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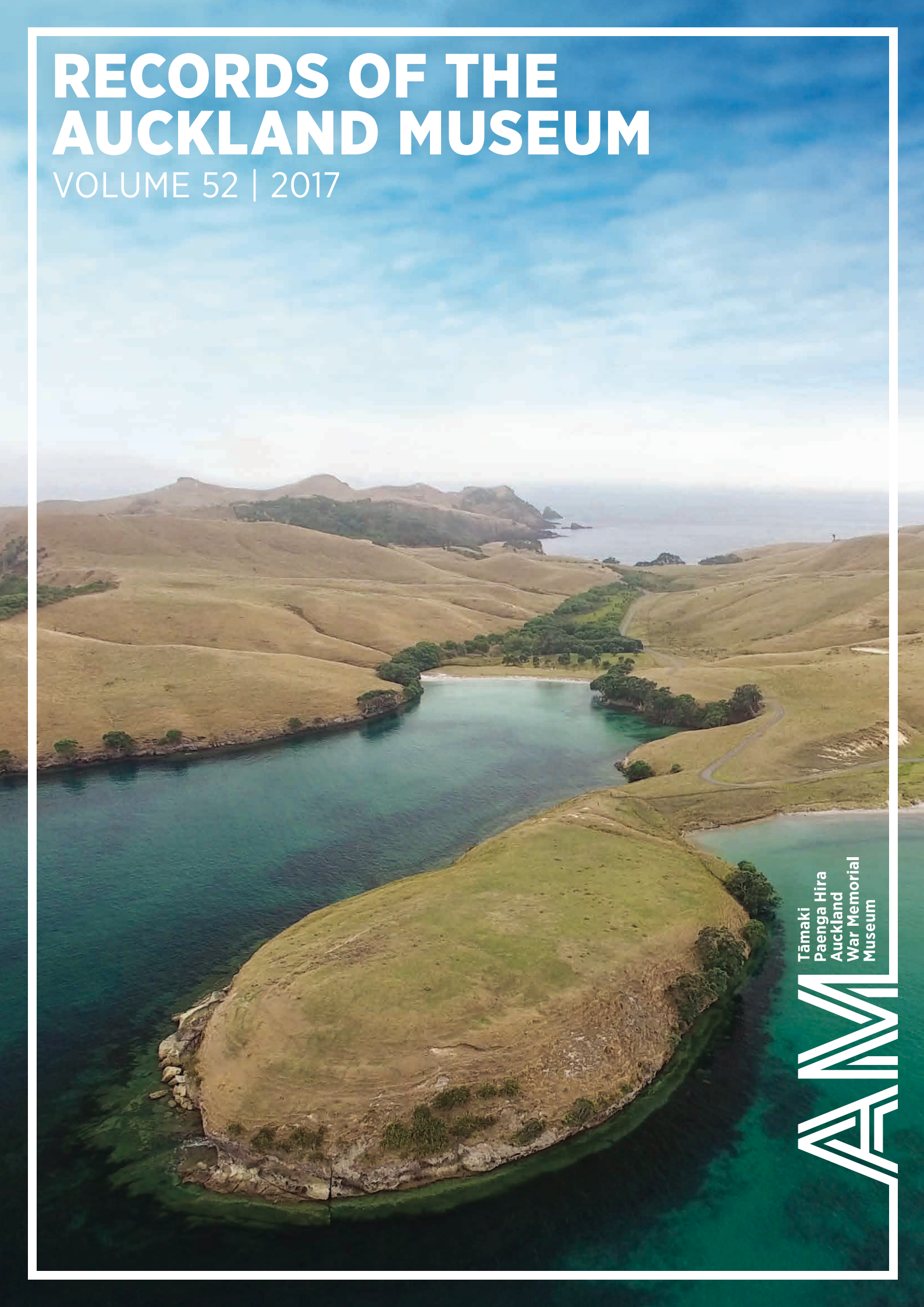

Tāmaki Paenga Hira Auckland War Memorial Museum

Matakawau Stingray Point Pa excavation, Ahuahu Great Mercury Island 1955-56

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Abstract
The 1955-56 excavation of Matakawau, a *pa* (fortified site) on the western side of Ahuahu Great Mercury Island, is described. A terrace low on the slope above the natural cliff defences contained five storage pits, dug at different times, and some with multi-period use. The terrace seems to have been used exclusively for storage, with unusual drainage features not reported elsewhere.

Keywords
Ahuahu Great Mercury Island, Matakawau Stingray Point Pa, kumara storage pits, Maori, archaeology.

In 1955 an excavation was carried out on Matakawau (Stingray Point Pa), Ahuahu Great Mercury Island. Led by Jack Golson, lecturer in archaeology at University of Auckland, the expedition was the first outing of the Auckland Archaeological Field Group (Golson 1955: 350) later to be renamed University of Auckland Archaeology Society and now a student-led group called ArchSoc. The aim of the fieldtrip was, in part, to develop experience among the participants in recognising and recording archaeological sites, and to train a skilled workforce for future archaeological work.[1] Approximately 25 individuals were involved in the fieldwork in January 1955, mainly students from University of Auckland and Auckland Teachers College.

Less than one year after arriving in New Zealand and after gaining local experience in Auckland on Taylors Hill, Golson in late 1954 was persuaded to go to Great Mercury Island by Robert (Bob) Brown.[2] According to the brief published article (Golson 1955) the island was very attractive for fieldwork because of the rich archaeological landscape in a small defined area, and the difficulty of access ensured the archaeological party would be able to work uninterrupted by regular visitors.

Approximately half of the three weeks on the island was spent recording and mapping sites, and the remaining time conducting an excavation on Matakawau Stingray Point Pa. From an assessment of surface features Golson considered that the pa was less complicated than other pa on the island (i.e. it had fewer terraces), was easily accessible from the camp site beyond the south end of White's Beach, and appeared the most promising for investigation (Golson pers. comm. 2013). Surface appearances can however be misleading.

A brief summary was published on the first season of activity (Golson 1955). Because archaeology was still in its infancy, there were no other excavations on the Coromandel Peninsula to compare Stingray Pa to, but eight years later when Green (1963a) published a summary of archaeological work in the area there had been a number of excavations in the Opito area including Sarah's Gully Settlement (Green 1963a), Sarah's Gully Pa (Birks 1960) and Skippers Ridge in Opito (Davidson 1975), all of which contained structures including storage pits. In the following decades the excavation on Matakawau was often referenced, but the lack of detail meant no interpretation could be teased out on what was obviously a sequence of events. Excavation field notes and plans were taken to Canberra in 1961 when Golson took up a position at Australian National University, and were retrieved in 2013.

Since 2012 there has been renewed interest in the archaeology of the island with the joint University of Auckland/Auckland Museum long term project to investigate the history of the island (Furey *et al.* 2013,

1 This was only the second or third excavation carried out by Golson in New Zealand after his arrival from Cambridge University in 1954. He was employed as a lecturer in archaeology at the University of Auckland, the first such dedicated archaeological position nationally.

2 Brown completed a MA at Auckland University College in 1954 on the prehistoric geography of Auckland (Davidson 2015:198-9). He was also an inaugural member of the New Zealand Archaeological Association, formed in 1954. Brown was a member of Golson's first expedition to Ahuahu and was responsible for photography and then developing the film in a specially outfitted tent in the campsite. In subsequent seasons photographs were taken by Wal Ambrose.

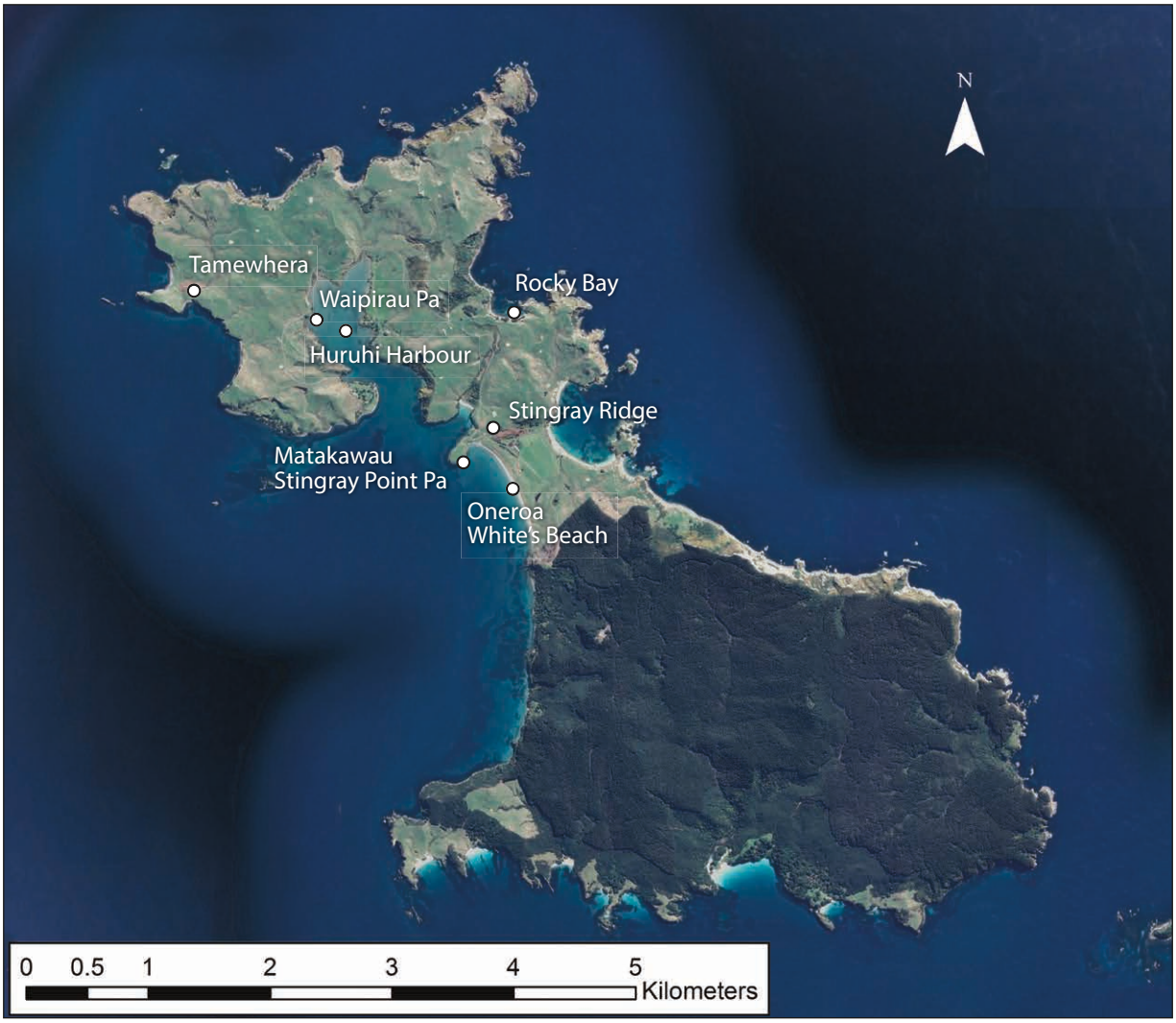

Figure 1. Great Mercury Island and location of Matakawau Stingray Pa.

