Archaeology of the Wellington Conservancy: Wairarapa

A study in tectonic archaeology

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To the memory of Len Bruce,

1920–1999,

A tireless fieldworker and a valued critic.

Cover photograph shows a view looking north along the Wairarapa coastline at Te Awaiti. (Photograph by Lloyd Homer, © Insititute of Geological and Nuclear Sciences.)

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A study in tectonic archaeology

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ABSTRACT

The Wairarapa region is a tectonic landscape at the southeastern corner of the North Island of New Zealand. Seismic events are an important key to its natural and cultural character. Archaeological sites and environmental events are dated by their stratigraphic relationship to earthquake-uplifted shorelines, and with dune-building phases and alluvial deposition episodes thought to be triggered by earthquakes.

Two cultural periods are recognised: early and late. Early period sites are older than or contemporary with a period of seismic activity dated to about the late 15th Century AD. The inferred early settlement pattern was coastal. At the time of Maori settlement the coast was largely forested with extensive lagoons between uplifted beach ridges, and it had been stable for at least 800 years. Economic pursuits, in particular gardening, were related to the geological nature of the coast. Gardening was common where a hard rock platform and coastal sediments of greywacke or limestone resistant to wave erosion occurred in front of the coastal hills. It was virtually absent from parts of the coast where the coastal hills were easily eroded mudstones fronted by soft rocks and coastal sediments poorly resistant to wave erosion. Parts of the coast were abandoned following uplift of the coast that drained lagoons, silted up streams, and reactivated building of stream fans on the coastal platform. I suggest that tsunami inundation killed off the coastal forest that remained following Maori clearance by fire.

During the late period the focus of occupation moved to the main Wairarapa Valley. Gardening was practised in the southern part of the valley and settlement sites tended to be concentrated on the eastern side of the valley. Forest clearance, however, seems to have focused for some reason on the extensive gravelly soils of the Waiohine fans that were deposited from the mountain ranges on the western side of the valley at the end of the last glaciation.

Future research is proposed with the intention of clarifying aspects of the natural and cultural history of the region and their interrelationship. Of particular importance are: the direct dating of two earthquakes that have uplifted the coast between Flat Point and Cape Palliser twice since human settlement; and the field identification of at least two tsunamis that have struck the coast since human settlement. Both types of events would have had severe consequences for the human communities living on the coast that should be detectable in the archaeological record.

1. Introduction

This report describes the pre-European Maori archaeology of the Wairarapa region of the Wellington Conservancy. An earlier report (McFadgen 1997) focused on the Kapiti-Horowhenua region. The Wairarapa region lies east of the Tararua and Rimutaka ranges. The region extends from the Manawatu Gorge in the north across to Akitio on the east coast, a distance of about 65 km, and south some 150 km to Palliser Bay (Department of Conservation 1994) (Fig. 1). Compared with the more northern parts of the North Island, the evidence for human habitation in the Wairarapa region is sparse.

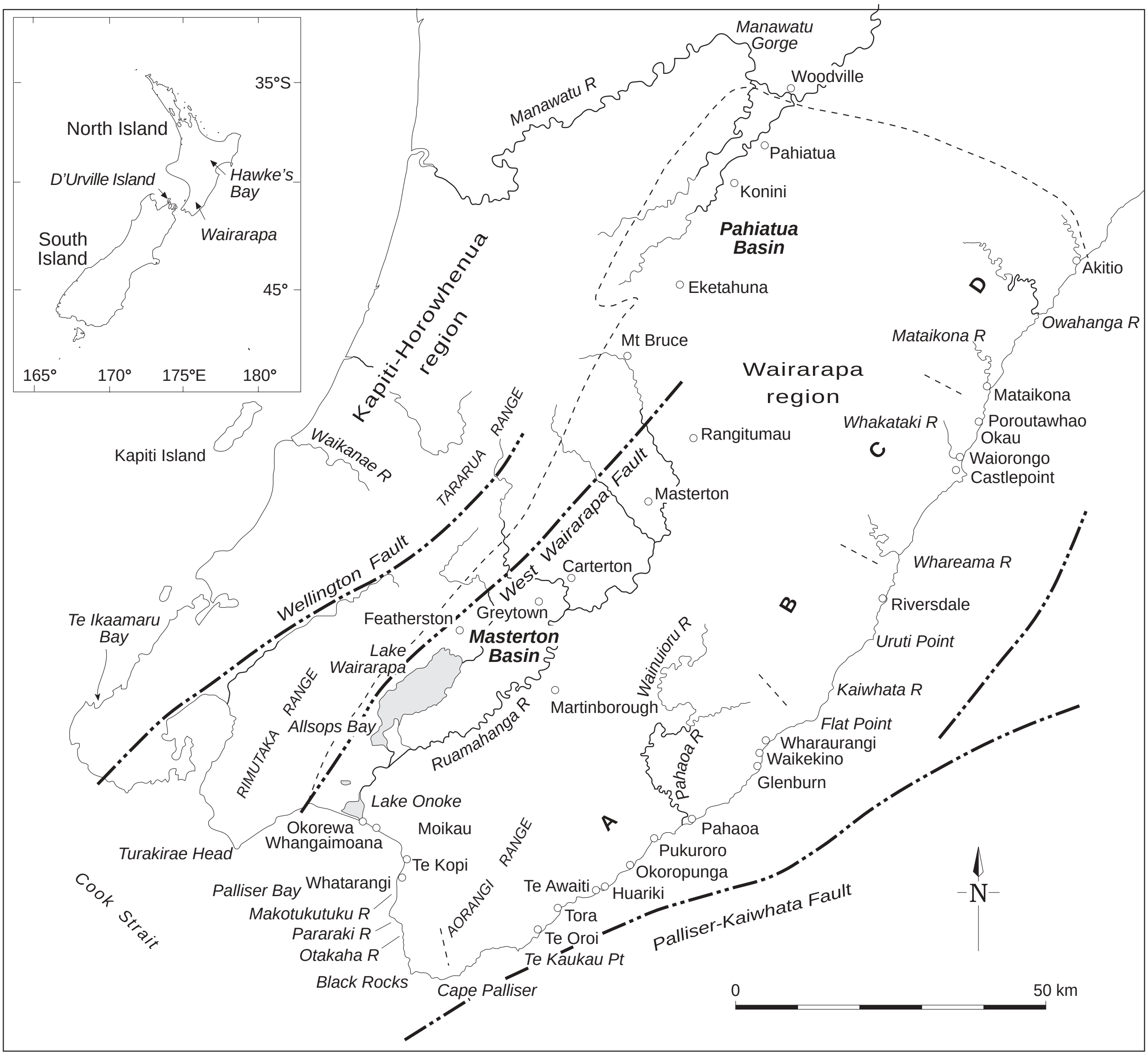

Figure 1. Southern North Island showing Wairarapa region (outlined by dashed line), and places mentioned in the text. Modern settlements and localities shown as open circles. The Wairarapa Valley is approximately the western third of the region. Faults active since human settlement important for Wairarapa archaeology are the Wellington Fault (Van Dissen & Berryman 1996), West Wairarapa Fault (Grapes & Downes 1997), and Palliser-Kaiwhata Fault (Ota et al. 1987; Barnes & Audru 1999). Tectonic sub-regions of Ota et al. (1987) are indicated A, B, C, D and separated by short dashed lines.

Very few of the known archaeological sites in the Wairarapa region are on land for which DOC has a management responsibility. Many sites, however, are on land in which DOC has a statutory interest, especially the coastal region, or a general advocacy interest, such as the protection of wetland habitats. Sites on land managed by the Wellington Conservancy are not representative of the site types across the landscape.

Geologically and environmentally, the region is extraordinarily dynamic. Between the arrival of first Polynesian settlers and of Captain Cook about 450 years later (McFadgen 1997), dramatic environmental changes occurred in response to natural processes such as earthquakes, and to cultural processes such as forest clearance. Polynesian settlers and their descendants burnt the forest to establish their settlements and gardens, and they exploited their environment to meet their needs for food, clothing and shelter. The environmental changes in turn influenced the activities of the prehistoric communities that lived in the region.

The attention given here to the prehistoric environment is more than is usual in archaeological reports. There are two reasons for this. First, when the environment changes, people either move away, adapt to the changes, or die. Understanding the changes that have occurred in the landscape is important for interpreting the cultural history of the region. Second, environmental changes often affect large areas of landscape. If they are short-lived events that leave some sort of recognisable remains, then they may be useful for dating.

Seismic activity has significantly influenced both the landform and the archaeology of the region. The region is severely faulted (Kingma 1967), and active faults have moved during the period of human settlement (e.g. Grapes & Downes 1997) (Fig. 1), causing widespread damage to vegetation, slipping of hillsides, and tsunamis. In 1848, for example, following the Marlborough earthquake, the missionary William Colenso remarked on the erosion of steep cliffs behind the coastal platform and deposition of scree brought down by winter rains from Pahaoa south into Palliser Bay (Bagnall & Petersen 1948). Earthquake uplifts created the coastal strip, and parts of the coastal strip have been subjected to both uplift and tsunami inundation at least twice since human settlement.

Friable soils on parts of the coastal strip were suitable for gardening, and their proximity to marine foods and former coastal forest made the coastal strip, especially at stream and river mouths, favoured places for early habitation. As a result, more than half of the recorded archaeological sites in the region are either located on the coastal strip or are very close to it (Fig. 2). Living on an earthquake-prone coastline close to sea-level exposed communities to the adverse impacts of seismic activity. On parts of the Wairarapa coast these were sometimes severe, and in the worst cases would have resulted in the loss of resources and settlements from uplift and tsunami inundation (Goff & McFadgen 2001). As well as damage and destruction, some of the earthquakes have left a record of uplifted shorelines that is useful for dating. Understanding the earthquake history of the region is, therefore, important for understanding its prehistoric occupation.

The report concludes with recommendations for future research. These focus broadly on the environmental processes and archaeological history of the Wairarapa region. The most pressing needs are for better understanding of the seismic processes, particularly the earthquake uplifts and tsunami events, that have affected the Wairarapa region, and of the impact of the processes on the prehistoric communities that lived there. Such understanding will both provide insight into the cultural history of the Wairarapa region and beyond, and contribute to better planning for coping with similar events in the future.

