



NEW ZEALAND
ARCHAEOLOGICAL
ASSOCIATION

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION MONOGRAPH 14:

Susan Bulmer, Garry Law and Douglas Sutton (eds), *A Lot of Spadework to be Done: Essays in Honour of Lady Aileen Fox*



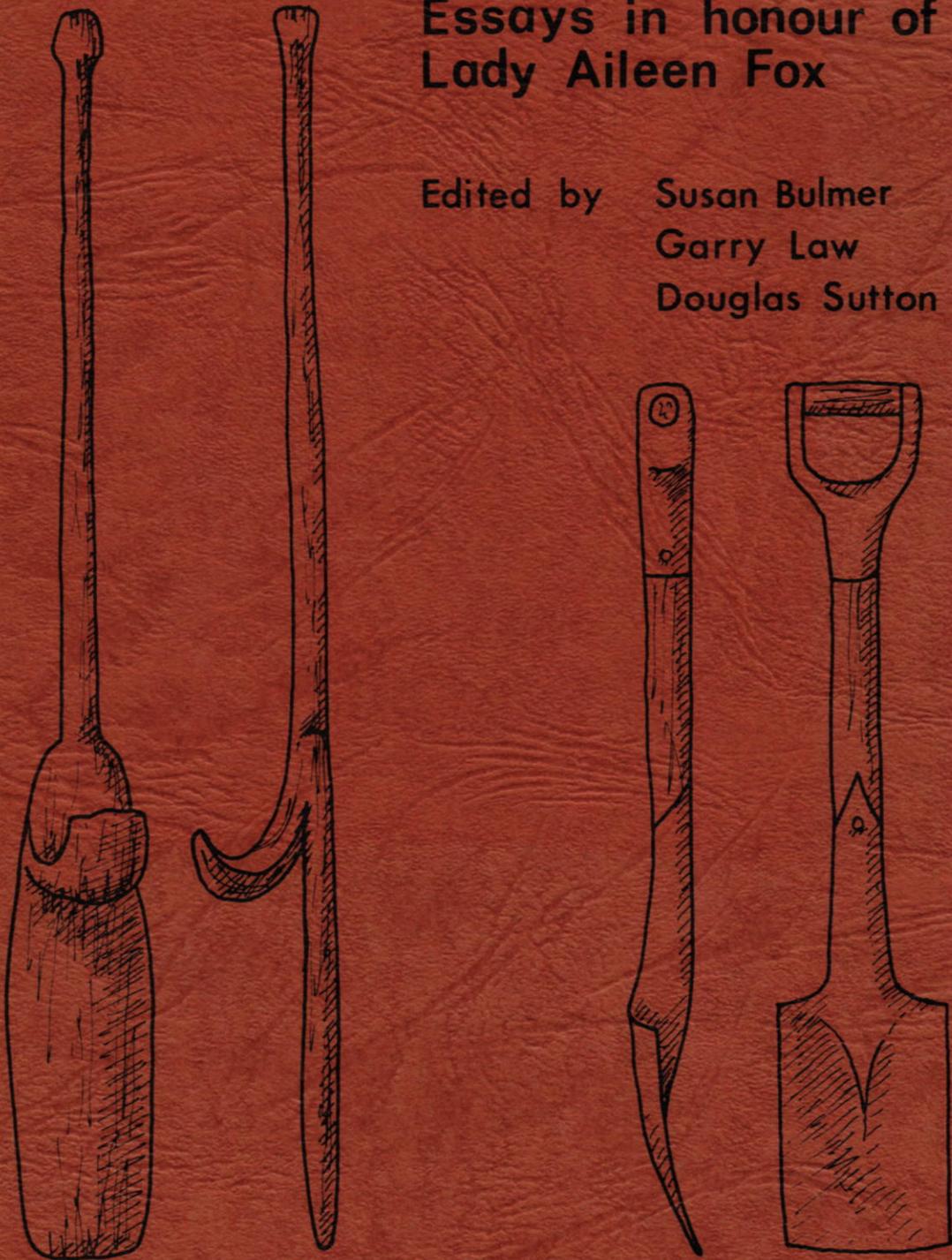
This document is made available by The New Zealand Archaeological Association under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

To view a copy of this license, visit
<http://creativecommons.org/licenses/by-nc-sa/4.0/>

A LOT OF SPADEWORK TO BE DONE

Essays in honour of
Lady Aileen Fox

Edited by Susan Bulmer
Garry Law
Douglas Sutton



RUA KUUMARA O KAWERAU



Ian Lawlor

New Zealand Forest Service
Auckland.

Introduction

Archaeological investigation into Maori horticulture over the last few years has often focused upon gardening soils, stone field-systems, the cyclical aspect of gardening, the major cultigens, the status of bracken fern (*Pteridium aquilinum* var. *esculentum*) within the gardening system, and pits. This paper continues the discussion of pits by examining the results of recent excavations at Kawerau in the Bay of Plenty.

Archaeologists have been concerned with pit age, form, construction, distribution and function, usually concentrating upon the relationships between the pits within a single site, and especially any associations between pit age and form, and pit function. It is only recently that specific attention has been given to interpreting architectural features such as postholes, slots, drains and channels and postulating the original form of the pit and its roof (Fox 1974). Current work on the Kawerau pits further extends that development.

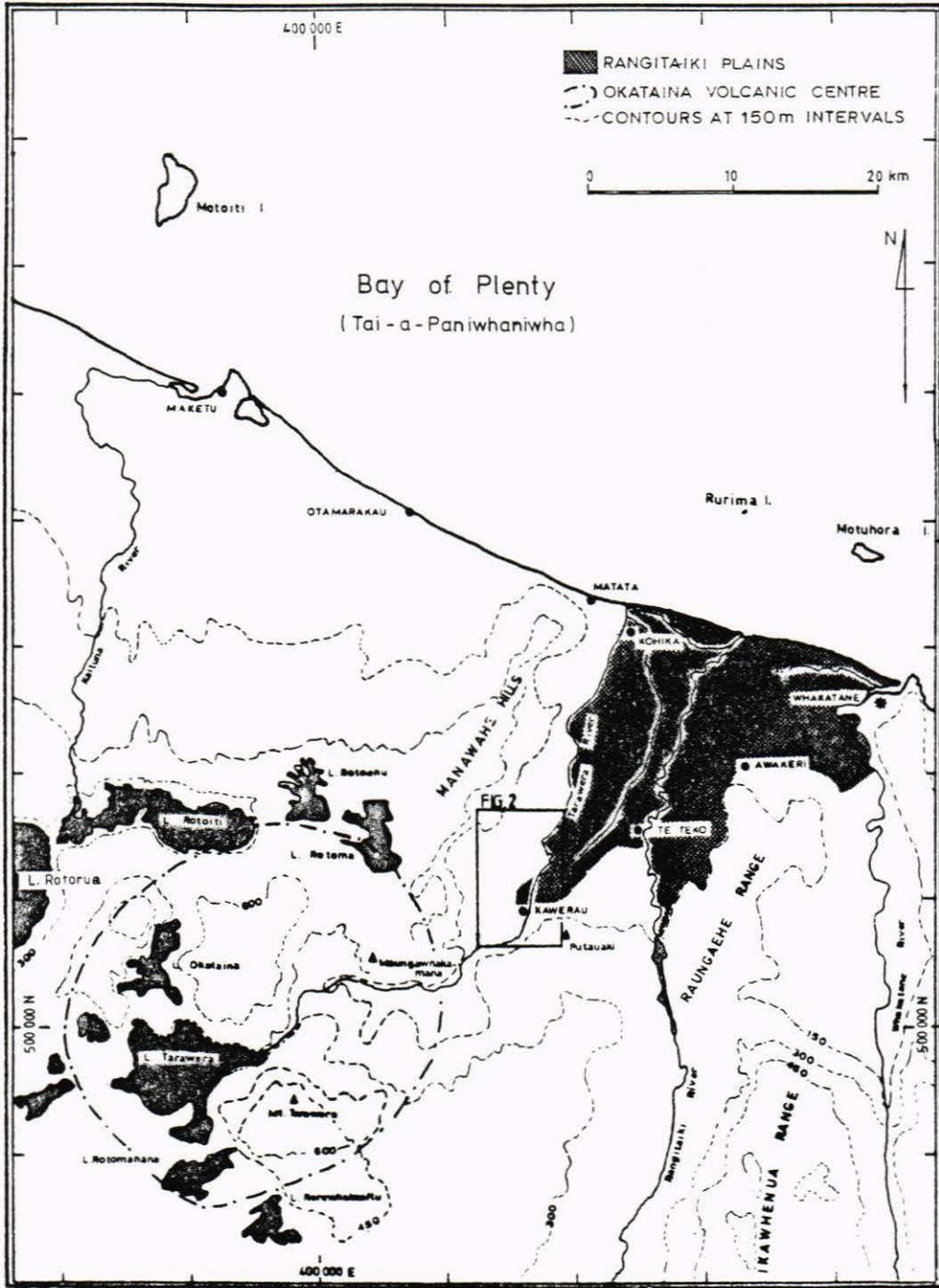


Fig.1 Map of the Bay of Plenty showing the location of Kawerau.

The Study Area

The Tarawera, Rangitaiki and Whakatane River systems once fed an extensive swamp in the central Bay of Plenty (Fig. 1). The swamp has been progressively drained this century so as to control flooding and to facilitate the development of farming and horticulture. The Rangitaiki Plains encompasses this area of previous swamp land.