Figure 2. Aerial of pa showing parallel triple ditches and diagonal earlier outer ditch. Stingray Ridge, referred to in the text is further up the ridge. Photo: T. Mackrell.

2017; Phillipps *et al.* 2014), and the forthcoming results of a number of excavations allow a more nuanced interpretation of the earlier excavation. The samples of charcoal, shell, and stone flakes from the excavation are in the Archaeology Collections of Auckland War Memorial Museum and the original field notes will also be archived there. Photographs from the excavations, housed for many years as black and white prints and negatives in the Photo Archive of the Anthropology Department, University of Auckland have been digitised and are available online through the University of Auckland library portal.

Matakawau Stingray Point Pa is on the headland at the north-western end of the low tombolo in the centre of the island (Fig. 1) and is one of 20 pa defended by earthworks on the 1700 hectare island. The headland is surrounded by vertical low cliffs on three sides, but on the landward side there are three prominent parallel ditches separated by banks, with a shallow, possibly earlier, ditch on a different orientation external to the group of parallel defences (Figs 2 and 3). The site is referred to in the NZ Archaeological Association Site File as T10/169 (previously N40/11) and measures approximately 200 x 100 m with an internal area of 1900 m^2 (McIvor 2015). In addition to the large platform situated at the highest elevation, there are an estimated 42 terraces. Erosion over a long period of time has blurred the edges of the higher terraces and shallow scarps are only discernible in high resolution 3-D laser scan (Fig. 3).

Four excavations were carried out on the pa: January 1955, May 1955, February 1956, and August 1956, expanding out each season from previous excavations as more features were uncovered (Fig. 4). In January 1955 a trench 1.8 m (6') wide x 19.5 m (64') long was excavated from the highest point of the pa to beyond the front edge of a terrace on the edge of the cliff (Golson 1955: 350). On the lowest terrace two pits were intersected, only one of which was visible on the surface. Excavation efforts were concentrated on this terrace and Pit A, closest to the back scarp, was uncovered. The excavation of the pit was completed in May 1955. During the third field season in February 1956 Pit A was re-excavated for plan drawing and Pit B was fully excavated. A truncated Pit E to the west of Pit B was also uncovered. In August 1956, excavations were extended to the east and west of Pit A, and the west of Pit B, revealing further pits: Pit C in the east and Pit D on the western baulk. Postholes and slots were also present and the large number of features on the plan alludes to the complexity of use and reconstruction on this terrace (Fig. 5), where apparently superimposed features have been reduced to a common level and reuse destroyed any stratigraphic evidence associated with the earlier activity.

The two large pits are unusual in the context of reported similar structures. Not only were there a large number of postholes in the floor of each pit but the area immediately surrounding the pits also indicated structures truncated horizontally and vertically. The two large fully excavated pits were themselves reused and remodelled on several occasions.

STRATIGRAPHY

The soils on Ahuahu are generically classified as brown soils, common to the Coromandel Peninsula also (https://lris.scinfo.org.nz/layer/159-soil-map-of-coromandel/, accessed 23 March 2017). On the headland the natural soil profile has dark grey brown loam topsoil over yellow brown subsoil weathered from the parent material of pumiceous ignimbrite, which occurs in a band from Stingray Pa through to Rocky Bay on the east coast (Hayward 1976) (Fig. 1). Characteristically disturbance of the natural profile is indicated by the presence of variably-sized pieces of broken up greyish white weathered ignimbrite mixed with topsoil and subsoil. Given the amount of modification on the terrace, through either terrace construction or digging of pits and other features, the generic fill layer over all the excavation area, regardless of chronology, was a mixed brown soil with ignimbrite fragments, or a mixed brown soil made up of topsoil and subsoil. Very little cultural material such as midden was recorded, and only directly under the topsoil on the eastern side of Pit A, and within the upper fill layer of Pit A.

The profile across the terrace (Fig. 6) indicates different fills in each pit (described in more detail below) and a number of redeposited layers on the outer slope edge which can be attributed to the cut and fill process of terrace construction. The terrace was widened by about 2 m with the infilling of Pit B. The section also confirms there was activity on the infilled surface of Pit B but this activity, or the associated features, is not well described in the field notes.

Slope trench

Field notes suggest terraces were intersected in the trench excavation (Fig. 7) from the summit of the pa but there is little detail of what was encountered: the field books and plans relate only to the lower end of the trench and expanded excavation area, that is over Pits A and B, and all the photographs are of the lower terrace excavations. During the dry summer of 2013 when grass was low, the outline of the 1955 trench was clearly visible and shows up on the laser scan (Fig. 3) taken the same year.

The field notes suggest the trench stratigraphy on the slope was relatively simple and was in part thin topsoil over natural subsoil (Fig. 8). However Fig. 7 shows a distinct cut into the subsoil and a level surface approximately 3 m (10') wide in squares M and L. The cut surface here was stained with charcoal, with a "cloddy back fill" 31 cm deep under the topsoil. This layer is elsewhere described in the field notes as the natural clay which has been partly broken up, similar to what might be produced during the digging of a storage pit, or terrace construction. A similar feature, again with a level clay surface and overlying fill layer 30 cm deep, was present in Square J. This particular feature, probably also a terrace, was evident on the surface and measured approximately 2.6 m (8' 6") wide. Shell midden under the topsoil extended from Square M to the lower end of the trench including over Pit A indicating later occupation on the Square M terrace surface which, in part, sealed

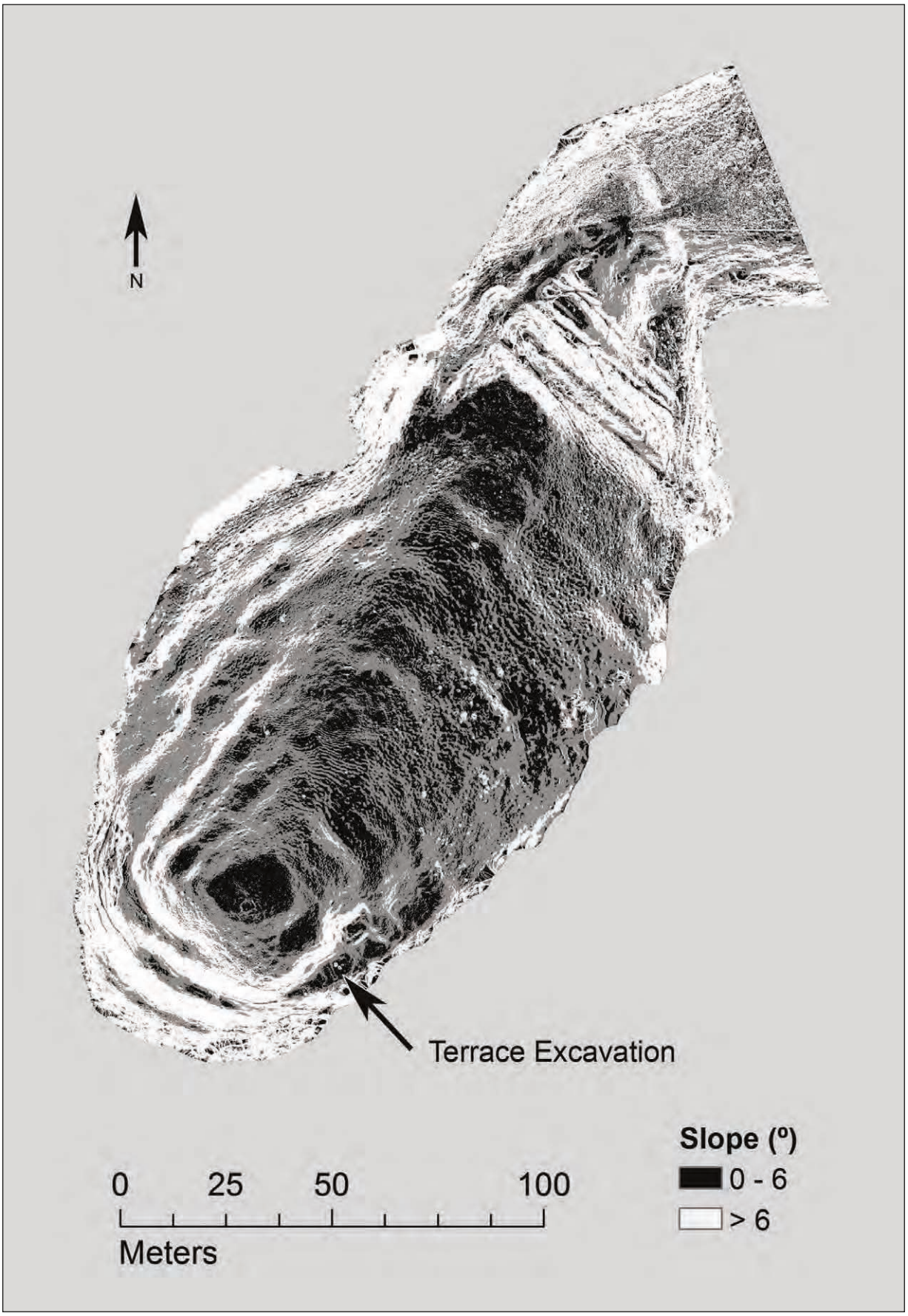

Figure 3. 3-D scan of Matakawau, Stingray Point Pa, 2013.