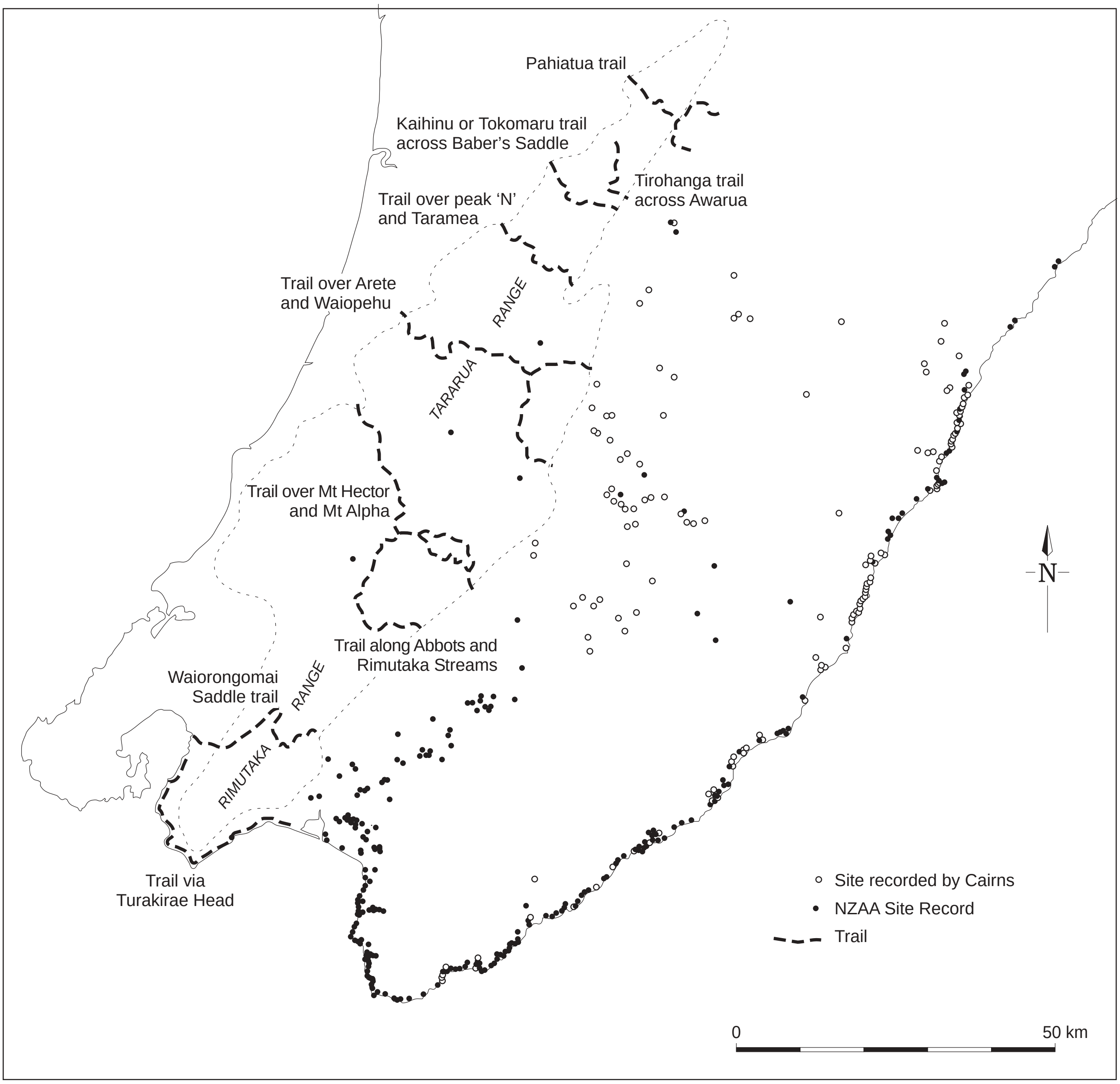

Figure 2. Distribution of archaeological sites in the Wairarapa region, and nine tracks across or around the Tararua Ranges. Track routes based on descriptions by Barton (1959, 1960).

2. Geology and geomorphology

The Tararua and Rimutaka ranges, comprised mainly of Mesozoic greywacke sandstone, rise to more than 1500 m, creating a barrier which restricted contact with the prehistoric communities west of the ranges. East of the ranges the gravel fans of the rivers that disgorge from the ranges form the Wairarapa plains, up to 18 km wide. The plains were the focus of Maori occupation at the time of European settlement. The southern plains, between Mt. Bruce and Palliser Bay (Fig. 1), drain to the south and contain two major lakes, Wairarapa and Onoke, and associated wetlands that traditionally, and to the present day, have been a prized source of eels (Beadel et al. 1998). The northern plains, from Mt. Bruce to a little north of Pahiatua, drain to the north and contain no significant bodies of water. Between the plains and the Pacific Ocean are the eastern hills of deeply dissected Tertiary rock, mostly limestone and easily-eroded mudstone, and Mesozoic rock, mostly greywacke sandstone, that in the south rise to more than 900 m. The region contains all or parts of eight ecological districts: Eastern Wairarapa, Aorangi, Wairarapa Plains, Puketoi, Woodville, Tararua, Manawatu Gorge South, and Eastern Hawke's Bay (McEwen 1987).

The region's coastline runs from Akitio River in the north, to western Palliser Bay in the south (Fig. 1), a distance of more than 180 km. It was the focus of Maori occupation in early prehistoric times, and served as a highway between Wellington and Hawke's Bay in early European times. Along much of the coast the sea is separated from the hills by the Holocene coastal platform, a narrow strip of land less than 1 km wide and no more than 15 m above sea-level (King 1930, 1932). The strip of land, formed by uplift of the coast during earthquakes (Singh 1971; Wellman 1971a, b; Ghani 1978; Ota et al. 1990), is covered with Holocene sediments including stream and river alluvium, colluvial fans, slope wash, sand dunes, and marine-deposited stones, gravel and sand that overlie a marine-cut bench. Older, higher pre-Holocene shorelines are preserved as marine-cut benches at the tops of the cliffs behind the coastal platform (King 1930; Ghani 1978), but they do not appear to have been occupied in pre-European times except at the southern end of the main Wairarapa Valley.

The hills behind the platform are broken at intervals by streams and rivers that flow out across the coastal platform, the biggest break being at Lake Onoke where the main Wairarapa Valley adjoins the sea. In prehistoric Maori times the streams and rivers would have given access to interior valleys and hills for hunting and, where the terrain was suitable, for settlements and gardens. Where the hills abutting the coastal platform are of limestone or calcareous Tertiary mudstone the sedimentary deposits on the coastal platform, especially old lagoon muds, are often alkaline and preserve old animal bones remarkably well. In contrast, where the hills behind the coastal platform are greywacke, which is more acidic than the mudstone and limestone, there are no good natural deposits of animal bones and the only bones that have survived are either very young, or in shell middens.

The present shoreline is predominantly rocky, with few sandy beaches or suitable places for landing canoes, especially in rough or windy weather. It is very exposed, and in spite of its generally southeast to southwest aspect, frequently buffeted by strong northwesterly winds which hit the coastal platform with enormous vigour.

3. Sources of information

The New Zealand Archaeological Association Site Recording Scheme is the main source of information about where archaeological sites are located. Site records have been contributed to the scheme for nearly 50 years by field recorders from archaeological societies, museums, and institutions of learning. The records generally note the type of site, its map reference and location details, and give a brief description of what was seen on the ground. Some 320 records are held by the Association, nearly all relating to sites along the coast or at the southern end of the Wairarapa Valley on the eastern side of Lake Wairarapa (Fig. 2). A second important source of information, particularly valuable for information about sites in the northern and southern Wairarapa valleys (Fig. 2), is the Cairns collection held by the Alexander Turnbull Library.

Keith Cairns was a Masterton resident with an active interest in Maori history. For more than 40 years he collected information about old Maori sites, very little of which was submitted to the New Zealand Archaeological Association Site Recording Scheme. In the early 1960s he wrote to nearly every farmer in the Wairarapa Valley asking for information about old Maori sites on their land (Cairns 1961) and received hundreds of replies. Each reply was recorded, and some sites visited and given a map reference (Appendix 1, Table A1.1). Some sites, such as oven remains uncovered by ploughing in the 1920s, would be difficult for a field recorder to discover today. Not all sites, however, were visited and many are located according to a landowner's name and a road or a river, so it is difficult to pinpoint their location on a map without more information (Appendix 1, Table A1.2). About half the records would be of this sort, but even in this form they are enough to indicate Maori occupation of areas such as the district around Eketahuna and Pahiatua where few other field records currently exist.

For this review the sources of information about the prehistory of the Wairarapa region include published accounts of archaeological investigations and fieldwork carried out over the last 50 years, supplemented by my own private notes and observations collected over the last 30 years. The most intensive archaeological investigation was research by the University of Otago Department of Anthropology into the cultural and economic prehistory of the southern Wairarapa region (B.F. Leach & H.M. Leach 1979a). Staff and students between 1969 and 1972 carried out fieldwork, which focused on the Palliser Bay coast and southern Wairarapa valley, and the investigation was the first, major regional research programme in archaeology to be carried out in New Zealand. The results of the research have had a major influence on the current understanding of, and subsequent research into, New Zealand prehistory. In contrast to the Palliser Bay programme, research on the eastern Wairarapa coast has been considerably less intensive and on a much smaller scale (e.g. Cairns 1959; Smart 1966; McFadgen 1980a, b).

4. Correlation and dating

In any study of prehistory, dating is the lens that brings the past into focus. An important part of the dating process is correlation, i.e. the finding of synchronous events in order to relate the sequence of deposits in one area (or site) with those in another. Radiocarbon dating is the usual method archaeologists use, but radiocarbon dates have an inbuilt measurement uncertainty, expressed as a standard deviation of the age, which is inherent in the method used to measure them (McFadgen 1982; McFadgen et al. 1994). The uncertainty is relatively large compared with the time between Polynesian and European arrival (probably less than 450 years for the Wairarapa region (McFadgen 1997)) and limits the use of the radiocarbon method. The usefulness of radiocarbon dating, however, can sometimes be improved by using the dates in conjunction with geological stratigraphy (McFadgen 1985, 1994, 1997).