On the southwest edge of the plains is located the Tasman Pulp and Paper Mill and the associated town of Kawerau (Fig. 2). The mill has expanded since its initial construction in the early 1950's, leading to the steady expansion of Kawerau. Housing subdivisions, mostly within the surrounding lowland valleys, have accommodated the increased population. In 1980-2 archaeologists from the University of Auckland investigated an extensive area of prehistoric occupation within two New Zealand Housing Corporation subdivision developments at Kawerau. The development blocks were located within the Ballantrae foothills and valley, and the Long and Marshall Valleys (Fig. 3). The investigations were undertaken on behalf of the New Zealand Historic Places Trust.

The development blocks under investigation are sited to the south and west of the Kawerau township within a region that was once an extensive area of back swamp and lowland foothills (Fig. 2). These foothills extend northwards from the rhyolitic dome Maungawhakangama, 20 kilometres along the western boundary of the Rangitaiki Plains toward the mouth of the Tarawera River (Te Awa O Te Atua). The lowland foothills rise 100 to 120 metres above the Rangitaiki Plains towards the Rotoma and Manawahe Hills (150 to 300 m a.s.l.) in the west.

The foothills are formed by poorly compacted late Quarternary pumice breccias and tuffs (Nairn 1981:28,142). Massive cuts and earthworks within the subdivision blocks in preparation for housing has shown that the steep to rolling lowland morphology originated with the Rotoiti Breccia Formation 42,000 years ago (pers. comm. Nairn

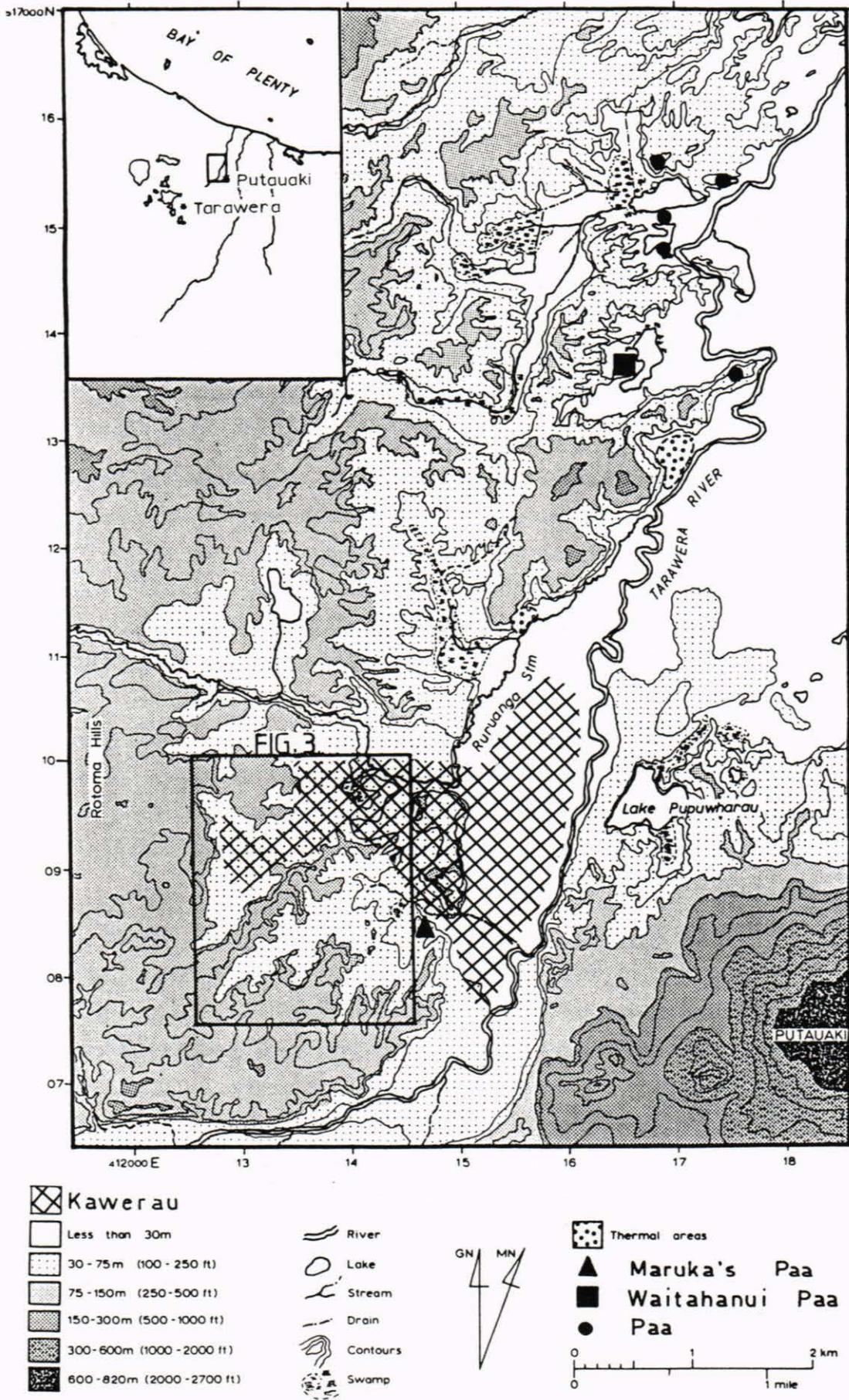


Fig.2

Location of the Maruka Investigations.

FIG. 4. MARUKA INVESTIGATION STAGES

STAGE	AREA	DATE	REPORTS	NUMBER OF PITS
I Survey	Sites N77/575 to N77/623 Ballantrae, Long and Marshall Valleys (493 Terraces)	December 1980 - January 1981	Phillips 1981a,1981b	53
II Excavation	Ballantrae Valley (6 Terraces)	January 11th - 6th February 1981	Lawlor 1981 Lawlor in prep.	10
III Excavation	Site N77/606-1 & 2 Long Valley (2 Terraces)	May 10th-28th 1981	Furey 1981 Furey in prep.	11
IV Excavation	Valley and valley floor areas associated with site N77/606, Long Valley	July 4th-16th 1981 August 1981	Lawlor <i>et al.</i> 1981 Lawlor 1982 Lawlor in prep.	-
V Excavation	Sites N77/587-4 and N77/588-6 at the junction of Long and Marshall Valleys (2 Terraces)	January 17th- 16th February, March 26th-30th 1982	Lawlor 1982 Lawlor in prep.	19
FINAL REPORT			Lawlor in prep.	

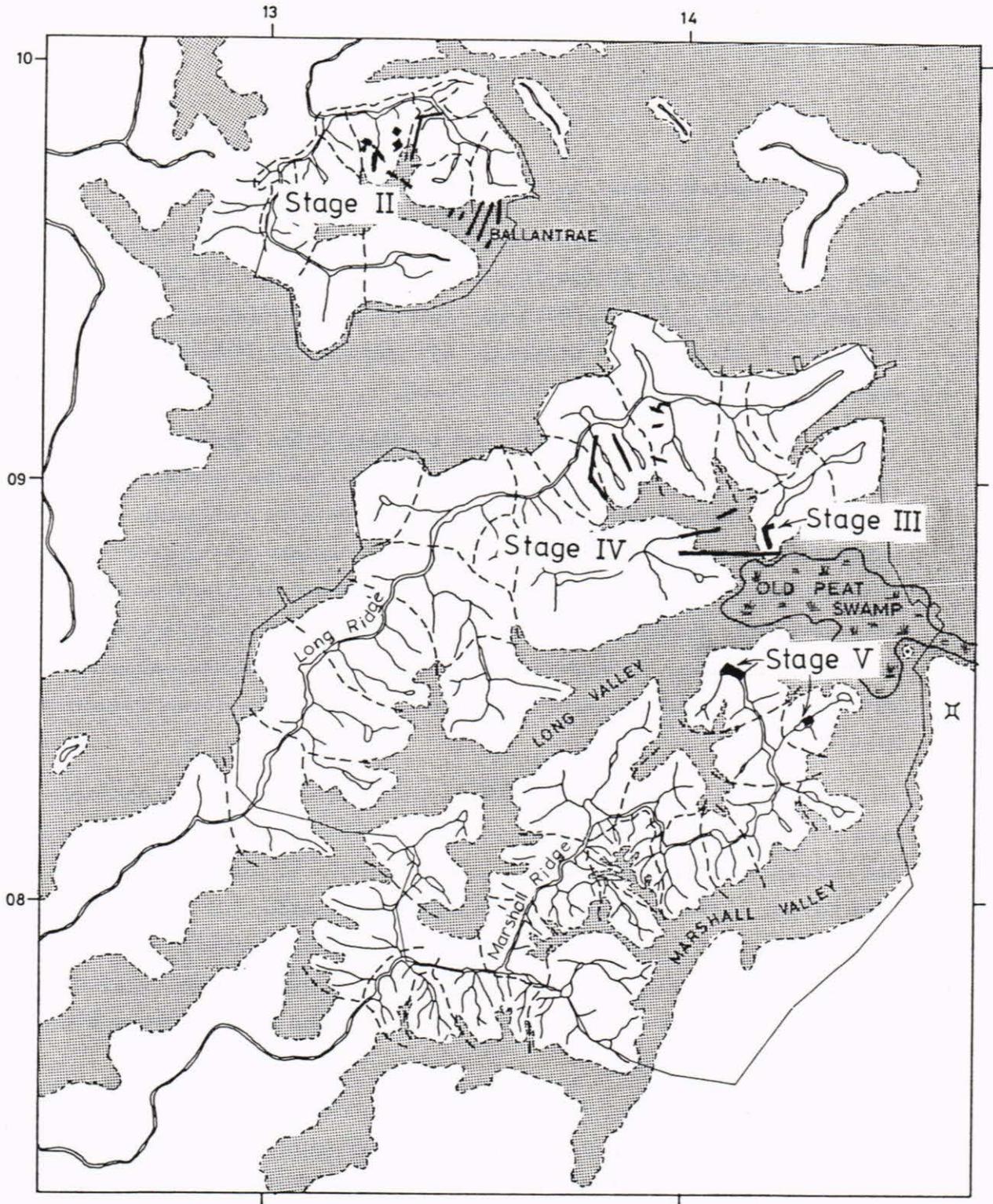
1982). This basal ash was subsequently covered by a series of air-fall ashes derived from the Okataina Volcanic Centre. The Mount Tarawera eruptions of 650 to 780 years B.P. (Kaharoa Ash) and nearly 64 years B.P. (Tarawera Ash 1886 a.d.) are the two most recent air-fall ashes (see Nairn et al. in prep; Nairn and Self in prep .)

