PREHISTORIC COMMUNITIES IN PALLISER BAY, NEW ZEALAND.

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ABSTRACT

A programme of archaeological research was undertaken in the Wairarapa region on the northern shores of Cook Strait, New Zealand. Some 27 excavations conducted during a 3 year period were designed primarily to examine prehistoric economy and settlement pattern in the region. In addition, studies were made of early historical records of Maori life, Maori traditional history, and aspects of the modern and prehistoric environment. In the analysis of excavated material, particular attention was given to physical anthropology, subsistence economy, and the trading patterns revealed by the importation of a number of rock types from elsewhere in New Zealand.

It was found that human occupation in Palliser Bay was most intense from about 1150AD to 1400AD, and that significant depopulation may have occurred by 1650AD. At least 6 kinship linked communities were resident in this early period, probably originating from further north. Over several centuries they strengthened their social ties with other communities in Cook Strait, progressively losing contact with northern areas. A conjunctive picture is reconstructed of a typical community of 30 to 40 people, and aspects of their physical condition, economy, technology, settlement pattern, external social relationships and ideology described. Their economy was initially a balance between hunter-gatherer pursuits and kumara-based horticulture, but in the course of time their forest clearing activities set into motion a series of episodes of erosion which culminated in the development of broad shingle river beds and active fans. High riverine sediment loads led to the loss of much of the local marine fauna at river mouths. A general climatic deterioration about 1450AD and then from 1600 onwards accelerated this process to render the environment largely unsuitable to Polynesian habitation. It is argued that coupled to these changes are settlement pattern modifications and an increase in human disease and malnutrition.

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CHAPTER 1

REGIONAL CULTURAL DIFFERENTIATION IN NEW ZEALAND ARCHAEOLOGY

Regional differences and their meaning have been a recurrent theme in reconstructions of New Zealand culture history. In the following chapter various aspects of regionalism will be discussed to provide a background against which the motivation and objectives of the present study can be put forward.

A REVIEW OF INTERPRETATIONS OF REGIONAL VARIATION

THE CULTURE AREA APPROACH TO REGIONAL DIFFERENCES.

One of the most vocal spokesmen for the importance of studying regional differences was H.D.Skinner, who commented in 1921:

> "the material cultures of different districts in New Zealand show marked and deeply seated differences,almost as great as those that separate the material cultures of, for example, the Hawaiian Islands, the Marquesas, and the Society Islands ...."
>
> (Skinner, 1974c:20)

He went on to divide New Zealand and the nearby Chatham Islands into eight 'culture areas', each with its own distinctive cultural items from dialect to house shape and food plants. Basically, however, the criteria on which Skinner concentrated were artefact forms and styles, in keeping with his museum orientation. He noted, for example, the variations in boat design, with double canoes characteristic of South Island areas, the single canoe in the North Island, and the wash-through boat in the Chatham Islands. Art styles and wood carving were also explored in some detail, in particular the virtual absence of carving in the south, and the importance of spirals and curvilinear patterns in the north. By contrast, decorative art in Murihiku and among the Moriori was based on rectilinear designs. At this stage Skinner was not able to document the differences in Central and East Coast areas in the North Island, and even for the other six culture areas he could offer only uneven coverage in many of the categories.

Skinner proposed that four of these districts (the Moriori, Murihiku, Kaiapoi and Wakatu) belonged to a separate group - the 'Southern Culture' - closely allied to Polynesia in the eastern Pacific, and that a 'Northern Culture' (the West Coast, the East Coast, and the Central and Northern Culture areas) found far closer parallels with Melanesian cultures in the western Pacific (Skinner, 1974c:22). He argued that the earliest people in New Zealand were from the western Pacific and that they settled the more northern areas; somewhat later some migrants from the eastern Pacific settled the east coast of the North Island and spread into the unoccupied southern districts (Skinner, 1974c:22-3; see also Duff, 1956:5). This opinion of a direct Melanesian immigration was revised by Skinner after his close examination of the Moriori between 1919 and 1924 (Skinner, 1923; 1928), when he became convinced of the thoroughly Eastern Polynesian character of these people. Any apparently Melanesian traits found in the Northern culture areas were then attributed to the marginal survival of very ancient styles present in Oceania generally, from Indonesia to the Marquesas (Skinner, 1974d:44). Skinner also noted as early as 1921 that the culture areas were remarkably similar to Cockayne's (1921) botanical provinces of New Zealand. His culture areas also showed some concordance with Maori tribal divisions. Neither of these conformities had been anticipated by Skinner, and of the former he remarked: "the significance of the correspondance of these two sets of areas based on wholly different data is not apparent" (Skinner, 1974c:23).

It seems fair to comment that Skinner was somewhat confused on the question of regionalism, and was unable in the course of his long academic career to provide a satisfactory explanation of its meaning in historical terms. However he was able to persuade most of his contemporaries to abandon the idea of multiple settlement of New Zealand, an idea which has emerged again quite recently as will be discussed below. His principal contribution to these issues was not his insight into historical questions but his documentation over many years of the actual details of regional variation. Between 1923 and 1969 Skinner's comparative studies have reinforced the distinctive nature of the Murihiku culture area in particular, with analyses of many more artefacts such as the paddle with central spine (1974e), the slate knife (1974f), and the paired chevroned amulet (1974b: 76ff). It is important to note that in his later papers where he presents such differences in distribution there is even less attempt to explain them. The majority of later workers have avoided any comment on these particular items, and this probably reflects the widespread uncertainty as to their cultural significance in prevailing historical frameworks.

To a large extent, therefore, Skinner's work was cartographic, and the resulting map was rigidly fixed in two dimensions with little provision for changes in a temporal axis.

THE MARGINAL SURVIVAL APPROACH TO REGIONAL DIFFERENCES

The tendency to look upon cultural evidence in the spatial dimension only, prevailed in island Polynesia also until quite recently; Danielsson has commented:

"no archaeological excavations were ever undertaken in

> Polynesia, prior to 1950, simply because everybody knew for certain that it was absolutely meaningless and useless to do so"
>
> (Danielsson, 1967:32)

This dogma partly rested on the belief that man's entry into the Pacific was so recent that few cultural changes could have taken place. However, as far back as the 1860s, significant temporal shifts had been demonstrated for New Zealand at least, by von Haast (1871); Skinner and others minimised the importance of chronology in favour of simple culture-area interpretations. The dogma was thoroughly criticised as early as 1940 by Shapiro who exclaimed that "Polynesia has a past and much has occurred in it" (Shapiro, 1940:11).

A major conceptual change occurred in the 1940s with the work of Duff and Lockerbie on Moa-hunter sites in the South Island (Duff, 1956; Lockerbie, 1959), when chronology became a crucial issue. As Duff himself remarked:

> "The problem was the difficulty of demonstrating in any one island or group that certain items were earlier, and other later, features in that culture; the problem was in short to unscramble the omelette"
>
> (Duff, 1956:5)

Duff attempted this when he undertook the first synchronic study of a prehistoric group in New Zealand - the people at Wairau Bar - and then compared their culture with that of the Maori observed at European contact. His principal conclusion was:

> "The Moa-hunter phase of Maori culture, as isolated and defined here, is in my opinion clearly distinct from pre-European Maori culture, although it is probably ancestral to it."
>
> (Duff, 1956:6)

Duff's excavations and analytical techniques have been the subject of much criticism, and there is some doubt as to whether the Wairau Bar evidence is truly synchronic. Despite this uncertainty, Duff was responsible for turning Skinner's 'map' on its side and emphasising the value of temporal as against geographical comparisons. The advent of radiocarbon dating did much to heighten the distinction, and in many ways New Zealand archaeologists have continued this pre-occupation with chronology to the present day.

Duff explained the regional differences in New Zealand in terms of 'Marginal Survival', a concept developed by Wissler (1923) to generate chronology out of spatial distribution. Duff simplified Skinner's culture areas into the Northern and Southern groups, and argued that after the initial settlement of the centre of the North Island, waves of people moved outwards, with those on the periphery of this movement retaining more of the earlier culture than those in the centre. He commented:

> "culture changes more rapidly in the heart or central area which is in this case the major land mass of the North Island"
>
> (Duff, 1956:7)

Thus the observed regional differences in New Zealand from the North to South Island were merely a reflection of changes through time, with the ancestral Polynesian culture surviving in a more intact form in the South Island. Implicit in this interpretation was the notion that the earlier culture in the North Island, when it was more fully documented, would be found to be similar to the same ancestral Polynesian culture as found in the South. In general terms this prediction was correct, although significant differences have been found between early sites in the two islands.

THE RETURN TO FIRST PRINCIPLES - GOLSON'S ORGANISATIONAL MODEL

Duff's research at Wairau Bar was followed by a decade of intensive excavations in the northern half of the North Island, particularly on sites thought to be comparable in age to southern Moa-hunter 'camps'. Although sufficient information had been assembled by 1959 to show that a fairly similar early culture had indeed existed in the north, the evolutionary relationship postulated by Duff between Moa-hunters and Maori was not proving as easy to document. Sufficient doubt had arisen on the propriety of the simple evolutionary model for Golson to re-open the question in 1959. He wrote:

> "What relationship exists between the late and the early types? Does the term Maori or Classic Maori..... denote a phase in the development of Eastern Polynesian Culture in New Zealand, or does it denote the product of hybridization between Eastern Polynesian and other as yet undefined traditions? At present we lack the data to answer these questions, though the title of Dr. Duff's book, The Moa-Hunter Period of Maori Culture, indicates the trend of orthodox opinion."
>
> (Golson, 1959:30)

Golson there suggested a return to first principles and offered a model for organising New Zealand archaeological data without pre-empting future interpretations. He believed that "the basic units of archaeological research should be defined without anticipating the solution to these problems, which is after all the end product of research" (Golson, 1959:30). There is little doubt that Golson realised the possibility of multiple settlement of New Zealand, a concept which as has been shown was abandoned by Skinner and others in the early 1920s. He argued further that:

"A systematic search for and excavation of non-Archaic sites should provide evidence as to whether we have to reckon in New Zealand prehistory with immigrant groups other than those responsible for the Archaic and whether these other groups were Polynesian or not. A theoretical framework has been suggested earlier in this paper to accommodate these possibilities."

(Golson, 1959:66)

Briefly, this open-ended framework was a blend of Old and New World archaeological theory in which prehistoric cultures were subdivided into temporal and geographical facies - defined as 'phases' and 'aspects' respectively. Golson considered that should New Zealand prehistory prove to be culturally diversified, different Phases or Aspects could be elevated to 'Culture' status with the minimum of reorganisation (q.v.Golson, 1959:35, 36).

Superficially, the paper appeared to offer a blend of Skinner's culture-areas and Duff's periods of prehistory with a promise of more divisions of space and time than had hitherto been possible. This illusion was destroyed, however, when Golson offered his re-interpretation of New Zealand archaeological data, for in place of Duff's Moa-Hunter and Classic Maori periods, he suggested the Archaic and Classic Maori phases - identical to Duff's periods in most respects other than name. On the question of aspect, Golson merely commented: "Only in Otago is the evidence sufficient for us to begin to think in terms of a regional aspect of the Archaic" (Golson, 1959:37); he was here alluding to Lockerbie's important study of this region (q.v. Lockerbie, 1959). No aspects were suggested for the Classic Maori phase.

Threaded through Golson's synthesis was a clear division of the evidence from the North and South Islands, paralleling the major divisions advanced by Skinner much earlier and followed by Duff. This was the only attempt to define regional boundaries despite the theoretical discussion of aspects.

While Golson doubtless set out to simplify space-time organisation of data, it is debatable whether there has been more or less confusion since, especially on the exact denotation of the term 'aspect'. Despite this shortcoming it would be wrong to underestimate the importance of this paper to subsequent archaeological work in New Zealand. For personal as well as academic reasons, Golson had a profound influence on contemporary archaeologists, and there have been many attempts to use the organisational model he devised (see below). Unfortunately these have often been confused, especially in the treatment of regional variation within the term aspect.

