden shift to other patterns of mobility and resource scheduling as Anderson and Smith (1996) suggest. Kahukura suggests instead, that a sedentary village way of life continued, but in an environment with reduced local resource opportunities and with more restricted access to long-distance exchange and mobility networks.

The midden assemblage at Kahukura shows a decrease in species diversity when compared to the faunal assemblages from Pounawea or Papatowai (Hamel 1978; 1979a; 1980; Teviotdale 1938a), a trend away from terrestrial hunting, and a specialisation in intensive local exploitation strategies. The mainstay of the production system was fishing and shell fishing. Fishing was focused on the high yield, low-risk species of barracouta and red cod that could have been caught within the local bays. Similar trends are noted at Long Beach, on the Otago coast, where evidence of a post-moa hunting occupation appears in the upper cultural layers (Fyfe 1982; Hamel 2001: 76). Shell fishing at Kahukura was focussed on the exploitation of rocky shore species such as those available on the reefs immediately adjacent to the site. This economy was supplemented by opportunistic strandline hunting and foraging for sea mammals. The relatively small sea mammal assemblage reflects a decline in local breeding and haul-out colonies (e.g., Smith 1985).

The stone assemblages from the transient villages of the Catlins were dominated by silcrete, porcellanite and argillite (Hamel 1977). The latter was overwhelmingly from the large stone working centres of Bluff Harbour and Riverton on Southland's south-coast, from where adzes and preforms were moved at least as far north as Kaikoura during that period (Jennings 2009). By contrast, Kahukura only contained ten small flakes of Southland argillite, which reinforces the suggestion that the southern production centres were no longer active (Jennings, 2009). Silcrete was also scarce at Kahukura, although porcellanite continued to dominate the flake assemblage. The six flakes of obsidian recovered at Kahukura may have been the last of the northern imports retained in the community, although it is conceivable that they were recycled from abandoned sites.

The transient village way of life was arguably the most successful settlement-subsistence mode in pre-contact coastal Murihiku. Capable of supporting relatively dense, sedentary populations inter-generationally, transient villages were stable as long as ecological conditions of resource clumping prevailed. When those conditions changed, population levels declined and new patterns of settlement emerged. Kahukura may represent a transitional phase that delayed population decline by retaining a sedentary village way of life for some time in an increasingly difficult economic climate. Following the eventual abandonment of Kahukura, the next evidence for human activity at the site is represented by material in Layer 2. This new phase of activity was likely connected to the late eighteenth and early nineteenth century movement south of Ngāi Tahu (Kāi Tahu) and related hapu, which was itself driven by tribal politics to the north, and responses to new European economic influences in the south (e.g., Anderson 1983; 1989; Anderson and Smith 1996; Beattie and Anderson 1994).

The Kahukura evidence adds to our understanding of post-moa hunting changes in economics, mobility and settlement patterns in Murihiku. The question remains as to how many other sites might fall within this same 'transitional' period and several possible candidates exist. These include Fortrose (F47/64), Sealers Bay 1, Whenua Hou (D48/5) (Smith and Anderson 2009) and Porpoise Bay (G47/7) (Jacomb 2012). These sites were occupied on the cusp of moa extinction, or slightly later; they display a limited range of lithic source material with a predominance of porcellanite, but they have rich midden records. Like Kahukura, these sites have multiple features, a varied material culture and appear to be more complex than simple one-off or multiple-visit camp sites.

Since the 2009 excavations at Kahukura, coastal erosion has removed at least four metres of site fabric along most of the 80 m beach exposure. Kahukura is not unusual in being vulnerable to coastal processes and provides a clear illustration of the threats currently being faced by New Zealand's coastal archaeology. These threats will only increase with climate change and there is now some urgency for archaeologists to identify sites that are at risk and to investigate where possible, before valuable information is lost.

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References

Allen, M.S. and Huebert, J.M. 2014. Short-lived plant materials, long-lived trees, and Polynesian c-14 dating: considerations for c-14 sample selection and documentation. *Radiocarbon,* 56: 257–276. DOI: 10.2458/56.16784

Anderson, A. 1981. Barracouta fishing in prehistoric and early historic New Zealand. *Journal de la Société des Oceanistes,* 72–73: 145–158.

Anderson, A. 1983. *When all the Moa Ovens Grew Cold.* Dunedin, Otago Heritage Books.

Anderson, A. 1989. *Prodigious Birds: Moas and Moa-hunting in Prehistoric New Zealand.* Cambridge, Cambridge University Press.

Anderson, A. 2001. The Origins of Muttonbirding in New Zealand. *New Zealand Journal of Archaeology,* 22: 5–14.

Anderson, A. and Smith, I.W.G. 1996. The transient village in southern New Zealand. *World Archaeology,* 27: 359–371.

Beattie, H. and Anderson, A. 1994. *Traditional lifeways of the Southern Maori.* Dunedin, University of Otago Press in association with the Otago Museum.

Bronk Ramsey, C. 2017. Methods for Summarizing Radiocarbon Datasets. *Radiocarbon*, 59(2): 1809–1833.

