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The Hamurana Road Site, U15/9, Rotorua, New Zealand

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ABSTRACT

Recent excavation at the Hamurana Road site revealed a series of pits, a line of postholes forming a fence, and a kākahi (*Hyridella menziesi*) midden. Little is known of the archaeology of the region, so analysis of the site sought to establish a baseline context for the Rotorua basin. A microfossil analysis was carried out to examine both the palaeo-environment and evidence of pre-European horticulture. An outline settlement pattern was developed, although there are limitations in the recorded site inventory. Several phases of activity were observed at the site, with radiocarbon dates indicating a series of short-term late pre-European occupations. It was concluded that part of the site probably relates to Paketuri, which is recorded in traditional history.
Keywords: ROTORUA, HAMURANA, MICROFOSSILS, KĀKAHI, SETTLEMENT.

INTRODUCTION

Archaeological research in the Rotorua region got underway in the 1950s and 60s, initially concentrating on the recording, and occasional excavation, of pā. While this may have been an understandable bias in the context of the times, our understanding of settlement and subsistence patterns in pre-European New Zealand has moved on in the interim. We now rely on a wider inventory of site types and a wider range of analytical techniques. Rotorua has received little attention from archaeologists since that initial burst of recording, so its archaeology remains much as it was 40 years ago, though clearly it is an important and potentially informative region. Recent excavations at site U15/9, Hamurana Road, have allowed us to begin to address these problems, and to examine ways in which archaeology in Rotorua might be productive.

Roadworks along Hamurana Road, between Te Waerenga Road and Unsworth Road, on the north shore of Lake Rotorua, directly affected the site. It was first recorded (as N76/8) in the early 1960s by local Rotorua amateur archaeologist Don Stafford as a midden of kākahi (freshwater mussel, *Hyridella menziesi*) and two bell-shaped rua. Stafford described "much midden material and two perfect cross section bell shaped pits" exposed by recent road construction. He went on to say "the middens exposed at this site and at the extreme N.E. end of the site are the largest concentration of midden shell I have seen on a lakes district Pa or other site." A photograph taken at the time shows one of the pits (Fig. 1). The site was re-recorded by Susan Forbes in 1989. The pits were no longer visible and the

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midden was severely eroded; only a 2 m long shell layer 300 mm deep remained. Much of the site was removed by road works in 1999 (Don Stafford pers. comm. 2004).

In 2003 Ken Phillips was contracted to assess the site prior to the road works (Phillips 2003). Three midden exposures were recorded: Middens A, B and C. Midden A was the midden originally recorded by Stafford and later re-recorded by Forbes. It was located on a small, remnant bank on the south side of the road, covered about 3 m^2 and was actively eroding. Midden B, also on the south side of the road, was heavily disturbed, possibly re-deposited from earlier earthworks. Midden C was a 10 m long exposure, up to 200 mm

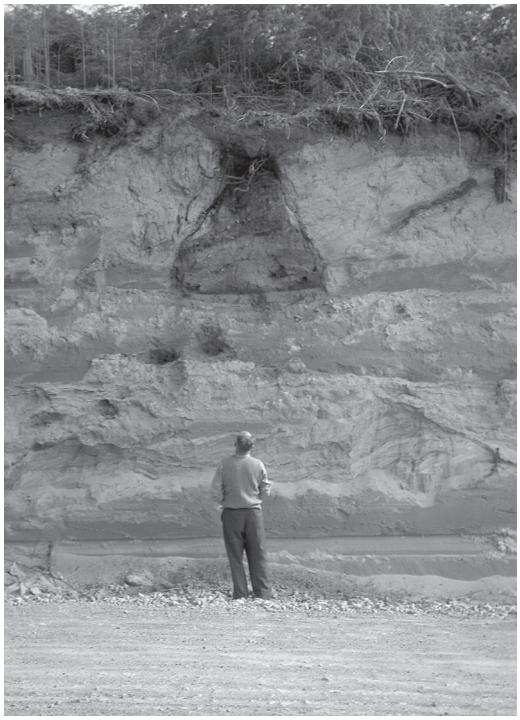

Figure 1: Rua exposed in a road cutting in the 1960s. This feature was removed by road works in 1999. Photo courtesy of Don Stafford.

deep, in the road cutting on the north side of the road. Phillips noted that the land behind the exposure was undisturbed and highly likely to contain archaeological features. No archaeological features were observed further to the east of the three visible middens, though it was noted that the traditional sites of Paketuri and Kakewhare were identified by Stafford (1994: 73) as being located here. A mitigation excavation was carried out between the 5th and 9th of January 2004. All affected archaeology is, for the purposes of this investigation, included in U15/9 and is reported here (see also Campbell and Phillips 2005).

In general the archaeology of the Rotorua region is not well known. Site types other than pā are poorly represented in the record and very few have been investigated through controlled excavation. Stafford's historical research indicates that much of this area was divided into small kāinga and garden plots in the late eighteenth to early nineteenth

centuries. In order to understand both the development of this historic settlement pattern and the archaeology of U15/9, analysis centred on outlining a basic settlement pattern based on the distribution of recorded sites. Plant microfossil analysis was used to provide environmental and vegetational information, including possible evidence of horticulture, and demonstrated the first instance, to our knowledge, of kūmara starch identified from a storage pit. The investigation sought to provide a foundation on which to base future archaeological research in the Rotorua basin. The results indicate that a multidisciplinary approach, combining archaeological data, microfossil analysis and traditional history may prove to be most productive.

TRADITIONAL KNOWLEDGE AND HISTORY

The traditional history of Te Arawa, whose rohe includes Rotorua, has been compiled by Stafford (1994, 1967) from a variety of sources, in particular the early records of the Native Land Courts. He records numerous named cultivations and kāinga in the Hamurana area; these are particularly dense around the Kaikaitahuna Stream.[3] Immediately west of Te Waerenga Road is Pukehinahina pā (U15/24), a stronghold of Ngati Rangiwewehi that became an urupā in the nineteenth century (Stafford 1994: 92). From Te Waerenga Road east the named cultivations are Ngahuapiri, Te Purangi, Te Hauhono, Te Whakakumanu and Te Kahu-o-te-rangi. The boundaries given by Stafford are not definite, but Middens A–C (Phillips 2003) are probably located in Te Purangi or Te Hauhono, while the site identified as Paketuri is located in Te Whakakumanu (Stafford 1994: Maps 17 and 18). The identification of Paketuri is not certain: Stafford (1994: 73) says only that it is "described as a pa lying between Pukehinahina and Tupakaria. It may well be this high point on the lake edge with clear indications of occupation some 200m east of Waerenga Road." Even so, the archaeological evidence uncovered during excavation indicates that Stafford's identifications are probably fairly accurate.

Several fishing grounds are also noted by Stafford in the vicinity, particularly Pangopangoa, Patupaiarehe and Tikona though, as he notes, the names and locations of fishing grounds vary between sources (Stafford 1994: 195, Map 40). Hiroa (1921: 436) records that fishing grounds in Lake Rotorua were "carefully marked and jealously guarded." They were either marked with reference to cross sighting to landmarks on shore or, where the water was shallow, by sinking posts called tumu into the lake bed.

THE PHYSICAL SETTING

U15/9 is located above the lakefront escarpment on the north shore of Lake Rotorua about 10 m above the lake level. Locally the landform is a gently rolling terrace, between 300 and 500 m wide. Another higher escarpment 100–120 m above the lake level to the north forms the boundary of the lakefront terrace, and leads north to a 2–3 km wide plateau before sloping down to the Bay of Plenty coast.

The soils of the Rotorua region are largely volcanic in origin, consisting of numerous bedded tephras. The soils at Hamurana are Oturoa Sand, described as "composite yellow-brown pumice soils on yellow-brown loams" (Rijkse 1979: 30), formed from Kaharoa Ash

[3] The name Hamurana is a transliteration of the biblical Smyrna. Kaikaitahuna is its original name (Stafford 1994: 20, 27).

overlying older tephra. Soil development has taken place on two or more contrasting tephra layers.

A section through these beds at Hamurana (Healy *et al*. 1964: Figure 36) showed a 170 mm upper layer of Kaharoa tephra overlying a 670 mm deep bed of Rotokawau tephra. Kaharoa tephra is typically white, though when encountered during excavation it was yellow or brown, as the description of Oturoa Sand implies. Rotokawau tephra is an older, soil-forming ash. In sections to the east of Hamurana, starting at Mourea, Tarawera tephra from the 1886 eruption overlies the Kaharoa tephra, but this was not encountered in any obvious way during excavation of U15/9. Sections to the west and east of Hamurana (Mamaku and Mourea), as well as nearly all other sections in the Rotorua region, showed 150 mm or more of the Taupo tephra. A tephra easily distinguished by the inclusion of coarse pumice lapilli up to 5 mm in size was encountered during the excavation of Trench 1 (see below), and is probably Taupo tephra, but this was not encountered elsewhere during excavation. Beneath the Rotokawau tephra is a further, unidentified tephra.

These tephras are generally fertile, well drained and rich in organic matter, though they may be low in magnesium, potassium and phosphorus. They are well suited to pre-European kūmara horticulture. The main restrictions would seem to be altitude and slope, which are not significant problems in the Rotorua basin, and the drainage of the underlying soils, which may be problematic. There is some susceptibility to summer drought. The growing season in an inland region like Rotorua is significantly shorter than in coastal locations, with ground frosts common between April and November and ground temperatures (recorded at Rotorua airport) reaching as low as –9 °C (data supplied by the National Institute of Water and Atmosphere Research Ltd). The growing season was extended by using geothermally warm ground to hasten the shooting of seed kūmara (Wade, cited in Williams and Walton 2003: 19). U15/9, then, is located on a narrow strip of fertile horticultural land (though climatically marginal for kūmara) with ready access to both lake resources and the forest resources of the uplands.

THE 2004 EXCAVATION

Two main areas were seen to be most intact and investigation concentrated on these. They were the area identified by Stafford (1994: 73, Map 18) as Paketuri pā, and the area designated Midden C by Phillips (2003).