APPLICATIONS OF GOLSON'S TERM ASPECT

In 1962 Parker published an "attempt to apply Golson's methodology to the analysis of structural evidence from two sites widely separated in the North Island" (Parker, 1962:223), namely Skipper's Ridge (Opito, N40/7) on the Coromandel Peninsula, and Kumara-Kaiamo (Urenui, N109/9) in Taranaki. Parker identified close similarities between the two sites, and of one set of structural evidence "proposed that the assemblage of this type should be recognised as a distinct Aspect of early New Zealand culture and that provisionally it should be called 'New Zealand Archaic B' " (Parker, 1962:224); of the other he commented: "This seems to justify treating these assemblages as another distinct Aspect and provisionally 'Archaic A' seems the most convenient name" (Parker, 1962:225). Clearly then Parker intended the two Archaic assemblages to denote Aspects (Golson's regional cultural segments), yet he was combining in single regional units assemblages which occur 300km apart on opposite coasts of the North Island. The matter was complicated even further when Green later referred to the evidence from Skipper's Ridge Level 1 as having been "assigned to the Coromandel Aspect of the Developmental or Archaic A Phase" (Green, 1963b:61). Finally, it must be noted that this sub-division of the Archaic cannot be into phases, which are defined as "significant segments in the complete evolutionary sequence of the culture" (Golson, 1959:35), because at Kumara-Kaiamo, Archaic B precedes Archaic A, whereas at Skipper's Ridge the reverse sequence applies (Parker, 1962:223-225). The theoretical significance of this reversal has been discussed a number of times (Shawcross, 1964c:96; 1966:65-6; Golson, 1965:86; Bellwood, 1969:204), and it now appears there is little chronological or spatial meaning in the distinction.

The most important application of Golson's model was the intensive study and synthesis of archaeological evidence in the Auckland province (Iwitini) carried out by Green (1963). Using a combination of economic and ecological evidence, structural features and settlement pattern, a series of six phases was suggested. Green's model involved an interplay of general theories of cultural evolution and information specific to New Zealand. As a result it is difficult to decide the extent to which the phases actually arise out of New Zealand archaeological data.

The Auckland Province was chosen by Green for this regional study for quite pragmatic reasons. He noted that the area had been the focus of controlled excavations in the previous decade of New Zealand archaeology, but stressed that it should not really be looked upon as a cohesive regional unit (1970:3). Nevertheless, he obviously regarded Iwitini as the probable birthplace of Maori culture. In applying Golson's term 'aspect' in the Auckland study, Green used a definition which was no more precise than Golson's: "An aspect is composed of a number of site components from a given region which occur within a given period of time" (Green, 1970:11). In various parts of Green's work can be found references to "the Coromandel Aspect of the Archaic Phase" (1970:17), " 'Bay of Plenty' as the name for that aspect" (ibid), and "The Sarah's Gully aspect" (1970:23). Clearly, an aspect can vary in size from a single site to a large region, and there is no implication that it denotes the activities of single communities. In Green's earlier joint paper with Shawcross, however, this was specifically intended. It was stated that:

> "Within any region of New Zealand at a given period of time one finds various types of sites which represent all the activities carried out by a community...... Together, these make up the regional aspect and may be designated by a local name to distinguish them from other aspects"
>
> (Green & Shawcross, 1962:215)

A year after this definition appeared, Green obviously considered the identification of single communities to be archaeologically impracticable, and in his conclusions redefines aspects in social terms:

> "The aspect is thought of as the basic operational unit within a region representing contemporaneous and culturally identical communities which exhibit no marked change over a particular period of time"
>
> (1970:43)

and elsewhere:

> "An aspect, then, is an <u>aggregate</u> of communities by which is meant certain number of communities which are bound together by close social, political, military, commercial ties...... In New Zealand it would correspond fairly well with the <u>iwi</u> or tribe, while the community, where it was monolineal, would correspond fairly well to a <u>hapu</u>, the so called sub-tribe...... or non-unilineal descent group"
>
> (1970:44)

In addition, Green raised the important point that the boundaries of aspects could change dramatically through time (1970:17). For example, he considered that far larger areas would be involved in the earlier aspects, presumably under the assumption that earlier communities were more mobile than later ones.

Overall then, Green illustrates some variation in his use of the term aspect, and this undoubtedly reflects difficulties and imprecision in the regional information available. Nevertheless, a more rigorous use of the term was called for. If 'community' was intended by the term, than 'Sarah's Gully Community' is more meaningful than 'Sarah's Gully Aspect'. The same point could be argued were aspect intended to refer to tribes, confederations, bands or any other aggregate of communities.

TRIBAL TRADITIONS AND DISTRIBUTIONAL STUDIES

In the recent studies of Groube (1970) and Simmons (1971) a break was made away from Golson's organisational model, and regional diversity was explored from an apparently new viewpoint. This approach involved the correlation of distribution patterns of particular types of pa, adzes, carving elements, tiki, and fish-hooks, with tribal territories and migrations recorded in Maori oral tradition. The result was an archaeological definition of Ngati Awa artefact and fortification styles. Surprisingly, the difficulties of writing culture history from oral traditions are not stressed in either of these studies, and in parts of the argument traditional evidence appears to prop up the archaeological data, despite Simmon's plea for independent analysis (1970:1), and Golson's earlier warning that:

> "only when the archaeological and traditional fields have been worked over, each in its own right and by its own techniques, can the results of the one safely and profitably be measured against those of the other."
>
> (Golson, 1960:380)

Correspondence between artefact distributions and tribal traditions was actually first noticed by Skinner in 1921 (1974c), and the interpretation of regional diversity which was offered by both Simmons and Groube was, in typical Skinner fashion, based on the historical phenomenon of migration.

CONCLUSIONS FROM THIS REVIEW

There are two features characteristic of these attempts to describe and interpret regional variation. The first is the insecurity of the basic information. One extreme example is the definition of Archaic art styles in New Zealand (Barrow, 1969), which is based on such items as the undated Kaitaia carving, the undated wooden dog from Monck's Cave, and the undated human figure from the Pyramids. These three carvings are practically devoid of associations and this lack of any cultural context is common to many museum collections. Not all cases are as extreme as this, but even though Green was able to integrate much material from controlled excavations, many of his sites had no dates, no published reports, and had been incompletely analysed. Similarly, a number of Golson's illustrated Type-artefacts came from museum collections derived from fossicked sites, for example, Shag River, Hurunui Mouth, and Lake Grassmere (1969:42).

It might also be claimed that the regional frameworks within which Skinner, Golson and Green were working, were too gross to be useful in the initial organisation of archaeological evidence. Within the Auckland area both Golson and Green experienced great difficulty in reconciling the evidence from Kauri Point in the Bay of Plenty with that from Opito and Tairua on the Coromandel Peninsula (Green, 1970:17; Golson, 1961:14). Similarly, Skinner offered no explanation for the presence of a distinctive adze tradition - the Southland Adze - within one portion of the culture area known as Murihiku (Skinner, 1974c:110). These problems undoubtedly stemmed from being unable to integrate the scattered, and in many ways unprovenanced information.

The second feature is an unwillingness to explain regionalism in synchronic terms; instead these prehistorians have fallen back on chronological interpretations. Even Skinner, the arch-advocate of 'Culture Areas', reverted to explanations in terms of migrations and the survival of ancestral styles. Likewise, both Golson and Green paid far more attention to phases than aspects; it should be remembered, however, that the quality of the available archaeological evidence virtually precluded the separation of contemporary groups in New Zealand. Nevertheless, far more emphasis could have been given to the need for intensive excavation and analysis of contiguous sites in a limited area of New Zealand. In this climate it is understandable that Green should conclude that:

> "Many of these [regional] differences have historical rather than ecological processes as a major part of their explanation"
>
> (Green, 1974:30)

The question of multiple settlement in New Zealand has often been associated with speculation about the meaning of regional variation, and this appeared in the works of Skinner (1974c, although the opinion was later revised), Golson (1959:66), and Green (1970:54). This tendency to cast around for explanations in terms of migration and diversity of origin reflects the inadequacy of prehistoric reconstructions at a regional level. When the cultural character of smaller groups of people has been more satisfactorily described, more meaningful comparisons will then be possible between these groups and communities on different islands in Polynesia at different periods. Only then can the question of multiple origins be properly evaluated.

PRIORITIES IN THE ORGANISATION OF NEW ZEALAND ARCHAEOLOGICAL DATA

Both Green (1970) and Golson (1965:90) maintained that the establishment of overall phases in New Zealand cultural evolution should precede the formulation of regional aspects by intensive archaeological investigation of discrete areas. Green expressed this principle as follows:

> "phases..... are most useful in the initial stages of archaeological investigation. Later, when the regional pre-history of New Zealand becomes better known, it may even be possible to abandon the use of phases and compare aspects from different regions at various points in time in order to trace the ebb and flow of contact, innovation, diffusion, migration, and adaptation with greater precision than is permitted by a stagal approach"
>
> (Green, 1970:11)

This view has also been influential in working out research priorities in island Polynesia (q.v.Spoehr, 1968:174), although there are notable exceptions (Green, *et al*.1967; Green and Davidson, 1969; 1974). Historically, the development of archaeology in Europe and

America saw a similar concern with sequence and chronology for many decades before attention was given to studies in the synchronic dimension, including settlement pattern, palaeoecology, and prehistoric social organisation (Willey, 1968; Daniel, 1968). There is no obvious reason why this historical sequence of events should be followed in the formulation of future archaeological strategies.Furthermore, there are a number of dangers inherent in this approach. Firstly, it does not encourage intensive scientific excavations aimed at achieving synchronic prehistory, for phases can and have been constructed on the basis of unprovenanced museum collections just as easily as on the evidence of more rigorous scientific archaeology, obtained at far greater cost. Secondly, the generalised reconstruction of prehistory which results from this approach need not be valid in any area of New Zealand. For example, moa extinction and the development of fortifications have been documented in totally different areas of New Zealand, and a simple evolutionary sequence involving both processes may, in the case of one single prehistoric group, be completely inappropriate. Even within the Auckland area it now appears that the residents of the Coromandel had no more to do with the origins of the pa than the people of the Auckland Isthmus had to do with moa extinction. A useful analogy might be made with the mathematical concept of the 'average', which is merely a scaled aggregate. In cases where the figures to be averaged exhibit marked variation, it is recognised that the resulting mean only poorly represents any one of the individual figures. No one would be foolish enough to misuse averages in such simple cases; however, the lesson also applies in far more complex problems involving multivariate analysis where this issue may be less transparent. For example, averages have been used to 'fill in' missing data in studies of cranial morphology (Pietrusewsky, 1969) resulting in the creation of hybrid skulls which could never have existed. A more sensible approach is to 'fill in' with an estimate based on the particular cranium rather than on the abstract population. This is achieved by first investigating the variability and co-variability of the original field of study and then applying such techniques as multiple regression to the individual skull. Similarly, in archaeology, which involves highly complex multi-factorial analysis, the use of aggregates in the characterisation of local prehistory can be very misleading. This theme will be returned to in another part of this thesis where it will be shown that the trends in particular cultural processes can be in one direction in one region of New Zealand, but in the opposite direction in another. The use of aggregates in a number of similar cases has masked these important differences.

In terms of logic then, the adequacy of generalisations about prehistory can only be assessed <u>after</u> the nature and extent of regional variability has been explored. Despite the contrary claims, sanctioned by the history of archaeology, the epistemological order which should be followed therefore must be aspects first and phases at some later stage.

This need not imply a moratorium on the writing of general culture history in stagal terms; on the contrary, discussion and controversy at this level is a constant source of stimulation and useful new ideas. The 'wait until all the evidence is in' policy is both impractical and unpopular (see Green, 1970:49; B.F.Leach, 1970; cf.Smith, 1910a:287). It might be thought that there is a contradiction between these two suggestions, but the relationship between the process of writing stagal prehistory and the archaeological investigation of aspects is a complex one. The key point is that much archaeology in New Zealand has been motivated by the larger prehistoric 'problems' and in the long run has turned out to be wasteful of archaeological resources. Had the definition of regional aspects been a prime objective, a different range of questions would have been asked of archaeological sites which cannot be answered at a later stage. Much economic evidence, which is of vital importance to understanding prehistory, has been discarded as having no bearing on the particular national problems which prompted the excavation. In addition the former approach can lead to excavations scattered thinly from one end of the country to another, with consequent problems of site conjunction. The difficulties which have been experienced in the interpretation of the Houhora site in Northland or the Heaphy River site in North Westland are in part attributable to their isolation from other excavated sites.

