The Mataraua site (U14/2351), Tauriko, Western Bay of Plenty

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and
Comanche Holdings Limited

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Introduction

Comanche Holdings Ltd are developing land for the creation of the Tauriko Business Estate, a commercial/industrial zone in the land bounded by the Route K Roundabout to the north, State Highway 29 to the west, Belk Road as far as Winterbre Lane to the south and the Kopurererua stream to the east. U14/2351 is located in this area on a north projecting spur to the north of Gargan Road (Figure 1). Works intended to borrow significant amounts of fill from the part of the hill on which the site was located. This report describes the archaeological investigation and analysis of U14/2351, which were carried out from 2–14 August 2007. Investigation was required as a condition of authority 2007/92 issued by the Historic Places Trust under Section 14 of the Historic Places Act 1993.

Background

A 1984 survey of the Bay of Plenty area recorded 14 sites in the development area. Only two of these sites, U14/2351 and U14/2361, were re-recorded in subsequent surveys by Bowers (1999) and Campbell (2004a) for earlier stages of the Tauriko Business Estate project. The 12 other sites were mostly findspots and scattered patches of midden that have been obscured over time, often through contouring for kiwifruit orcharding in the later 1980s.

A number of archaeological assessments have been conducted in the area, not all related to the Tauriko Business Estate development, as well as swamp coring (Bowers 1996, 1999; Campbell 2004a, 2004b, 2006a, 2006b). A 2004 assessment survey of the development area concluded that prehistoric occupation was probably short term and by small groups who were perhaps travelling up and down the plateau between the Kopurerua and Wairoa valleys (Campbell 2004a). It was suggested that kumara pits and other prehistoric occupation evidence may survive.

A historical assessment of the area was conducted by Arabin and Campbell (2004). This recorded that soldier settler Robert Farrell's 1870s house, destroyed by fire, was the only likely archaeological evidence of European settlement in the valley before the 20th century. Some remains of a tramline belonging to the Tauranga Rimu Company mill are still present on Lot 124 and other remains can be found in the nearby area. The opening of the mill dates to 1914 so, while it is not an archaeological site under the

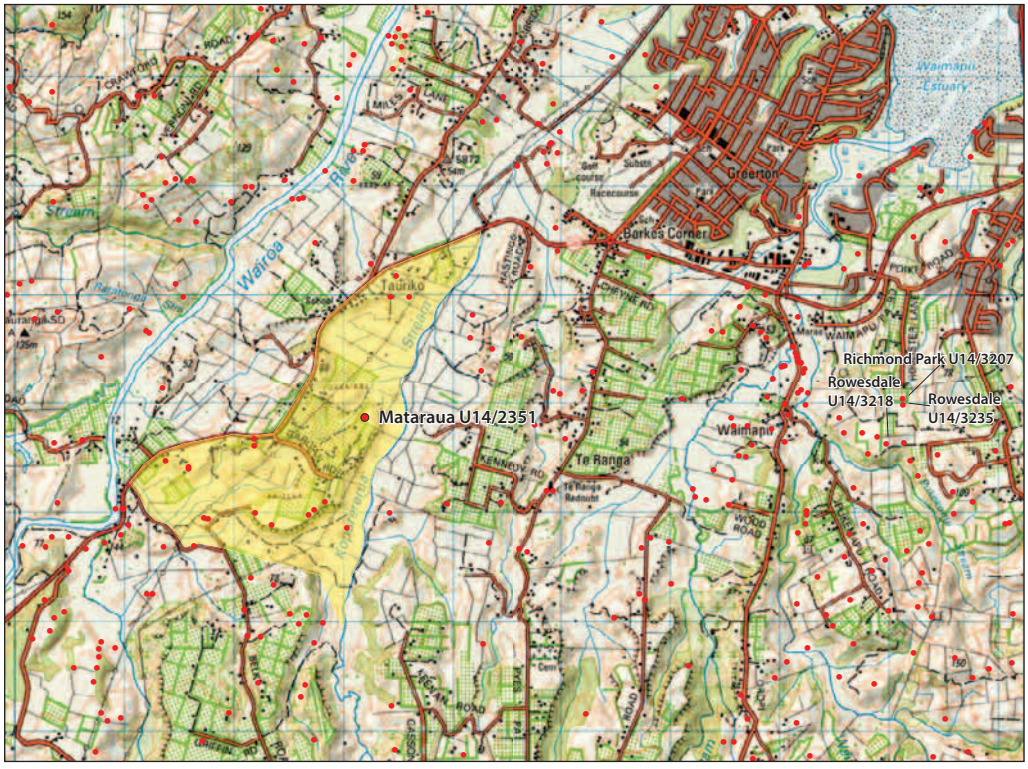

Figure 1. Location of Mataraua U14/2351 and the Tauriko Business Estate (approximate extent shaded yellow), showing other recorded sites in the general vicinity. Other sites mentioned in the text are labelled.

Historic Places Act, it is still considered part of the historic fabric of Tauranga.

Site U14/2351 had been recorded under the NZAA Site Record Scheme in 1984 as a "terrace feature partly cut into upper slope of ridge top 10 x 8m. No surface features evident… a further terrace directly below this which although appears to be natural has a 1.2m circular depression on it." Archaeological assessment in February 2006 (Campbell 2006b) found that the upper terrace was visible but the lower terrace was not.

Research Design

Of the 14 archaeological sites recorded in the Tauriko Business Estate area, only U14/2351 and U14/2361 are still visible. It seems that the others have been either destroyed or covered over by contouring for orcharding. As development proceeds some of these sites can be expected to be uncovered again, and new sites may be found, though monitoring of Stage 1 of the development in the north of the area revealed no archaeological material. The value of U14/2351 was seen to be that it was the first excavation in the area and so would be expected to provide a valuable insight into the kinds of archaeology to be expected in future, as well as identify the effects of contouring on archaeological sites.

Traditional History

The following history was supplied by Des Tata and Peri Hoko of Ngai Tamarawaho.

The general area around Mataraua has been occupied over the centuries by descendants of the people who arrived in Tauranga from Takitumu in Rarotonga during the 11th century. Prominent among these, ca AD 1700, was Nako whose descendant, Tahuri Wakanui, lived at Ranginui a

Figure 2. ML 541, Plan of Land Surveyed at Mataraua, Tauranga, *dating to 1865. The site is located on the spur at the top of the plan.*

Tamatea, a pa at Poike where the current Polytech stands. On his deathbed he told his children that they should move from Poike because of the domineering attitude of his sister, their aunt. Mokoroa moved to Puke Toromiro, a pa by the current Route K, in the lower Kopurererua Valley. Mataraua was part of his rohe and would have been associated with his gardens up the valley. He also gardened along Cambridge Road and near Greerton.

Maori Land Plan ML 541 shows the area still in Maori hands in 1865, though the survey was probably connected to the raupatu (confiscations) that followed the battles the previous year at Gate Pa and Te Ranga. The spur on which U14/2351 is located is clearly shown at the top of the plan. The plan confirms the name of Mataraua for the site.

Landform

The site is located on a spur at the north end of what is referred to by the developers as the "Gargan Plateau", a very flat topped area of some 1400 x 300 m, running north–south, intersected by Gargan Road. State Highway 29 runs along the western border of this plateau before the land drops away to the Wairoa Valley. To the east is the Kopurerua stream, which also feeds swampy ground to the north. South of the plateau there are again swampy areas feeding the Kopurerua and tributary streams of the Wairoa, with isolated hills rising out of the swamps. Though they were drained for agriculture, and have since been covered with several metres of fill as a result of the Tauriko Business Estate development, the swamps were very wet at the time of the June 2004 assessment survey.

The soils are the layered tephras typical of the Tauranga area (Briggs et al. 1996). These highly fertile soils are ideal for kiwifruit and the site had been contoured for kiwifruit orchards in the 1970s or 80s. Prior to this, however, the flat top of the plateau had been converted to an airstrip, which is visible aerial photos dating to 1959 (NZ Aerial Mapping SN 1218). A 1943 run of aerial photos (NZ Aerial Mapping SN 229) (Figure 3) shows the landform as it was prior to the airstrip. While the plateau is still very flat-topped, viewing a stereo pair of photos shows a defensive ditch at the narrowest point of the plateau, confirming that Mataraua was a pa. As the results of our excavations show, very little of the site remained.

Method

A hydraulic excavator was used to remove topsoil in areas A–E (Figure 4). Area A was a wide area at the northward tip of the plateau, bounded to the south by a shelter belt.

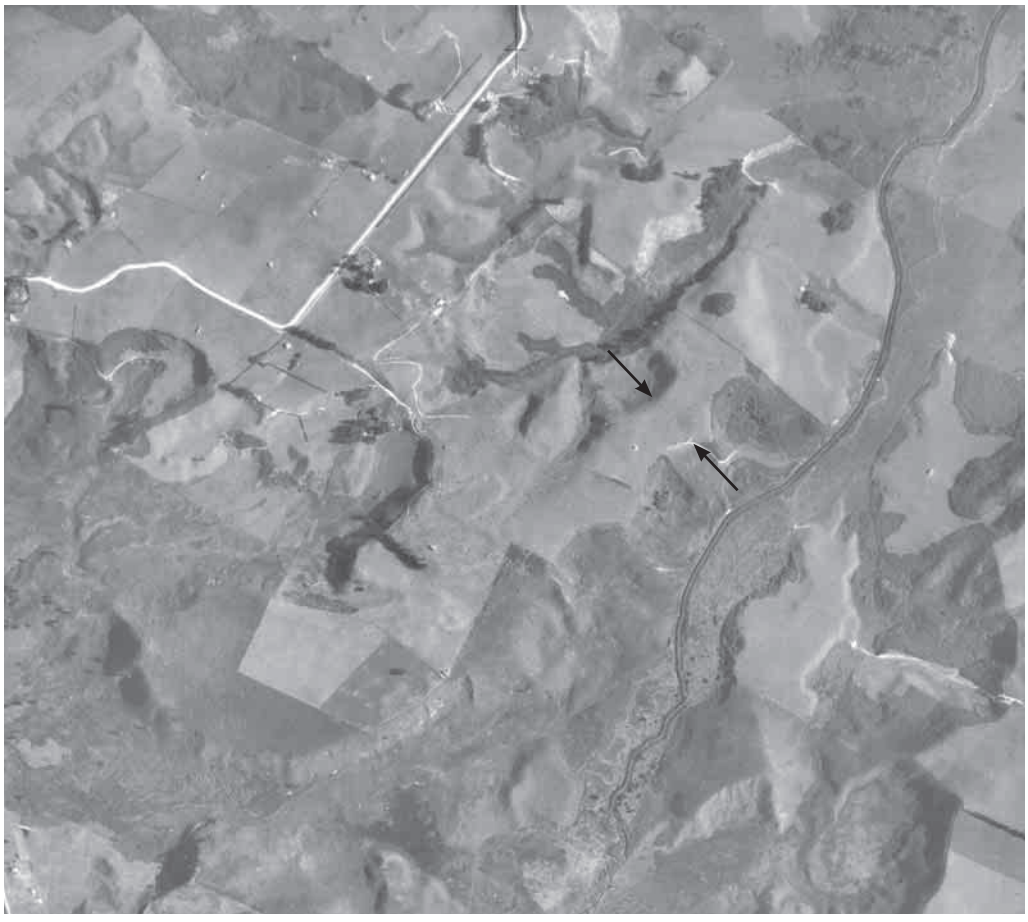

Figure 3. Aerial photo dating to 1943 (detail) showing the area of the site prior to any historic period earthworks. The defensive ditch, which is much clearer in stereo pair, is arrowed.