By geological stratigraphy I mean *normal* geological stratigraphy of the kind used for correlation by Haast (1874), by Wellman (1962a, b) and by McFadgen (1985, 1994). From the point of view of archaeology, geological stratigraphy is *off-site* stratigraphy (McFadgen 1997). On-site stratigraphy is concerned largely with man-made features such as pits, postholes, and middens. Off-site stratigraphy is concerned with extensive regular layers and provides a stratigraphic record to which on-site stratigraphy can be tied.

Useful off-site stratigraphy in the Wairarapa region includes such sediments as sand dunes, stream alluvium, and uplifted shoreline deposits. It contains a chronological record of environmental events, some of which, like earthquakes and tsunamis, were short-lived and affected a wide area. Local events, such as the occupation of archaeological sites, can sometimes be stratigraphically related to the short-lived, widespread events, and their relative ages established. The radiocarbon dates are then used to find the absolute ages of the widespread events used for correlation. Off-site stratigraphy is currently most useful for correlation in the coastal environment, but only because this is where it has so far been most studied. It is possible that future work, for example on late Holocene river terraces, will find off-site stratigraphy useful for correlation in the Wairarapa valley.

Two identifiable sea-rafted pumices, Taupo Pumice (Healy et al. 1964) and Loisels Pumice (Wellman 1962b), have proved valuable for correlation (McFadgen 1985). Both occur extensively along the North Island east coast. Taupo Pumice is part of the Taupo Tephra Formation (Froggatt & Lowe 1990), and its adopted age, based on the age of airfall tephra from the Taupo Pumice eruption, is 230 AD (1720 cal BP[1]) (Sparks et al. 1995). Loisels Pumice comes

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[1] For consistency, all dates and time intervals are given in the text of this report in calendar years unless otherwise indicated. Radiocarbon ages are indicated by 'radiocarbon years BP' i.e. radiocarbon years before 1950 AD. Calendar dates are derived from radiocarbon dates using the most up-to-date radiocarbon calibration curves for terrestrial and marine samples (Stuiver et al. 1998) and are given in years AD or calendar years BP (cal BP) i.e. calendar years before 1950 AD. For a more detailed discussion on the calibration of Wellington Conservancy radiocarbon dates see McFadgen (1997).

from at least two unknown sources in the southwest Pacific (Shane et al. 1998), and its adopted age is 1360 AD (590 cal BP) (McFadgen 1994). Sea-rafted pumice is known to disperse widely and wash up on beaches far from its source within about 2 years of its eruption (Coombs & Landis 1966), and the age of primary sea-rafted Taupo Pumice is therefore assumed to be the same as of the Taupo Pumice eruption. Loisels Pumice has no known sources, and its age is based on radiocarbon dates from coastal sections. There is currently no evidence that Loisels Pumice from the different sources arrived at greatly different times, and the adopted age is assumed to apply to pumice from each source. This assumption, however, needs to be tested by directly dating when the Loisels Pumice was erupted, possibly by using a technique such as Optically Stimulated Luminescence.

Primary sea-rafted deposits of pumice are the most useful for correlation but their identification as primary deposits is always uncertain because all sea-rafted pumice is subject to possible reworking. Any recognisable pumice is, nevertheless, worth considering for correlation, and even secondary deposits provide maximum ages for the deposits above them. As in coastal sections along other parts of the North Island east coast, the earliest evidence for human activity on the Wairarapa coast, which is cultural charcoal derived from the burning of vegetation on the nearby coast, lies just below the first appearance of Loisels Pumice (McFadgen 1985).

Even in the coastal environment not all events can be correlated by stratigraphy, and radiocarbon dates alone must be used. A full list of archaeological radiocarbon dates for the Wellington Conservancy is given in McFadgen (1997, Appendix 2). Four additional radiocarbon dates, all on shell, have been measured since 1997 and are listed in Table 1 and Appendix 2 (Table A2.1).

Radiocarbon dates are converted into calendar dates by using calibration curves, one for dates of terrestrial plants and animals and one for dates of marine animals (Stuiver et al. 1998). The terrestrial calibration curve is compiled from Northern Hemisphere tree ring data. Whether the terrestrial curve can be applied without modification to calibrate Southern Hemisphere dates is open to debate. Some researchers (e.g. McCormac et al. 1998) observe a difference in radiocarbon content equivalent to about 27 calendar years between contemporaneous trees in the two hemispheres, others observe no difference (e.g. Sparks et al. 1995), or a variable difference which at times is nil (Knox & McFadgen 2001). Following Sparks et al. (1995), no hemisphere correction is made here. The marine calibration curve is a global curve to which a regional correction, ΔR, is applied to compensate for regional variations in the radiocarbon content of surface ocean water around the world. Two values of ΔR are currently available for New Zealand: -30 ± 15 (McFadgen & Manning 1990) and -25 ± 15 (Higham & Hogg 1995). Statistically, there is no difference between the two values and $\Delta R = -30 \pm 15$ is adopted for this report.

5. Off-site stratigraphy in the coastal environment

The Holocene coastal platform that separates the hills from the sea is a wave-cut marine bench overlain by sediments. The sea cut the marine bench at the end of the last glaciation. Following the melting of the ice, sea-level rose reaching the present sea-level about 5500 BC (6500 radiocarbon years BP, Gibb 1986), at which time the shoreline would have been at the foot of the hills. The bench has since been uplifted by intermittent earthquakes and covered with marine sediments, stream and river alluvium, colluvial fans, sand dunes, and slope wash.

The depositional environments with useful off-site stratigraphy are sand dunes, streams, former wetlands, and marine-derived sediments on uplifted former shorelines. Sections, near-vertical exposures a few metres high, usually along a coastline or riverbank (Fig. 3) are extremely important for unravelling the sequence of deposits and events represented in off-site stratigraphy. Ideal sections contain a sequence of fluvial, aeolian, and marine deposits, sea-rafted pumice of known age, buried soils, and occupation remains and give some idea of the nature and age of deposits behind them (McFadgen 1985).

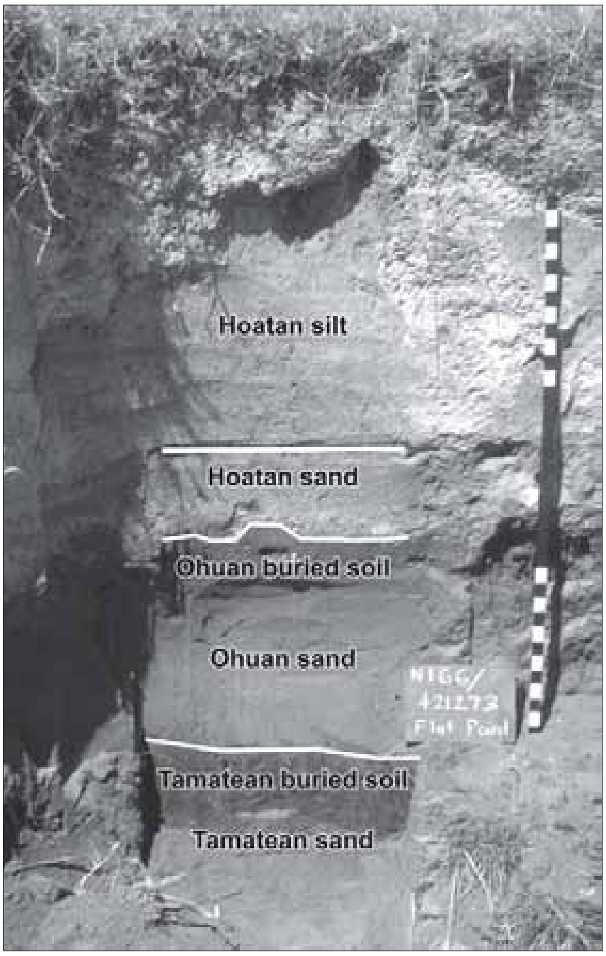


Figure 3. Section exposed in the east bank of the Te Unu Unu Stream at Flat Point showing three sand layers, one silt layer, and two buried soils. Section adjacent to M_1 and M_2 in Fig. 4. Scale = 1 m. (*Photograph: B.G. McFadgen.*)

5.1 SAND DUNES

There are sand dunes at several places on the Wairarapa coast, notably between Glenburn and Flat Point, and between Castlepoint and the Mataikona River (Fig. 1). Flat Point is the only place where the dune stratigraphy has been studied (McFadgen 1985), and here the dunes form a belt about 1 km wide across the Holocene bench. Three phases of dune-building are recognised, named in order of decreasing age, Tamatean, Ohuan, and Hoatan (Fig. 4). The oldest dunes are the farthest inland, and dunes of younger phases have advanced inland burying some dunes of the older phases. Ground soil profile development of each dune-building phase is remarkably uniform. The soils of older phase dunes are more developed than younger phase dunes, and each phase can be identified by its degree of ground soil profile development.

The Tamatean dunes contain primary sea-rafted Taupo Pumice and began to accumulate before the Taupo Pumice eruption. They were still accumulating when the Loisels Pumice was deposited and appear to have stabilised soon after. The Ohuan dunes became active about 1500 AD and may have been active locally until possibly as late as 1650 AD (McFadgen in press). The Hoatan dunes overlie European artifacts in the bank of the Te Unu Unu Stream (Fig. 4) (McFadgen 1985). The three phases match dune accumulation in other parts of New Zealand and Flat Point is the type locality for three depositional episodes apparently synchronous in dunes over much of the New Zealand coast (McFadgen 1985, 1994). The adopted ages of the dune-building phases, based on radiocarbon dating and historic evidence from many sites around the New Zealand coast (McFadgen 1985), are: Tamatean 150–1500 AD; Ohuan 1500–1800 AD; Hoatan 1800 AD to the present day.