When the present research began in 1969, there had been very few programmes in New Zealand of archaeological research in which a regional prehistory was an important objective. Lockerbie's research in South Otago produced a regional picture after many years of sporadic excavations, and his reconstruction in 1959 of the economic shift from moa-hunting to shell-fish gathering and fishing is perhaps the classic documentation of the effects of moa extinction (Lockerbie, 1959). No later publication has appeared, however, with details of the excavations, nor the quantities and identifications of shells, fish and bird bones.

Similarly, the concentration on sites near Opito on the Coromandel Peninsula was not a deliberately formulated regional research programme. Golson began work at Sarah's Gully with the aim of comparing North Island Moa-hunter culture with that defined by Duff for the South Island, and testing the hypothesis that man was contemporary in the North with only a remnant and declining moa population (Golson, 1959:13). Other excavations in this area were motivated by salvage needs and the desire to provide stratigraphical and artefactual links between various site types already explored, particularly the middens and pits. Again, the initial lack of a well integrated research programme operating on a number of fronts in this area seems to have affected the later stages of the work, for only interim reports have appeared, and tasks such as midden analysis and lithic identifications are only now being undertaken for some of the sites (Davidson, n.d.; Rowland, n.d.; S.Best, 1975). Despite this handicap, Green on several occasions has tried to weld together the available information to provide a regional prehistory of this part of the Coromandel (for example Green, 1970; 1972).

Work on a number of sites on the South Taranaki coast was apparently also motivated by finds of Archaic artefacts and moa-bones (Buist, 1961; Robinson, 1961). Once again, no integrated programme was devised and no final reports or regional synthesis has appeared.

Another area of concentrated research was on the shores of Tauranga Harbour at Ongari Point and the nearby pa and undefended settlement at Kauri Point. Work began here under Golson in 1960, and was initially aimed at defining "the relationship between the Archaic and Classic Maori" (Golson, 1961:13; see also Shawcross, 1964c:79). Later work by Green on midden sites and the undefended settlement was motivated by the desire to expand the cultural picture of the various periods (Green, 1963c:144), which up until that time had been primarily written in terms of structural evidence from the Kauri Point Pa (for example, Ambrose, 1962). Subsequent excavations at Ongari Point by

Shawcross (1964c; 1966) were designed to test the range of variation of cultural evidence in the area, and also to try and tie down the floating chronology of the Kauri Point Pa (Shawcross, 1964c:81). For the first time several archaeologists were cooperating in the one area on related problems. Much of the economic material has never been fully studied, however, and a synthetic regional prehistory has yet to be published.

Since 1969, the excavations on Motutapu have been written up in a series of papers which together constitute a regional report of considerable significance (Allo, 1970; Davidson, 1970a; 1970b; 1972; 1974a; 1974b; Leahy, 1970; 1972; Scott, 1970; Sullivan, 1972). Where available, information on earlier excavations by Golson was also presented (Scott, 1970), but much of the previous work was designed to investigate only the apparently late survival of the Archaic culture in this area (Davidson, 1970b:2, 10); research planning therefore was very limited in scope and outlook until the recent period, when a far wider range of problems and sites was investigated.

THE PROBLEM OF DEFINING ASPECTS

From the foregoing it should be clear that Golson's model fared rather badly in the hands of others, and the principal reason for this was probably the lack of clear directives as to how phases or aspects might be discovered from New Zealand archaeological evidence. Clearly, such subdivisions can only be justified after identifying some kind of discontinuity when mapping cultural evidence in time and space. Of particular relevance then is the notion of rate of culture change, as distinct from first order change, and the importance of mapping such rates was first stressed by Groube in his discussion of strophic models (Groube, 1967). Even here, however, few practical guidelines were advanced, although a pilot attempt was made to identify changes in the rate of change of cultural evidence in New Zealand using the Mahalonobis D square statistic (Leach, 1969:130-133). This example demonstrated the practicability of identifying chronoclines (Trigger, 1967) from archaeological evidence within the relatively short time-scale of New Zealand prehistory.

It has often been commented that the analysis of portable artefacts in New Zealand is not capable of yielding subdivisions of the past beyond the broadest segregation of assemblages (Golson, 1965: 79); this issue was taken up by Terrell who expressed "doubt on the utility of the concept of 'aspect' in New Zealand" (1965:125). His principal complaint appears to have been the difficulties of controlling chronology in New Zealand and undertaking temporal inferences because of a supposed lack of diagnostic artefacts. Shawcross (1964), however, in a detailed study of stylistic changes in wooden combs from Kauri Point showed the undue pessimism of this view, and Ambrose (1966) pointed out that there are many facets of prehistoric culture other than portable artefacts which can be used to relate sites and sequences together. In fact Terrell seems to have ignored the plethora of architectural features of North Island sites and a range of economic evidence such as changes in the utilization of different species of moa, obsidian types, and also of different species of shellfish. Such evidence had already been put to very effective use by Green (1970; see also Golson, 1965) in relating sites and sequences together. A more accurate characterisation therefore is that the real "limitation on archaeology in New Zealand is not the lack of 'diagnostic' artefacts but the lack of analysis" (Ambrose, 1966:73).

Since Green's study of the Auckland Province the analysis of excavated materials has put new forms of evidence into the hands of archaeologists, of use in assessing the similarity between sites. These include behavioural markers such as different butchering techniques of birds and mammals, subtleties in the trading of raw materials (such as the importation of roughly shaped adze blanks by communities with less sophisticated technology), and differences in the collecting strategies and cultural preference for different shellfish species. In addition, the last decade has seen a revolution in archaeological methodology, and this has resulted in a profusion of lines of evidence which can be used to relate sites in time and space. Techniques have been culled from biology, physics, mathematics, geology, and many other scientific fields (Brothwell & Higgs, 1969; Butzer, 1971; Clarke, 1968; 1972; Evans, 1972; Goodyear, 1971; Higgs, 1972; 1975; Hodson, et.al., 1971; Renfrew, 1973; Tite, 1973), and these promise a far richer return for archaeological labours in future.

At the same time a fundamental problem still exists concerning the current definition of 'aspect' which stresses an aggregation of communities. This cannot be a basic operational unit in archaeology, simply because of the great variety of groupings that human societies have evolved, sometimes crossing linguistic and other cultural boundaries. These can vary through time and space, and many of the larger groupings are only mobilised on rare occasions in one man's lifetime. The well known phenomenon of segmentary opposition (Evans-Pritchard, 1940:142ff) means that one must always answer the question 'what are the circumstances?', before discussing aggregates of communities. By implication, an archaeologist should expect to find evidence of several sorts of aggregations in the remains left by any one community in its archaeological sites. In other words, an aggregate of communities is an ephemeral sociological concept which can only be described by archaeologists after long and intensive regional study.

A more restricted definition for aspect is desirable, and the possibility of returning to the earlier concept of community (Green and Shawcross, 1962:215) should be explored. It should be noted, however, that this earlier definition was thought of in terms of 'assemblages of types' - a blend of the theories of Childe (1935) and Spaulding (1960). The modern archaeologist is much more concerned with the behaviour that produced these 'types' and thus his community is composed of people rather than artefacts. Communities are probably the easiest social unit for the archaeologist to reconstruct out of the archaeological components of layers and sites. In many parts of New Zealand this unit of organisation may involve evidence from several archaeological sites. For example, each of the various communities comprising the Poutini Ngai Tahu tribe (or aggregate) has been shown to have evolved a system of both nuclear and satellite settlements for effective environmental exploitation (H.Leach, 1969). However, in other instances the major archaeological component of a community would be the single village site.

The most important features of a community are habitual social contact and economic cooperation within a particular area. With this less ambitious definition of aspect, combined with the improved techniques for assessing it, the obstacles in the way of regional studies have greatly diminished.

It is important to note that if the basic operational unit is the single community a wide range of archaeological questions about human behaviour are relevant which have not been important in research aimed at diachronic prehistory, the principal subject of which is cultural change. If synchronic reconstructions are the initial goal then the questions which must be asked have the community as their referent - from where did these people obtain their raw materials, how did they fashion them into implements, what preferences did they have in shellfish gathering, what strategies were adopted to overcome winter shortages, how did they divide land equitably, what rules did they follow in positioning houses and pathways, what kind of interaction did they have with other contemporary communities? In this orientation - which might be called the interrogative or behavioural approach, where the referent is the community - people are the object of study, and the bones, artefacts and soil layers merely the vehicle of research.

It is not claimed that diachronic studies are less important; on the contrary, research into cultural evolution and change is closer to the long term goals of anthropology. However, in this epistemological framework, diachronic research is logically subsequent to the reconstruction of community behaviour in time and space. In addition, the study of temporal change will refine the synchronic reconstructions, since ultimately a structure "can only be meaningful when used as an historical expression to denote a set of relations known to have endured over a considerable period of time" (Evans-Pritchard, 1961:11).

In suggesting that archaeologists use the single community as their basic social unit rather than an aggregate of communities, it is recognised that the main practical difference will be the type of questions posed during excavation and analysis. Significant cultural variation may exist between communities welded together in larger aggregates, and this is especially true of economic behaviour such food gathering strategies and the utilisation of local resources. To ask such questions of aggregates clearly invites oversimplification.

For example, in the case of the Poutini Ngai Tahu aggregate only the Mawhero community had access to fernroot (H.Leach, 1969:69), while the production of the greenstone mere was restricted to the community at Taramakau (Heaphy, 1846:237). It would be wrong to attempt the reconstruction of a single economic pattern for this tribe.

It is also realised that the investigation of a single community may necessitate the use of archaeological evidence which belongs strictly to another community separated from it in time or space. This compromise reflects archaeological realities, because not all components of any one community will survive. Nevertheless, this procedure can be controlled more confidently than the alternative of accurately grouping the discrete components of an aggregate.

CONCLUDING REMARKS

The issue of regional cultural variation has been taken up by leading New Zealand prehistorians for many years and their continuing interest must be seen as an indication of the significance of the differences. Yet it has been shown that the explanations they have offered are often vague references to historical events such as migration. What is needed is a series of intensive archaeological programmes involving the excavation of a range of sites in a restricted area. Whereas earlier regional studies appear to have had a 'sequence' as a prime objective, future programmes should aim to first reconstruct community activities in their ecological context, and only later undertake a study of evolutionary developments. This can only be achieved by research on a much broader front, utilizing some of the many new techniques developed over the last decade.

The desire for intensive regional research prompted the formulation in 1969 of an integrated programme in the South Wairarapa. In subsequent chapters of this thesis the practical aspects of this type of programme will be examined in detail, as the culture history of selected Palliser Bay communities is explored.

