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THE IMPORTANCE OF LITHIC TECHNOLOGICAL STUDIES IN ARCHAEOLOGICAL INVESTIGATIONS

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The importance of lithic technological studies in archaeological investigations cannot be stressed enough. This is because the majority of artefacts that we as archaeologists recover are made of lithic material (stone tools and the debitage, or waste material, that is associated with their manufacture). The history of mankind has been dominated by technologies associated with the making and using of stone tools; people have been making and using stone tools for over two million years, accounting for over 99% of our history (Crabtree, 1972:1). Obviously past peoples have also been making and using tools of organic materials (e.g., wood, bone and fibre), but because of preservation problems these materials are rarely preserved for archaeological study. What is preserved, however, are the stone tools that were used to work these organic materials. Archaeologists must strive to get as much information as possible from lithic materials to be able to say more about the daily lives of the people who are being studied.

Archaeologists in Polynesia have long been interested in stone tools, with a primary focus on stone adzes (see Cleghorn, 1984, for a review of Polynesian adze studies). This long held interest is due in part to the intrinsic beauty of well made adzes as well as the recognition that there are similarities in adze forms throughout Polynesia, which could be used as a means of tracing relationships between various island groups. More recently, however, archaeologists, especially in New Zealand, have begun to study the more mundane lithic artefacts, the flakes and small bits of stone that abound in almost all archaeological sites (Leach, 1969; Jones, 1972; Norwood, 1974; Gillies, 1981; Brassey, 1985).

Three different approaches can be used to interpret lithic materials; typical archaeological analyses, ethnographic analogy, and experimental tests. Archaeological analyses consist of detailed analyses, based on both deductive and inductive logic, where variables (metrical and non-metrical) are factored out and reasoned explanations are given (e.g., Leach, 1969). This is the mainstay of archaeological investigations and convincing results are often obtained in this manner. Ethnographic analogy is often used by archaeologists to interpret excavated materials, while this can be useful, some have criticized archaeologists for their dependence on ethnographic analogy in that it simply pushes the ethnographic present back into the past and nothing new is

learned (Gould, 1980). The use of experiments in archaeology, as an analytic tool, is a relatively new development within the discipline and has enormous potential, especially in regards to lithic technological studies (Coles, 1979; Cleghorn, 1982:8-12).

It is argued here that an approach combining technological analyses of archaeologically recovered lithic material with a programme of experimental tests can produce accurate reconstructions of past behavioural activities. Once solid reconstructions are produced, explanatory interpretations can be offered for these past activities. Such an approach will be followed with the lithic artefacts recovered from the Pouerua Archaeological Project.

Experimental lithic technology

Experiments are important in that they are controlled situations that can be set up to approximate past happenings. They are controlled situations, because the variables involved can be isolated and controlled. Experiments also have the advantage of being able to be repeated, so that the results of several experiments can be compared. One of the strengths of archaeological experiments is that they provide a source of independent data for the testing of hypotheses regarding past human activities. In discussing the role of experiments in archaeological investigations, Ruth Tringham (1978) has made the useful distinction between bi-product experiments and behavioural experiments.

The principle aim of bi-product experiments is to test the physical properties of raw materials and the processes involved in the alteration of these materials. Bi-product experiments tend to be mechanical in nature, where the variables involved can be strictly controlled. These types of experiments have been used to investigate attrition and edge-holding (Cleghorn, 1982:64-79; Gould et al, 1971), fracture mechanics (Bonnichsen, 1977; Cleghorn, 1982:83-91; Faulkner, 1972; and Speth, 1972), heat treatment (Purdy, 1975), and use-wear (Keely, 1977; Tringham et al, 1974).

Behavioural experiments, also sometimes referred to as replicative experiments (Flenniken, 1978), are not mechanical in nature and the variables involved are more difficult to control. The purpose of behavioural experiments is to test the "skill and techniques of the artisans performing different tasks, and to discover the technical problems that had to be overcome by prehistoric stoneworkers" (Cleghorn, 1982:10). Behavioural experiments are important as they can replicate postulated manufacturing sequences as well as the final products and the waste material associated with manufacture (Flenniken, 1978 and 1981). They can also produce information on debitage accumulation rates, and production time estimates (Cleghorn, 1982:221-341).