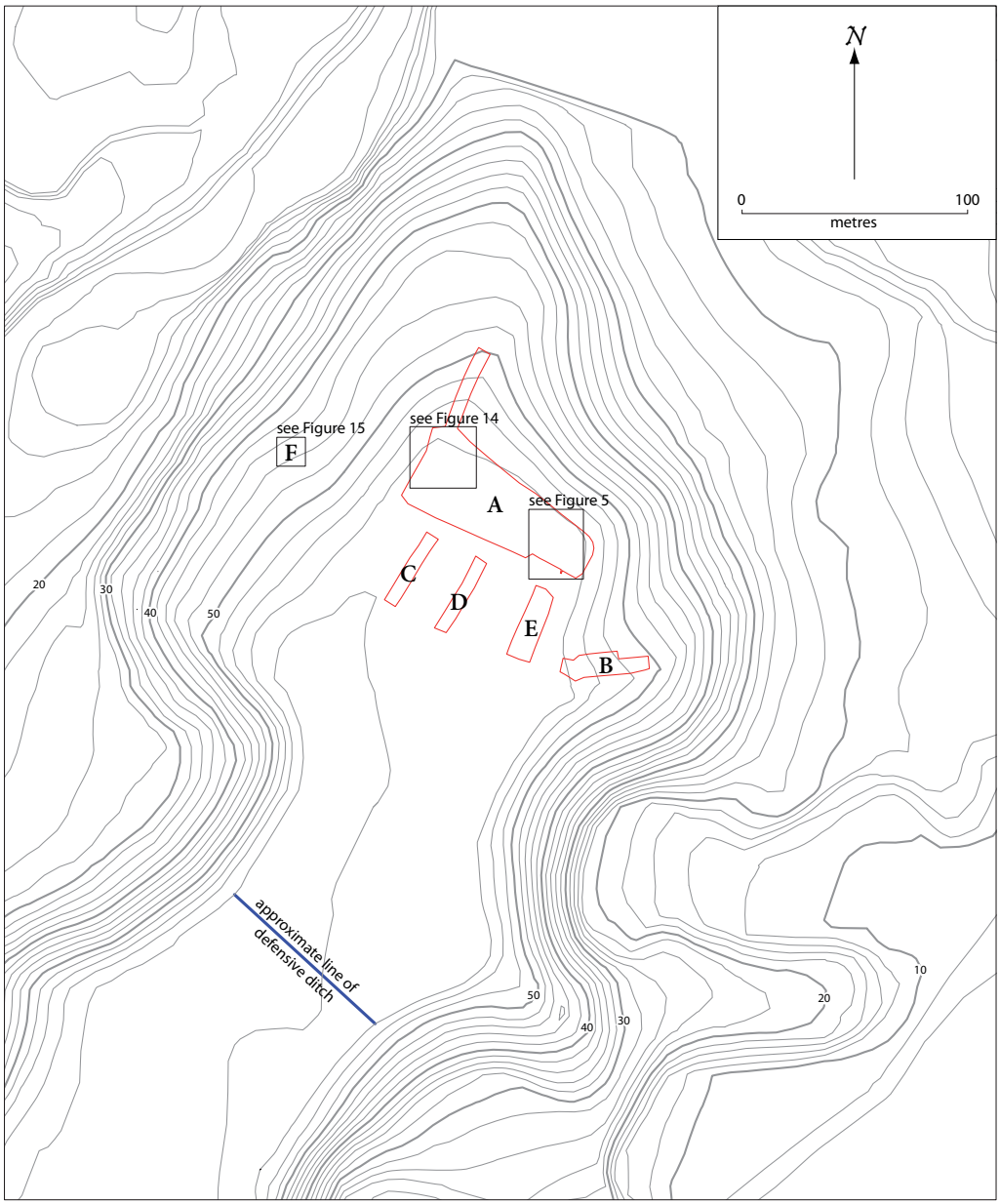

Figure 4. Site plan showing areas A–F. Contour interval = 2 m.

Area B was a small spur running east off the main ridgetop to the south of Area A. Topsoil on the level area on top of this spur was stripped with the backhoe. Areas C–E were three parallel areas to the south of the shelter belt, running north–south across the centre of the flat plateau. Topsoil was stripped off these areas with the backhoe.

Following topsoil stripping, portions of Area A and all of Area B were cleaned down by hand with spades and hoes to check for features in the subsoil. No potential features had been visible during the stripping of Areas C–E; the area south of the shelterbelt had clearly been most affected by the contouring undertaken for the orchards and airstrip. Bulldozer ripper marks were clearly visible in the subsoil once the thin redeposited topsoil had been removed. No further investigations were carried out in Areas C–E.

Two clusters of features were apparent in Area A: the eastern end (Area A East) and the northwest corner (Area A West). No archaeological features were noted during the topsoil stripping in the centre of Area A. It was not further cleaned by hand as it was expected that this area had been similarly affected by contouring as Areas C–E. Most features in Area A East were excavated fully or in half section, though a number of pits along the southern edge of this area were only partially excavated – in most cases a corner was excavated in order to find the base. In Area A West features were surveyed and their appearance on the

surface was recorded, but they were not excavated due to time constraints.

All features were recorded in Data on the Run on an HP IPaq 4750 handheld computer which was synchronised with an MS Access database on a laptop. Attributes recorded included feature type, fill dimensions and relationships to other features (Appendix A). Artefacts, when not within the fill of a feature, were also numbered on the same numbering system and surveyed individually. The excavation was mapped using a Leica 1205 robotic total station. Features were photographed with a digital SLR camera before, during and after excavation.

Most features were excavated only by hand, but when two particularly large pits were discovered (Features 122 and 123) the hydraulic excavator was used to remove the bulk of the pit fill and the walls and floor of the pit were then excavated by hand.

After the main excavation was completed, and bulk soil removal with heavy machinery had commenced, a series of nine oven scoops and an area of disturbed midden were found by tangata whenua monitors (Area F). This area were investigated by Matthew Campbell on 25 September 2007.

Two 10 litre midden samples were collected from the fills of oven scoops. No substantial areas of intact midden were found and few other features contained shell.

Results

Soil profile

The basic soil profile was a thin topsoil overlying recent tephras. In the Western Bay of Plenty these are usually mixed and cannot be distinguished, but at Gargan Road a yellow layer up to 200 mm thick, with occasional grey patches, possibly the Kaharoa tephra, overlay a red-brown tephra up to 300 mm thick, below which was a consolidated tephra-derived clay layer. Usually the sandy Rotoehu ash is found beneath the upper tephra layers (Briggs et al. 1996), but this was not encountered during excavation. However, this profile had been disturbed by contouring for kiwifruit orcharding in the 1970s and 80s. This had truncated the soil profile at the margins of the spur, exposing the red-brown tephra, as well as cutting down the central part of the spur by an unknown amount. It seem probable that archaeological features would have at one time been present to the south of the excavated area and the shelterbelt, but these have been contoured away. Over the area where archaeological features did survive, a mixed yellow tephra was in places redeposited over the contoured surface, initially obscuring the features after topsoil stripping (see Figure 11, for instance).

Area A East

Area A East was dense with inter-cutting pits of varying sizes. Three distinct phases of activity were discernable, though many features could not be phased with any certainty.

Phase 1

Phase 1 consisted of seven long rectangular pits laid out in parallel running north–south (Pits 33, 39, 40, 43, 64, 73 and 91), two smaller bin pits (Pits 76 and 83) associated with Pits 64 and 33 respectively, and one large pit, Pit 122, laid out on the same axis (Figure 5). There were wide spaces sufficient for walking between them, presenting a very regimented appearance. These pits, with the exception of Pit 122 and the bin pits, were much the same size and shape, ranging between 3300 and 4400 mm long and 1020 and 1700 mm wide (Figure 6). Their depths had been truncated by contouring and all were deeper in the southwest corner than the northeast as contouring had cut down towards the margins of the spur to the north east. All of the larger pits, except Pit 122, had a single row of two or three round postholes running along the midline. Pit 43 had a square sump in the northwest corner coming down to a flat clay base. Pit 39 had a step 300 mm wide and 550 mm high across its northern end.

Pits 91 and 43 were intercutting, but their sequence could not be determined. They were of similar dimensions and form to the other Phase 1 pits. In addition to three postholes along its midline, Pit 91 contained a small bell-shaped pit in its base (Pit 96). This had a round opening of 250 x 220 mm belling out to 450 x 420 mm under the surface and was 210 mm deep.

In two cases these large, long pits were associated with small bin pits. Beyond the southern end of Pit 64 lay a rectangular bin pit, Pit 76, which was 580 mm deep and oriented east–west. This pattern was repeated by the adjacent Pit 33 and bin Pit 83, 1130 mm deep. While the former bin pit was not as deep as its associated pit, the latter was considerably deeper than its associated pit. This pattern of a deep bin pit off the end of a long rectangular pit was been previously noted in the western Bay of Plenty (e.g., Campbell 2005).

