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– ARTICLE –

The Long Bay Restaurant Site (R10/1374), Auckland, New Zealand, and the Archaeology of the Mid-15th Century in the Upper North Island

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ABSTRACT

Excavation at the Long Bay Restaurant resulted in the discovery and disinterment of 25 pre-European Māori burials. The full clearance and sieving strategy employed to recover all kōiwi tangata (human remains) produced a fine-grained 13 × 12 m excavation of a stratified coastal site, providing detailed faunal and material culture samples. Coupled with a Bayesian radiocarbon analysis that places the six cultural Phases in a tight 55 year span, analysis of the material has contributed to our understanding of social, economic and technological changes that took place in mid to late 15th century in the Auckland region. New Zealand archaeologists have often debated the timing and rate of these changes, as the first East Polynesian settlers became Māori. The Long Bay Restaurant site contributes new data to this debate.

Keywords: Long Bay, New Zealand, Archaic, Classic

INTRODUCTION

During refurbishment of the Long Bay Restaurant at Long Bay Regional Park on the northern outskirts of Tāmaki (the Auckland region) in 2013, kōiwi tangata (human remains) were found and work was halted. An initial exploratory excavation was undertaken in 2014 (Campbell *et al*. 2014) and work on the restaurant then resumed. Further kōiwi were found towards the end of 2014 and work again halted. Following discussions with mana whenua (Māori groups with ancestral ties to the land at Long Bay), who were consulted throughout the excavation, a complete excavation of the restaurant footprint was undertaken in the summer of 2015–16. A further 23 kōiwi were excavated and it was decided to abandon the restaurant project. This paper reports on the archaeology of the Long Bay Restaurant site (R10/1374) (Campbell *et al*. 2019) and discusses how the site contributes to an understanding of the timing and nature of social change in the northern North Island. The kōiwi will be described elsewhere and in this paper discussion is largely limited to their stratigraphic and chronological context.

ARCHAEOLOGY

The site sits at the back of the low foredune which runs the length of Long Bay. This system is typical of the New Zealand east coast where dunes are formed by wave and wind action (Goff *et al*. 2003:164). When vegetation can grow the dune system is stable, but when vegetation is removed, whether through natural or, more commonly, human-induced processes, the dune system becomes mobile, and redistribution of beach sands and blowouts will occur (Masselink *et al*. 2011: 291).

Alternating periods of dune stability and instability are the reason for the complex stratigraphy of the site. Each phase of occupation disturbed the dune vegetation resulting in sand movement. Blown-out sand capped the midden,

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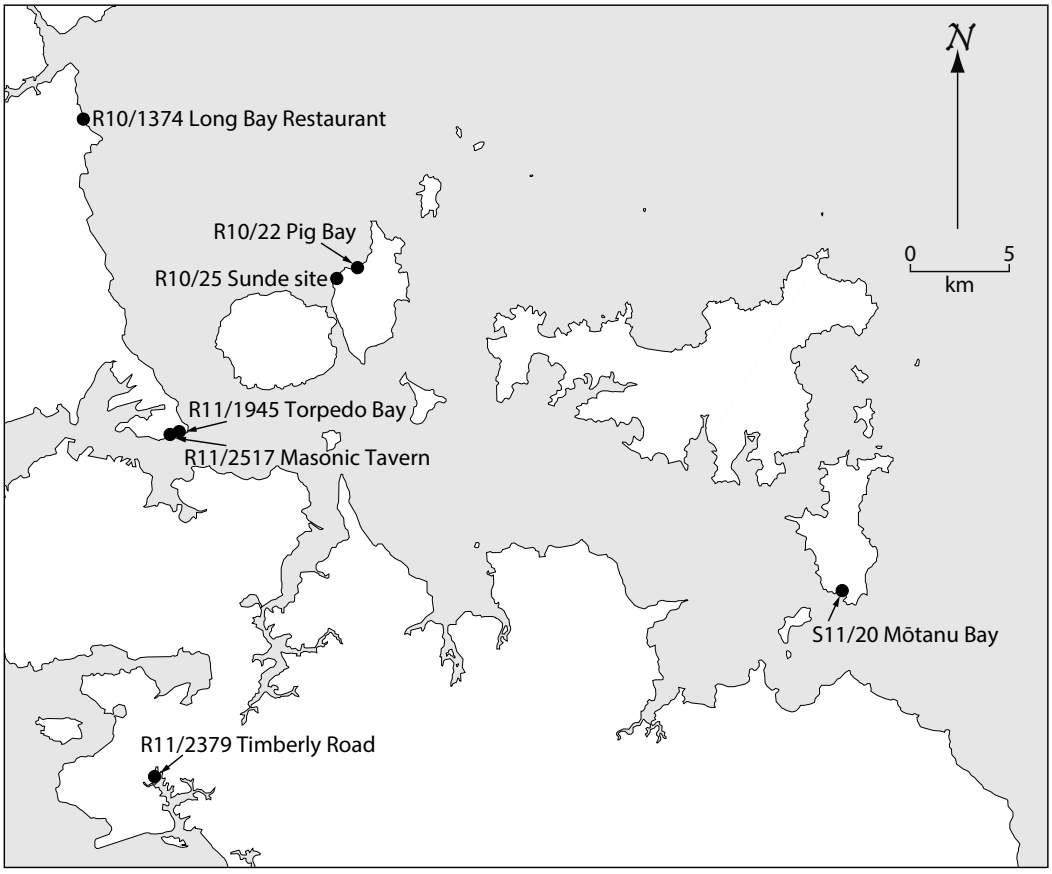

Figure 1. Location of the Long Bay restaurant site and other Tāmaki sites mentioned in the text.

which in turn was stabilised as the vegetation grew back. This process was repeated at least six times, but the fact that the cultural layers, as they were encountered during excavation, are not extensive indicates that they have also been partly destroyed through blowouts. Additional occupations possibly do not survive at all or survive on parts of the dune outside the excavated area.

Excavation took place within the concrete ring foundation of the restaurant and 3 m to the west. There the stratigraphy was more disturbed by service trenches and construction and not all layers could be traced. The inter-occupation Phases (2, 6, 8 and 11) generally consisted of clean, yellow-white, windblown dune sand, varying in extent and depth.

The necessity of recovering all kōiwi allowed a 100% sampling strategy to be adopted, with all midden dry sieved in the field, most through a 3 mm screen but some through 6 mm. Initially it was sorted in the sieve but a strategy was soon adopted of returning the samples to the lab where they were wet sieved through a 3 mm screen. Comprehensive material culture and faunal assemblages have now been analysed, some by student volunteers, though much still remains unanalysed.

For ease of interpretation, reference to cultural layers will generally be by Phase rather than numbered layers.

Phase 1 (Occupation Phase)

Phase 1 covered about 7 × 5 m in the northern part of the excavation inside the foundation (Figure 3), although disturbed lenses of similar material were found west of the foundation. The matrix consisted of a mottled, moderately compacted yellow-grey sand containing shell midden. Four firescoops were excavated as well as several small postholes, some of which formed alignments representing structures such as wind breaks or drying racks rather than larger structures such as houses. Postholes tended to have a fill only a little darker than the surrounding matrix and were very hard to see – it is probable that further postholes may have been present in all Phases but were not recorded. An oven stone cache in a clean sand fill was found beneath one of the firescoops – this is probably the earliest excavated feature on the site. Very little material culture was found: a single shell fishhook point and a single flake of obsidian from Mayor Island, though it is possible that some of the Phase 4 stone material may be a lag deposit from Phase 1. Fish and shellfish were relatively plentiful but small bird numbers were low; there was a single tuatara (*Sphenodon punctatus*) bone, very little terrestrial or marine mammal and, although this is the earliest layer, no moa.

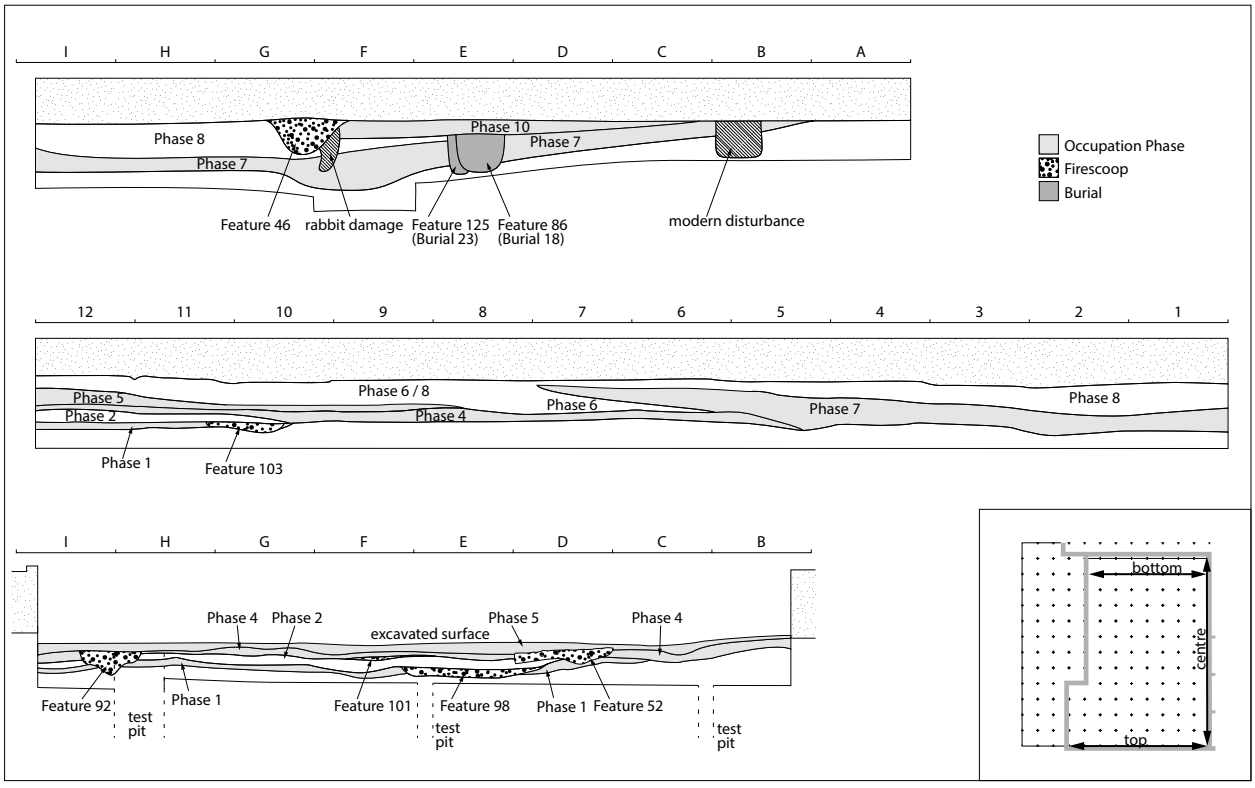

Figure 2. Profiles of: top, the South wall; centre, the east wall; bottom, the south face of Row 12.