CHAPTER 2

THE WAIRARAPA RESEARCH PROGRAMME

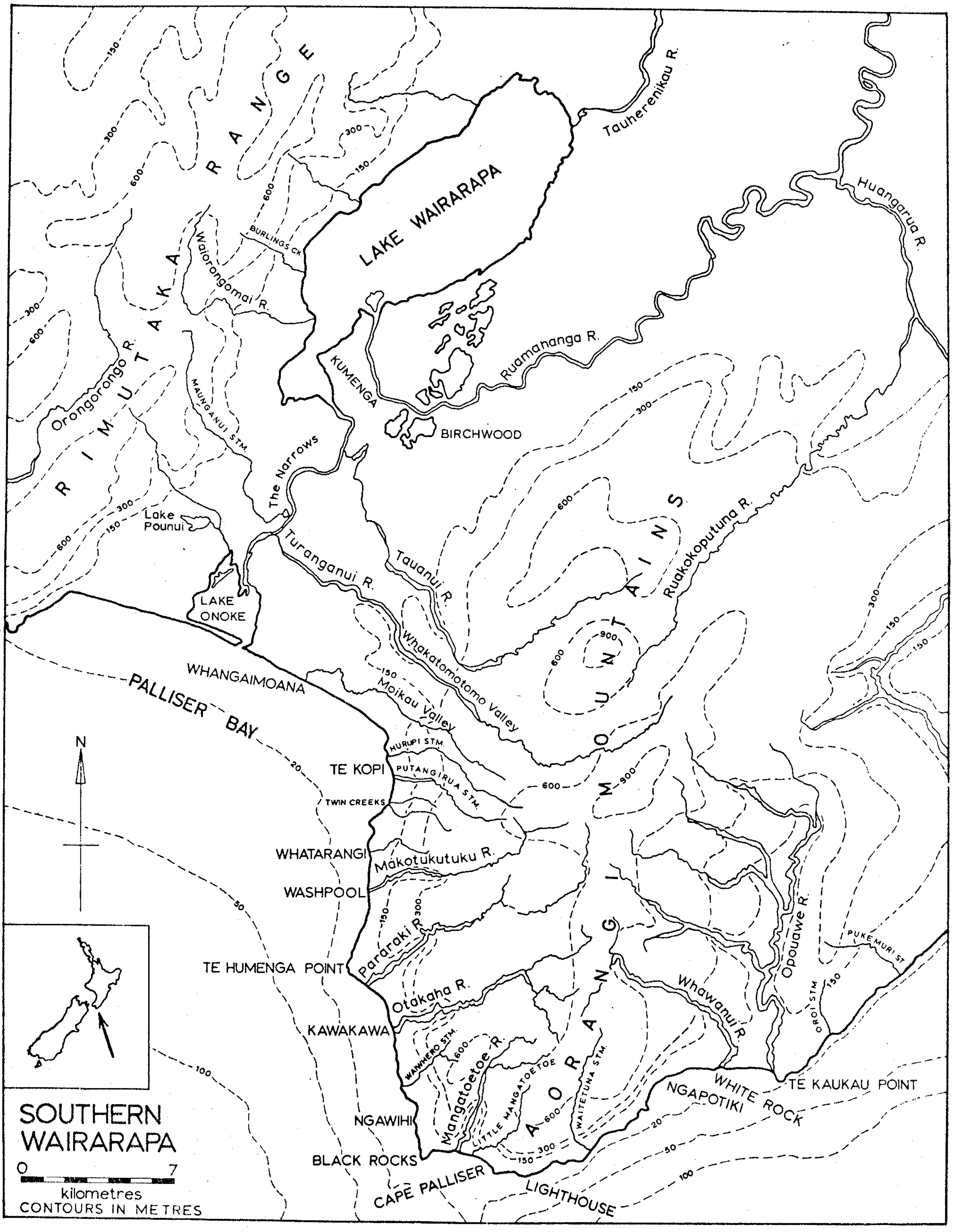
THE CHOICE OF REGION

Although many areas of New Zealand are suitable for a regional research programme, the Wairarapa region (see Figure 1.) seemed particularly outstanding in 1969. There were a number of reasons for this, some of which related to certain practical advantages. The major reasons, however, lay in its archaeological potential.

Archaeological sites along the coastline in particular were relatively well preserved. There had been little curio-hunting, and previous archaeological work in the area had been only limited in scope. Most of the coastal strip had not been ploughed and interference from European farming was restricted to the vicinity of farm homesteads. Roadworks were minimal, and there were only fords across the rivers. This was especially important as many sites in New Zealand are situated at the mouths of streams and rivers where they are susceptible to destruction from bridge building and landscaping. In coastal Wairarapa, many factors including European deforestation and grazing have restricted soil development to such an extent that on many thousands of acres of land, the modern surface is very close to that occupied by prehistoric people. As a result sites are unusually visible. Certainly, in some areas wind deflation and other erosion processes were a problem; on the whole, however, the visibility of sites more than compensated for this disadvantage.

In short, the archaeological resources, therefore, were in a nearly pristine condition, seldom encountered in many other regions of New Zealand as for example Otago.

FIGURE 1 LOCATION MAP



There were several prior indications that the Wairarapa had a rich archaeological potential, and these were decisive factors in the choice of this region. These indications are from two sources: firstly, from the small amount of archaeological work conducted in the area prior to 1969, and secondly, from the region's strategic location on Cook Strait, an area well known for numerous sites along both of its shorelines, some of which had already produced useful results.

In the first significant publication on the Wairarapa, Adkin (1955) drew attention to the apparent high density of settlement in eastern Palliser Bay and also to the stone walls which he considered were indicative of early gardening. The artefacts he described were typical of Moa-hunter sites, as are many items now in private hands (Budd collection, Holmes Warren collection, Broughton collection) or in the National Museum.

In the late 1950s at least four burial sites were excavated, one near Honeycomb Rock which had an unusual tiki grave-offering made from Glycymeris laticostata (Barrow, 1959:6-7), and a further three at the mouth of the Pararaki River (q.v. Davis, 1959:18; Keyes, 1975: pers. comm.). One of these was accompanied by a shark tooth necklace (Cairns, 1971). Several short publications also appeared about this time (Davis, 1957; Cairns, 1959a; 1959b; 1960; 1961; Palmer, 1961) reflecting a growing interest in the Wairarapa which culminated in the NZAA Conference field trip to the Glenburn area in 1960 (Scarlett, 1960a:10).

Wellman (1962a:38) included parts of the Wairarapa coast in his coastal reconnaissance of the North Island. While he drew attention to the presence of Euryapteryx geranoides in close association with human occupation at Cape Palliser, he did not believe there had been significant settlement in the region.

> "The coast is extremely windswept and so inhospitable that the small population it would have supported are unlikely to have left a continuous record of their presence, and the moa bone is probably younger than the first period of human occupation recorded from the more favourable localities to the north"
>
> (Wellman, 1962a:39)

The question of moa remains in association with man will be fully discussed in a later chapter. It should be mentioned here, however, that substantial deposits of moas and other flightless birds had also been found in the Aorangi Mountains. Although it is true that the bulk of these deposits probably date to a period before human occupation, perhaps by several millennia, they are not without significance (Harrison, 1920; Dell, 1956a;McLeod, 1902; Oliver, 1949:16ff; Yaldwyn, 1956; 1958; 1960a; 1960b).

The systematic location of prehistoric sites in the Wairarapa began in 1961 with Smart and Cameron's survey of the Pahaoa area (Smart, 1966). This was followed up by a reconnaissance of the coastline between Cape Palliser and Pahaoa in the summer of 1963-1964 by Hitchings and O'Rourke (n.d.). A group of students led by Mitcalfe revisited parts of this area on a series of weekends in 1968, and also extended the survey further north (Mitcalfe, 1968a-f; 1969; n.d.). Apart from a few records made by Smart and Cameron, Mitcalfe and Barrow, only a small fraction of known archaeological sites were ever filed in the NZAA site recording scheme.

Until Park's study of an area high in the Tararua ranges in 1968-9 (q.v. Park, 1970) no direct indication of the time depth of Wairarapa prehistory was available. This excavation of an oven complex, dated to 1209 AD ± 54, yielded important palaeoclimatic information.

In summary, archaeological work in the Wairarapa prior to 1969 was limited in scope, and no systematic site surveys had been conducted in the main alluvial valley or the coastline of Palliser Bay. Where Adkin and Barrow had surveyed sites along this coast, their coverage was uneven and their records incomplete; even fewer details are known of their excavations. Despite this, there was sufficient evidence to suggest that Polynesians had settled the region fairly early in the prehistoric period when they possessed a material culture similar to that of Moa-hunters in the South Island. Economic similarities with the South Island were more tenuous since there appeared to be only a weak correlation in the Wairarapa between archaeological sites and moa remains. In contrast there were fairly good indications of early horticulture. Because both the development of horticulture and the decline of moa-hunting were important problems in New Zealand prehistory, it was clear that the Wairarapa furnished a suitable testing ground for studying these issues.

In 1963 Green set up a model of the Auckland sequence. One of his aims was to redress the imbalance whereby New Zealand prehistory was primarily based on evidence from the South Island (Green, 1970:3). The result of Green's work was a second distinct cultural sequence isolated spatially from the first. The Wairarapa, situated in the centre of New Zealand, is therefore ideally placed to balance these two pictures.

Cook Strait today is usually viewed as a natural barrier between the two major land masses of the North and South Islands. At present it is debatable how far this European concept has influenced our interpretations of New Zealand prehistory which is often seen as possessing these two separate streams. In fact there are some contrary indications that Cook Strait was seen more as a thoroughfare by prehistoric inhabitants of New Zealand. Skinner formalised this view by suggesting that the area was "an intermediate belt where the cultures of the North and South Islands blended" (1974c:21). This view was also expressed by Cumberland (1949) and Green (1970). It should be noted that Cook recorded that people he met in the Marlborough Sounds were in contact with North Islanders in 1770 (Cook, 1968:250). The Wairarapa was seen as a suitable area to document this relationship between the two islands.

The Cook Strait littoral fringe had a substantial early population, of 'Moa-hunters', or at least people with a similar material culture and on the basis of artefact distribution it may have seen a later population decline. Evidence for early settlement has been documented over a long period beginning with Robson's discoveries in the 1870s on the Grassmere Spit and further south at Cape Campbell (Robson, 1876; Duff, 1956:258-260). A few miles north is the large site of Wairau Bar (Duff, 1942; 1956), which is still regarded as the type-site for the Moa-hunter culture, and is often used as characteristic of the earliest phase of New Zealand prehistory (Emory and Sinoto, 1964:157). Extensive Archaic occupation has also been recorded in the Nelson area (Millar, 1964; 1967; 1971) and on D'Urville Island (Keyes, 1960; Wellman, 1962b; Prickett and Walls, 1973). Although structural evidence has been the focus of attention in the Marlborough Sounds (Rutland, 1894; 1897; Palmer, 1959), Archaic artefacts have been found there as well (Trotter, 1974:11).

Intensive European settlement has confused the archaeological picture in the Wellington area, but there is evidence of Archaic occupation, especially at Paremata, Rongotai (Duff, 1956: 276-7; Smart, 1962), and Makara (Davis, 1962). Many Archaic artefacts have been found in the Horowhenua - Foxton area (Adkin, 1948), and an intensive archaeological project at Foxton has documented the environmental setting of Archaic people on this coastal plain (McFadgen, 1972).

These investigations have concentrated on the southern and northwestern shores of Cook Strait, and demonstrate the intensity of Archaic occupation in these areas. That this conclusion also applies to coastal Wairarapa had been indicated by Adkin's study in 1952 (Adkin, 1955). Many aspects of the economy and settlement pattern of Archaic communities remain obscure despite more than a century of investigation, and this is especially true of the Cook Strait area, In choosing the Wairarapa for a regional study there seemed a good chance that detailed information would be forthcoming.

A related reason for selecting the Wairarapa was its position on the transportation route of vital raw materials crossing Cook Strait in both directions. The Straits area was itself endowed with high quality geological resources which were used extensively throughout the prehistoric period. These included chert and indurated limestone from the Wairarapa (Keyes, 1969; 1970; 1972) and the Amuri Bluff - Ure River area (K.Walls, 1971), greywacke and unbaked argillites from the northern shores, and metasomatised argillites and serpentines from the Nelson Mineral Belt (Duff, 1946; Keyes, 1961; 1975; Skinner, 1914; Thomson, 1918; J.Walls, 1974). Cook Strait also functioned as a funnel for the transfer of important lithic materials from much further afield, especially nephrites and bowenites from the West Coast of the South Island, and obsidian from the northern half of the North Island. Obviously, investigations in the Wairarapa would be useful in focussing on the exchange of materials between the two islands.

Finally, the Wairarapa traditionally acted as a staging post for groups of East Coast origin migrating to the South Island. One of these groups, which became known as the Ngai-tahu, is believed to have been responsible for the introduction of Classic Maori Culture into the South Island (MacKay, 1873; Duff, 1961). Archaeological work in the Wairarapa might be expected to elucidate such movements of people on the eastern side of the mountainous divide of the North Island.

DESIGN OF THE PROGRAMME

As outlined in Chapter One, the principal aim of this programme was to construct a well documented regional culture history by the close study of its prehistoric communities, investigating as many facets of their culture as possible. Much of the inducement for this conjunctive approach came from the writings of W.Taylor (1948) whose outspoken criticism of the narrow compass of American prehistory also seemed relevant to the situation in New Zealand in 1969. It was regarded as most important to describe the economy within a matrix of environmental change and stability. Such a programme followed the lead set by British archaeologists such as Clark (1954), and exemplified in New Zealand by the work of Shawcross (1967) and Higham (1968). Both Taylor and Clark had stressed the need for specialist assistance in biological analysis, and the help of a number of natural scientists was obtained for the Wairarapa project. From the outset it was clear that midden analysis would provide much of the basic economic information, and it was considered important to couple this with studies of the modern and prehistoric environment. As a result, specialists became involved in research both in the field and in the laboratory.

