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HNZPTA authority 2016/916

REPORT TO
Heritage New Zealand Pouhere Taonga
AND
Powerco Ltd

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Archaeological investigations at Maketu: Powerco 11 kV underground cables (HNZPTA authority 2016/916)

Danielle Trilford, Peter Holmes and Matthew Campbell

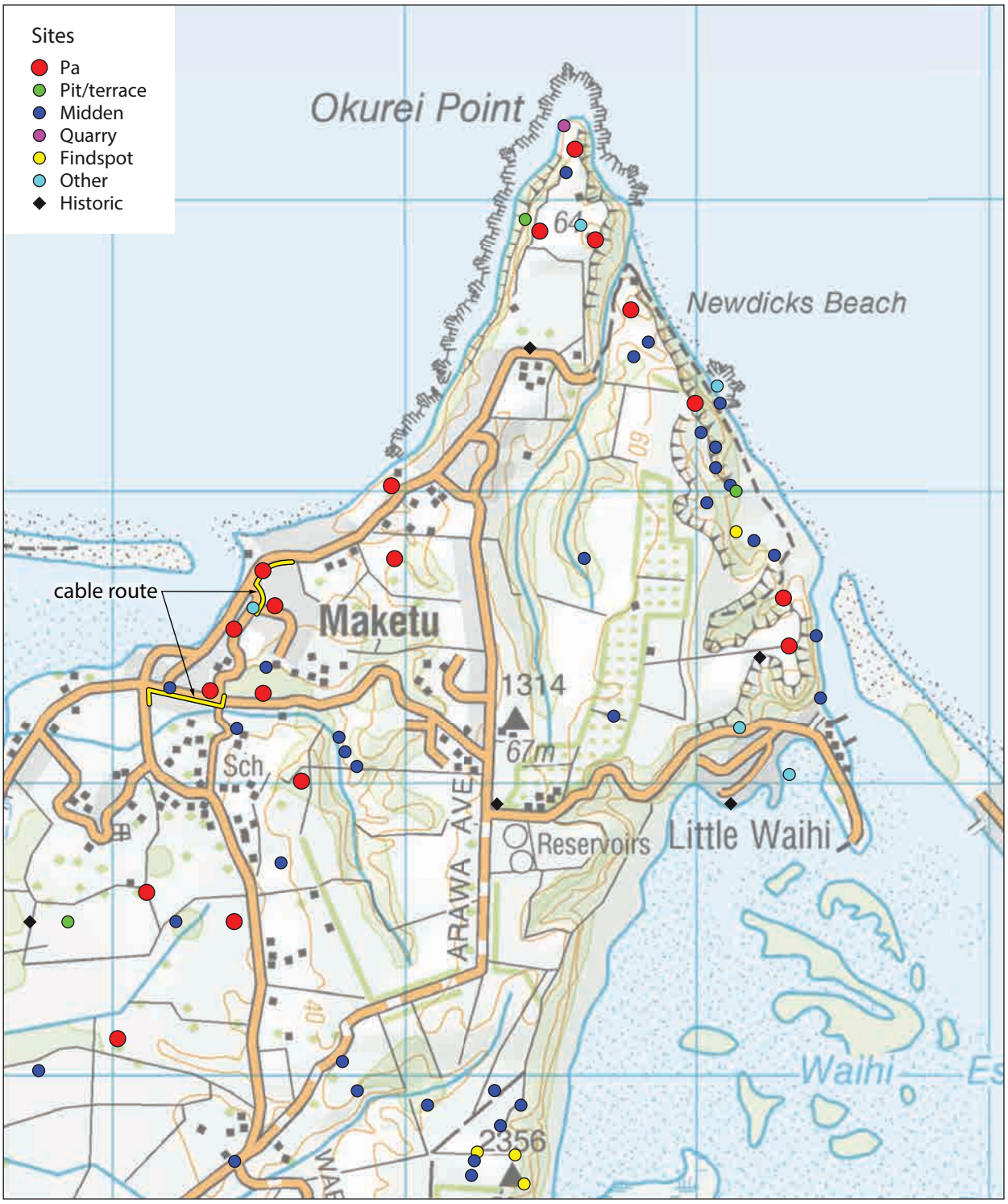
Powerco has installed new 11 kV power cables in Maketu to act as a backup in case of future power failures. Work began on these in 2013 but was halted when it was realised an archaeological authority was required from Heritage New Zealand Pouhere Taonga (HNZPT). Maketu is a dense archaeological landscape and several significant sites are recorded in the vicinity of the cable project in the New Zealand Archaeological Association (NZAA) Site Recording Scheme (SRS), including Maketu Pa (V14/14), Takaihuahua Pa (V14/27), other pa (V14/8, V14/28, V14/29), an early period occupation site (V14/187) and a late period midden (V14/188). An archaeological assessment of the cable route was undertaken in by Matthew Campbell of CFG Heritage in 2015 in support of an application for an archaeological authority to HNZPT to undertake the works. Authority 2016/916 was issued to Powerco 29 April 2016. Earthworks were monitored by Peter Holmes of CFG Heritage between 15 December 2016 and 20 February 2017. Manu Pene and William Rakeiao were iwi monitors for the project.

Background

Maketu is the final landing place for the *Arawa* waka and is a significant cultural landscape for Te Arawa (Tapsell 1940). The history of Maori occupation of the peninsula and wider area is recorded in Tapsell (1940) and Stafford (1970). Several of the first waka arriving to New Zealand landed at the Bay of Plenty, including *Takitimu*, *Mataatua*, *Te Arautauta* and *Nukutere*. Those who settled the area appear to have chosen it for easy access to resources such as Tuhua / Mayor Island obsidian, a stone which was moved across the country including to most of the earliest known sites in New Zealand (Walter et al. 2010). Maketu fits the typical attributes of a settler period archaeological site in coastal New Zealand, near a sheltered harbours and river mouth with access to open ocean, and abundant food from land and sea (Law 2008). The presence of moa bone in site V14/187 confirms people lived in the area within the first few years of landfall in New Zealand (Moore 2008; Holdaway and Jacomb 2000). Most archaeological work at Maketu has been site recording and, while limited excavation has provided dates from later periods, it has yet to be determined if settlement was continuous or included periods of abandonment. Fertile volcanic soils would have been a major attraction to Maori horticulturalists throughout the pre-European period. The topography of Maketu also enabled defensive systems which are more frequent in late-period Maori occupation. This occupation and early historic period occupation at Maketu are also evident in several watercolours and sketches by contact period British voyagers (Figures 2–4).

European History

Maketu was observed by James Cook who saw a large settlement on the peninsula and described it as "Town Point." A strong gale then took the *Endeavour* out to sea, so did not see the size of Tauranga Harbour for comparison until later (Law 2008).



1. Location of the trenches and archaeological contexts found on Maketu Peninsula with nearby archaeological sites.

British settlers also occupied Maketu from the earliest stages of arrival, which is one of the earliest European settlements in New Zealand (Matheson 1996).