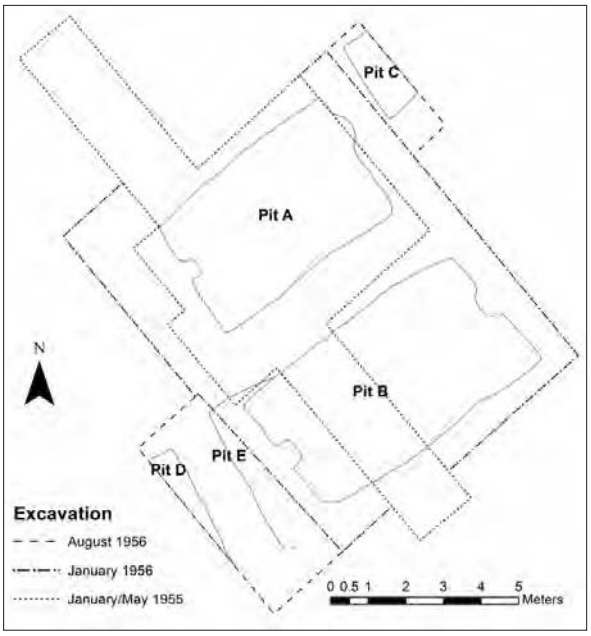

Figure 4. Areas excavated in each season.

in activity on the lower terrace. Flakes of obsidian and chert were recovered from the midden in squares M and N and fish and dog bone from Square J. The methodology for sampling and sieving has not been described, so it is uncertain whether there was total collection of all material, or only a sample. Shell was not retained.

Pit A

Pit A, visible on the surface as a depression at the rear of the terrace, was oriented east-west on the long axis. Upon excavation it measured 5.5 x 3 m (17' 6" x 10') with a wall depth of 70 cm at the northern uphill scarp and 30 cm on the southern side. A well-defined buttress is present in the centre of the western end and the plan shows a central protuberance from the pit wall at the eastern end which is probably a less-defined buttress (Fig. 9). There is a shallow drain in the pit floor at the base of the west, north and east walls, possibly with a sump at the south-western end (1 in Fig. 9). The drain exits through the wall in the south-east corner of the pit (Fig. 10). There is also a channel cutting through the upper part of the wall between Pits A and B. At the time this feature was thought to relate to an earlier event on the terrace as it

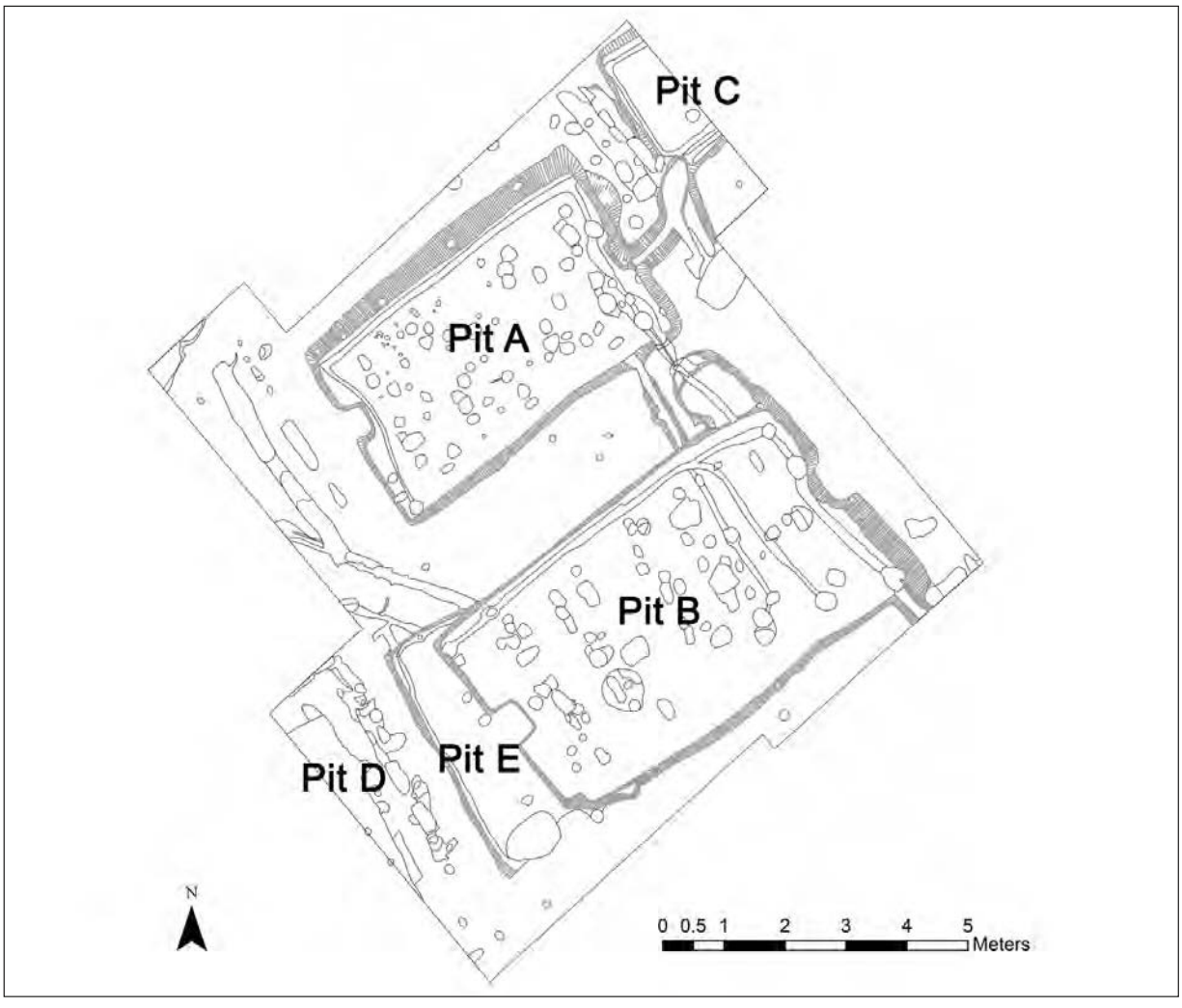

Figure 5. Excavated area showing all features.

is not at the level of the pit floor. It has been concluded however that it has been formed by a tree root, and will be discussed later. Similarly a feature which originates from near Pit C enters Pit A to the south of centre in the eastern wall, and may also be a root mould.

The numerous postholes in the floor, along with drain features and shallow depressions represent several phases of renewal of the roof. Some of the postholes may also relate to earlier activity on the terrace prior to when Pit A was dug. Smaller diameter postholes and stakeholes are likely to indicate the presence of internal racks or shelves for storing kumara (*Ipomoea batatas*) tubers.

Stratigraphy of Pit A

Layer 1, topsoil, contained flakes of obsidian. The presence of the flakes in the topsoil suggests natural movement post-occupation, and they may have been from near the interface with the next layer (Fig. 11). Layer 2 contained shell which was thinly scattered over the whole pit but thickest in the centre of the pit where the underlying fill layers had compacted. The shells were predominantly cockle (*Austrovenus stutchburyi*), but other species included cats eye (*Lunella smaragdus*), mudsnail (*Amphibola crenata*), *Cominella* sp., pipi (*Paphies australis*), tuatua (*Paphies subtriangulata*), dog cockle (*Tucetona laticostata*), and paua (*Haliotis* sp.). Photographs suggest the shell was in a mixed matrix. Layer 3 was a dark charcoal-rich layer with some blackened stones interpreted at the time as an in situ fire feature. However the stones closely follow the sloping contour of the fill layer suggesting it is more likely the stones were dumped there as part of the infilling process. Layer 4, on the floor of the pit, was deepest near the walls and interpreted as a natural in-wash or silting process after pit abandonment. The walls of the pit were cut into clay at the upper levels and weathered ignimbrite below. The concave nature of the fills suggests the pit was left open and was initially filling naturally, with some of the infilling (Layers 2 and 3) derived from activity in adjacent areas.

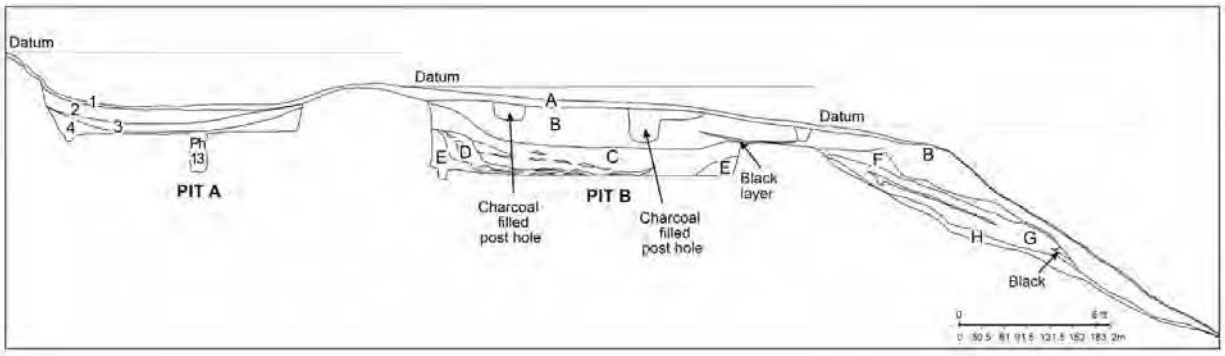

Figure 6. Composite section across the terrace showing stratigraphy of Pits A and B, and the outer slope. Iden layers are referred to in the text.

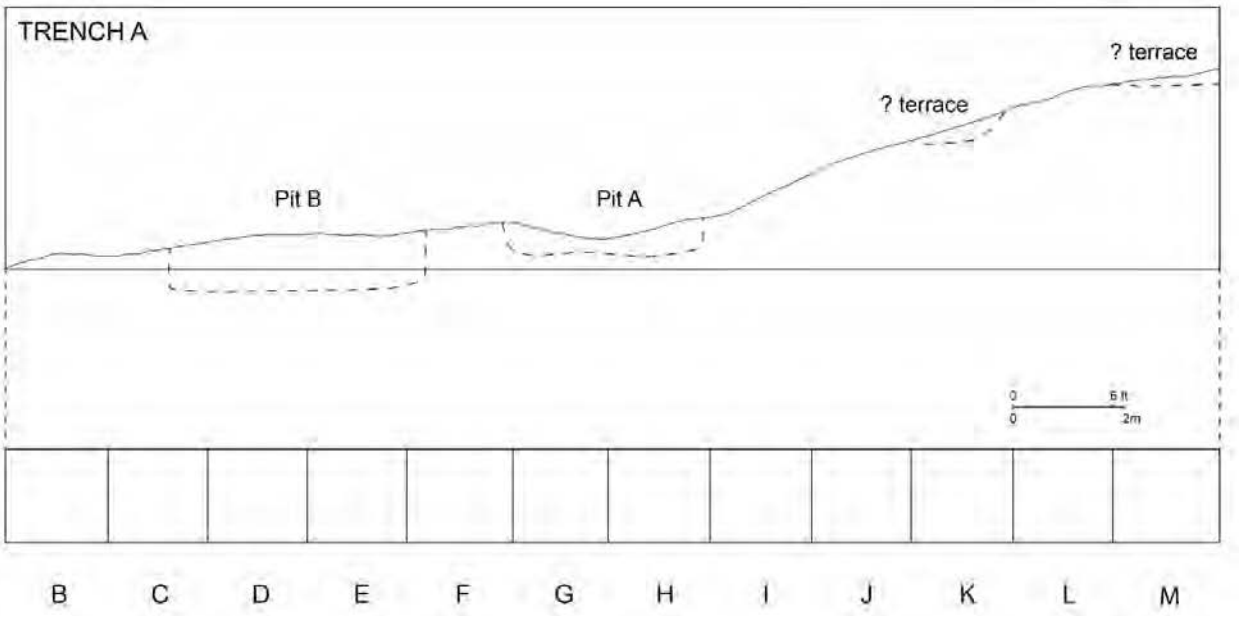

Figure 7. Pr of the lower end of the trench showing former terraces in Squares L and M, and J.