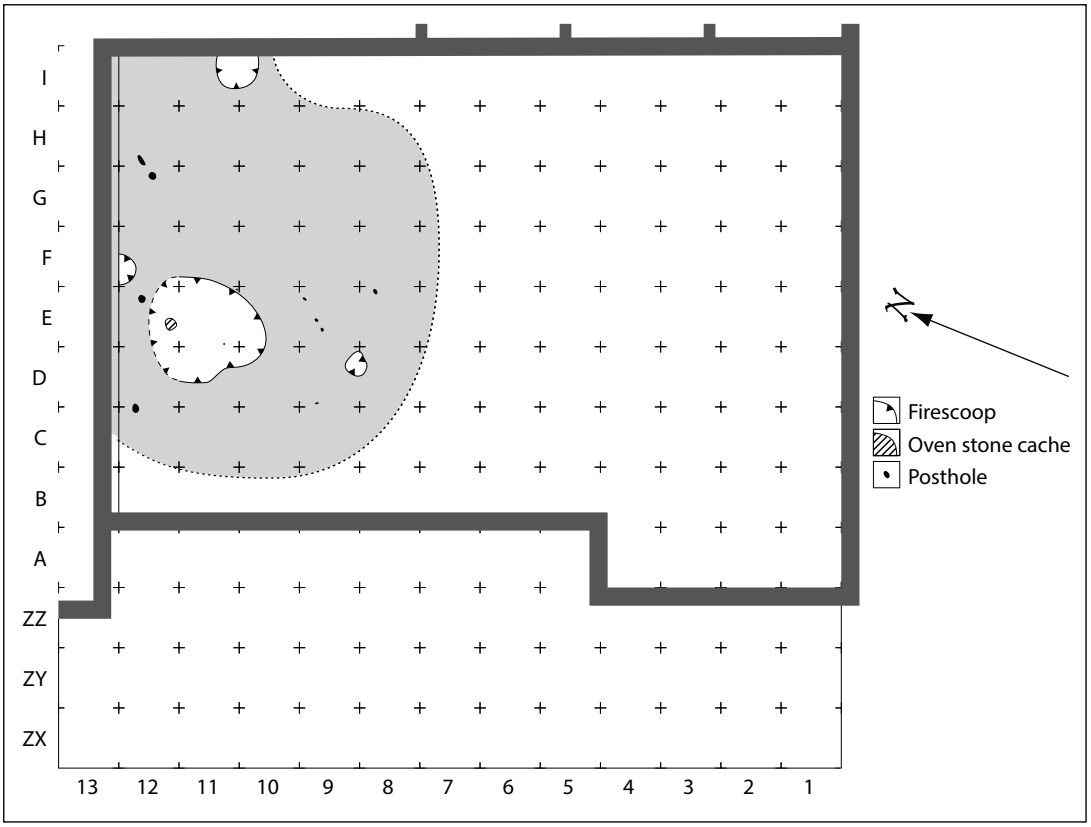

Figure 3. Phase 1.

Phase 3 (Burial Phase)

Phase 3 contained three burials (Figure 4). These were all securely located beneath Phase 4 midden or features although none of the grave cuts were particularly deep, indicating that they may have been truncated to some degree prior to the build-up of Phase 4.

Phase 4 (Occupation Phase)

Phase 4 was the most extensive, covering most of the area inside the foundations as well as to the west, although here it had probably been mixed with Phase 5 material. The matrix consisted of a lightly compacted, yellow-brown to dark brown, charcoal stained sand containing shell midden. Twenty-three firescoops were recorded, along with a posthole, an oven stone cache and two areas of ashy rake-out (Figure 5). This was the densest midden and contained the most features of any Phase. More material culture was found in Phase 4 than in other Phases: 11 shell fishhook points and two moa bone one-piece hooks, two sandstone files, a broken basalt adze, some pieces of worked bone and shell, and flakes of obsidian, chert and greywacke. Phase 4 contained the largest analysed assemblages of shellfish and fish, as well as assemblages of small bird, tuatara, terrestrial and marine mammal and moa; the only non-artefactual moa bone found on site, apart from a bone disturbed out of context in the fill of a Phase 3 burial.

Degraded bird, terrestrial and marine mammal and moa bone that appeared to have been weathered through surface exposure was found in Phase 4 but only beyond the extent of the underlying Phase 1. This implies that this bone was originally deposited in Phase 1, which was formerly more extensive but partly blew out, leaving the dense bone behind as a lag deposit that was subsequently incorporated into Phase 4. A similar process is evident for weathered mammal bone in Phase 7 that originated in Phase 5 (Figure 6), although it is also possible that some of these bones were present on the dune surface naturally.

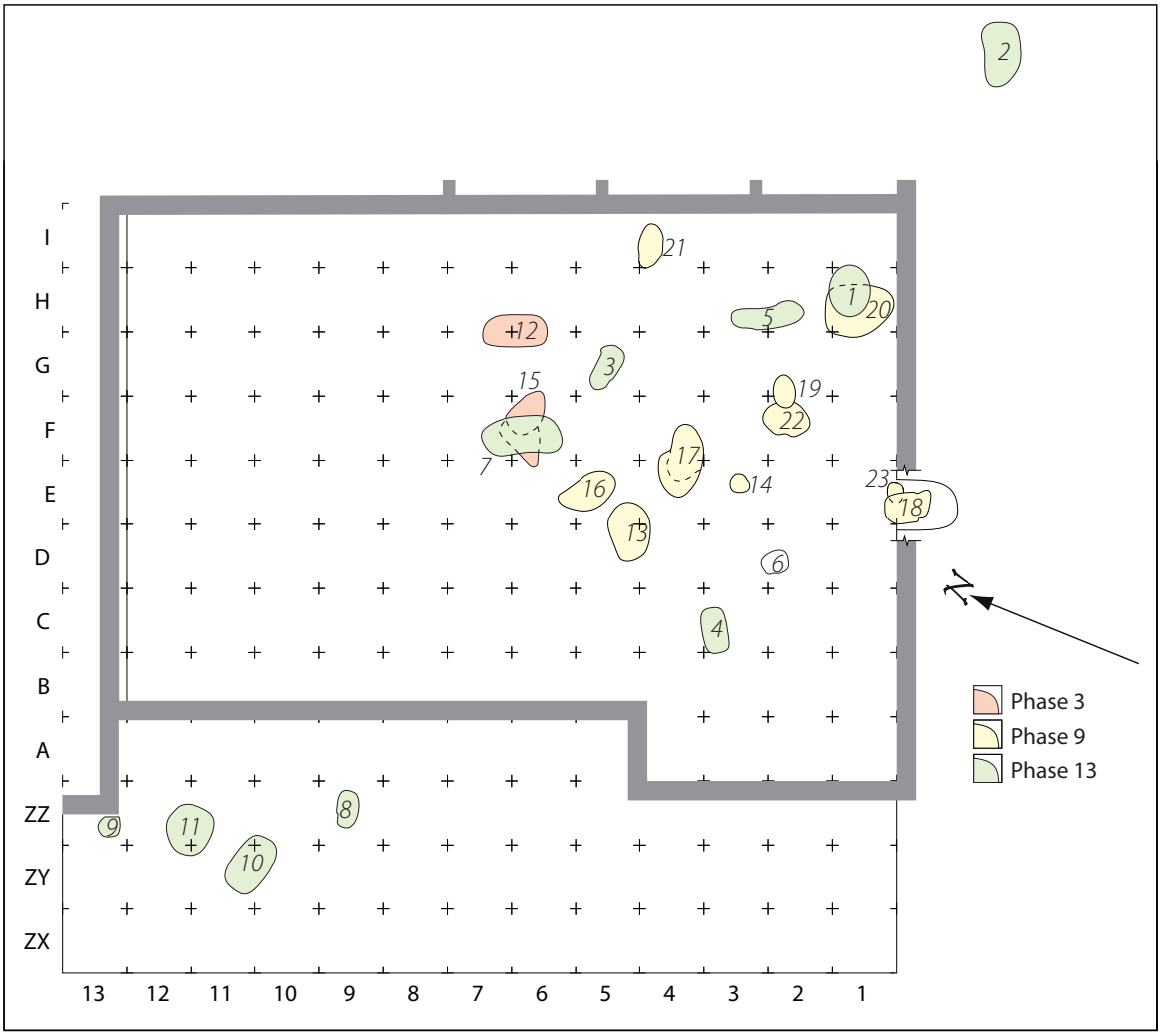

Figure 4. All burials from all phases.

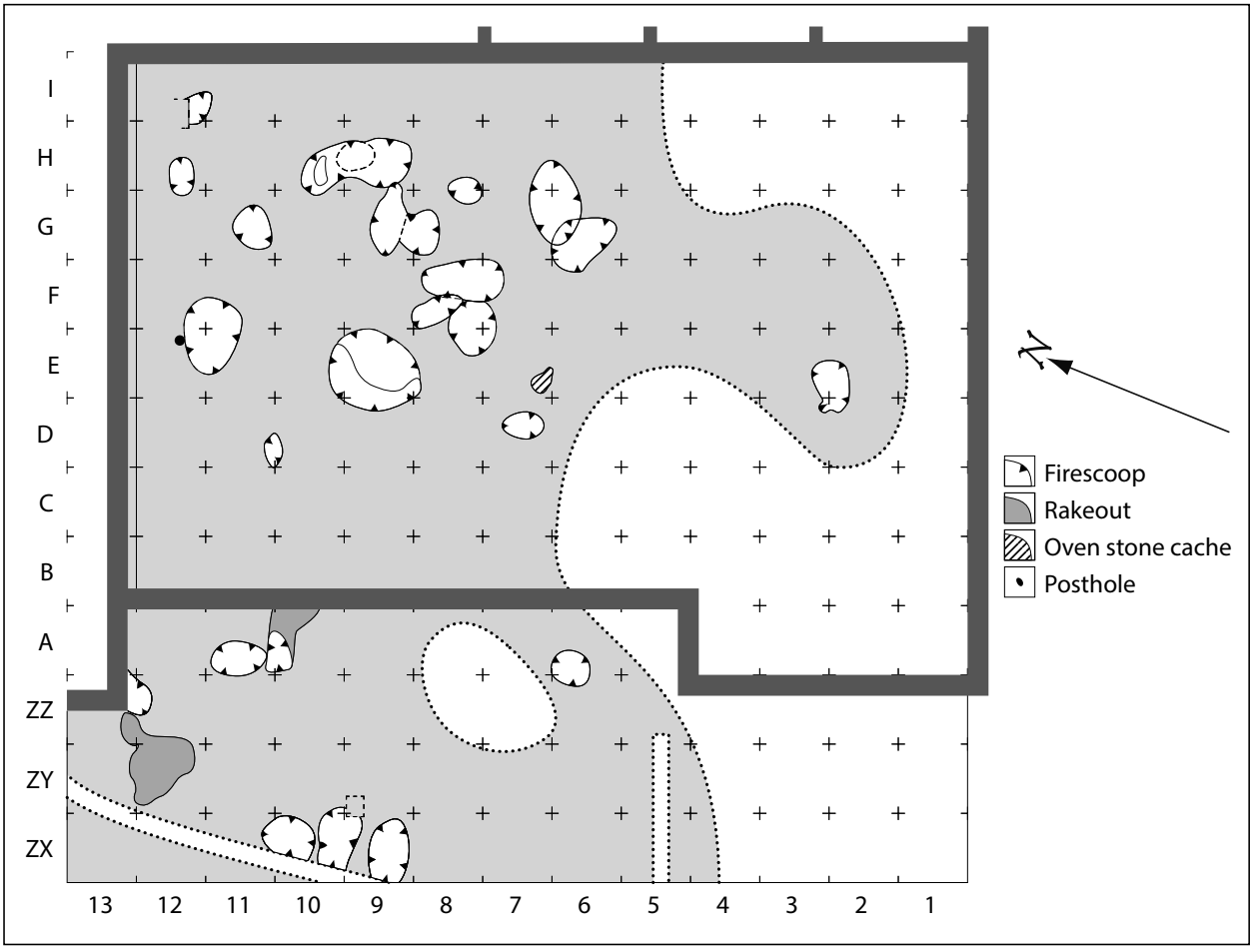

Figure 5. Phase 4. To the west of the restaurant foundation Phase 4 is disturbed.

