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TERRACES AND GRAVEL-ADDED SOILS  
OF WHITIREIA PENINSULA, PORIRUA

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Water-worn pebbles, often referred to as 'gravel', have been identified in the soils on man-made terraces on the Whiti-reia Peninsula, Porirua. It has been suggested (Best, 1914) that the gravel was deliberately added to the soils for the purpose of kumara growing. This suggestion has never been tested and new evidence indicates that other possible origins of the gravel need to be considered.

Whiti-reia Peninsula is the southern side of the entrance to Porirua Harbour. It is hilly, with broad ridges and steep slopes, and is cliffed on the western seaward side. The soils are formed in thin loess or weathered greywacke drift, and overlie greywacke. There are a few small areas of flats in the bays between Te Neke and Kaitawa (Fig.1).

In 1914 Best described archaeological remains on the peninsula as part of a wider survey of the Porirua area. Some 45 years later, in 1959, the Wellington Archaeological Society began recording sites there. The results are summarised in a paper by Daniels (1961). An unpublished report (Walton, 1984) describes site recording done to 1984.

The terraces on the peninsula have long been the subject of discussion. They were first described by Best in 1914, were later the subject of a brief debate amongst geologists in the late 1920s (Ongley, 1931), were discussed by Daniels in 1961, and by Macnab in 1969.

The terraces

There are numerous sets of terraces on the Whiti-reia Peninsula. There are four possibilities for the origin of the terraces: they are,

1. entirely natural features;
2. natural features that have been occupied or cultivated;
3. natural features that have been re-shaped and occupied or cultivated; or
4. man-made features.

Distinguishing man-made terraces from those of natural origin by their surface form is a problem on the Whiti-reia Peninsula (and in the Wellington area generally). A cultivated soil, indicated by rare fragments of bracken fern charcoal,