Most of the 79 postholes dug into the floor of Pit A (Fig. 9) can be assigned to different phases of use. There may possibly have also been an earlier pit in the same location, and other shallower postholes may be the bases of posts from earlier structures on the terrace. Five vertical postholes visible in the upper levels of the northern wall are unlikely to be associated with Pit A and there were no postholes or other features recorded as present during excavation of the fill. The pit depression being well defined on the surface also precludes use of the area as a later living surface. Posthole 1, bell-shaped with a narrow opening and broadening out inside, and angling to the west, was filled with Layer 4 (slumped or eroded material from the pit wall), indicating it was open at the time the pit was abandoned, and therefore quite likely to be a sump. Although the main system of drainage directed water through the exit in the south-eastern wall the level of the drain may have directed some flow into posthole 1.

Postholes within the pit were of different sizes and shapes, and fills were equally varied. Two or three common fills were identified (thought at the time to be relevant in assigning phases of use) but Golson later realised that this was an erroneous assumption as similar posthole shapes which were aligned and therefore contemporary had different fills. Generally speaking however there were three main fill types. One was the equivalent to Layer 4, the silty eroded material in the base of the pit suggesting the postholes with this fill may be from the last use of the pit. The second was a fragmented

Figure 8. Lower end of the trench showing the slope excavation and intersected pits. Photo: W. Ambrose.

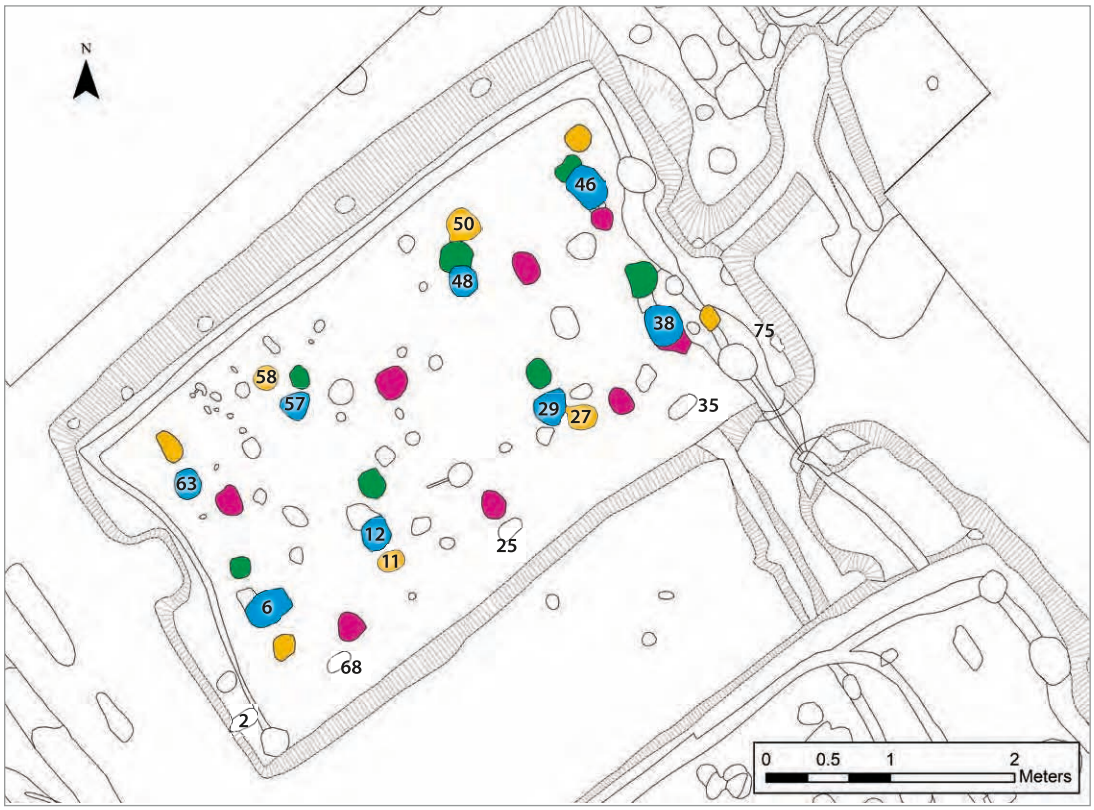

Figure 9. Pit A features with phases of postholes. Those mentioned in text are numbered.

Figure 10. Excavated pit A and partially excavated pit B. Photo: W. Ambrose.

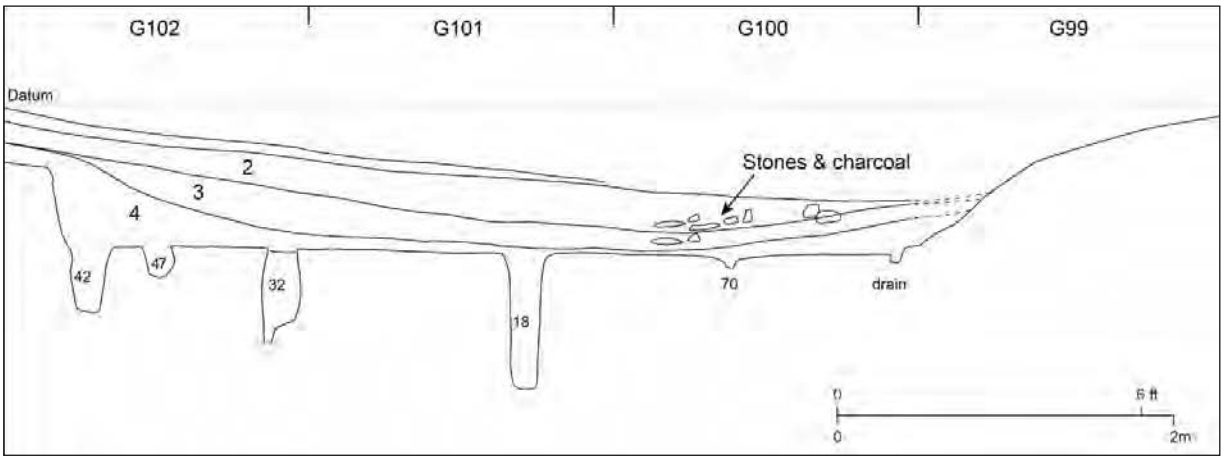

Figure 11. Pit A section east-west.

ignimbrite, lighter in colour than the first type, and the third type was a loose black fill which tended to be present in the smaller holes. The number of postholes has made it difficult to reconstruct periods of use and superstructure form from fills alone, and patterns of size, shape, and position within the floor have been used to determine which postholes may be contemporary.

The large number of postholes in the pit seems, at first glance, to have no pattern. It is apparent there is more than one phase of use represented and to tease out the postholes requires consideration of posthole depth, and spatial analysis. The pattern of postholes within storage pits generally conforms to a regular pattern and there is symmetry in placement including distance from the side and end walls, distance between posts in a row and between rows (Fox 1980; Fox and Green 1982; Green 1963b; Lawlor 1983). In small or narrow pits there might be only a single row of postholes on the centreline of the pit to hold up the ridgepole. In larger and wider pits, multiple rows supported the rafters, and in some cases there was also a row of posts to also support the ridgepole. If similar observations of post placement are applied to Pit A and Pit B postholes, patterns become apparent.

As referred to above, Golson initially thought posthole fills had a role in identifying phases of use. However the overall distribution of fills was quite random, with the majority having type 1 fill (i.e. silty layer similar to Layer 4 of the pit fill). Depth and diameter of postholes is a better indication, with postholes able to be separated out into those under 20 cm depth, 20-40 cm, 41-60 cm and over 60 cm. Several postholes (2, 68, 25, 35 and 75) are elongated slots oriented the same way along the southern side of the floor. All of these postholes are also quite shallow suggesting they were not structural within the pit or, alternatively, are remnants of a pre-pit structure. The narrow rectangular shape suggests they held dressed planks rather than the usual round posts.

Aligned postholes 6-12-29-38 are matched by 63-57-48-46 as a double row supporting the under-rafter purlins (horizontal beams supporting the rafters) (Fig. 9). All of these holes are between 60 and 75 cm deep. Postholes 58 and 50 in one row and 11 and 27 in another row are of similar depths. Several of these postholes were impressively large and deep, and Golson drew comparisons to exposed palisade postholes on the north side of the pa. However given their placement well back from the edge of the terrace it is unlikely these posts had a defensive function. Much more likely they were the solid foundations for the pit superstructure: the terrace is very exposed to the predominant south-westerly wind which can at times be severe, and deep postholes may have been a necessity for stability of the roof structure.

The posthole patterns suggest the size of the pit was not altered over time. Two clear posthole patterns are apparent where there are four sets of opposing postholes (Fig. 9). One set (blue) are all over 60 cm deep, and four of the eight are between 70 and 75 cm deep. The second set (orange) is more variable in depth at between 50 and 80 cm. While the sequence of postholes can't be determined, the south-eastern posthole is within the drain, and the field notes refer to the drain being over the hole. This suggests the postholes of more variable depth are earlier. Interestingly, the distance between the second and third postholes in each configuration is greater than the distance between any other two postholes. There are still many postholes unable to be accounted for as aligned posts, suggesting multiple uses of this area prior to the construction of Pit A. Postholes for internal racks and bins for holding kumara can probably account for some of the smaller diameter holes but there are several large diameter and deep holes which cannot be assigned unequivocally. Another possibility for a pit superstructure is eight postholes (pink), the south-eastern one having been truncated by a post from blue structure. A possible earlier alignment is shaded green, again truncated by the blue series of postholes. However neither of these alignments is centred on the central buttress so are unlikely to be postholes associated with this final pit size and shape.