Paketuri is located on a level terrace about 105 m in length above the lakefront escarpment. During the initial assessment a backhoe was used to strip away the topsoil in a trench running along the terrace exposing a number of rectangular storage pits. The main investigation in this area involved stripping the topsoil from five areas, of which three were selected for closer investigation, Areas A and D by hand, and Area C by machine (Fig. 2).

The exposed surfaces of Areas A and D were cleaned down by shovel and trowel, all features were excavated by hand, and samples were taken from oven features for environmental charcoal analysis and radiocarbon dating. Two bell-shaped rua in Area D were, for safety reasons, excavated by machine half-sectioning. In Area C fewer small features such as postholes or oven scoops were visible in the exposed surface, but two rua and three rectangular pits were observed. The surfaces of these were defined using shovels and they were excavated by half-sectioning them with the backhoe.

Midden C was located on a slope below a level ridge top or terrace. Phillips (2003) had described the slope as undisturbed. The removal of large pines in the interim had disturbed

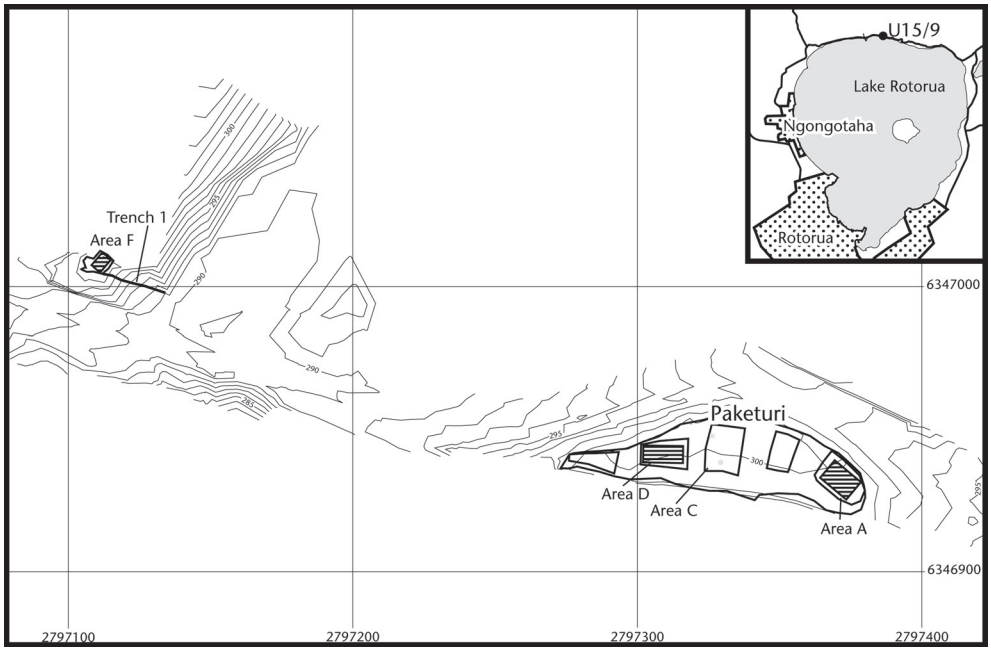

Figure 2: The investigation area, showing site location and excavated areas. Hatched areas refer to site plans in Figures 3, 5 and 8. Datum is NZMG, contour interval is 1 m. Base data supplied by Sigma Consultants Ltd.

the ground surface on both the terrace and the slope below it, exposing the midden. On a preliminary visit four shovel test pits were dug into the terrace and midden in order to test its depth, density and extent. Two midden samples were taken in order to devise suitable methods of analysis for kā̄kahi (Campbell 2005). The topsoil of the level terrace above the midden (Area F) was machine stripped in order to investigate the nature of any possible levelling activities and expose any features, and a trench (Trench 1) was cut from here down the slope and through the midden. Excavation of Area F proceeded as for Areas A and D.

The trench through the midden was placed so as to cut a section through the densest depth of deposit. The exposed profile was cleaned by hand, photographed and drawn. Samples, of approximately 6–7 litres, were taken from each of the two densest deposits, and three soil samples were taken from possible garden soils below the midden.

The site was mapped at a large scale with an electronic theodolite, and any fine details, such as sections or plans, were mapped by measured drawing. The theodolite map was tied into existing construction plans and survey marks, and measured plans were located with reference to the theodolite data.

EXCAVATION RESULTS

PAKETURI AREA A

Area A measured 19 x 11.5 m (Fig. 3). Excavation revealed a number of oven scoops, postholes and a single rectangular storage pit. The pit, Feature A9, measured about 2600 x 1500 mm in plan, though its edges were not well defined. A quarter section measuring 2000 x 900 mm was excavated in the western corner, to a depth of 750 mm below the machined surface. Only one posthole, measuring 80 x 70 mm and 200 mm deep, was observed, unusually in the corner rather than down the centre line. Presumably similar postholes were present at the other three unexcavated corners. The upper edges of the pit were somewhat

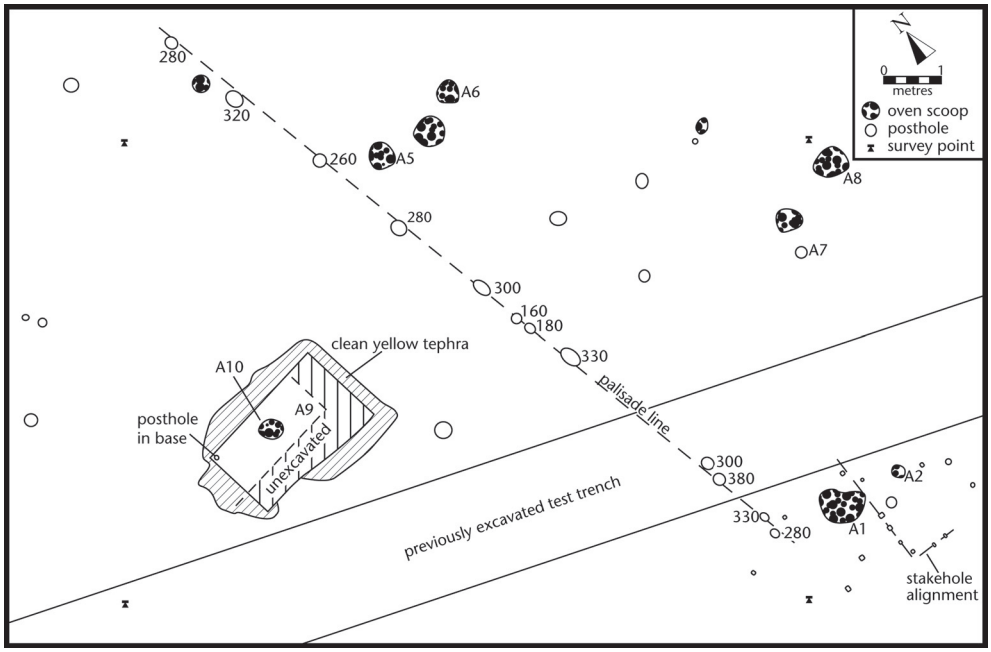

Figure 3: Plan of Area A. Depths of postholes are given in mm.

eroded, indicating that it had been left open for some time after it had ceased to be used. The lower 300 to 450 mm had filled with a mixed fill of clean tephra and topsoil, while above this a layer of yellow tephra, between 50 and 450 mm deep, extended out around the edges of the pit and appeared to have been deliberately placed. An oven scoop, Feature A10, was located in the surface of this layer, indicating that the pit continued to have a use after it had ceased to function for storage. Above this layer a natural build up of topsoil had completed the filling process. A soil sample was taken from the thin humic layer, 20 mm thick at most, from the base of the pit to test for the presence of kūmara starch grains.

The main feature of Area A was an alignment of large, deep postholes running diagonally north-west to south-east at roughly 45° to the lakefront escarpment (Fig. 4). They range in

size from 170 x 130 to 390 x 240 mm in plan, with the longer dimension running in the direction of the alignment, and from 260 to 380 mm deep. They were generally between 1.5 and 2 m apart, with a 3 m gap at the south-east end and then two sets of double postholes, with just under 14 m of the alignment exposed by excavation. Two postholes close to each other in the middle of the alignment were smaller and shallower. The fill of the postholes consisted of a well mixed subsoil, and no post moulds were observed. The postholes were

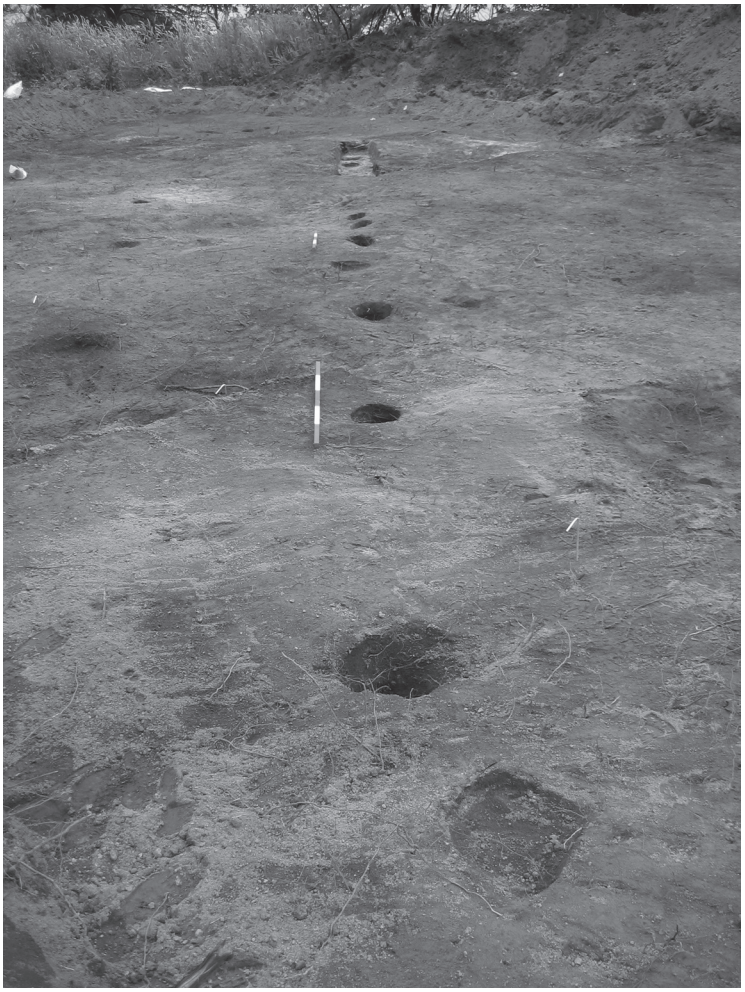

Figure 4: Palisade or fence line in Area A, looking south east. Scale = 1 m.

not close enough together to indicate a proper defensive palisade; they seem to represent a simple fence. The 3 m gap and double postholes may indicate an entrance that needed repair at some stage, while the two shallow postholes probably also represent repair or reinforcement of the fence. Given that the radiocarbon dates (see below) indicate the possibility of an early historic period occupation for the site it is possible that these

postholes represent a pig fence, although there is no other indication of European animal, plant or technological introductions.