Maketu appealed to British settlers, mainly due to the access to timber, flax, and fishing. Danish merchant Phillip Tapsell arrived to Maketu in 1830 trading for flax and other goods. This trade attracted many Maori to Maketu to take advantage of new opportunities (Stokes 1980: 53). He bought his trading post at Maketu for "one

2 (above). Watercolour of the Maketu peninsula in 1865 by Major General Horatio Robley (Te Papa Art collections, 97968).

3 (below). Watercolour of Maketu coastline in 1849, photo by James Richardson, original artist unknown (Sir George Grey Special Collections, Auckland Libraries, 4-4540).

4. Watercolour of Maketu Pa, probably dating to 1864, by H.M.L Atcherley (Alexander Turnbull Library, A-196-009).

case of muskets, one cask tabacco, one case pipes, seven cwt lead, thirty-six axes, and thirty-six tomahawks", paid to chiefs Tupaea and Hikareia of Ngaiterangi at nearby Te Tumu. Within a year there were hundreds of people living at Maketu and Te Tumu to scrape flax.

Maketu had been taken by Ngaiterangi in the early 18th century during their expansion into the Western Bay of Plenty. In 1836 Te Waharoa of Ngati Haua from Matamata sacked Maketu to obtain utu for the death of his kinsman there. In response, Te Amoua of Ngati Whakaue sacked nearby Te Tumu pa. By 1838 Ngati Whakaue and Te Arawa had permanently retaken Maketu.

European houses and a school were established during the 1840s and 1850s The 1860s land wars saw several pa in the Maketu area reused for redoubts (Stokes 1980: 78). During the 1870s Maketu was a significant seaport for the Te Puke and Rotorua districts. The port remained useable until 1907 when a flood broke through the sand dunes at the main meander of the Kaituna River and the river mouth moved 3 km west to Te Tumu and the estuary at Maketu silted up. Extensive flax milling operations expanded in the wider area around the 1870s, employing 40–70 men. Around the 1880s over 200 Te Arawa, mainly Ngati Pikiao and Ngati Whakaue lived in Maketu (Stokes 1860: 113).

Previous archaeological investigations

Maketu is a dense archaeological landscape (Figure 1). In the vicinity of the project several pa are recorded, along with two middens recorded and investigated by Moore (2008) while monitoring water main replacement in 2007. As he noted, very little archaeological work has been undertaken in Maketu apart from site recording. It would normally be expected that middens and pit/terrace sites would be much more common in landscape like Maketu, so it appears that the early site recorders concentrated on large scale sites like pa, and many more sites would be present if archaeologists made a concerted effort to record them. The town is now

fairly densely settled and many archaeological features will have been destroyed through development.

Of the two sites investigated by Moore, V14/187 was an early period midden containing several moa bones representing at least 3 individuals, as well as seal, dog and bird bone, but "no shell and remarkably little fish bone" (Moore et al. 2009: 94). A radiocarbon date taken on the moa bone returned an age of cal AD 1320–1415 at a 68% confidence interval. In contrast, V14/188 was a shell midden dominated by tuangi, tuatua and ostrich foot. Nine fish species were identified, of which over half by MNI were mackerel. Two radiocarbon dates on pipi returned contrasting ages of cal AD 1435–1535 and cal AD 1510–1640 at a 68% confidence interval.

While the presence of an early site at Maketu is not unexpected, the majority of middens in this area are more likely to be late period sites similar to V14/188.

Methodology

Archaeological monitoring of the site was undertaken by Peter Holmes of CFG Heritage between 15 December 2016 and 20 February 2017. Trenches were excavated with a hydraulic digger and works ceased while investigation and recording of any archaeological features was occurring.

Earthworks for the project was scheduled in three stages. Stage I involved monitoring earthworks in Wilson Road for the recovery of an existing cable from previous works and the excavation of trenches to realign the cable for connection with an existing power pole. Stage II covered the inspection of trenches excavated between Town Point Road and Te Awhe Road in preparation for drilling a duct and cable installation. Stage III involved enlarging two existing trenches at Town Point Road and the corner of Beach Road and Te Awhe Road for the installation of the 11 kV cable into the duct. There were nine trenches completed, of which three exposed archaeological deposits (Figure 5).

Features were hand excavated where exposed during trenching, then photographed and recorded following standard archaeological recording procedure. A handheld GPS, with a reported accuracy of ± 5 m, was used to record the location of points of interest. All spatial information was uploaded to the project GIS. Bulk samples of each midden deposit exposed were taken for analysis.

Results

There were four contexts exposed: three middens in three separate trenches, one of which had a fire scoop cut into the midden deposit. Feature 1 is located on Town Point Road, beside the Town Point Road carpark; Feature 2 and 2A are located on the corner of Beach Road and Te Awhe Street; Feature 3 is on Te Awhe Street. No structural features such as post holes or storage pits were found during the investigation. Six other trenches were also excavated and monitored but no further archaeological deposits were observed (Figure 5).

Feature 1

The midden was exposed in a 2000 x 300 mm x 1700 mm deep trench (Figures 6–8). The midden profile was exposed 1000–1400 mm below ground surface and appeared undisturbed. The midden was between 25–40 mm thick and lay above a dark grey, undulating estuarine sand which sloped downward and west to the coast. A bulk sample was taken for analysis.

5. Maketu, showing the location of the trenches.

Feature 2 and 2A

A 7.2 m long trench was cut and midden was located at a varying depths of 400–600 mm below the ground surface, overlain by a dark grey, poorly consolidated sandy loam and above a pale grey sand (Figure 9). The surrounding ground surface was probed to determine the extent of the midden, which ran up to 4 m west and over 1 m south of the trench, and appeared to extend into private property (42 Beach Road) north of the trench. A bulk sample was taken for analysis.

Feature 2A was a midden filled fire scoop exposed within the Feature 2 midden layer. The feature was a distinct charcoal stained sandy matrix with noticeable fire cracked rock (Figure 10). A bulk sample of the fill of the fire scoop was taken for analysis. The fire scoop is 400 mm deep and 600 mm wide in profile in the trench wall.

Feature 3

The trench in which Feature 3 was located was 2000 x 700 mm x 1500 mm deep. A 200 mm deep midden deposit was located 500 mm below the ground surface. The deposit was below a light-grey sandy silt and lay on a layer of highly consolidated pale brown silt. The midden did not have any evidence of disturbance. A bulk sample of the midden was taken for analysis.

6 (above left). Feature 1, facing south.

7 (above). Feature 1, facing south.

8 (below left). Feature 1.

9 (below). Feature 2.

10. Features 2 and 2A, facing north east.

11. Feature 3, facing west, showing midden at the base of the A-horizon.

Midden analysis

Two quantification methods are used, NISP and MNI. NISP (Number of Identified Specimens Present) is a simple count of identified elements for any taxonomic group. MNI is the Minimum Number of Individuals and is calculated on the most common element by side for each taxon, e.g., right dentary. In general, NISP is

preferred. MNI counts are given in order to facilitate comparisons with other published assemblages but in general they are not discussed further; MNI for fish is based on the conventional method developed by Leach (1986). Each feature is generally considered to be a discrete assemblage and no effort is made to subdivide or aggregate these assemblages.