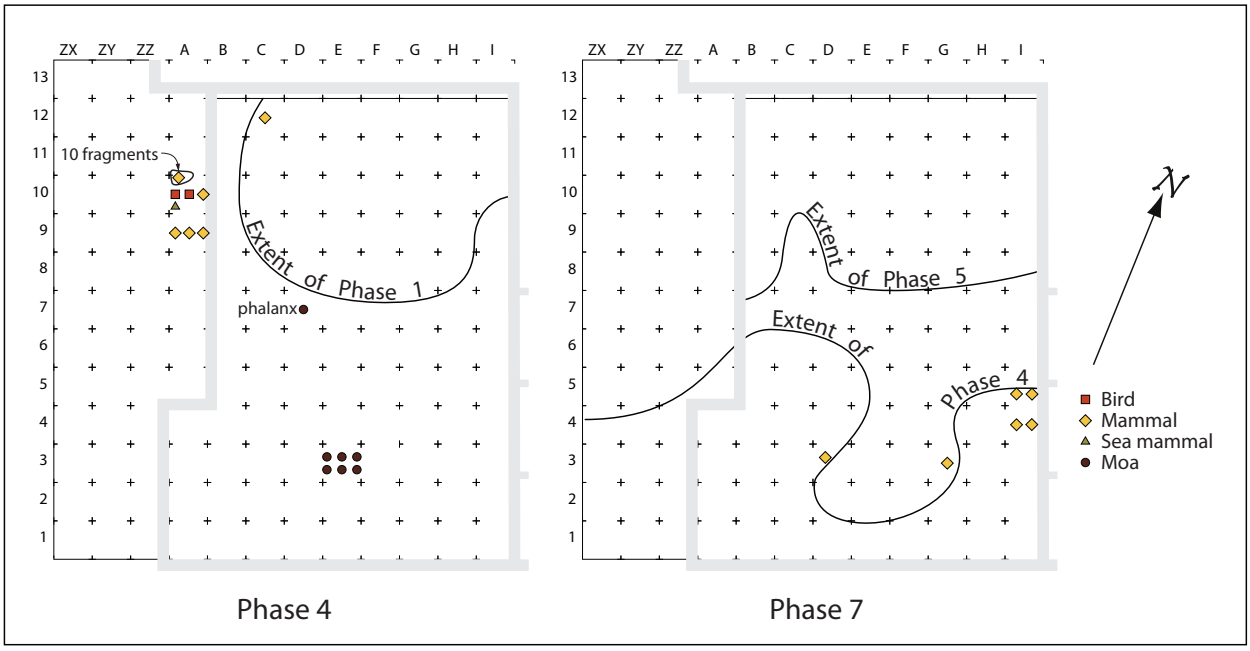

Figure 6. Distribution by square of weathered bone in Phases 4 and 7.

Phase 5 (Occupation Phase)

Phase 5 was found in the north portion of the restaurant foundation but was not recorded west of the foundation where it had probably been mixed into Phase 4. Within the foundation, it was distinguished from Phase 4 primarily on colour and texture (it was lighter in colour and less dense) – in places Phases 4 and 5 were separated by a thin, intermittent lens of windblown sand, while in other places they overlay each other directly (Figure 8). Phase 5 did not extend as far south as Phase 4. The matrix of Phase 5 was a clean yellow-grey sand containing a moderately dense shell midden. Only five features were recorded: four firescoops and a lens of ash (Figure 7). Artefacts included a barbed bone bird spear point, a trolling lure shank, probably of moa bone, two shell fishhook points and flakes of obsidian, chert and greywacke. The faunal assemblage included shellfish, fish, small bird and terrestrial mammal.

Phase 7 (Occupation Phase)

Phase 7 consisted of a mottled grey-brown, moderately compacted sand containing a generally sparse shell midden, though dense in patches particularly at the base. To the west, Phase 7 and Phase 10 were no longer separated by the clean sand of Phase 8 and it was not possible to tell which Phase the material belonged to – this was separately recorded as Context 41. The only features were three postholes found in a tight cluster. Artefacts included a one-piece bone fishhook, possibly of whale bone, 3 shell fishhook points, a trolling lure shank, a small chisel, an adze, the largest obsidian assemblage, as well as flakes of chert and greywacke. More than 90 individual human bones and bone fragments were scattered through the layer. The faunal assemblage included shellfish, fish, tuatara, small bird and terrestrial mammal. The fishbone assemblage was the only one where snapper (*Chrysophrys auratus*) accounted for less than 50% of the total, and was notable for containing pilchard (*Sardinops sagax*), which was also found in low numbers in other Phases (Campbell and Nims 2019). Dog coprolites were more abundant than in other layers though dog bone is not overly abundant.

Phase 7 also had a concentration of several thousand forest snails, analysed by Bruce Marshall and Jacqueline Craig. These came primarily from Square G7 and nearby, and were uncommon in other Phases. Some were taxa that prefer bark or fallen logs and so may have been collected on firewood, but others were leaf litter taxa and it isn't clear what forest resource was being targeted.

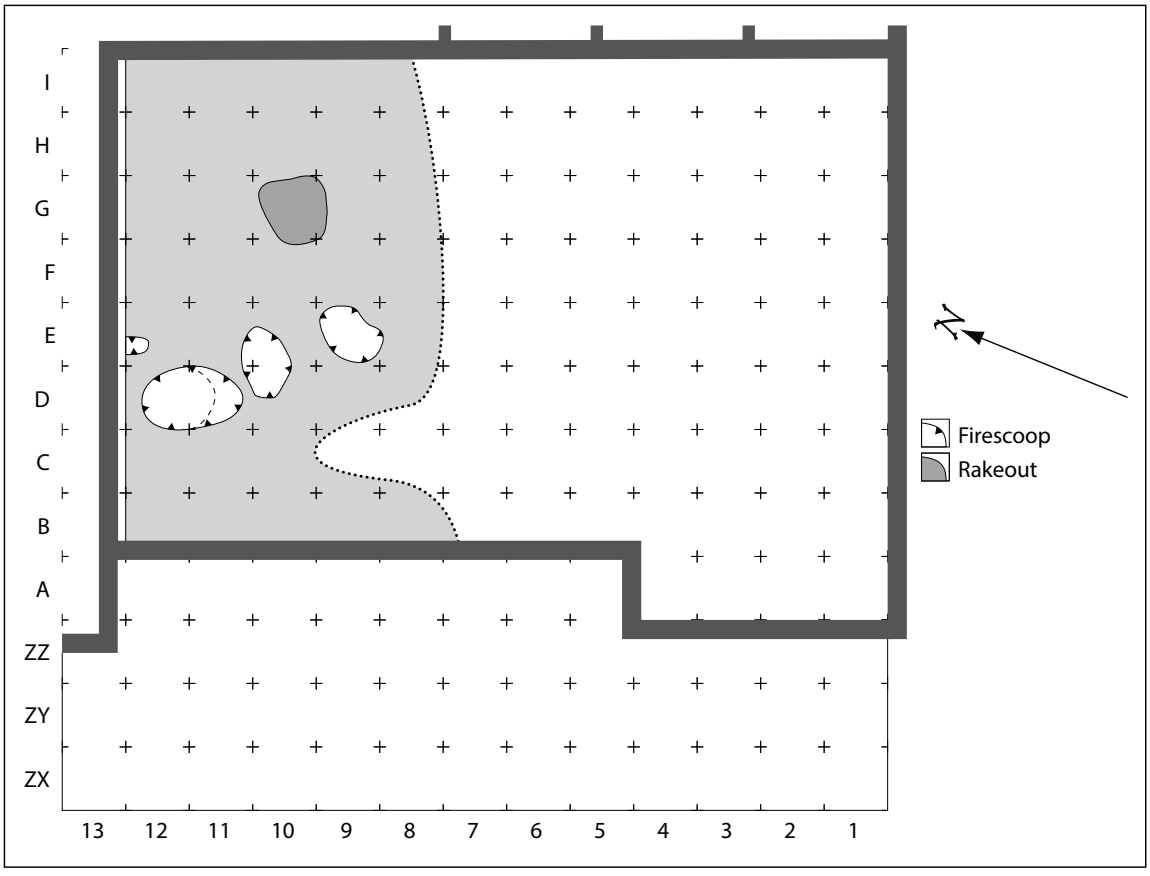

Figure 7. Phase 5.

Figure 8. Phases 1, 4 and 5 in profile in Squares E12 and F12, looking south. To the right, a firescoop from Phase 1 is visible, overlain by the clean sand of Phase 2, with a Phase 4 firescoop at a higher level in the centre. The thin, discontinuous lens of clean windblown sand separating Phases 4 and 5 is also visible. Scale = 1 m.