The Investigations

Five stages of archaeological investigation were completed between December 1980 and March 1982. Figure 3 shows the location of the investigation stages within the development blocks, and Figure 4 lists relevant reports and numbers of terraces and pit features associated with each stage. The final report for the investigations is presently in preparation.

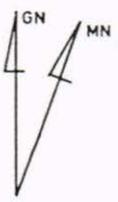
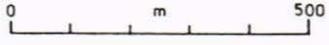
During excavations Messrs. Albert Te Rire and John Fox, elders of the Tuwharetoa Urupa and Historical Trustees, visited the site to view the investigations. The Trustees suggested that Maruka would be an appropriate name for the investigations. The name Maruka is that of a grandson of Tuwharetoa-i-te-Aupouri, the eponymous ancestor of the Ngati Tuwharetoa tribe. Oral tradition records that the pits and gardens under investigation belonged to him (Moore 1964b). Maruka's paa is located on the eastern boundary of the area under investigation (Fig. 3). The archaeological investigations are henceforth referred to as the Maruka Investigation .

The Stage I survey identified a total of 493 terraces within the 371 hectare subdivision development blocks. Forty-one of these terraces contained 53 surface pit depressions. The report on Stage I states that "the pits...were remarkable for their size and depth, especially considering the amount of material that had been deposited during the Tarawera Eruption (1886 A.D.)...Sizes range from 1.8 by 1.3 m up to 11 by 7.5 m with one abnormally large pit measuring 14.4 by 10 m. Depths, though generally shallow, did reach 1.2 m and the larger pits were often over 0.4 m deep" (Phillips 1981b:26-7). The



- Valley floor
- Base of ridge
- Main ridge line
- Side ridge and spur
- Site boundary
- Development boundary
- Maruka's pa

Stage I Survey of Development Blocks



(after 1981a)

Fig.3 Investigation area showing the location of stages I to V.

pits were located almost solely on the ridge-tops and ridge terraces.

It was hypothesised that the survey area could represent part of a settlement system focussing on the lightly fortified site called Maruka's paa (see Phillips 1981b:38). Detailed and undisturbed evidence of cultivation, storage, and possibly of occupation associated with the paa, could be found.

Stage II, III and V of the investigations exposed 40 pits upon 10 terraces (see Appendix 1). Only four of the exposed pits were previously recorded during the survey (Fig. 5), an indication that approximately 10% of the pits present were visible as surface evidence. The tabulated length and width dimensions show that these four pits were generally smaller than seemed apparent from the surface evidence before excavation. This difference between surveyed and excavated pit dimensions was the result of the masking effect of the Tarawera Air-fall Ash.

The size of the 53 surveyed and 40 excavated pits has been plotted on a scattergraph (Fig. 6). Although incompleated excavations and irregular pit-shapes make it impossible to be precise about dimensions, three general observations can be made: 1) the 50 to 60 cm deposit of Tarawera Air-fall Ash completely masked pit depressions less than 2 metres square; 2) excavations uncovered many smaller pits; and 3) there are some very long pits and of these some are narrow for their length.

The survey and excavation results indicate that the subdivision area contains a very large number of pit and terrace sites. By taking the 493 surveyed terraces and multiplying this number by 2, 4 and 10, these figures representing possible numbers of pits per terrace based upon excavation findings (see Fig. 4 and Appendix 1), three estimates of pit numbers within the development blocks may be derived:

Fig. 5 Dimensions of surveyed and excavated pits at Kawerau.

Pit No.	5	19	35	40
NZAA Site No. (N77)	579	606	588	587
Terrace No.	4	2	6	4
Surveyed dimensions (m):				
Length	5.3	6.3	7.2	14.4
Width	3.0	5.0	7.0	10.0
Depth	-	0.6	0.5	1.2
Excavated dimensions (m):				
Length	5.8	5.7	?4.8	11.8
Width	?2.3	3.0	?3.6	?5.6
Depth	?0.9	1.6	-	2.4

? estimated only.

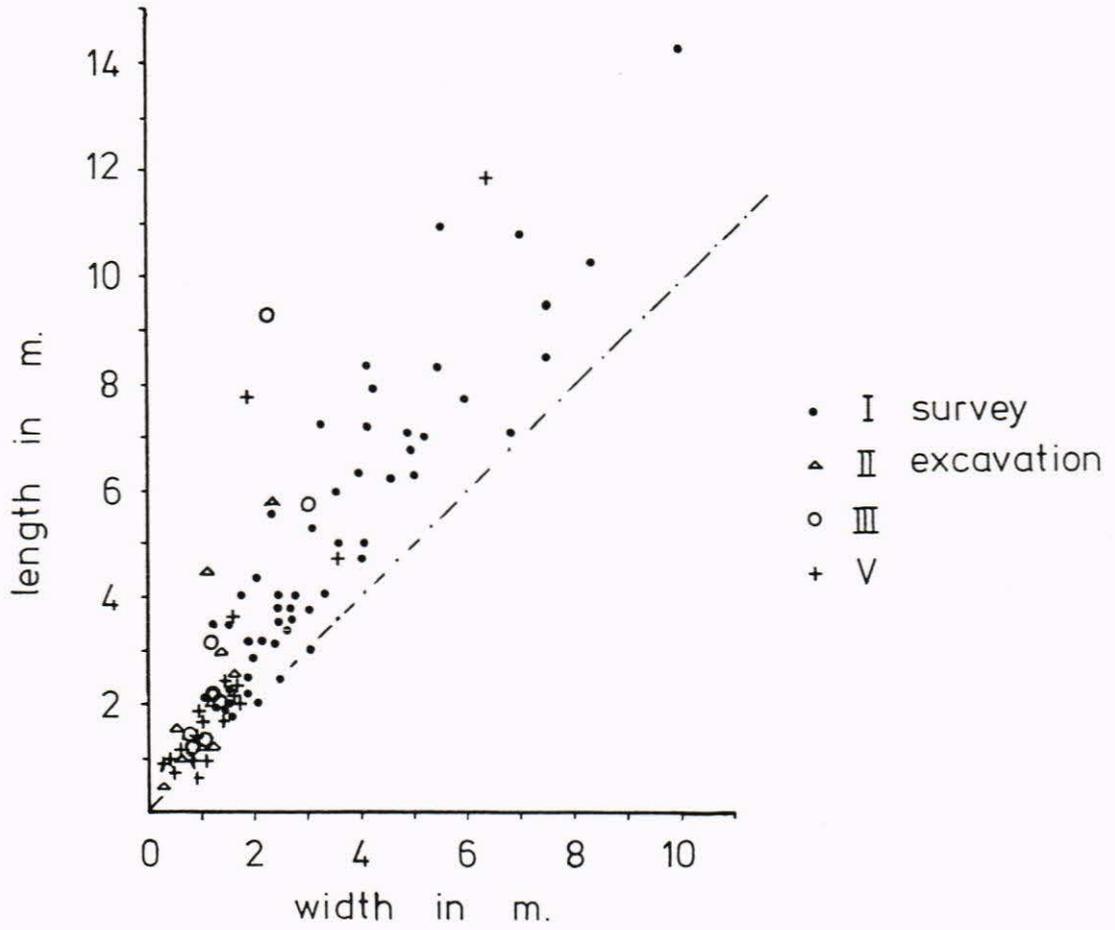


Fig.6

Graph of dimensions of 53 surveyed and 40 excavated pits.