Pit 122 was also aligned north–south, parallel to the other Phase 1 pits, though it was quite different in form and placed very close to Pit 39, i.e., there was no walking space between it and Pit 39. It is very likely, though not certain, that it belongs to Phase 1. It was the largest pit on site, measuring 5750 x 3600 mm (20.7 m^2) and was up to 1550 mm deep. At its base were 72 further features, including 66 postholes (Figures 7–9). Three rows of five postholes supported the roof. These were typically square (around 200 mm across and 230–700 mm deep) and some had round postmoulds visible within them. At the base of the southern wall was a large mound of earth measuring 2000 x 600 mm that appeared to have been packed in around the southernmost post of each row. This could have been

intended for added support or may have been a collapsed step (Figure 9).

The eastern wall of the pit was irregular and had suffered some collapse. Slots in the pit base, hard against the eastern wall, with post moulds in their fill and post impressions in the wall above them, indicated that a retaining wall had been built to support the pit wall (Figure 7). The rest of the base was dotted with stakeholes. Two groups of these formed rough lines running east-west across part of the pit base, suggesting the division of a 1300 x 1000 mm space in the northwest corner of the pit. A rectangular feature in the base of the pit against the western wall had the appearance of a sump, although it was only very shallow with a depth of 120 mm. The small irregular feature next to the middle posthole on the central line may also have been a sump.

Phase 2

The large, uniform pits of Phase 1 were in some cases cut into by later, smaller pits (Figure 5). For example, Pit 40 was cut into at either end by smaller pits which were oriented east–west (Figure 10). Both of these had two round

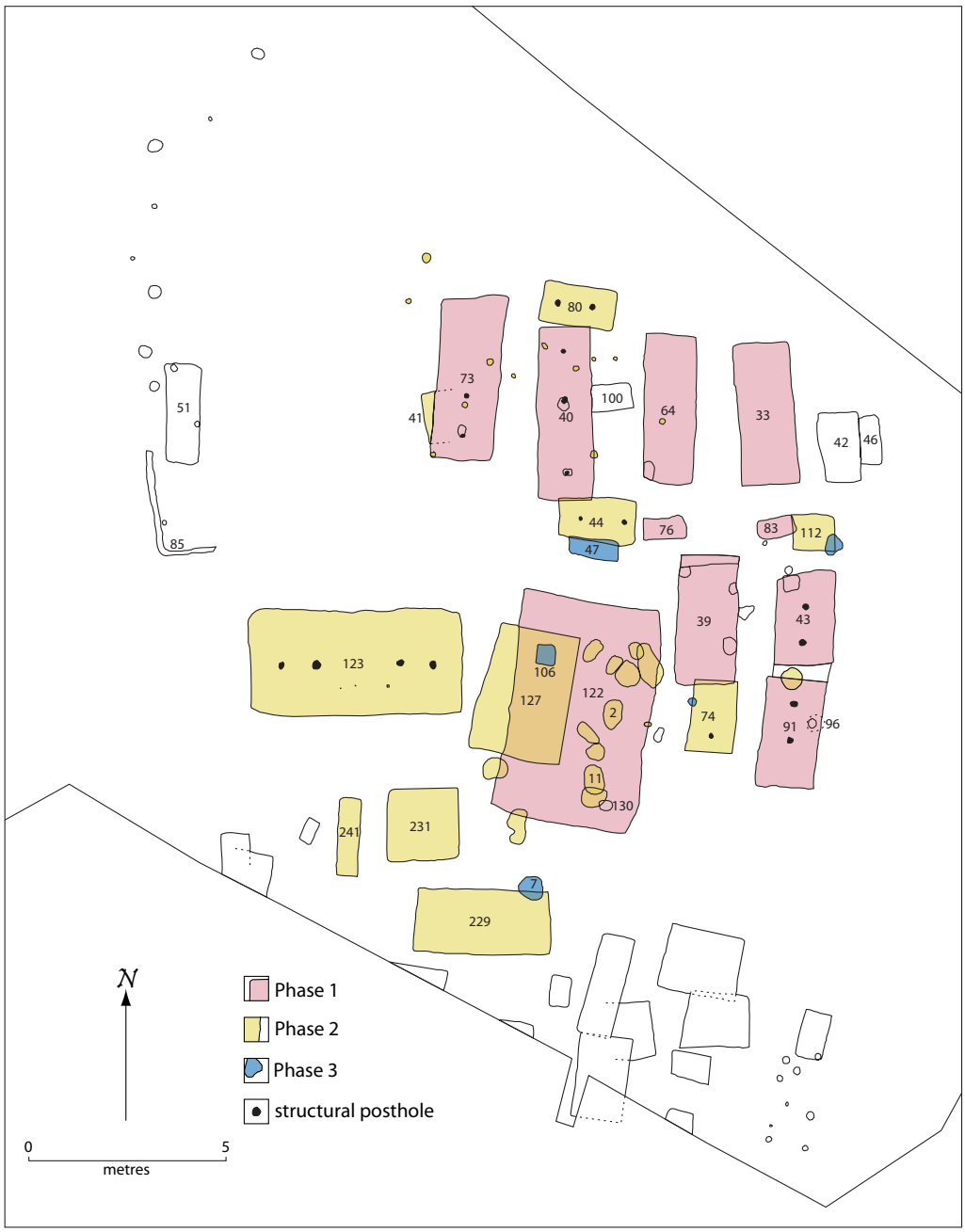

Figure 5. Plan of Area A East, showing phasing of the area. Pit 122 is shown in greater detail in Figure 8. Features mentioned in the text are numbered.

Figure 6. Feature 33, an example of the relatively uniform Phase 1 pits. Facing south, scale = 1 m. Note that some of the 'postholes' are tree root moulds.

Figure 7. Pit 122, the largest pit excavated. Pit 127 was partially dug into Pit 122 and can be seen on the left. In the top right are the slots for retaining wall with post impressions in the wall above them. Facing north, scale = 1 m.

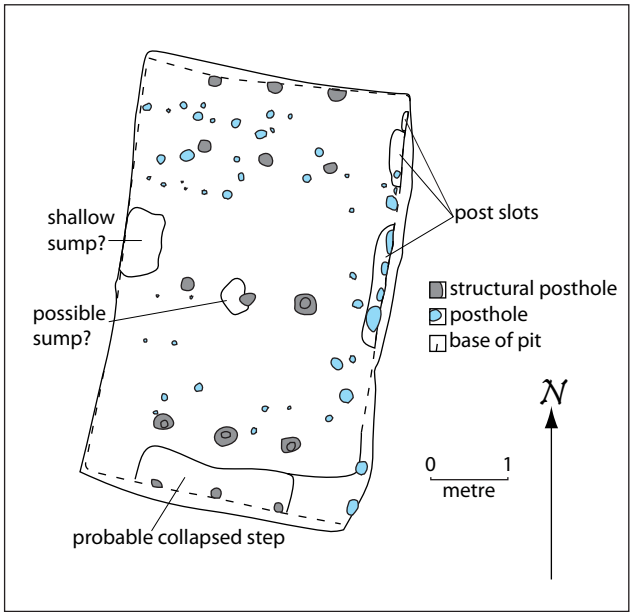

Figure 8. Plan of Pit 122.

Figure 9. Earth packed around postholes in the southern end of Pit 122, possible collapsed step. Photo taken facing south. This is the other end of the pit from the view in Figure 7; the same postholes are visible in the foreground of each photo. Facing south, scale = 1 m.

postholes along the midline. Pit 41 was cut into the fill of the large Phase 1 Pit 73. Only one edge of it, where it lay to the west of Pit 73, was clearly visible, with the fill of the two pits very hard to distinguish – it appeared to be roughly square in plan.

The second largest pit at the site, Pit 123, was also oriented east–west and probably belonged to this phase. It measured 5400 x 2800 mm (15.12 m^2) x 1200 mm deep, and lay close to the large Phase 1 Pit 122. Pit 123 had a single line of four deep postholes up to 800 mm deep along its midline and so was a much simpler feature than Pit

Figure 10. The large Phase 1 Pit 40, and the smaller Phase 2 Pits 80 (back) and 47 (front). To the right is Pit 64 and in the very foreground is the Phase 3 bin Pit Feature 47. Facing north, scales = 1 m, 0.25m.

122. This pit was largely obscured from the surface by the mixed layer of overburden that covered the southern portion of the site (Figure 11).

In Pit 123 a small piece of red ochre and a small obsidian flake were found resting on a thin layer of clay within the fill that initially appeared to be a floor. In Pit 122 a piece of obsidian was also found on a similar level of fill.

Pit 127 was a large, rectangular pit oriented roughly north-south, though a little out of alignment with the Phase 1 pits. It was partially dug into the fill of Pit 122 which made defining its north and east edges difficult. A minimum width measurement could be taken though because during excavation a large lump of clay fill in 122 could be seen to have been cut through on a right angle. Although it postdates Pit 122, it does not appear to have been exactly contemporary with Pit 123, since the very narrow gap between them would likely have been very unstable if both were open at the same time. Nonetheless

Figure 11. South wall of Feature 123. The layer of mixed yellow soil covering this area of the site is visible in the wall. Visible behind the feature is the strip that was re-scraped by the digger to clear this overburden. Scale = 1 m.

it is assigned to Phase 2. Pit 127 had been cut into by the later bin Pit 106.

Pit 112 was a square pit measuring 1050 x 950 x 750 mm deep. It cut through the Phase 1 bin Pit 83, and had in turn been cut into by a later oven scoop belonging to Phase 3.

Pit 74 was a very shallow feature cut into the top of the Phase 1 Pit 39. The yellow fill of Pit 74 was clearly visible in the fill and wall of Pit 39. While it had a definite cut at the northern end and appeared on the surface like many other pits, it was only 50 mm deep and was obscured at the southern end by disturbance and mottled black soils, probably as a result of pre-European activity rather than historic period contouring. One small posthole was found in its base. A later posthole cut into it.

Several other pits were also oriented on the same east–west axis and may well have belonged to Phase 2: Pits 229, 231 and 241 seem most likely to fall into this category though none of them had a definite stratigraphic relation to any Phase 1 features and not all features in the southern part of the area were excavated.

Numerous oven scoops and postholes were dispersed across Area A East. In many cases these cut into the surface of pits. Most of the oven scoops were clustered together and had been cut into the surface of Pit 122. Many appeared to have been raked out but Feature 2 contained crushed, burnt shell, charcoal and stones (Figure 12). Oven scoops were only found in the part of the site that was least contoured, so there may have been more across the rest of the site that have since been contoured away while postholes, which tend to be deeper, had better survival. A 10 litre midden sample was taken from Feature 11, one of the ovens scoops overlying Pit 122, for analysis and radiocarbon dating.