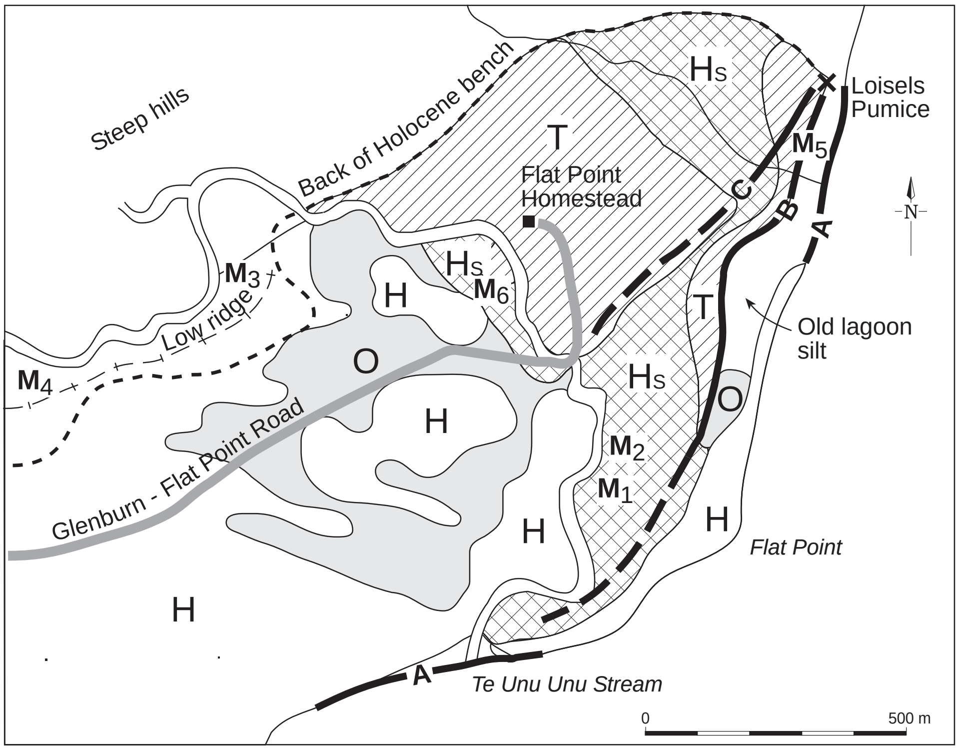


Figure 4. Sketch map of the Flat Point area after McFadgen (1985). Map drawn from aerial photographs. A, B and C are the youngest of 5 beach ridges; A is the growing beach ridge; B and C are uplifted beach ridges. Wind-blown sands belong to three depositional episodes: H = Hoatan; O = Ohuan; T = Tamatean. Hs = Hoatan silt. Six shell middens on buried soils in the sand dunes are shown as M_1 to M_6. ✕ = location of Loisels Pumice in Beach Ridge B.

Ground soils on the dunes, and the dune soils buried by later dune advances, represent surfaces on which people lived. The oldest evidence for human occupation in the dunes is an oven on Tamatean soil exposed in the left bank of the Te Unu Unu Stream (site T27/12). The oven, which was buried by Ohuan sand, contained a moa claw (*Euryapteryx* sp.) with the bones still in a position of articulation when found. Both the Tamatean and Ohuan buried soils contain shell middens.

5.2 STREAM ALLUVIUM AND COLLUVIAL FAN DEPOSITS

On the eastern Wairarapa coast, episodic deposition of stream alluvium is recorded in sections through stream fans at Te Awaiti and Te Oroi (Fig. 5) and is correlated with the Tamatean, Ohuan, and Hoatan depositional episodes (McFadgen 1985). In both sections the alluvium overlies estuarine lagoon mud.

On the eastern Palliser Bay coast there was renewal of colluvial fan activity at several places following human settlement (H.M. Leach & B.F. Leach 1979, pp. 236–237). The renewed activity was explained in terms of human impact on the landscape and change in climate from relatively calm and warm to stormier and cooler (H.M. Leach & B.F. Leach 1979). Goff & McFadgen (2001), however, propose seismic activity as an alternative explanation for the renewal of colluvial fan activity in Palliser Bay, and it is likely that seismic activity accounts for the episodic deposition recorded in fans on the eastern Wairarapa coast as well.

Like the soils on the dunes, ground soils on stream alluvium, and the soils buried by later alluvial deposits, represent surfaces on which people lived. Both the Tamatean and Ohuan buried soils on stream alluvium contain shell middens, and fan surfaces have been gardened.

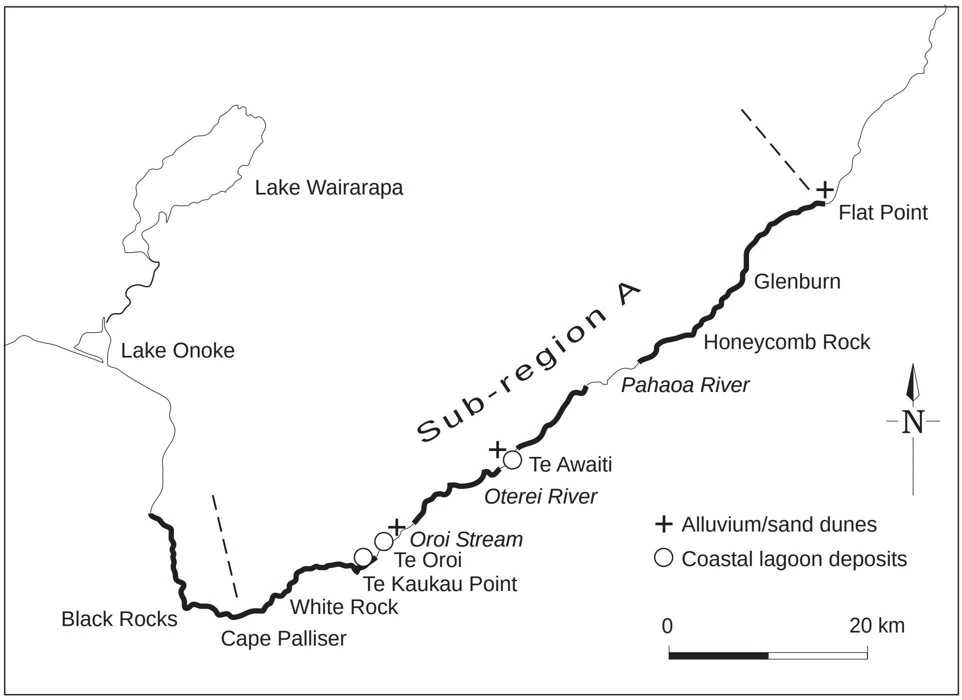


Figure 5. Southeast Wairarapa coast showing sub-region A, and depositional environments with off-site stratigraphy useful to archaeology. Thick line = coast with uplifted beach ridges; + = alluvium (Oroi Stream and Te Awaiti) and sand dunes (Flat Point) correlated with depositional episodes; ○ = coastal lagoon deposits.

5.3 UPLIFTED SHORELINES

Uplift of the Holocene bench is evident as a sequence of terraces that are progressively older and higher with distance from the shore. The terraces are former sub-tidal platforms that have been abraded by wave action and raised above sea-level by sudden earthquake uplifts. The initial uplift was followed by formation of the terrace cover beds by build-up of beach ridge deposits (high tide and storm beach deposits), estuarine silt and mud, marine sediments, stream and river alluvium, sand dunes, and slope wash that accumulated on the newly exposed wave-cut platform after each uplift (Ota et al. 1987, 1990).

Ota el al. (1987) recognised four distinct sub-regions (A to D) between Cape Palliser and Akitio (Fig. 1). Terraces in sub-regions A and B may have uplifted as a result of movement along the Palliser-Kaiwhata Fault (Fig. 1) (Ota et al. 1987; Barnes & Audru 1999). The number of uplifted terraces varies from place to place to a maximum of seven, the highest (at Flat Point) lying about 17 m above sea-level (Ota et al. 1990). Terraces are labelled in order of decreasing age: I, II, III…, the oldest terrace in each sub-region being I. Ota et al. (1987) dated the terraces using radiocarbon and concluded that only in sub-region B, between Flat Point and the Whareama River, has the coast been uplifted since human settlement. The radiocarbon dates for sub-regions A and B are reassessed in Appendix 3, taking into account inbuilt age and the evidence of sea-rafted pumice deposits. The reassessment confirms Ota et al's (1987) dates for sub-region B, but I infer that sub-region A, between Cape Palliser and Flat Point, has been uplifted twice since human settlement.

The beach ridges on the uplifted terraces are roughly parallel to the present coast. They mark former Holocene shorelines in sub-region B at Flat Point and Glenburn (Wellman 1971a), and in sub-region A at Okoropunga (Appendix 3), Oterei (Singh 1971; Ghani 1978), White Rocks (Wellman 1971b), and Cape Palliser (Ghani 1978) (Fig. 5). The number of uplifted beach ridges varies from place to place to a maximum of seven. The beach ridges, by convention, are labelled in order of increasing age: A, B, C..., the youngest (growing) ridge being A, and are composed of coarse sand, gravel and stones derived from material thrown up by the sea. None of the beach ridges is continuous along the coast, parts having frequently been buried by alluvium, eroded away, or never formed. The ridges contain sea-rafted pumice, which is important for dating uplift (Appendix 3), and they have generally well drained and friable soils on them, the older of which were gardened in pre-European times.

Prior to human settlement sub-regions A and B had been tectonically stable for about 800 years. In sub-region B the uplift following human settlement happened about 1450 AD and stranded Beach Ridge B at Flat Point. In sub-region A, the first uplift following human settlement happened about 1500 AD and stranded Beach Ridge C at various places from south of Flat Point to Palliser Bay. Considering the uncertainty of radiocarbon dating the two uplifts may have been a concurrent event sometime during the late 15th Century.

There is no direct evidence for the uplift of Beach Ridge B in sub-region A, and no historic record of uplift since European settlement of the Wairarapa. The uplift of Beach Ridge B probably occurred sometime between about 1550 AD and 1840 AD. If the inference made by Goff & McFadgen (2001), that renewal of colluvial activity followed earthquake uplift, is correct then the uplift of Beach Ridge B possibly occurred at the end of the Ohuan Depositional Episode, c. 1800 AD.