Estimate	Number of pits per terrace	Total number of pits within the development blocks
conservative	2	986
moderate	4	1972
maximum	10	4930

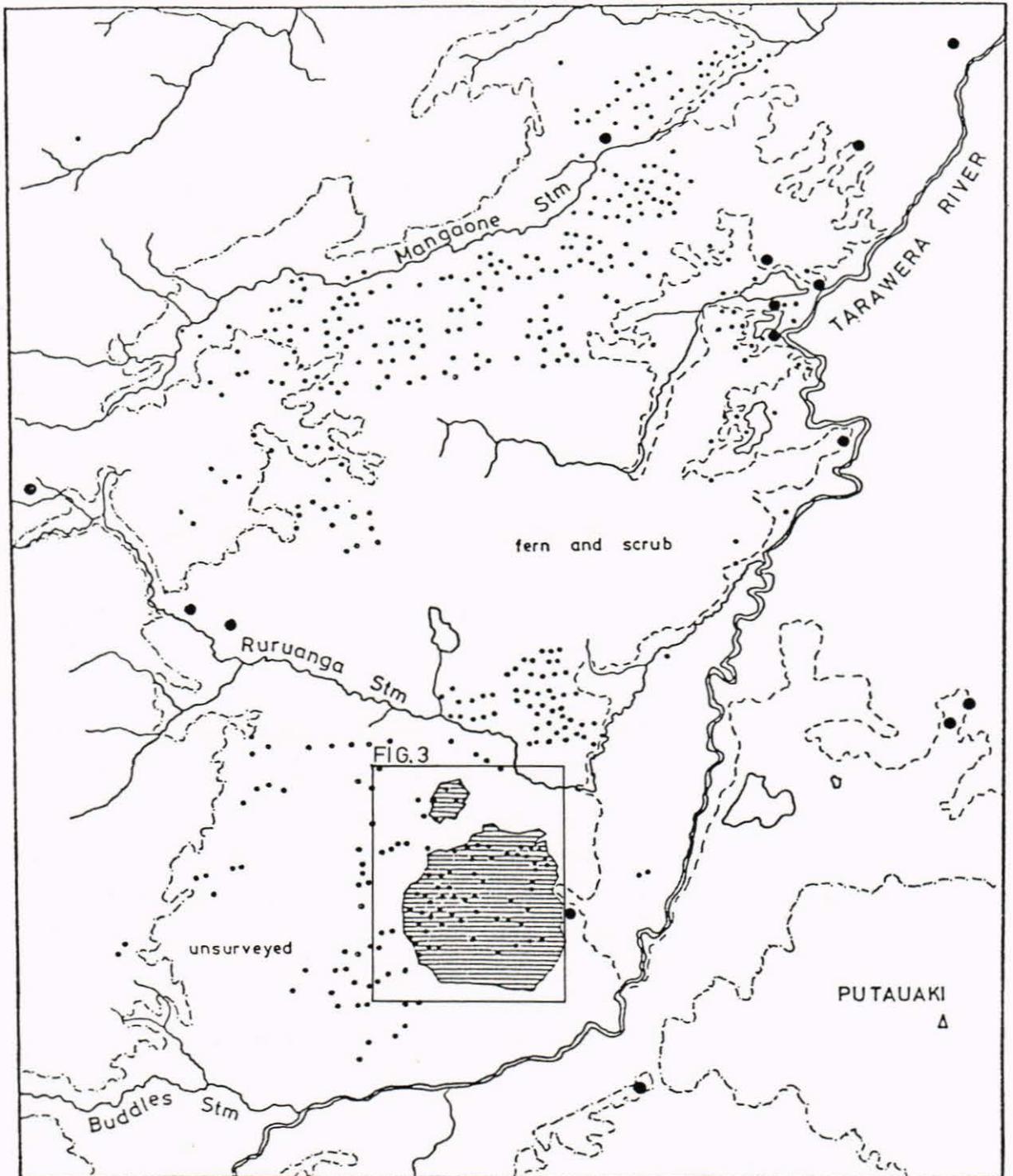
Taking into account the fact that excavations have also uncovered archaeological features not recorded in the survey, the area under investigation could easily contain between 500 and 1000 pits. If this figure is applied to the total area of back swamp lowlands and foothills (approximately 3510 hectares), there may be as many as 10,000 pits (Fig. 7). This is probably a conservative estimate and although the present data is limiting, the writer believes there are probably many more pits within the region, perhaps as many as 30,000. A general conclusion from these figures, on the assumption that most pits were for sweet potato (*Ipomoea batatas*) storage, is that a considerable amount of kumara was grown and stored within the foothills of the Kawerau and Onepu area of the Bay of Plenty (cf. Moore 1964a and 1965; also see Walton 1981).

Pit Problems

The remainder of this paper deals specifically with the basic pit problems of age, form, construction, distribution and function.

1. Age

There are three sources for estimating the age of the pits at Kawerau: Firstly, traditional accounts of prehistoric occupation within the area; secondly, the relationship of pit features to the tephrostratigraphy; and thirdly a single radiocarbon age estimate. Other charcoal and shell samples have been submitted for dating, but the



- Prominent features
- Pa sites
- - - 150m (500 ft) contour
- - - 30m (100 ft) contour
- ⊕ Survey area

0 1 2 km
0 1 mile



Fig.7

Previously surveyed sites and the present survey blocks. (After Phillips 1981a)

results are not yet available.

All prehistoric occupation uncovered by excavations in the 1980-82 project occurred after the Kaharoa Ash (Lawlor 1982). The age of this event has been debated over the last 20 years (see Nairn *et al.* in prep.). Recent radiocarbon age estimates of peat deposits surrounding the ash within the Kohika swamp site (N77/104) indicate that the eruption event occurred in the late 13th century (655 ± 58 B.P.) (Lawlor 1980:267). This result is comparable with another age estimate of the Kaharoa Air-fall Ash (NZ1765 656 ± 56 B.P.), and confirms Wellman's 1300 A.D. estimate made in 1960 when a few radiocarbon dates indicated a much earlier age of 1000 A.D. (Wellman 1960:92).

It is difficult to estimate how much time had elapsed after the Kaharoa Ash Eruption before the area was occupied and cultivation and storage commenced. Archaeological sections through valleys indicate that a 10 cm topsoil had accumulated before being disrupted by gardening activities (Lawlor in prep). It therefore seems likely that the area was occupied after a substantial period of time, possibly by the 15th century.

A single date has been received from the Institute of Nuclear Science, DSIR Lower Hutt. A radiocarbon age estimate of tree-fern remains (?ponga post) from along the wall of a pit on site N77-579-4 indicates that it was probably used in the early 16th century:

Excavation Find No.	N.Z.	C ¹⁴ years B.P. (5568 half-life)	Years B.P. (Secular Correction)	Calendrical Age Range at 1 s.d.
199	5318	336 ± 56	421 ± 58	1587 - 1471

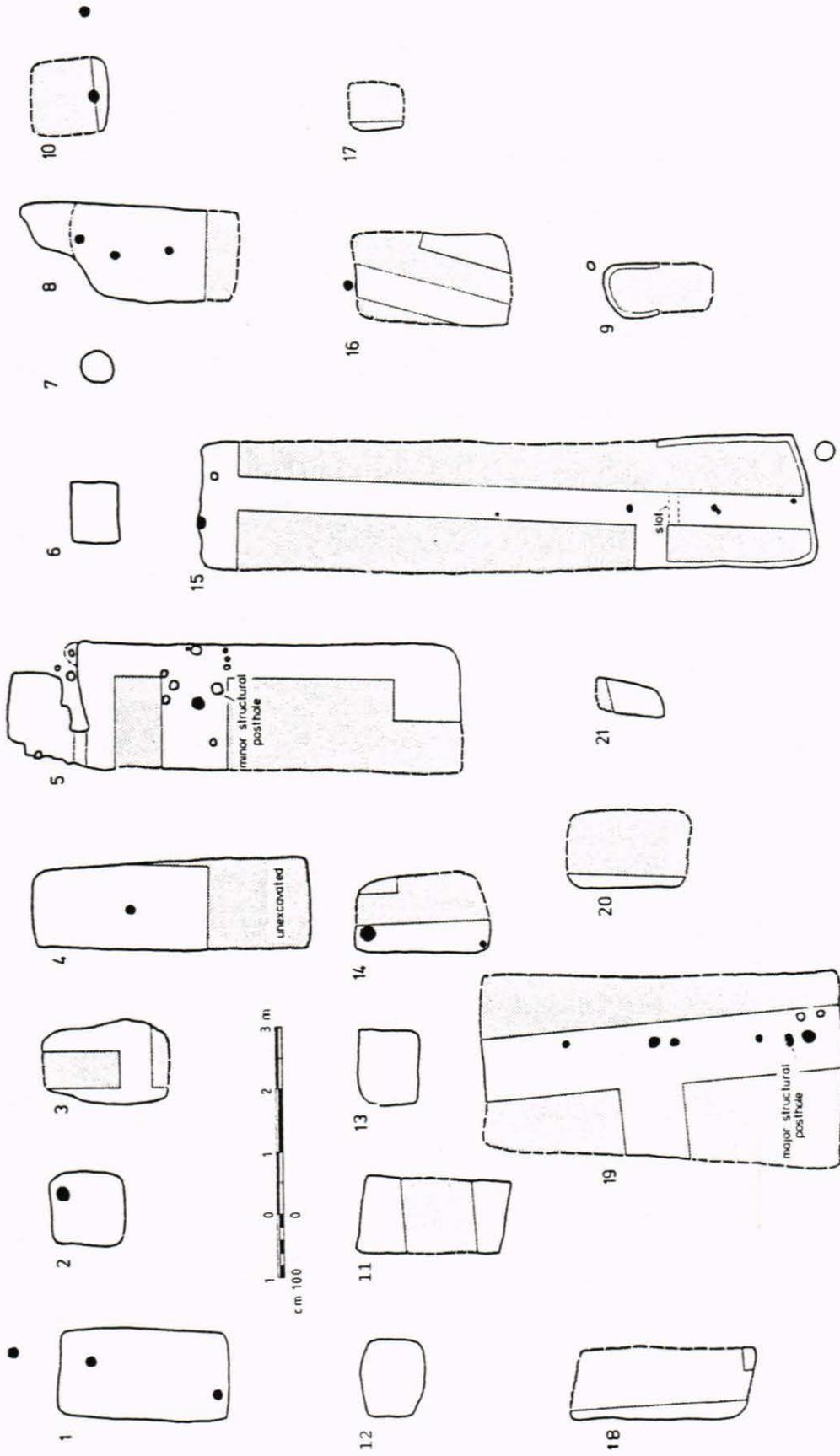


Fig.8a Excavated pits.