A group of postholes, several of them overlying the Phase 1 Pits 40, 64 and 73, appeared to be related as they were of similar dimensions and contained the same pipi (*Paphies australis*) shell fill. These were clustered in the north of the area, along with several other small postholes without the shell, but no alignments were obvious.

A cache of river cobbles, Feature 130, was dug into the surface of the fill of Pit 122. There was no sign of burning in either the feature or the stones in it. This cache of stones weighed 15 kilograms and was 300 mm below the surface of the pit.

Altogether, Phase 2 presents a less tidy picture than Phase 1 with its very regular pits. Not all the features assigned to it would necessarily have been contemporaneous – the majority of them cut Phase 1 features while others were assigned to Phase 2 on the basis of their orientation.

Later phases

Some Phase 2 features were cut into by other features, representing later activity at the site. Although these did not form such coherent groups as the first two phases, they are for convenience referred to as Phase 3. Pit 47 was a narrow rectangular bin pit oriented east–west and similar in appearance to the Phase 1 bin pits. It belongs to a later phase though, since it cut through the Phase 2 Pit 44.

One oven scoop, Feature 27, overlay a definite Phase 2 feature, Pit 112 and another, Feature 7, cut into the possible Phase 2 Pit 231. A posthole filled with charcoal stained tephra and burnt crushed shell cut through the Phase 2 pit 74 and the rectangular bin Pit 106 cut into the fill of a pit that was cut into Phase 1 Pit 122. Pit 106 also contained charcoal stained tephra and burnt crushed shell.

Figure 12. Oven scoop Feature 2, excavated in half section. Facing west, scale = 0.5 m.

Undetermined phase

Several features remain that cannot be assigned to a phase. Features 46 and 42 belong to consecutive phases; 42 cuts through 46. It may be that 46 belonged to Phase 1 and 46 to Phase 2, though this is uncertain as they are not typical of those phases. Pit 100, another rectangular bin pit, intercut with Pit 40 but their fills were difficult to distinguish.

To the north west of the area were the remnants of a probable house (Feature 85) (Figure 13). It was outlined to the south and west by an L-shaped footing trench defining two walls of a structure. The floor was outlined by a mottled grey/yellow fill that partly overlay Pit 51, another unphased pit, to its north. It was very shallow and its edges were clear in some places but not in others. This floor contained a cluster of artefacts: one small basalt adze and 13 obsidian flakes. A line of oven scoops and postholes to the

Figure 13. The possible house floor where the adze and cluster of obsidian flakes were found. In the foreground is the L-shaped footing trench, Feature 85. At the back is the partially excavated rectangular pit, Feature 51. Facing north, scale = 1 m.

north of this feature were also not phased and their relationship to the house floor is unclear.

There was a clear cluster of postholes in the south east corner of the site. These had a similar fill to each other, a dark mixed topsoil and tephra, and were of similar dimensions. They were not excavated due to time constraints; none of them overlay other features.

Once it could be seen that there was a mixed layer of overburden obscuring many features, the hydraulic excavator was used to remove a further 150–200 mm from the south east border of the excavation area. This revealed many more small pits. Most were not similar in appearance to those already excavated. They can roughly be grouped according to shape: square pits; long, narrow pits oriented north–south; and small, rectangular pits. A further five pits here were only just visible protruding from the southern baulk. Some of the pits intercut with each other but unfortunately the homogeneity of their fills obscured their sequence.

Area A West

This area was not fully investigated; time constraints meant that features were recorded from their surface appearance, and mapped (Figure 14).

Nine pits were visible here, of differing sizes and orientations. None intercut another and it seems probable that they all belong to a single phase. Pits 129 and 131 were two large pits 5000 x 2200 mm (11 m^2) and 5000 x 1500 (12.5 m^2) respectively, oriented northeast–southwest parallel to each other. Nearby, the smaller Pit 132 was also parallel to these. Features 136 and 137 were small square pits and 135 and 148 were small and rectangular. Features 133 and 134 disappeared into the baulk. The chronological relation between this and Area A East is not known. It can be tentatively suggested, based only on their orientation, that the Features 129 and 131 were created during Phase 2 of Area A East.

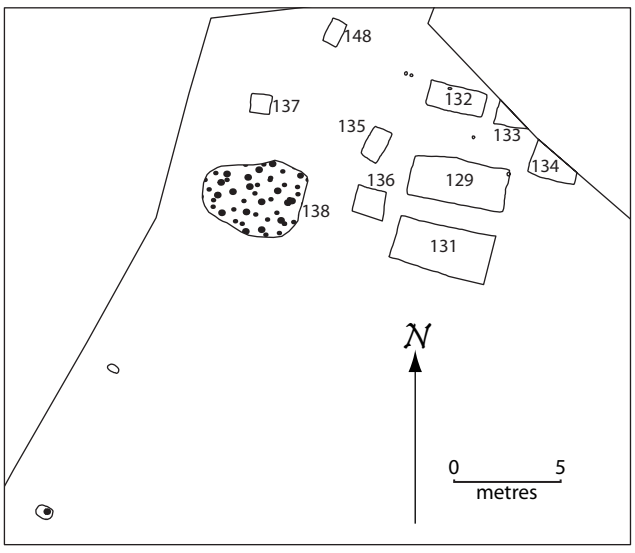

Figure 14. Area A West. Features mentioned in the text are numbered.

A rough line of five round postholes along the northern border of the site contained a very dark soil and shell midden fill. These overlay pits 132 and 129.

Feature 138, was a 4 x 5 m oven scoop filled with very black, charcoal stained soil containing a large number of obsidian flakes; 20 were collected altogether. The flakes were surveyed and gathered from the surface of the feature and more were recovered when a 1000 x 600 mm section of the feature was excavated. It also became clear that this feature sat on top of a pit: once the scoop of blackened material was removed, a pale brown fill was encountered. This was 200 mm deep and came down to a flat clay base.

Two small oven scoops (Features 125 and 126) were excavated along the western border of the site.

Area B

Area B was a small spur running east off the main ridgetop to the south of Area A. This seemed like a likely place to find archaeological evidence. Topsoil on the level area on top of this spur was stripped with the backhoe, over an area measuring 40 x 10 m. The area did not appear to have been contoured but no archaeological features were observed.

Areas C, D and E

Areas C, D and E were three strips running south of Area A, on the other side of the shelterbelt, each about 35 m long. Topsoil was stripped with the backhoe but no archaeological features were observed. This area seemed to have been heavily truncated by contouring and bulldozer ripper marks were clearly visible in the subsoil.

Area F

Area F consisted of nine oven scoops and a patch of disturbed midden on a small, north-facing, natural terrace down slope to the north west of Area A. The terrace measured approximately 20 x 4 m, running east–west, with the midden located on the slope to the north (Figure 15). The oven scoops ranged in size from 450 x 400 mm to 900 x 850 mm. Feature 284, which was one of the better preserved features, was excavated in half section and a 10 litre midden sample was taken. Feature 284 had straight sides 110 mm deep and the base had a maximum depth of 220 mm. Some burning of the soil was observed in the base (Figure 16). The fill consisted of fairly clean whole and broken shell overlain by dark, charcoal stained soil, implying that the oven had been raked out and subsequently refilled with clean midden.

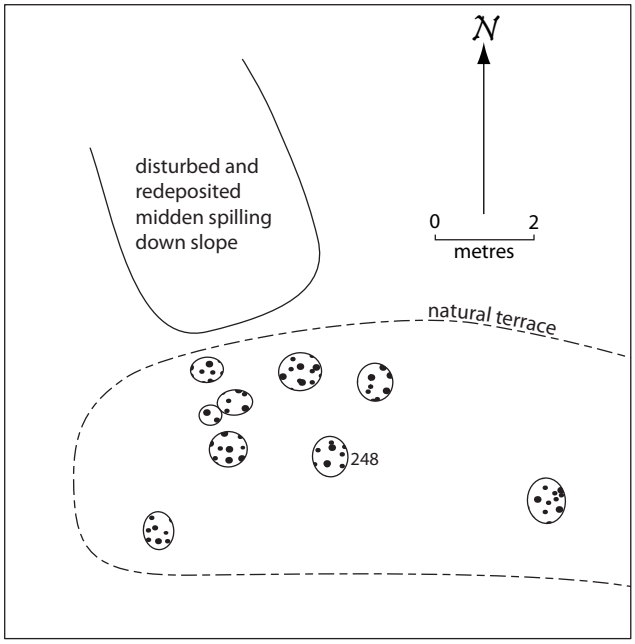

Figure 15. Area F. Features mentioned in the text are numbered.

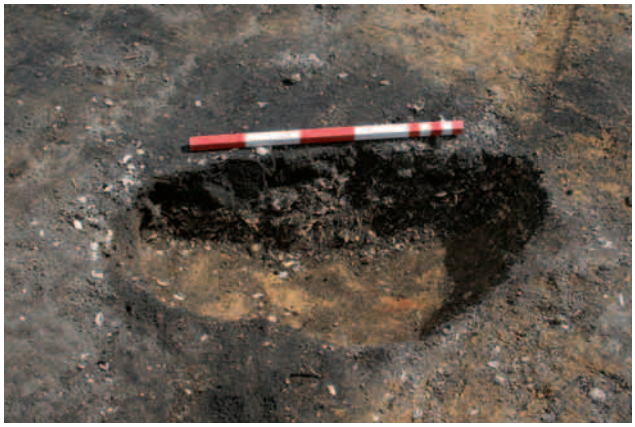

Figure 16. Feature 284 excavated in half section. Facing west, scale = 0.5 m.

Stone artefacts

Marianne Turner, Anthropology Department, University of Auckland

Forty seven obsidian artefacts, one small adze and a piece of kokowai (red ochre) were recovered from the site.

Obsidian

Details of form (Table 1), shape and size were recorded along with manufacturing details and use wear patterns. Each piece was weighed, but measurements were assigned to 10 mm size classes based on maximum dimension.

All pieces were green in transmitted light and can be sourced with confidence to Mayor Island, about 25 km from Tauranga Harbour by sea. As is typical for obsidian from this high quality source, there was very little cortex (weathered outer surface).

	number	%
Cores	1	2.1
Angular fragments	7	14.9
Shatter	4	8.5
Flakes	35	74.4
Total	47	

Table 1. Obsidian artefacts by type.