All configurations of posthole patterns indicate double rows of posts holding up the under-rafter purlins of the pit superstructure. There was no evidence of central posts holding up the ridge pole, and no central postholes external to the pit to support the ridge pole (see discussion below).

The buttresses at the ends of the pit are not centrally placed with respect to any of the posthole patterns, but the role of buttresses within pits has not been satisfactorily explained. The position of the entrance to the pit could also have influenced the placement of posts and buttress.

An unusual form of drainage is present in the pit. The open floor drain runs around three of the walls, diverting around the buttress at each end. Near the south-eastern corner the drain goes through the pit wall, forming a tunnel. Remnants of tree fern fibre within the tunnel suggest a hollow trunk of tree fern may have acted as a pipe through which water flowed. This drainage system only makes sense by reference to Pit B, where an annex at the north-eastern corner of Pit B appears to be related to the construction of this feature and post-dated use of Pit B. The floor of the annex was higher than the floor of Pit B but at the same level as the floor of Pit A. Overlapping stone slabs laid on their flat sides partly covered the base of the annex, and extended at the same level across Pit B to exit through an open drain in the southern wall of the pit. The floor drain in Pit A, the tunnel and the stone slabs are therefore all part of the same drainage system. Further description is given in the section on Pit B.

The channel present high in the wall between Pit A and B didn't appear to be associated with any pit or other feature and there was no evidence of it on the south side of Pit B if its function was water removal to the outside slope. The V-shaped channel in the eastern wall of Pit A was at roughly similar level suggesting the two features were associated. However for the two sections to join up there would have to be a sharp curve in the feature, which would seem unnecessary unless a diversion was required around an existing feature. There was however no evidence of that. The channel in the east was itself curved, again unusual, and there was no substantial post-pit structure in the eastern part of the excavation which would account for the curve. It was concluded given the channel's stratigraphic position and lack of beginning or end on the outside slope, that the excavators had traced a tree root mould and not a constructed drain.

Pit B

Pit B was excavated in two stages. In the first, the main trench 1.8 m wide was dug across the terrace intersecting the pit but the pit was not fully excavated until a year later in February 1956.

Pit B measured 6.45 x 3.82 m (21' 6" x 12' 9") after excavation (Fig. 12). It was 91 cm deep on the north side and 43 cm on the south side and was not visible on the surface. Like Pit A there was a well-shaped and prominent buttress at the western end, a less prominent protuberance at the eastern end, and a continuous drain in the floor near the northern (D1) and eastern (D4) walls. Two other drains oriented north-south (D2, D3) intersected the floor towards the eastern end and terminated in what appear to be postholes (ZC, J) but may also have been sumps for draining excess water (similar to posthole 1 in Pit A). Drain 4 exited the pit in the south-eastern corner through an open drain to the outside slope. The tunnel drain through the wall between Pits A and B did not align with the floor drain at the eastern end of Pit B, and was at a higher level.

There were four fill layers within Pit B sealed in by topsoil (see Fig. 6). The upper fill (Layer B) was characterised by brownish 'earth' (probably topsoil and subsoil) mixed with flecks of weathered ignimbrite (referred to as rhyolite in the field notes) which on the southern side extended over the southern wall and down the external slope. Features immediately under the topsoil were cut into the surface of this layer but little has been recorded about them. Layer C was similar to B but was compact and characterised by large pieces of weathered ignimbrite which gave the layer a white appearance. There were also charcoal rich lenses on the northern side. The underlying Layer D was black and contained more charcoal and intact twigs, thought at the time to be tree fern and interpreted as the burnt remains of the pit roof. Lenses of a brown 'gritty' soil were interleaved within Layer D. Charcoal from burnt posts was protruding through this layer reinforcing the notion that the pit roofing was left intact on abandonment and was subsequently burnt. Layer E, silty clay, occurs only around the edges at the base of the pit filling the internal drain and is interpreted as material eroding from the walls of the disused pit. This implies a period after use during which the superstructure decayed and weathering of the pit walls occurred.

Seventy one postholes were present in the pit floor, some uncovered during excavation of layers C and D, others when the floor was scraped down. Golson interpreted two main stages of activity for the pit

– postholes associated with the final use of the pit, some of which were evident in the top of the eroded Layer E; and postholes evident after all the fill covering the pit floor had been removed. The field notes also refer to a 'skin of rhyolite' over the western part of the floor which sealed in some postholes. This is likely to be a description for a fine layer of eroded white ignimbrite which settled on the floor after the first phase of postholes was infilled. Like Pit A, the large number of postholes indicates the pit was reroofed several times, and rather than placing posts in the existing holes, new holes were dug adjacent. An alternative explanation for the large number, some of which appear to be paired, is that there were double posts holding up the roof but the differing fills in adjacent posts suggest otherwise. Like the posts from Pit A, some were exceptionally deep at up to 90 cm, and dug into hard weathered ignimbrite. The posts would therefore be stable and not require supplementary supports.

The position of the drains in the floor provides some clues for teasing out the pattern of postholes. Multiple contemporary drains on the floor of a pit are not common, and if it is assumed (based on published examples of excavated pits) that drains predominantly occur around the outside edge of the pit floor, it becomes possible to identify different phases of pit size, and rows of longitudinal and transverse postholes at different phases. The final form of the pit had an enlarged floor area, utilising and lengthening the existing drain on the northern side which then followed the newly lengthened pit wall, ending in a sump (J). Therefore postholes P, ZL, and M (slab timbers), the only three postholes at this end of the pit, form the end postholes of the last superstructure. Equidistant postholes on the same east-west alignment are shown in Fig. 12. Given the absence of other postholes at the eastern end of the floor it is concluded that the pit had been enlarged lengthwise, and also in width on the southern side, prior to the last use. An enlargement in length on one other occasion is suggested by the location of sumps associated with transverse drains 2 and 3 compared to the final length. The absence of exit drains associated with these earlier channels suggests that the sumps may have been the only means of removing water, but in the final pit form water was diverted to the outside slope by means of an external drain.

Some of the postholes, particularly those from the final phase, are of very large diameter and irregular in shape. This may be a factor of how holes were constructed in the hard ignimbrite, but an alternative explanation is that the posts were levered out for reuse elsewhere. Charcoal analysis from recent excavations on the island has shown that the vegetation of the island was extensively modified quite early in the history of settlement and conifers were

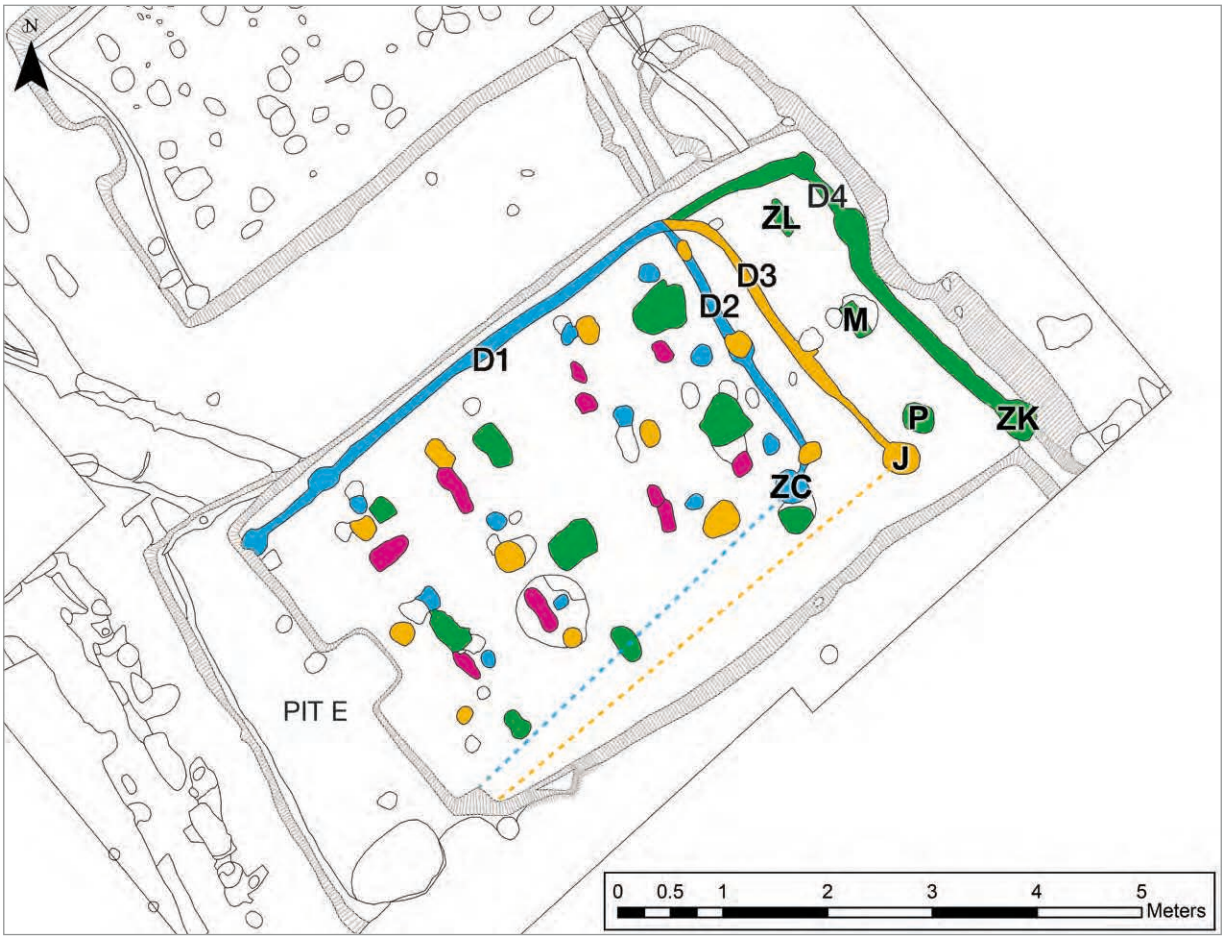

Figure 12. Pit B features with phases of postholes. Features mentioned in text are numbered.

virtually absent during most of the pre-European period. If timber suitable for structures was scarce on the island it may have been obtained from the nearby Coromandel Peninsula and thus recycled reusable timbers would indeed be a valuable resource.

The first phase of Pit B is most likely associated with three rows of four postholes, and a drain around the north and eastern sides (drain 1 and 2) (Fig. 12, blue shading). Drain 2 ended in a sump (ZC) which would have been against the south wall. The pit in this first phase can therefore be assessed as having a length of 5.17 m and a width of 3.2 m.

