NEW ZEALAND
ARCHAEOLOGICAL ASSOCIATION
NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER

A GARDEN SOIL AT ROCKY BAY, WAIHEKE ISLAND, N43/72

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Abstract

A section cut into a soil profile is described and interpreted. The upper 5 ft of the section consists of an accumulation of garden soil with added sand and gravel which has built up at the toe of a gentle slope. Radiocarbon dating suggests accumulation of the soil started by at least late 16th Century A.D.

INTRODUCTION

Rocky Bay is a south-west facing bay on the south side of Waiheke Island in the Hauraki Gulf (Fig. 1). In the course of a period of site surveying, the author encountered the site (N43/72) and made the records for this report. The cross-section was surveyed by Abney level at section 80 (Fig. 3) and the long section (Fig. 2) is related to a datum set by a tide strand level. The site consists of a section at high tide level cut by the action of the sea. This section is up to 10 ft high and about 200 ft long and borders McMillan Road, part of the Omiha settlement of the homes of retired people and holiday beaches. The ground behind the section and the road is a low rounded spur. The plan dimensions of the section were taken (Fig. 1) and 10 columns at 10 ft intervals along a typical part of the section were measured and recorded, as well as some of the more important features between the columns (Fig. 2). This method of recording was adopted to obtain an overall view of the stratigraphy without having to painstakingly record the entire section accurately which, while desirable, was beyond the scope of the manpower and the limited equipment.

STRATIGRAPHY

1/	Topsoil, darker than 2
2/	Silt soil with inclusions of round chert gravel, light brown, slightly structured, agricultural soil.
2a and 2b/	As 2, but more gravelly lenses
2c/	Lens without gravel (? interruption).