Because there were several researchers involved in the programme it was essential to strike a balance between its overall objectives and the objective of each participant. Balance was achieved by encouraging the maximum freedom in the use of data, while at the same time imposing certain constraints on data collection techniques and recording and cataloguing methods used both in fieldwork and laboratory analysis. Virtually any theoretical stance could be adopted by members of the party, but not at the expense of the basic information. Theoretical orientations inspired by such diverse studies as proxemics, ethology, and niche theory resulted.

The archaeological principles to which all members adhered arose from a strong belief in three concepts. Firstly, emphasis was placed on areal excavation - the exposure of large contiguous squares laid out to reveal the full extent and spatial organisation of evidence - in contrast to such layouts as alternate squares and checkerboard patterns. The philosophy behind the latter excavation strategy is based on sampling theory quite inappropriate to the functional study of human communities (see below; also Fagan, 1972:85ff; Hole and Heizer, 1973:182ff). Similarly, trench excavation was discouraged, except in the study of soil profiles (H.Leach, 1976: Chapter 3). This excavation method provides much information about sequence, but very little about the range of activities within each stratigraphical unit.

Secondly, in accordance with British archaeological principles, chronological control was maintained by excavation according to stratigraphic layers. Unit level excavation was precluded, except occasionally to subdivide single layers.

Thirdly, a particular stance was adopted to sampling. Wherever possible total excavation was practised, and massive residues removed to the laboratory for detailed analysis. This approach was adopted in the belief that the analysis of cultural samples will only reveal information about the samples and not the population from which they derive. This view was subsequently described in detail by Anderson (1973c) who concluded that:

> "Cluster, random and column sampling methods are based on a fundamental misconception of the nature of sampling. In situations where the qualities of the sampling universe are unknown and cannot be assumed, there are no methods available which can produce a sample known to be representative and there is no way of determining the degree of bias in any sample obtained, short of examining the nature of the universe as a whole. As a consequence, the primary midden sampling objective of predicting the composition of the midden as a whole is dubious.
>
> A more sensible approach is to reject that objective as primary, to excavate on the basis of research objectives rather than chance, and to restrict interpretations, in the main, to the results of a full and careful analysis of everything excavated."
>
> (Anderson, 1973c:124)

One of the common pitfalls in New Zealand archaeology has been a tendency to return to an area for fieldwork over a prolonged period, perhaps in the belief that what was unintelligible from previous seasons will be made clear by the accumulation of new data. The adage 'the research has raised more problems than it has solved' is probably more applicable to archaeology than any other discipline, and there are good grounds for limiting an archaeological research programme to a fixed duration. In the present case a time limit of three years was set on fieldwork, from August 1969 to August 1972.

The subdivision of individual projects followed research topics rather than areas. This procedure was adopted to minimise repetition of effort. The choice of sites for excavation followed a site survey which covered about 1700 km^2. At the same time artefacts in private collections and museums were photographed and catalogued.

The results of this work are discussed in Chapter 3.

The division of research into projects was organised to strike a balance between areally intensive and extensive research. The first project isolated was a thorough extensive analysis of the literature dealing with the early historic period. It involved a wide variety of sources of information and covered the whole of the Wairarapa region. It set out to describe the natural environment, the traditional history, the settlement pattern, cultural affiliations and communications networks of people living in the area throughout the protohistoric period. This division between protohistory and prehistory was not conceived of as one of content but rather of method, since G.M.Mair who undertook the research was primarily involved in searching archives and some site surveying, but little or no excavations or laboratory work (Mair, 1972). At the conclusion of this project, excavation of protohistoric sites would have been a worthwhile undertaking, but because of lack of time was not included in the programme. It is important to note that there was no intention to use Mair's results as a springboard for the 'Direct Historical Approach' (Steward, 1942), by projecting backwards in time; the principal aim was to isolate and describe one period in the culture history of the region.

The second project was to be an intensive study of a complex of sites in a confined area; it was hoped that these sites might represent various components of the activities of one, or only a few, socially related communities. As will be seen in Chapter 3, the site survey revealed a number of site clusters, and of these the Makotukutuku Valley set was chosen for several reasons. The complex contained a variety of site types which were clearly isolated from other evidence; they were spread over 1 km of coastal platform and extended 4 km inland up the valley. Three environmental zones were adjacent to the sites -

the sea, the sandy coastal platform, and the forested reaches of the valley. In short, the area offered a suitable location for a study of many aspects of prehistoric human ecology. Two other reasons were important; there was a minimum of natural and human modification to the sites, and a large field party could be accommodated nearby. Most research in this area was undertaken by the present author.

The third project was to be an extensive study of one specific aspect of prehistoric evidence. The stone walls of Palliser Bay, when viewed against the background of other sites in New Zealand, were an outstanding and unusual feature. The possible relationship of these structures with prehistoric horticulture was clearly a promising field of study. For many years the antiquity and nature of horticulture in New Zealand has been a subject of contention, and it was felt that these issues might be clarified in the Wairarapa. More important, however, the aim of achieving an overall conjunctive picture of prehistoric settlement demanded that considerable attention be devoted to this evidence, since stone walls were the most common site type on the coast. It was felt that this aspect of prehistoric activity could best be explored by conducting research over the entire coastal area rather than by concentrating on any one complex. As is well known, direct evidence for prehistoric New Zealand cultigens is very difficult to find, since they do not normally produce either pollen or seeds. Consequently, discussion of horticultural practices rests largely on indirect evidence gained from wider areas, and sources of information. Understanding prehistoric horticulture in Palliser Bay cannot be divorced from a consideration of the selection of favourable climatic zones, cycles of erosion, the need to clear new land, and eventually to shift settlements.

A wide knowledge of the physical character of the whole coastal platform and adjacent valleys would have been required by prehistoric peoples engaged in horticulture, and thus an extensive research project was thought necessary to achieve an understanding of their gardening practices. This major project was undertaken by H.M.Leach (1976).

As was anticipated, a number of projects needed to be formulated after the excavations in the first season. Human skeletal remains were recovered from a number of sites, and their discovery provided an opportunity for research into the health, stature, mortality, fecundity, and dietary adequacy of individual members of the communities being studied. This project was undertaken by D.G.Sutton (1974).

When initial excavations in the Makotukutuku valley failed to uncover remains of substantial houses, a separate project was formulated by N.J.Prickett (1974) to study domestic structures in the Moikau Valley, where the site survey had shown clear surface traces of house foundations and hearths.

Similarly, the study of prehistoric marine food exploitation was hampered at the Makotukutuku Valley by the unstable present day conditions along the adjacent coast, and the accumulating evidence for gross local changes in the marine environment during the prehistoric. A project was therefore devised by A.J.Anderson (1973a) to study the correlation between modern fish and shellfish populations and middens at the relatively stable reef area of Black Rocks.

Landsnails were a significant component in several of the archaeological sites, and as is well known, the various species are sensitive indicators of previous environmental conditions (Evans, 1972). In view of the growing evidence for environmental shifts in this general area, it became necessary to study the correlation of landsnail species with modern habitat in order to assess fully the palaeoenvironmental significance of these finds. This project was conducted by G.Hamel and P.Cresswell, and their results are discussed in Chapter 3.

Stone artefacts were a major component in every archaeological site examined, and also made up large collections in the National Museum and in private hands. Lithic materials are now amenable to study from a variety of viewpoints such as technology, function and sourcing. K.Prickett (1975) chose to study two particular aspects: the prehistoric knowledge and utilisation of local stone resources, and by means of sourcing techniques, the unravelling of communications networks involving Palliser Bay communities and other groups in New Zealand. The latter study was seen as providing a crucial link between the regional study and the overall course of prehistory at a national level.

SUMMARY

The Wairarapa region furnished highly visible sites which it was possible to record and analyse in detail. It also included intact sites in selected localities able to be excavated in their entirety, or at least in large part, which spanned much of the known length of New Zealand prehistory. Not only was there a potential for examining the issues of moa hunting and horticulture, but also a host of other problems from the ethnohistoric present to trade in the past between the North and South Islands. As such the Wairarapa region constituted a highly suitable area for an intensive programme of research focussed on localised communities.

CHAPTER 3

RESEARCH IN THE WAIRARAPA OTHER THAN EXCAVATION

A regional research programme must involve more than a series of excavations and analyses. Among other potential sources of information are historical and traditional accounts of the region, surveys of its sites, its vegetation, its soils, its marine life, and even its land snail populations. The site survey is probably the best known example of a discrete regional study not involving excavation, and in fact is a necessary prelude to it. In the Wairarapa programme it was considered necessary to add a marine survey, and a study of the modern land snail fauna and vegetation. As such surveys can only make sense in the context of a traditional and historical framework, it is convenient to group them in one chapter, thereby furnishing a setting for the more restricted and focussed archaeological research in the chapters which follow.

TRADITIONAL HISTORY AND THE PROTOHISTORIC PERIOD

INTRODUCTION

The main sources of information on the protohistoric period in this area are the records of explorers, missionaries and early settlers, together with the minutes of hearings of the Maori Land Court set up in 1865. An analysis of these documents by Mair (1972) forms the basis of much of the following discussion. The traditional evidence, however, relies on additional sources, especially in the discussion of the Ngai-tahu migration, as it also affected areas outside the Wairarapa.

Direct European contact with the Ngati-kahungunu of the Wairarapa was slow to develop, and it was not until after 1840 that explorers and settlers began to move into this area. Nevertheless, European contacts elsewhere had already affected the Wairarapa Maori. In fact cultural change began during the initial stages of European exploration. Thus, when Captain Cook made the first contact off Cape Palliser on February 9, 1770, he had at that time sailed only as far south as Cape Turnagain on the east coast and had not made any contacts on the west coast, yet he was immediately asked for nails by the Palliser people. When these were offered, the Maoris asked Tupaia (Cook's interpreter) what they were. Clearly their demand for iron stemmed from an effective communication network linking different parts of the east coast of the North Island. Thus Cook set in motion changes in the Wairarapa economy some months before he had direct contact. The beginnings of the protohistoric period in the Wairarapa therefore coincide with Cook's landfall on October 7, 1769 in Hawkes Bay.

Later events in the Wellington area prompted a massive migration of people from the Wairarapa in the 1830s, and resettlement did not occur until the signing of the Treaty of Waitangi in 1840, which marked an important turning point in this region. Direct European contact was only significant from 1853 onwards when the Small Farm Settlement scheme was instigated by Government. At that time unbroken historical records begin, setting a convenient date for the end of the protohistoric period. This is later than for most areas of New Zealand, but Mair argues that a clear knowledge of Maori culture in the Wairarapa only begins to emerge from records made between 1840 and 1853. She therefore suggests that the pivotal role of the Treaty of Waitangi should be formalised and identifies two Phases in the region's contact period - an Early and Late Protohistoric. This scheme is followed below.

TRADITIONAL HISTORY UP TO THE NINETEENTH CENTURY

Two aspects of traditional history will be discussed. The first examines the belief that Wairarapa Maori were in some way involved in certain events which took place in the South Island culminating in the penetration of North Island groups possessing a 'Classic Maori' culture into the South Island, and resulting in its adoption by local residents. These events are usually identified with the so-called 'Ngai-tahu migration'. The second aspect involves the traditional history of occupation in the Wairarapa itself.

The Ngai-tahu Migration

It is commonly believed that "the vehicle for the spread of Classic Maori to Murihiku [in particular] may well have been the Ngai Tahu" (Golson, 1959:60). Individual artefact forms are sometimes identified with this movement of people. Duff for instance ascribed a fish-hook fragment with a somewhat questionable shank barb from the Pariwhakatau site to the Ngai-tahu, and claimed that this supports the hypothesis of an East Coast (North Island) derivation of Classic Maori in the South Island (Duff, 1961:287-8; see also Scarlett, 1960b:5). The idea that fish-hooks of this type have their "widest distribution in the North Island, around the East Coast" (Hjarno, 1967:35), and that their appearance in South Island sites heralds the Ngai-tahu influx, can be traced to a paper by Skinner (1942:218; see also 1959:237). Although little is known of its antiquity, most examples have been found in late archaeological contexts. Trotter's (1956) recent study of the type demonstrates a good correspondence between its distribution and the major areas for which Ngati-kahungunu and Ngai-tahu influences have been recorded. Hooks of this form occur at Mahia Peninsula and nearby Portland Island, at the mouth of Happy Valley near Wellington, at Paua Bay on Banks Peninsula, at Kaikoura, and at Murdering Beach. A few specimens are less securely located but are believed to come from the East Coast area (Trotter, 1956:251). None have been recorded in the Wairarapa itself.