5.4 TSUNAMI DEPOSITS

In 1855 AD a massive earthquake struck the southern North Island, generated by a rupture of the West Wairarapa Fault (Fig. 1). The tsunami that followed the earthquake struck Te Kopi in Palliser Bay as a series of waves up to 12 m high, removing houses and bales of wool, and possibly continuing along the east coast as a wave up to 9 m high (Grapes & Downes 1997). Goff et al. (1998) attribute tsunami deposits more than 2 km inland in the Okorewa Valley in central Palliser Bay (Fig. 1) to the 1855 AD tsunami, although the dating is uncertain and I think that they may be from an earlier event in the late 15th Century AD that followed a rupture of the Wellington Fault (Goff & Chagué-Goff 1999) or possibly the Alpine Fault (Goff et al. 2000).

Late 15th Century AD tsunami deposits are identified in the wider Cook Strait coastal region, in wetlands of the Abel Tasman National Park (Goff and Chagué-Goff 1999) and in a lagoon at the north end of Kapiti Island (Goff et al. 2000). They are tentatively identified at Te Ikaamaru Bay on the west Wellington coast (Goff & McFadgen 2001). On the Wairarapa coast there are potential tsunami deposits in the vicinity of the Okau Stream, Uruti Point, Okoropunga, and Te Oroi that need to be analysed to establish their origin. The deposits at Okoropunga and Te Oroi are in a stratigraphic context that indicate an age for the deposits that is younger than the uplift of Beach Ridge C and older than uplift of Beach Ridge B.

5.5 COASTAL LAGOON DEPOSITS

At least four lagoons, fed by groundwater or streams, formed behind Beach Ridge C at Te Kaukau Point, Te Oroi (north and south of the Oroi Stream), and Te Awaiti (Fig. 5) while the beach ridge was the growing ridge. The oldest and thickest deposit is at Te Oroi, south of the Oroi Stream, and the lagoon, which contains large lumps of Taupo Pumice, probably began forming more than 1800 years ago. All four lagoon deposits contain Loisels Pumice and were drained by the late 15th Century uplift.

Charcoal from forest fires lit to clear land first appears at or just below the Loisels Pumice in the lagoon deposits. The angular charcoal, which has not travelled far, probably came from fires on the nearby coast (McFadgen 1994).

Too little of the section is left at Te Awaiti to make an inference about the area of the lagoon. Judging from the sections and the positions of beach ridges, the Te Oroi north and south lagoons may each have covered about a hectare. The Te Kaukau Point lagoon was probably > 100 m long but < 20 m wide.

The lagoons would have provided a good source of food and raw materials for artifacts, but these resources would have been lost when the lagoons drained.

5.6 CORRELATION OF OFF-SITE STRATIGRAPHY AND ADOPTED AGES FOR EVENTS

The correlation between terraces and beach ridge uplift with the depositional episodes in sand dunes and stream alluvium is shown in Fig. 6. The adopted age for the late 15th Century AD uplift of Beach Ridge C in sub-region A and Beach Ridge B in sub-region B is 1475 AD. The adopted age for the uplift of Beach Ridge B in sub-region A is 1800 AD.

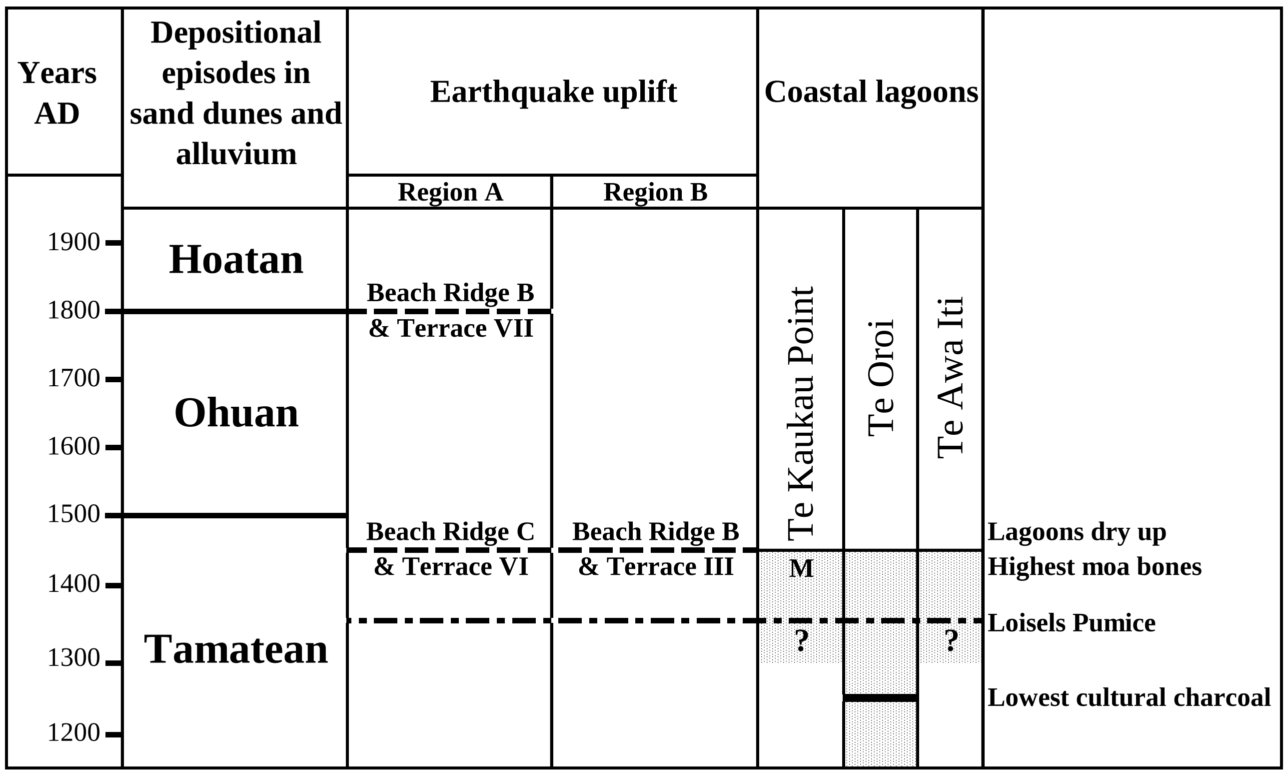


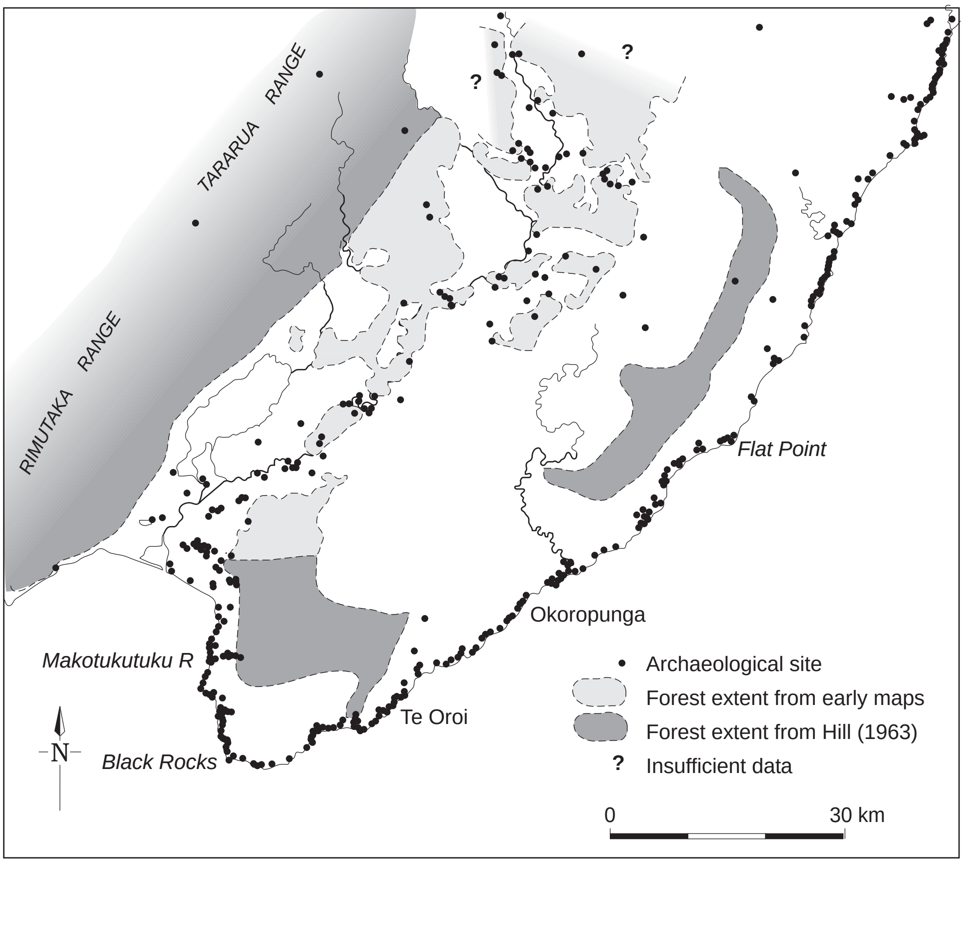
Figure 6. Correlation of depositional episodes, uplifted beach ridges and terraces, and lagoon deposits. Youngest moa bones (M) are bones found in a position of articulation. Uplift of beach ridges and terraces in regions A and B are represented by dashed lines. Position of Loisels Pumice relative to beach ridge uplifts and lagoon deposits is represented by dash-dot line.
? = uncertainty of age of lagoon deposits below Loisels Pumice. Lowest cultural charcoal in lagoon deposits is represented by solid line.

6. Vegetation

It now appears that the Wairarapa region would have been largely forested at the time of Maori settlement (McGlone 1989). Only some riverbeds, unstable dunes along the foreshore, and the youngest beach ridges are likely to have been without forest. To the first settlers the coast would have presented a variety of vegetation types, each depending on the type of soil and site on which it grew. Plant communities that depended broadly on the age of the soil would have been older and more developed on older beach ridges and sand dunes (cf. Bagnall 1975).