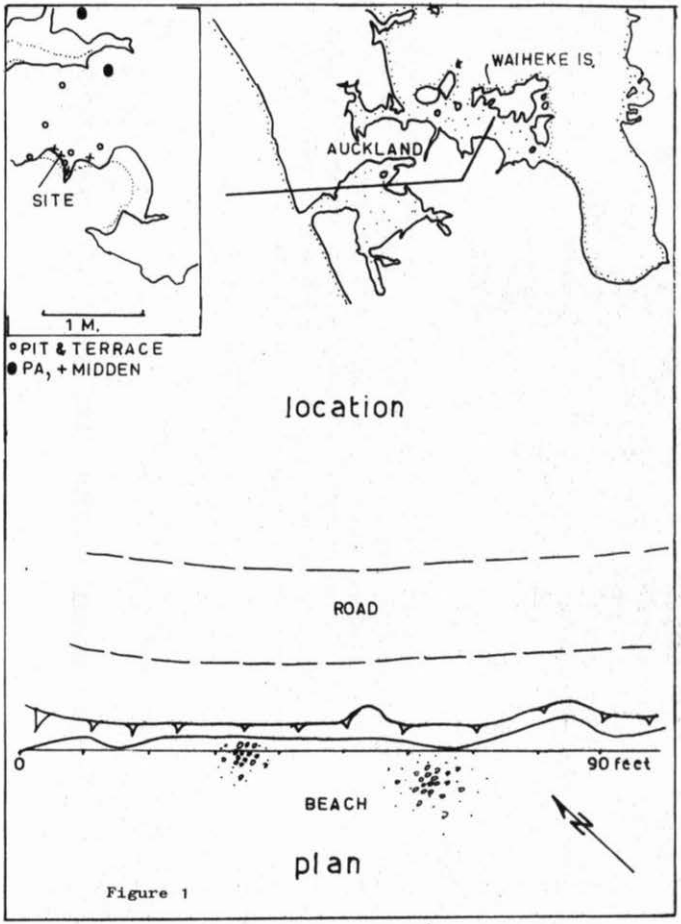

Figure 1

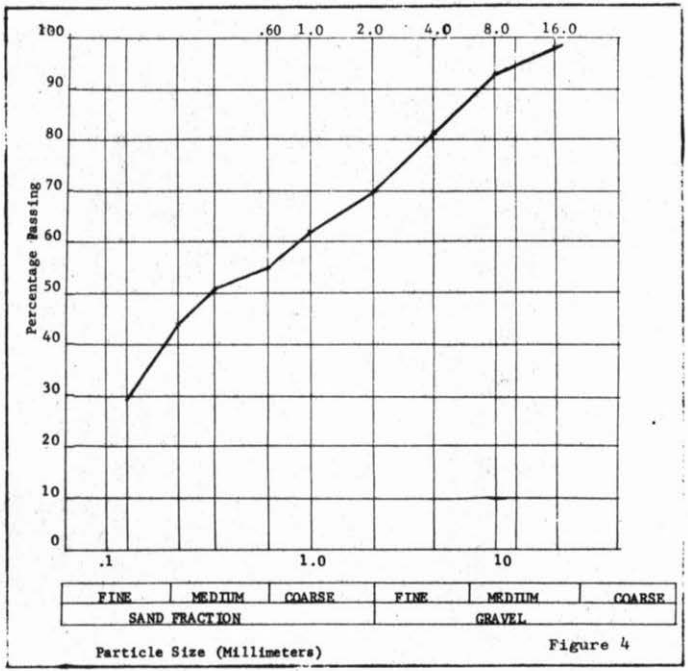

Figure 4

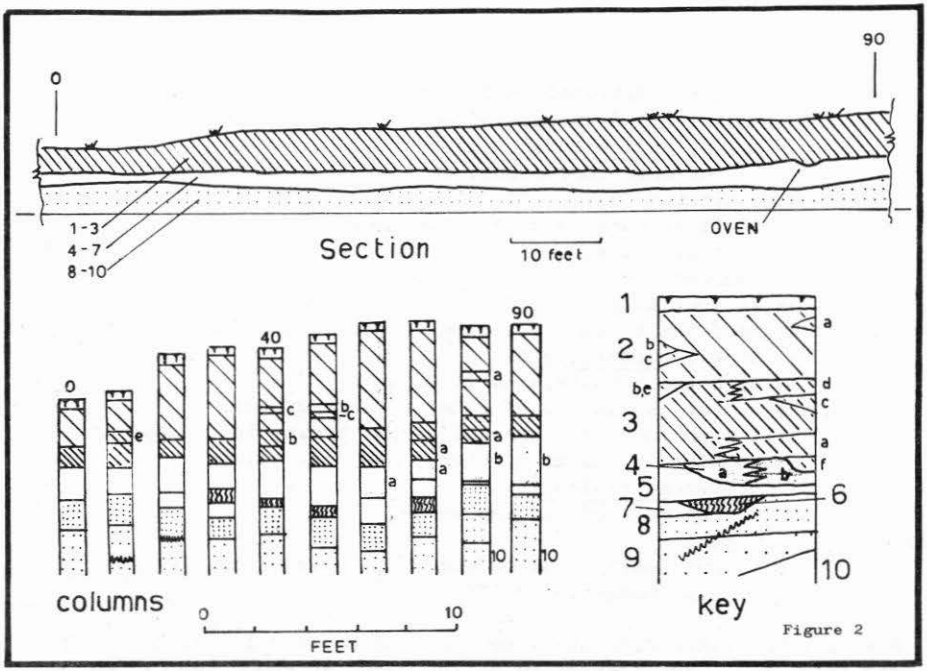

Figure 2

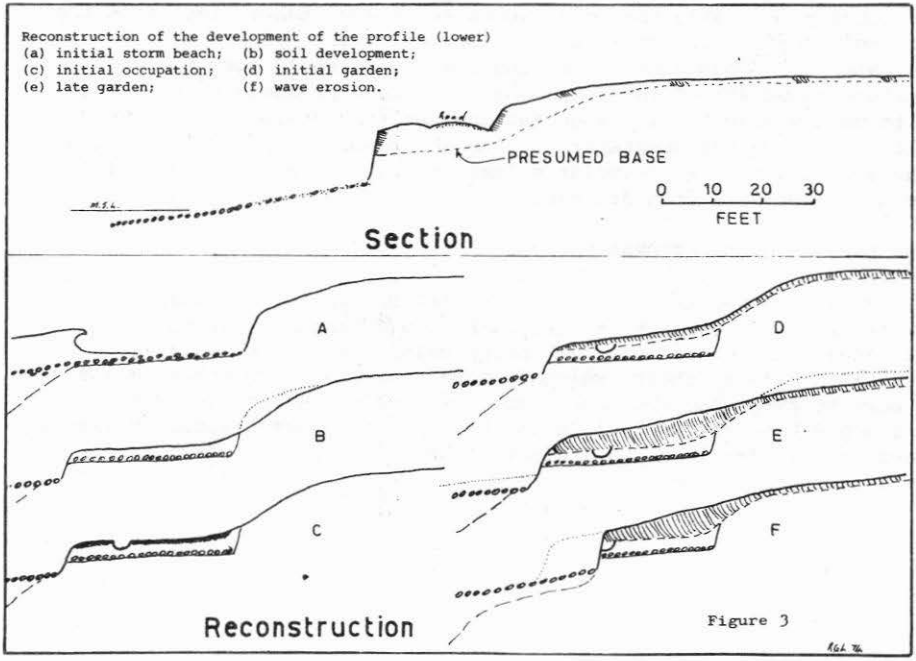

Figure 3

3/	As 2, but additional inclusions of shell, charcoal, occasional fishbone and burnt angular rocks, dark brown, agricultural soil.
3a, b, d, e/	As 3, but more inclusions, dark brown to black.
3/	Heat altered lens
3f/	Pit full of burnt angular rocks, oven.
4a/	Silt soil, blocky structure, chocolate brown, inclusions of rounded chert gravel, paleosol.
4b/	As 4a, but without inclusions, paleosol.
5/	Rounded chert gravel, slightly weathered and some silt, brown, former beach.
6/	As 5, but black staining (? organic).
7/	As 8, but inclusions of rounded chert gravel.
8/	Silt hard mottled brown and darker brown, inclusions of angular fragments of chert, residual joints, greywacke residuals.
9/	As 8, but mottled red and white.
8-9a/	Iron pan.
10/	As 8, but mottled yellow and white, black staining in joints (manganese oxide).

A sample was taken from the lower part of Layer 2 for sieve analysis (Fig. 4). The flattening of the curve at about the 0.5 mm size probably indicates the point where the change takes place from the parent soil dominating the size distribution to the point where the added material is dominant. The added material would seem to constitute about 45% of the total soil and to be predominantly in the fine to medium gravel size range but include some coarse sand. This sample may not be representative of the whole soil. The wide grading on the soil leads to a low voids volume in the soil and consequently the soil is not very free draining.

INTERPRETATION OF STRATIGRAPHY

Layers 8, 9 and 10 represent a typical fascies of residual greywacke soils. Unweathered greywacke would probably not be encountered until 40 or more feet below this level. The local greywacke is rich in chert, which is more resistant to weathering and will survive even when the parent rock is highly weathered. These layers would have attained close to their present form several thousands of years ago. The iron pan indicates that the former surface level was no great distance higher.