In the south-east corner of Area A a set of small rectangular stakeholes in two alignments at right angles to each other seemed to indicate a structure, though only two walls were present. These stakeholes ranged between 70 x 40 and 80 x 90 mm in plan, and 60 and 200 mm deep, and tapered towards the base, indicating that they had been driven into the ground. They seem to outline a simple shelter on an alignment roughly parallel with the fence line.

Area A contained further postholes, though no clear alignments were visible. One of these, A7, contained some kākahi midden in its fill, and this was sampled. Otherwise the posthole fill was clean, well mixed subsoil. Several oven scoops were also visible. Only one, A10, in the pit fill, contained substantial numbers of hāngi stones. Otherwise they contained a dark, charcoal-stained soil with whole pieces of charcoal present to varying degrees. In some instances the surrounding soil was burnt red. Samples were taken from several oven scoops for charcoal and environmental analysis, and possible radiocarbon dating.

PAKETURI AREA D

Area D measured 16.5 x 11 m (Fig. 5). Excavation revealed a number of oven scoops, postholes and two rua. Although many of the postholes occurred in clusters the only clear alignments were in the western edge of Area D, where two parallel alignments indicated a house 3 m wide and at least 3.5 m long (Fig. 6). This house possibly has a porch 1 m deep at its eastern end, but this seems unlikely given that the structure is rather small.

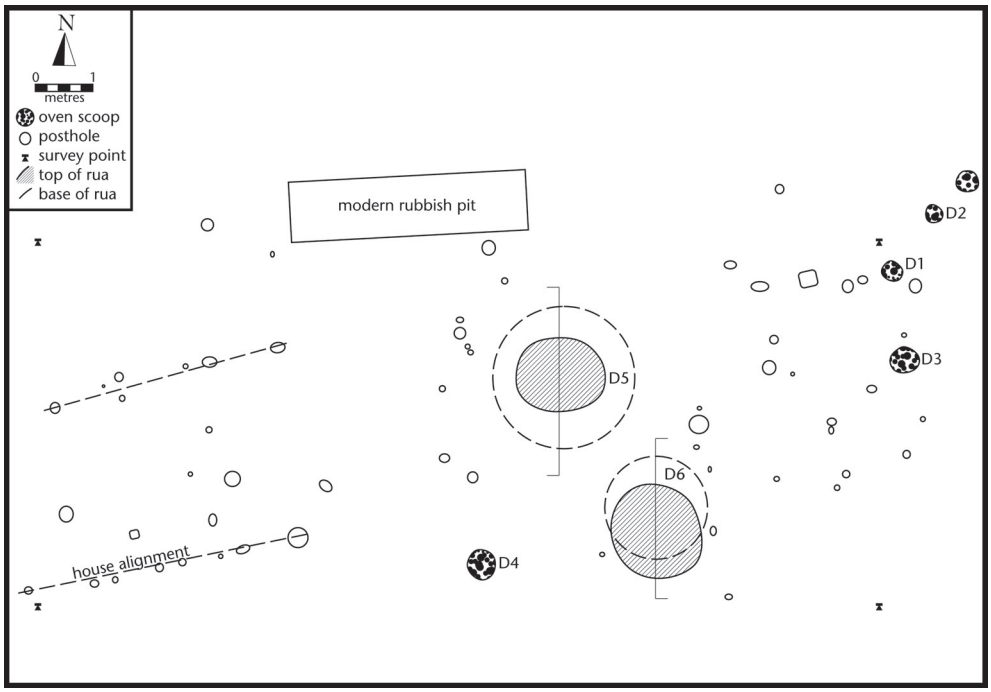

Figure 5: Plan of Area D. Depths of postholes are given in mm.

Figure 6: Photomontage of house in area D, looking east. Scale = 1 m.

Figure 7: Rua, feature D5, in section, west profile. Scale = 1 m.

The two rua were half sectioned with the backhoe. The largest, D5, measured 1550 mm deep and 2350 mm wide at the base (Fig. 7). The top of the feature in the cleaned surface had a maximum diameter of 1200 mm, narrowing in the exposed section to 1050 mm about 600 mm below the surface. The roof on the northern side had partly collapsed, but the southern side appeared to be intact. It was filled with a rich, loamy, charcoal-stained topsoil, with small layers of clean tephra and minor changes in soil composition demonstrating that the infilling process was not a single event. An interesting feature was a two level floor, with a 'lip' 350 mm wide and 200 mm high separating the two levels, which differed in height by 100 mm. This may represent either a division of the rua into two parts, or perhaps a central post or a ladder. The excavation technique could not reveal exactly what this was, and time constraints precluded further investigation.

Feature D6 was another irregularly shaped rua. The feature measured 1100 mm deep and 1700 mm across the base, but the base was offset towards the north. The diameter in the cleaned surface was also 1700 mm, and the feature lacked the neck found in classic rua. Filling of this feature had occurred in a series of episodes, with topsoils and clean tephras forming distinct layers. Another unusual feature was the placement of three flat rock slabs in the fill to form a level 'step.' It is not clear what such a step would have led to—perhaps it was just part of the fill.

Like the oven scoops in Area A, those in Area D contained a dark, charcoal-stained soil with whole pieces of charcoal also present. No hāngi stones were found. D4 contained a small amount of fragmented kākahi shell. Samples were taken from several for charcoal and environmental analysis, and possible radiocarbon dating.

PAKETURI AREA C

Area C measured 17 x 12.5 m. The only visible evidence of features after machine stripping and cleaning the surface was of three rectangular pits, two rua and three isolated postholes (Fig. 2). The pits were investigated by machine sectioning—due to time constraints no closer investigation was made. The features were mapped by electronic theodolite. One of these, C6, showed evidence of stratified fill. A charcoal sample was taken for environmental analysis, and a soil sample was taken from the thin humic layer at the base of the pit to test for the presence of kūmara starch. A similar sample was taken from one of the rectangular pits, C8.

MIDDEN C/AREA F

Area F, measuring 8.5 x 8.5 m (Fig. 8), was located on the level terrace above the exposed kākahi midden, Midden C, through which Trench 1 was dug.

Excavation revealed a number of postholes, two oven scoops and a rua. The postholes were generally shallow, though one isolated example was 440 mm deep, and formed no discernible pattern. The surface was very level, and it seemed likely that it had been levelled at some stage, truncating the remaining features. This was confirmed when the rua was excavated. It had clearly been truncated, with the top and neck removed leaving a feature 900 mm deep. The fill consisted of reworked topsoil mixed with fairly clean tephra, indicating deliberate filling.

Two oven scoops were found in the levelled surface, indicating that levelling occurred in prehistoric times, followed by further use of the new surface. This was confirmed by the Trench 1 midden profile (Fig. 9). Here at least four separate episodes of activity were

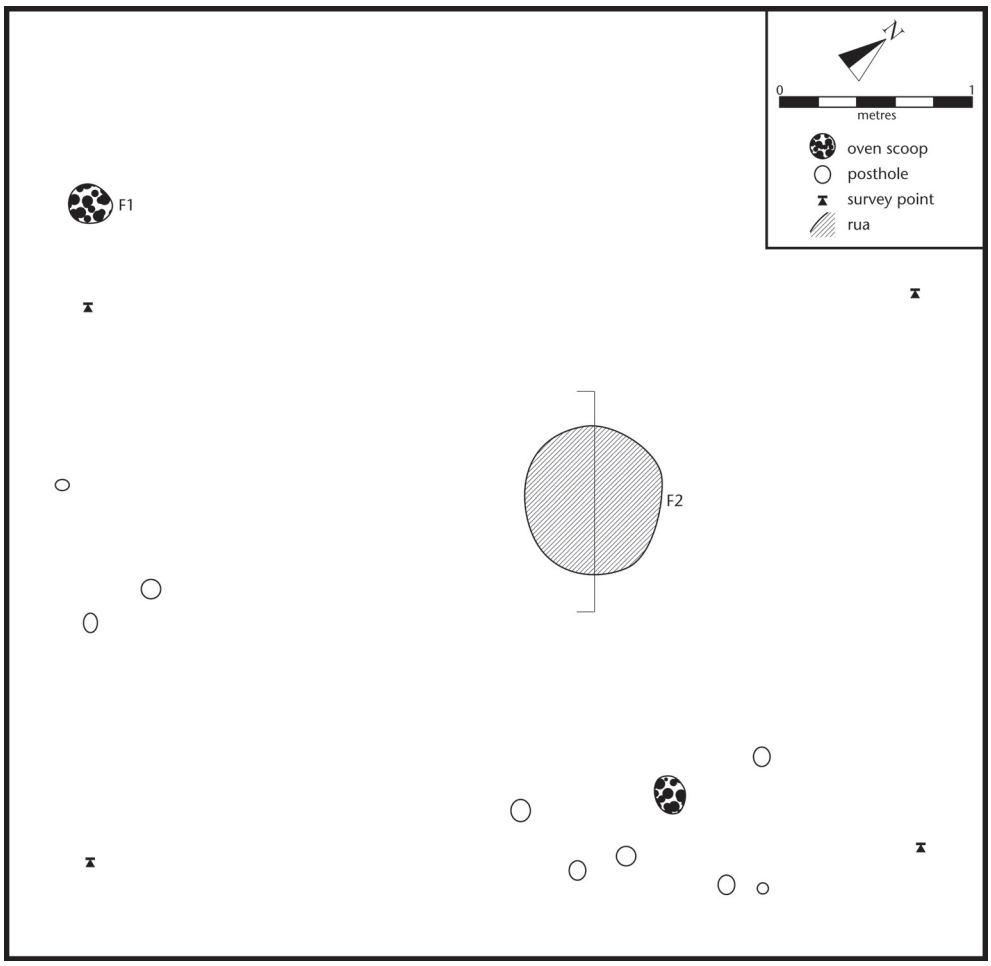

Figure 8: Plan of Area F.

visible. The first of these is the use of the lower, more level part of the slope for gardening, as indicated by mixed and mottled soils up to 400 mm deep and the microfossil analysis (see below). These also contain small lenses of kākahi midden, which may indicate either that an earlier episode of midden deposition had occurred, but was subsequently dug into the soil, or that shell was deliberately incorporated into the gardens, perhaps as a mulch. Three soil samples were taken to test for microfossil evidence of gardening (Samples 3, 4 and 5).

