NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER

B. Pedological Observations at Kauri Point

by W.A. Pullar

So many questions have been askedabout soil on the Kauri Point site that this article is in the nature of a defensive essay on applied pedology.

In the field the pedologist has to exercise judgement as to what is soil and what is not soil and to assist him in his assessment the following criteria have proved useful in practice:

(i) soil has live plant roots;
(ii) soil has aggregation of particles which are expressed in definite form called structure;
(iii) soil has wormcasts which are usually regarded as a part of structure;
(iv) soil has root channels;
(v) soil has visible organic matter mainly as roots and rootlets;
(vi) soil has consistence expressed in terms of friability, firmness and massiveness;
(vii) soil may have clay skins along channels or cavities in the B horizon.

The above are minimum criteria; in my opinion, a few or occasional wormcasts are insufficient to denote a soil.

Description and Interpretation of Selected Sections

The deposit on the slope of the terraced hill and on its top (squares L28 - 36) is roughly stratified as follows:

(a) cap of surface soil;
(b) fill;
(c) base of volcanic ash.

This general profile will be considered with reference to the rather different one at the base of the terraced hill, in square L26.

The Natural Soils

Before any interpretation of these sections can be offered, it is necessary to look at the natural soils on which the site is built: to quote from my article, "Problems of Site Interpretation in Archaeology - Pedology", published in the September 1960 issue of the Newsletter, Vol. 3 no. 4".....To estimate the degree of disturbance the pedologist has to refer to the natural soils in the vicintiy ..... No worthwhile opinion can be offered on a mere spot examination...."

The following column was recorded in a road cutting near the site:

Ash Bed 1 12ins. black sandy silt; loose (?) Holocene (soil);
2 22ins. strong brown weathered ash (soil);
3 12ins. yellowish brown weathered ash;
4 12ins. brownish yellow weathered ash;
5 4 ins. mauve ash, little weathered, on
6 "chocolate" ash , weathered to tough, non-sticky clay.

The Base

If we assume ash bed 1 to be the A horizon of the surface soil and the upper part of bed 2 to be the B horizon, then the A horizon is only present in place restrictedly on the excavated site : at the top of the terraced hill in L36 and at the bottom in L26. Here there is merely a remnant of 3 ins, through which the excavators had understandably cut, down to the firm top of ash bed 2.

The abbreviated profile at L26 is:

3ins. brown sandy loam; loose; grains clean; ash bed 1;
8ins. variegated yellow and brown clayey sand; clay skins beginning to line channels; ash bed 2;
6ins. variegated yellow and brown sandy clay; pores, channels and cavities rich in clay skins; grains fused; ahs bed 2.

Ash bed 1 can be regarded as the A horizon because clay has moved out and ash bed 2 as the B horizon because clay has moved in.

Where the A horizon is abbreviated, as in L26, or absent, as in its vicinity, it is suggested that the soil from this horizon had been used as fill elsewhere.

Overall the base ranges from ash bed 2 at the foot of the slope to ash bed 6 at the top. In the top 12ins. of ash bed 2 dark brown patches are common and a suggestion was proffered that these patches are casts excreted by subsoil worms. Examination under a handlens, however, showed no recognisable difference between the fabric of the so-called casts and the surrounding mass. The patches are roughly square in outline and in no way resemble subsoil worm casts common in the Wairarapa district. Furthermore, Dr. K.E. Lee in his book The Earthworm Fauna of New Zealand (1959) says the large subsoil species Octochaetus multiporous is found throughout much of the South Island and the southern North Island but burrows of Spenceriella gigantea have been observed on Little Barrier Island. In recent soils from alluvium I have attributed such patches to treeroot channels now filled with casts made by topsoil dwellers, the lumbricid species. In this instance, no satisfactory explanation can be offered at present.

The upper 12in. of ash bed 2 is a buried soil because of clay skins

lining pores, channels and cavities. As the profile for L26 described above demonstrates, the paleosol is established without reference to wormcasts.