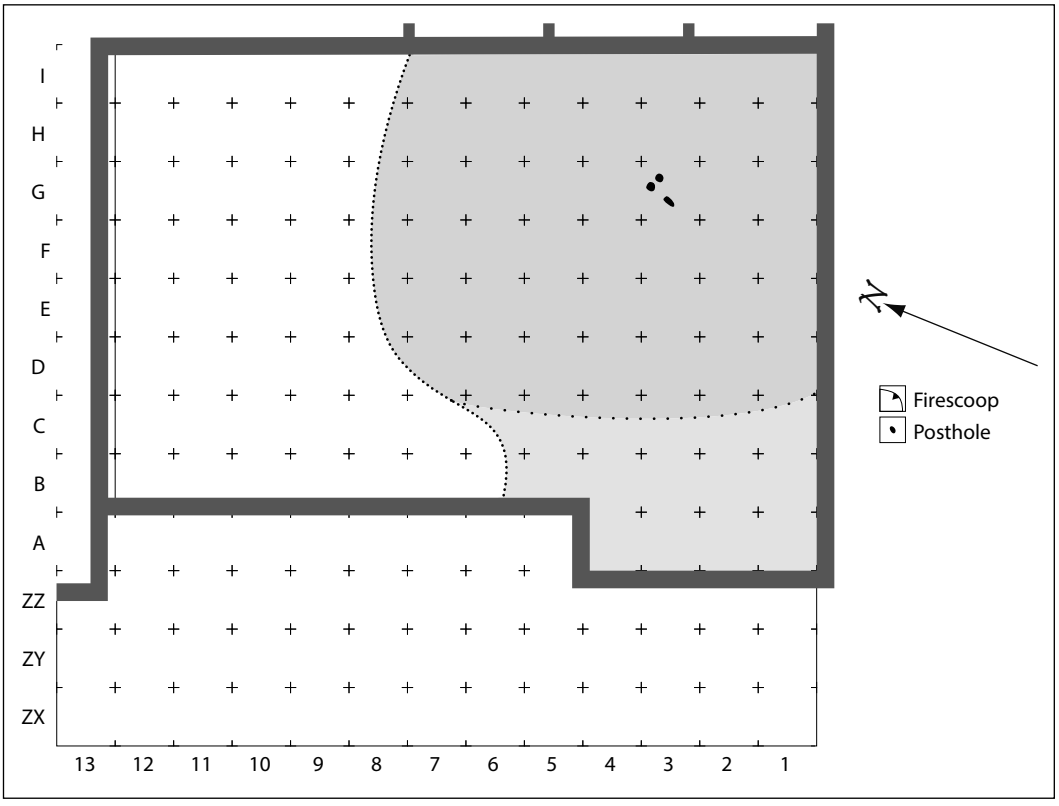

Figure 9. Phase 7. In Squares A1 to C6, Phases 7 and 10 could not be distinguished (Context 41).

Phase 9 (Burial Phase)

Eleven burials, and one 'kōiwi scatter' consisting of several bones in a small feature, were assigned to Phase 9 (Figure 4). Generally, the fill of the grave cuts was difficult to distinguish from the surrounding matrix and in some cases the grave cut was not noticed until kōiwi were encountered. Burial 18 was located beneath the south wall of the foundation and the grave cut could be observed in profile below the Phase 10 cultural layer and traced through the windblown sand of Phase 8 into the cultural Phase 7 and the clean natural sand beneath it (Figure 10). While the grave underlay Phase 10 it was unclear if it was contemporary with it. Further burials that appeared to be at a similar level in the excavation, and had similar fill, were assigned to this Phase. Phase 8, the clean sand separating Phases 7 and 10, included a significant fraction of white, shelly sand and inclusions of this material in the fill of the grave cuts was a common feature of Phase 9 burials.

Phase 10 (Occupation Phase)

The Phase 10 matrix was a mottled grey-brown sand containing a sparse midden and occasional scattered kōiwi. Three features were found: two firescoops and a small pit (Figure 11). The only artefacts were four shell fishhook points. The faunal assemblage included shellfish, fish, small bird, tuatara and terrestrial and marine mammal. A lag deposit of oven stones in the western part of the layer indicated that much of the material here originated from deflation of an overlying cultural layer that may not have otherwise survived (Figure 12). Phase 10 seems to represent a disturbed occupation layer or layers.

Phase 12 (Occupation Phase)

Phase 12 is the uppermost undisturbed cultural layer. The matrix of Phase 12 was generally a homogenous, grey-brown sand containing a sparse midden. No formal artefacts were found in this layer. The only features were two shallow firescoops and a discrete scatter of kōiwi (Figure 13). The faunal assemblage included shellfish, fish, small bird and terrestrial mammal.

Phase 13 (Burial Phase)

The final Burial Phase contained 10 burials including the two found during demolition (Figure 4). Because the grave cuts had been truncated by restaurant construction and demolition, their origins could not be determined, but they

Figure 10. The south baulk of the excavation, showing Feature 86 / Burial 18, overlain by Phase 10 material. The kōiwi are pixelated.

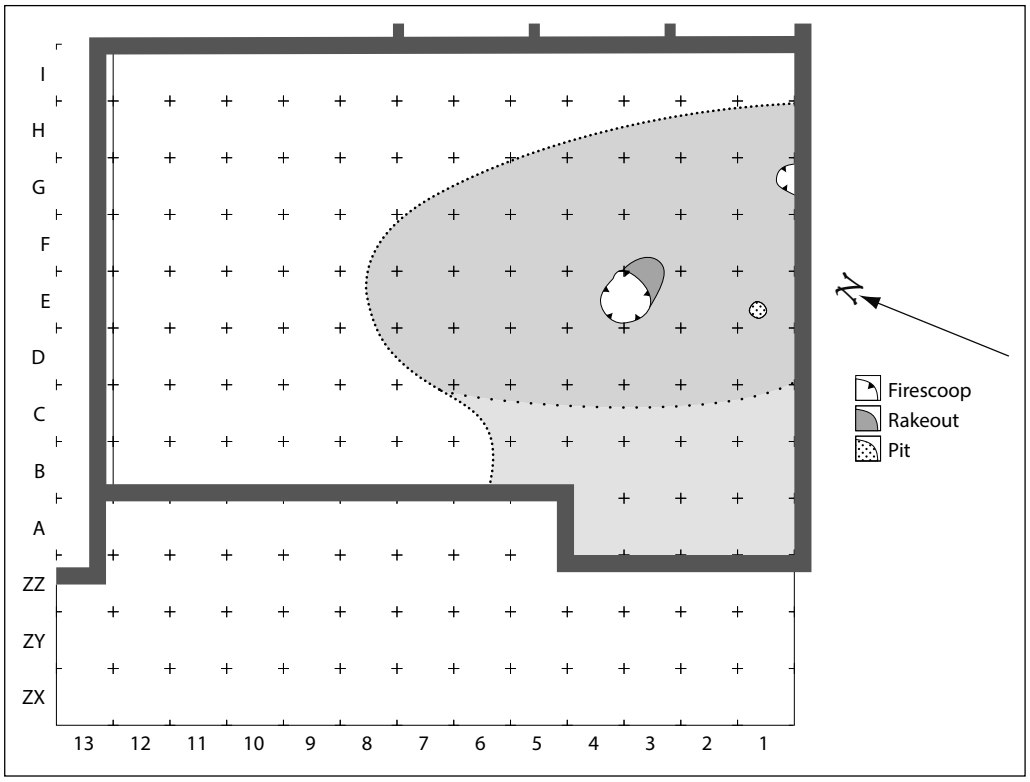

Figure 11. Phase 10. In Squares A1 to C6, Phases 7 and 10 could not be distinguished (Context 41).

Figure 12. Lag deposit of fire cracked rock on the deflated surface of Phase 10.

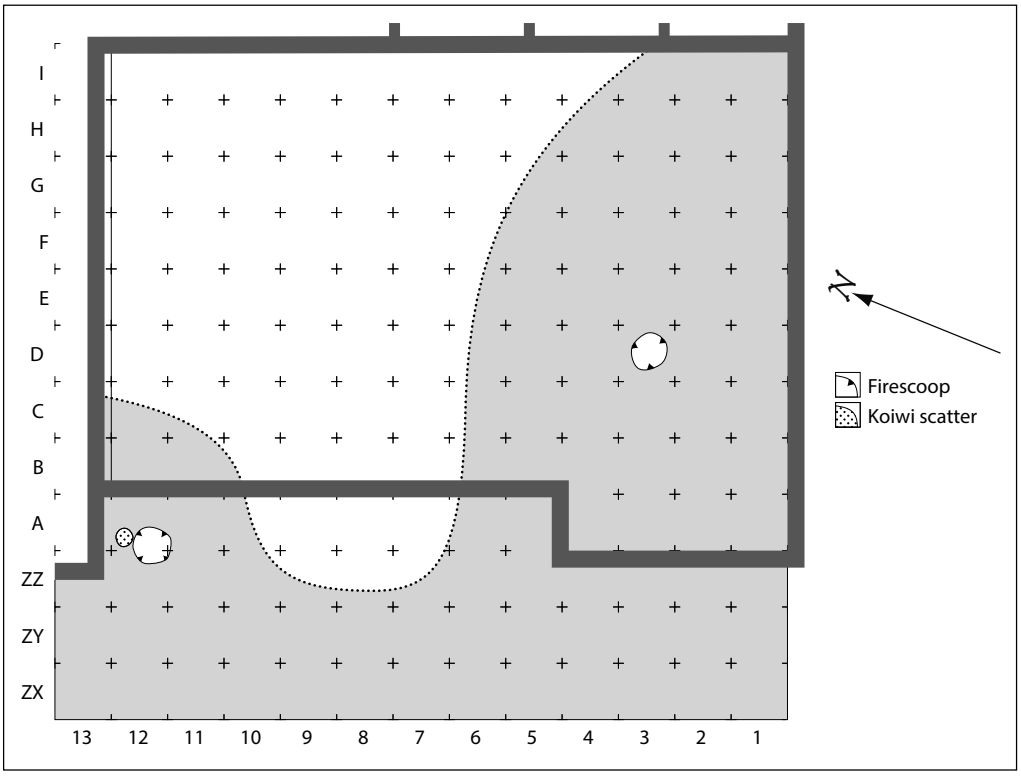

Figure 13. Phase 12. The midden to the west of the foundation was generally disturbed by historic period activities.

cut through Phase 12. It seems probable that they originate in a later cultural phase that has not survived, either through natural processes or restaurant construction. They may not all belong to the same Phase but there was nothing in the archaeology to distinguish them.

Phase 14

Phase 14 consists of upper layers that had been disturbed by the original construction and subsequent demolition of the restaurant. It is assumed that evidence of these occupations survives in better condition outside the area disturbed by restaurant construction.

CHRONOLOGY

Eleven samples were submitted to the Radiocarbon Dating Laboratory at the University of Waikato for AMS dating. For the lower and upper cultural layers, Phases 1 and 12, three samples were submitted, one each of charcoal, shell (tuatua, *Paphies subtriangulata*) and fishbone (snapper), which were grouped by Phase to provide a tighter distribution for the start and end of the sequence. For the intermediate Phases a single shell sample was submitted. In addition, with the approval of mana whenua, a calcified structure, probably a lymph node, from Burial 2 was also submitted for dating, the only date on any material directly associated with the kōiwi.

Charcoal (twigs of lancewood coprosma, mahoe, rewarewa and mapou) dates were calibrated against SHCal13 (Hogg *et al.* 2013) and shell and fishbone dates against Marine13 (Reimer *et al.* 2013) using a New Zealand reservoir correction value (ΔR) of -7 ± 45 ^{14}C years (Petchey *et al.* 2008). For dog and human lymph node dates (Table 1) a percentage mix between the marine and terrestrial curves has been calculated using the measured gelatine δ^{13}C values using linear regression between terrestrial and marine endpoints (Petchey *et al.* 2014). OxCal v4.3 (Bronk Ramsey 2018) was used to determine the age of start, end and duration of each Phase. A Bayesian Sequence Analysis was developed and is shown in Figure 14 and modelled boundary ages are shown in Table 2. High convergence values (>98%) generated by the MCMC algorithms indicate that the model is robust (Bronk Ramsey 1995). The results place occupation between cal AD 1430 and 1485 (68.2% probability).