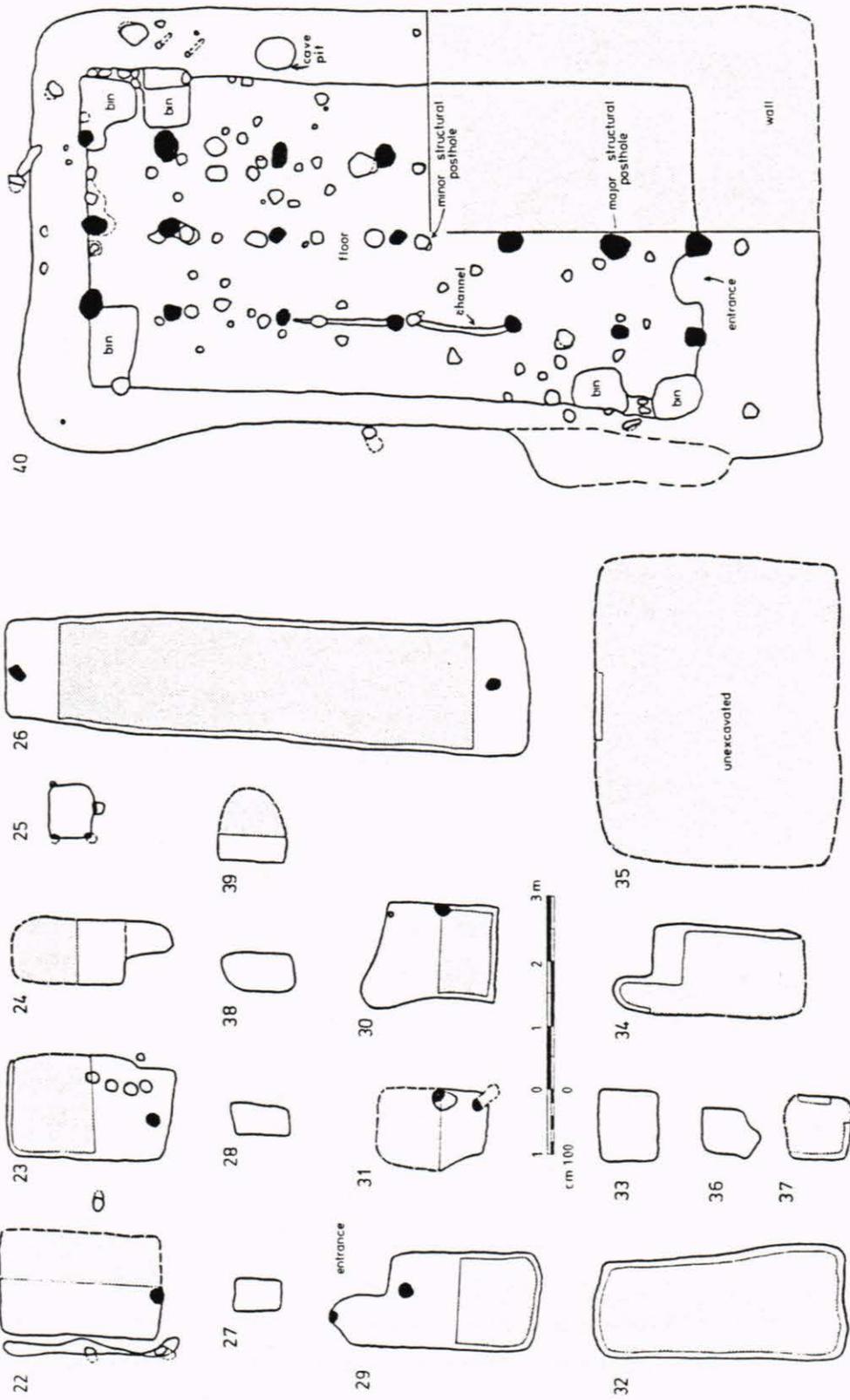


Fig.8b Excavated pits.

Tradition records that Tuwharetoa, the ancestor of the tribal group Ngati Tuwharetoa, lived in the Kawerau area during the 16th century (Grace 1970:103-8). He was the son of Mawaketaupo the high chief who lived at Waitahanui paa, and was a direct descendant of Ngatoroirangi, the high priest of the Awara canoe. On his mother's side Tuwharetoa traced descent from the aboriginal tribes of the Bay of Plenty (Toi, Hapuoneone and Te Tini O Kawerau).

Under the leadership of Tuwharetoa his tribe (Ngati Rongomaihuia) extended their land by taking over existing fortified paa in the district as well as building new fortifications. On many an expedition Tuwharetoa was assisted by his friend Tutewero, who was also a man of high rank and a warrior of renown.

Tutewero, who lived in the early 16th century, was the son of Maruka. Maruka's paa is located on the outskirts of the area under investigation (Fig. 3). Many kuumara pits and garden plots surrounded the paa (Moore 1964b:49).

In summary, most of the pits within the development blocks will most likely date to the 15th and 16th centuries when the land was intensively occupied by hapuu of the Ngati Tuwharetoa. The use of the area for cultivation and storage of kuumara probably started in the 15th century and continued up until the Tarawera Eruption of 1886 A.D.

2. Form

Although some excavated pits were not completely uncovered it has been possible to reconstruct their original form. Figure 8 is a plan drawing the 40 excavated pits. The shaded areas of the plans show unexcavated areas and the dotted lines represent reconstructed pit edges. The pits have been drawn to the same scale to facilitate the comparison of form. Appendix 1 lists the pit dimensions.

The pits can be grouped into three basic types (Fig. 9):

1. small bin pits;
2. a cave pit with a domed roof and side entrance; and
3. large semi-subterranean (roofed) rectangular pits.

Bin Pits: Bin pits are small rectangular or circular holes (Fox 1974:141). Their length and width dimensions were usually under 1.0 m and they were seldom over 50 cm in depth. They differed from rectangular pits in that they had no entrance-way feature (see below) and they generally had no postholes associated with them.

Fifteen bin pits were recorded during the investigations. One had a circular form (number 7) and the rest were rectangular in form (numbers 2,6,10,11,13,17,21,25,27,28,33,36,37 and 38). Three of the bins (numbers 2,10 and 25) had posthole features associated with them indicating they were possibly roofed over. The remaining bins did not have any evidence of postholes and were most likely covered over with a lid.

The sides of the bins without postholes were always perpendicular, indicating they were either used for short periods and deliberately infilled or reinforced with timbers. Short use and infilling seems more likely because no wood was found.

Cave Pits: Cave pits are artificial holes cut into vertical faces of rock or compact sediments. The floor plan of cave-pits vary from rectangular and oval to D-shaped. The roof is nearly always 'dome-like' or 'beehive-shaped', or some other variation on this basic form (see Best 1974:92-98).

A single cave pit was uncovered during Stage V investigations of site N77/587-4. This pit (number 39) was cut into the side of a very large semi-subterranean pit (number 40); the original excavation

FIG. 9 LIST OF PIT TYPES FROM
THE MARUKA INVESTIGATIONS

PIT TYPE ¹			INVESTIGATION STAGE			TOTAL
			II	III	V	
BIN (B)	NO POSTHOLES (B ^o)	CIRCULAR (B ^{oc})	1			1
		RECTANGULAR (B ^{or})	1	4	6	11
	POSTHOLES (B ¹ or B ²)	1	1			1
		2	1	1		2
CAVE (C)				1	1	
RECTANGULAR SEMI-SUBTERR- ANEAN (R)	SINGLE POSTROW (R ¹)	NO ENTRY FEATURE	4	7	5	16
		ENTRY FEATURE (R ^{1e})	2		4	6
	MULTIPLE POSTROWS (R ² or R ³)	2			1	1
3				1	1	
TOTAL			10	11	19	40

¹The symbols in brackets have been used to identify the pit types (see Appendix 1).

and building of the large pit (by the Maori) had exposed a near vertical face of old relatively compact as (Rotoiti Breccia). Stratigraphic evidence (Lawlor in prep.) indicated the cave-pit had been cut after the large rectangular pit had ceased to function as a semi-subterranean structure.

The Kawerau cave pit was first located during excavations by its entrance hole (60 cm wide and 80 cm high). The excavation of half the fill of the cave pit made it possible to estimate its size as 1.8 m wide by (approx.) 1.2 m long. The floor-plan was D-shaped with the straight edge located beneath the entrance. The roof was slightly domed, although this appearance may have resulted from roof-fall. The entrance was raised 50 cm above the floor of the cave pit. Best (1974:95-6) wrote that the position of the entrance on such pits was a design feature to conserve warmth. No doubt the entrance position also made it more difficult for rats (kiore) to enter the pit.