These two types of experiments differ in the questions that they address, as well as their ability to control variables. Both generate independent sets of data that can be used to explain archaeological phenomena. As such, they constitute a powerful methodological approach for the understanding of past behavioural activities.

The Pouerua Archaeological Project

The Pouerua Archaeological Project, directed by Douglas Sutton, has just completed its third and final phase of fieldwork. Several articles (Sutton 1982, 1983, 1984) have been published describing the background and preliminary results of the project, and a master's thesis has been produced analysing the lithic assemblages recovered during the first season (Brassey, 1985).

The overall goal of the project is "to clarify the origin and operation of the Maori chiefdomship in central Northland" (Sutton, 1983:117). More specifically, the project aims to "define prehistoric settlement patterns and food production strategies at Pouerua" by considering: "(1) antiquity of occupation, (2) methods of land modification and patch improvement used in food production, (3) definition of different types of settlement units present, (4) clarification of the relationships between settlement patterns and methods of food production and how these changed through time" (Sutton, 1983:107).

In three seasons of excavations, six open settlement sites (N15/236, 237, 255, 501, 505 and 507) and four pa sites (N15/5, 44, 224 and 261) have been excavated (Figure 1). The following are brief descriptions of these sites.

N15/236 is a small hillock, where excavations revealed two phases of occupation: first a storage pit was dug into the ground surface, which was subsequently filled in, and then a small, temporary field shelter was constructed and utilised for a short period of time (Sutton, 1983:113).

N15/237 is a ridge top open settlement. A square-shaped house with a single phase of occupation was uncovered. Contiguous to the house was an area used for cooking and food preparation (Sutton, 1983:112).

N15/501 is a hillock top open settlement. Excavations revealed two roughly square-shaped houses, one superimposed over the other, atop an artificial terrace (Sutton, 1983:112).

N15/507 is a ridge top open settlement consisting of six terraces. Excavations in one of the terraces revealed a semi-subterranean house, and possibly evidence of an earlier occupation which was obliterated by the construction of the house (Marshall, ms.).

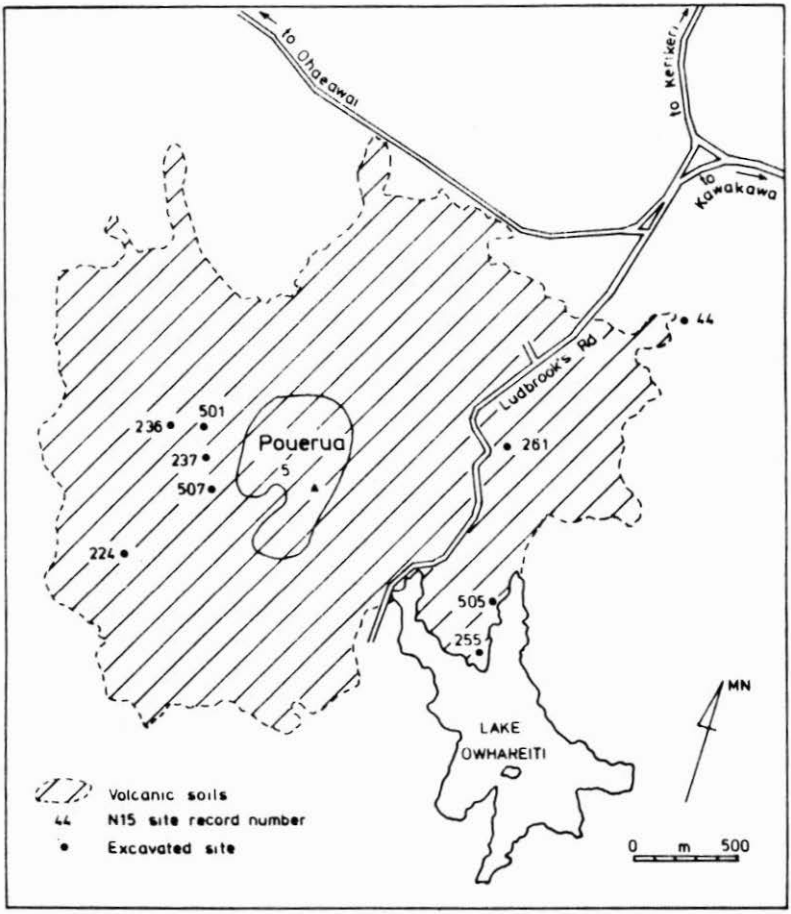

FIGURE 1. Pouerua area showing location of sites mentioned in text.