CHARCOAL

Charcoal was analysed by Rod Wallace. Analysis indicates that throughout the half century of occupation coastal broadleaf podocarp forest dominated the local vegetation. This vegetation type was present during all occupation Phases with the only significant change being the sharp increase in bracken in the final two Phases probably representing plants colonising the site itself between periods of occupation. There is no evidence of large scale clearance

Table 1. *Radiocarbon results.*

Lab No.	Phase	Material	CRA BP	cal AD 68%	cal AD 95%
Wk-38630	grey layer	dog bone*	675 ± 30	1500–1635	1445–1665
WK-45299	1	charcoal	519 ± 18	1420–1450	1410–1560
Wk-45300	1	shell	826 ± 19	1440–1530	1410–1620
Wk-45301	1	fish	902 ± 15	1390–1480	1330–1500
Wk-45302	4	shell	869 ± 19	1420–1500	1350–1540
Wk-45303	5	shell	853 ± 19	1430–1500	1360–1370 (0.5%); 1380–1580 (94.9%)
Wk-45304	7	shell	845 ± 19	1430–1510	1390–1590
Wk-45305	10	shell	842 ± 19	1430–1510	1390–1590
WK-45306	12	charcoal	421 ± 15	1450–1500	1450–1510 (78.5%); 1590–1620 (16.9%)
Wk-45307	12	shell	872 ± 18	1410–1490	1350–1540
WK-45308	12	fish	851 ± 18	1430–1510	1380–1580
Wk-45309	13	lymph node†	430 ± 15	1450–1490	1450–1510 (85.8%); 1590–1620 (9.6%)

* 90+% marine, $\delta^{15}N = 16.45 \pm 0.2‰$, $\delta^{13}C = -12.07 \pm 0.2‰$, gelatine yield = 2%
† 60% marine, $\delta^{15}N = 17.02 \pm 0.2‰$, $\delta^{13}C = -15.34 \pm 0.2‰$, gelatine yield = 2.1%

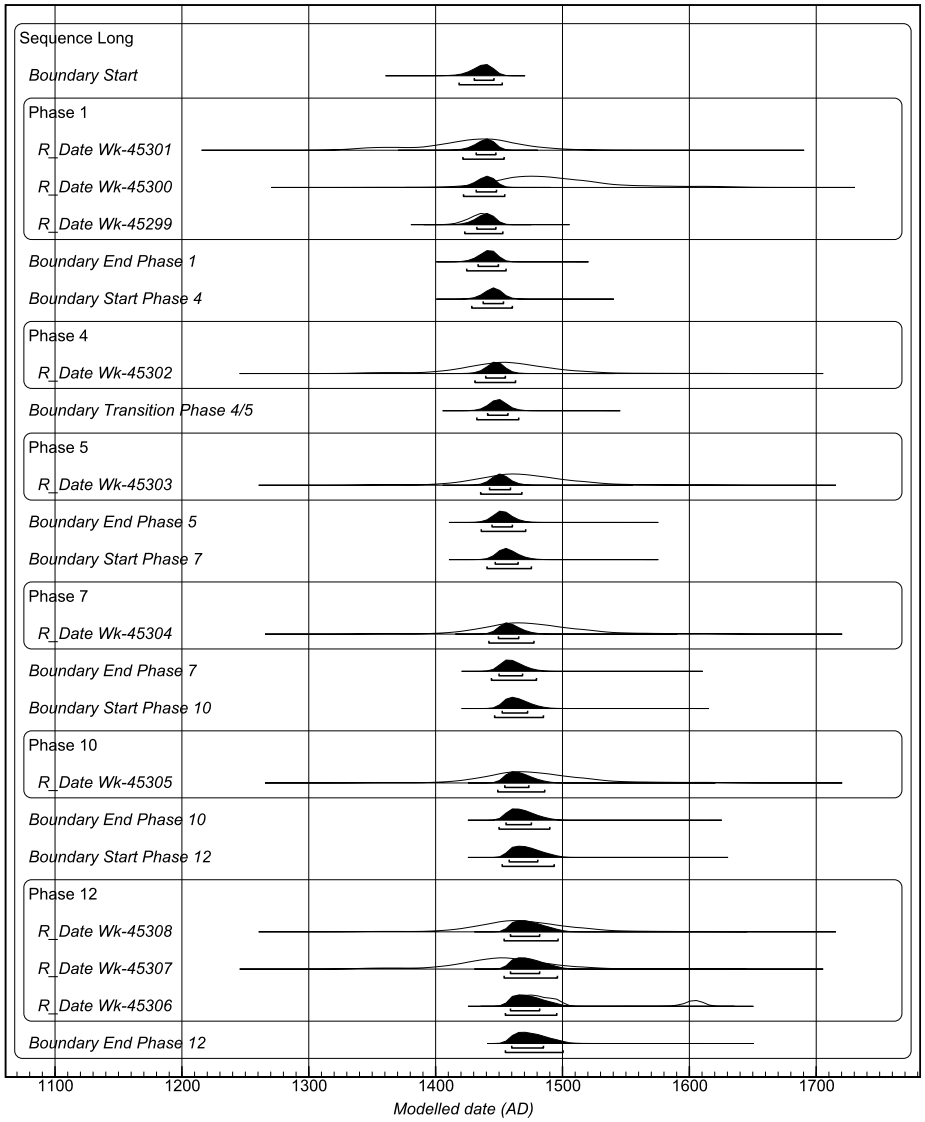

Figure 14. Bayesian age model for the occupation Phases at Long Bay. The light outline distributions are the unmodelled calibrated dates. Darker shade distributions represent the results after Bayesian modelling.

Table 2. *Modelled results of the Bayesian analysis showing boundary ages, cal AD.*

	68.2%		95.4%	
	from	to	from	to
Boundary start	1430	1446	1418	1452
Boundary end Phase 1	1433	1449	1424	1455
Boundary start Phase 4	1437	1453	1428	1460
Boundary transition Phase 4/5	1441	1457	1432	1465
Boundary end Phase 5	1444	1460	1436	1471
Boundary start Phase 7	1447	1465	1440	1475
Boundary end Phase 7	1435	1506	1395	1584
Boundary start Phase 10	1435	1506	1395	1584
Boundary end Phase 10	1435	1510	1397	1589
Boundary start Phase 12	1435	1510	1397	1589
Boundary end Phase 12	1460	1485	1455	1500

for gardening but, given the lack of good horticultural soils in the vicinity, this is not surprising. A similar situation is evident at Mōtanau Bay (S11/20), occupied at much the same time on nearby Pōnui Island (Irwin in press). Charcoal analysis indicates that these were the first occupations at Long Bay.

MATERIAL CULTURE

Several taonga (formal artefacts) were recovered from the site. These were analysed by Louise Furey. Nine bone awls were recovered from Burial 5, a young adult female, near the right side of her face and the end of her left hand in a tight group, probably wrapped in a bundle. Where the bone could be identified to taxon, they are gannet (*Morus serrator*) and shag (*Phalocrocorax* sp.). One is from a bird larger than a gannet, possibly a mollymawk (*Thalassarche* sp.).

Figure 15. A selection of taonga from the site: top, awls buried with Kōiwi 5; centre left, bird spear; centre right, moa bone fishhooks; bottom, shell fishhooks.

There was also an unmodified gannet radius. A bird bone awl was recovered from Phase 4 but only the point and a short section of bone shaft remained. Where it could be observed, usewear on the awls consisted of polish to a high sheen, indicating they were not used on coarse or hard objects, though absence of organic materials in archaeological sites makes it difficult to determine what they were used on.

Burial 3 was of an infant (11–16 months), which had been partially disturbed and scattered by restaurant construction. Associated with the burial were 323 *Antalis nana*[1] beads, 8–12 mm long, found above and below the kōiwi, indicating that the beads had surrounded the body at the time of burial. In one place, a small group of beads appeared to be arranged in parallel rows (Figure 16), suggesting that the beads were part of an ornament or garment of multiple beaded strands wrapped around the child's body. Some beads were found in the surrounding matrix over an area of about 2 × 2 m.

Antalis nana shells are not common, as scaphopod molluscs are found in water 50–200 m deep. They are poorly researched, but it seems unlikely that the fragile shells would survive wave action and being washed up on a beach (Dell 1956). They are known to occur in shallower water in the Manukau Harbour and Leach (1977: 481) concluded they could be harvested in selected shallow waters and traded. *Antalis* beads commonly occur as grave goods: with two adult burials at Kaikōura (Trotter 2011); with a child at Paremata, Wellington (Smart 1962); and with children at both the Washpool Midden and Makotukutuku in Palliser Bay, Wairarapa (Duff 1977: 99; Leach 1977; Leach and Leach 1977: 208).

A 75 mm long barbed bird spear, probably made from the long bone of a large bird species, was recovered from Phase 5. While there are few bird bones present in the faunal material, some of those species may have been hunted with spears.

Fishing gear is represented by three one-piece fishhooks in moa bone, two moa bone trolling lure shanks and 22 shell fishhook points. Most of the shell fishhook pieces are from two-piece hooks with the points lashed to a, probably wooden shank, though two are probably from one-piece hooks and one is a shank. All were made from Cook's turban (karaka, *Cookia sulcata*).

Other artefacts included three adzes, two of greywacke, one of which was complete, and one of basalt, and five sandstone files.

1 *Antalis nana*, a tusk shell (Scaphopoda), was previously referred to as *Dentalium nanum*. Archaeologists are more familiar with the term 'Dentalium bead.'

Figure 16. *Antalis* beads in situ during excavation.

Flaked stone

Flaked stone was analysed by Arden Cruickshank and Andrew McAlister. Four stone types were identified: obsidian, chert, basalt and greywacke, with obsidian and chert further separated based on their colour and quality (Moore 1988; Cruickshank 2011).

Obsidian

Obsidian represented 92% of the flaked stone assemblage by count. Initially it was separated into three colour categories: green (Type A), red/brown (Type B) and grey (Type C). The 239 flakes from secure contexts that were larger than 10 × 10 mm were analysed. The exception is the red/brown Type B flakes, of which all were analysed due to their rarity. Geochemical analysis of obsidian was undertaken using a Bruker Tracer III SD portable X-ray Fluorescence (pXRF) analyser. Analytic methods followed those described by McAlister (2019) and are reported in detail in the Supporting Online Material.

The majority of the obsidian derives from either Tūhua/Mayor island (n = 108) or the Te Ahumatā source on Aotea/Great Barrier Island (n = 110). The third most common group was assigned to the "Poor Knights" source (n = 10). The precise location of this source is unknown but chemical analysis indicates this material is chemically similar to sources on Great Barrier and Fanal Islands, suggesting an island source related to the Coromandel Volcanic Zone (Robinson 2016). The red/brown Type B flakes (n = 8) all cluster together and were associated with the main Awana source on Great Barrier Island. Finally, single specimens each were matched to Cooks Beach, Hahei and Awana II, a geochemically distinct sub-group of the main Awana source (McAlister 2019).