There is little doubt that a series of events took place which might be referred to as the 'Ngai-tahu migration'; however, what is questionable is the extent of Wairarapa and East Coast involvemeht in these movements, for the traditions are less certain than many secondary sources suggest. In White's account of South Island traditions, for example, the link is clearly stated:

> "The Nga-i-tahu, having firmly established themselves at Kaikoura, sent a canoe across the Strait back to Wai-rarapa to inform their friends of their success, with the request that others of the Nga-i-tahu should join them on the Middle Island, to enable them to conquer all the Middle Island tribes. To this request the Wai-rarapa people gladly responded"
>
> (White, 1887:309, see also 303)

> "The Nga-i-tu-ahuriri again sent an invitation to their friends at Wai-rarapa, on the North Island, for aid, in response to which invitation another body of the Nga-i-tahu from Wai-rarapa crossed the Strait and took up their abode at O-takou"
>
> (White, 1887:311)

The validity of these comments is difficult to check since White welds together passages from published papers and Maori manuscript sources without clearly identifying the source of each section. In this particular case the information may derive from "a valuable paper, 'Nga-ti-mamoe', by James Mackay, Esq., Native Commissioner" (White, 1887:iv). It is unfortunate that it was apparently never published, and the primary source therefore remains unknown. A similar statement made by Alexander Mackay, however, is open to closer scrutiny. Again, no reference is made to the informant:

> "Shortly after the removal of some of the Ngaitahu from Kaiapoi to the West Coast, another section of their tribe arrived from Wairarapa, and located themselves at Otakou (Otago), and war was again resumed with the Ngatimamoe, with increased vigour"
>
> (Mackay, 1871:44)

It is important to note that Alexander Mackay's views on South Island traditional history diverge in some respects from earlier accounts against which they can be checked. More important, his use of published information involved modification of details and sequences to suit these views. This detracts from the acceptability of the passage as authentic tradition. A comparison of two additional passages reveals Mackay's attitude to his sources:

<u>From Shortland, 1851:99-100</u>

(Source stated as Tuhawaiki)

"The desire to possess themselves of the pounamu, which was only to be found on the Middle Island, seems to have been the chief inducement which urged large bodies of this tribe, at different times, to invade the country of Ngatimamoe, who had become celebrated as possessing this treasure.

The earliest of these inroads took place about two hundred and seventy years before the present; for Tuteahunga, a chief of this tribe, who lived nine generations back, is recorded to have been killed at Kaikoura. His family were styled Ngaitahu, from his grandfather, Tahu. Another family, called 'Te Aitanga-Kuri' (Progeny of Kuri), Kuri being a cousin of Tuteahunga, came over soon after, and united their force with Ngaitahu; but did not advance beyond Kaikoura, where their chief, Manawa, was killed in a skirmish by Tuikau of Ngatimamoe.

About this time a powerful reinforcement from Ngatikahununu, was brought by a chief named Turakautahi, whose father and grandfather, in making a similar attempt before, had been drowned, with their crew, off Raukawa, where their canoe was upset. Turakautahi

<u>Mackay, 1871:40-41</u>

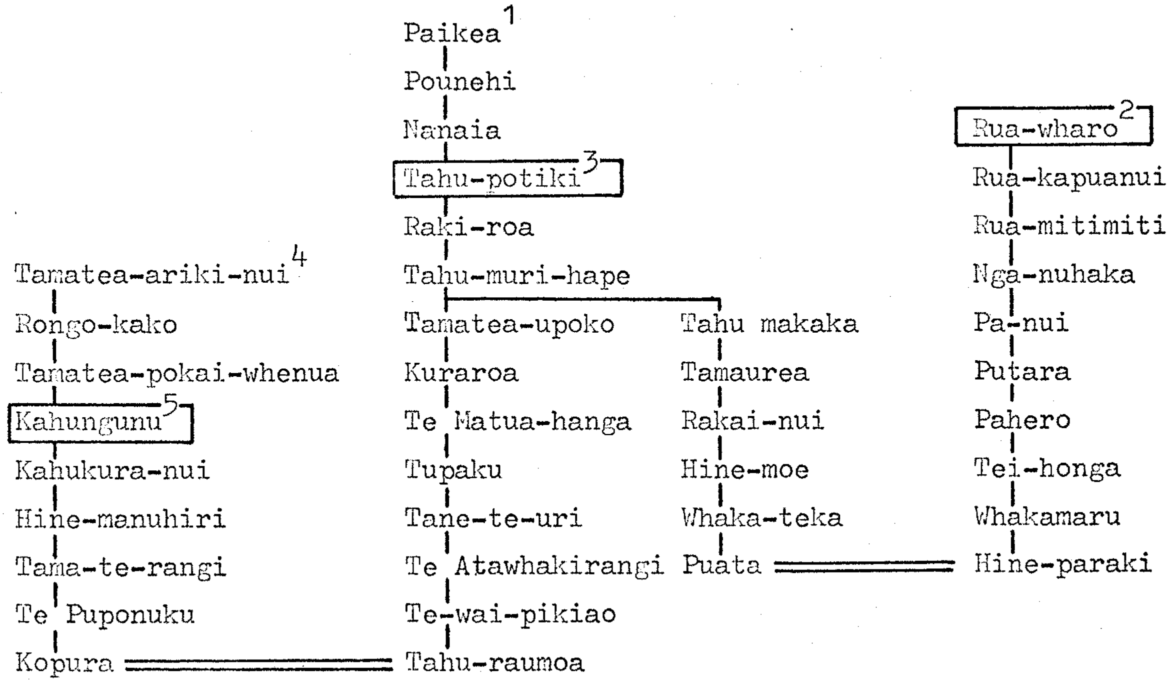
(Source not stated)

"About this time a powerful reinforcement was brought over from Terawiti by a chief named Turakautahi, whose father and grandfather, in making a similar attempt before, had been drowned with their crew, by the upsetting of their canoe off Raukawa (Cook's Strait). Turakautahi, with his younger brother Moko, landed his forces at Totaranui, Queen Charlotte Sound, and had to fight his way through Ngaitara and Te Huataki before he could join the Ngatikuri at Kaikoura .... the branch of the Ngatikahuhunu who located themselves in the Middle Island, were styled Ngaitahu, from their ancestor Tahu. The desire to possess themselves of the greenstone (pounamu), which was only to be found in the Middle Island, is supposed to have been the chief inducement which urged large bodies of this tribe at different times to invade the country of the Ngatimamoe, who had become celebrated as possessing the treasure."

with his younger brother Moki, landed his forces at Totaranui; and had to fight his way through Ngaitara, and Te Huataki, before he could join those of his own tribe, who had preceded him, and who were then seated at Kaikoura."

These two passages are quoted in full because of their importance in the following discussion. There is clearly no doubt that Mackay was basically paraphrasing Shortland, but it is equally evident that he has changed certain details, and the order of events. For instance, Mackay claims that Turakautahi was from Terawiti (a locality in the western Wellington area), whereas Shortland's informant claimed he was a Ngati-kahungunu. The most important difference, however, is that Mackay has deleted the reference to the eponymous ancestor of Ngai-tahu as being the grandfather of Tuteahunga. This claim, made by Tuhawaiki to Shortland, differs from the more commonly accepted view that the ancestor Tahu lived many generations before. The latter Tahu, whose full name is rendered Tahu-potiki is generally regarded as belonging to "an early section of Ngati-kahungunu" (Adkin, 1959:8, see also White, 1887:293). This claim is not easy to reconcile with the genealogies which show consistently that Kahungunu (the founding ancestor of Ngati-kahungunu) lived at about the same time or even later than Tahu-potiki (see Figure 2). In fact Best (1901:120, 132) argues that Tahu-potiki, along with Paikea (variously given as his father or great grandfather), and Tamatea-Pokai-whenua (the father of Kahungunu) were together in the Takitimu canoe. Buck, on the other hand, names Kahungunu as being in the canoe (1962:58).

In this section and that which follows it should be remembered that European rendition of Maori names can lead to some surprisingly different records, and too much can be read into slight differences.



<u>Figure 2</u>: <u>Genealogy of Kahungunu and Tahu-Potiki</u> (adapted from Mitchell 1944: ii, vi)

1. Paikea was one of the principal men on the Takitimu canoe (Best, 1901:120, 132)

2. Rua-wharo was one of the priests on the Takitimu (Buck, 1962:58)

3. Tahu-potiki is widely claimed to be the eponymous ancestor of the Ngai-tahu, and is claimed to have been on the Takitimu (Best, 1901: 120, 132)

4. Tamatea-ariki-nui was the chief man on the Takitimu (Mitchell, Gen.2; Buck, 1962:58)

5. Kahungunu is the eponymous ancestor of the Ngati-kahungunu and was on the Takitimu canoe (Buck, 1962:58)

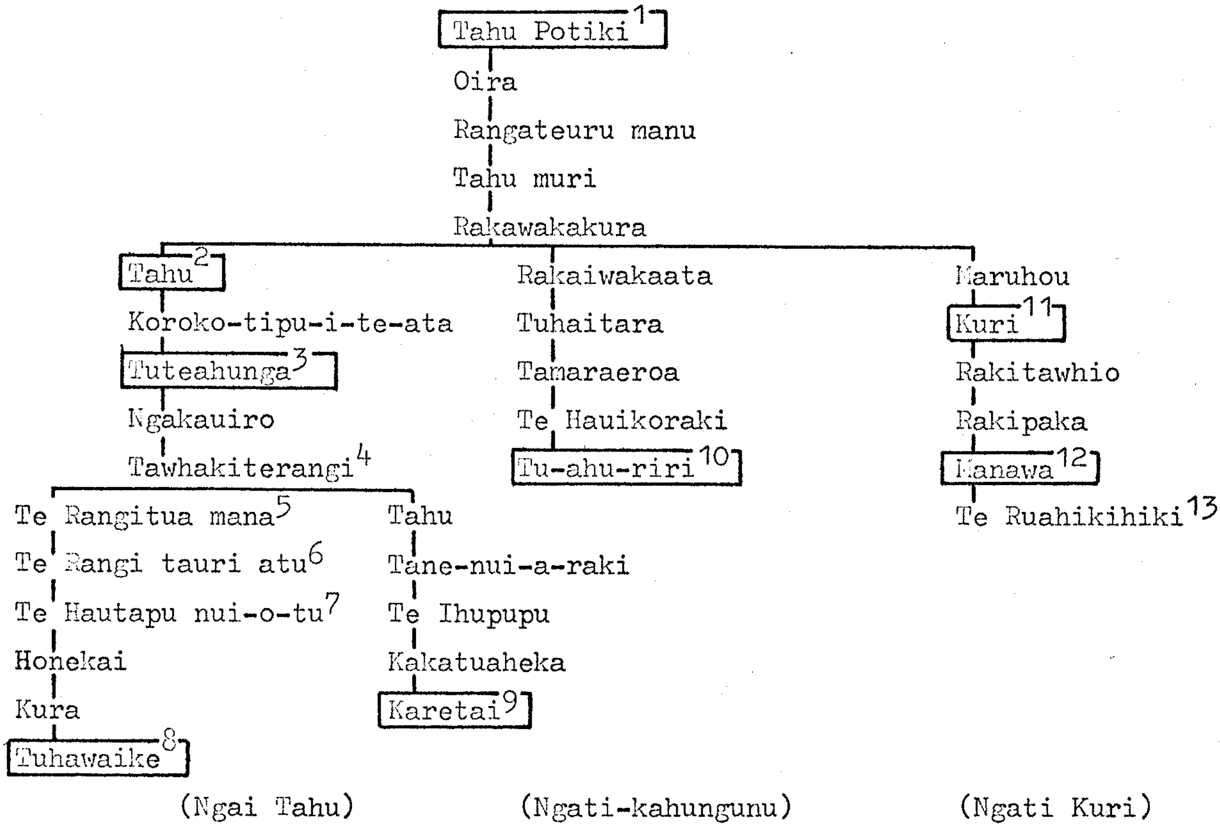


Figure 3: Tuhawaike and the 3 main Kahungunu lines in the South Island. Most of the information for this was extracted from Shortland (1851).