Cores

Cores are pieces from which flakes have been struck for use as various tools. They usually have flake scars on at least two surfaces. When cores get below about 40–50 mm maximum dimension they become difficult to hold or position in order to strike off flakes effectively and are then described as exhausted.

The single core was small and could be considered exhausted. It had at least four striking platforms from which flakes were struck with sides showing multiple scarring where flakes had been removed.

Angular fragments

Angular fragments are pieces that are not flakes, that is, they lack characteristics like a striking platform or a clear dorsal and ventral surface with a bulb of percussion. They generally have a blocky appearance with flat surfaces. There is a possibility that some are broken pieces snapped from cores but the evidence of flake removal is not conclusive, usually due to breakage.

In experiments reducing three obsidian cores into useable flakes, the frequency of angular fragments produced was low. In several of the obsidian assemblages from the lake-side village at Kohika in the Eastern Bay of Plenty, dating to the later 16th century (Irwin and Jones 2004), a little later than Mataraua, and where all the obsidian also came from Mayor Island, frequencies of angular fragments are considerably higher (Holdaway 2004), similar to Mataraua, suggesting they were being produced from some other process than flake production. Probably large pieces were being broken up quite violently to produce small more manageable and better quality cores.

Shatter

Shatter is defined as tiny flakes or broken pieces of flakes less than 1 gm in weight and often less than 10 mm maxi-

mum dimension. They are generally created during flake strike, while retouching edges, or while trimming striking platforms on cores and are too small to hold adequately for any type of use. Experimental evidence shows that large numbers of these are generated during flake manufacture but many are very tiny and would slip through even the finest of sieves. The result for Kohika (44.7%, Holdaway 2004) is an example of what could be expected from an excavated sample where all material is carefully screened. In the contrast the results for the Mataraua assemblage is low, probably reflecting sampling procedures in the field.

Flakes

The majority, if not all, of the flakes have been struck deliberately from cores.

Analysis of the Kohika 2007 obsidian assemblage showed a high correlation between flake breakage and flake use (M. Turner, unpublished data). In the Mataraua assemblage the frequency of broken flakes was quite high (27.6%), notably higher that the experimental result but not as high as that for Kohika (64.1%). A high frequency of flakes exhibited visible modification (88.6%) a little higher than for Kohika, in both cases, mostly, if not all, the result of human activity during the occupation of the site (as opposed to more random processes like trampling during the site's occupation or historic period agricultural practices). The majority of flakes that had no visible modification were small, 20 mm or less in maximum length, but many of these had fine edges that would have been ideal for fine cutting, a use that leaves no visible edge modification (Table 2).

Flakes were often snapped deliberately for a variety of reasons. Snapping creates instant sharp corners that were sometimes then retouched to create points. Another common reason for snapping was to provide a flat surface or 'backing' for resting the finger when using the opposite edge. The edges of this snapped surface are often blunted to further aid handling.

The largest flake was 60 mm maximum dimension. Most of the flakes fell between 20 and 40 mm maximum size. This data corresponds quite well with the core size and the dimensions of flake scars on its surfaces.

Degree of Use	40–60 mm	20–30 mm
None	0	4
Very Minor	1	4
Minor	4	10
Moderate	5	6
Heavy	1	0
Total	11	24

Table 2. Obsidian relationship between flake size and use.

Correlated with the degree of use wear, there was a clear pattern where the degree of modification increased with flake size. Only four flakes had no visible edge modification and they were all in the 20–30 mm size class. All the flakes 40 mm and over had modification with over half displaying moderate to heavy use wear (Table 2) compared with only 30.4% of the 20–30 mm sample showing moderate use wear and none showing heavy use wear.

Manufacture

No flakes, chunks, cores or shatter had any cortical evidence on their dorsal surfaces, supporting their original extraction from large non-cortical parent material. There is further support for this in that only three flakes have plain dorsal surfaces, that is, they show no flake scars from previous flake removal. The remainder are made up of flakes showing multiple scarring and those showing minor scarring in equal numbers.

Use wear/modification

The number of obsidian pieces exhibiting post-manufacturing modification in the assemblage is high (88.6%) and the range of edge modification is wide (Table 3). This variation may relate both to a range of uses and to different degrees of use.

With obsidian, which is ideally suited to the cutting of soft materials, some uses will leave no visible or even microscopic damage. From experimental evidence, different uses, for example, cutting, scraping and sawing, can result in similar edge modification. The size of the flake and characteristics of the edge such as its shape and edge angle will also influence both how it is used and the resulting edge modification. New Zealand flake tool assemblages are not generally characterized by formal types of tools (Jones 1972; Shawcross 1964) thus the employment of functional labels such as 'scraper' and 'knife' can be misleading. Commonly flakes and pieces can exhibit a diverse range of modification. This might reflect a multi-purpose tool, or edge rejuvenation and re-use for the same or a different purpose. It can also be difficult to identify the working edge or end from modification to aid handling. When a tool has subsequently broken as a result of use or post-depositional processes, these difficulties are even greater.

Below is a description of the different types of edge modification as outlined in Table 3, and their possible functions.

Type 1: minor edge modification. The four flakes in this category have light serration probably most commonly from careful cutting of soft materials against a hard surface like an anvil.

Type 1a: minor edge modification with backing. Four of the seven flakes in this category have only light serration

Type	Description	flakes	angular fragments
Type 1	minor edge modification	4	0
Type 1a	type 1 with backing	7	0
Type 2	sharp pointed edges	2	3
Type 3	retouch and use wear	3	1
Type 4	retouched Points	1	0
Type 5	heavy edge wear	0	1
Type 5a	pecking tools	0	1
Type 6	multiple modification	8	0
Type 7	knives	1	0
Type 8	natural sharp edge	3	0
Total		29	6

Table 3. Use wear and Modification

consistent with cutting soft materials gently against a hard surface. Three others, however, have heavier damage with steeper serration characteristic of scraping, probably of wood.

Type 2: basic points/projections. These are sharp projections that were created either by snapping one or two sides to create sharp junctions, or are natural sharp projections at flake corners. Three flakes and two angular fragments in this category are generally sharp with delicate tips and their most likely function is in muka (flax) preparation. Finishing touches on delicate/intricate wood carving is also possible.

Type 3: retouched edges overlaid with use wear. As for Type 1 but more heavily used with rejuvenation of the edges when they get too blunt. Subsequent use wear on the three flakes and one angular fragment ranged from heavy serration to crushing and fracturing. Sawing of bone is probably a major use where edges are straight.

Type 4: retouched broken points. More robust points, deliberately shaped. Often they are broken and when the working end is missing, their function is unclear.

Type 5: heavy modification of edges. Edge damage comprises major fracturing and shattering of the edge. Function is not precisely identified but seems to indicate damage from impact rather than just pressure. Possibly crushing or use against a hard surface like an anvil.

Type 5a: pecking tools. Heavy damage, usually at thick corners or edges with the edge generally further flattened by chipping, crushing and bruising. This damage suggests targeted impact like regular tapping and pecking, but not with a huge degree of force. The crushing of seeds on an anvil is an example that would cause this sort of damage.

Type 6: multiple modification. These flakes exhibit a combination of different types of modification as outlined above, indicative of quite complex use histories. These artefacts suggest different functions relating to the particular task at hand. They could also represent episodes of re-use at different times, and this does not necessarily suggest use by the same person though this may have been the case. Some of this modification is related to improving handling. Almost all eight flakes had a combination of pointed sharp projections at the corner and sharp edges that had some fine serration. Five had been snapped to improve handling, several with additional blunting and retouching. One flake was also notched to one side suggesting three types of use: cutting, scraping and incising.

Type 7: knives. This is a rare example of what appears to be a consistent and deliberately constructed form, with a distinctive fine curved edge leading up to a sharp point. The opposite edge is usually snapped to provide a back for handling. The working edge is generally fine and sharp.

Type 8: sharp edges. These are flakes with good sharp fine edges that nevertheless show no visible signs of use but the potential exists for use in the cutting of soft materials that would leave no use wear. A most likely use is in the preparation of flax fibre.

Discussion

The range of edge modification outlined above suggests a range of activities was taking place at the site, including bone sawing, wood working and the cutting of soft materials like flax. Heavier damage on some of the flakes and angular fragments suggest activities involving crushing and pounding.

Some of these pieces had evidence of multiple use and/or modification for handling suggesting prolonged use and

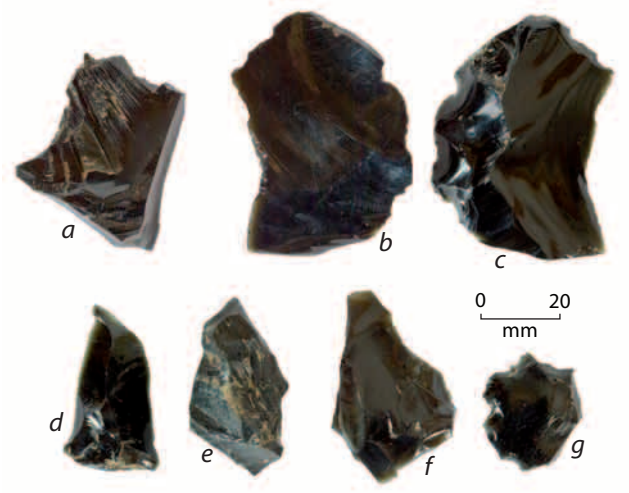

Figure 17. A selection of obsidian flake artefacts: a, large flake with snapped edges; b and c, large flake with use wear and retouch on several edges on both sides; d, knife-like flake; e, exhausted core; f, flake with notching and edgewear; g, probable scraper with heavy notching and retouch.

reuse. It must be remembered that often the flakes were being used to make wooden tools that do not themselves survive into the archaeological record, that is, the flakes were not the end product but a means to the end. Patterns of reuse indicate that flakes may have been returned to stockpiles for later use, often resulting in complex histories of multiple use – eight of the 29 flakes had signs of multiple modification. Obsidian was the only stone type recovered, other than the basalt adze, and so would have been put to multiple uses.

Despite being a relatively small sample, the Mataraua assemblage shares many affinities with the settlement of Kohika. A similar range of activities are represented, as well as similar approaches to the production of cores, flakes and other pieces for use. Part the value of obsidian was its flexibility, in that it was very easy and fast to flake, retouch and modify according to needs. Smaller cores were likely to be close at hand for everyone should they need a fresh sharp flake.

The manufacture of artefacts from wood and fibre is indicated, such as the making of clothing and cords and the smoothing of wooden handles. These activities are time-consuming and thus more likely to be undertaken in a semi-permanent settlement context.