The second phase of construction again had three rows of four posts and the length and width represented by drains 1 and 3 which ended in sump J (Fig. 12, orange shading). The pit was 5.6 m long and 3.65 m wide, and not significantly different in dimensions to that of the earlier pit. Again, like the earlier pit there is no evidence of a drain to the outside slope.

The third phase is represented by three rows of four posts with the eastern most row in the floor of the newly extended pit (Fig. 12, green shading). Drain 4 ended in sump ZK against the newly extended southern wall. An extension of the south wall may have been related to encountering the fill of Pit E which had been truncated by the construction of the original Pit B. The final iteration of the wall of Pit B may therefore have been taken back to the angle of the original wall of Pit E. Further support for the widening of the pit on the southern side is the multiple remnant corners in the south-western corner which line up with sumps ZC and S.

Additional postholes in the floor of the pit can't be paired up or associated with any particular phase. However the postholes which can't be accounted for are all relatively shallow (less than 12 cm deep) and may be the bases of postholes dug from a higher level, in particular the floor of Pit E which was 20 cm higher than the floor of Pit B, and truncated by the construction of Pit B.

It is assumed from the stratigraphy that the pit was abandoned and left initially to infill naturally. Unfortunately the absence of an east west stratigraphic section hampers the conclusive interpretation of subsequent events, and the field notes do not discuss changes to the eastern end.

When the fill at the eastern end was being excavated, an alignment of abutting and slightly overlapping flat stone slabs were uncovered which did not follow the alignment of drain 4 at the northern end, and they were 10-12 cm above the floor of the pit, resting on pit fill and at the same level as the elevated flat floor of the annex. Removing fill from the annex revealed the slabs extended beyond the northern wall of Pit B (Figs 13 and 14) and stopped at the tree fern pipe between Pit B and Pit A,

Figure 13. Overlapping stone slab alignment resting on om Pit A. Photo: University of Auckland.

Figure 14. Pit A stone slabs and annex within Pit B. Photo taken from the south. Photo: University of Auckland.

which was the exit for the drain in Pit A. The stones covered a drain but the cut of the drain could only be seen in the annex floor where the drain was cut into hard ignimbrite. The purpose of the stones was to prevent the drain from filling with Layer C into which the drain was cut. The flat stones also continued beyond the south wall of Pit B into the open drain to the outside slope.

Peripheral areas

While the lengthier main excavation seasons focussed on the large pits a further visit took place in August 1956 with a small crew of five to investigate spaces to the west of Pit B and east of Pit A (Fig. 5).

The extension to the west of Pits B and E measured 5.79 m x 2.13 m (19' x 7'). Another partial pit, D, with a complicated series of postholes and slots around the periphery, was uncovered. The extension at the eastern end of Pit A measured 3.65 x 1.2 m (12' x 4') and aimed to investigate the feature which also cut the eastern wall of Pit A. Multiple features were uncovered, all with the same type of fill, but which obviously relate to different events. Remnants of a pit, C, was also uncovered, along with what might possibly be another cut down pit.

West of Pit B

Pit E was truncated by the construction of Pit B and on a slightly different alignment (Figs 15 and 5). The fill was "brown with the rhyolite of Pit B", referring to the fragments of lighter coloured ignimbrite which indicates a new pit was being dug and an older pit backfilled. Pit E was 43 cm deep and had a drain in the floor on the north and west walls, possibly feeding into a large sump in the south-west corner (plan sketchy and vague). The pit was at least 4.1 m wide. Several postholes external to Pit B appear to have been associated, described as having a fill similar to Pit B and immediately under the turf. No postholes have been noted for the floor of Pit E but given the sketchy and incomplete nature of the plan in this area, and lack of definition of the south wall, the floor may not have been scraped down properly.

Pit D (against the western baulk) also had a fill similar to Pit B and was over 70 cm deep. It was on the same orientation as Pit E and may have been contemporary. However only a small part of D was excavated and the floor not uncovered.

The stratigraphic profile in this area (Fig. 16) shows the natural hillslope had been built up to a near level surface by the addition of four fill layers. Layer 1 was a mixed layer similar to the pit fills. It was most likely derived from digging another nearby pit as it contained large pieces of broken up light coloured weathered ignimbrite. Beneath this was a yellow coloured layer (2) with postholes dug into the surface. A highly contrasting black layer (3) was also about 20 cm deep and was probably the same material as the black layer in the same context identified on the outer slope in the main section across the terrace (see Fig. 6). A brownish Layer 4 at the northern end of the section was described as being darker than Layer 2, and filled postholes and slots between pits D and E. The layer appears to merge with Layer 5 the original topsoil, suggesting the postholes were the first activity on this part of the terrace.

A diagonal excavated cut across the western end of the excavation appears to have been truncated by the northern wall of Pit B (Fig. 17). It is approximately 36" above the floor of the pit but, if cultural, is not evident in plans or photographs of the other side of the pit. While it was initially thought to be a drain that pre-dated construction of Pit B, it coincides with diagonal vertical natural bedding in the ignimbrite on the floor of Pit B, and the best explanation is that it is a continuation of the geological feature at surface level and erroneously excavated as a cultural feature.

The line of slots and postholes between Pits D and E ran parallel to the respective eastern and western pit walls (Fig. 5). Some of the postholes appeared to be within a shallow trench. The roughly north-south line was matched by an east-west line following the orientation of Pit D and the field notes refer to a similar slot on the south side of Pit D against the baulk at the top of the yellow Layer 2. As the slots are approximately equal distances from the wall of Pit D, and follow its alignment they are almost certainly associated with the pit. There is very little detail in the field notes about these features, and there are no photographs. The features are shallow and no more than 30 cm deep: adjacent slots G and H were 60 x 24 cm and 30 cm deep, but the postholes were smaller at between 7 and 18 cm in diameter but were possibly unrelated to the slots as they were not quite on the same alignment. Three of the postholes were

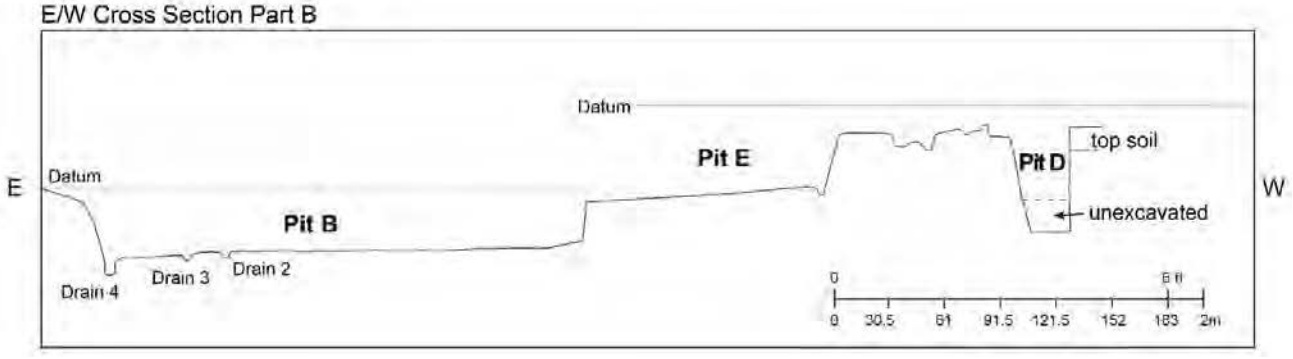

Figure 15. East to west cross section through pits B, D, E.

angled but in different directions. The depth and size of the postholes here contrasts sharply with the depth of postholes within Pits A and B. Golson thought this group of features were associated with Pit D as they are parallel to the east and northern pit walls. If this is so, it is an otherwise unknown form of pit superstructure, essentially a rectangular pit enclosed by vertical walls. More likely there are multiple events represented here.

Immediately to the north two similar rows of slots are parallel to the end of Pit A (see Fig. 6 and 17) The westernmost of these appears, from the plan, to intersect the geological feature which runs diagonally across the excavation area terminating at Pit B. The western slots are, from the north, 167 cm long, 53 cm long possibly truncated by the southern slot 129 cm long. Widths were

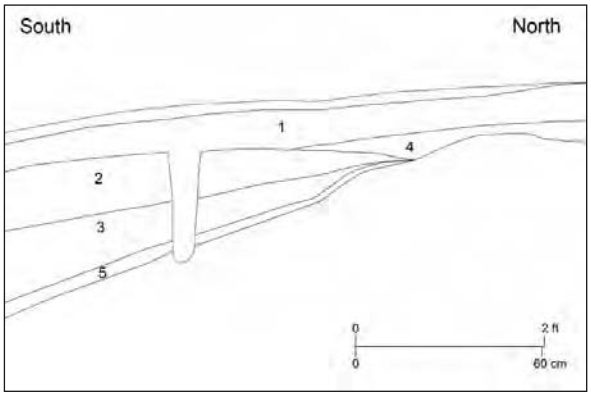

Figure 16. Section west of pit B.

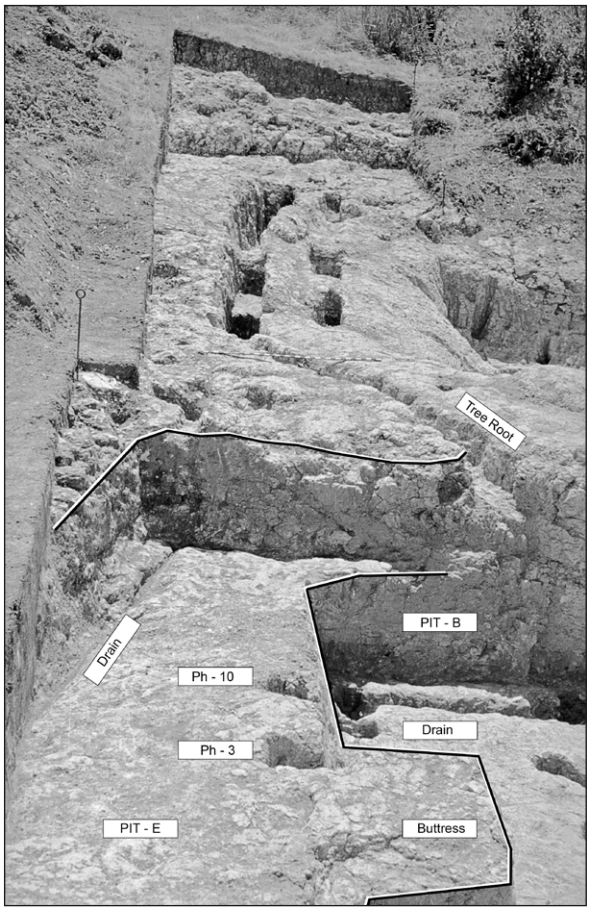

Figure 17. Slot postholes to the west of Pit A, of Pit E and Pit B in the foreground. Photo: University of Auckland.