Shell

Several bulk samples were taken from all features and all the material was analysed. The results are summarised in Table 1. The midden was washed and analysed using conventional methods, with species identification based on Morley (2006). Kina (*Evechinus chloroticus*) spines, mouth pieces and tests (hard outer plate) fragments were weighed to note presence, but not given a NISP. Table 1 provides the weights of the samples dried before sieving, and the weights after the shell was washed and dried. The shell middens appeared to be in a primary and undisturbed context during excavation but 63–78% of the material by weight made was up of midden matrix (mostly sand) indicates that the middens are in general not dense. Shell made up only 5–18% of the samples by weight and much of this material was unidentifiable residue, particularly in Feature 2 and 2A.

	Feature 1		Feature 2		Feature 2A		Feature 3	
volume (L)	56.4		108		4.5		40	
dry weight (g)	44812		146960		5950		39950	
sieved weight (g)	16690		36336		1329		14325	
sieved matrix (g)	28122	62.8%	110624	75.3%	4621	77.7%	25625	64.1%
shell (g)	3381	7.5%	1999	1.4%	408	6.9%	1170	2.9%
residue (g)	1892	4.2%	4196	2.9%	639	10.7%	862	2.2%
non shell* (g)	11417	25.5%	30141	20.5%	282	4.7%	12293	30.8%
ratio shell:residue	1.8		0.5		0.6		1.3	

*stone, bone, charcoal, etc.

Table 1. Summary statistics for the midden samples.

Fifteen shellfish species were identified in the Feature 1 sample and the species present are evenly spread over harbour / estuarine, rocky, or sandy shores. However, the dominance of harbour shellfish is prevalent when measured by weight and MNI – this is due to the large amount of pipi (*Paphies australis*) in the sample. A much smaller presence of rocky shore and open sandy beach shellfish were also present in the sample on sum of weight and MNI.

The high counts of residue in Feature 2 are not associated to site disturbance, but instead interpreted a result of the burning and cooking evident in a black charcoal stained matrix (Figure 10) (Table 3). The Feature 2 midden is mostly pipi and tuatua (*Paphies subtriangulata*), with a lower but significant count of mussel (Mytilidae sp.). While the MNI and weight values of the deposit is almost all pipi and tuatua, there are 13 shellfish species in the sample. Almost all the sample indicates people were collecting their shellfish from harbour / estuarine and sandy open shores, with mussel the only rocky shore species. Some of the smaller species were probably a bycatch from mass collection of pipi and tuatua.

Taxon	MNI	Weight (g)	Environment	Tidal zone
Paphies subtriangulata	14	142	Sandy open beach	Low tide
Paphies australis	1440	1520	Harbour / estuarine	Mid to low
Austrovenus stutchburyi	34	41	Harbour / estuarine	Mid to low
Turbo smaragdus (opercula)	3	3	Rocky shore	Mid to low
Turbo smaragdus	1	1	Rocky shore	Mid to low
Struthiolaria papulosa	15	48	Sandy open beach	Low
Mactra discors	13	103	Soft / Sandy shore	Low
Evechinus chloroticus	N/A	5	Varies	Mid to deep
Mytilidae sp.	N/A	93	Rocky shore	Varies
Glycymeris modesta	2	7	Varies	Low to deep
Dicathais orbita	1	2	Rocky shore	
Macomona liliana	1	2	Harbour / estuarine	Mid to low
Cellana sp.	1	1	Rocky shore	
Dosinia sp.	N/A	6	Varies	Low to deep
Zeacumantus subcarinatus	1	1	Rocky shore	High tide
Cominella glandiformis	3	6	Harbour / estuarine	Mid to low
Dosinia subrosea	1	24	Sandy open beach	Low to deep

Table 2. Summary of shellfish species identified at Feature 1, environment and tidal depth data are based from Morley (2006) and Powell (1961).

Taxon	MNI	Weight (g)	Environment	Tidal zone
Paphies subtriangulata	233	925	Sandy open beach	Low tide
Paphies australis	286	695	Harbour / estuarine	Mid to low
Austrovenus stutchburyi	3	8	Harbour / estuarine	Mid to low
Maoricrypta monoxyla	8	2	Rocky shore	Mid to deep
Mytilidae sp.	112	355	Rocky shore	Varies
Evechinus chloroticus	N/A	2	Varies	Mid to deep
Glycymeris modesta	5	5	Varies	Low to deep
Chiton glaucus	1	1	Rocky shore	Mid to deep
Cellana sp.	2	2	Rocky shore	
Maoricolpus roseus	1	1	Harbour / estuarine	Low
Pelicaria vermis	2	1	Harbour / estuarine	Mid to low
Sigapatella novaezelandiae	1	1	Rocky shore	Low to deep
Melagraphia aethiops	1	1	Rocky shore	Mid to deep

Table 3. Summary of shellfish species identified at Feature 2, environment and tidal depth data are based from Morley (2006) and Powell (1961).

Seven species of shellfish were present in the sample analysed from Feature 2A, the most common species was tuatua followed by pipi, with lesser counts of Mussels and other rocky or harbour shellfish species (Table 4), a pattern also seen in Feature 2. While not measured, it was observed that the ribbed slipper shells (*Maoricrypta costata*) were very large, all above the average size identified in Morley (2006: 93). This may indicate people were collecting rocky shellfish from relatively under-exploited environments.

Taxon	MNI	Weight (g)	Environment	Tidal zone
Paphies subtriangulata	54	217	Sandy open beach	Low tide
Paphies australis	48	126	Harbour / estuarine	Mid to low
Austrovenus stutchburyi	2	1	Harbour / estuarine	Mid to low
Mytilidae sp.	12	42	Rocky shore	Varies
Dicathais orbita	1	11	Rocky shore	Low tide
Maoricrypta costata	3	9	Rocky shore	Low to deep
Pelicaria vermis	2	1	Harbour / estuarine	Mid to low

Table 4. Summary of shellfish species identified in Feature 2A.

Eight shellfish species were present in the sample analysed from Feature 3 (Table 5). Pipi is the main species when counted by MNI, but tuatua is the most prevalent species when counted by weight. This difference may indicate a difference in shellfish collection techniques, where tuatua were probably handpicked for larger specimens, resulting in a lower count but higher weight. Pipi appears to have been collected using a mass collection strategy, such as dredging or raking, with all sizes scooped together. This difference is measurable, where the average weight for tuatua valves are much higher than that of pipi (NISP / weight) (Table 6). Over 98% of the diagnostic weight from Feature 3 is either pipi or tuatua, indicating people strategically collected their shellfish from harbour / estuarine environments and open sandy beaches at mid to low tide, and probably for these specific species. The amount of rocky shellfish present is minor however shows people opportunistically collected shellfish from the rocky points of the Maketu Peninsula. Feature 3 is much smaller in volume and weight than Features 1 and 2, so the narrower breadth of species in Feature 3 could in part be due to sample size (Table 1).