The above sites are all located in Study Area I (Sutton, 1983) and the preliminary results suggest that the settlement pattern of this area involved single household open settlement sites, probably of late prehistoric age. The houses were probably used for short periods of time, while agricultural pursuits (clearing, planting, harvesting etc.) were being followed (Sutton, 1983:113).

N15/255 consists of two houses, a small shed, a large pit, and two small terraces clustered together on a small hillock. Sutton (1983:114) suggests that both houses were in use at the same time and that "the difference in their form, construction and contents are taken, at present, to reflect functional differences or status differentiation". Brassey (1985:115-119) provides data to support the functional differentiation interpretation.

N15/505 consists of a cluster of habitation sites on a small modified hillock. Excavations revealed that the hillock had been modified to a large extent during three different occupation phases. At least five houses and three storage pits were constructed at this site (Marshall, n.d.).

The above two sites are located in Study Area II on the northwest side of Lake Owhareiti (Sutton, 1983) and are more complex than the sites investigated in Area I.

N15/5 - Pouerua. The largest pa in the project area, and the most intensively investigated. After exploratory excavations during the summer of 1983-84, intensive areal excavations were conducted this past summer. The purpose of these excavations was to show the stratigraphic and functional history of the tihi area.

N15/44 is a pa that had three areas trenched which revealed a complex stratigraphic sequence. One of the areas excavated produced preserved kumara (Sutton, 1984:Plate 1).

N15/224 is a pa that had excavations conducted in six areas. It is unusual because of its stone retaining walls and because it only had evidence of a single phase of occupation (Phillips, personal communication; see also Phillips, 1980:Fig. 8).

N15/261 is a pa that had three areas excavated. Excavations in the lower terrace revealed a complex stratigraphic sequence that culminated in prehistoric and early historic houses.

These four pa are the most complex archaeological sites investigated in the project area. Each site (with the exception of N15/224) has a complex stratigraphic history, and there is a good possibility for functional differentiation between areas of each site.

All of these sites have produced large numbers of artefacts (Table 1), the majority of which are lithic artefacts. The lithic artefacts from these sites will be analysed during the

course of this year. The general aim of these analyses is to determine the technological bases of the different types of stone tools (i.e., the raw materials used, how the raw material arrived at the site, and the manufacturing techniques utilised), and the functions of these stone tools. This information will then be related to the overall goals of the Pouerua Archaeological Project by:

1. producing information on the operation of households in terms of what tasks were done with stone tools and where manufacture and repair of stone tools was done in and around houses;
2. clarifying the differences in distribution of these activities within and between structures, so that we can identify patterns and detect differences; and
3. identifying common materials and artefacts present in the sites (and by implication uncommon or curated materials and artefacts), so that we can determine if their spatial or chronological distribution has any significance in relation to status associations.

Site Number	Total Artefacts Recovered
N15/5	4,162
N15/44	240
N15/224	353
N15/236	21
N15/237	515
N15/255	4,180
N15/261	2,852
N15/501	226
N15/505	1,921
N15/507	100
Total	14,570

TABLE 1. Artefacts recovered from the Pouerua Project. (Note: Artefact numbers are based on computer printouts of original field artefact registers; some modification of numbers may result when the assemblages are analysed).

A research design

Given the number of sites that have been excavated at Pouerua and the number of lithic artefacts that have been recovered, several general research topics can be addressed. Robert Brassey's (1985) thesis on some of the Pouerua lithic assemblages is an excellent place to start, as he has put forward several interpretations and testable propositions that can lead to further lithic technological studies.

In discussing the Phase I sites, Brassey (1985:106-108) shows that Sites 255 and 505 had more than one house present and interprets these sites as habitations for extended family units. In contrast, Sites 236, 237, 501 and 507 were probably for domestic units of a smaller scale, and possibly occupied for shorter periods of time. In his Table 8, Brassey indicates that the extended family sites have more material from a wider range of sources present and more activities represented, than the houses interpreted to be for small domestic units. Given this dichotomy, we might expect discrete specialised activity areas in the Sites 255 and 505, and overlapping activity areas in the other sites. We might also expect more evidence of "housekeeping" (sweeping material up and disposing of it in special areas) in the sites 255 and 505, than in the other sites. This distinction between size of domestic unit and duration of occupation is intriguing and holds promise for the interpretation of other sites in the project area.