Early European accounts and studies of present day bush remnants provide glimpses of what the pre-human forest was probably like (e.g. Hill 1963; Wardle 1967; Sawyer et al. 1997; Simpson 1997; Beadel et al. 1998). Although few remnants of the original indigenous vegetation remain today in the Wairarapa region east of the Tararua Ranges, the many small areas of indigenous secondary growth vegetation in the Eastern Wairarapa collectively indicate a past rich flora (Sawyer et al. 1998). By the time of European settlement, however, large areas of the region had been cleared of forest and replaced by scrub, fern, and grassland (Hill 1963, see figure 1) (Fig. 7). Forest was still present on the eastern slopes of the Rimutaka and Tararua Ranges, on the higher parts of the Aorangi Mountains, parts of the southern Wairarapa Plains, and the higher hills between the Wairarapa Valley and the east coast. The coastal platform, however, had been almost entirely cleared of forest except for a small remnant

Figure 7. Forest cover in the Wairarapa region at about 1853 scaled from early surveyors' maps, and from data collated by Hill (1963). Note that archaeological sites generally fall outside the forested area.



at Te Oroi, and was described by Colenso in the 1840s and 1850s as barren and treeless (Bagnall & Petersen 1948). Elsewhere, the vegetation is described as a patchwork of grass, swamp, scrub, and forest mingled in varying proportions (Hill 1963).

Forest clearance would have begun on the coast with the arrival of the first settlers who would have needed to clear land for settlements and gardens. At Okoropunga, a totara tree (*Podocarpus totara* or *P. hallii*) growing out on the coastal platform had been burnt and the site later used as a Maori garden (McFadgen 1980b). Only part of a charred root remained, in position of growth in soil buried beneath the garden. The root was radiocarbon dated to about 1350 AD and early Maori settlers had probably cleared the tree in order to establish the garden. Whether all of the destruction of coastal forest occurred as a result of human activity is doubtful. Tsunami inundation, flooding tree roots and killing trees with salt water, was noted by Alfred Wallace (cited in Severin 1997, pp. 131–2) and Minoura et al. (1996), and it is possible that forest clearance of the coastal platform was assisted by tsunami inundation that is thought to have occurred during the 15th Century AD (Goff & McFadgen 2001).

Former coastal forest is indicated by land snail shells in middens on the Tamatean buried soil at Flat Point, Te Awaiti, and Te Oroi (McFadgen 1985), and land snail shells and insect remains in late Tamatean peat at Te Kaukau Point (Appendix 4). In middens on the Ohuan buried soil at Flat Point and Te Awaiti, however, there is a paucity of land snail shells and McFadgen (1985) infers that by about 1500 AD the forest edge was well inland of the middens.

On the eastern Palliser Bay coast, land snail shells in the midden of an early settlement at the mouth of the Makotukutuku River represent dry coastal scrubby forest (Wallace 1979), and in a site about 1.5 km upstream, dense forest. In contrast, land snail shells from an early site at Black Rocks indicate an open sparse cover of grasses and herbs, that later appears to have been replaced by scrub and dry forest (Wallace 1979).

When the inland forest was cleared is not known. Fyfe (1990), possibly on the basis of Maori tradition, suggests around 1600 AD following prolonged drought, and Sawyer et al. (1997) suggests the mid 17th Century AD. In the Eastern Wairarapa, forest remnants, particularly on the taipos (steep, prominent ridges and hills of greywacke (Kamp & Vucetich 1982)), show evidence of having undergone widespread clearance around 450 years ago (A. Townsend pers. comm. 2000). Further work is needed to define more closely the pattern and age of vegetation clearance. For the main Wairarapa Valley, such information will give some indication of how and when the valley was first settled.

Of interest is the possible role played by the late 15th Century AD uplift of the eastern Wairarapa coast. Strong earthquakes can severely damage vegetation growing on steep hillsides. The destruction of nearly one-third of the forest on the western Rimutaka Range followed the historic 1855 AD Wellington earthquake (Grapes & Downes 1997), and vegetation damage along the Buller River, some of which can still be seen in the Buller Gorge today, followed the 1929 AD Murchison and 1968 AD Inangahua earthquakes. It is possible that in the Wairarapa, forest clearance by fire was enhanced by vegetation destroyed by the late 15th Century AD earthquake, which when dry would have fuelled large fires over a wide area.

Not only were the forests burnt, but also new species were introduced. The karaka tree (*Corynocarpus laevigatus*), an important source of food in prehistoric times and often found near former settlements (Mitcalfe 1969), is now a feature of secondary coastal forests (Simpson 1997). It is widespread on the Wairarapa coast, but it is also known to have recently spread aggressively into areas of bush such as Wellington's Otari Native Botanic Garden and Wilton's Bush Reserve, possibly helped by the native pigeon (Gabites 1993), and it need not indicate former Maori settlement.

Forest clearance would have begun with the arrival of the first settlers in order to establish settlements and gardens. Over time there would have been additional reasons for clearing the forest, such as: to induce the growth of bracken fern, to keep tracks open, for security, and for hunting (McGlone 1983). In the dry environment of the Wairarapa, accidental fires may have played a prominent role in clearance (McGlone 1983). For whatever reason, forest clearance continued more or less throughout the prehistoric period until nearly all of the forest had been cleared from the coastal platform, and large inroads had been made into the forest on the southern Wairarapa plains and hills to the east. The forest, however, provided shelter, raw materials for artifacts, and food and its clearance was to have severe consequences for the communities that lived on the east Wairarapa coast.

7. Natural faunal remains, moa and moa hunting

Natural deposits of sub-fossil bones from caves, notably near Martinborough (Yaldwyn 1956, 1958), from coastal lagoon muds near Te Kaukau Point (Appendix 5), and from coastal dunes (Brodie 1950), indicate that a wide range of forest birds and other animals such as tuatara have disappeared from the region since the time of first human settlement (McEwen 1987). Prominent among the bones are those of moa which roamed the Wairarapa region before human contact. Introduced predators and habitat destruction as a consequence of forest clearance, will account for the disappearance of some birds, but bones of many of the species are also found in shell middens (e.g. Anderson 1979; B.F. Leach 1979a; Appendix 6) and indicate that hunting contributed to their disappearance.

Moa bones and moa eggshell are found in sand dunes and swamps at many places along the Wairarapa coast from Akitio to Palliser Bay, but rarely in archaeological sites, a pattern which appears to be common along the whole of the Wairarapa coast (Hill 1914; Brodie 1950). Prior to human settlement, moa nested in the dunes between the Whakataki and Mataikona Rivers and the sand contains extensive deposits of broken eggshell and moa bones. The eggshell and bones probably accumulated over hundreds of years but the coastal strip is not large and the moa population, which at any time would not have been great, probably did not survive very long after human settlement. In the Palliser Bay excavations, so few moa bones were found that it was inferred that moa had become extinct in the southern Wairarapa before human settlement, and that those bones that were found had been imported from the South Island (B.F. Leach 1979a, b) for making artifacts (H.M. Leach 1984). The natural deposits of bones from Te Oroi and Te Kaukau Point include moa bones from above the Loisels Pumice (Appendix 5) and demonstrate that moa were living in the southern Wairarapa after human settlement.

Why are so few moa bones are found in archaeological sites? The answer may simply be that moa were difficult to transport. It is not only moa bones that are uncommon in sites. Fur seals, which still have a colony on the Palliser Bay coast today, are of comparable size to moa and are also not common in Palliser Bay archaeological sites (Smith 1979). Where transport was relatively easy, moa carcasses would be taken to a settlement site to be butchered (Anderson 1989). Where transport was difficult, moa would be butchered where they were found (e.g. Adkin 1948). The Wairarapa coast is rugged in many places and difficult to traverse, with a rocky shoreline and frequent heavy seas (Leach & Anderson 1979a), and there are few large rivers. Based on the analogy of the Maori treatment of pigs in the Wairarapa, reported by Weld in 1845 (Mair 1972) it is likely that when moa were killed, only the flesh was taken and the bones were left behind.

8. Archaeological sites

Archaeological sites are places where human activity has left behind some physical trace—usually, but not necessarily, in the ground. In the Wairarapa region, for pre-European archaeological sites, and for many Maori archaeological sites from the first years after European contact, nearly all of the traces are in the ground. A notable exception is groves of karaka trees, once an important food source. Karaka trees are often found near former settlements, especially near the coast.

The traces are of several different kinds, from discarded waste such as flakes, shells, and bones in middens, to modification of the ground surface from the digging of terraces, pits, and ditches, and mounding up of soil into banks, to changes in soil horizons from gardening. Not all traces would normally be considered as archaeological sites. Some traces are found in depositional environments, such as charcoal and pollen in lake mud, and may record human activity that occurred several kilometres away.

The absence of recorded archaeological sites at any place is not necessarily evidence that sites do not exist. Some parts of the Wairarapa region have not been systematically surveyed for archaeological sites and the absence of recorded sites possibly reflects a lack of attention by archaeologists. Furthermore, the archaeological evidence, which is usually below the ground surface, is easily obscured, for example by later human activity such as farming filling in pits, or by deposition of alluvium by streams and rivers. Some types of gardening leave few visible traces on the ground surface and for some areas is indicated by other types of evidence such as storage pits. The distribution of some types of sites, such as some varieties of gardens, may therefore be biased because they leave few visible traces.

Archaeological site types to which this report refers generally follow the conventions of *Archaeological Site Recording in New Zealand* (Walton 1999).

Pa (Fig. 8) are earthwork fortifications, usually found on hills, often in conspicuous places. The term 'pa' is used by archaeologists in the special sense of a fortified place and contrasts with the use of the term in early European times, and in common use today, to mean a Maori settlement. In early European times if a place was fortified it was often referred to as 'fortified pa' (cf. McFadgen 1963). Pa were defended by ditches and banks, scarps or terraces, and served a variety of purposes. Some were small refuges, some were citadels, and others are full of pits and were possibly fortified storehouses. Headland pa, most common in the Wairarapa region, are the end of a ridge or spur cut off by one or more transverse ditches and banks,

Figure 8. Headland pa typical of many on the Wairarapa coast. The site (New Zealand Archaeological Association site number T28/36) is north of Okoropunga on the southeast Wairarapa coast. Defensive bank labelled B. (*Photograph: B.G. McFadgen.*)

and usually with steep natural defence around the other sides. Less common are ring ditch pa, which have ditch and bank defence along two or more sides. Pa are found mainly on the eastern Wairarapa coast and in the Wairarapa Valley (Fig. 9). There are very few on the Palliser Bay coast.