The second episode was the deposition of Midden 2, which was deposited over the garden soil. It appeared to be 100% kākahi, with very little soil matrix included, and just a little charcoal. At the time of excavation it was partially fragmented, with very few completely whole shells visible, and a great deal of shell 'dust.' In places there was evidence that the shell had been burnt. A sample was taken (Sample 2).

A topsoil then formed over Midden 2, indicating a hiatus in occupation. This was followed by the levelling of the terrace above, and the deposition of a clean tephra fill derived from

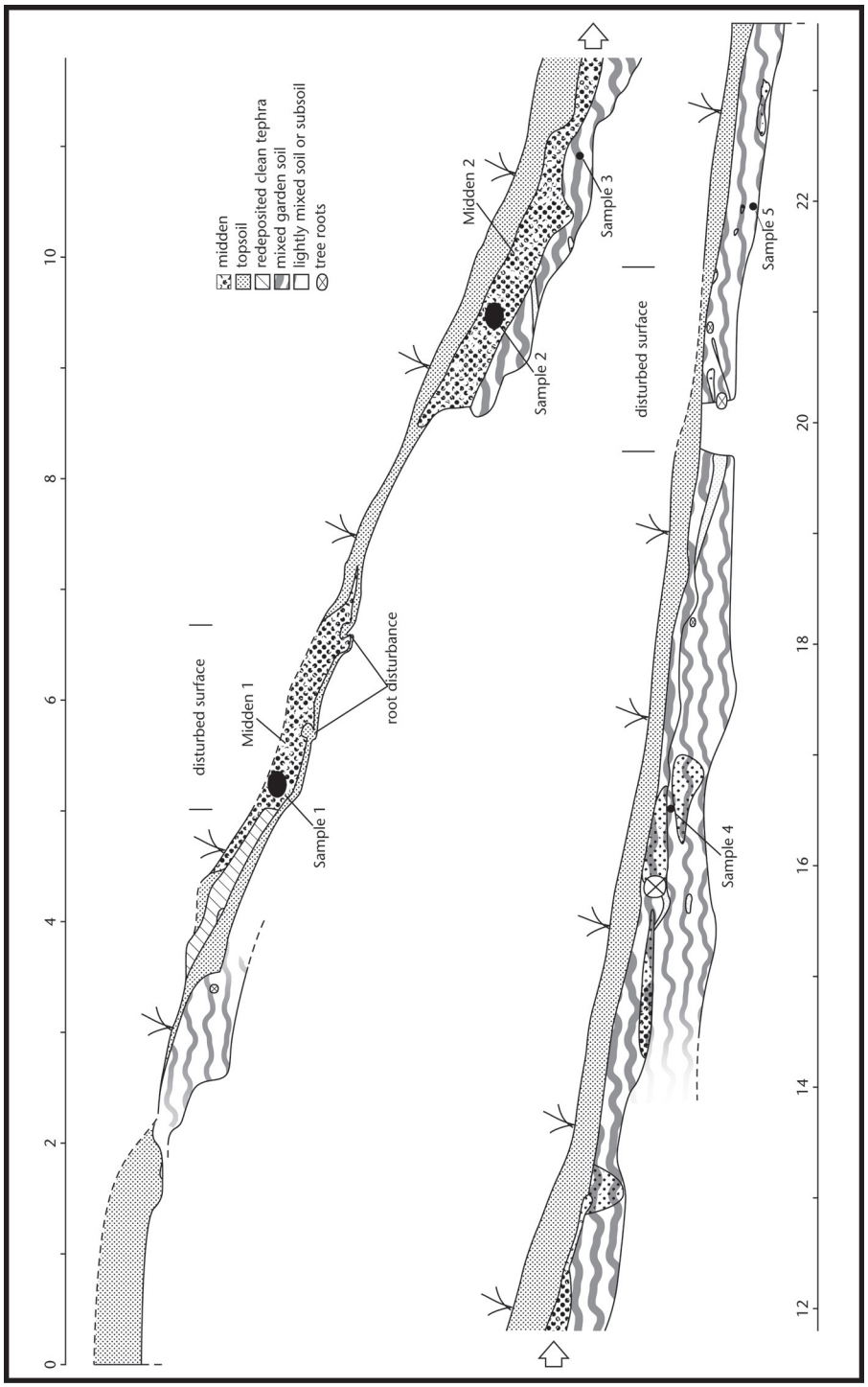

Figure 9: Profile of Trench 1, Midden C.

this activity at the top of the slope. Finally, Midden 1 was then deposited over this fill and over the old topsoil. The surface of Midden 1 had recently been disturbed by heavy machinery, but it seemed clear from the remaining profile that a topsoil would have covered Midden 1. This was cleaner than Midden 2, with shell more complete, but again few completely whole shells visible. A sample was taken here also (Sample 1).

The midden extended only 2 m north of Trench 1, and its distribution continued to be patchy. Small lenses of midden could also be observed in profile in the road cutting between 3 and 4 m south of the trench.

This series of four events: gardening (we might expect, but cannot be certain, that the rua in Area F is associated with this first event); midden 2 deposition (followed by a hiatus in occupation); terrace levelling; and midden 1 deposition (probably the oven scoops in Area F are associated with this phase): is indicative of neither particularly intensive nor long term occupation. Rather it indicates relatively mobile, small family groups utilising the area for a short while then moving on. This does not of course mean that they moved far. Instead they shifted their garden sites elsewhere within their territory. Given that so little is known of the archaeology of the central North Island such a settlement and subsistence pattern cannot be outlined in any detail.

MIDDEN A

The remnant midden of the site originally recorded by Stafford in the early 1960s, Phillips' (2003) Midden A, was cleaned down in profile and photographed. Much of what remained was generally intact, though it is unclear how extensive it had originally been or how much it has lost off its surface, and it had been disturbed and redeposited towards its western margin, probably some time after it was first recorded. It contained fairly clean, fairly whole shell, with very little additional matrix. A sample was taken (Sample 6).

MIDDEN ANALYSIS

The vast majority of middens excavated and analysed in New Zealand are coastal middens, where species like pipi (*Paphies australis*), cockle (*Austrovenus stutchburyi*) and tuatua (*Paphies subtriangulata*) predominate. Very little is known about inland middens of kākahi, which makes careful analysis of the U15/9 middens important, for two reasons: we do not know yet what midden analysis can tell us about inland subsistence and society; and suitable methods of analysing this material have not yet been developed. These points are considered in greater detail by Campbell (2005).

The lack of strength in the shell presented some challenges for the analysis, as it was not clear how well the shell would stand up to cleaning or sieving. It soon became apparent that both wet and dry sieving were very destructive of the shell and the only feasible method seemed to be to air dry the entire sample uncleaned, and then to sort it by hand. Any shell for which the hinge remained whole or nearly whole was counted. Left and right shells were not distinguished and MNIs were calculated by halving the count of all valves. The results are given in Table 1.

TABLE 1
RESULTS OF MIDDEN ANALYSIS

	Kākahi		
Sample	**MNI**	**%**	**Notes**
Trench 1, Sample 1	43	100	Very crushed shell, dense, very little charcoal staining in matrix.
Trench 1, Sample 2	261	100	Less dense, more matrix, very little charcoal staining. One fish (*Scomber australasicus*) vertebra, several land snails, some burnt shell.
Sample 6	363	100	Medium density, very little charcoal staining in matrix. Some shells still paired, several land snails.

Only a single fish bone was found, a vertebra in Sample 2. Although fish vertebrae are not usually identified in New Zealand midden analysis it is almost certainly from a blue mackerel (*Scomber australasicus*). This species is not often encountered even in coastal middens, so it is surprising to find it so far from the coast. It is probably from an individual preserved at a coastal site and transported inland for trade or gift exchange, or because the occupants of U15/9 had rights to use coastal resources; it would probably represent a much greater quantity of preserved fish that may have brought on to the site, but we cannot say much more than that from a single bone.

In addition to the three samples taken for midden analysis, five other samples were taken from various features (A7, D1, D2, D4 and F1) from throughout the site. Only two of these, A7 and D4, contained any shell, but many others contained kākahi periostracum. These features, with the exception of A7, were oven scoops, indicating that cooking and burning are particularly destructive of kākahi shell.