Fill:

In square L32 where the section transects dwelling pit C, the presence of stones, charcoal, globules and pieces of "chocolate" ash and yellow brown ash testify to fill material. In this square, however, 4 separate layers occur and each has pedogenic characters by way of granular structures, live grass roots, dead bracken roots, root channels, bright colours of adventitious fragments toned down and merging; so it could be said that each is a soil and that infilling has occurred slowly and in steps. On the other hand, it could be that aggregates are derived from the A horizon of the natural soil and have remained intact. We cannot distinguish between aggregates of the old soil and those of the new. As an indication of rate of infilling, I would say that the bottom 13in. was fairly rapid, the next 7in. similarly, and the next 15in. and 5in. upward much slower as soils are better developed.

My interpretation of Mr. Golson's mixed gritty and sandy formation, (Mr. Schofield's layer 2), separating periods 1 and 2 at the bottom of the hill, is, on the basis of observations in L26, as follows:

The formation is composite and consists in the main of two layers beneath a surface covering of soil and shell. The upper layer (Schofield's layer 2.3) is a firm, massive, greyish brown silty sand rich in shell fragments, and the lower one (Schofield's 2.1), separated by a sharp boundary, is a brown and yellow silty sand, also firm and massive.

I would hesitate to call these layers soil in the accepted sense. The material has the appearance of being dumped in place, but against this view is the occurrence of micro-stratification in the form of a line of burnt material (Schofield's layer 2.2). More probably the material was added gradually and then tramped or walked on by people living on the site.

Surface Soil

The A horizon from L28 to 36 is quite distinct and consists of 5ins. black, friable, sandy silt loam with a well developed granular and cast granular structure and with 3ins. tongues of wormcasts penetrating the C horizon. Colour and structure contrast strongly with the C horizon.

Here is a picture of a soil forming from material largely derived from ash bed 2. In this instance the C horizon and the parent material are the same (which is not always the case), so it is assumed that the parent material was dumped on the site in one load or dollop. Eventually, if left undisturbed, the A horizon will become 7ins. to 9ins. thick. Isolation of a soil from its own parent material and with the A horizon

moving downwards is a new experience for me, as I am accustomed to A horizons moving upwards into new flood deposits on recent soils of floodplains.

In trying to place an age on the site at the time the Maori vacated it, we must know the history of European farming in the area, and some relevant remarks on this subject by Mr.Melvin are included below. Anyway, the surface soil of the site is not the modal (i.e. most commonly occurring) soil of the area, so we are unable to match profiles of natural soils.

In contrast to the situation in squares L28-36, the surface soil at L26 (Schofield's layer 4:3) sits over a shell bed (layer 4.2).

Beneath is a black soil with some shell, (Schofield's layer 4.1). There are tongues of black projecting into the underlying layer of yellow sandy silt loam (Schofield's layer 3), which contains yellow fragments of ash bed 2. This suggests that the top formation of the section, called by Schofield layer 4, is equivalent to the surface cap mantling squares L28 to 36, on the terraced hillside and hilltop.

The soil above the shell (Schofield's layer 4:3) is black and has a granular structure. A question arose as to its origin and the following suggestions were submitted:

(a) by worms transporting soil from below the shell bed (i.e. from Schofield's layer 4.1);
(b) as fill spread by European farmers;
(c) by sheetwash covering the shells, followed by vegetation and later by plants trapping dust and fine sheetwash.

Age of the Surface Soil at the Kauri Point Excavations

In order to discover which of the agencies listed above was responsible for the topsoil at Kauri Point, Mr. Melvin searched the literature and pursued personal enquiries as to the probable character of European farming at the site, while I myself examined and compared structures of surface soils round about. As well, both of us, from different walks of life, were impressed by the close similarity of profiles in square L26 (shell bed covered by surface soil) and on some residential sites in Tauranga borough. We have come to the conclusion that the age of the surface soil dates from the time of European occupation.