Pits (Fig. 10) are shallow, more or less rectangular depressions in the ground, with or without a raised rim, and rarely longer than 4 m. They are most common in coastal areas, especially on hill slopes and in valleys behind the coastal platform (Fig. 11). Many are found within pa sites. Some rectangular pits are the remains of old houses, but most are probably former kumara stores and they provide indirect evidence of gardening.

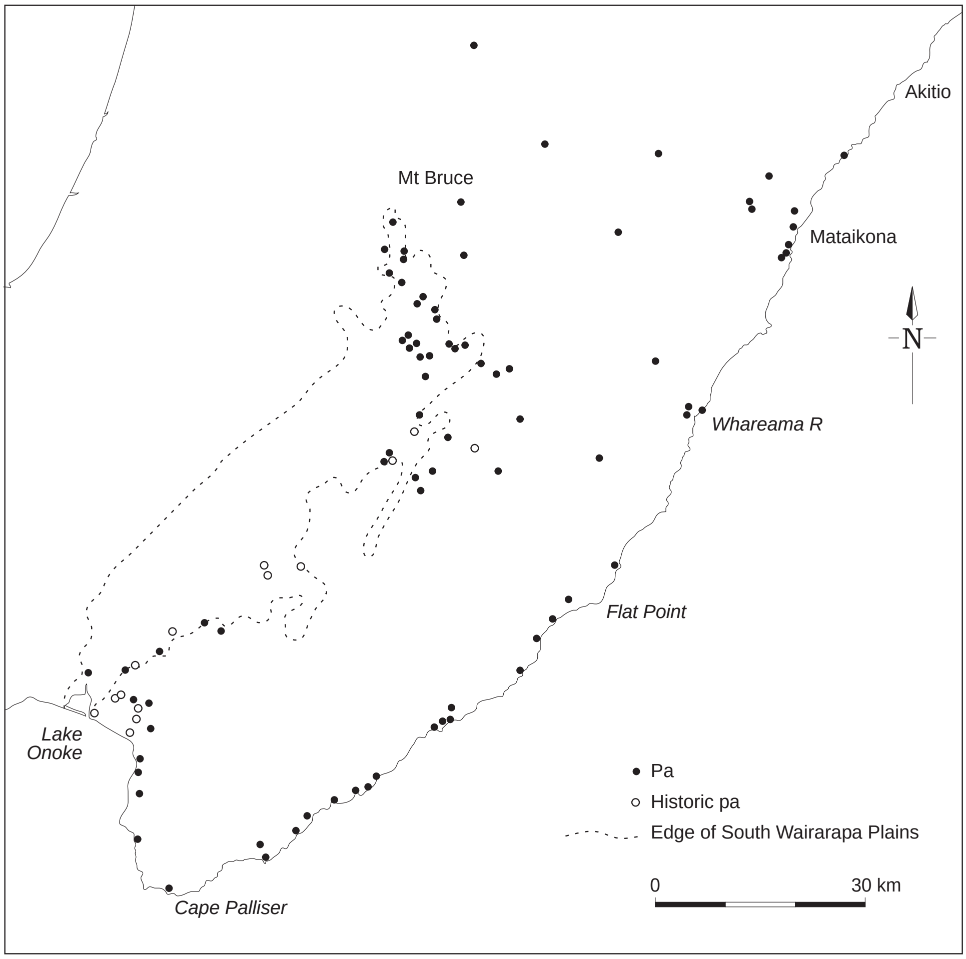
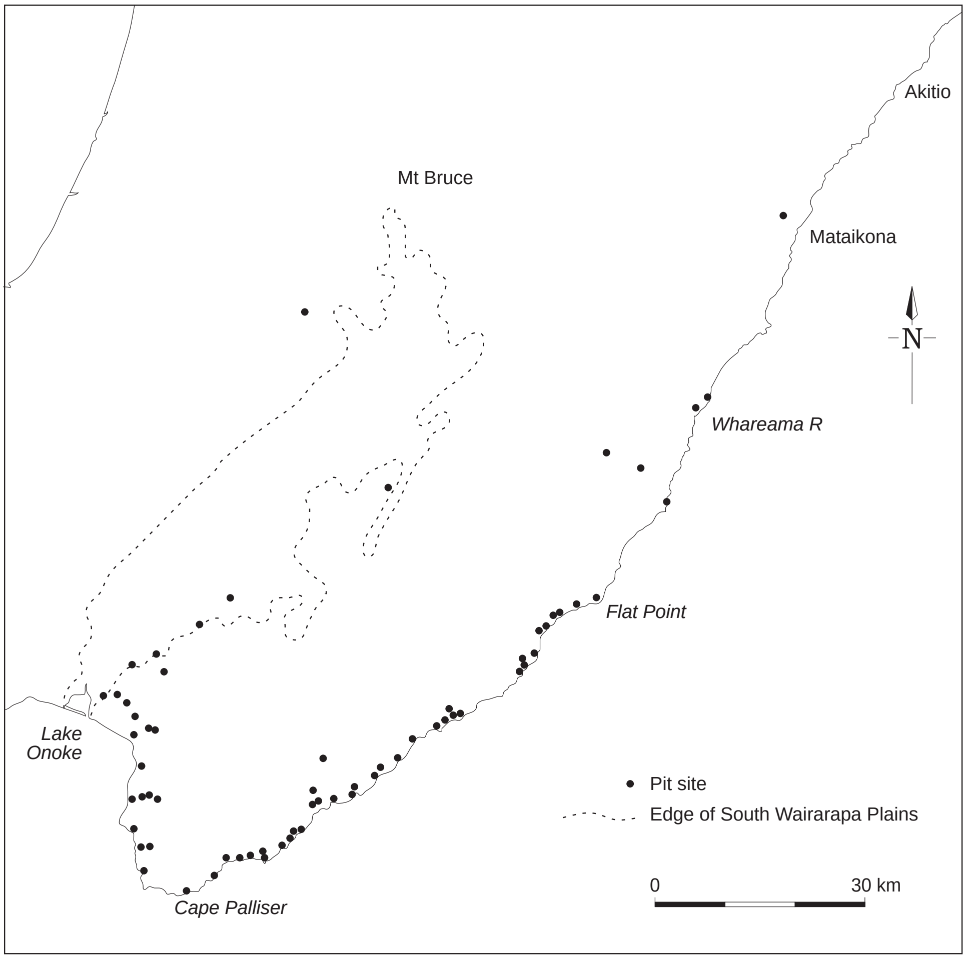


Figure 9. Distribution of pa sites in the Wairarapa region. Dotted line = edge of the southern Wairarapa Plains. Note that because of the map scale, some dots represent more than one pa.

Figure 10. Raised rim pit (New Zealand Archaeological Association site number T28/54) at Pukuroro on the southeast Wairarapa coast. (*Photograph: B.G. McFadgen.*)

Figure 11. Distribution of sites with pits in the Wairarapa region. Dotted line = edge of the southern Wairarapa Plains. Note that because of the map scale, some dots represent more than one pit.

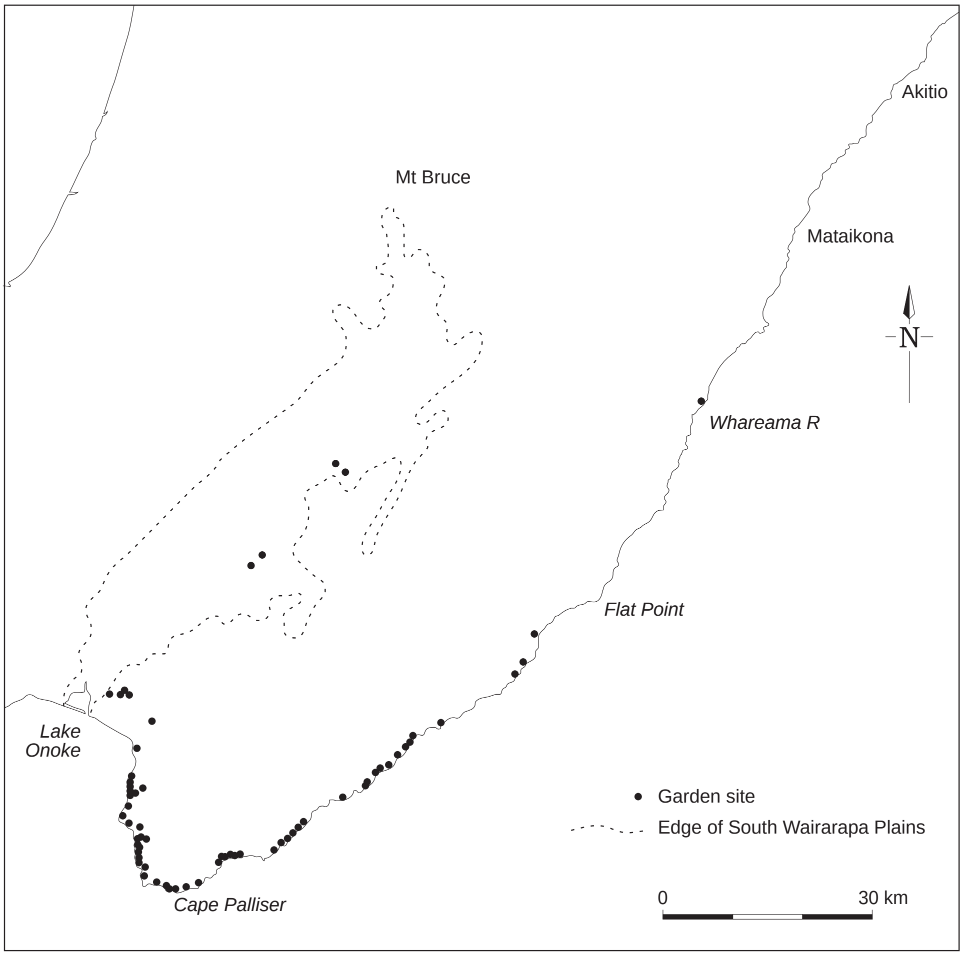


Raised rim pits in Palliser Bay are commonly found singly, or in isolated clusters of two or three, on the edges of high river terraces, and with small terraces. Large groupings, sometimes fortified, are found in the Wairarapa Valley. They were possibly introduced into the Wairarapa from the Hawke's Bay towards the latter end of the prehistoric period (H.M. Leach 1979b).