1. Also known as Taupotiki (Shortland, 1851: Table A)

2. Also known as Tahumutu (ibid). Tuhawaike claims this man to have been the eponymous ancestor of the Ngaitahu (Shortland, 1851:99)

3. Killed at Kaikoura (op.cit.:Table A)

4. Killed at Kaikoura (ibid)

5, 6. Died at Kaikoura (ibid)

7. Died at Lake Ellesmere (ibid)

8. Died at Timaru after being paid for Otakau (ibid)

9. Chief person at Otakau (ibid)

10. See Figure 4 for further details

11. The eponymous ancestor of the Ngati-kuri (op.cit.:99)

12. The principal chief of Te Aitanga Kuri, and known to have lived at Hataitai in Wellington before migrating southwards (White, 1887:204)

13. Is also claimed (Note 9) to be the direct ancestor of Karetai (Shortland, 1851: Table A)

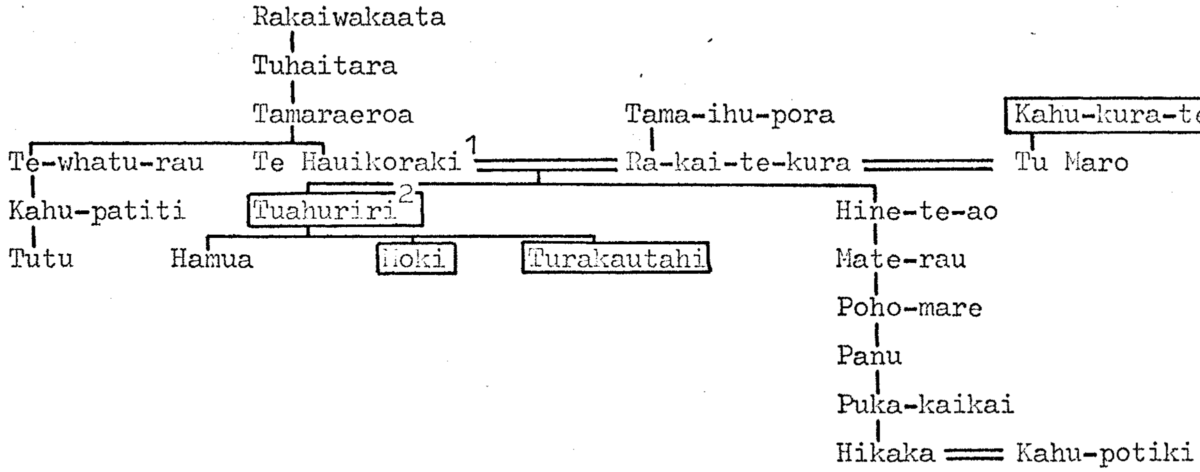


Figure 4: The Wairarapa Branch of the Ngati-kahungunu in the South Island

This genealogy is a combination of information from several sources. The central 8 figures from Rakaiwakaata to Turakautahi were recounted to Shortland by Tuhawaiki (Shortland, 1851:Table G); the rest are taken from North Island information recorded in White (1887: 180ff etc.). The overlap between the two sources involves the 5 characters below Te Hauiko-raki. The circumstances of the birth of Tuahuriri and his mother and legitimate father are recorded by White (1887:197ff). Ra-kai-te-kura's father is given as Tama-ihu-pora by Best (1901:140).

1. Also known as Te-au-hiku-raki (rangi) (White, op,cit.:198) and Ahu-ku-rangi (White, op.cit.:180). According to White (op.cit.:198) Tu-maro, who was descended from Kahu-kura-te-paku, married Ra-kai-te-kura, who was 7 generations removed from Tahu-potiki. In Tu-maro's absence from Hataitai in Wellington Ahu-ku-rangi took Ra-kai-te-kura as a lover; and their offspring, Te-ahu-riri, was therefore the illegitimate son of Tu-maro.

2, 3. Tuahuriri or Tu-ahu-riri, also known as Te-hiku-tawa-tawa-o-te-raki (White, 1887:201) as well as Tuahu and Tāhu (Best, 1901:141) is well known in North Island traditions. Upon reaching manhood he shifted from Hataitai to the south-east coast of the North Island (presumably in or about Palliser Bay) and established a famous pa called Te-mata-kikai-poika. Some time later he crossed Cook Strait searching for his father, whom he believed to be Tu-maro, and after a series of events (described by White, 1887: 200ff) he returned to his pa with his classificatory grandfather, Kahu-kura-te-paku. A famous battle then occurred at this pa and most of Te-ahu-riri's followers were killed. The North Island tradition states that his enemies were drowned in Cook Strait upon leaving the pa; the South Island version (Shortland, 1851:100), however, claims it was the father and grandfather of Turakautahi who were drowned in Cook Strait (i mate ki Raukawa), and

Figure 4 cont'd

this probably refers to Tu-ahu-riri and his classificatory grandfather, Kahu-kura-te-paku. Tu-ahu-riri is variously said to have had wives named Hine-to-wai (White, op.cit.:181), and Hine (or Hina)-kai-taki (ibid:212) or Hine-kahitangi (Best, 1901:142) and Tuara-whatu (White, op.cit.:212; Best, 1901:142). His progeny are better known in South Island traditions, but occur in North Island stories also. Moki, one of his sons, is known to have died at Kaikoura.

Kahungunu, for example, is variously referred to as Kahuhunu (Mackay, 1871:41), Kahuunuunu (White, 1887:197), or Kahununu (unu unu) (White, 1887:46), and Tahupotiki as Tahumatua (Mitchell, 1944:ii), and Taupotiki (Shortland, 1851:Table A). Bearing in mind the possible range of generation gaps as outlined by Roberton (1956), it seems likely that Tahu and Kahu were roughly contemporary, and the names could even be references to the same person, for T to K is a common Polynesian sound shift (Green, 1975:pers.comm.). This latter possibility is strengthened by a general lack of stories about a Tahu of this period, compared with the many accounts of the exploits of Kahu-ngunu. Whatever is the case, if the eponymous ancestor was Tahupotiki then the Ngai-tahu could not be a later branch of the Ngati-kahungunu as is widely believed, and Tuhawaiki's claim that the Ngai-tahu are named after a much more recent Tahu, the grandfather of Tuteahunga, should be seriously considered.

The relevant kinship relationships for Tuhawaiki's claim are outlined in Figure 3 , from which it can be seen that Raka-waka-kura had three sons, Tahu, Rakai-waka-ata, and Muruhou. The three lines of descent from these men are known in the South Island as the Ngati-tahu (sometimes referred to as Kai-tahu in the South Island), the Ngai-tuahuriri, and the Ngati-kuri respectively. The eponymous ancestor of the Ngati-kuri is Kuri, and his great grandson Manawa played an important part in the warfare with the Ngati-mamoe in the South Island. In North Island traditions, Manawa lived at Hataitai before moving to the South Island. The eponymous ancestor of the Ngai-tuahuriri is Tu-ahu-riri (qv Figure 4); and it is significant that in the South Island Tuhawaiki referred to the son, Turakautahi, as Ngati-kahungunu rather than Ngai-tahu (Shortland, 1851:100). White on the other hand appears to assume that the Nga-i-tu-ahuriri were Ngai-tahu (op.cit.:310ff), although he applies the latter term far more widely than other writers. If the eponymous figure of the Ngai-tahu were the much earlier Tahu-potiki (as shown in Figure 3), than the three lines of issue would all be described as Ngai-tahu. The fact that Turakautahi is designated Ngati-kahungunu strengthens the suggestion that these three lineages were not Ngai-tahu beyond Rakawakakura, but were Ngati-kahungunu. It must be remembered, however, that the circumstances of recording lineages greatly influences which ancestor is emphasized, particularly when early land claims were being made; White notes (1887:289), for example, that Kuri also traced descent from Ngati-ruanui.

On the whole, there would appear some grounds for suggesting that a branch of the Ngati-kahungunu, at about the time of Rakawakakura, split up into three hapu which later gained tribal or sub-tribal status, known as Ngai-tahu, Ngai-tuahuriri, and Ngati-kuri, although this suggestion does not preclude the existence of an earlier character Tahu-potiki. A story recorded by White (informant not specified) reinforces the later origin of the Ngai-tahu:

> "It was only in the generation of men after the time of Kahu-ngunu and Tahu-potiki that their descendants began to separate, and some came to this, the Wai-pounamu (South Island). There were two reasons for these people separating - one was on account of a woman and the other was on account of a dog; and it was on account of the quarrel about this dog that part of the Nga-i-tahu-potiki left the main tribe and came to the South Island; and these were ever after called Nga-ti-kuri (the descendants of the dog). And those of the Kahu-ngunu who left the main tribe were called Tu-te-kawa"
>
> (White, 1887:178)

It has been shown that Tuhawaiki's account is reliable where it is possible to check. His version of the basic chronology of the so-called 'Ngai-tahu migration' is borne out by the kinship links illustrated in Figures 3 and 4. Tuhawaiki suggested (qv Shortland, 1851:99-100) that there were actually three migrations: the first headed by Tuteahunga (the Ngai-tahu) from Hataitai, the second by Manawa (the Ngati-kuri) also from Hataitai, and a third by Turakautahi (the Ngai-tuahuriri, a branch of Ngati-kahungunu) from the Wairarapa, probably Palliser Bay. Shortland (1844:123) names Turanga as the point of origin of Turakautahi, which could either be Turanga-nui-a-rua in Poverty Bay, or the Turanga-nui area in Palliser Bay. The fact that his father was resident in Palliser Bay (White, 1887:200), suggests that the latter is more likely.

Various authors have attempted to date the Ngai-tahu migration. Duff (1961:270) believes it started about 1602 AD. Shortland (1851:82) records that Tuhawaiki's son, Topi-kihau, was 14 in 1844, which if used as a datum, would have Tuteahunga born about 1605 AD (using 25 years per generation). The three southward movements then may have taken place at about 1635 AD, 1685 AD, and 1710 AD.

Finally the relationship between the southern dialect and the Ngai-tahu should be examined. Shortland recorded a basic vocabulary of the 'Kaitahu dialect' (1851:305ff), and Skinner later commented in 1921:

> "In vocabulary the Southern dialect has many words that are rare or unknown in the North, ... It is to be noted that the phonetic differences between Northern and Southern Maori appear to be greater than the phonetic differences between Northern Maori and the dialect of Easter Island"
>
> (Skinner, 1974c:20)

Opinions vary on the magnitude of the linguistic differences, nevertheless the idea of a well marked dialect in the south is still favoured. There has been little systematic study of New Zealand dialects, but it is important to note that there is little if any suggestion of a close link between the East Coast and Ngai-tahu dialects; in fact the contrary might be argued (see for example comments by Green, 1966:28, 32). This situation does not accord with the suggested relatively recent separation of the Ngai-tahu from Ngati-kahungunu, and some explanation is necessary.

In contrast to this apparent linguistic gulf between the East Coast and Kaitahu dialects is the view of one of the informants quoted by White:

> "You, the Nga-ti-kahu-ngunu, must not believe that you speak a different language from that which is spoken by us, the Nga-ti-tahu-potiki. No; but our languages are the same, and the two men from which each of our tribes had their origin spoke the same language and lived at the same place. Kahu-ngunu .... and Tahu-potiki .... lived in the districts called Turanga-nui-a-rua .... and Te-poroporo-ki-hua-riki ...., and it is that locality where the cultivation of our ancestor Ue-roa .... is situate, which we call Tuara-haua"
>
> (White, 1887:177-8)

The key to this problem may lie in the number of people involved in this Ngai-tahu movement. The commonly held view is that "the Ngai Tahu seem to have been greater in number than the Ngati Mamoe, and gradually forced the latter back from one pa to another, southward" (Scarlett, 1960b:2-3). This belief, however, may be invalid. The only numbers recorded in the traditions refer to 70 followers of Tu-ahu-riri who accompanied him on one southward expedition, and the 170 who participated in a later movement (White, 1887:200, 201); the same traditions suggest that most of these actually returned to Palliser Bay. It is also recorded that the Ngai-tahu chiefs became overlords of the Ngati-mamoe rather than of their own people: for example, the two Ngai-tahu cousins Apoka and Tuteuretira were chosen by Ngati-mamoe as their leaders (Mackay, 1871: 41; White, 1887:239). On some occasions these groups were considered Ngai-tahu, and on others, particularly during warfare, Ngati-mamoe (see for example Mackay, 1871:42). In short, while large numbers of people may have been involved in the internecine battles, on many occasions it may have been Ngati-mamoe pitted against Ngati-mamoe encouraged by a few Ngai-tahu leaders.