Taxon	MNI	Weight (g)	Environment	Tidal zone
Paphies subtriangulata	98	585	Sandy open beach	Low tide
Paphies australis	701	555	Harbour / estuarine	Mid to low
Austrovenus stutchburyi	6	5	Harbour / estuarine	Mid to low
Mytilidae sp.	1	1	Rocky shore	Varies
Turbo smaragdus	1	2	Rocky shore	Mid to low
Glycymeris modesta	2	1	Varies	Low to deep
Dosinia sp.	1	2	Varies	Low to deep
Struthiolaria papulosa	2	8	Sandy open beach	Low

Table 5. Summary of shellfish species present in Feature 3.

Taxon	NISP	Weight (g)	Average weight per shell (g)
Paphies subtriangulata	196	585	2.98
Paphies australis	1401	555	0.39

Table 6. Count of weight and count of pipi and tuatua in Feature 3.

Fish

The fish assemblage was analysed following a methodology that builds on the conventional methodology developed by Leach (1986) and widely used in New Zealand and the Pacific. This method counts the five main paired mouth bones: the left and right dentary, articular, quadrate, maxilla and premaxilla – along with 'special' bones for some species. These bones were selected by Leach because they are generally distinctive to a low taxonomic level and survive well in archaeological contexts. Leach's method is widely applied and can be used to make comparisons between different sites and assemblages.

Recently several researchers working in the tropical Pacific have widened the number of bones that are identified (Vogel 2005; Walter 1998; Weisler et al. 2010). They found that with an expanded range of elements, taxa not identified by the conventional method could now be identified; that some of these taxa were actually quite common in the assemblage; and that the relative abundances of taxa changed as more elements were identified. An extended set of fish bone was identified for the Maketu fishbone assemblage, including: the paired sub-cranial elements palatine, hyomandibular, ceratohyal, epihyal, opercular, preopercular, cleithrum, scapula, supracleithrum and postemporal; the unpaired cranial elements vomer and parasphenoid; and vertebrae, identified to atlas (first vertebra), thoracic vertebrae, caudal vertebrae and urostyle (last vertebra) (Campbell 2016).

NISP scores for fish are given in Table 7 for the extended set of analysed bone, while conventional MNI scores are given in Table 8 to allow comparison with other published assemblages.

Several fishbones could not be identified to any low taxonomic level – these include up to 3 medium sized taxa as well as numerous vertebrae, some of which were from small taxa (Table 7). Four vertebrae from sharks and rays (Chondrichthyes) were identified but only one could be identified to species level, an eagle ray (whai repo, *Myliobatis tenuicaudatus*) vertebra from Feature 3.

Despite the relatively small assemblages there is a high number of identified taxa. Table 9 shows the total NISP for Features 1 and 3 (counts were too low for

Feature	Barracouta (*Thyrsites atun*)	Eagle ray (*Myliobatis tenuidaudatus*)	cf Flounder (cf *Rhombosolea* sp.)	Fish sp.	Grey mullet (*Mugil cephalus*)	Gurnard (*Chelidonichthys kumu*)	John Dory (*Zeus faber*)	Kahawai (*Arripis trutta*)	Mackerel (*Trachurus* sp.)	Morwong (Cheilodactylidae)	Red cod (*Pseudophycis bachus*)	Shark/ray (Chondrichthyes)	Snapper (*Pagrus auratus*)	Tarakihi (*Nemadactylus macropterus*)	Trevally (*Pseudocaranx dentex*)	Turbot (*Colistium nudipinnus*)	Yellow eyed mullet (*Aldrichetta forsteri*)
1	7		21	44		21	1	9	39 (153)	2	12		2		1	1	17
2				1		4		2	(1)				4	6			
3	6	1	2	11	2	6	4	4	43 (86)		1	3	1				1

Table 7. Extended NISP for fishbone from all features. Numbers in brackets indicate the count of scutes for mackerel.

Feature	Barracouta (*Thyrsites atun*)	cf Flounder (cf *Rhombosolea* sp.)	Grey mullet (*Mugil cephalus*)	John Dory (*Zeus faber*)	Kahawai (*Arripis trutta*)	Mackerel (*Trachurus* sp.)	Red cod (*Pseudophycis bachus*)	Tarakihi (*Nemadactylus macropterus*)
1		1			2	6		
2								1
3	1	1	1	1	1	9	1	

Table 8. Conventional MNI for fishbone from all features.

Feature 2 to make biodiversity statistics meaningful), discounting the unidentified fish species. In each feature there are a total of 12 identified taxa, S, which is a simple measure of assemblage richness (biodiversity statistics in Table 9 follow Magurran 2004). Because richness is dependent on total NISP Menhinnicks' index, which dives S by the square root of NISP, and Margalef's index, which divides S by log NISP, are also given. These show both assemblages to be rich, with Feature 3 richer than Feature 1, as it has the same number of taxa but a smaller total NISP. Measures of diversity, Berger–Parker's 1/d and Simpson's 1/D, show Feature 1 to be highly diverse while Feature 3 is much less so. Feature 3 is dominated by a single species with mackerel (hāture, *Trachurus* sp.) making up nearly 60% of the total NISP. In Feature 3, while mackerel is the most common species, it makes up a much lower proportion of the total and numbers are more evenly spread across the assemblage. Similarly, the measure of evenness, Simpson's $E_{1/D}$, shows Feature 1 to be more even.

While the application of biodiversity statistic to archaeological faunal assemblages is a fairly new technique in New Zealand archaeology (Campbell 2016) the

Feature	NISP	S	Menhinick's D_{Mn}	Margalev's D_{Mg}	Berger–Parker's 1/d	Simpson's 1/D	Simpson's $E_{1/D}$
1	133	12	1.04	5.18	3.41	6.17	0.51
2	17	5					
3	74	12	1.39	5.88	1.72	2.84	0.24

Table 9. Biodiversity statistics for fishbone from Features 1 and 3 (not counting Fish sp.).

statistics for Features 1 and 3 would seem to be rather unusual, both in terms of the richness of Feature 3 (S compared to total NISP) and the diversity and evenness of Feature 1. These statistics indicate mass capture techniques for the fish, in other words, netting which will take numerous fish species indiscriminately, rather than targeted techniques such as using baited hooks. Fish bone assemblages along the Bay of Plenty coasts are often dominated by mackerel (e.g., Felgate 2005) and these are often thought to be indicative of netting in summer when mackerel spawn in shallower waters. This seems to be the case for Features 1 and 3. Gilbert Mair, cited in Best (1977[1929]: 11), describes netting at Maketu in 1885 using traditional techniques. The net "was a huge seine 95 chains (2,090 yards) in length—well over a mile!... the spectators, not less than a thousand persons, were unable to haul the net … some 37,000 fish were tallied, not including many small-fry and a number of sharks… this is our champion fish-story of New Zealand." Notwithstanding that this *is* a fish story, Best also cites early explorers (Cook, Banks, Roux) who describe nets five fathoms (10 yards) deep and up to 400 fathoms (800 yards) long and it is evident that Maori nets were very large and catches very bountiful. Anon. (1837: 90) at Hokianga describes: "mackerel are taken in the main stream and tideway in vast numbers. Sometimes a long net, made of the native flax, is run across the mouth of a creek, made fast to stakes previously driven into the beach at low water, and masses of fish are enclosed and killed. Not unfrequently the shoals are driven, or straggle into the streams, where they are intercepted and almost any quantity the natives please taken. The natives prepare them on hot stones; they keep for months; they never attempt salting them."