With the rise in sea level at the end of the last glaciation, the sea approached its present level and built up a gravel and sand beach in Rocky Bay. In a storm layer 5 a gravel layer was carried up by wave action and laid over the greywacke residuals, possibly after their surface horizons had been removed (Fig. 3A). In the contact between layers 5 and 8, layer 7 may represent either a failure of the layer 8 material to filter the gravel, or a naturally mixed in earlier and slighter gravel layer. Layer 6 may be either 5 stained by seepage water, or a former organically rich layer. Over parts of layer 5 a well-developed paleosol formed layers 4a and b, probably from material derived from higher up the slope and deposited over the gravel layer by slope movement, although some sand and silt material deposited with layer 5 may have contributed the parent material (3B). The development of this soil makes it likely that the start of its development was earlier than the arrival of man in New Zealand. A thin layer 4 may originally have extended over all of layer 5 but was later disturbed. The oven marks the arrival of man. Over the whole section a thin layer of midden was laid down (3C) at this point and before any further natural deposition took place this layer had been cultivated and gravel, and no doubt sand brought up from the beach, has been added (Layer 3), (Fig. 3D). The shell in the midden is mostly pipi *(Amphidesma australe)*, and cockle *(Chione stutchburyi)*, with occasional rock oyster *(Crassostrea glomerata)* and scallop *(Pecten novaezealandiae)*. The first three live in the bay at present. At least one interval after the cultivation started, more midden material was deposited and mixed in (layers 3b, 3d and 3e) and fires lit on this surface (layer 3c). Layer 2 overlying this has little shell but still some charcoal and is relatively homogeneous with some more gravelly lenses, and one fine-grained level, possibly representing a worm accumulation in an interruption of the gardening. Otherwise this layer suggests a long and relatively continuous garden accumulation (Fig. 3E).

The humified topsoil layer is consistent with a halt of a century or more since the accumulation finished. There is no indication in the section that any of the spoil from the road construction was moved in this direction. It is possible there is some causative relationship between the prehistoric removal of gravel and sand from beach and the present erosion.

The depth of accumulated soil apparent in the beach face continues for at least 20 feet back from the beach for the four foot cut at the road edge is entirely in the made soil. This soil continues on the surface to cover the gently sloping area above the road, but the depth here has not been determined.