Table 3. *Results of XRF sourcing by Phase, including Burial Phases.*

	Phase							
	1	**3***	**4**	**5**	**7**	**9***	**10**	**12**
Awana					4		2	2
Awana II					1			
Cook's Beach			1					
Hahei				1				
Tūhua	1	2	28	16	51	5	1	4
Poor Knights		1		1	7			1
Te Ahumatā			11		59	2	19	19
Total	**1**	**3**	**40**	**18**	**122**	**7**	**22**	**26**

* Burial Phase

Recent research in Tāmaki has demonstrated a shift from assemblages dominated by Tūhua obsidian to assemblages dominated by Te Ahumatā obsidian, dated to around AD 1500 (Cruickshank 2011). The Bayesian analysis of the radiocarbon dates provides a very tight dating sequence for the six Phases of occupation, while a comparison of the obsidian sources in each Phase (Figure 17) shows that the change from Tūhua to Te Ahumatā occurred in the interval between Phase 5 and Phase 7, and is complete by the commencement of Phase 10. The shift in procurement strategies in Tāmaki can, on the basis of the Long Bay Restaurant site evidence, be dated to the mid-15th century.

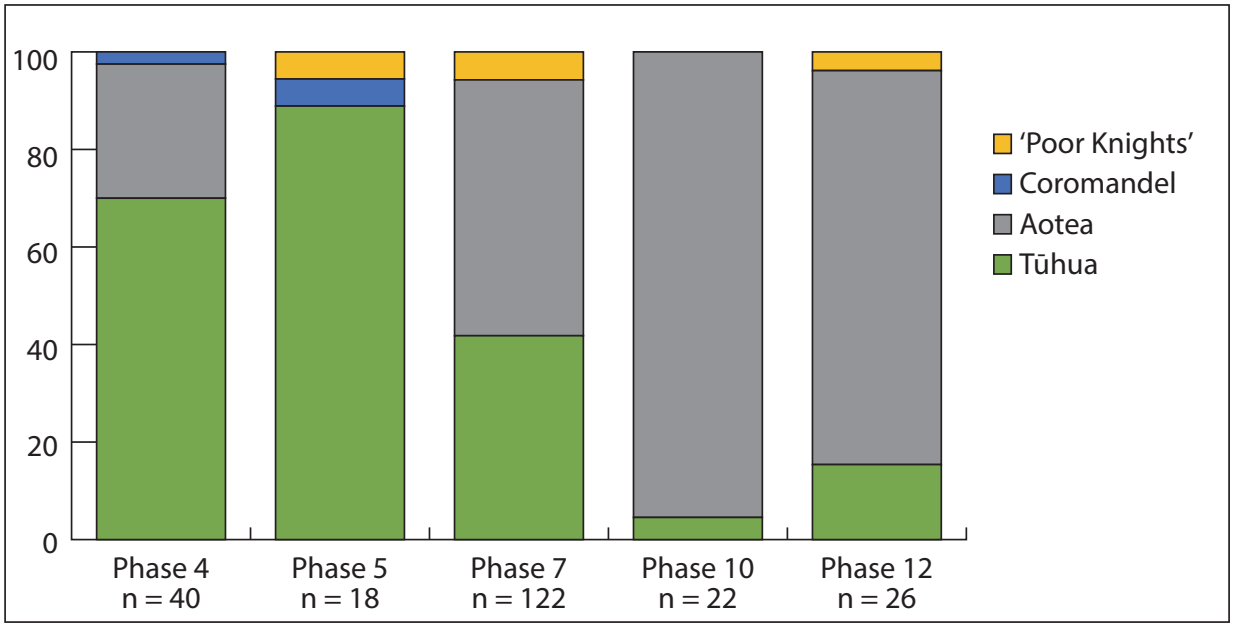

Figure 17. Percentage of obsidian identified by pXRF from each Occupation Phase, showing change over time from Mayor Island to Great Barrier Island sources (Phase 1, with only a single flake, is omitted).

Other flaked stone

Fifteen flakes were recovered that were recorded as chert, a catch-all term for a variety of siliceous rocks that cannot be easily distinguished macroscopically (Moore 1977). Good quality chert is available on the Hauraki Gulf islands and South Auckland. It is difficult to source as it is often chemically indistinct and geochemical analysis is often inconclusive (Sheppard 2004). Cherts are best differentiated on macroscopic physical characteristics and comparison to known local sources (Moore 1977; Cruickshank 2011; Phillipps *et al*. 2016). The cherts from the Long Bay Restaurant site were assigned to six types based on colour, distributed through all Phases except Phase 1.

There were 21 flakes of greywacke recovered, probably all Motutapu greywacke, which occurs on several Hauraki Gulf Islands and, in generally poorer quality, near Kaiaua on the mainland. The closest known source to Long Bay is Motutapu Island, approximately 16 km southwest of this site, from where it could be directly procured.

A single, complete flake of basalt was recovered at the site from a natural windblown layer (Phase 6).

FAUNA

While animal protein was an important part of the diet, plant foods would probably have been a more significant component but very little evidence of this survives. The teeth of the kōiwi show clear evidence of an abrasive diet, possibly including tough plant matter like bracken fern root, but no garden soils or kumara storage pits were excavated.

All faunal classes were analysed to the lowest possible taxonomic level. Most of the assemblage was dry sieved in the field or wet sieved in the lab through a 3 mm screen but some was sieved in the field through a 6 mm screen. Bone of larger taxa was handpicked during excavation. The counts used in the analysis are based on NISP (Number of Identified Specimens) except for shell which is reported by MNI (Minimum Number of Individuals); bivalves were not identified to left or right, so MNI is NISP divided by two, while the MNI for gastropods is equivalent to the NISP. Student volunteers continue to analyse shell and fishbone – the counts tabulated here are as at 5 August 2019.

Shell

Shell was the most common faunal type at the site with 31 taxa identified including very small taxa that are considered to be bycatch or non-economic species. It was analysed by Arden Cruickshank, Danielle Trilford and student volunteers. Phases 1, 4, 5 and 7 were dominated by tuatua, accounting for between 48.2% and 84.9% of the assemblages. The next most common taxa were cat's eye (pūpū, *Lunella smaragda*) and tuangi (*Austrovenus stitchburyi*) (Table 4). This distribution of shellfish is typical for a site located on an open sandy shore – shellfish are generally gathered from the local environment and tuatua would have been the prevalent local species, easily gathered at low tide. Cat's eye could have been gathered from the rocks at either end of Long Bay. Very few shellfish were present in Phase 12.

Several of the identified gastropod species have opercula, but only three of these were identified during analysis: cat's eye, black nerita (matangarahu, *Nerita atramentosa*), and Cook's turban (Table 5). Only two Cook's turban opercula were identified but shell was present in all Phases except Phase 12 while cat's eye opercula were more common than shells in all Phases except Phase 1. This indicates that cat's eye may have been brought to the site already processed, with the flesh removed from the shell but with the opercula still attached, while Cook's turban may have been industrial material. Twenty-one fishhook points made from Cook's turban were found – these may have been manufactured on site as several sandstone files were found, though no drill points or manufacturing waste.

Echinoderms

The remains of kina (*Evechinus chloroticus*), including spines, shell fragments and teeth, were found in small numbers but are not analysed further.

Fish

Fish was analysed by Matthew Campbell and Reno Nims using comparative collection at CFG Heritage and the Anthropology Department, University of Auckland. The most common fish in all Phases was snapper (tāmure, *Chrysophrys auratus*), accounting for 50% or more of NISP in all assemblages except Phase 7 (Table 6), followed by gurnard (kumu, *Chelidonichthys kumu*) in Phases 1, 4, 5 and 7, and yellow-eyed mullet (aua, *Aldrichetta forsteri*) in Phases 10 and 12. Kahawai (*Arripis trutta*) was generally the fourth most common species with the exception of Phase 7 where mackerel (hāture, *Trachurus* sp.), shark/ray (mango/whai, Chondrichthyes) and pilchard (mohimohi, *Sardinops sagax*) were more common. In the upper North Island assemblages are generally dominated by snapper in sites on embayments and by mackerel on more open coasts (Leach 2006; Campbell *et al*. 2009). The dominance of snapper at the Long Bay Restaurant site is typical, as is the presence of gurnard and kahawai. These species, along with many of the other taxa identified, are open water fish that could all have been caught with the types of hooks found during the excavation. Some of the taxa identified, particularly yellow-eyed mullet and pilchard, are small fish with small mouths and were presumably netted (Campbell and Nims 2019).

Small bird

Small bird bone analysis was undertaken by Tristan Russell and Karen Greig using the Otago Archaeological Labo-

Table 4. *All identified shell taxa by* MNI *for each Occupation Phase. Non-economic species are separated out by size.*

	Phase					
Taxon	**1**	**4**	**5**	**7**	**10**	**12**
Bivalves						
Dog cockle (*Tucetona laticostata*)		1	1			
Dosinia (*Dosinia* sp.)	2	1	1			
Fine dosinia (*Dosinia subrosea*)			1			
Frilled venus (*Bassina yatei*)		1				
Mussel (Mytilidae sp.)	10	79	16	1	1	
Oblong venus (*Ruditapes largillierti*)				1	1	
Pipi (*Paphies australis*)	1	556	164	30	6	
Rock oyster (*Saccostrea cucullata*)	7	228	58	10		1
Scallop (*Pecten novaezealandiae*)		2	4			
Toherua (*Paphies ventricosa*)				1		
Tuangi (*Austrovenus stutchburyi*)	57	1343	614	66	3	7
Tuatua (*Paphies subtriangulata*)	1046	36206	4799	682	324	21
Gastropods						
Bluish top shell (*Diloma nigerrima*)		2	4			
Brown Periwinkle (*Austrolittorina cincta*)				1		
Cat's eye (*Lunella smaragda*)*	201	3242	2634	162	320	
Cook's turban (*Cookia sulcata*)	1	73	15	11		
Denticulate limpet (*Cellana denticulata*)		1	2			
Green top shell (*Trochus viridis*)		1				
Limpet (*Cellana* sp.)	16	18	11	1		
Mud Whelk (*Cominella glandiformis*)		3				
Nerita (*Nerita atramentosa*)	11	28	45	1	7	
Ostrich foot (*Struthiolaria papulosa*)		10	28			
Radiate limpet (*Cellana radians*)		10	4	1		
Siphon whelk (*Penion sulcatus*)	4	14	1	3	1	
Smooth ostrich foot (*Pelicaria vermis*)	11	22	9	1	1	
Spotted top shell (*Melagraphia aethiops*)	8	168	65	6		
Swollen trumpet (*Argobuccinum pustulosum*)	15	33	11	1	2	
Trumpet (Ranellidae sp.)		14				
White rock shell (*Dicathais orbita*)	3	42	27	13		1
Non-economic taxa	39	762	314	63	8	
NISP	**1432**	**42860**	**8828**	**1055**	**674**	**30**

* operculum, except Phase 1

Table 5. *MNI of shell and opercula of three gastropod taxa for each Occupation Phase.*

	Cat's eye		Cook's turban			Black nerita	
Phase	shell	opercula	shell	opercula	fishhook points	shell	opercula
1	201	145	1		1	11	14
4	993	3242	73	5	11	28	4
5	1071	2634	15	7	2	45	2
7	67	162	11		3	1	
10	6	320	*		4	7	

* undiagnostic residue only

ratories reference collection. A total of 19 species of bird were identified (Table 7) but numbers are low in all Phases with the highest totals from Phase 7, and many taxa are represented by a single bone in each Phase. The most common species is the fluttering shearwater (pakaha, *Puffinus gavia*) with a NISP of 17 in Phase 7, though it is not found in other Phases. Tūī (*Prosthemadera novaeseelandiae*) was the next most common taxon, and the most widely distributed across Phases.