Brooks, E., Jacomb, C. and Walter, R. 2010. Preliminary report on excavations at Kahukura (G47/128), February 2009, *SPAR Report Series*. Report to Te Ao Marama and the New Zealand Historic Places Trust. Dunedin, Southern Pacific Archaeological Research, Anthropology Department, University of Otago.

Brooks, E., Walter, R. and Jacomb, C. 2008. Southland Coastal Heritage Inventory Project Waiparua Head to Rowallan Burn, *SPAR Report Series*, Dunedin: Southern Pacific Archaeological Research.

Chiswell, S.M. 1996. Variability in the Southland current, New Zealand. *New Zealand Journal of Marine and Freshwater Research,* 30: 1–17.

Crowe, A. 1999. *Which seashell? : a simple guide to the identification of New Zealand seashells.* Auckland, N.Z., Penguin.

Cunliffe, E.A. 2014. *Whales and whale bone technology in New Zealand prehistory.* MA Thesis, University of Otago.

Cunliffe, E.A. and Brooks, E. 2016. Prehistoric whalebone technology in Southern New Zealand. *International Journal of Osteoarchaeology,* 26: 384–396. DOI: 10.1002/oa.2427

Dieffenbach, E. 1843. *Travels in New Zealand; with contributions to the geography, geology, botany, and natural history of that country.* London,, J. Murray.

Duff, R.S. 1956. *The Moa Hunter Period of Maori Culture.* Wellington, Government Printer.

Egerton, R. and Jacomb, C. 2009. Southland Coastal Heritage Inventory Project. *Archaeology in New Zealand,* 52: 250–258.

Fisher, J.W. 1995. Bone surface modifications in zooarchaeology. *Journal of Archaeological Method and Theory,* 2: 7–68.

Fyfe, R. 1982. *Prehistoric Fishing Behaviour at Long Beach S164/20.* M.A. thesis, Otago.

Golson, J. 1959. Culture change in prehistoric New Zealand. In, Freeman, J.D. and Geddes, W.R. (eds.) *Anthropology in the South Seas.* New Plymouth, Avery, pp 29–74.

Grayson, D.K. 1984. *Quantitative zooarchaeology : topics in the analysis of archaeological faunas.* Orlando, Academic Press.

Hamel, G.E. 1977. *Prehistoric man and his environment in the Catlins, New Zealand.* PhD Thesis, University of Otago.

Hamel, G.E. 1978. Radiocarbon dates from the moa-hunter site of Papatowai, Otago, New Zealand. *New Zealand Archaeological Association Newsletter,* 21: 53–4.

Hamel, G.E. 1979. Subsistence at Pounawea: an interim report. *New Zealand Archaeological Association Newsletter,* 22: 117–121.

Hamel, G.E. 1980. Pounawea: The last excavation, Unpublished report to the New Zealand Historic Places Trust.

Hamel, G.E. 1982. South Otago. In, Prickett, N. (ed.) *The First Thousand Years.* Palmerston North, The Dunmore Press Limited, pp 129–140.

Hamel, G.E. 2001. *The Archaeology of Otago.* Wellington, Department of Conservation.

Harris, T., Lilley, K.A. and Walter, R.W. 2017. The Varying Role of Vertebrae in Pacific Fishbone Analysis: Comparing Tropical Versus Temperate Midden Assemblages. *International Journal of Osteoarchaeology*: 1038–1047. DOI: 10.1002/oa.2628

Hjarno, J. 1967. Maori Fish-hooks in Southern New Zealand. *Records of the Otago Museum, Anthropology,* 3.

Hogg, A.G., Hua, Q., Blackwell, P.G., Niu, M., Buck, C.E., Guilderson, T.P., Heaton, T.J., Palmer, J.G., Reimer, P.J., Reimer, R.W., Turney, C.S.M. and Zimmerman, S.R.H. 2013. SHCal13 Southern Hemisphere calibration, 0–50,000 years cal BP. *Radiocarbon,* 55: 1889–1903.

Jacomb, C., Walter, R. and Jennings, C. 2010. A Review of the Archaeology of Foveaux Strait, New Zealand. *Journal of the Polynesian Society,* 119: 25–59.

Jennings, C. 2009. *The use of Southland Argillite in New Zealand Prehistory; distribution, chronology and form.* MA, University of Otago.

Jennings, C., Weisler, M. and Walter, R. 2018. Colyers Island: Polynesia's southernmost adze manufacturing complex. *Archaeology in Oceania,* 0. doi:10.1002/arco.5151

Leach, B.F. 1997. *Guide to the Identification of Fish Remains from New Zealand Archaeological Sites.* NZ Journal of Archaeology, Special Publication.

Leach, H.M. and Leach, B.F. 1980. The Riverton site: an Archaic adze manufactory in Western Southland. *New Zealand Journal of Archaeology,* 2: 99–140.

Ledyard, J. 1783. *A journal of Captain Cook's last voyage to the Pacific Ocean, and in quest of a North-west passage, between Asia & America.* Hartford, Nathaniel Patten.