FOODS OF LAKE ROTORUA

Only two animal species were encountered during the midden analysis: kākahi and blue mackerel. Lack of freshwater fish bone is surprising. Hiroa (1921: 435) notes that "in pre-trout days [Lake Rotorua] teemed with food which to the Maori palate was far more appetizing than the introduced trout which has displaced so much of it." It is certain that freshwater fish would have been present in the lake at the time the midden was deposited, since kākahi larvae are parasitic on fish and so can not reproduce without them. Dieffenbach (1974: 394) recorded that Rotorua contained "eels, and other species of fish of a small size; also a well-tasted crawfish, and a bivalve shell-fish called kakahi: all these serve to the natives as food." A few years later, in 1849, Cooper (1999: 126) described "a large basket of *inanga* … which is taken with a seine net in great quantities in all these lakes at a certain season." Mair records that Hatupatu, "pioneer of acclimatisation", stocked Lake Rotorua with eels and kōaro (*Galaxias brevipennis*) "five centuries ago." Mair witnessed kōaro being netted in the Hamurana Stream in the 1860s, with "several hundredweight" taken in a night's fishing. Kōkopu (*Galaxias fasciatus*) were also taken (Mair 1923: 41, 43; see also Best 1977: 103, 228). Best (1977: 229) lists Rotorua, Rotoiti and Taupo as the main lakes from which the kōura or freshwater crayfish (*Paranephrops planifrons*) could be taken. Presumably there are hard parts of kōura, such as mandibles, that could survive in middens, as there are of salt-water crayfish, but these are often not recognised during midden sorting

(Leach and Boocock 1993: 18). Hiroa (1921) lists all these species as being important, even in the early twentieth century, and presumably they would have been much more so in pre-European times though no evidence of this was found during midden analysis.

Kākahi were obtained with the use of dredge rakes called kapu or mangakino (Hiroa 1921: 445). These consisted of a triangular frame of mānuka with a 40 mm mesh net about 1 m long trailing behind it. It was dragged from a canoe on a pole up to 10 m long. As Hiroa says, this would have been a very skilled task. Although kākahi are generally described as tasteless and rubbery it was a very important food in pre-European times and much sought after (Hiroa 1921: 449); it was said to be very good for motherless infants and recuperating patients. It could be eaten raw or cooked.

ENVIRONMENT

Although, as the preceding section indicates, midden analysis was not particularly informative regarding the palaeoenvironment of Hamurana, more information was obtained from microfossil and charcoal analyses.

MICROFOSSILS

Microfossil analysis was carried out with two purposes in mind: firstly, to aid in reconstructing the pre-European environment; and secondly, to look for evidence of horticulture. Nine samples were submitted for analysis from a variety of contexts: the three samples taken from the lowest layers of Trench 1; three pits, including one rua; two possible garden soils in the baulks of Areas C and F; and Section 3, which was dug into the base of the damp gully below Trench 1 (Fig. 2).

Samples were prepared for pollen analysis by the standard acetylation and hydrofluoric acid method (Moore *et al*. 1991). For each sample, at least 100 pollen grains and spores were counted, and slides were scanned for types not found during the count. Algal spores were excluded.

Pollen and spores appeared moderately to poorly preserved in the samples, which is typical of archaeological sites and indicates alternate wetting and drying resulting in a high rate of decomposition, reflecting the high porosity of the local volcanic soils. Relative proportions of the different pollen and spore types are shown in Figure 10. Pollen assemblages are dominated by spores of *Cyathea* tree ferns and, except for the three Trench 1 samples, bracken (*Pteridium esculentum*). Although all other pollen types record very low values, the following types, which were identified in most samples, are significant: rātā (*Metrosideros robusta*), rewarewa (*Knightia excelsa*), tutu (*Coriaria arborea*), pūhā/dandelion (*Sonchus*/*Taraxacum*) and hornworts (Anthocerotae). Microscopic charcoal is present in all samples in high concentrations.

Samples were prepared for biogenic silica analysis by density separation (Pearsall 2002). For each sample at least 100 phytoliths were counted, and slides were scanned for biogenic silica types not found during the count. Diatoms and sponge spicules were excluded.

Biogenic silica appeared generally well preserved in all samples. Relative proportions of the different types are shown in Figure 11. Phytolith assemblages are dominated by trees: especially spherical verrucose and, in some samples, spherical nodular types. Spherical smooth phytoliths recorded low values in most samples.

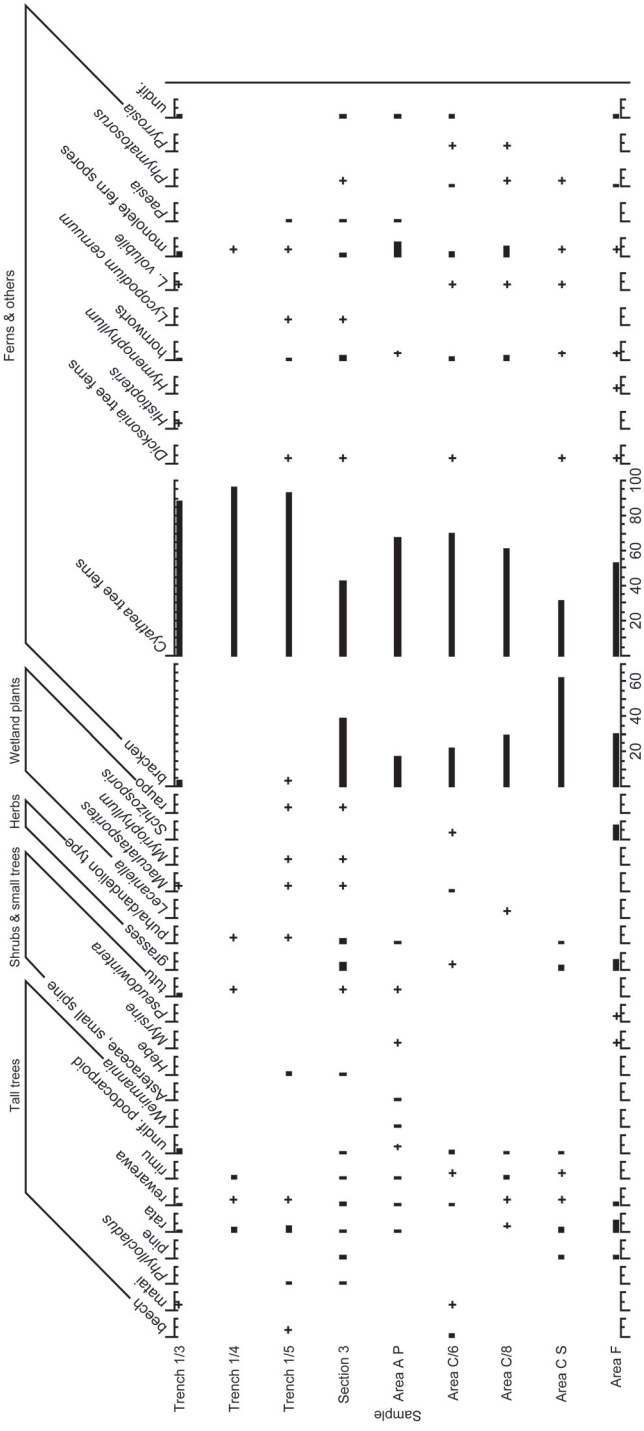

Figure 10: Percentage pollen diagram from U15/9 (cross represents rare types found after initial count).

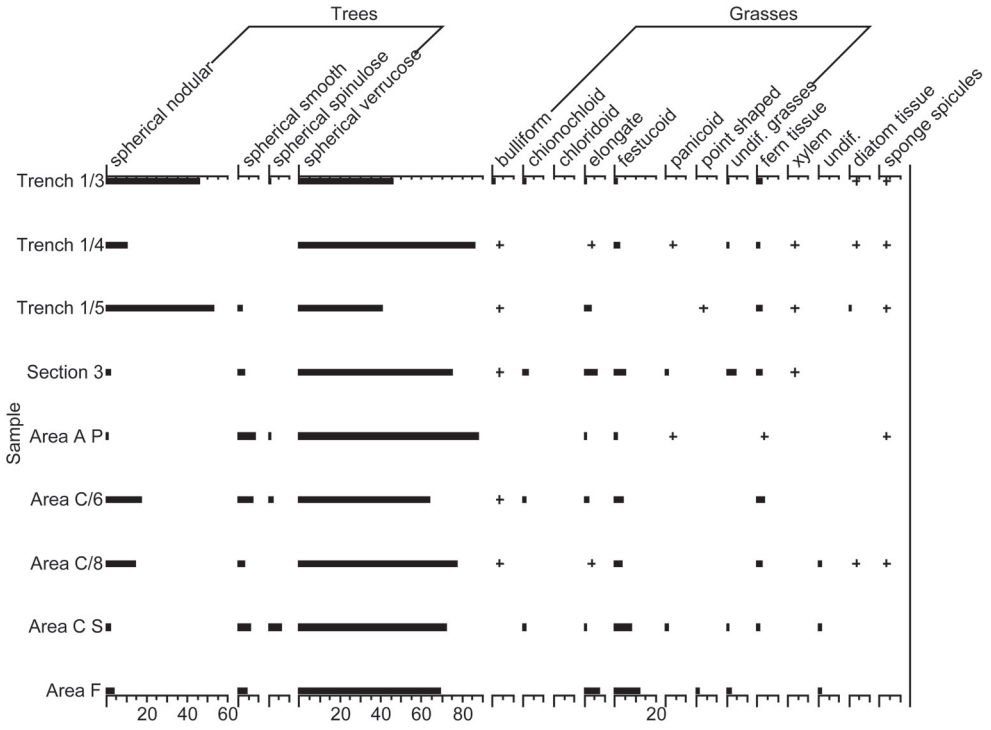

Figure 11: Percentage diagram of biogenic silica from U15/9 (cross represents rare types found after initial count).

Starch and other residues were prepared for analysis by density separation (Horrocks *et al*. 2004). For each sample, slides were scanned and presence/absence of starch residues noted.

Significant starch grains and xylem vessels were found in five samples (Fig. 12). Most are poorly preserved. The starch grains are present individually or attached to cellulose tissue and many show signs of gelatinisation: discolouration, swelling and loss of birefringence. Xylem vessels are present as fragments and similarly discoloured. Despite poor preservation, many starch residues showed features diagnostic of kūmara (*Ipomoea batatas*) root. Kūmara starch grains are spherical to sub-spherical, often bell-shaped, smooth, mostly <20 μm in diameter, with a vacuole at the central hilum, often fissured in larger grains, and one curved surface and up to six flattened pressure facets (Loy *et al*. 1992; Horrocks *et al*. 2004). Xylem vessel elements of kūmara root are up to 90 μm across with walls up to 5 μm thick, and alternate slit-like pits up to 20 μm across. The single indigenous species of this genus (*I. cairica*), which has similar starch residues, can be ruled out because its southern limit is Tiritiri Matangi Island in the Auckland region (E. Cameron pers. comm.). Xylem tracheids of kauri (*Agathis australis*) wood, uncarbonised, were also found in one sample (Fig. 12) (Patel 1968). Rotorua is close to the southern limit of kauri (38° south, Allan 1961), so this may be from a local source.