Other Stone Artefacts

Two other stone artefacts were recovered. A small piece of red ochre (kokowai) was recovered from Pit 123. This material was commonly used as a colourant on a variety of surfaces, including the human body.

The other stone artefact is a small adze 61 mm long with a blade width of 26 mm, poll width of 22 mm, thickness of 12 mm and a weight of 45 g. It was recovered from the surface of Pit 51 (Figure 5).The cross-section is rectangular with the front marginally wider than the back. The stone material is Tahanga basalt from the major adze quarry at Opito on the Coromandel east coast.

Functionally the adze is more like a chisel. The grinding and haft polish on the flat poll indicates that it was probably slotted into a socketed haft in the manner of an ordinary adze, not an in-line haft as is sometimes employed with chisels and gouges. The blade is in good workable condition though it is higher at one corner due to previous repair of a corner chip, the remnants of which are still visible. In its present state it would have been useful for a range of light chopping tasks.

The adze has been reworked from a piece from what was once a much larger adze. The poll was once part of the fractured surface when the original adze broke. Reworking flake scars struck down from this broken surface can still be seen on the front. The back also shows a remnant flake scar probably related to its reworking into this much smaller adze. Otherwise the adze is well ground.

Figure 18. The Tahanga basalt adze.

This adze in one form or other may have had a long use-life. Use of the quarry at Tahanga ceased around AD 1500 but the adzes made up to that time continued to be used, repaired and reworked for at least several hundred years (Turner 2000: 275–280) until their reduced size meant they were no longer usable.

Midden

Two ten litre midden samples were retained for analysis. These were taken from Feature 11, an oven scoop from Phase 2 in Area A East overlying Pit 122 (Figure 5), and Feature 248, an oven scoop in Area F (Figure 15). Each sample was air dried, weighed, wet sieved through a 2 mm mesh and redried. Weight loss through wet sieving (in other words, the amount of soil sieved out of the sample), as a percentage, is used to quantify the density of the midden, that is, how much material there is in the sample and how much of it is shell. These statistics are shown in Table 4. In this respect the two samples are very similar, with between 44 and 49% of dry weight made up of soil.

Context	Dry weight (g)	Sieved weight (g)	% weight loss
F11	9740	4953	49.2
F248	9450	5267	44.3

Table 4. Weight statistics for midden samples.

Shells were identified to species level following Morley (2004). Minimum numbers of individuals (MNI) were calculated for bivalves by dividing the total count in half. Each species was weighed and uncountable residue was also weighed. Table 5 gives the species composition of the samples. While the two samples are dominated by pipi (*Paphies australis*) there are some clear differences between them. The only other species in Feature 11 was cockle but in very small amounts, while in Feature 248 cockle comprised nearly 9% of the sample by weight and 10 other species were identified, though only in very small quantities. Approximately 20% (estimate) of the pipi from Feature 11 showed signs of burning, while only about 5% of the pipi from Feature 248 was burnt. Feature 248 also contained small quantities of stone and charcoal, which were not evident in Feature 11. Uncountable residue accounted for 40% of the Feature 11 sample, but 60% from Feature 248. This shows that, although the Feature 11 shell was more burnt, the Feature 248 sample was more fragmented. This fragmentation may not reflect any prehistoric processes however, as Feature 248 was directly exposed by heavy machinery, which will certainly have affected the shell.

Context	Taxon	Common name	MNI	weight	%weight
F11	*Paphies australis*	pipi	639	2886	58.3
	Austrovenus stutchburyi	cockle	72	47	0.9
	Residue			2020	40.8
F248	*Paphies australis*	pipi	1526	1618	30.7
	Austrovenus stutchburyi	cockle	660	462	8.8
	Macomona liliana	large wedge shell	4	2	0
	Nucula hartvigiana	nut shell	1	1	0
	Chiton sp	chiton	1	1	0
	Cominella adspersa	speckled whelk	10	10	0.2
	Cominella glandiformis	purple mouth whelk	8	2	0
	Zeacumantus lutulentus	horn shell	3	1	0
	cf. *Xymene ambiguus*	large trophon	1	1	0
	Zethalia zelandica	wheel shell	1	1	0
	Turbo smaragdus	cat's eye	1	1	0
	Diloma subrostrata	mudflat top shell	1	1	0
	small gastropods		5	1	0
	Residue			3165	60.1

Table 5. Species composition of midden samples.

Of the 12 species identified, only the single wheel shell (*Zethalia zelandica*) from Feature 248 would not be found in the mudflats of Tauranga Harbour and its arms. However, the 10 other minor species from Feature 248 are represented in such small numbers that they are either an accidental by catch or, as is more certainly the case for the wheel shell, were already dead when they were picked up. Pipi and, to a lesser degree, cockle were the main target species. This is typical for sites around Tauranga Harbour. For instance, at Rowesdale (Campbell 2005) from 11 samples pipi accounted for between 22 and 89% of the catch (by number), with cockle making up most of the balance (two adjacent samples contained 17% tuatua (*Paphies subtriangulata*), an open beach species). At Oropi Downs (Campbell and Hudson 2008) pipi made up to 95% of most samples. In contrast, from the Papamoa Gateway site the midden is dominated by the open beach species tuatua and ostrich foot (*Struithiolaria papulosa*) with pipi making up 12% by weight at most (CFG Heritage report in preparation). The species composition of these middens is determined by the local environment, with little or no shellfish being moved between environments or within different groups of people.

Chronology

Two shell samples (pipi, *Paphies australis*) were submitted for radiocarbon dating from Features 11 and 248. The results are shown in Table 6. These dates, roughly AD 1450–1650, are typical of sites in the valleys south of central Tauranga. While three phases of occupation were evident in Area A East we would not expect these phases to be far separated in time, in fact all the occupations represented could have occurred within a decade or less.

Discussion and conclusions

Dates in the AD 1450–1650 range are typical of sites in the valleys leading south from Tauranga Harbour (Campbell 2005; Campbell and Hudson 2008). This contrasts with dates from the Papamoa dunes, which regularly fall within the range AD 1450–1750. These results confirm the general pattern of expansion away from the Tauranga Harbour in the late 15th century both inland and along the open beaches to the east. Inland occupation ended after 200 years at the most, while Papamoa was occupied for a further 100 years, ending when invasion by Ngaiterangi led to a change in settlement pattern (Campbell 2008). In contrast, it seems more likely that inland occupation ended

Context	Lab number	CRA	$\delta^{13}C$	cal AD 68%	cal AD 95%
F11	Wk 24223	762 ± 35	1.3 ± 0.2	1480–1620	1450–1660
F248	Wk 24222	797 ± 35	1.5 ± 0.2	1450–1570	1430–1650

Table 6. Radiocarbon dates from Mataraua. Calibrated ages are given at both 68% and 95% confidence intervals.

as the human-induced environmental changes rendered the valleys increasingly unproductive. It is not clear where populations moved to, perhaps further inland.

These dates indicate occupation of Mataraua prior to the time of Nako, Tahuri Wakanui and Mokoroa though the Ngai Tamarawaho ancestors of these people are likely to have built and occupied the site. Only a small part of the original site, defined by its defensive ditch 200 m to the south (Figure 4), was excavated and so we have only a snapshot which is not necessarily typical of the larger site.

A 200 m long site is quite large – we refer to it as a pa on the basis of its having a defensive ditch and the site would have been quite easily defended with steep slopes on the other three sides. We weren't able to relocate the ditch, which lies outside the current area of development and we aren't sure how well it survives, if at all. When and if the ditch is ever located we may be able to say something more about the defences: were they strongly built or just for show? There was no evidence of any palisading or terracing to the west, north or east of the excavated area so it seems likely that the site was not strongly defended. Instead, it could more accurately be described as an occupation site, with a ditch and, presumably, fence at one end to mark the extent of the settlement and control the movement of people. Of this occupation, we have 45 pits and one probable house remaining, with two quite distinct phases of use and evidence of subsequent use after Phase 2. The full site would have been much more complex, evidence of a wider range of activities, more phases, not necessarily clearly related, and possibly a greater range of dates. But it seems likely that we would still refer to it as an occupation site rather than a pa. The stone artefacts recovered, though small in number, indicate that a wide range of activities were taking place on site including wood and bone working and flax preparation. These domestic activities reinforce the interpretation of the site as an occupation.

Pit 122 is the largest and most complex feature on site. It is the only feature containing more than one row of structural posts – it has three rows of five posts; it is the only pit to have so many other features cut into its base; and it is the only pit with clear subdivisions within it. The other pits on site, particularly the Phase 1 and some of the Phase 2 pits, all tend to be very long: Pit 40, for instance, is 4410 x 1400 mm, a ratio of 1:3.15. Pit 122 has a much wider length to width ratio of 1:1.64. The length to width ratios of all pits in Area A East are shown in Figure 19. Although several pits are small bin pits and several are very square, of the larger pits Pit 122 stands out.

Other sites in Tauranga also contain a single large, wide pit that stands out from other pits on site. At the Richmond Park site, U14/3207, in the Ohauiti Valley, Pit 4, measuring 4500 x 2600 mm, had two rows of three postholes that had been dug out at the end of the pits life leaving square postmoulds, indicating that the posts were deliberately shaped

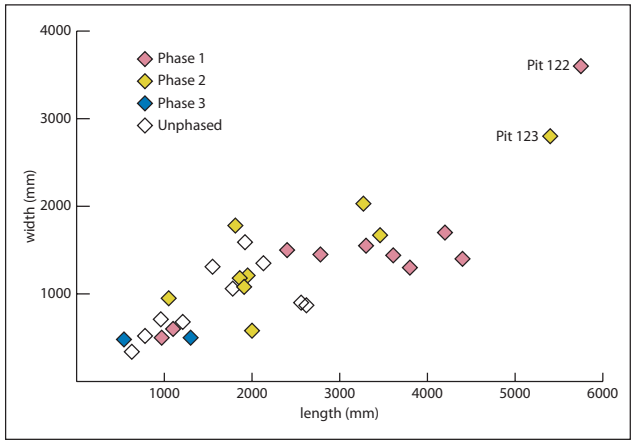

Figure 19. Length to width ratios of all pits from Area A East for which measurements could be taken.