European Farming (contributed by L.W. Melvin)

The mode of farming for the area has been documented. George Vesey Stewart in his Notes on the Stewart Special Settlement No. 4 Bay of Plenty (1883) says: "I have no hesitation in saying that it is simply a waste of money to plough the Te Puke or Katikati lands when they are required for grazing purposes only. The first operation is simply to burn off the fern in the end of February or early March; then sow the clover and grass

seeds on the surface, having first prepared the soil with a "Randall harrow", an American implement; then cover lightly with a chain harrow and roll. But I have seen splendid crops of clover produced without any such operations, by simply sowing clover on the newly burnt soil..."

Arthur J. Gray, a grandson of one of the pioneers, wrote this account in his story of the Katikati settlement:(1) "Following Vesey Stewart's advice, the settlers cleared their land by burning from ten to thirty acres of fern; the land was then surface — sown in grass, or roughly ploughed and harrowed, and planted in potatoes, onions, maize, oats or wheat. Farming equipment was limited. There were few horses or ploughs...."

We can assume, therefore, that surface sowing of pastures was a common practice on virgin fern and scrub lands and that the land on the site of the excavations was not likely to have been tilled by the European.

Soil Structure

The soil structure was examined immediately above and below the shell layer in square L26, above the shell layer on top of the hill at the entrance to the farm, above and below the shell layer in Elizabeth Street, Tauranga, and each compared with the natural soil (a yellow brown loam) at the intersection of the Tauranga-Waihi highway and the Kauri Point road. All soils above the shell layer have well developed medium and fine granular structures whereas below the structure is poorly developed, with much single grain. Fine aggregates are commonly rounded suggesting wormcasts. The natural soil has a strongly developed medium granular and fine cast granular structure with the larger granules tending towards nutty. The interpretation is that good structures have been produced under grass and that in time aggregates of man-made soils would tend to become more nutty than granular, even in sandy loam textures.

Levelling by Spreading

The comparison of the profile in square L26 where a layer of soil overlies a bed of shells with a similar one in Elizabeth Street, Tauranga, is a useful lesson in showing how a strikingly similar profile can be produced merely by spreading in the process of levelling, irrespective of who did it, or the precise method practised. It would be that the Maori spread material over the shell heap much in the same way that the European spread earth over the shells at Tauranga. We can suppose the age of the Tauranga site to be of the order of 50 years and this could well be the age of the ground surface in square L26. For the ground surface in square L36 on top of the hill, the thickness of the A horizon, the well developed structure, and sharp boundary with the C would indicate a greater age; but we have no knowledge of the rate of soil formation on yellow brown loams.

Diagnostic Surface Horizons

The natural soil has been mentioned and a comment may notbe amiss here. The American Soil Survey pays great attention to the effects of soil disturbance by man even to the extent of dismissing properties in the A horizon as criteria for soil classification at the high level. They do recognise, however, six diagnostic surface horizons of which two are of importance to field archaeology. One is called the anthropic epipedon and refers to land under long-continued systems of farming involving large additions of organic matter, nitrogen and phosphate, and the other is the plaggen epipedon, a man-made surface layer commonly identified from its content of artefacts and even spade marks (1).

In New Zealand, the European has not settled long enough for his kind of farming to effect an anthropic horizon, but the Maori has left his impress permanently with his practice of gravel mulching and such soils N.H. Taylor has called Maori soils. In the Bay of Plenty region, a plaggen horizon could be identified more by disturbance of the ash-bed stratigraphy than by the finding of artefacts.

Reference

(1) An Ulster Plantation (2nd edition) 1950, p.31

(5) Conclusions and Hypotheses

by J. Golson

Excavations in the long trench at the Kauri Point site have demonstrated the existence of three periods of structural activity. Little is known about the first of these but the second is abundantly represented in a complex series of sunken structures disturbed by the ditch and overlain by the bank of the pa of period 3.

The pits in the terraces and the summit of the terraced hill are plausibly assigned to period 2. A number of these have been totally excavated and exhibit a number of types (habitation,storage) and a patterning of associated types.

Excavations on the northern flank of the pa confirm the lateness of the defences. The deep shell middens through which the outer ditch cuts are most logically attributed to the intensive occupation of period 2.