Lilley, K. 2016. *Kahukura: Faunal Exploitation in a Southern New Zealand Context.* MA Thesis, University of Otago.

Lockerbie, L. 1953. Further excavation of the Moa-hunter camp site at the mouth of the Tahakopa River. *Journal of the Polynesian Society,* 65: 13–32.

Macara, G.R. 2013. The Climate and Weather of Southland*, National Institute of Water and Atmospheric Research (NIWA) Science and Technology Series*. New Zealand, NIWA.

McCoy, M.D. and Carpenter, J. 2014. Strategies for Obtaining Obsidian in Pre-European Contact Era New Zealand. *Plos One,* 9. 10.1371/journal.pone.0084302

McFadgen, B.G., Knox, F. and Cole, T. 1994. Radiocarbon Calibration curve variations and their implications for the interpretation of New Zealand prehistory. *Radiocarbon,* 36: 221–236.

Mead, S.M. 1975. The origins of Maori art : Polynesian or Chinese? *Oceania,* 45: 173–211.

Morley, M.S. 2004. *A Photographic Guide to Seashells of New Zealand.* Auckland, New Holland Publishers.

Olsen, S.L. and Shipman, P. 1988. Surface modification on bone: Trampling versus butchery. *Journal of Archaeological Science,* 15: 535–553.

Petchey, F., Anderson, A., Zondervan, A., Ulm, S. and Hogg, A. 2008. New marine ΔR values for the South Pacific subtropical gyre region. *Radiocarbon,* 50: 373–397.

Powell, A.W.B. 1976. *Shells of New Zealand : an illustrated handbook.* Christchurch, Whitcoulls.

Reitz, E.J. and Wing, E.S. 2008. *Zooarchaeology.* Cambridge Manuals in Archaeology*,* Leiden, Cambridge University Press.

Robertson, H.A.; Heather, B.D. and Onley, D.J. 2015. *The hand guide to the birds of New Zealand.* New Zealand, Penguin Books.

Scofield, R.P. and Stephenson, B. 2013. *Birds of New Zealand : a photographic guide*. New Haven: Yale University Press,.

Seelenfreund-Hirsch, A. 1985. *The exploitation of Mayor Island obsidian in prehistoric New Zealand.* PhD Thesis, University of Otago.

Seersholm, F.V., Cole, T.L., Grealy, A., Rawlence, N.J., Greig, K., Knapp, M., Stat, M., Hansen, A.J., Easton, L.J., Shepherd, L., Tennyson, A.J.D., Scofield, R.P., Walter, R. and Bunce, M. 2018. Subsistence practices, past biodiversity, and anthropogenic impacts revealed by New Zealand-wide ancient DNA survey. *Proceedings of the National Academy of Sciences*. 10.1073/pnas.1803573115

Sellet, F. 1993. Chaîne opératoire; the concept and its applications. *Lithic technology,* 19: 106–112.

Shipman, P. and Rose, J. 1983. Early hominid hunting, butchering, and carcass-processing behaviors: approaches to the fossil record. *Journal of Anthropological Archaeology,* 2: 57–98.

Skinner, H.D. 1934. Maori Amulets in Stone, Bone and Shell. *Journal of the Polynesian Society,* 43: 198–215.

Smith, I.W.G. 1985. Sea mammal hunting and prehistoric subsistence in New Zealand. In, Sutton, D.G. (ed.) *Saying so doesn't make it so: Papers in honour of B. Foss Leach.* Auckland, New Zealand Archaeological Association Monograph 17, pp 76–108.

Stevens, M.J. 2011. What's in a name?: Murihiku, colonial knowledge-making, and 'thin-culture'. *Journal of the Polynesian Society,* 120: 333–347.

Teviotdale, D. 1937. Progress report on the excavation of a moa-hunters' camp at the mouth of the Tahakopa River. *Journal of the Polynesian Society,* 46: 134–153.

Teviotdale, D. 1938a. Final report on the excavation of a moa-hunter camp at the mouth of the Tahakopa River. *Journal of the Polynesian Society,* 47: 114–118.

Teviotdale, D. 1938b. Further excavations at the moa-hunters' camp at Papatowai. *Journal of the Polynesian Society,* 47: 27–37.

Walter, R., Brooks, E. and Buckley, H. 2008. Report on emergency recovery of koiwi at Kahukura (G47/128)*, SPAR Report Series*. Dunedin, Southern Pacific Archaelogical Research, Anthropology Department, University of Otago.

Walter, R., Jacomb, C. and Bowron-Muth, S. 2010. Colonisation, mobility and exchange in New Zealand prehistory. *Antiquity,* 84: 497–513.

Ward, G.K. 1972. *Obsidian and New Zealand Archaeology : a paradigm for sourcing artefact assemblages using X-ray fluorescence spectrography.* MA Thesis, University of Otago.

Worthy, T.H. 1999. What was on the menu? Avian extinction in New Zealand. *New Zealand Journal of Archaeology,* 19 (1997): 125–160.