(Campbell 2004c). Two sites at Rowesdale also had similar pits. At U14/3235 Pit 22 measured 4260 x 3250 mm and had two rows of five postholes, though these contained round posts and had been left in situ when the pit was abandoned – the round post moulds were clearly visible in the pit fill. It also contained several large, deep sumps (Campbell 2005). The most spectacular such pit was Pit 762 at U14/3218, an extensive, palisaded pit site. Pit 762 measured 8000 x 4600 mm and is one of the largest pits excavated anywhere in New Zealand. It had a further 148 features cut into its base – no other pits have been recorded in New Zealand containing this complexity of sub-features. At least three, and probably four, phases of construction and reconstruction are evident, and the sub-features include square postholes/post moulds, round postholes/post moulds, sumps and bin pits. Some of the posts had been dug out, as at Richmond Park. In one sump alone five sub-phases of postholes, cut and fill, postholes, compaction and further postholes could be made out (Campbell and Harris 2007).

Such pits stand out due to their complexity as much as their size; there is, so far, only one such pit at each site and it seems certain that they had a special function. What that function was is less certain; the removal of square posts from Pit 4 at the Richmond Park site indicates that some sort of value may have been attached to the posts and hence to the pit and its contents; on the other hand Pit 22 at Rowesdale U14/3235 had round posts that were not removed; in Pit 762 at Rowesdale U14/3218 some square posts were left in situ, some posts of unknown shape were removed and there was evidence of repeated activity within the pit; and Pit 122 at Mataraua there was evidence of the subdivision of space within the pit. It is quite possible that these pits were used to store seed kumara, which would explain the subdivision of space, but does not necessarily explain the apparent ritual aspects of Pit 4 at Richmond Park. Pits were not necessarily used to store kumara, or

at least, not exclusively. While each site has a large pit that stands out from the rest, the very fact that they stand out indicates that they had other or additional uses. While it is difficult to specify these uses it seems likely that they were connected to the power of chiefs and the unity of the community.

It is not clear how far this pattern of a single large pit at each site extends: it may be limited to this particular time and place, 16th century inland Tauranga; it may extend more widely through the Bay of Plenty; it may extend more widely through the upper North Island. Law (1999) has examined pit dimensions from a number of upper North Island occupation sites and noted that at each site some pits are very long (length to breadth ratio of about 3:1 or greater), though few are very large (of the pits discussed here only Pit 762 at Rowesdale U14/3218 falls into this super pit category, greater than 35 m^2). Law suggests that long pits were associated with display of wealth and feasting. On the basis of the pits discussed here it would be worthwhile looking at the wider archaeological record to see what other patterns, such as the one we have outlined, can be teased out of the data. It is becoming clear that pits that had been previously thought of by archaeologist in purely economic terms – winter storage of kumara – had a much wider role to play in pre-European Maori culture, and concepts such as display, mana and performance have just as big a role to play in our interpretations.

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Appendix A. Feature list

Context	Type	Length	Width	Depth	Phase	Matrix
2	oven scoop	750	500	140	3	Charcoal stained tephra
3	oven scoop	900	500	60	3	Mixed tephra
4	oven scoop	570	620	110	3	Mixed tephra
5	oven scoop	500	500	40		Charcoal stained tephra
6	oven scoop	600	700	90		Charcoal stained tephra
7	oven scoop	650	550	90		Clean tephra
8	oven scoop	400	400	120	3	Charcoal stained tephra
9	oven scoop	650	400	100	3	Mixed tephra
10	oven scoop	500	600	50	3	Mixed tephra
11	oven scoop	550	490	290	3	Charcoal stained tephra
12	posthole	310	230	280		Charcoal stained tephra
13	posthole	150	150	360		Mixed tephra
14	oven scoop	500	330	100	3	Mixed tephra
15	posthole	160	140	110		
16	oven scoop	350	300	90		Mixed tephra
17	posthole	110	90	200		Mixed tephra
18	oven scoop	460	400	160		Mixed tephra
19	posthole	120	110	120		Clean tephra
20	posthole	250	180	150		Mixed tephra
21	oven scoop	350	350	130		Charcoal stained tephra
22	oven scoop	640	510	290	3	Charcoal stained tephra
23	posthole	140	110	210		Mixed tephra
24	posthole	120	170	200		Mixed tephra
25	posthole	210	120	80		Charcoal stained tephra
26	posthole	160	110	150		Mixed tephra
27	oven scoop	520	500	160		Mixed tephra
28	posthole	270	260	210		Mixed tephra
31	oven scoop	370	300	90		Charcoal stained tephra
32	posthole	220	210	310		Charcoal stained tephra
33	pit	3610	1440	590	1	Clean tephra
34	oven scoop	1300	500	120		mixed fill
35	posthole	130	100	250		mixed tephra
39	pit	3300	1550	730	1	clean tephra
40	pit	4400	1400	680	1	mixed tephra
41	Pit	0	0	450	2	
42	pit	1780	1060	540		clean tephra
43	pit	2400	1500	600	1	clean tephra
44	pit	1950	1210	450	2	mixed tephra
46	pit	0	1140	270		clean tephra
47	pit	1300	500	880		clean tephra
51	pit	2560	930	240		mixed tephra
57	posthole	160	0	570		mixed tephra
58	posthole	0	0	0		mixed tephra
64	pit	3800	1300	750	1	mixed tephra
68	sump	390	30	120		mixed tephra
71	posthole	14	10	32		mixed tephra
72	posthole	140	140	580		mixed tephra
73	pit	4200	1700	800	1	mixed tephra
74	pit	1860	1180	50	2	mixed tephra

Context	Type	Length	Width	Depth	Phase	Matrix
75	posthole	360	200	190		charcoal stained tephra and mixed
76	pit	1100	600	580	1	mixed tephra
79	posthole	100	170	360		mixed tephra
80	pit	1910	1080	320	2	mixed tephra
81	posthole	130	130	310		clean tephra
82	posthole	110	140	440		clean tephra
83	pit	970	500	1130	1	mixed tephra
84	posthole	160	120	290		mixed tephra
85	footing trench	0	150	80		clean tephra
86	posthole	150	140	150		
87	posthole	160	150	150		clean tephra
88	posthole	280	260	160		mixed tephra.
89	posthole	160	120	240		clean tephra
90	posthole	180	140	270		clean tephra
91	pit	2780	1450	640	1	mixed tephra
92	pit	150	200	700		clean tephra
93	pit	150	150	480		clean tephra
95	sump	430	500	340	1	mixed tephra
96	pit	250	220	410		clean tephra
97	drain	650	100	200		clean tephra
98	posthole	200	200	500		mixed tephra
99	posthole	110	110	50		clean tephra
100	pit	0	680	350		mixed tephra above, clean below
101	posthole	110	100	100		dark soil and shell
102	posthole	110	100	100		dark soil and shell
104	posthole	360	200	440		clean tephra
105	posthole	130	130	10		clean tephra
106	pit	540	480	200		mixed tephra
107	posthole	100	100	290		clean tephra
108	posthole	100	80	170		clean tephra
109	posthole	170	230	50		clean tephra
110	posthole	360	270	370		clean tephra
111	posthole	110	120	220		clean tephra
112	pit	1050	950	720	2	mixed tephra
114	posthole	0	0	0		fill of pit
115	posthole	0	0	0		fill of pit
116	posthole	0	0	0		fill of pit
120	oven scoop	450	370	340	3	charcoal stained tephra
121	oven scoop	360	700	160	3	charcoal stained tephra
122	pit	5750	3600	1550	1	
123	pit	5440	2800	1200	2	
126	oven scoop	600	370	50		midden pipi
127	pit	3270	2030	630		clean tephra , bit mixed
128	posthole	0	0	0		mixed and pipis
129	pit	5000	2200	0		
130	cache of rocks	0	300	300		
131	pit	5000	2500	0		
132	pit	2850	1300	0		
133	pit	0	0	0		
134	pit	0	0	0		
135	pit	1700	1000	0		
136	pit	2000	1670	0		
137	pit	1550	960	0		

Context	Type	Length	Width	Depth	Phase	Matrix
138	artefact concentration	0	0	0		
143	posthole	0	0	0		charcoal stained tephra
144	posthole	0	0	0		charcoal stained tephra
145	posthole	0	0	0		charcoal stained tephra
146	posthole	0	0	0		charcoal stained tephra
147	posthole	0	0	0		charcoal stained tephra
148	pit	1300	860	0		
149	posthole	100	110	220		clean tephra
150	posthole	160	140	600		clean tephra pit fill
151	posthole	240	210	720		clean tephra pit fill
152	posthole	260	290	700		clean tephra pit fill
153	posthole	210	160	800		clean tephra pit fill
154	posthole	30	30	20		clean tephra pit fill
155	posthole	50	50	30		clean tephra pit fill
156	posthole	170	170	600	1	clean tephra
157	posthole	220	180	260	1	clean tephra
158	posthole	250	200	700	1	clean tephra
159	posthole	180	170	580	1	clean tephra
160	posthole	180	180	390	1	clean tephra
161	posthole	180	150	500	1	clean tephra
162	posthole	150	150	430	1	clean tephra
163	posthole	230	190	440	1	clean tephra
164	posthole	230	280	320	1	clean tephra
165	posthole	200	250	310	1	clean tephra
166	posthole	150	140	230	1	clean tephra
167	posthole	160	140	230	1	clean tephra
168	posthole	140	120	380	1	clean tephra
169	posthole	190	170	390	1	clean tephra
170	posthole	200	160	300	1	clean tephra
171	posthole	100	100	120	1	clean tephra fill 122
172	posthole	40	40	100	1	clean tephra fill 122
173	posthole	100	100	340	1	clean tephra fill 122
174	posthole	120	140	250	1	clean tephra fill 122
175	posthole	50	50	100	1	clean tephra fill 122
176	posthole	60	50	200	1	clean tephra fill 122
177	posthole	120	50130	390	1	clean tephra fill 122
178	posthole	150	100	350	1	clean tephra fill 122
179	posthole	30	60	200	1	clean tephra fill 122
180	posthole	80	80	400	1	clean tephra fill 122
181	posthole	50	50	200	1	clean tephra fill 122
182	posthole	50	50	50	1	clean tephra fill 122
183	posthole	60	50	200	1	clean tephra fill 122
184	posthole	30	30	100	1	clean tephra fill 122
185	posthole	40	40	110	1	clean tephra fill 122
186	posthole	60	60	230	1	clean tephra fill 122
187	posthole	130	130	400	1	clean tephra fill 122
188	posthole	100	110	230		clean tephra fill 122
189	posthole	100	100	230		clean tephra fill 122
190	posthole	100	100	230		clean tephra fill 122
191	posthole	100	120	150		clean tephra fill 122
192	posthole	40	40	140		clean tephra fill 122
193	posthole	50	50	50		clean tephra fill 122
194	posthole	50	60	140		clean tephra fill 122

