



NEW ZEALAND
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NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER



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CHEMICAL ANALYSIS IN ARCHAEOLOGY

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This is an abbreviated version of a paper read at the 1971 N.Z.A.A. Conference at Auckland. Further details are available in Park (1969a).

Over the past two decades an important change has taken place in the study of prehistory in New Zealand as well as overseas. Archaeologists have begun to realise that their proper study is not material culture alone, but man. An important but, until recently, largely ignored aspect of the life of man is his diet. Faecal analysis, which has been used with some success, especially in North and Central America, is one method of reconstructing prehistoric diet. However, the samples for such studies are usually found only by chance in the course of archaeological excavations. If a study of foods is to be made by faecal analysis, then a means of retrieving samples more systematically will have to be found.

This study was undertaken to examine the likelihood of the existence of concentrations of faecal matter in prehistoric contexts in New Zealand, and to explore avenues for their location.

There are three major types of evidence which suggest the likelihood of the existence of latrines in prehistoric New Zealand: ethnographic, mythological and archaeological.

There is a conspicuous absence of records of latrines in the accounts of Cook (q.v. Beaglehole, 1955, 1961, 1967), Roux (q.v. Kelly, 1951; Kenedy, 1969), Savage (1807), D'Urville (q.v. Wright, 1950), or Angas (1847). However, two of Cook's men were more observant or less prudish. On October 21st, 1769, at Anaura Bay, Joseph Banks wrote:

"One peice of cleanliness I cannot omit, as I believe it is almost unexampled among Indians. Every house or small knot of 3 or 4 has a regular necessary house where one repairs, and consequently the neighbourhood is kept clean, which was

by no means the case at Otahite."

(q.v. Beaglehole, 1963: Vol. 1: 418).

William Anderson wrote on February 20th, at Queen Charlotte Sound:

"It is remarkable that though the indians are not very cleanly, they have places for doing their necessary occasions at each end of the place without the houses."

(q.v. Beaglehole, 1967: 800).

Latrines appear in the Tawhaki myth cycle, which is widespread in Polynesia, and in another interesting account from the Tainui legends (Park, 1970; Kelly, 1949: 113). Best (1924a, 1924b, 1925, 1927) gives a number of accounts which show the importance of the latrine to a number of rites and ceremonies to ward off wizardry, to cure the sick, or to perform divination.

It is unlikely that if latrines were a post-European feature in New Zealand they would have become incorporated so deeply into the magico-religious life of the Maori. It seems clear that what Banks and Anderson saw was indigenous. This conclusion is borne out by a small amount of archaeological evidence.

There have been several isolated finds of faeces in excavations over a number of years in New Zealand. These have seldom been accorded much attention, and references to them are usually by word of mouth, rather than by publication. The only latrine structure to have been adequately investigated archaeologically is that found by Bellwood at Otakanini (Bellwood, 1969; 1971; pers. comm.). He concluded that it could definitely be assigned to the prehistoric period. Analysis of the coprolites demonstrated the preponderance of fern-root in the diet.

This brief survey has shown that latrine structures are likely to be a part of the prehistoric record in New Zealand. Their rarity in excavations can be attributed to the cultural factor that they were placed at some distance from the features most likely to attract the attention of the archaeologist. Even the recent trend towards areal excavations will not solve the problem, since to excavate a wide area of largely sterile ground in the hope of finding a latrine, which may not even be present, would be a tragic waste of time.

Research has been under way in California which has a bearing on this problem. It has been found that the manure production of animals

can effect major changes in the chemical constituents of the soil. Most animals deposit their faeces randomly, but man, the cultural animal, depositing his waste in specific localities will leave 'anomalies' in the overall chemical makeup of the area. This fact has usually been applied to studies of sites in depth, but clearly the location of such anomalies in and around the area of archaeological sites could be expected to assist in the location of prehistoric latrines, as well, of course, as modern latrines, buried stock, concentrations of fertiliser, and so on. The nature of the anomaly can be tested only by excavation.

To examine the potential of this method, the following experimental research was carried out.

Soil samples for analysis were collected during the course of excavations at Tiwai Point, Southland (q.v. Park, 1969). In the time available, the most useful analyses were thought to be those for phosphates, nitrates and hydrogen ion concentration (pH).

Phosphate analysis:

The method followed was basically that of Metson (1961: 42). It involved the preparation of the samples by drying, crushing and sieving, then adding citric acid to dissolve the phosphates, and removing the solids by filtration. The resultant solutions were placed in a photospectrometer, and the absorptions read. The results were converted to parts per million.

Nitrate analysis:

The method was based on that of Eddy and Dregne (1964). It notes the colour change caused by the addition of a diphenylamine reagent to a solution of the soil in water. Samples with a high nitrate content produce an intense blue colour, the colour being less intense for lesser concentrations.

pH analysis:

Filtered solutions of the soil in water were analysed by means of a glass electrode pH meter, as described by Metson (1961: 17 ff.).

Results:

Detailed results are given in Park (1969a). Some more general results should be noted here.

It was expected that a swamp adjacent to the site would give fairly uniform readings, due to the equilibrating effect of water. However, five high readings were detected in the swamp, while other swamp samples showed average or low readings. Two high values occurred elsewhere in the site. The cause of these anomalies could be ascertained only by excavation, but it is possible that one or more represent latrines.

An interesting and unexpected result of the analysis was the generally low pH value of the soil, denoting acidic conditions. pH readings showed a gradient over the site, rising to neutral or slightly alkaline in the midden areas. It has often been claimed in the archaeological literature that an absence of midden material in a site can be attributed to the acidic soil conditions. Saurin comments: "These organic remains have certainly been dissolved in this porous, red, acidic earth, whose pH value is between 5.0 and 6.0" (Saurin, 1963: 434 - my translation). pH at Tiwai was between 5.0 and 6.0 also, yet a great deal of organic material was found. The edges of a midden deposit will be decayed in an acidic soil, but in the process the soil in the immediate vicinity will be neutralised, and the rate of decay slowed. In the time depth Saurin is discussing (thousands of years), complete dissolution could have occurred, but it is unlikely in the short space of New Zealand prehistory. Demonstrably, in a site some 500 years old (1508 \pm 53, NZR2311) abundant midden remained in a quite acid soil.

Because of the rescue nature of the Tiwai Point excavations, it was not possible to test the findings. However, the research carried out shows the potentiality of chemical analysis of archaeological soils for the location of latrines and middens, and suggests that this method might be of use in the location of other features such as houses or cooking areas. This can be done quickly and fairly simply, by surface sampling only - clearly an important advantage given the limited resources of time and finance which usually pertain in New Zealand archaeology.

Chemical analysis is a difficult and complex subject, in which few New Zealand archaeologists have any training. However, many of the most basic tests can be carried out by practically anybody, granted access to standard laboratory equipment, and a suitably qualified specialist willing to give the necessary advice. The author has no training in chemistry beyond an elementary high school level, but was fortunate to receive the advice of a number of people. Once a suitable procedure was developed, the analysis became a largely mechanical task.

It is believed that the methods of analysis discussed in this paper will prove of value to other archaeologists, in the location of material for faecal analysis, the immediate problem under investigation, but also in wider applications of the study of the chemical composition of archaeological sites.

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