Gardens (Fig. 12) often leave few visible traces at the ground surface. Surface remains which are associated with former gardens include stone rows and stone mounds on uplifted beach ridges and old stream fans (Fig. 13); and gravel or grit added to an original soil i.e. plaggen soil (see below). Where surface features are absent, finding old gardens depends on identifying disturbed soil profiles. Sites along the east and south coasts are today extremely windy, so windy that it seems surprising that the Maori could have lived there, let alone gardened. In many places on the east coast today it is difficult to even get trees to grow (Dan Riddiford pers. comm.).

Few of the plants cultivated in tropical Polynesia are viable in temperate New Zealand. Six of these plants were cultivated in New Zealand at European contact: kumara (*Ipomoea batatas*), gourd (*Lagenaria* sp.), taro (*Colocasia esculenta*), yam (*?Dioscorea alata*), ti (*Cordyline* sp.), and paper mulberry (*Broussonetia papyrifera*) (H.M. Leach 1979b); but only kumara and gourd, and to a lesser extent taro, are likely to have been grown in the Wairarapa region.

Figure 12. Distribution of gardens (stone row systems, Maori Plaggen Soils, plaggen soils, terrace gardens, and historic cultivation grounds) in the Wairarapa region. Dotted line = edge of the southern Wairarapa Plains. Note that because of the map scale, some dots represent more than one garden.



Stone row systems (Fig. 13) are the most striking archaeological features of the Wairarapa region. They occur in coastal areas, generally on or near stony deposits such as stream fans, riverbeds, and uplifted beach ridges. The rows are long narrow mounds of stones about 2 m wide and 20–30 cm high, laid out in a more or less rectangular fashion interspersed with roughly circular stone mounds 1–2 m in diameter. Their purpose is not fully understood except that there is general agreement that they are in some way related to gardening. There are two contrasting views for their origin. The first, is that the stone rows are a by-product of gardening, the stones having been cleared from garden plots between the rows and used to mark the boundaries of the plots (H.M. Leach 1979a, 1984). The second, is that the stones were gathered together for the express purpose of building the rows, in some instances being 'mined' from nearby underground deposits (McFadgen 1980a), leaving well-defined borrow pits (Fig. 13). In the second view it is not necessary for the plots between the rows to have been gardens, since it is the rows themselves that were the focus of attention.

Plaggen soils (Fig. 13) are soils with added gravel or grit (McFadgen 1980b). They are called Maori Plaggen Soils if they are prehistoric and plaggen-like soils if they are not prehistoric or their age is unknown. It is generally accepted, but not proven, that gravel and grit were added to make soils more suitable for growing kumara and taro (Best 1925). Plaggen soils are similar in that they all contain silt, sand, and gravel, and are sufficiently friable to be worked with a

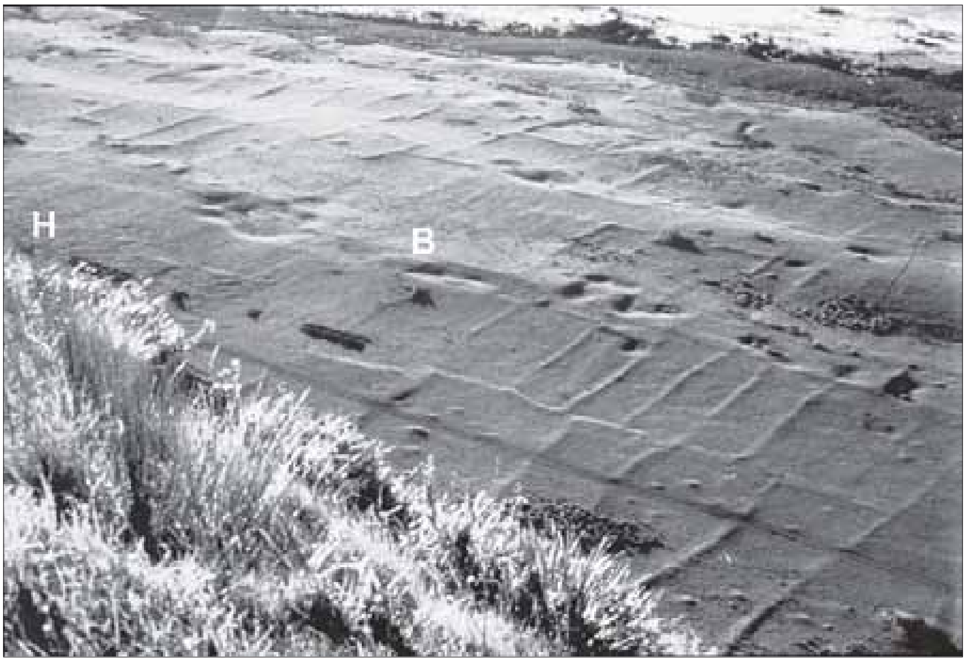


Figure 13. Stone row system on uplifted beach ridges at Okoropunga on the southeast Wairarapa coast. Although the rows appear to delineate garden plots the soils within the plots show no sign of cultivation. Attention appears to have been focused on the rows and mounds. Note the borrow pits (example labelled B) along the beach ridge crests from where the stones in the rows and mounds were mined. Hummocky ground to the left of the photograph (labelled H) is a Maori Plaggen Soil probably used to grow kumaras. (*Photograph: G. Billing.*)

digging stick. Few plaggen soils are recorded for the Wairarapa region. In other parts of New Zealand they are often found because borrow pits, from which grit or gravel have been obtained, are conspicuous, being up to a metre or more deep, and because the soils themselves are distinctive. Their usual size is less than 2.5 ha.

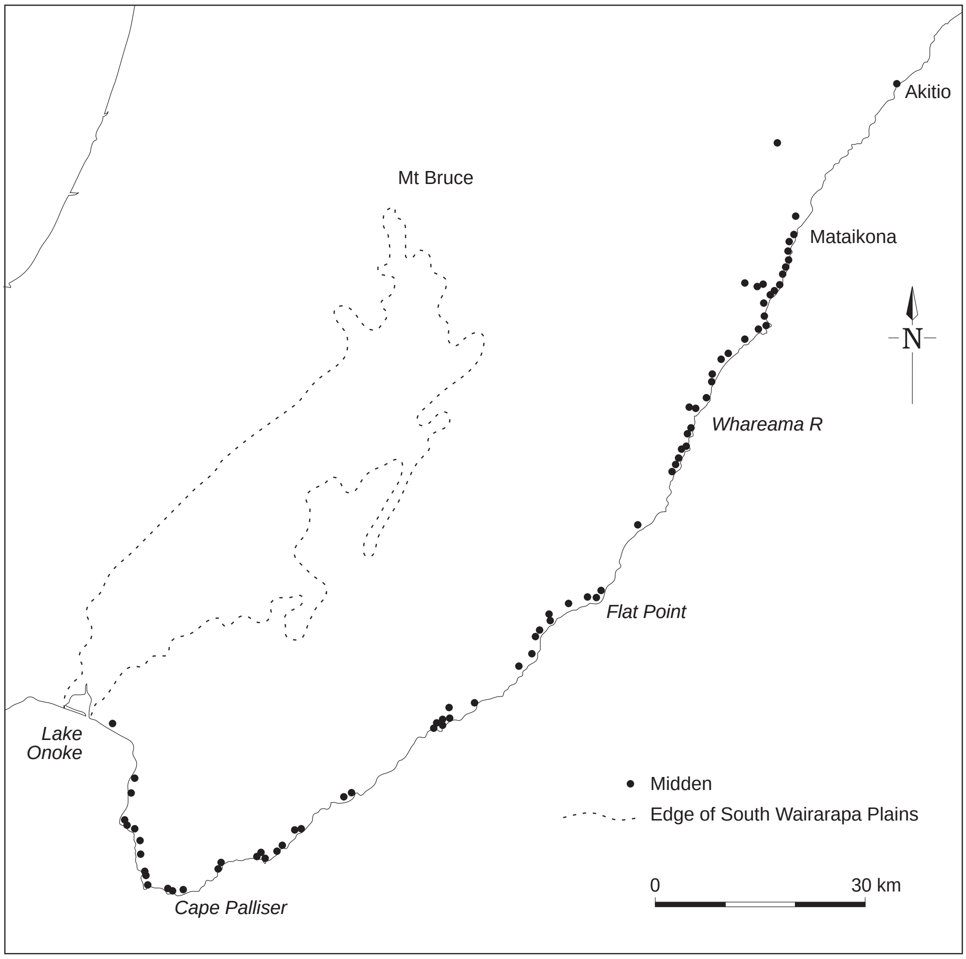
Terraces. Occasionally garden sites are terraces (B.F. Leach 1979a). Terraces were used for many different purposes and their presence is not in itself sufficient evidence for gardening unless, like the Washpool terrace at the mouth of the Makotukutuku River at Palliser Bay (B.F. Leach 1979a), the soils on them are shown to have been gardened.

Shell middens vary from heaps to extensive layers of food refuse: shells and animal bones, generally with charcoal and oven stones. They are rarely conspicuous features in the Wairarapa landscape except when seen on eroding sand dunes. They are found only in coastal areas and rarely more than a few kilometres inland (Fig. 14).

Ovens are the remains of cooking fireplaces or hangi and are usually found as concentrations of burnt stones and charcoal. Farmers in inland Wairarapa reported many areas of oven stones to Keith Cairns, which they had found when they ploughed up river terraces.

Occupation layers are traces of occupation with charcoal and, rarely, oven stones, associated with, but more extensive than, middens. They are rarely visible at the ground surface, but are conspicuous in vertical sections exposed by erosion along the shoreline or along the banks of rivers and streams.

Figure 14. Distribution of sites with middens in the Wairarapa region. Dotted line = edge of the southern Wairarapa Plains. Note that because of the map scale, some dots represent more than one midden.



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