Context	Type	Length	Width	Depth	Phase	Matrix
195	posthole	40	40	100		clean tephra fill 122
196	posthole	40	40	120		clean tephra fill 122
197	posthole	50	50	150		clean tephra fill 122
198	posthole	60	50	200		clean tephra fill 122
199	posthole	80	80	160		clean tephra fill 122
200	posthole	50	50	70		clean tephra fill 122
201	posthole	100	100	250		clean tephra fill 122
202	posthole	70	80	200		clean tephra fill 122
203	posthole	70	80	120		clean tephra fill 122
204	posthole	40	40	110		clean tephra fill 122
205	posthole	70	70	90		clean tephra fill 122
206	posthole	60	90	80		clean tephra fill 122
207	posthole	120	130	180		clean tephra fill 122
208	posthole	60	80	150		clean tephra fill 122
209	posthole	160	190	140		clean tephra fill 122
210	posthole	200	170	250		clean tephra fill 122
211	posthole	160	160	230		clean tephra fill 122
212	posthole	170	180	500		clean tephra fill 122
213	slot	1600	230	180		clean tephra fill 122
214	slot	1020	450	370		clean tephra fill 122
215	posthole	70	90	220		clean tephra fill 122
216	posthole	160	160	100		clean tephra fill 122
217	posthole	150	150	350		clean tephra fill 122
218	sump	880	470	120		clean tephra fill 122
219	pit	1210	680	100		
220	pit	1920	1590	160		
221	pit	1550	1310	160		
222	pit	960	710	500		mixed tephra
223	pit	0	720	200		mixed tephra
224	pit	0	1430	200		mixed tephra
225	pit	2620	870	250		mixed tephra
226	pit	2130	1350	270		mixed tephra
227	pit	780	520	150		mixed tephra
228	pit	0	0	160		mixed tephra
229	pit	3460	1670	720	2	mixed tephra
230	pit	0	0	720		mixed tephra
231	pit	0	2350	250	2	mixed tephra
232	posthole	100	100	200		same as pit fill
233	posthole	190	0	400		clean tephra
234	posthole	180	0	110		clean tephra
235	posthole	160	140	300		clean tephra
236	posthole	170	0	100		clean tephra
237	posthole	220	0	350		clean tephra
238	posthole	130	0	260		clean tephra
239	posthole	60	0	160		clean tephra
240	posthole	150	0	200		clean tephra
241	pit	2000	580	220	2	mixed tephra
242	pit	630	340	120		mixed tephra
243	pit	0	0	0		mixed tephra
244	posthole	120	120	330		pit fill
245	posthole	150	200	290		pit fill
246	oven scoop	0	0	0		
247	oven scoop	0	0	0		

Context	Type	Length	Width	Depth	Phase	Matrix
248	oven scoop	0	0	0		
249	oven scoop	0	0	0		
250	oven scoop	0	0	0		
251	oven scoop	0	0	0		
252	oven scoop	0	0	0		
253	oven scoop	0	0	0		
254	oven scoop	0	0	0		

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Report on Radiocarbon Age Determination for Wk- 24222

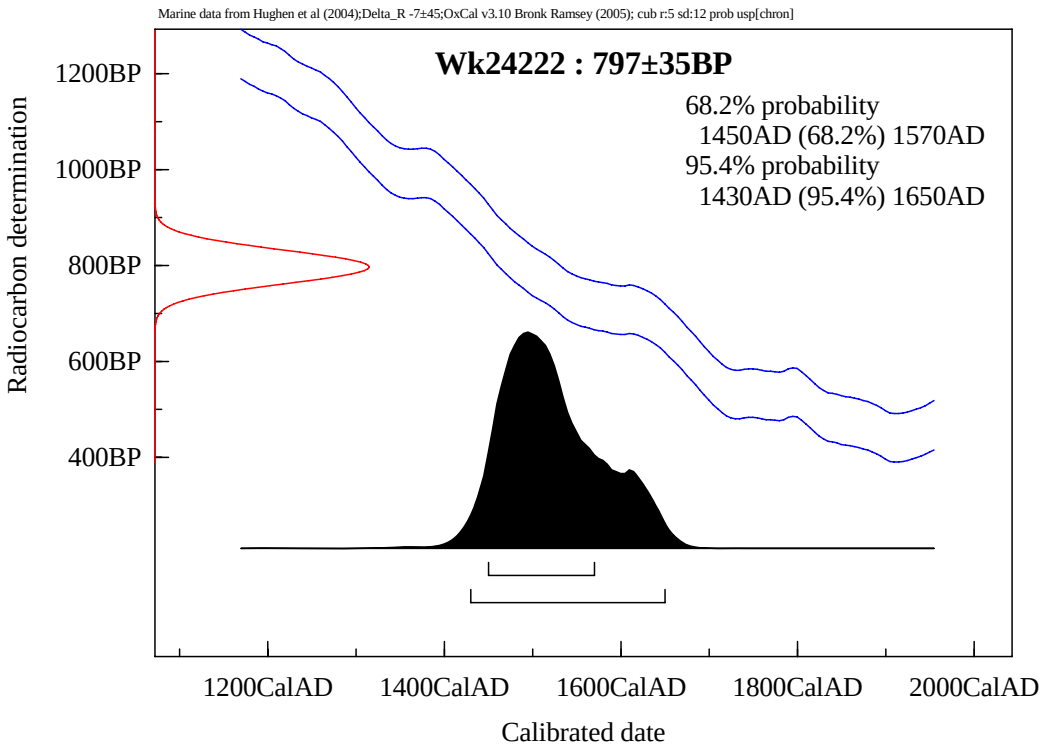
Submitter	M Campbell
Submitter's Code	U14/2351 F 248
Site & Location	Gargan Road, Tauriko, Tauranga, New Zealand
Sample Material	Pipi
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 300 seconds, rinsed and dried.

$\delta^{13}C$	1.5 ± 0.2	‰
$D^{14}C$	-94.5 ± 3.9	‰
$F^{14}C\%$	90.6 ± 0.4	%
Result	**797 ± 35 BP**	

Comments

17/10/08

- Result is *Conventional Age or % Modern* as per 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.
- $F^{14}C\%$ is also known as pMC (percent modern carbon).


Marine data from Hughen et al (2004);Delta_R -7±45;OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]
Wk24222 : 797±35BP
68.2% probability
1450AD (68.2%) 1570AD
95.4% probability
1430AD (95.4%) 1650AD
Radiocarbon determination
1200BP
1000BP
800BP
600BP
400BP
1200CalAD
1400CalAD
1600CalAD
1800CalAD
2000CalAD
Calibrated date

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Report on Radiocarbon Age Determination for Wk- 24223

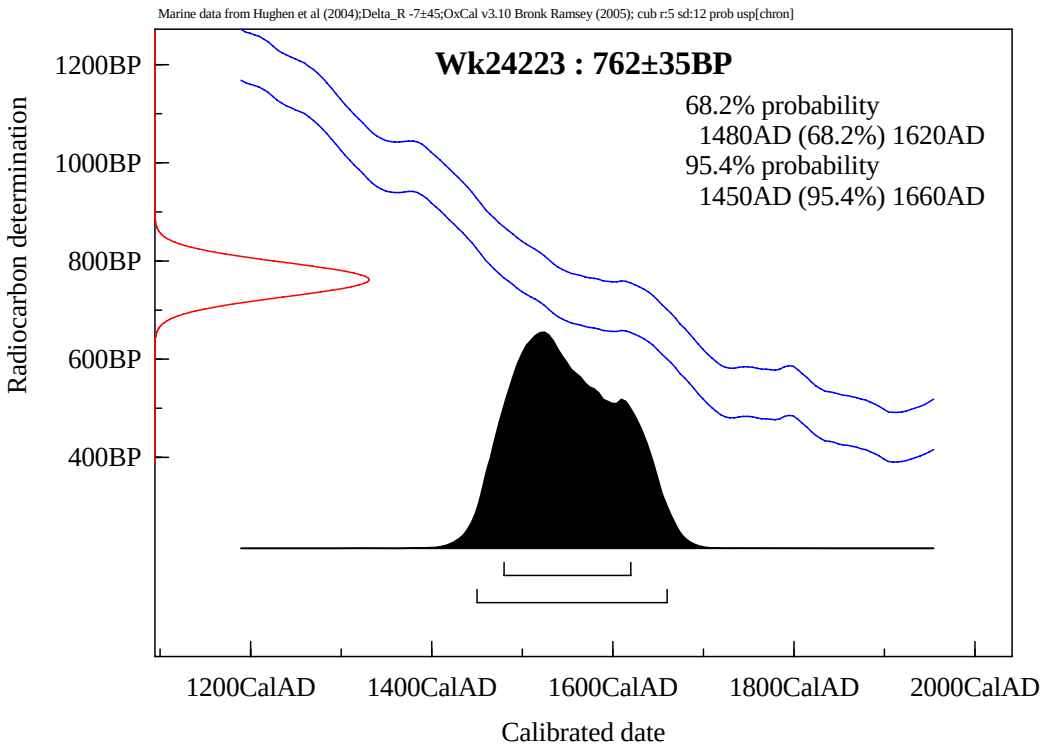
Submitter	M Campbell
Submitter's Code	U14/2351 F 11
Site & Location	Gargan Road, Tauriko, Tauranga, New Zealand
Sample Material	Pipi
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 300 seconds, rinsed and dried.

$\delta^{13}C$	1.3 ± 0.2	‰
$D^{14}C$	-90.5 ± 3.9	‰
$F^{14}C\%$	91.0 ± 0.4	%
Result	**762 ± 35 BP**	

Comments

17/10/08

- Result is *Conventional Age or % Modern* as per 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.
- $F^{14}C\%$ is also known as pMC (percent modern carbon).


Marine data from Hughen et al (2004);Delta_R -7±45;OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]
Wk24223 : 762±35BP
68.2% probability
1480AD (68.2%) 1620AD
95.4% probability
1450AD (95.4%) 1660AD
Radiocarbon determination
1200BP
1000BP
800BP
600BP
400BP
1200CalAD
1400CalAD
1600CalAD
1800CalAD
2000CalAD
Calibrated date