Rectangular Semi-subterranean Pits: Rectangular pits were the most numerous form found during the investigations of the terrace sites. The pits were rectangular, or more usually oblong or 'playing card' shape, with an approximate 2:1 ratio of the length and breadth dimensions (cf. Fox 1974:141). Three pits were atypical with length breadth ratios of 3:1, 4.5:1 and 5:1 (numbers 5, 16 and 26 respectively).

The rectangular pits were all approximately 1.0 m in depth. Three pits were deeper, these measured 1.3 m, ?1.6 m and ?1.4 m in depth (numbers 15, 19 and 22 respectively).

Some depth measurements cannot be relied upon to indicate former actual depths of the pits because excavations have shown that a great deal of reconstruction had occurred upon the terraces. Old terraces were extended and levelled to create new ones. This levelling activity had clearly planed off the upper half of some pits (numbers 26, 30 and 31), and may have affected others as well.

The postholes located within the pits, and upon adjacent surfaces, indicate that each pit was covered over with a roof. The most common form of roof, as indicated by the posthole features alongside pit number 22 (Fig. 10), indicated the pitch of the roof was reasonably steep (approximately 82 degrees).

In many cases a single row of centre posts was aligned to one side of the pit. This pattern of placing an end post to one side probably indicates the position of the entrance of the pit.

One notable feature of six pits (number 5, 8, 24, 29, 30 and 34) has an extension at one of the short ends. This D-shaped feature extended across half of the width of the pit end and was usually half as deep as the pit. The feature was identified as an entrance, probably associated with a small roro, or porch-like extension of the roof (see Best 1974:102), which served to protect the face of the pit and doorway from the weather (see Fig. 11).

The most formal and best preserved example of this extension was found on pit number 5. The entrance-way to the pit was identified by two grooves cut into compact ash. The grooves most likely held the timbers which were slotted into place to close the pit.

Posthole features associated with pit number 1 show the ridge-pole was sunk into the bank behind the pit (Fig. 10) suggests the wall had been built to retain a collapsed segment of bank.

The largest pit (number 40) measured 11.84 m long by 5.6 m wide and 2.4 m deep (approximately 160 cubic metres in area). Only three-quarters of the pit was excavated, but five bin features and 73 postholes were uncovered on the floor of the pit. The bin features were most likely constructed to hold tree-fern posts to reinforce the pit corners, rather than to act as sumps to drain the floor. The volcanic ash, into which the pit was cut, was porous and free draining. One may assume that the corners were structurally the weakest points because of the numerous ash layers present, so it is more likely that

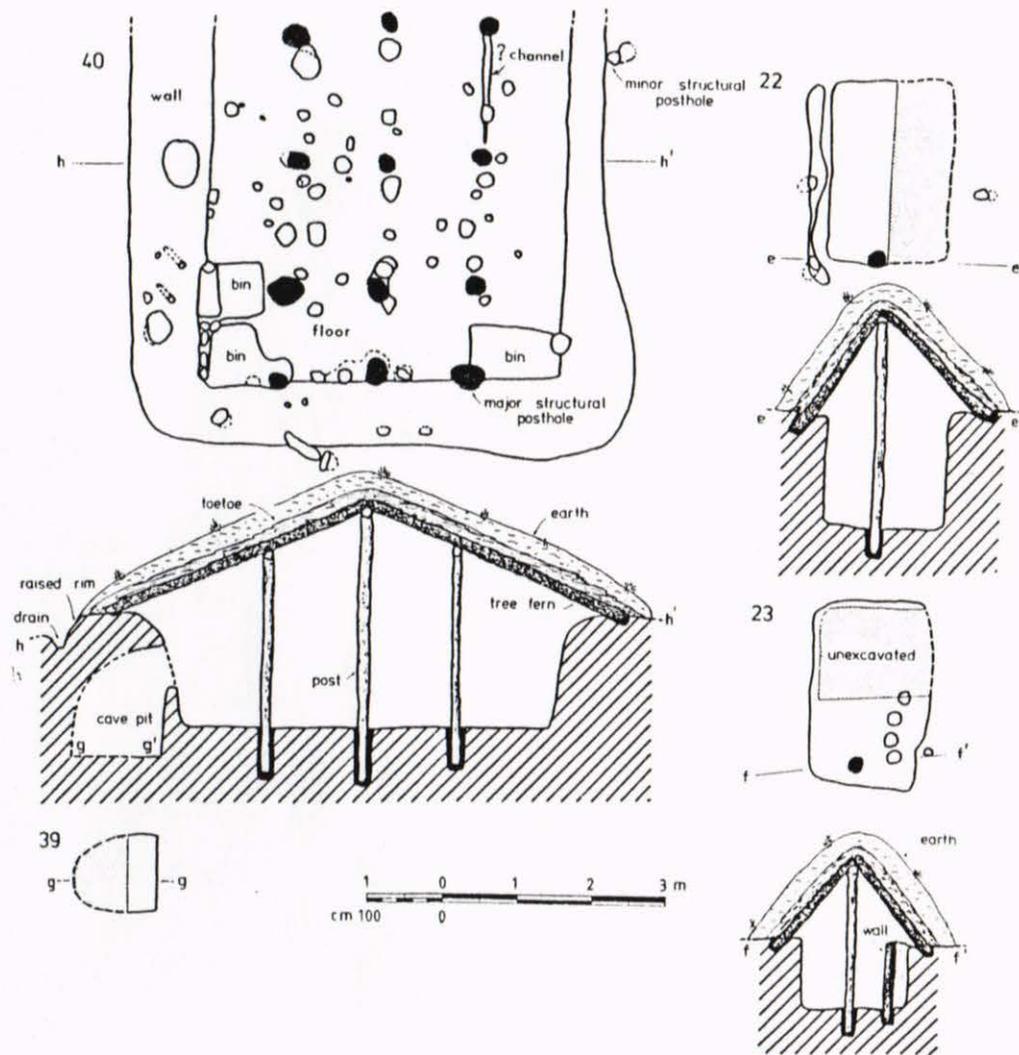
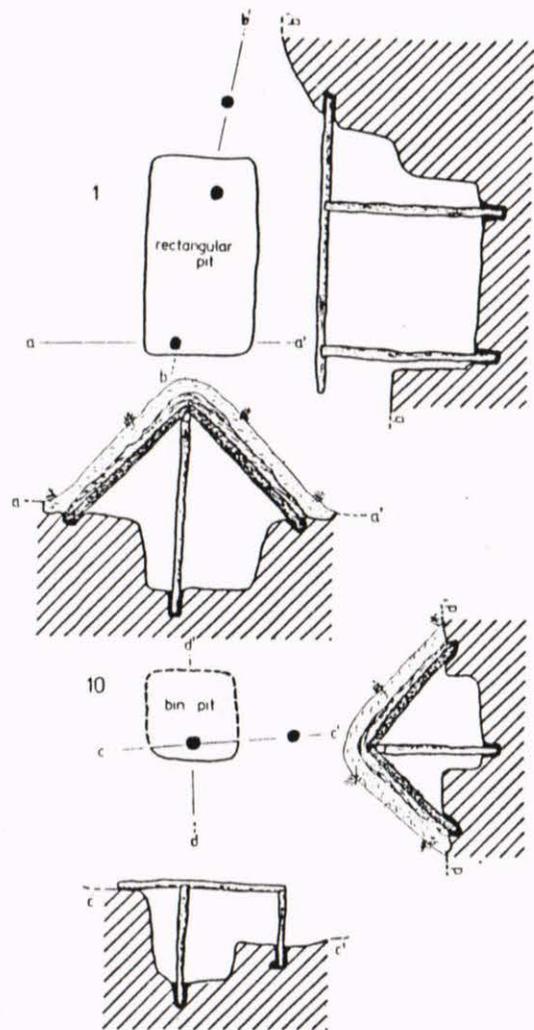


Fig.10 Pit reconstructions.



Fig.11 Late 1800's photograph of a Maori settlement at Te Kaha (Te Kaha in photo caption), eastern Bay of Plenty. Kits of kumara are ready for stacking within a newly constructed rua. Thatching is exposed along the base of the roof. (Photo reproduction by Anton van der Wouden, Whakatane Museum)

these were structural features.

Eighteen postholes were identified as major structural features of the original pit, while most of the remaining 55 postholes appear to represent reconstruction activities. Some may have functioned as additional support posts, and other smaller stake holes may have been related to internal subdivisions of the larger pit. A further 20 postholes were located upon the pit walls. The entrance to the pit was identified at one end by a step on the pit floor. The pit has a raised rim and a drain feature outside and along its northern edge. Also, a shallow (4 cm) channel feature was uncovered on the floor of the pit.

In summary, the rectangular semi-subterranean pit was by far the most dominant form within the investigations at Kawerau. A common pit form not present at these sites in the 'well' or 'bell-shaped' pit which was entered through a hole in the top. As Best pointed out (1974:84) this pit form did not suit loose soil such as that found in the pumice country. This is probably the reason why this pit form has not been found during the investigations (cf. Moore 1976 and 1977).

A single cave pit suggests that the use of this form was limited in this region. The construction of an extremely large pit had exposed a vertical face of relatively compact ash. This vertical face was a unique feature within the ash-covered rolling landscape and was used to advantage in this one case.

A number of factors appear to be related to the form of pits. These factors include ash stability, slope angle of hillsides, and accessibility of the consolidated ash deposits. Topography, together with the nature of the substrata, help to explain why a 2:1 ratio of length to breadth was common. In terms of the amount of energy and materials used in the construction of pits, the long and thin pit,

with a single row of posts, was possibly the most economical. It would have been much easier to extend the length of a pit than increase its width by adding a new postrow.