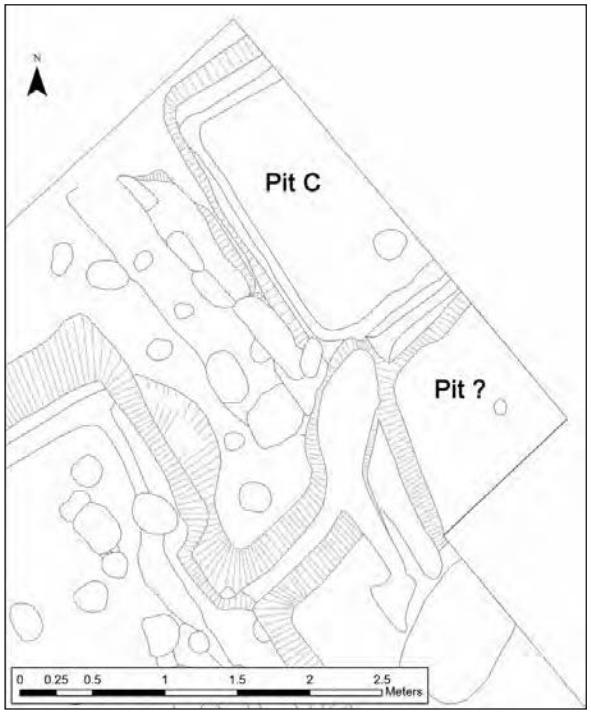

Figure 18. Plan detail of east of Pit A.

Figure 19. East of Pit A with Pit C and drain in upper right and a series of superimposed postholes and slots to the west. The large depression in the lower centre may be a combination of pit sump and drain or is a tree root mould. Photo: University of Auckland.

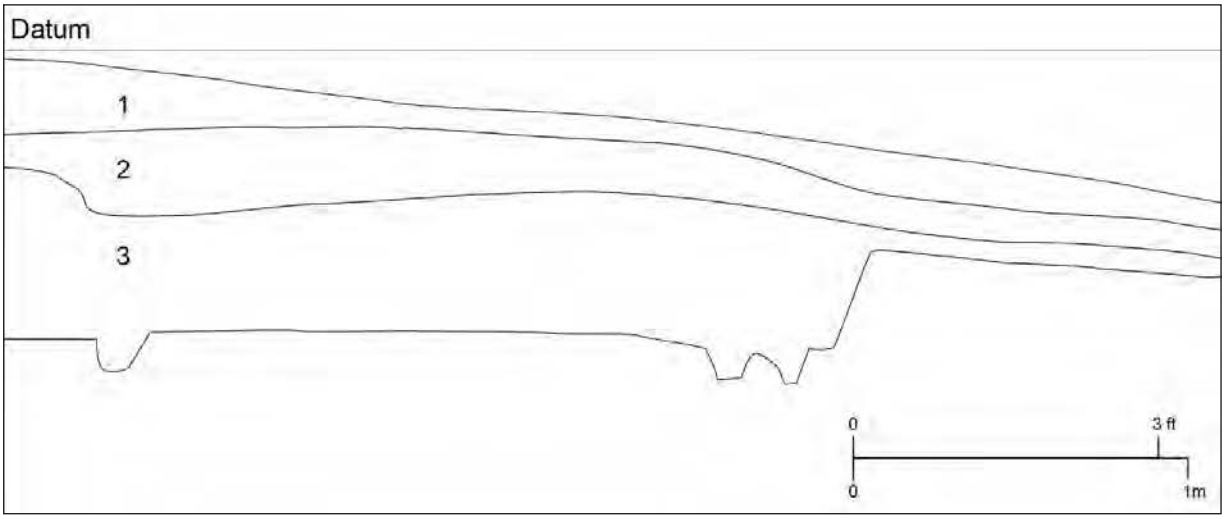

Figure 20. Pit C was sealed by shell midden originating from the adjacent terrace to the north-east. The radiocarbon sample was obtained from the midden at this corner.

consistently 27 cm and depths ranged from 33-50 cm. The eastern row was 17 cm wide and 20-25 cm deep. These features somehow relate to the pits and their roof structure, but they are not easy to interpret. They may well be part of the external gable wall and be analogous to those found between pits E and D. Similar features have not been reported in pit-related literature: however, in this case the solid ignimbrite parent material into which they are dug may have ensured their atypical survival.

East of Pit A (Pit C)

Excavation to follow the large deep feature intersecting the east wall of Pit A uncovered more postholes and slots as well as the floor and drains of Pit C (Fig. 18). The large sump in the south-western corner of Pit C which appeared to be the origin of the feature seems excessively large and deep relative to the size and depth of the pit and is irregular in shape. It is quite possibly also part of the tree root mould that enters the eastern end of Pit A mentioned above. The western wall of Pit C has been almost completely removed and is visible in Fig. 19 only as a remnant stub near the baulk and the section through the pit shows there was, unusually, a double parallel drain on the south side at the base of the 30 cm high wall (Fig. 20, also Fig. 18). The fill of the pit consisted of a single layer of "brown natural silt as Pit A and B", in other words the generic mix of topsoil and subsoil which filled other pits, capped by shell in dark brown to black soil, overlain by modern topsoil. The pit measured more than 2.5 m (8' 6") wide as the northern wall was not found. The pit continues into the baulk in an east-west direction. The shell originated from the terrace to the north-east, and also covered part of Pit A. The level area against the south-east baulk is also likely to be the surviving remnant of the floor of another pit.

The slots and potholes between Pits A and C are a confusing set of cut down features without stratigraphic differentiation. The absence of the western and southern walls of Pit C indicates that, at some stage, at least 30-40 cm depth has been removed. Two north-south oriented slots were excavated: the higher westernmost one had circular and square postholes within it, while the lower easternmost slot, containing two smaller shallow slots, was hard up against the remnant stub of wall belonging to Pit C. The features were all less than 30 cm deep but that depth is unlikely to be representative of the original depth. There were also several round postholes between the slots and the wall of Pit A. Clearly, there has been a substantial amount of cutting down, and only partial infilling, in this part of the terrace. Given the amount of disturbance, and lack of post-fill layers overlapping the fill of Pit A, Pit C most likely predates construction of Pit A. The postholes could have served a similar function to the less-confusing alignments at the western end of Pits A and B, with the multiple rows being associated with the eastern end of Pit A, and the western end of Pit C.

Charcoal analysis

Meaningful interpretation of charcoal to identify structural timbers or vegetation present in the surrounding area requires knowledge of context of the sample, and clear provenance (Wallace and Holdaway 2017). There were eight samples ranging from a bulk sample to small pieces of apparently randomly collected charcoal. All are from pit fill, or drain fill, and therefore relate to post-pit landscape vegetation rather than firewood collecting behaviour. Unfortunately none of the samples were from a secure location, or related to described events, so were unable to be radiocarbon dated.

Kauri is identified from the drain at the western end of Pit A, and may be remnants of building timbers as analysis of charcoal from elsewhere on the island shows the species has a very low incidence except in the oldest sites. Excavations in 2013 on a terrace at Tamewhera in the north-west part of the island revealed a house structure with posthole slots containing kauri wood (Phillipps *et al.* 2014). It is therefore likely that kauri may be present as structural timbers throughout the occupation sequence.

The remaining six samples from the pits contained puriri or pohutukawa along with abundant bracken aerial stems, manuka, and a range of smaller shrub and scrub species (Table 1). The mix of species is typical of woody vegetation colonising an abandoned site.

In 2016 the corners of the earlier excavation were re-excavated to obtain spatial coordinates, allowing the Matakawau excavations to be incorporated into the Ahuahu Archaeological Project database. The north-east corner of Pit C (Fig. 20), and Pit A (Fig. 11), were sealed by shell midden originating from a higher terrace diagonally to the north-east. During the original excavation it was noted that shell midden in Pit A came from higher up the slope in squares L and M. The species present were described in the original field notes (shell not retained), and the composition of the midden from the terrace in the north-east was remarkably similar. However while there may have been two sources of shell in the fill of Pit A, the sample obtained in 2016 originated from the terrace to the north-east. A paired sample of shell and charcoal was submitted for radiocarbon dating to give a terminal date for use of Pit A and the final occupation of the terrace.

Cockle shell and twigs of coprosma were extracted from the sample as being a short-lived species suitable for dating. The radiocarbon determinations suggest that the terminal date for Pit A and the terrace is in most likely between 1650–1810 cal. AD (Table 2). While not particularly useful for dating use of the structures, the multiple phases of use of each pit and the later remodelling in the area after the terrace ceased to be used, does indicate that there is likely to be a long time depth to occupation of Matakawau, as has been found on other pa such as Pouerua (Sutton *et al.* 2003).

Table 1. Charcoal iden tions from pit and dr Stingray Point Pa.

Species	Plant Type	# Pieces Identified	%
Bracken (*Pteridium esquilinum*)		35	27
Tutu (*Coriaria* sp.)	Shrub or Scrub species	4	39
Hebe (*Hebe* sp.)		1	
Coprosma (*Coprosma* sp.)		9	
Corokia? (*Corokia* sp.)		3	
Ribbonwood (*Plagianthus regius*)		2	
Ngaio (*Myoporum laetum*)		4	
Manuka (*Leptospermum scoparium*)		23	
Kanuka (*Kunzea ericoides*)		4	
Mahoe (*Melicytus ramiflorus*)	Broadleaf trees	4	22
Hinau (*Elaeocarpus dentatus*)		1	
Puriri (*Vitex lucens*)		9	
Pohutukawa (*Metrociderous excelsa*)		15	
Kauri (*Agathis australis*)	Conifers	15	12
Totals		129	100

Table 2. Radiocarbon results, Stingray Pa. Calibration was conducted with OxCal v4.3.2 (Bronk Ramsey 2017). Charcoal was calibrated with the SHCal 13 atmospheric curve (Hogg *et al.* 2013). Shell was calibrated with the Marine13 marine curve (Reimer *et al*. 2013).