Three of the samples were from the mixed soils on the terraces below the midden layers in Trench 1, where it was assumed that the soils had been gardened. A further three samples were taken from the bases of two rectangular pits and one rua, which are generally

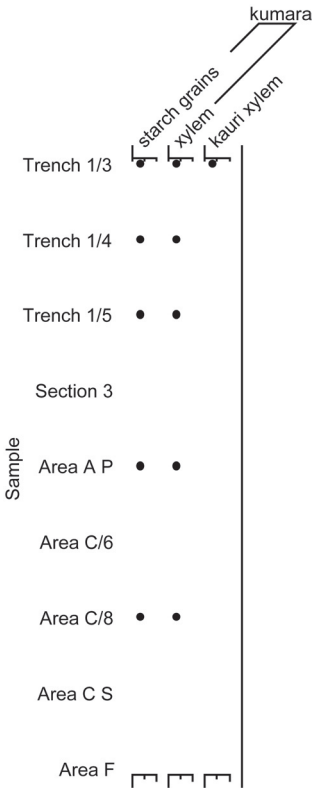

Figure 12: Diagram of starch and other residues from U15/9 (dot represents presence).

presumed to have been used for kūmara storage. Kūmara starch residues were found in all three samples in Trench 1 and from both rectangular pits but not, interestingly, the rua. The reason for this is not obvious: it may be due to a sampling error in the field; it may be that the pit was cleaned out soon before it was abandoned; it may be that it was not used for kūmara storage. It seems unlikely that starch residues would have deteriorated to the point where they cannot be identified. As far as we know, this is the first evidence of kūmara starch recovered from pits in New Zealand. The reasons why kūmara starch may or may not be found in any particular pit context deserve further investigation and research.

Three final samples were taken from soils not directly associated with archaeological features: the baulks of Areas C and F, and Section 3. The latter seemed the most likely place that evidence of taro (*Colocasia esculenta*) horticulture might be found, if it had been grown. None of these samples contained any kūmara or taro starch residues, and in fact the presence of pine (*Pinus* sp.) pollen (Fig. 10) indicates disturbance of the soils in historic times. Of the grass phytoliths, the higher values of elongate and festucoid types in these three samples suggest introduced pasture grasses.

CHARCOAL

Charcoal analysis refers to a different aspect of the environment than microfossil analysis. The latter shows what plants were growing in the general area, but it must be borne in mind that pollen and phytoliths will persist in the soil after the forest had been cleared, and so the results may reflect several hundred years of vegetation change. On the other hand, charcoal analysis shows what woods were available to people to light fires and cook with at the time, and so is restricted to only one aspect of the environment and is mediated by human interaction with it. The analysis was carried out by Dr Rod Wallace of the Anthropology Department, University of Auckland. The results are summarised in Table 2. Broadleaf trees and shrubs dominate the charcoal assemblages, with conifers recording a very low percentage.

TABLE 2
HAMURANA RD (U15/9), CHARCOAL IDENTIFICATIONS

Species	**Pieces**	**Plant type (%)**	**# samples**
Bracken	1	Fern (0.5%)	1
Shrub sp.	1	Shrubs (27%)	1
Tutu (*Coriaria arborea*)	15		4
Coprosma sp.	7		4
Mingimingi (*Leucopogon fasciculatus*)	2		2
Rangiora (*Brachyglottis repanda*)	1		1
Patē (*Schefflera digitata*)	1		1
Wineberry (Aristotelia serrata)	1		1
Pittosporum sp.	5		2
Pseudopanax sp.	2		2
Fivefinger (Pseudopanax arboreus)	19		6
Māhoe (Melicytus ramiflorus)	10		4
Porokaiwhiria (*Carpodetus serratus*)	24	Broadleaf trees (69%)	5
Hīnau/Pōkākā (Elaeocarpus sp.)	3		3
Tarairi (*Beilschmiedia tarairi*)	95		12
Pūriri (*Vitex lucens*)	3		1
Tawa (*Beilschmiedia tawa*)	6		1
Matāi (*Prumnopitys taxifolia*)	5	Conifer (2.5%)	3
Unknown exotic?	2	Exotic? (1%)	2
TOTALS	**203**		**12**

DISCUSSION

The microfossil and charcoal (macro and micro) evidence indicates disturbed forest at the site in prehistoric times, with associated regolith disturbance. The twelve charcoal samples suggest broadleaf forest lacking conifers, in general dominated by tarairi, and extensive

shrubland. Similarly, the presence of several pollen indicators of vegetation disturbance, namely bracken, tutu, pūhā/dandelion and hornworts indicates deforestation. Bracken can form dense, extensive stands up to 4 m tall, and is associated with repeated vegetation burning, while tutu often forms closed stands in succession colonising recent soils (Macphail and McQueen 1983). Hornworts, tiny inconspicuous plants, also colonise freshly exposed soils. Pūhā is a weedy herb used by Māori as a green vegetable (Crowe 1997). The pollen evidence also indicates that rātā and rewarewa were present in local forest remnants.

Pollen profiles from the southern shore of Lake Rotorua show that the pre-human vegetation of the catchment during the Holocene was extensive conifer-hardwood forest dominated by rimu (*Dacrydium cupressinum*) (McGlone 1983). The profiles also show that major deforestation commenced in the area around 650 BP and by about 400 BP most of the forest cover had been reduced to fernland, grass and scrub. Dieffenbach (1974: 388) saw very few trees in 1840: "generally the country is open and covered with fern." He also noted that the woods were burnt frequently in a short swidden cycle, as "the soil soon becomes exhausted, compelling them to seek fresh spots of ground" (1974: 389).

Although high percentages of *Cyathea* tree fern and bracken fern spores indicate that these taxa were important components of the vegetation in the area at the time, they also in part reflect differential preservation; fern spores are more resistant to bio-chemical degradation than pollen grains (Dimbleby 1985). The relative lack of bracken spores in the three samples from Trench 1 suggests that gardening on the hill slope below Area F is the earliest activity represented archaeologically at U15/9. This occupation may have occurred in the early stages of local forest clearance, before bracken had become established. It probably represents the first occupation of the site, though not necessarily of the Rotorua region.

The phytolith assemblages (high tree values) appear at odds with those of the pollen (low tree values). This is in large part because trees are over-represented in North Island phytolith spectra (Kondo *et al*. 1994). Spherical spinulose phytoliths are exclusively from nīkau (*Rhopalostylis sapida*). Spherical verrucose phytoliths are common in, but not restricted to, *Fuscopsora* (southern beech species other than silver beech), and rewarewa. Spherical smooth phytoliths are found in southern beech, kāmahi (*Weinmannia racemosa*), tawa, rātā, *Cyathea* and wire rush (*Empodisma minus*). Little is yet known about the range of plants that give rise to the spherical nodular type. The very low percentages of fern phytoliths, despite high fern spore values, strongly suggest that ferns are under-represented in phytolith spectra, although many of these spores may have been wind-transported to the site and, unlike the fern phytoliths, not necessarily be from local plants.

The starch residues provide direct evidence that the mixed soils in Trench 1 are garden soils, having been used to grow kūmara prior to the deposition of the midden. The evidence also shows that kūmara was stored in two rectangular pits, one from Area A and one from Area C. We would expect that similar pits at the site, if not the rua, were also used for this purpose. Microfossils of kūmara and several other introduced Polynesian crops have been identified at archaeological sites elsewhere in New Zealand (Horrocks and Barber 2005). The other crops comprise taro, yam (*Dioscorea* spp.), bottle gourd (*Lagenaria siceraria*) and paper mulberry (*Broussonetia papyrifera*). Lack of microfossils of these other species in our samples does not necessarily mean they were not cultivated locally.

Interestingly, smooth spherical phytoliths are found in the leaves of kūmara (Horrocks *et al*. 2000; Basset *et al*. 2004) as well as the indigenous *Ipomaea* species. However, kūmara phytoliths are difficult to differentiate from those of the indigenous plants, so we cannot say that the ones in our sample are from kūmara.

CHRONOLOGY

Although shell from coastal sites is commonly submitted for radiocarbon dating, kākahi, and inland aquatic material generally, is not a suitable material for this purpose due to the old carbon effect. Therefore the four samples submitted for dating from U15/9 were all wood charcoal from short lived species. The resulting dates are all modern (Table 3, Fig. 13)—statistically, any of the samples could date as late as AD 1960, though the archaeology makes clear that this is not the case. There is no evidence of any European material, so the occupation of the site probably predates the arrival of European missionaries and traders in the Bay of Plenty, such as Phillip Tapsell at Maketu in 1830. The missionary Thomas Chapman was active around Rotorua the following year, and in 1834 Tapsell set up a trading station on Mokoia. Chapman established a permanent missionary presence in 1835 (Stafford 1999: 27). European artefactual material often does not appear in any quantity in Māori sites until the 1830s, and often later (Bedford 1996: 412). An occupation between about AD 1650 and about 1830 is indicated by the radiocarbon and historical evidence.

TABLE 3
RADIOCARBON DATES FROM U15/9
Calibrated with OxCal 3.10 (Bronk Ramsey 2005), using the southern hemisphere calibration curve (ShCal04) (McCormac *et al*. 2004).