3. Construction (see Fig.10)

A general observation from Stage II (Lawlor 1981) and Stage III (Furey 1981) excavations was that pit features were located at the back of terraces and were cut into the consolidated Rotoma Ash. Pits located upon ridgetop terraces were also positioned towards the centre of the ridge to gain easy access to this ash. This pattern of pit construction was recognised again during Stage V excavations (Lawlor 1982).

The remains of wood planks, tree-fern (?ponga) posts, and wood (?maanuka) stakes, were found within pit and posthole features. The remains of many carbonized tree-fern posts and a wooden plank within pit number 5 indicated the structure was burnt. The pit had subsequently collapsed under the weight of the earth covering the roof. The jumbled mess of burnt tree-fern made it difficult to determine if the walls of the pit had been lined. In all cases except one (number 23 discussed above) the pits did not appear to have been lined with posts although there were possible corner posts within bins in pit 40.

The archaeological evidence indicates that pits were probably constructed in a similar manner as those described by Tuta Nihoniho, of the Ngati Porou tribe (in Best 1974:98). The discussion of large semi-subterranean storage pits, similar to pit number 40, is under the heading 'East-coast types of food stores':

The rua tahuhu type... These were the best constructed store-pits of the roofed kind, and were sometimes large enough to contain an immense quantity of tubers. Special names were assigned to them, usually the names of ancestors...large rua tahuhu had three tahu - the true ridge-pole and the longitudinal pole parallel with it on either side of the roof. These poles helped

to support the roof, or, if hewed beam, to break joints of roofing-slabs on i.e., to support the end of such slabs if they were not long enough to reach from the ridge to the top of the earthen wall. There were posts to support each longitudinal beam, the number of such posts depending on the length of the store. If a large one, there might be two hononga or joinings of these beams. Although there might be two series of slabs to form the roof of a large store pit, there was no break in the slope of the roof, be that a hoka (sharp-pitched) or a kaupaparu (low-pitched) one.

(1974:98-99)

The description continues outlining the construction of the roof out of slabs or planks of tootara or tree-fern, followed by a thatching of toetoe leaves or bark strips of maanuka or tootara, and finally a covering of earth.

A number of features within pit 40 suggest that it was similarly constructed (Fig. 10). These features include the spacing of major structural postholes, posthole depths, tree-fern post remains, and rubble fill in the bottom of the pit. The fill indicates that when the pit fell into disuse, the timbers were removed and earth covering was allowed to fall into the pit. Unfortunately no evidence of thatching remained.

The problem of pit reconstruction was discussed in 1982 by the author with the elders of the Tuwharetoa Urupa and Historical Trustees, Albert Te Rire and John Fox of Onepu. They said that a thatching of toetoe (Arundo conspicua) was used when they had assisted with the building of pits. Thick layers of leaves were placed down over a roof construction of tree-fern or mamuka (Cyathea medullaris) posts. The toetoe filled the small gaps between the posts to insulate the interior from moisture and earth was placed over the thatching. The toetoe was preferred over other grasses and sedges because it was more resistant to decay, and the leaf-form, when correctly thatched, was very efficient at shedding water.

The tree-fern posts used in the construction of the roof

rested upon a ridge-pole and were dug into the ground at the side of the pit. Burying the roof posts into the ground was important because this was a weak point where rats could gain entrance into the pit. The door was a second point where special attention was given to making a secure structure (pers. comm. 1981). Similar methods of pit construction were used by the East Coast descendants of Eruera Stirling of Whanau-a-Apanui (Stirling and Salmond 1980).

A late 1800's photograph (Fig. 11) of a Maori settlement at Te Kaha (East Cape) shows a thatched and earthed over rua kumara. A man is standing in a depression at the front of the pit. This depression appears to be similar to the entrance features that were uncovered during the investigations.

4. Pit distribution within a single terrace site

Stage V excavations of site N77/588-6 uncovered the remains of 17 pits and two whare (houses) distributed across a 300 sq.m. terrace area (Lawlor 1982). The majority of bin pits were clustered around the houses suggesting that they may have been related to domestic activities.

The orientation of the pits and stratigraphic evidence indicated that there had been at least three rebuilding periods. The sequence of pits shows that the first pits were constructed along a ridge between two knolls, probably to take advantage of the easy access to the consolidated Rotoma Ash. The ridge would have also offered exceptional drainage. At a later date the knolls at either end of the ridge were remodelled and a series of new pits built. Remodelling occurred a third time. Stratigraphic evidence indicates that three pits were probably in use when the two houses were occupied.

The re-use of terraces and their remodelling may help to explain why many pits have retained a very regular form. This form suggests they were dismantled and purposefully filled immediately after they had ceased to be used as storage pits. The length of time that

a pit was used for the storage of kuumara is not easily assessed. The main limiting factor upon pit use may have been the length of time thatching continued to function properly. As the Archdeacon Walsh noted "the labour bestowed on them (pit stores) in those early times, before the use of iron, was immense, and they were mostly renewed as to the reed-work every year" (quoted in Best 1974:111; also see Stirling and Salmond 1980:104). This implies that pits were re-used, possibly over a number of season.

5. Function

A review of the literature indicates that the Maori used pits for a variety of purposes: for food (kuumara, taro, aruhe and European potato) and water storage; as rubbish receptacles; to facilitate the fermentation of foodstuffs (hiinau and European maize); for rat (kiore) catching; for the temporary storage of food and material goods; as dwellings; as repositories for sacred objects; and as a place for the practice of 'witchcraft'.

Thirty-nine pits in the Maruka Investigations probably functioned as food stores. One bin pit (number 27) was possibly an exception because it was located within a posthole outline of a whare, and it may have been a temporary storage hole for items other than food.

Although there was no direct evidence of food within the pits it seems most likely that they functioned as stores for kuumara. Indirect evidence to support this storage function includes: (1) the similarities between excavated pits and ethnographically recorded kuumara stores of the East Coast region; (2) traditional records indicate that kuumara cultivation was practised; kuumara has been cultivated and stored in the region in more recent times (pers. comm. Messrs. Albert Te Rire and John Fox 1981); (3) there is

strong archaeological evidence for extensive gardening areas which surround the terrace sites (Lawlor 1981, 1982, in prep.; Lawlor et al. 1981). The very number of pits in the area is difficult to explain if any other function is considered for more than a small proportion. The location of the pits on ridges rules out water storage or fermentation as functions.

The variety of pit shapes and sizes that were uncovered during the excavations may be related not only to the size of family groups using the pits, but also to the storage of sorted kuumara. The kuumara sorting process, termed kopana or maahiti (Best 1974:105) grouped tubers by size, texture, and the purpose for which they were to be used.

Tuber size ranged from diminutive pencil thick (kuumara hekerau) through very small (taakora), small (koai), medium (taranga), long narrow (kuumara kookau), to large and round (kuumara taapuku). Tubers with a smooth even surface were called (kuumara mahora).

Kuumara variety, taste, size, texture and preservation quality, resulted in tubers grouped for immediate use, for guests, long term use, and for seed. These sorted tubers were stored, either within a single pit if there was enough room, or within different pits. The different sizes of pits within the Maruka Investigations probably reflect sorted kuumara set aside for different purposes (cf. Groube 1965 and Shawcross 1966:67).

Summary Discussion and Conclusions

This paper has examined problems of age, form, construction, distribution and function, of the 40 pits uncovered during the Maruka Investigations at Kawerau, Bay of Plenty. These pits can be taken as being representative of a much larger number which were used by a community over a particular period of time. This examination has been facilitated by the fact that the area of investigation lies within a

a well defined region; tephro-stratigraphy allows a 'control' for the identification of the temporal use of the land by a single tribe, (the Ngati Tuwharetoa) for the cultivation and storage of kuumara.

Archdeacon Walsh noted in 1902 that the Maori followed no uniform pattern in the construction of their storing places: "as usual with them, the idea they had in their minds was worked out subject to local conditions, and, as these varied more or less in every locality, it is not surprising to find a corresponding variety in their appliances" (quoted in Best 1974:109). The 'local conditions' which were most likely of major influence for pit building within the Maruka region of investigations, were ash stability, slope of hill-sides, ash porosity, and accessibility to consolidate ash deposits. The implications for the study of pits within other regions is that topography and the nature of the substrata are factors which have an important influence upon the form and construction of pits. A similar conclusion was reached by Te Rangi Hiroa when he suggested that the contrasting modes of storing the kuumara crops on the East Coast, the West Coast, and in the north, may be due to the climatic conditions and the varying nature of the soil (1925:24; quoted in Firth 1929:69).

The semi-subterranean rectangular pit was the most common form found during investigations. Evidence suggests that within this type posts and ridge-poles supported a roof of tree-fern posts or planks. The roof was probably thatched before being earthed over to insulate the interior. Some of the rectangular pits had entrance features. Long and thin pits with a single row of posts were possibly the most economical form in terms of energy and materials used in construction.

The majority of bin pits were clustered around two houses upon terrace site N77/588-6. This distribution suggests the bins

may have been related to domestic activities. They may have contained sorted kuumara set aside for different purposes. The different sizes of rectangular pits may also have been related to this sorting.

The cave pit and 'well' (or 'bell') forms were limited in the region. This is most likely due to a lack of vertical faces of rock and compact sediments, into which these pits could be dug. These types of pits would not have been easily constructed in pumice soils and were probably prone to collapse.