Mackerel scutes, bony scales form the lateral lien of the fish, are also common, indicating that the fish were probably scaled and gutted on site.

Other bone

Feature 1 contained a right dog pelvis (kuri, *Canis familiaris*) and other mammal bone that could not be identified further. A small assemblage of partly burnt mammal bone from Features 2 and 2A could not be identified further. The unidentified bone is most likely to be kuri. A modern deposit of sheep and immature cattle bone was exposed at the Wilson Road trench.

Lithics

A single flake of obsidian was retrieved from Feature 2. The flake was analysed following the methodology described by Holdaway and Stern (2004) and use wear patterns described by Beyin (2010) and Turner (2005). It was also inspected macroscopically to ascertain its geographical source following Moore (1988).

The flake was green in reflected and transmitted light, and exhibits the characteristics of obsidian from Tuhua / Mayor Island. This is the most exploited source of obsidian in New Zealand and has been identified in sites throughout the country, as far afield as the Kermadec, Chatham and Auckland Islands (Green 1967; Leach and de Souza 1979; Leach et al. 1986).

Because it is less than 10 mm^2 in size it has been classed as shatter and as such, no further analysis on typology or use-wear was undertaken.

Additionally, there were several obsidian pebbles retrieved from the deposits (all less than 18 mm at the longest measurement). There are several naturally occurring obsidian pebble deposits in the area (Moore 2004:170), and it is thought that the pebbles found during this investigation are not likely to be manuports due to their size and are most likely naturally present in the deposits.

Charcoal

The samples from all sites are dominated by small shrub or scrub species with 68% being either tutu, hebe, coprosma or corokia, small woody species that accompany bracken vegetation. The remainder are broadleaf and conifer trees (Table 10). The results suggest the local vegetation was largely open bracken and shrubs with a few stands of trees.

Species	Plant type	# Samples	# Pieces	% Pieces
Tutu	small shrub or scrub species	6	27	74%
Hebe		9	41	
Coprosma		6	13	
Corokia		6	15	
Ngaio		1	1	
Mapou		1	1	
Manuka		6	6	
Mahoe	broadleaf trees	2	4	9%
Pukatea		1	2	
Beech		1	1	
Puriri		1	1	
Pohutukawa		3	5	
Kahikatea	conifers	3	4	17%
Matai		6	20	
Totals		12	141	

Table 10. Summary of charcoal analysis results from samples taken from Maketu.

Chronology

Samples of pipi valves from each of the three middens were submitted to the Radiocarbon Dating Laboratory at the University of Waikato for dating, and one hebe sample from Feature 2A was also dated. The results from Feature 1 dates to

Feature	Lab no.	Sample	CRA BP	cal AD 68%	cal AD 95%
1	Wk 46085	shell	774 ± 27	1470 –1583	1451–1649
1	Wk 46546	charcoal	267 ± 15	1647–1667	1637–1673 (78.9%) 1745–1759 (5.4%) 1781–1797 (11.0%)
2	Wk 46086	shell	658 ± 23	1573 –1686	1505–1725 (93.6%) 1740–1755 (1.0%) 1789–1801 (0.8%)
2A	Wk 46547	charcoal	134 ± 16	1709–1720 (8.2 %) 1812–1837 (17.7%) 1847–1858 (7.3%) 1880–1928 (35%)	1697–1725 (15.2%) 1807 (80.2%) …
3	Wk 46545	shell	716 ± 32	1530–1645	1479–1680

Table 11. Radiocarbon dates.

the mid-15th to mid-17th century; Feature 3 is a little younger; and Features 2 and 2A are younger again, possibly as late as the beginning of the 19th century.

Site association

At the time of excavation it was unclear how or if the middens related to previously recorded sites. It was decided to wait for the radiocarbon and midden analysis before making these attributions.

Feature 1: recorded site V14/188.

The results from Feature 1 match those from nearby recorded site V14/188. Water main works investigated by Moore (2008) showed that the site runs for at least 140 and possibly up to 200 m along the coastline (Moore et al. 2009). Feature 1 from the current investigation lies on the other side of the road, around 10–15 m from Moore's investigation. Moore dated the site to cal AD 1460–1630, which is very similar to the date for Feature 1. The faunal results are also similar, with the midden dominate by pipi, a much smaller count of tuangi, along with small amounts of mussel and fish bone.

Feature 2 and 2A: new site V14/194

This site fits within the probable extent of V14/188 described by Moore but has a later date. The midden has been assigned a new site number, V14/194 – future investigation may show it to be continuous with V14/188.

Feature 3: new site V14/193

The results from Feature 3 cannot be confidently associated to either nearby sites V14/8 or V14/29 with confidence. The midden has been assigned a new site number V14/193.

Discussion and conclusion

V14/188

The results from this investigation support several findings from earlier site works by Moore 2008. Occupants of V14/188 were consuming large amounts of shellfish, fish, and dog. Moore's larger investigation also found human bone, but none was recovered in the current study.

The chronology of the site suggests people collected food here around the early 16th century. The midden lies immediately below Mako Rangi pa V14/28, unnamed pa V14/29, and Takaihuahua Pa V14/27. The midden is likely to be associated to one of the pa. If so, the radiocarbon dates for the midden would indicate one or some of the pa were also occupied in the 16th century.

Moore's (2008) investigation of the V14/188 midden slightly further south from the Feature 1 trench proposed several points which this investigation can test. Moore proposed the lack of fishhooks suggested the fish were caught by netting or traps and the biodiversity statistics support this.

Moore's small pipi and tuangi valves seen in V14/188 are like those from this investigation. The small size of the shellfish can suggest over-exploitation, as suggested by him (2008). The results can also suggest other scenarios, one is that the population within the harbour were simply small at that specific locale. This concept is known as "patchiness" and essentially allows for the fact shellfish are

not spread uniformly across a shoreline, they are broken into a mosaic of smaller patches at different rates of growth, where immediately adjacent patches on the same shore will have different average sizes (Campbell 2017b: 283; Thakar et. al. 2017). Often exploitation intensity is best represented in the co-variation of the maximum and minimum size of the species in a sample (Campbell 2017b: 283). The small tuangi and pipi in V14/188 could be due to over-exploitation across the estuary, or could be due to patchiness – unfortunately the two scenarios cannot be tested in this investigation because valve sizes were observed, not measured. This is a topic which can be considered in future research at Maketu

Similarly, the bulk collection method such as dredging or raking as suggested by Moore (2008: 22) seems likely based on the smaller valves and sheer quantity of shellfish present. As mentioned earlier, this cannot be systematically tested in this investigation, however, mass collection of shellfish can be represented by coupling two results: the shell size and age. Deliberate selection (such as hand picking) is likely to provide a narrow range of individuals in terms of size and age (Somerville et. al. 2017: 28). A wide distribution of shell size may represent shellfish mass collection without any selection, or two or more collection events, hence the need to pair the results with chronometric results.