Sample	**Context**	**$\delta^{13}C$‰**	**CRA yr BP**	**Cal AD 68.2%**	**Cal AD 95.4%**
Wk-16046	Trench 1 Sample 1	-27.2 ± 0.2	160 ± 46	1680–1730 1800–1900 1920–1960	1670–1960
Wk-16047	Trench 1 Sample 2	-26.8 ± 0.2	266 ± 49	1520–1540 1620–1680 1730–1810	1500–1600 1610–1710 1720–1810 1830–1880 1920–1960
Wk-16048	Feature A5	-29.8 ± 0.2	228 ± 35	1650–1680 1740–1800	1630–1710 1720–1820 1830–1880 1920–1960
Wk-16049	Feature D4	-27.8 ± 0.2	242 ± 34	1650–1680 1730–1800	1630–1700 1720–1810

The line of postholes in Area A has been interpreted as a possible pig fence and if this is the case then the occupation postdates the arrival and spread of pigs in New Zealand. Contrary to popular belief, today's wild pigs may not be descended from pigs landed by Captain Cook. The most likely source of the first pigs to become established in New Zealand is the sealers and whalers of the late eighteenth century (Judith Robins, pers. comm. 2005; Robins *et al.* 2003: 561). Pigs breed quickly, and once established would have been moved around and gifted throughout the North Island in a very short space of time. In 1840, Dieffenbach (1974: 386) noted "natives from Rotu-rua … driving some pigs", but they must

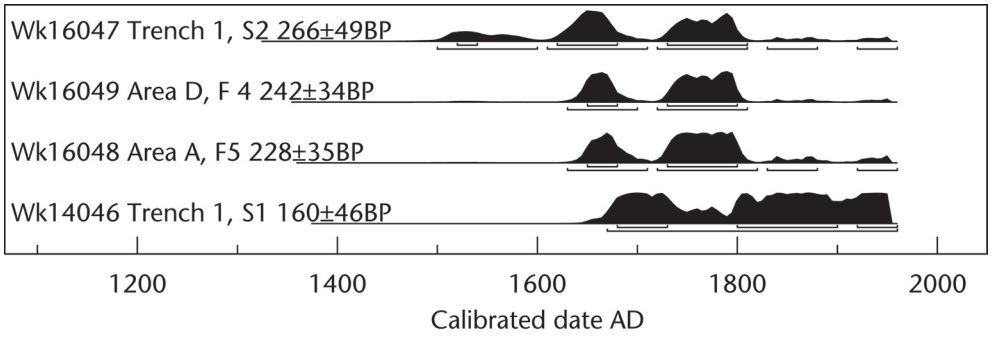

Figure 13: OxCal multiplot of radiocarbon dates from U15/9.

have been established well before then. Their nuisance value for gardeners would also have been noted very quickly, and remedies such as fences soon developed.

Between the arrival of the pig, around the 1790s, and the arrival of European trade goods in the 1830s is a fairly narrow timeframe, and potentially places the main occupation and use of the site within the late prehistoric/early historic period that is discussed by Stafford (1967) in *Te Arawa*. Unfortunately this attractive scenario relies on a somewhat circular argument based on a provisional interpretation of the line of postholes. The radiocarbon dates do not contradict it, but the occupation could equally be late prehistoric.

Two of the dates were obtained from the midden samples from Trench 1: Samples 1 and 2 (Fig. 9). The Sample 1 date (Wk-16046) is the youngest of the sequence, while the Sample 2 date (Wk-16047) is the oldest. The two other dates, from Area A (Wk-16048) and Area D (Wk-16049), are both much the same and lie in between the other two. The stratigraphy of Trench 1 showed four episodes of occupation: gardening, midden deposition, levelling of the Area F terrace and further midden deposition. While the first of these remains undated, it seems probable that the levelling of the Area F terrace coincided with the occupation of Paketuri, while the two kākahi middens were laid down either side of that.

THE PLACE OF U15/9 IN THE SETTLEMENT PATTERN

Settlement patterns are governed by a number of factors: for instance, historical factors related to land tenure systems; iwi and hapū structures; or cultural and ritual factors such as attitudes to lakes like Rotorua. This analysis takes no account of these—they are important but could only be understood through a far more comprehensive research programme (Phillips and Campbell 2004). The settlement pattern analysis at this stage must largely be restricted to analysing recorded site distributions with respect to economic and environmental variables—an old fashioned approach to settlement, as opposed to a more modern landscape approach, but providing a solid baseline for future research.

The purpose is to place the archaeology of site U15/9 in a wider context, though this context is somewhat limited. In 1959 the New Zealand Archaeological Association conference was held at Rotorua and a two day excavation was undertaken at Matapara pā (usually referred to as Pakotore, Don Stafford pers. comm. 2005), but this has never been reported (Golson 1959, 2004). The site is located just outside the Rotorua Basin. Site

recording over a wide area between the coastal Bay of Plenty inland to Kawerau and Rotorua was well underway by this time (Golson and Stafford 1959; Moore 2004), though this early work tended to concentrate on recording pā, which were most visible and seemingly most significant. More recently Tupakaria pā, site U15/35, located 2 km east of U15/9, was excavated by Des Kahotea in 1987 (Kahotea 1988) prior to roading realignment.

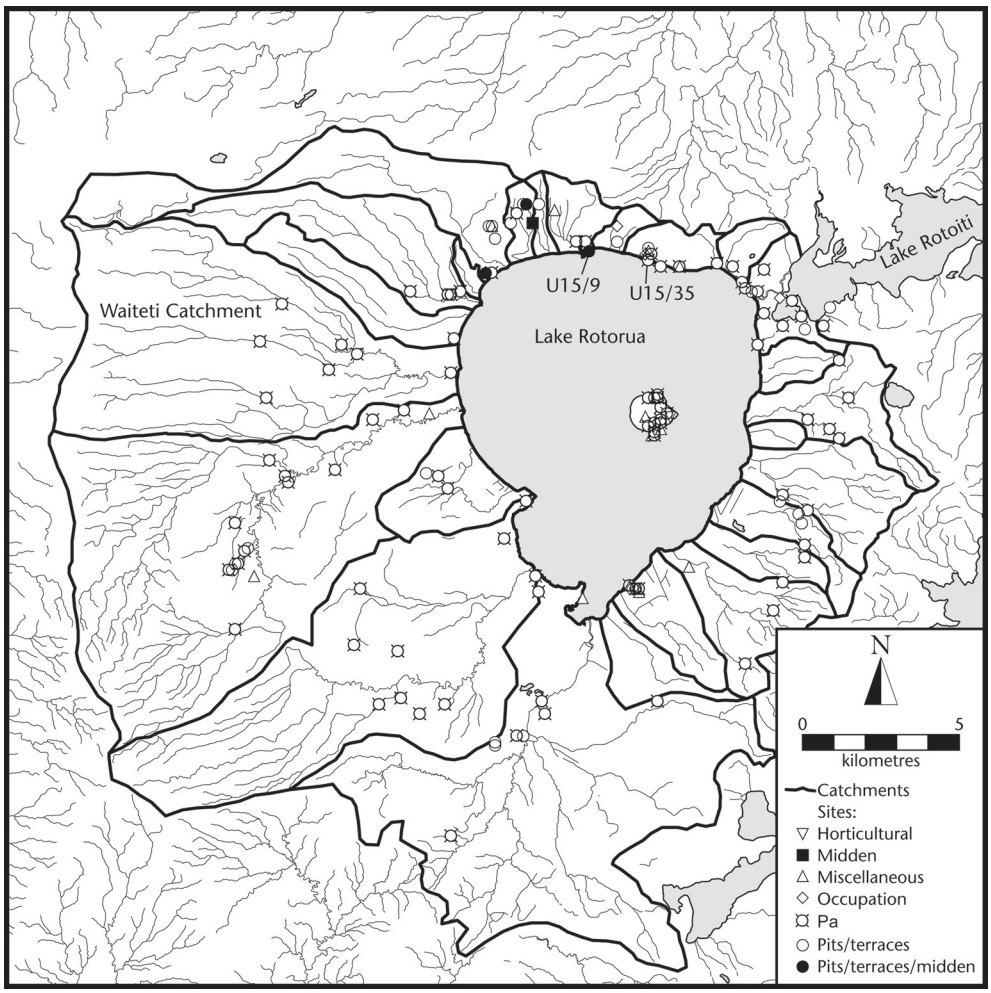

Figure 14: Distribution of recorded archaeological sites in the Rotorua basin in relation to catchments that drain into the lake (catchments are approximate only).

Three trenches and five smaller squares were excavated to reveal small deposits of kākahi midden; postholes, including palisade lines; and extensive ditch and bank earthworks. The site was not dated. This seems to constitute all the archaeological research in the Rotorua area, though clearly the region has considerable potential.

The distribution of recorded sites in the Rotorua Basin was plotted in relation to the catchments that drain into the lake (Fig. 14). These were chosen as potential prehistoric territories on the basis of similar territorial divisions elsewhere in Polynesia, for instance the tapere system of Rarotonga (Bellwood 1978; Campbell 2001) or ahupua'a system of Hawai'i (Green 1980). In such a system each political grouping holds a wedge-shaped piece of land centred on a valley, running from the mountains to the sea, enabling the group to access hill slope, valley floor, coastal plain, lagoon and reef resources. Walter (1984) noted that the distribution of sites in the Kaiaua region on the west coast of the Firth of Thames followed this sort of pattern. Each valley had one or two large pā and several pit and terrace complexes, while the middens were all coastal, with midden contents dominated by local species. Pā were evenly spaced. Each valley system had access to a full range of resources, including the inland forest, to good fertile river soils, upland agricultural storage areas, coastal plain and marine resources. Walter concluded that each valley system contained an autonomous settlement occupied by an autonomous hapū of a single iwi. Valleys/catchments would seem to be a good way to start looking at the Rotorua data.

Apart from the bias toward pā in the recorded site inventory, there are large gaps in the site distribution: for instance the town of Rotorua itself, the Mamaku Plateau, or the extensive exotic forests to the southwest of the lake. Fuller research into the history of site recording in the Rotorua region would be required before we could say to what degree these gaps exist because there are no sites there (unlikely), the sites that are there are not easily recognised (quite likely) or very little site recording has been carried out there (most likely). The analysis at least is able to identify areas where future research is likely to be productive.

TABLE 4
RECORDED PREHISTORIC SITES IN THE ROTORUA BASIN.