The majority of identified small bird remains come from coastal (NISP = 40) and forest (NISP = 19) environments, with only one duck species from a general lowland environment, which could also be on the margins of coast or forest (Scofield and Stephenson 2013; Robertson *et al.* 2015). Overall, the results suggest that birds were taken occasionally and

Table 6. *All identified fish taxa by NISP for each Occupation Phase (3 stingray barbs were also found associated with Burial 2, from Phase 13).*

	Phase					
Taxon	**1**	**4**	**5**	**7**	**10**	**12**
Barracouta (*Thyrsites atun*)	1	3		8		
Blue cod (*Parapercis colias*)	5	4	4	1	4	
Blue mackerel (*Scomber australasicus*)	2	31	9	3		
Eagle ray (*Myliobatis tenuicaudatus*)		8		3		
Flounder (*Rhombosolea* sp.)			5			
Grey mullet (*Mugil cephalus*)		17	8			
Hapuku (*Polyprion oxygeneios*)		2				
John Dory (*Zeus faber*)	4			1		
Kahawai (*Arripis trutta*)	64	151	301	12	10	10
Kingfish (*Seriola lalandi*)			3	4		
Mackerel (*Trachurus* sp.)	17	42	91	128	5	5
New Zealand sole (*Peltorhamphus novaezelandiae*)		2				
Parore (*Girella tricuspidata*)	1		2	3		
Pilchard (*Sardinops sagax*)	1	2	10	192		6
Pink maomao (C*aprodon longimanus*)	1	1	2	1		
Piper (*Hyporhamphus ihi*)	7		20	3		
Ray (*Dasyatis* sp.)	1					
Red cod (*Pseudophycis bachus*)			1			
Red gurnard (*Chelidonichthys kumu*)	908	1060	616	236	111	81
Shark / ray (Chondrichthyes)		4	1	21	1	2
Snapper (*Chrysophrys auratus*)	1626	2211	1507	525	310	389
Sweep / blue maomao (*Scorpis* sp.)		1	1			
Trevally (*Pseudocaranx georgianus*)	5	52	4	2		
Wrasse (*Labridae* sp.)	10	7	15	6	1	
Yellow-eyed mullet (*Aldrichetta forsteri*)	366	589	314	129	129	137
NISP	**3019**	**4187**	**2914**	**1278**	**571**	**630**

opportunistically throughout the sequence of occupation, in contrast to the shellfish and fish remains which demonstrate a strategy of targeted resource exploitation.

Reptile

Reptile bone analysis was undertaken by Tristan Russell and Karen Greig using the Otago Archaeological Laboratories reference collection. The only reptile found at the site was tuatara, which is often found in small numbers in early sites although its role in subsistence economics has not been explored by archaeologists. The limited presence of tuatara (Table 8) suggests that they, like the small bird, may have been exploited opportunistically, though they may have been present naturally and subsequently incorporated into the midden.

Terrestrial mammal

Terrestrial mammal bone analysis was undertaken by Tristan Russell and Karen Greig using the Otago Archaeological Laboratories reference collection. The terrestrial mammals in pre-contact Māori archaeological contexts (other than human) are the kurī (dog, *Canis familiaris*) and kiore (Polynesian rat, *Rattus exulans*) that arrived with the first settlers around AD 1280–1320. Kiore was the most common by NISP, though kurī would have provided significantly more food (Table 9). Numerous mammal bones could not be identified to taxon due to their fragmentary nature, but these are almost certainly kurī – they are too large to be rat. Two of the identified kurī bones from Phase 7 suggest the presence of a sub-adult.

Fifty-seven coprolite samples were found ranging across all Phases. Although these have not been analysed, it is assumed that they are kurī coprolites.

Marine mammal

Marine mammal bone analysis was undertaken by Tristan Russell and Karen Greig using the Otago Archaeological Laboratories reference collection. The only marine mammal species identified was fur seal (kekeno, *Arctocephalus*

Table 7. *All bird taxa by* NISP *for each Occupation Phase.*

	Phase					
Taxon	**1**	**4**	**5**	**7**	**10**	**12**
Australasian gannet (*Morus serrator*)		1				
Australasian shoveler (*Anas rhynchotis variegata*)						
Broad-billed prion (*Pachyptila vittata)*	1					
Brown kiwi (*Apteryx australis mantelli*)						
Cape petrel (*Daption capense)*		1				
Chicken (*Gallus gallus*)						
Common diving petrel (*Pelecanoides urinatrix*)				1	1	
Fluttering shearwater (*Puffinus gavia*)				17		
Grey teal (*Anas gracilis*)				1		
Little shag (*Phalacrocorax melanoleucos)*				2		
Morepork (*Ninox novaeseelandiae*)		1		2		
Pied shag (*Phalacrocorax varius)*				2		
Pied stilt (*Himantopus himantopus)*		1		1		
Red-billed gull (*Larus novaehollandiae*)		1				
Red-crowned parakeet (*Cyanoramphus novaezelandiae*)				4		
Spotted shag (*Stictocarbo punctatus*)				1	1	
Tūī (*Prosthemadera novaeseelandiae*)	2		1	2	1	
Variable oystercatcher (*Haematopus unicolor*)	3					
Yellow-crowned parakeet (*Cyanoramphus auriceps*)				1		
Parakeet sp.				4	1	
Shag sp.		2		3		
Stilt sp.				1		
Bird sp.	14	64	4	71	46	2
NISP	**20**	**71**	**5**	**113**	**50**	**2**

Table 8. *Identified reptile species by* NISP *for each Occupation Phase.*

	Phase			
Taxon	**1**	**4**	**7**	**10**
Tuatara (*Sphenodon punctatus*)	1	6	7	3

Table 9. *Identified terrestrial mammal taxa by* NISP *for each Occupation Phase.*

	Phase					
Taxon	**1**	**4**	**5**	**7**	**10**	**12**
Kurī (*Canis familiaris*)		48	14	20		2
Kiore (*Rattus exulans*)	1	13	1	108	15	2
Mammal sp.	2	26	6	25	12	2
NISP	**3**	**87**	**21**	**153**	**27**	**6**

forsteri) (Table 10), while two highly fragmented sterna were recovered that is probably also fur seal, though the morphological similarities between fur seal and New Zealand sea lion (rāpoka, *Phocarctos* sp.) sterna made species-level identification impossible.

The size and robustness of an atlas vertebra from Phase 4 suggest a large adult male, while the epiphysis of a left metatarsal from Phase 7 was unfused, indicating a juvenile or sub-adult. The pre-human breeding ranges of fur seals and sea lions included all of the North Island but by AD 1500 fur seals no longer bred north of about Marlborough (Smith 2002; Collins *et al.* 2013). The fur seal at the Long Bay Restaurant site would not therefore have come

Table 10. *Identified marine mammal species by* NISP *for each Occupation Phase.*

	Phase			
Taxon	**1**	**4**	**7**	**10**
Fur seal (*Arctocephalus forsteri*)	1	5	4	2
Marine mammal sp.		1		
NISP	**1**	**8**	**4**	**3**

from a breeding colony, but non-breeding colonies would have continued to be present, and exploited, in northern New Zealand during the period of the Long Bay Restaurant site occupation.

One fur seal left femur from Phase 4 had clear transverse cut marks on the shaft, particularly the anterior and medial faces clearly indicating butchery. The two fur seal sternal portions from Phase 4 had visible lesions on them indicating an unknown disease (Figure 18).

Moa

Moa bone analysis was undertaken by Tristan Russell and Karen Greig using the Otago Archaeological Laboratories reference collection. Bones of the extinct moa (Dinornithiformes) are an important marker of early sites – moa were probably extinct by AD 1450 (Holdaway and Jacomb 2000). With the development of ancient DNA analysis there has been some doubt on the accuracy of moa species identification to low taxonomic levels on bone morphology alone (Bunce *et al.* 2003), but none of the moa bone could be identified to species or genus level.

All bones were fragments except a single complete phalanx (Table 11). All were weathered, suggesting exposure to the elements on the dune surface prior to incorporation into the midden matrix (Figure 6). It is probable therefore that they represent a lag deposit from either the underlying layers or from Phases of occupation that have not survived.

Any moa bone recovered from the site dates from very close to the period of extinction proposed by Holdaway and Jacomb (2000). The fragmentary nature of the remains provides no evidence regarding whether moa bone was brought on site as food or industrial material, but the latter seems most likely. Several moa bone artefacts were recovered from the site including three fishhooks and a two trolling lure shanks, but there was no evidence of bone working either as industrial waste or manufacturing tools.

Table 11. *Identified moa by NISP for each Occupation Phase.*

	Phase
Taxon	**4**
Moa (Dinornithiformes)	7

Figure 18. Top, fur seal femur with butchery marks; bottom; fur seal sterna with lesions.

DISCUSSION

The Long Bay Restaurant site was occupied at least six times between AD 1430 and 1485. The surviving evidence is not particularly dense, although it has been disrupted by erosion and redeposition of the dune sands. While the occupants were clearly fishing and gathering shellfish, and opportunistically taking birds, as well as cooking these foods, there isn't much archaeological evidence of other activities. There was no widespread evidence of forest clearance for gardening, besides which local soils are not well suited to kumara horticulture. There is no evidence of tool manufacture or other industry. Evidence of revisitation of burials and removal of bone (not discussed further here) suggests repeated engagement with the site by the same kin group, who visited it on a regular, probably seasonal basis and at the same time engaged in their everyday activities such as fishing and birding. A seasonal encampment that was also used for at least three Phases of burial seems unusual, and in this respect, the site remains a bit of a mystery.