			Probability 68.2%	Probability 95.4%
Wk45406	Charcoal, coprosma	195 ± 17 BP	1670–1700 cal. AD (21.9%); 1720–1780 cal. AD (36.7%); 1790–1810 cal. AD (9.7%)	1660–1710 cal. AD (26.9%); 1720–1820 cal. AD (60.2%); 1830–1880 cal. AD (5.9%); 1930–1950 cal. AD (2.4%)
Wk45405	Shell, cockle	599 ± 15 BP	1650–1810 cal. AD (68.2%)	1560–1850 cal. AD (95.4%)

Stone artefact analysis

Very few stone artefacts were recovered from the fill of the pits, or from the terrace surface. The greatest number of obsidian flakes came from trench quadrant M, reinforcing that there was probably an occupation surface present (Table 3). There were also 49 obsidian flakes recovered from quadrants O, Q and R, again suggesting activity in this area, but there are no field notes related to the trench on the higher part of the slope. The basalt flakes from the trench are all Tahanga basalt.

The obsidian from Pits A and B fill was analysed with a Bruker Tracer III SD portable X-ray Fluorescence analyser (pXRF). The method employed for machine setup and analysis of the results follows that outlined in Phillipps *et al*. (2016). All samples were analysed though an air path and a filter composed of 304.8 μm Al and 25.4 μm with an x-ray tube setting of 40 keV and 28 μA. Ten reference samples were used to calibrate the results, and included samples of New Zealand obsidian. In total 31 obsidian artefacts were analysed with pXRF: 26 were from Mayor Island (83.9%), four from Hahei (12.9%), and one from Whangamata (3.2%). The predominance of the Mayor Island source is in keeping with results from more recently excavated site assemblages from Tamewhera and from the tombolo sites (Phillipps *et al.* 2014; Furey *et al.* 2017).

Table 3. St es by square or feature.

Location	Obsidian	Chert	Basalt
Pit A L1	2		
Pit A L2	17	3	
Pit A L3	1		
Pit A unspec.	4		
Pit B L1	7		
Sq. I	4	1	1
Sq. J L2	2	2	1
Sq. M L1	14	5	10
Sq. N	8		

DISCUSSION

Several observations can be made about the excavation results. The terrace was repeatedly used for storage. Excavations in 2013 on a terrace at Tamewhera in the north-west part of the island revealed a house structure with slots for postholes (Phillipps *et al.* 2014) and a similar relationship between the rectangular slots and posts is a possibility for the Matakawau terrace also, particularly on the western side of Pit A. However if the slots were associated with a residential structure the living surface had been removed leaving only the bases of the features. However, given the overall use of the terrace for storage, it is most likely the slots here are related to the pit roof. The slots around three sides of Pit D suggest upright walls surrounding a semi-subterranean pit at about 45-60 cm distance from the pit edge. While slots might be a feature of end walls, the sloping sides should rest on or nestle into the soil which doesn't appear to be the case. Perusal of literature has revealed no similar structures over a storage pit. Historic literature refers to multiple items from nets and weapons to kumara being stored in pits (Davidson *et al.* 2007) but there is no known difference in observed appearance or it hasn't been described.

The ignimbrite, although weathered, is still very compact. Considerable effort would be involved to dig a pit to a depth of nearly 1 m and then also dig postholes up to 85 cm into the floor. Use of a ko in construction is evident from the parallel vertical marks in pit and posthole walls and was remarked on by the excavators.

Storage pits have a limited life for reasons unknown but there has been speculation that it was possibly due to fungus or bacterial contamination within the pit affecting the survival of the kumara tubers (Davidson *et al.* 2007). One proposed remedy was to build fires in the floor of the pit to kill off any contaminant (Ambrose n.d.). However as Davidson et al. (2007) observed, we know very little about the requirements for storage of kumara, and the excavation literature reveals diverse information on pits. In the Bay of Plenty, where soft tephra-based soils are present, pits were possibly used for only one storage season before being backfilled with uniformly clean fill derived during the construction of adjacent pits (Shawcross 1964; Furey and Hudson 2008). Elsewhere, where the substrate is harder and more difficult to dig, refurbishment was more common and usually involved re-roofing and digging new postholes to hold up the roof structure. Most of the literature refers to new posthole configurations within the same-size pit, but on Stingray Pa remodelling of Pit B involved enlargement on two occasions. Reuse without resorting to sterilising suggests this was not essential in the majority of cases. However archaeology cannot determine how many seasons each pit was used, or why it was reroofed, although we can speculate that the roof structure had a limited life, perhaps due to increasing permeability, and needed to be periodically renewed.

In contrast, the storage pit excavated in 2013 on nearby Stingray Ridge was shallow at only 30-40 cm deep, and with dimensions of 5 x 2.5 m was smaller than the pits on Stingray Pa. The walls were dug into subsoil and the depth influenced by the upper horizon of the hard ignimbrite. The single row of central postholes in the floor of the pit was not as large and deep as those on Stingray Pa and there was no structural re-building involving digging of new postholes. However, like Pit A there was a substantial drain over 7 m long which exited the pit at one end and terminated on the southern slope (Phillipps *et al.* 2014).

The drainage for Pit A on Stingray Pa was particularly ingenious involving a tunnel through the pit wall, and a stone-covered drain through the fill of previously back-filled Pit B. There are exposures of andesitic rock on the island which weathers and fractures

Table 4. Pit dimensions and areas.

Pit	Dimensions (m)	m^2
Pit A	5.5 × 3	16.5
Pit B1	5.17 × 3.2	16.54
Pit B2	5.6 × 3.65	20.44
Pit B3	6.45 × 3.82	24.64
Pit E	? × 4.1	

into slabs: present to the south of White's Beach but also on the coast to the west of Huruhi Harbour. Use of stone slabs is however not unique: stone was also used as a drain cover at Hamlin's Hill, Auckland (Davidson 1970; Nichol 1980), as a pavement or footpath and also as drain covers at Ruarangi Pa near Whangarei (Hougaard 1971). A large extent of flat paving was used as a working surface at the older site of Heaphy River Mouth South Island (Wilkes and Scarlett 1967). Two of the pits on Waipirau Pa on Ahuahu also contained a stone slab and Irwin (2015) couldn't rule out that they were originally covering a sump but had been subsequently displaced. It appears on Matakawau the stone covering was a practical way to ensure the drain did not become blocked with sediment.

Pits C and D were not fully excavated so little can be inferred about size relative to pits A and B, and part of Pit E was destroyed by the construction of Pit B. Storage pit A was not obviously increased in size during its different phases of use, unlike Pit B which had a 20% increase in size in each of the re-building phases (Table 4). Comparing the sizes of Pits A and B with Law's (2000: 36) analysis of pit sizes, all phases of both pits are large pits, defined as 10 m^2, and larger than the majority of the excavated pits. Law inferred the large pits (and super large pits) to have been for community (as opposed to individual family) storage, and possibly as visual indications of community surplus and abundance.

Interestingly the posthole pattern within the pits in Pit A was based on support for roof purlins rather than the more usual ridgepole. Pit B, although of similar width in the first two phases, also had purlin support. Consistently in all phases of pits A and B, there is a greater distance between the second and third rows of central posts than between them and the end rows. There was no evidence to suggest at which end the entrance was placed.

Jack Golson's assumption that the pa, with only a few well-defined terraces, would prove to be a simple exercise without complications was in fact the opposite. There is a large amount of reoccupation and reworking of the terrace surfaces: cutting down, expanding, and construction of new terraces. The surface feature of the one pit depression obscured seven or eight earlier occupations on the terrace. The evidence from the terraces at the lower end of the pa contrasts with the shallow, and from the lack of reported stratigraphic evidence, apparently little used terraces higher on the slope which were encountered in the initial trench. However the lack of reported evidence may not be a true indication of occupation.

Side by side pits on a terrace are often assumed to be contemporary. However this is a highly unlikely scenario for Pits A and B as the drain from Pit A is constructed on the fill of the abandoned and partly filled Pit B. The only way the two pits could be contemporary is for Pit A to share a common drain with the first two uses (shorter length) of Pit B, subsequently destroyed when Pit B was extended. Pit A would however have no drainage once Pit B was lengthened to its final form. More likely construction of Pit A followed the final use of Pit B and the depression was still evident when Pit A was constructed. It is also possible the material used to fill Pit B was derived from the digging of Pit A.

To summarise the sequence of activity, Pits D and E were dug and infilled before Pit E was truncated by construction of Pit B. Postholes towards the rear of the terrace, in the vicinity of Pit A, indicate there was a structure at some stage. The posthole pattern in the floor of Pit B indicates enlargement and reroofing on two occasions. Pit C is also likely to have been earlier than B. Pit A, the last pit to be constructed, was used on at least two occasions, or possibly three although the evidence for this is weaker. At the same time there was activity on the surface of the infilled Pit B area. Later, use of the terrace to the north-east resulted in midden covering the eastern end of Pit A fill. The activities were not all on a single surface and are likely to have involved substantial earthmoving after use of Pit C when the wall of the pit was removed entirely, possibly during a period of terrace remodelling and reconfiguration. Expansion of the excavation area to the east and west would enable a better picture of how much activity took place in this area and whether there was a general trend for enlargement of terraces over time. The end result of the Stingray Pa terrace excavation is a complicated series of events on the terrace but the amount of time which elapsed from first to last isn't known. This terrace is only the final iteration of a number of events, some of which are likely to be sequential within the same occupation, but others likely involved abandonment and reoccupation.

There are few pa excavations to provide a comparison to Stingray Pa: Pouerua (Sutton *et al*. 2003) arguably revealed the most complex set of activities and superimposed occupations with remodelling of terrace surfaces, although Kauri Point Pa (Ambrose n.d.) which has not been fully reported on also had a complex history involving multiple phases. Closer to Great Mercury, Sarah's Gully Pa revealed little activity within the defences aside from pit storage and cooking evidence (Davidson pers. comm.). Geoff Irwin's (2015) excavation at T10/323, Waipirau Pa in the upper reaches of Huruhi Harbour also had limited evidence, much of it pre-dating the ditch and bank construction. Pits at Sarah's Gully and Waipirau were of single central row type but quite different to one another, and to the Matakawau pits. As observed by Davidson *et al.* (2007), the final word has not yet been said on storage pits,

and we lack understanding of the variability of pits supposedly used for the same purpose.

The Stingray excavations revealed an emphasis on storage on this terrace with no evidence of palisade defences to supplement natural vertical cliffs. There is no surviving evidence of cooking from any period of use, and certainly no midden dumping although disposal over the slope into the sea might account for its absence. However it is more likely there were several adjacent terraces which formed an inter-related functioning complex dedicated to residential use, cooking, and storage. Far from the pa having a simple occupation sequence, it is likely very complicated with the pa having a different form at different stages in its past.

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