Shellfish collection and midden deposition processes are a poorly understood topic in New Zealand archaeology, the sheer size of V14/188 can provide a good baseline to test collection and site deposition theories to the New Zealand context. This potential should be noted in further excavations of the midden.

V14/194

The midden from Feature 2 and 2A comprise new site V14/194. The site dates slightly later than the other two middens from this investigation. The two dates, from Features 2 and 2A, are quite different but from the archaeology there cis no reason to suspect that they represent different occupations. However, examining site stratigraphy in profile in the sides of trenches only provides a very limited view of a site and a wider aereal excavation may have demonstrated greater stratigraphic complexity. The midden in both features has a large amount of burning, evidence of shellfish harvesting, mostly from the nearby sandy shores environment, cooking mammal bone, and some fishing. Notably, less fishing is evident in V14/194 than the other two features from this site. The difference may represent a decrease in fishing at Maketu over the century, but more sampling is necessary before this hypothesis can be tested.

V14/193

The results from this deposit show people were mainly eating harbour shellfish while also collecting fish by net, probably in summer. The shellfish were caught at some stage between the early 16th to mid-17th century. Two nearby recorded sites, V14/8 is a pa/urupa and V14/29 is a pa. Like most of the sites in Maketu, neither nearby sites have been investigated by an archaeologist before, however both have noted midden eroding. Should these sites be associated to the investigated midden, it is likely they also date to the early 16th to mid-17th century. The 16th century period of shellfish collection is also present at the large scale deposit of V14/188, (Feature 1) from this investigation.

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Thursday, 5 October 2017

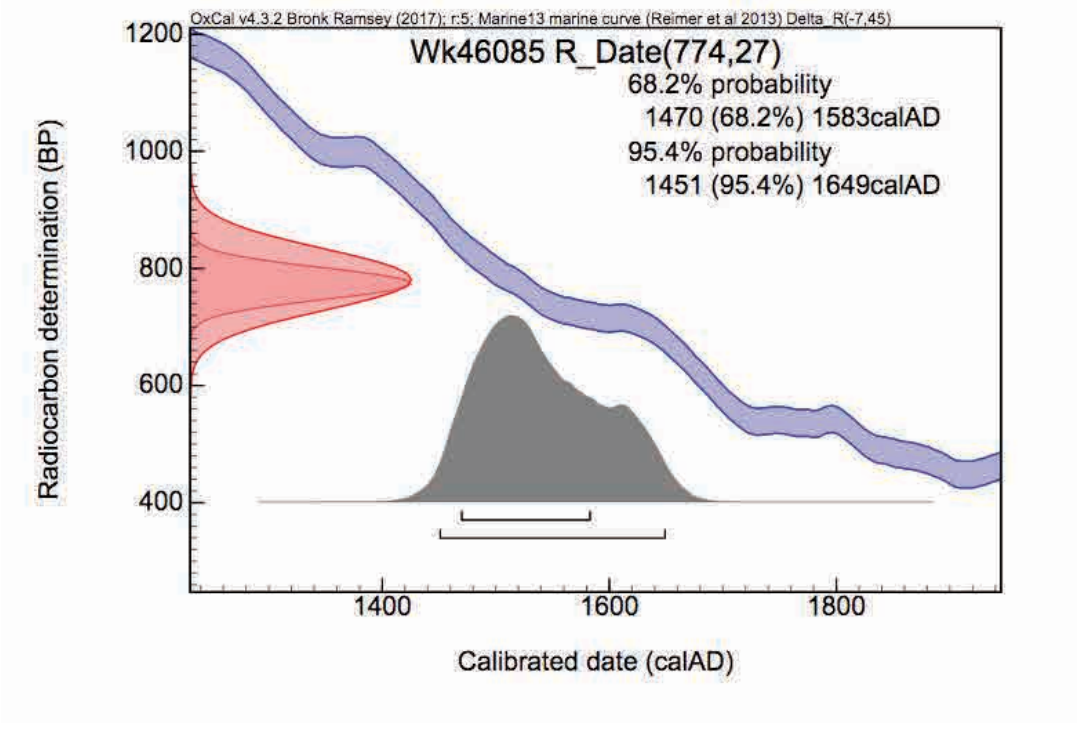
Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 46085

Submitter	M Campbell
Submitter's Code	Maketu Feature 1
Site & Location	Maketu Peninsula, New Zealand
Sample Material	Paphies australis
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 120 seconds, rinsed and dried.

$\delta^{13}C$	3.4	±	0.3 ‰	(CRDS)
$D^{14}C$	-91.8	±	3.0 ‰	
$F^{14}C\%$	90.8	±	0.3 %	
Result	**774 ± 27 BP**			

Comments



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- Result is *Conventional Age or Percent Modern Carbon (pMC)* following Stuiver and Polach, 1977, Radiocarbon 19, 355-363. This is based on the Libby half-life of 5568 yr with correction for isotopic fractionation applied. This age is normally quoted in publications and must include the appropriate error term and Wk number.
- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

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Thursday, 7 December 2017

Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 46546

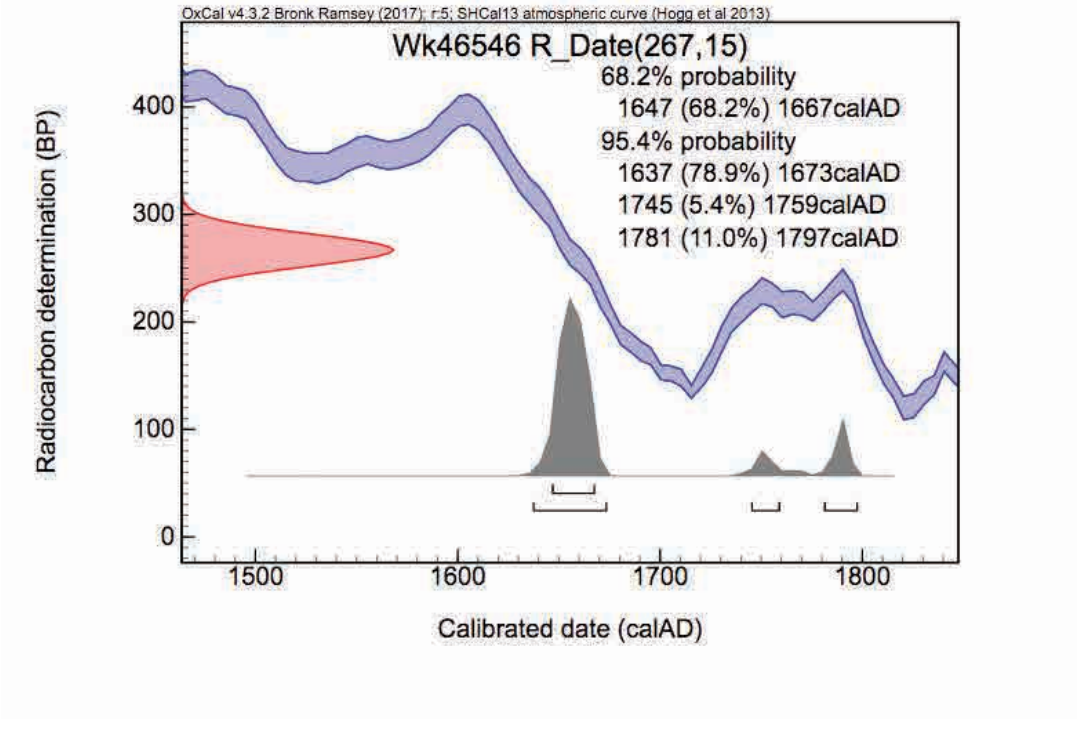
Submitter	M Campbell
Submitter's Code	Vector works, Maketu, Feature 1
Site & Location	Maketu peninusla, Bay of Plenty, New Zealand
Sample Material	Hebe
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-32.7 ± 1.9 ‰
$F^{14}C$%	96.7 ± 0.2 %
Result	**267 ± 15 BP**

(AMS measurement)

Comments

Please note: The Carbon-13 stable isotope value ($\delta^{13}C$) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured $\delta^{13}C$ value can differ from the $\delta^{13}C$ of the original material and it is therefore not shown.