The archaeological investigations at Kawerau have indicated a need for experimental kuumara cultivation and storage work. This is especially true now there is an expansion of horticultural development throughout the Bay of Plenty and East Coast Regions. Introduced horticultural techniques and tuber varieties are replacing the old. The concrete and iron roofed rua is no longer being widely used for home storage of seed kuumara and traditional varieties appear harder to come by. The market production orientation of modern horticulture is removing incentives for the use of the rua kuumara.

Mr. Ken Moore, the NZAA filekeeper for the Bay of Plenty, recorded a local saying: "between Mount Tarawera and Umuhika (Matata) lies hidden wealth untold. Seek it and nurture it" (1980:1). I would like to conclude this paper by suggesting that this 'hidden wealth untold' is not the vast quantities of gold, as some local people believe, but that it is the soil that was used by the prehistoric Maori to cultivate and store the kuumara.

Acknowledgements

I would like to express my thanks to all those who have taken part in the Maruka Investigations at Kawerau. The Fox and Te Rire families of Onepu have been supportive throughout our work.

Kei te mihi ki nga kaumatua o Ngati Tuwharetoa-i-te-Aupouri mo nga tohutohu me nga manaki i roto i nga mahi. No reira e Te Rire, e Fox me te whanau nga mihi ki a koutou katoa.

Roger Green, Sue Bulmer and Bevan Mudie read a draft of this paper and provided constructive criticism. Kati Kereszturi typed the manuscript.

My first archaeological surveying experience was carried out under the direction of Aileen Fox. I have many fond memories of this work and I am grateful to Aileen for this start in archaeology.

Appendix: Types and dimensions of excavated pits from Maruka investigations.

<u>Pit No.</u>	<u>NZAA Site No. (N77)</u>	<u>Pit Type</u> *	<u>Dimensions</u>			<u>Excavation Feature No.</u>
			<u>Length</u>	<u>Width</u>	<u>Depth</u>	
<u>Stage II</u>						
1	579-2	R ¹	2.60	1.65	1.00	5
2	579-2	B ¹	1.20	1.00	0.80	14
3	579-3	R ¹	2.00	1.27	?0.88	1
4	579-4	R ¹	?4.50	1.20	1.20	1
5	579-4	R ^{1e}	5.80	?2.34	?0.90	2
6	579-4	B ^{or}	1.00	0.70	0.30	
7	579-4	B ^{oc}	0.45	0.45	0.30	
8	579-6	R ^{1e}	?3.00	1.40	?1.00	
9	580-1	R ¹	?1.50	?0.50	-	1
10	576 (trench 1)	?B ²	?1.20	?0.65		
<u>Stage III</u>						
11	606-1	R ¹	1.26	?0.90	?0.50	1
12	606-1	B ^{or}	2.15	1.20	?0.30	2
13	606-1	B ^{or}	1.20	?0.90	0.10	3
14	606-1	R ¹	?2.00	1.10	0.90	4
15	606-1-2	R ¹	9.30	2.20	1.20	5
16	606-1-2	R ¹	?2.10	?1.40	0.50	6
17	606-1-2	?B ^{or}	?1.20	?0.80	?0.25	7
18	606-2	R ¹	?2.70	1.20	?0.80	8
19	606-2	?R ¹	?5.70	?3.00	?1.60	9
20	606-2	R ¹	?1.80	?1.20	?0.50	10
21	606-1	B ^{or}	?0.80	?0.40	?0.58	11

* For key to pit type symbols see Fig. 9.

Appendix (continued).

<u>Pit No.</u>	<u>NZAA Site No. (N77)</u>	<u>Pite Type</u> *	<u>Dimensions</u>			<u>Excavation Feature No.</u>
			<u>Length</u>	<u>Width</u>	<u>Depth</u>	
<u>Stage V</u>						
22	588-6	R ¹	2.35	1.60	?1.40	15
23	588-6	R ¹	2.40	?1.20	?0/85	16
24	588-6	R ^{1e}	1.66	1.00	0.95	17
25	588-6	B ^{2r}	0.60	0.76	1.14	78
26	588-6	R ¹	7.76	?1.90	?0.58	79
27	588-6	B ^{or}	0.65	0.47	0.50	84
28	588-6	B ^{or}	0.70	0.40	0.26	86
29	588-6	R ^{1e}	2.26	?1.50	?0.70	91
30	588-6	R ^{1e}	1.72	?1.50	?0.58	114
31	588-6	R ¹	?1.25	?1.10	0.30	115
32	588-6	?R ¹	3.68	1.58	-	1.20
33	588-6	B ^{or}	0.88	1.10	0.34	167
34	588-6	R ^{1e}	?2.26	?1.30	-	180
35	588-6	?R ²	?4.80	?3.60	-	190
36	588-6	B ^{or}	?0.80	?0.40	?0.46	197
37	588-6	B ^{or}	0.96	0.96	?0.70	198
38	588-6	B ^{or}	1.04	0.60	?1.00	205
39	587-4	C	?1.20	?1.80	?1.70	11
40	587-4	R ³	11.84	5.60	2.40	587-4

REFERENCES

- Best, E. 1974. Maori Storehouses and Kindred Structures. Government Printer, Wellington, (Reprint).
- Buck, P.E. 1925. (See Rangi Hiroa, Te).
- Fox, A. 1974. Prehistoric Maori storage structures: problems in interpretation. Journal of the Polynesian Society. 83(2):141-54.
- Firth, R. 1929. Economics of The New Zealand Maori. Government Printer, Wellington.
- Fox, J.H. 1981. Personal communication.
- Furey, L. 1981. Interim report on excavations at N77/606. Kawerau. N.Z.A.A. Newsletter 24(3):192-97.
- Furey, L. In prep. Excavation of site N77/606, Long Valley Kawerau: Final Report. Department of Anthropology, University of Auckland.
- Grace, J.H. 1970. Tuwharetoa. A.H. and A.W. Reed, Wellington.
- Groube, L.M. 1965. Settlement Patterns in New Zealand Prehistory, University of Otago, Anthropology Department, Occasional Papers in Archaeology, 1.
- Lawlor, I.T. 1980. Radiocarbon dates from Kohika swamp pa N68/104, Bay of Plenty. N.Z.A.A. Newsletter 23(4):256-67.
- Lawlor, I.T. 1981. Maruka excavation, Kawerau 1981: an interim report. N.Z.A.A. Newsletter 24(3):184-91.
- Lawlor, I.T. 1982. Interim report on stages IV and V of the Maruka Investigations, Kawerau, Bay of Plenty. Unpublished report, Department of Anthropology, University of Auckland.
- Lawlor, I.T. In prep. Maruka Investigation Report 1981-82. Department of Anthropology, University of Auckland.

- Lawlor, I.T., Allen, H., Phillips, C. and L. Furey. 1981. Maruka Investigations, Kawerau: summary report and recommendations. Unpublished report, Department of Anthropology, University of Auckland.
- Moore, K.W. 1964a Pit Terrace site, Kawerau. Whakatane Historical Review 12(1):34-5.
- Moore, K.W. 1964b. Kawerau, its history and background. Part 1 continued. Whakatane Historical Review 12(2):42-54.
- Moore, K.W. 1965. Pits, terraces at King's farm, Onepu. Whakatane Historical Review 13(2):90-5.
- Moore, K.W. 1976. Rakei Hopukai (N77/4), Te Teko, Bay of Plenty. Whakatane Historical Review 24(2):103-9.
- Moore, K.W. 1977. Te Koutu pa - N76/66 - Lake Okataina. Whakatane Historical Review 26(2):104-12.
- Moore, K.W. 1980. Editorial, Kawerau's Silver Jubilee - 1954: 1969. Whakatane Historic Review 28(2):1.
- Nairn, I.A. 1981. Some studies of the geology, volcanic history, and geothermal resources of the Okataina Volcanic Centre, Taupo Volcanic Zone, New Zealand. Unpublished Ph.D. Victoria University, Wellington.
- Nairn, I.A. 1982. Personal Communication.
- Nairn, I.A. and S.Self. In prep. The Kaharoa Eruption of Tarawera volcano, Taupo Volcanic Zone, New Zealand.
- Nairn, I.A., McGlone, M.A. and W.A. Pullar. In prep. Age and duration of the Kaharoa Eruption episode. (To be submitted to Journal of Geology and Geophysics).
- Phillips, C. 1981a. Kawerau site survey 1980-1: an interim report. N.Z.A.A. Newsletter 24(3):179-83.

- Phillips, C. 1981b. Kawerau Site Survey. Final report 1980-1. Unpublished report, Department of Anthropology, University of Auckland.
- Rangi Hiroa, Te (P.E. Buck). 1925. The Coming of the Maori. Cawthorn Lecture ii. Nelson (Quoted in Firth, 1929).
- Shawcross, F.W. 1966. Ongari Point - Second Season. N.Z.A.A. Newsletter 9(2):53-71
- Stirling, E. and A. Salmond. 1980. Eruera. The Teachings of A Maori Elder. Oxford University Press, Wellington.
- Te Rire, H.A. 1981. Personal communication.
- Walton, A. 1981. A storepit site (N77/574) at Kawerau. Whakatane Historical Review 29(2):71-81.
- Wellman, H.W. 1960. The stratigraphy of human occupation layers in North Island coastal sections, New Zealand. Asian Perspectives 3(1):9-14.