Site type	**Number**
Horticultural	1
Midden	1
Occupation sites	4
Pā	90
Pits/terraces	22
Pits/terraces/midden	3
Miscellaneous:	
Adze grinding	1
Burials/urupā	6
Carved or tapu rock	2
Fishing weir	1
Trails and tracks	3

Table 4 shows that 90 of 134 recorded sites, about two thirds, are pā. It is certainly expected that many more pit, terrace and midden sites will exist in the area. It would be quite dangerous to try and come to any definitive conclusions regarding the settlement pattern in general or the wider context of U15/9 by examining the distribution of a specialised site type like pā. The recorded site data give us a site distribution map, which forms the basis of the settlement pattern analysis. The limitations of the data, however, must always be borne in mind, and the resulting analysis might be regarded as merely indicative.

Pā are reasonably evenly distributed throughout the Rotorua Basin, given that the basin is more extensive to the south and west of the lake than to the north, where U15/9 is located. Pā probably divide into two types: headland pā that utilise the lake escarpment in their defences; and the more typical hilltop or ridge pā. Many pā on the north side of the lake seem to be of the first kind, including Tupakaria, U15/35. Elsewhere, where there is more room, the majority of pā are located away from the lake. Only four sites have been recorded as containing midden, and all of these are on the north side of the lake, including U15/9. This is probably because midden was not noted by the recorders rather than that it is absent. What we might expect if we had a full suite of site types recorded is that sites like U15/9, an occupation site that was mostly visible as a pit associated with midden, would form part of a wider settlement pattern that would reflect both the use of the landscape to provide the economic resources necessary to maintain society and social life as well as the territorial expression of social and political structures. This settlement pattern would also reflect the mobility that is implied by the repeated short term occupation of Area F/Midden C. The details, however, escape us at present.

The distribution of pā indicates that a catchment-based analysis might be productive. Many are close to the rivers and streams, in the middle of the catchments, rather than the boundaries between catchments, which would generally be the higher ground. The Waiteti catchment is a case in point (Fig. 14). Here only seven sites have been recorded, all pā. The sites are distributed along the river and stream valleys fairly evenly. One is located close to the lake, and each major branch of the Waiteti has at least one pā along it. This might indicate that each catchment could be further subdivided into major tributary catchments, but if we were to do so only one could have access to the lake shore. Conversely, the small catchments to the north and east of the lake might not have been economically viable on their own and a hapū might have occupied more than one in the course of their daily and seasonal rounds.

The other way in which site distributions are analysed here is with respect to soils. Land use capability descriptions for soils (Harmsworth 1996) were reclassified as good, marginal or poor for kūmara cultivation on the basis of drainage, fertility and proneness to erosion—light free-draining soils are considered ideal. Harmsworth's classifications, of course, are designed to highlight the potential land uses for modern agriculture, not pre-European cultivation. Māori gardens were much smaller than European farms. Pockets of suitable soil would probably be found within gross units classified as unsuitable, and steep soils prone to erosion, but otherwise fertile, could be terraced. Figure 15 shows these distributions. In most instances sites are located on or close to fertile soils, the main exception being along the north-east shore of the lake, where the narrow lake terrace and steeper topography result in soils being classified on a gross scale as unsuitable.

Pā are located either close to fertile soils or further up valleys, just beyond their margins. This indicates that different pā may have served separate functions: firstly directly defending garden lands against local threats, that is to say, against neighbours; and secondly, defending tribal territory against an outside threat, against whom neighbours had to unite. It would be interesting to see if these pā on the margins of the valleys were in any way different from those in the valley interiors. A pattern of larger pā oriented towards an external threat has been noted at Poutu on the North Kaipara Head (Irwin 1985), and might be expected in Rotorua also. However, these sites have been recorded in insufficient detail to come to any useful conclusions based on site size. Within the context of short-term occupation and mobility, pā would have served as visible declarations of land ownership and rights that anchored small groups with a larger hapū and rohe.

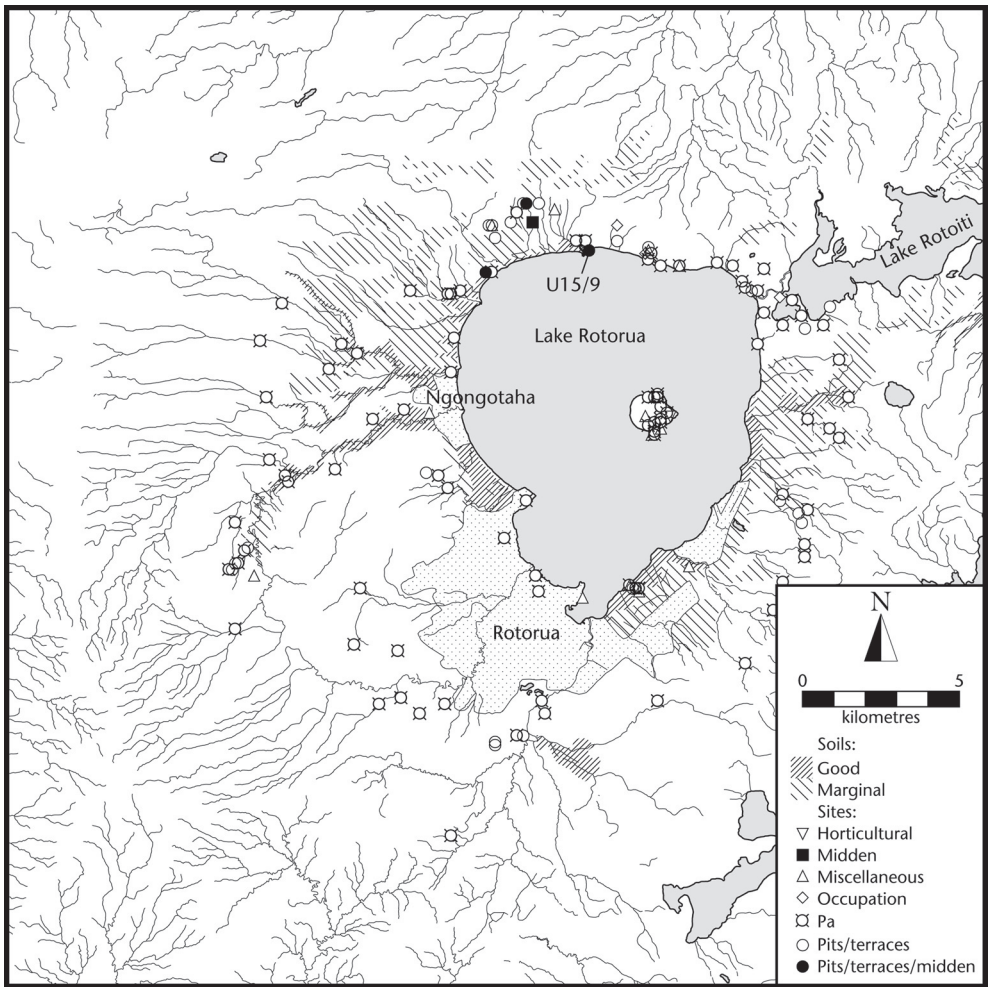

Figure 15: Distribution of recorded archaeological sites in the Rotorua Basin with reference to fertile soils. Soil data provided by Landcare Research NZ Ltd.

The only other inland region for which comparable data are available is Taupo, which is somewhat better known archaeologically than Rotorua. Here Williams and Walton (2003: 19) note that, due to climatic limitations more extreme than at Rotorua, kūmara could probably only have been grown in selected microclimates. They characterise the settlement pattern as a "small number of people [living] in the Taupo region in the late prehistoric and early historic period, with the population being mobile and dispersed" (2003: 24). The climatic restrictions on settlement and subsistence that applied at Taupo were less marked at Rotorua, but this analysis shows that some similarities between the two are likely—at least inland settlement patterns will differ from the better known coastal patterns in significant ways.

In conclusion, the analysis has suggested that an approach based on drainage catchments as basic territorial units, analogous to the tapere system of Rarotonga, is a useful start in identifying the settlement pattern of Rotorua. There are indications from the excavation of U15/9 that repeated short-term occupation, mobility and access to resources may be key concepts. Many other useful questions might be addressed by future research: how many similar sites are to be found on the lakefront terrace; how does a late site like Hamurana Road fit into settlement and subsistence pattern change through time; how are sites like these related to sites like pā, agricultural sites or pit and terrace sites elsewhere; or how are sites other than pā related to factors such as landform or horticultural soils? One final aspect of the archaeology deserves mention: the single blue mackerel vertebra from Midden C indicates contact with the coast, perhaps through trade or gift giving, perhaps through whakapapa-based rights of access to coastal resources. Another important source of data that will probably throw considerable light on this aspect of pre-European society is traditional history, particularly the records of the early Native Land Court. These latter have been used, along with other resources, to reconstruct the wider history of the Arawa people (Stafford 1967), but an examination in order to discover the details and nature of settlement would be instructive. Arawa territory, of course, extends to Maketu on the Bay of Plenty coast.

CONCLUSION

The radiocarbon dates from U15/9 indicate a late occupation of the site, while the possibility of a pig fence and lack of European material indicates perhaps a very early historic period occupation: the late 1700s or early 1800s. There is evidence of gardening in the form of both terraces—confirmed by the microfossil analysis—and kūmara pits. The midden shows the importance of lake resources, particularly kākahi. There is evidence of simple housing, while both the archaeology and the radiocarbon dates indicate repeated, small scale occupation. The site is probably Paketuri, identified by Stafford. Cooper (1999: 122), in 1849, described "a few native huts, inhabited by about a dozen people, with some potato plantations" above Awahou: essentially what we find from the archaeology of U15/9, only some 10 km away and 50 to 150 years before.

Paketuri is part of a late period settlement pattern, but it is not clear how this pattern developed or what it developed out of. The excavation of U15/9 is the first comprehensive archaeological excavation undertaken in the Rotorua basin, albeit a rescue mitigation. Its main value lies in providing some preliminary insight into the archaeology of the region, including cultivation of kūmara, and providing a baseline for future research into the general pattern of occupation in the Rotorua Basin.

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