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- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB and is measured on sample CO_2.
- $F^{14}C$% is also known as *Percent Modern Carbon (pMC)*.

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Thursday, 5 October 2017

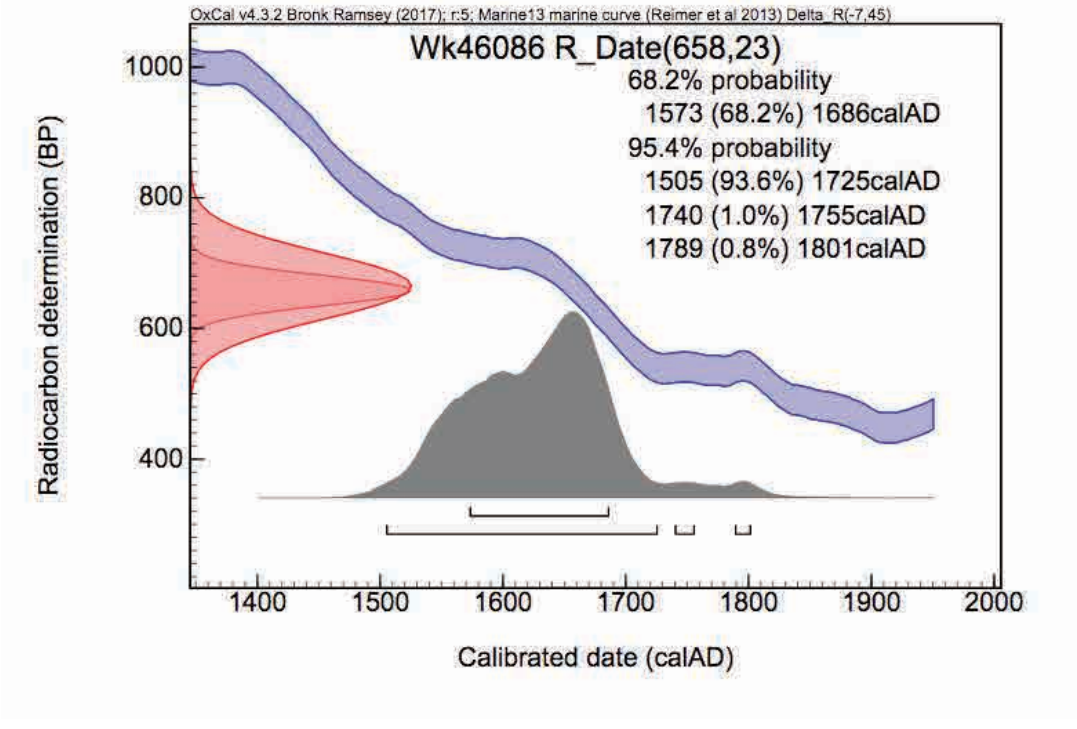
Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 46086

Submitter	M Campbell
Submitter's Code	Maketu Feature 2
Site & Location	Maketu Peninsula, New Zealand
Sample Material	Paphies australis
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 120 seconds, rinsed and dried.

$\delta^{13}C$	1.8	±	0.3 ‰	(CRDS)
$D^{14}C$	-78.6	±	2.7 ‰	
$F^{14}C$%	92.1	±	0.3 %	
Result	**658 ± 23 BP**			

Comments



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- Result is *Conventional Age or Percent Modern Carbon (pMC)* following Stuiver and Polach, 1977, Radiocarbon 19, 355-363. This is based on the Libby half-life of 5568 yr with correction for isotopic fractionation applied. This age is normally quoted in publications and must include the appropriate error term and Wk number.
- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB and is measured on sample CO_2.
- $F^{14}C$% is also known as *Percent Modern Carbon (pMC)*.

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Thursday, 7 December 2017

Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 46547

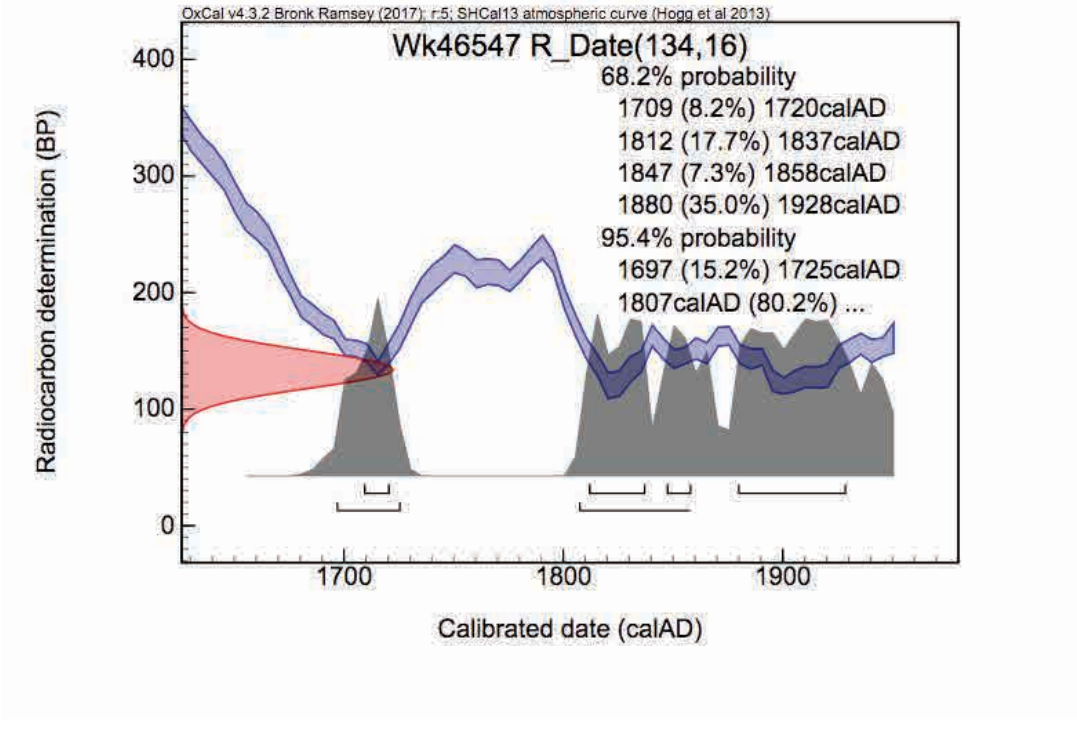
Submitter	M Campbell
Submitter's Code	Vector works, Maketu, Feature 2A
Site & Location	Maketu peninusla, Bay of Plenty, New Zealand
Sample Material	Hebe
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-16.5 ±	2.0 ‰
$F^{14}C$%	98.4 ±	0.2 %
Result	**134 ± 16 BP**	

(AMS measurement)

Comments

Please note: The Carbon-13 stable isotope value ($\delta^{13}C$) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured $\delta^{13}C$ value can differ from the $\delta^{13}C$ of the original material and it is therefore not shown.