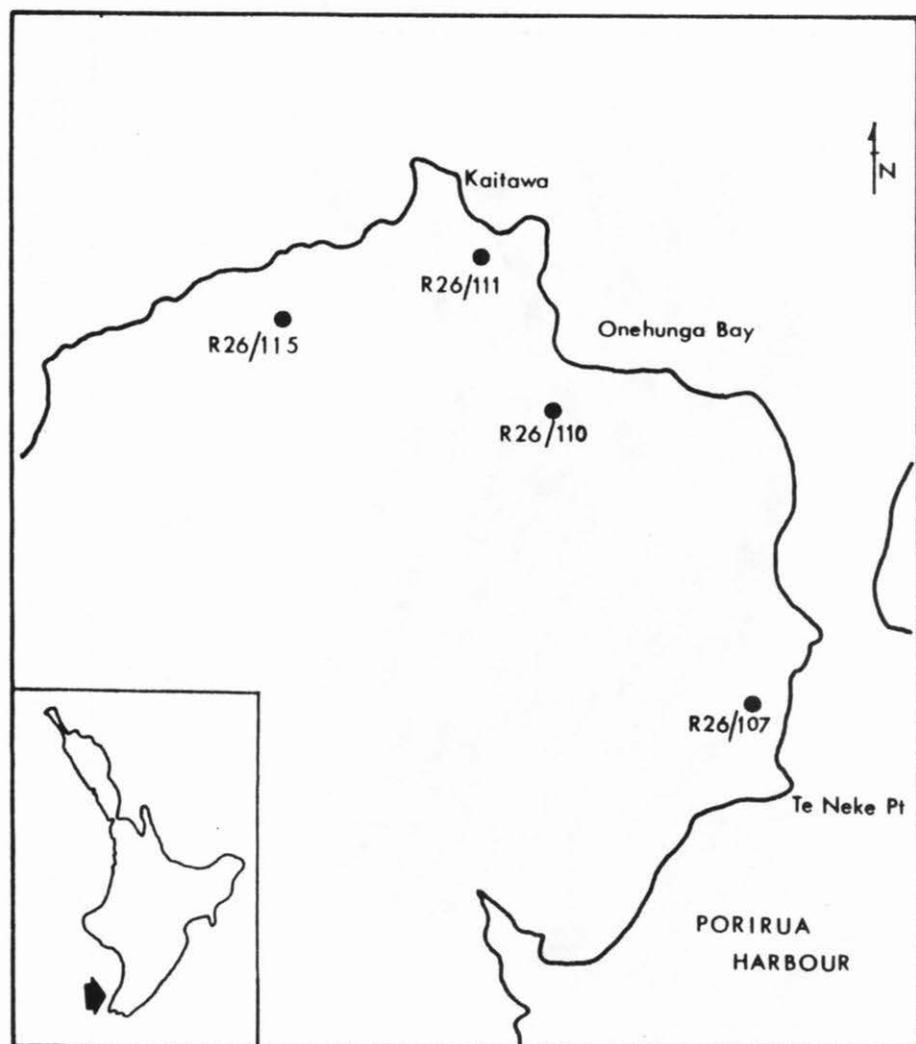


FIGURE 1. Whitireia Peninsula: sites mentioned in text.

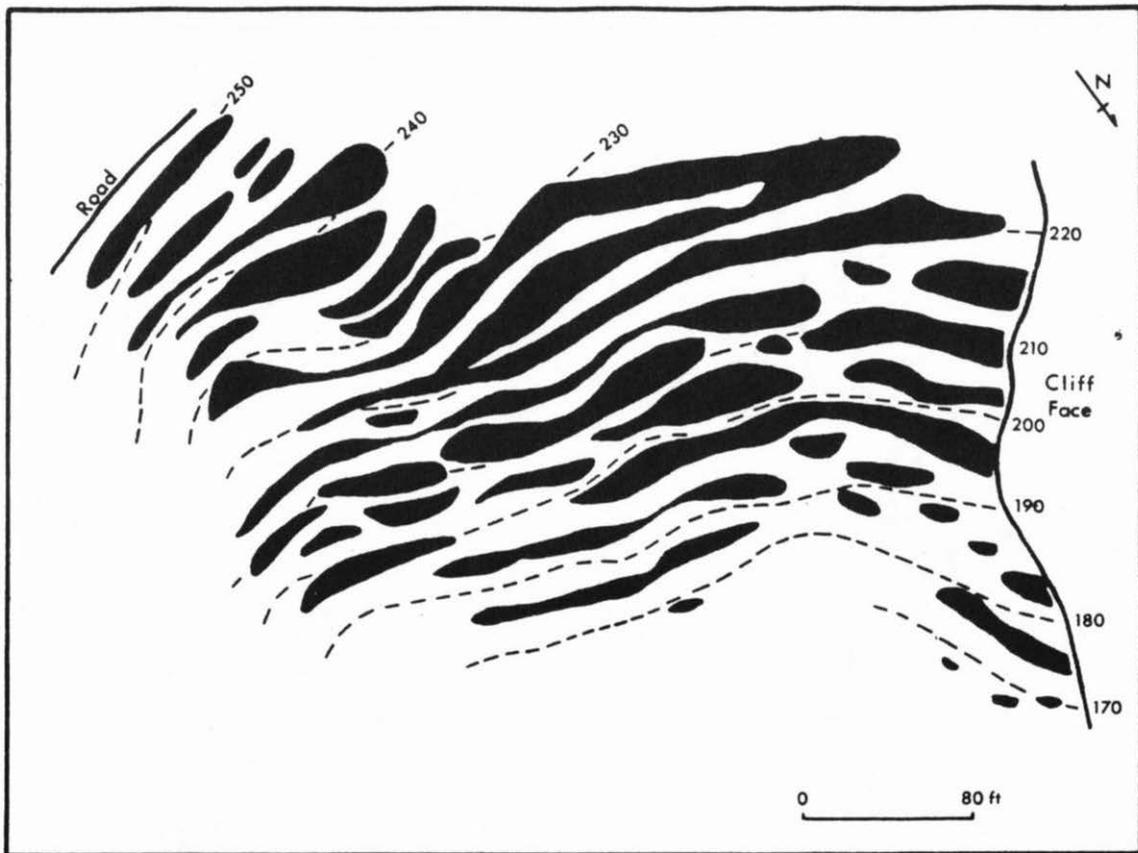


FIGURE 2. Plan of R26/115. From original plan with two feet contour intervals by Bruce McFadgen, 1966. Terrace treads in black. Contours show height above mean sea level.

has been identified on the terrace treads of only one (R26/115) of the sites on the Whitireia Peninsula. (However, suitable exposed sections have not often been available at other sites).