The down-slope soil transportation process is believed to be largely due to cultivation movement. The slope (about 12° when complete) is too flat to consider slip movements. Mudflows can be rejected as these normally leave clear stratigraphic evidence and occur on rather different land-forms and soils. Slope wash may well be a contributing factor but it cannot be the sole factor. The area contributing to the build-up is not large and for gravel to still occur on the area, and in the top of the sectioned profile it must have been replenished during the slope movement process. Further, to transport the soil with little apparent selection of finer soil fractions over the gravel, requires considerable surface flows and/or steep slopes. The location on a spur end with no contributing catchment must make large surface flows rare events.

ADJOINING SITES

To the east there are two large pit and terrace sites (Fig. 1), one of which has midden extending down to the beach. To the west, there is a further surface midden and cooking area rake-out exposed at the back of the beach.

SURFACE ARTEFACTS

Eight water-worn flakes of basalt and two of greywacke were collected from the beach from in front of the three sites on the beach, including that described here. The author was shown an artefact which its finder indicated came from just above the low tide mark in front of the site. This was a right-angled corner broken from a tabular piece of nephrite. It was polished on both faces and on two edges and had been water-worn. One edge was decorated with five notches. Subjectively, the piece seemed rather thin for an adze.

DATING

A sample of charcoal-rich soil from the haangi fill, layer 3f, was submitted to the Institute of Nuclear Sciences, NZDSIR, Wellington, for dating, and a result has been received. The charcoal was finely divided and softened. The sample was leached with phosophoric acid to remove shell carbonate from marine shells included in the soil. The date listed below is calculated using the 5568 year half life with respect to the 0.95 NBS oxalic acid standard.

Charcoal	NZ 1900	410 ± 60 years B.P.

A date supplied by the laboratory which corrects this for secular effects is A.D. 490 ± 40. A consideration of the correction curve for secular effects (MASCA 1973) and allowing plus and minus two standard deviations suggests an age between A.D. 1390 and A.D. 1610. As usual with charcoal samples, there is an attendant risk of the use of old wood in the fire. Use of driftwood is not likely to be a major risk at this site. Given that smaller diameter poles make ideal firewood for haangi, the association of the date with the event dated is hopefully close. With the rapid deep burial of the layer, root intrusion should not have been a problem.

It should be noted that the date is not directly a date for gardening activity or of clearing the area for gardening, but rather is an early limit for this activity. However, given the depth of accumulation in the garden soil and the transitory nature of the basal cooking deposit, it is reasonable to assume the gardening must have started soon after the initial use. It is even possible the midden represents food use by the party clearing the area for a garden.

DISCUSSION

There is no reason why there should not have been gardening activities in the bay as soon as it was occupied, and indeed this might be expected.

A locality such as Rocky Bay is not an ideal base for exploiting the region's resources. Better soils occur in other localities, the shellfishing resources of other areas are more extensive, freshwater fish and shellfish resources, together with lake-edge and swamp plant resources, are available elsewhere and areas with access to a greater range of bird inhabitants can be chosen. In short, it is not a site which on *a priori* grounds we would expect early settlement. Sites dated earlier than this occur in the region. The use of this locality for habitation by the 15th or 16th Century A.D. would be consistent with a model in which an increasing population progressively occupied less favourable localities.

The local soils derived from greywacke are not of noted fertility (Soil Bureau 1954; 107), or of very suitable texture for gardening using the introduced Polynesian cultivars.

The area here on a gentle slope adjacent to the shore, probably with an initial fertility boost from the occupation refuse, over part of the area, and a texture alteration by use of an additive clearly became a valuable resource and was repeatedly used as a garden. It is

the likelihood of repeated use at this site which gives the site its interest. In the past, some emphasis has been put on Maori gardeners frequently moving their areas of cultivation, and fertility depletion of the soils when in use. Here we find soil apparently treated as a valuable resource and its texture and perhaps fertility husbanded.

It must be admitted that this site is at present exceptional in having evidence suggesting frequent recultivation. Despite this, it can be noted that this data is of use in discussion of points raised recently regarding the application of swiddening models to Maori agriculture, the population support potential of agriculture in northern New Zealand, and the cyclic occupation of pa claimed to have been recognised archaeologically and suggested as being agriculturally determined through soil exhaustion. Discussion of these points is however not appropriate to a paper such as this.

The use of soil additives such as here is a New Zealand innovation with Polynesia. There is evidence from other sites of its being a relatively early development and the site in question supports this dating. This will be discussed further in a following paper.

The considerable downslope movement at this site is of a different character from slope instability apparently induced by clearing and gardening at other localities seen by the writer, but nevertheless indicates one aspect of man/soil relationships which has been neglected in the past.

REFERENCES

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