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- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB and is measured on sample CO_2.
- $F^{14}C$% is also known as *Percent Modern Carbon (pMC)*.

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Thursday, 7 December 2017

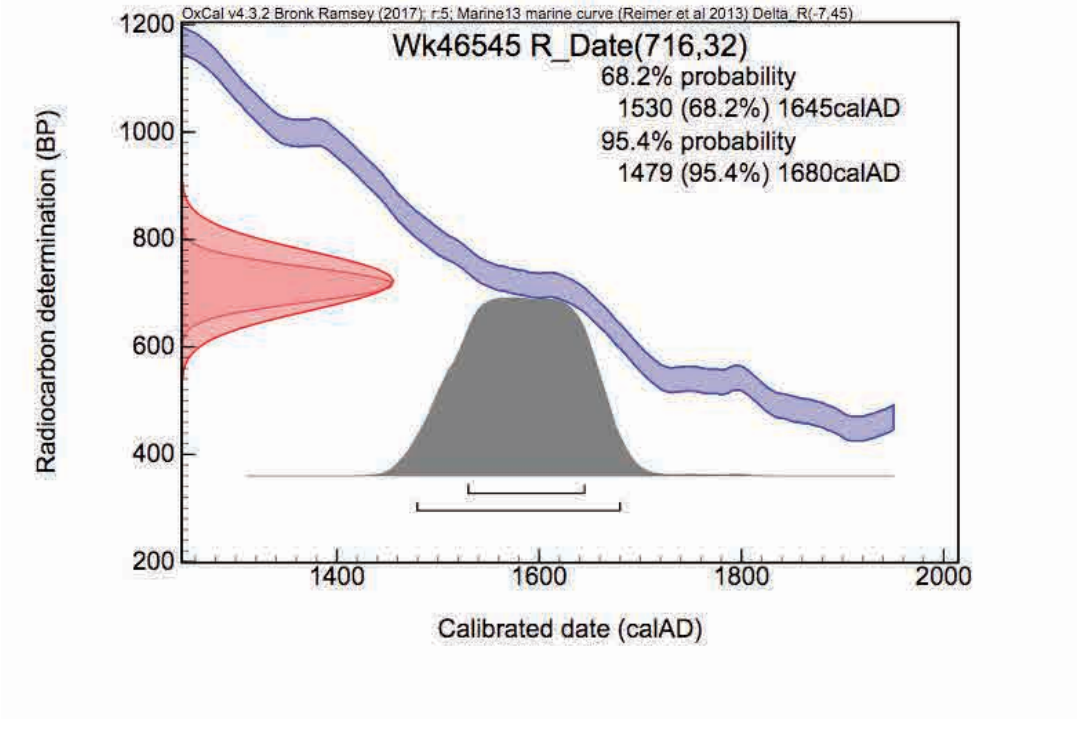
Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 46545

Submitter	M Campbell
Submitter's Code	Vector works, Maketu, Feature 3
Site & Location	Maketu peninusla, Bay of Plenty, New Zealand
Sample Material	Paphies australis
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 120 seconds, rinsed and dried.

$\delta^{13}C$	2.1	±	0.3 ‰	(CRDS)
$D^{14}C$	-85.3	±	3.6 ‰	
$F^{14}C\%$	91.5	±	0.4 %	
Result	**716 ± 32 BP**			

Comments



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- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

Al Hogg

Charcoal Identification for Underground Cable sites in Maketu, Bay of Plenty

Report to
CFG Heritage, PO Box 10 015, Dominion Road, Auckland 1024

Rod Wallace
3rd July 2017

Raw Results

Maketu – F.1 – P.H. – S# 52

Hebe	6	C14 sample
Corokia?	3	

Maketu – F.1 – P.H. – S# 23

Hebe	2	C14 sample
Coprosma	2	C14 sample
Corokia?	8	C14 sample
Manuka	1	C14 sample
Kahikatea	2	

Maketu – F.1 – P.H. – S# 13

Hebe	2	C14 sample
Corokia?	1	C14 sample
Manuka	1	
Matai	1	
Kahikatea	1	

Maketu – F.2 – S# 49

Tutu	3	C14 sample
Hebe	6	C14 sample
Coprosma	2	C14 sample
Manuka	1	
Mahoe	3	
Pohutukawa	3	
Matai	6	

Maketu – F.2A – S# 33

Tutu	6	
Hebe	15	C14 sample
Coprosma	3	

Maketu – F.2 – S# 28

Tutu	2	

Hebe	4	C14 sample
Coprosma	2	
Manuka	1	
Mahoe	1	
Pohutukawa	1	
Matai	4	

Maketu – F.3 – S# 43

Tutu	2	
Hebe	1	C14 sample
Coprosma twig	2	
Manuka	1	C14 sample
Matai	4	

Maketu – F.2 – S# 38

Tutu	12	C14 sample
Corokia?	1	
Puriri	1	

Maketu – F.1 – P.H. – S# 18

Hebe	2	C14 sample
Corokia?	1	
Manuka	1	
Kahikatea	1	

Maketu – F.1 – S# 5

Hebe	3	C14 sample
Ngaio	1	
Pukatea	2	
Pohutukawa	1	
Beech	1	
Matai	4	

Maketu – F.1 – P.H. – S# 9

Coprosma	2	
Corokia?	1	
Matai	1	

Maketu – F.3 – S# 43

Tutu	2	C14 sample
Mapou	1	

Summary of Maketu Charcoal Results				
Species	**Plant type**	**# Samples**	**# Pieces**	**% Pieces**
Tutu	Small shrub or scrub sp.	6	27	74%
Hebe		9	41	
Coprosma		6	13	
Corokia		6	15	
Ngaio		1	1	
Mapou		1	1	
Manuka		6	6	
Mahoe	Broadleaf trees	2	4	9%
Pukatea		1	2	
Beech		1	1	
Puriri		1	1	
Pohutukawa		3	5	
Kahikatea	Conifers	3	4	17%
Matai		6	20	
Totals		**12**	**141**	

Discussion

These samples are dominated by small shrub or scrub sp. with 68% being either Tutu, Hebe, Coprosma or Corokia, small woody species that accompany bracken vegetation. The remainder are broadleaf and conifer trees. I would suggest the local vegetation was largely open bracken and shrubs with a few stands of trees.