Best believed the better defined terraces to be artificial but this conclusion was by no means obvious to others. In the late 1920s, geologists who examined the terraces advanced a number of hypotheses on their origins. However, Ongley (1931) concluded that, "no geological process appears capable of explaining them, and they are not, in the author's opinion, geological phenomena". Their regularity, rarity, and small extent (in geological terms) suggested that they were man-made. Best's views were cited as support for this identification.

While Ongley's paper settled the question of the origin of the Whitireia terrace sites such as R26/111 and R26/115, he discussed the origin of only the more prominent sites. There are other terraces that appear to be natural. The difficulty is exemplified by the following discussion of site R26/110. Daniels (1961:27) noted that a "series of terraces occurs on a steep face above Onehunga Beach (which are) ... discontinuous and very irregular, so much so that in some cases they are indistinguishable from natural slump terraces. They also show gravel on the surface, and their narrow width ... does not make them appear at all suitable for habitation. Here again no pits or midden refuse are evident". The terraces had previously been noted by Best and the presence of the gravel appears to have been a significant factor confirming their identification as terraces.

#### Gravel-added soils

The presence of water-worn pebbles in the soils on the terraces has been an important element in various arguments about the origin of the terraces. Best, writing in 1914, was the first to suggest that the water-worn gravel in the soils on the terraces was transported there by man.

This is Best's argument about the largest flight of terraces (R26/115 (N160/28) - see Fig.2):

"Practically the whole of this face has been carved by human hands into terraces ... The question that naturally presents itself is, for what purpose was all this labour performed in so stiff a soil? To which we reply they must have been formed for one of two purposes, namely, as hut sites, or as a means of cultivating the warmth-loving kumara ... after a careful examination of the terraces we have detected no signs of hut sites or foundations, so common on the sites of deserted hamlets where the soil is fairly stiff,

no sign of fire pits or of earth banking of former walls. But we did find foreign waterworn gravel in the soil, often a sign of an old cultivated area; such gravel, when obtainable from beach or pit, being spread on the surface of sweet potato cultivations and placed in the holes in which taro was grown. Hence we come to the conclusion that these terraces were formed as kumara gardens on the sunny slope, and doubtless each terrace would have on its outer margin a windbreak of manuka or other material, to shelter winds so prevalent here".

(Best, 1914)

The argument that the terraces were used for cultivation rests on their form and on the absence of any evidence indicative of habitation. The suggestion that they were used for kumara growing is based on the occurrence of the water-worn pebbles in the soils. Best's interpretation of the significance of the pebbles has generally been accepted by later fieldworkers. Daniels (1961:27), for example, reported that "gravel, an inevitable sign of kumara cultivation, (was) evident on the surface of the terraces" at R26/115. However, the presence of pebbles is only significant if similar pebbles, in similar quantities, are absent in surrounding unmodified soils. The surrounding soils provide the standard necessary to reliably identify the changes in the soil that are attributable to human intervention (Pullar and Vucetich, 1960:4). Best (1914) noted the presence of pebbles in soils away from the terraces but concluded that they too had been used for cultivation. There is, however, another possibility: that pebbles occur naturally in these soils. The presence of pebbles in Wellington (loess) soils was commented on as early as the 1880s (Crawford, 1884) so a natural origin for the pebbles needs to be seriously considered. Unfortunately, the situation in the vicinity of R26/115 is different from that in the area of R26/111 and so these two cases need to be dealt with separately.

When natural soils in the vicinity of the R26/115 were examined pebbles were found to be present in similar quantities to that of the terraces. The pebbles are found sparsely distributed through the topsoil and subsoil in about the same quantities as in the terrace soils, although the quantities did vary somewhat from place to place. Pebbles are defined on the Wentworth scale as being between 4 and 64 mm and most of the pebbles found fall at the lower end of the range. The pebbles may be gastroliths (crop or gizzard stones). This suggestion arises partly from the high proportion of quartz pebbles which are otherwise rare in the present day environment. The origin of the pebbles remains obscure but human transport appears unlikely.

Macnab is cautious in his interpretation of the soils at R26/115. The cultivated soil is a friable fine sandy silt loam with numerous, naturally occurring, fine granules (2-4 mm) (Macnab, 1969:104). Although his paper is concerned to demonstrate that modification of soil or slope, or both, was a feature of kumara growing in New Zealand, Macnab (1969:104) notes that "physical modifications of the soil had not been great" at R26/115. He suggests that "additional sand may have been laboriously carried up the hill from the beach" (Macnab, 1969:105) but offers no evidence. The present day beaches adjacent to the site are shingle beaches, but with some deposits of coarse sand and fine gravel. This material would be readily identifiable if it were present in any quantity in the soils on the terraces but there is no evidence that it is present.