Long Bay in context

Early sites are not commonly described in Tāmaki. The Mātātūāhu site (Q11/344) at the Manukau South Head is known from the artefacts collected there by the Brambley family. The site is poorly documented archaeologically (Ambrose 1961; Prickett 1987). Other sites are known from islands in the Hauraki Gulf. The Sunde Site (R10/25) on Motutapu, excavated in the 1980s, is not well dated but the presence of limited amounts of moa bone and artefact forms support a 14th or early 15th century occupation (Nichol 1981). The Pig Bay site (R10/22), also on Motutapu just north of the Sunde site, was excavated by Golson in 1958 and 1959 but only recently reported (Davidson and Leach 2017). The stratigraphy is complex and the site is also not well dated but the presence of seal bone and artefact forms indicate a later 15th century occupation, probably overlapping with the Long Bay Restaurant site. The Mōtanau Bay site (S11/20) on the south coast of Pōnui Island was excavated by Fisher in the late 1950s (Nicholls 1964). These excavations were not dated but the site was subsequently re-excavated in 1994 by Irwin and dated to the 15th century, also probably overlapping with Long Bay (Schmidt 2000: 72; Sheppard *et al.* 2011: 52; Irwin in press).

Only two early sites have been excavated in the built up area of Auckland City, both recent excavations in Devonport. The Masonic Tavern site (R11/2517) is not yet fully reported (Russell Gibb pers. comm. 10 June 2017). Torpedo Bay (R11/1945) contains two phases of occupation with the early phase dating to the 14th to mid-15th centuries (Campbell *et al.* 2018). An isolated firescoop at Timberly Road, Manukau, (R11/2379) yielded a late 14th century date although the rest of the excavated site dated to the 16th to 17th centuries (Farley *et al.* 2015; Farley and Bickler 2017).

Several other sites around Tāmaki, including the Hauraki Gulf Islands, have been recorded as early on the basis of artefact forms or the presence of moa or seal bone, though none have been systematically excavated or dated.

Like other early sites around the country, those in Tāmaki contain local and imported stone materials. Tūhua obsidian usually predominates but obsidian from the Coromandel Peninsula, Aotea and Northland is often present (Cruickshank 2011). Despite Tāmaki having a source of good quality stone suitable for adzes (Motutapu greywacke), adzes made of Tahanga basalt and Nelson–Marlborough argillite are common. These sites would have had close links to sites of similar age throughout the upper North Island, but these ties remain unexplored.

By the mid-15th century moa had certainly become extinct in the North Island and probably also the South Island (Holdaway and Jacomb 2000; Anderson 2000), though they would never have been as important in the north as in the non-horticultural south. Seals were no longer breeding in the North Island (Smith 2002) although, as the Long Bay evidence indicates, non-breeding colonies remained. By the end of the 15th century pā construction was underway (Schmidt 1996).

The exploitation of megafauna and the construction of pā are obvious markers of early and late in the pre-European Māori sequence. In addition, there was an early emphasis on rocky shore shellfish, larger and more easily exploited but also, like megafauna, more easily overexploited, replaced by an emphasis on soft shore species. Settlement expanded from sheltered coastal locations to open coast or inland localities (Gumbley *et al.* 2003; Campbell *et al.* 2009; Anderson 2016). These various archaeologically visible events are generally considered the result of changes that are less visible archaeologically – the building of pā signals a response to a (hypothesised) phase of population growth which, coupled with environmental decline (for which there is good archaeological and palynological evidence), led to growing competition over resources and increased warfare.

A two phase model of New Zealand pre-European history was developed in the 19th century (Haast 1871; Duff 1977) and was codified by Golson (1959) who proposed the Archaic and Classic phases, a dichotomy that has persisted in New Zealand archaeology, though it is more common recently to refer to early and late periods. The opposition of Archaic and Classic has the effect of polarising New Zealand pre-European history between two extremes, useful in highlighting the differences between the two ends of the sequence but implying that change took place all at once rather than gradually throughout the sequence (Green and Shawcross 1962). Some have proposed a transitional period, for instance Davidson (1984) developed a three-part sequence, based on settlement patterns, economy and technology, that might differ regionally. More recently Anderson (2016) proposed a transitional period from AD 1450–1650, marked by an expansion of population,

movement into the interior and an increase in the extent and intensity of gardening. The Long Bay Restaurant site would appear to fall into this 'transitional period.'

There is no doubt that the archaeology of the first East Polynesian settlers in New Zealand, from *ca.* AD 1300 to perhaps 1450, is notably different from the archaeology of the Māori observed and documented by James Cook and the crew of the *Endeavour* in 1769, or by numerous missionaries, traders and explorers from the early 19th century. The first settlers would have been met with an abundance of terrestrial and marine resources in a pristine environment, including moa as well as several other large, flightless bird species that have since become extinct, along with the species that Māori continued to exploit. Moa bone was also an important industrial material, used to make tools and ornaments.

Formal artefact forms, initially similar to their East Polynesian antecedents, began to change very quickly as people adapted to new materials (Furey 2004:39). For instance, the proportions of one- and two-piece fishhooks changed as moa bone for large one-piece hooks became less available (Groube 1969:1). In the early period, adzes were highly specialized, designed to make complex deep-hulled voyaging canoes, and required high quality, fine-grained stone. There were few sources of such stone – principally Tahanga basalt and Nelson-Marlborough argillite – and it was moved over long distances from a small number of quarries (Best 1975; Turner 2000).

Groube proposed that, while archaeologically visible changes took place (1967:11):

> the first people who came here (East Polynesian) were a neolithic, fishing, agricultural people… When Cook came to these shores the New Zealand Maori were still a neolithic, fishing, agricultural people … demonstrably there was no change in the economic status of the people, although practically all of their items of material culture, possibly their art styles, and probably their social organization were transformed from that of the first migrants.

Rather than an all-encompassing phase change from Archaic to Classic, these developments, firstly, were not necessarily directly connected; secondly, occurred at different rates in different places; and thirdly, occurred on a continuum throughout the sequence and not just in a transitional period between two monolithic phases.

Conclusion: temporal patterns at Long Bay

At a time when New Zealand archaeologists were concentrating on defining the Archaic and Classic end points of the sequence, Groube (1967) proposed that pre-European Māori archaeology could be encompassed in a single phase. Given that the date of first settlement has proven to be considerably more recent than previously thought (Anderson 1991), there is in fact very little time to fit a phase change into the pre-European Māori sequence. First settlement in New Zealand occurred around the turn of the 13th century, barely 450 years before the arrival of Captain Cook. The Long Bay Restaurant site was first occupied about a century and a half later – the Bayesian model dates the six Phases to AD 1430–1485. Dates on kurī bone from the 2014 excavations and from Burial 2 indicate continued occupation after Phase 12 into the 17th century (Table 1).

Other sites in the Long Bay catchment have also been dated: five dates from R10/289 place the site in the 16th century, while the date from R10/201 is at least 200 years later (Trilford and Campbell 2018). Dates from the Awaruku Headland ranged from the 15th to 19th centuries (Phillips and Bader 2007).

Charcoal analysis of the Long Bay Restaurant site indicates that the local forest was largely intact during Phase 1, in other words this is the first occupation of the wider Long Bay area, or close to it. Long Bay and its immediate hinterland were occupied and reoccupied constantly from the early 15th century, and the Long Bay Restaurant site documents the beginnings of this sequence of occupation.

This represents a possible change in settlement patterns similar to patterns that are well documented in the Western Bay of Plenty, where initial settlement was centred on the Tauranga Harbour (Mallows 2007; Holmes *et al.* 2014) but around AD 1450 spread east along the Papamoa dune plains (Campbell *et al.* 2009) and south to the fertile inland valleys (Campbell and Harris 2007). Later in the 15th century, large scale settlement of the Waikato Basin commenced as people moved from the west coast harbours to occupy fertile inland soils (Gumbley *et al.* 2003; Campbell and Hudson 2013; Anderson 2016). Despite more limited evidence, Long Bay allows us to propose that similar process occurred in Tāmaki, with settlement spreading out from favoured locations on the Devonport Peninsula and the Hauraki Gulf islands to less favourable locations like Long Bay on the clay-based soils of the northern coastline. Future work around Tāmaki could confirm and strengthen such a model.

The Long Bay evidence allows us to outline an economic and social model of the upper North Island in the 15th century, developing the model proposed by Walter *et al.* (2010), who suggested that early trade of high quality lithics such as South Island argillites, Tahanga basalt and Tūhua obsidian reflected the need for small, scattered coastal communities of early settlers to maintain reproductive, economic and social contacts. As populations stabilised and communities became self-sufficient, these networks of contacts and, with them trade and exchange systems, became less important. This system, dependant on voyaging canoes and the procurement of high-quality stone needed for the tools to make them, would have been expensive to maintain and easily disrupted, and once disrupted there was no need to re-build it. Self-sufficient communities

ceased voyaging and became more inward looking, laying greater claim to their own resources. Social and political, though not necessarily economic, competition increased and pā developed at the end of the 15th century as the local settlement pattern intensified and settlement expanded into less favourable areas such as Long Bay.

At the Long Bay Restaurant site these events seem to have occurred in sequence. Initially, expansion from favoured locations to the less favoured uninhabited coastal environments at Long Bay (and, it may be assumed, other similar sites throughout Tāmaki) around AD 1430, signals the establishment of self-sufficient communities. This was followed by a change from Tūhua obsidian to Te Ahumatā obsidian beginning around AD 1450–1465, indicating that these communities were no longer reliant on long-distance trade and exchange. The commencement of pā at the end of the 15th century (Schmidt 1996) is argued to reflect an increase in conflict between groups. Although there is no evidence of pā at the Long Bay Restaurant site and there is no evidence of traumatic injury in early Burial Phases, two women and a child from Burial Phase 13 appear to have died from blows to the head, which may indicate an increase in violence in later Phases, though whether through intra- or inter-group conflict is unclear.

This seems like a simple chain of cause and effect – population increase leads to self-sufficient local communities, leads to cessation of long-distance voyaging and exchange, leads to increased territoriality, leads to warfare and pā construction. But history is not linear and this apparent simplicity obscures what is likely to be a more tangled web of local changes occurring at different times and in different ways that had separate, though interrelated, causes. For instance, it isn't clear that a date of AD 1450 for the beginnings of this process of contraction of social networks, marked in Tāmaki by the change from Tūhua to Te Ahumatā obsidian, can be generalised to the rest of the country. Ladefoged *et al.* (2019) have shown that patterns of interaction and obsidian exchange in the upper North Island are complex but dating is not yet well enough refined to examine change through time. At Long Bay change may have been triggered by some political, social or economic circumstance particular to Tāmaki and networks may have been maintained for longer elsewhere. Equally, expansion of settlement would probably have been a process extending over years or generations and would have continued after stone distribution patterns changed. The Long Bay Restaurant site is a demonstration that change is a gradual, non-linear process that would have occurred throughout the sequence and not just in some transitional interlude between two monumental phases that mark either end of the pre-European Māori occupation of Aotearoa.

Only recently have technological improvements allowed radiocarbon dates to be reported with a precision of ± 25 years that allows the Bayesian model for the Long Bay Restaurant site to be so successful. The calibration curve for the 14th century and the period of first settlement is much wigglier than for the 15th century and precise dates are lacking. Even so, it is certain that economic, social and technological change was under way from the moment East Polynesian settlers arrived on these shores. Perhaps we now have the technological tools and conceptual models to trace them.

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