Brassey (1985:115-119) also makes a functional distinction for the two houses that were excavated in Site 225. The Area 1 house is the larger of the two and contained a large amount of chert and obsidian as well as a range of other artefacts, including a number of gabbro artefacts which he interprets as being indicative of adze manufacture. The Area 2 house is smaller and semi-subterranean. It contained chert but no obsidian artefacts, and also contained a range of artefacts associated with stone working (at least six grindstones and 18 complete or broken attrition saws). Brassey suggests that the Area 2 house was probably occupied by males who specialised in working stone within the house (particularly nephrite) and that they did not carry out any activities that required obsidian. If it is true that the Area 2 house was utilised by stoneworking specialists, we might expect that the chert flakes in this house were detached with greater skill than those found in the Area 1 house.

A third interpretation offered by Brassey relates to the general nature of Pouerua flake assemblages. He states that "the flake material in the Pouerua assemblages appears to be similar to other New Zealand assemblages... in that there is no obvious preferred shape or method of manufacture" (1985:71; emphasis added). This interpretation is immediately testable:
1. flakes can be measured (length and width) and ratios calculated to see if there is a preferred size that was being manufactured;
2. the edge morphology, or flake shape, can be recorded to see if there is a pattern to the shape of flakes that were being produced; and
3. replicative experiments can be conducted that aim to determine the technological processes involved in producing these flakes.

Following the lead provided by Brassey's (1985) work, this year's research will commence with an analysis of the N15/5, Area IV assemblage. The house that was uncovered in this excavation is being interpreted by Sutton (personal communication) as a late prehistoric meeting house, that was abandoned after 1820 but before 1835. This assemblage is being chosen because its location on top of Pouerua suggests that there will likely be contrasts between it and the smaller domestic unit assemblages previously analysed. The analyses to be undertaken aim to address the following research topics:

1. Sort out the artefacts and waste material by material type (obsidian, chert, etc.) and determine what types of artefacts were being made out of each type of material. Do these different artefact types serve different functions? Is there some physical property of the stone that would explain the different artefact types? If not then why are they being made out of different materials?

2. Utilising Brassey's (1985) sourcing data, compare artefacts that were made from material that was transported a great distance with artefacts that were made of locally available material (e.g., Mayor Island vs. Kaeo obsidians). Are there differences in the artefact types that are being made? Are there differences in the physical properties of the different sources? (Brassey (1985:134), for example, proposes that the Kaeo obsidian is inferior to the Mayor Island obsidian; this needs to be tested). If the answer is no to both of these questions, then some sort of sociological explanation will have to be found.

3. The assemblages recovered from the different sites excavated during the course of the project will be compared to see if there is any indication of craft specialisation or differential skill at the different sites. Two measures of differential skill have been developed in the study of Hawaiian adze preform manufacture (production output estimates, and flake striking platform thickness to flake length ratios) (Cleghorn, 1982:160-164, 213-214, 322-323 and 338-341). The latter measure should be applicable to the Pouerua situation (i.e., if we find structures with assemblages that have significantly higher ratios than we can interpret these to be the result of greater skill and possibly produced by specialists).

4. In order to determine the form of the material when it arrived at the various sites, the flake material will be examined for the presence of cortex (the natural chemical or physical weathering that covers the surface of naturally occurring nodules of lithic material). This will provide clues as to the state of lithic material when brought to sites, i.e. as natural nodules or as prepared or trimmed cores. Brassey (1985:73) has done some preliminary work along this line and has proposed that the chert in Sites 255 and 505 was probably brought to the sites in nodule form, covered with cortex.

5. As part of the analytical programme, experimental work will be done on replicating the manufacturing processes of the various types of artefacts present at the sites. The results of these experiments, when combined with the results of technilogical analyses of the archaeological assemblages will allow statements to be made regarding the actual behaviour of the prehistoric artisans.

These lines of inquiry should enable us to develop an understanding of how the artefacts were being made, potential functions of the artefacts, information on the selection of raw material, and some insight into the behavioural aspects of the stone tool industry, i.e., craft specialisation, differential stone working behaviour, and possible reasons for importing raw material.

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