Natural soils in topographical positions comparable to the terraces of R26/111 were also found to contain small quantities of pebbles. The pebbles were at the lower end of the range in terms of size but quartz pebbles were a minor component. The pebbles were generally similar to those on the adjacent beaches. Many of the pebbles on the terraces of R26/111 are found on that part of the site nearest the beach and are part of a narrow belt of pebbles found behind the beach: a common pattern in coastal soils on the Whitireia Peninsula and the coast south of Titahi Bay. Many pebbles were found in situations (e.g. in the subsoil, in greywacke talus, on narrow ridges or other confined positions) that make human transport for gardening an unlikely explanation. There are a number of ways that pebbles may have come to be in these soils. The quantities of pebbles in soils immediately behind the beaches is consistent with deposition by wave action in storm conditions and transport by birds and other animals. These background conditions preclude the positive identification of cases of human transport unless material was transported in some quantity.

The presence of pebbles has been the main argument for the use of the terraces for kumara growing. However, a new argument is used by Macnab (1969). Macnab argues that since potatoes are fairly tolerant "there was no need to go to elaborate lengths in order to prepare slope or ground for its cultivation" (Macnab, 1969:99). He argues that the form and regularity of the terraces (R26/115) indicate that the whole flight was constructed at the one time and that the magnitude of the effort involved precludes their construction for growing potatoes (Macnab, 1969:108).

It is not evident, however, that form and regularity are sufficient grounds for making that sort of judgement. Potato growing becomes at least a possibility if the terraces were constructed piecemeal or were re-shaped from existing, natural terracing.

Since McNab wrote, a radiocarbon date on charcoal has been obtained for the site by McFadgen (1979:127). The charcoal, collected from the base of a topsoil buried by windblown silt, has been identified as bracken fern and is thought to have been dug deep into the soil by cultivation. It gives a date for the use of the terrace. The date is  $70 \pm 40$  BP (NZ2696A) and should be read as indicating an age of less than 250 years (McFadgen, pers.comm.). The date is not conclusive but it does suggest that use of the terraces is not of any great antiquity and it does not rule out use of the terraces in the contact period.

While evidence for human transport of beach gravels onto the prominent sets of terraces at Whitireia is lacking, there is evidence of such transport elsewhere in the Porirua area. Sparse well-rounded unweathered pebbles, and rare small pieces of charcoal, have been found in a cultivated soil some 3 km away on the northern side of the Pauatahanui Inlet (McFadgen, 1980:7-8) and their presence appears to be the result of human transport. Similar pebbles have also been found in small quantities in shell middens around the Pauatahanui Inlet (Sheppard and McFadgen, n.d.). At present there is only one site at Whitireia where it appears that human transport is probable. McFadgen (pers.comm.) has found a 20 cm thick layer of fresh unweathered water-worn gravels in test pits dug on the four terraces of R26/107. This is well in excess of background levels. Examination of exposed sections on other sites, however, has yet to produce any comparable examples. Ironically, the gravels have been found on terraces that were regarded as being clearly for habitation. Daniels (1961:25), for example, argued that "the distinction between habitation and cultivation terraces becomes obvious on closer examination" and recorded R26/107 as a habitation site. Two raised-rim storage pits are evident, on separate terraces. This is the only example of storage pits occurring on terraces. It is, of course, always possible that the gravel was transported for purposes other than cultivation.

### Conclusions

The presence of pebbles has played a significant role in the identification and interpretation of the terraces of the Whitireia Peninsula. However, pebbles are a feature of the soils of the area and must, therefore, be considered natural in origin. This not only removes one argument for the use of the terraces for kumara cultivation, it also raises the old problem of the identification of the terraces themselves. The more prominent terraces were almost certainly cultivated, but whether for kumara or potato is unresolved.

However, these terraces do not stand alone, but are one end of a continuum. It is, therefore, possible that they are only partly man-made, that is, they were natural features that have been re-shaped for, or by, cultivation. Further work, including excavation, is required to resolve some of the growing problems of interpretation.

#### Acknowledgements

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