Another relevant factor is discussed by Shortland as follows:

> "Thus the two races [Ngai-tahu and Ngati-mamoe] became incorporated into one tribe, which, as most of their principal families had in their veins the blood of Tahu, was generally called Ngaitahu, or Kaitahu.
>
> I found that all the families of the present day, of any consideration, traced their origin to the Turanga, or Poverty Bay sources - as being the conquering side, and therefore the more honourable - and neglected altogether the Ngatimamoe sources, beyond the time of their conquest"
>
> (Shortland, 1851:102)

It is therefore suggested that only a relatively small number of people may have been involved in the 'Ngai-tahu migration'. While the newcomers were instrumental in the cultural upheavals of the 18th century, and may indeed have spread the 'Classic Maori' culture to the South Island, they appear to have had little influence on the language spoken by the conquered tribe. In short, what is known as the Southern or Kai-tahu dialect might more aptly be referred to as the Ngati-mamoe dialect.

In this brief survey of the traditional background testifying to a Ngai-tahu migration to the South Island it has become clear that with the exception of Tu-ahu-riri and his followers who probably lived in Palliser Bay, little direct contact is indicated in tradition between the Wairarapa and the South Island people at the beginning of the 18th century. While the invaders traced their tribal affiliations to the Ngati-kahungunu, as did the people of the Wairarapa, their traditional connections are in fact indirect, and probably rather more ancient. It would appear that the main impetus for the changes in the South Island are more directly traced to Hataitai on the shores of Wellington Harbour in the 17th century.

The Traditional Occupation of the Wairarapa

The most coherent traditional history of the Wairarapa is that compiled by Smith (1904). Unfortunately, the precise details of his sources are not provided, although Smith (1904:154, 165, etc) makes repeated references to "my informant", suggestive of one primary source. This may have been Major Tu-nui-a-rangi, whose genealogy appears in the article, particularly as it was he who related the story about a south Wairarapa pa site published in the same volume (Tu-nui-a-rangi, 1904). In addition to this unspecified informant Smith also refers to Judge Mackay, T.W.Lewis, and Henare Pohio of Hawkes Bay (op.cit: 154, 157, 158).

In tradition, before the arrival of Europeans, the Wairarapa was occupied for some centuries by a group of Maoris known as Ngati-kahungunu. This tribal name is used as a general referent to cover many different groups (Smith, 1904:153), such as Ngati-hikawera, Ngati-rakai-waka-iri, Ngati-rua, and others (Mair, 1972:Table 4). These were spread from Cook Strait to Mahia Peninsula, and inland as far as the Rimutaka, Tararua, Ruahine, Kaimanawa and Ahimanawa ranges and as far north as Lake Waikaremoana.

As Smith (op.cit.:153) points out, little is known of groups in occupation before the Ngati-kahungunu, a fact consistent with the view that the principal informant was himself Ngati-kahungunu. Several tribal groups such as Tini-o-Awa, Maru-iwi, Ngati-ira, and Rangitane have been suggested as occupants prior to the Ngati-kahungunu. It is difficult to cross check the various stories. Accepted at face value they appear to attest to two principal movements of Ngati-kahungunu from a home territory near Poverty Bay.

The first of these movements was led by two Ngati-kahungunu chiefs, Taraia and Rakai-hiku-roa, some 16 to 17 generations ago (Smith, 1904:156), or about 1475 - 1500 AD. They pushed southwards from Poverty Bay as far as the Heretaunga Plains (Hastings). This brought them into contact with Maru-iwi and Te Tini-o-Awa. The former are believed to have been pushed further northward and eventually over-run, while the latter are claimed to have moved south and occupied the Te Kawakawa (Cape Palliser) area.

The second movement took place about 13 generations ago (op.cit.:159), or about 1575 AD, and appears to mark the main influx of Ngati-kahungunu into the south Wairarapa in particular. The stories relating to this movement are quite detailed, and constitute a coherent and probably authentic historical record at least in broad outline. In brief, a particular incident near Havelock in Hawkes Bay sparked off the emigration of 4 canoes of people looking for new land. The following chiefs and canoes are known to have been involved, and their lineages can be traced to some of the principal Ngati-kahungunu hapu in the area today (some of these are given in Smith, 1904:165).

Chief	Canoe
Rakai-rangi	Whakaeanga-rangi
Rangi-tawhanga	Whakaeanga-rangi
Pouri	Te Maka-whiu
Tu-te-miha	Pokai-kaha
Tuputa	Whai-tomuri
Kari-whare	?

The canoes landed at the mouth of Lake Onoke in Palliser Bay where they encountered Te Rerewa, a chief of the Rangitane who occupied the south Wairarapa at this time. This raises the question of what happened to Te Tini-o-Awa in the interval. The solution to this may lie in the suggestion by H.Ropiha that the name Rangitane was a general name which included such groups as Te Tini-o-Awa, Whatu-mamoa, Te Tini-o-Rua-tamore, Te Te-Upoko-iri, Ngai-tara, and Muaupoko (qv Mair, 1972:42; Smith, 1906:70-72). Another more obscure group, the Ngati-ira, are believed to have coexisted peacefully with the Rangitane, occupying the area from Otaraia to Te Kawakawa. They later moved into the Wellington district, where they lived until Te Rauparaha's invasion (Adkin, 1959:47). In the latter district they became a well known tribe.

The story of the Ngati-kahungunu contact with Te Rerewa is quite detailed, and the location of the meeting can probably be identified today. Te Rerewa's house was named Te Wharau-o-kena, and was claimed to be immediately to the north of the outlet from Lake Onoke. Only one site was found within several miles of this locality during the site survey, and this is now known as Okorewa (N165/11). This position was occupied in the 19th century by a group of fishing huts and was painted by Brees (qv Mair, 1972:158; see also Adkin, 1959:7). Te Rerewa traded his land for 4 canoes, and a further 3 which Te Rangi-tawhanga made from local totara, and went to Wairau in the South Island. Some Rangitane remained, however, and it was not until the time of Te Hiha (or Te Miha qv Smith, 1904:161-2), the grandson of Te Rangi-tawhanga, that the Rangitane were either expelled or absorbed.

At the time of Captain Cook's visit, it appears that the Ngati-kahungunu were firmly in control of the land from Wairarapa to Hawkes Bay.

Chronology of Events during the Protohistoric Period

Three years after Cook's initial contact in 1770 (Cook, 1968: 250) he again sailed along the shores of Palliser Bay, this time searching for Furneaux who some weeks earlier in the 'Adventure' had obtained crayfish and berries from a Wairarapa canoe in exchange for nails (Cook, 1969:741). Cook himself saw no inhabitants in the bay, but noticed smoke onshore (Cook, 1969:299).

The next well documented visit to the area was by D'Urville in the 'Astrolabe' in 1827. D'Urville sailed close to Cape Turakirae and followed the coast along to Cape Kawakawa (Cape Palliser) in a vain search for a suitable beaching spot. A Maori canoe came out to the ship, and although he took several of the occupants on board, he described them only briefly (D'Urville, 1950:102-106). In addition, it is believed that two ships, the 'England Glory' (Wilson, 1939:126-129; Mackay,1966:80), and the 'Coquille' may have made contact towards the end of the 18th century. A Maori account of the wreck of a vessel called 'Rongotute' is noted by Smith (1899:203), and this may refer to the 'Coquille'.

At the time of D'Urville's encounter the Ngati-kahungunu's possession of the southern Wairarapa had already been threatened. This resulted from European trade as far north as the Bay of Islands, so that many Nga-puhi in Northland, for instance, were equipped with muskets by 1820 (Urlich, 1970:402). Such groups were quick to seize the opportunity of raiding other groups who occupied territories some distance from trading centres. According to Travers:

> "Bands of the Ngapuhi, armed with weapons whose destructive power was unknown to the great majority of the native people, marched from one end of the North Island to the other, carrying dismay and destruction wherever they went"
>
> (Travers, 1872:46)

Between 1820 and 1822 the Wairarapa was visited by two separate forces drawn from the Northland Nga-puhi, the Auckland Ngati-whatua and the Waikato Ngati-toa (qv Mair, 1972:60ff). Smith (1899:227; 1910b:304-5) identified the pa captured by the first group in the Wairarapa as Tau-whare-nikau (or Tauherenikau near Featherston), and Mawhitiwhiti (on the Ruamahanga River). The second expedition did not reach the southern Wairarapa, stopping short at Pahiatua in the north and Porirua to the west (Mair, 1972:66). Despite their losses, Ngati-kahungunu groups remained in control of their vast territory. The Ngati-toa chief Te Rauparaha led a migration from Kawhia in 1821 which culminated in his seizure of Kapiti Island about 1823, from where he traded for muskets with European vessels using Cook Strait. The Taranaki tribes of Ngati-tama, Ngati-mutanga, and Ati-awa, and the Waikato tribe, Ngati-raukawa, joined the Ngati-toa in the Wellington area. By 1825-1826 the first Taranaki migrants penetrated the Wairarapa valley (Smith, 1910b:449). Quoting the Land Court evidence of 1888, Mair (1972:71-2) described the first conflict between them and the Ngati-kahungunu as stemming from news that a Wairarapa chief had obtained muskets by dressing flax. The death of this chief in battle was followed by the departure of his followers to Mahia Peninsula. The Taranaki groups infiltrated the valley over the next 4 to 5 years, residing chiefly to the west of Lake Wairarapa, in apparent friendship with the Ngati-kahungunu. Suspected treachery caused the latter people to attack the Ngati-tama settlements near Wharepapa and at Te Tarata (west of Lake Onoke) which were in the process of being fortified. This act set into motion a series of attacks and retaliations about 1830 and began the mass exodus from the valley to the supposed safety of the Mahia Peninsula (Mair, 1972:74-76).

Until 1840 when the signing of the Treaty of Waitangi created suitable conditions for their return, the Wairarapa valley was occupied by only small groups of Ngati-kahungunu who harrassed any of the Taranaki tribes who attempted permanent settlement there. This was sufficient to maintain Ngati-kahungunu rights to the land (op.cit.:77). These were recognised in 1840 and the Rimutaka and Tararua ranges were established as the boundary between the Taranaki tribes and the Ngati-kahungunu.

Resettlement commenced in 1842 at Te Kopi on the coast of Palliser Bay (which appears to have been a whaling station at this time, qv Millar, 1971:62), and the several hundred Maoris who returned from Mahia attempted to re-establish the former hapu territories as they spread up the valley. The first 'on-foot' European exploration of the lower Wairarapa was by Charles Heaphy in 1839. From 1840 until the arrival of the first squatters in 1844, at least a dozen Europeans visited the valley (Mair, 1972:Table 1). Some of these such as Hadfield and Cole were missionaries, others were engaged on official business, while still others were in search of suitable land for sheep stations. The period between 1844 and 1853 saw an increase in these visits and one of the early settlers, Weld, gives the impression that the pathways and waterways of the Wairarapa valley were in constant use by both Maoris and Europeans (Mair, 1972:228), a situation which one informant said was reminiscent of the pre-musket era (op.cit.:217). It is from the records of these missionaries, squatters, surveyors and other visitors that an account of Maori life in the mid-nineteenth century in the Wairarapa has been compiled (Mair, 1972: Chapter 5).

Wairarapa Communities in the Mid-Nineteenth Century

Population Distribution

The distribution of the Maori population remained largely coastal for 2 years following the return from Mahia. Although the Te Kopi area was the initial base, it appears that settlements were quickly established in the warm and fertile Moikau and Turanganui valleys a few miles from Te Kopi. Even at Te Kopi itself the residents were spread over three pa (Mair, 1972:136). The food requirements of the displaced hapu were met by temporary grants of land for potato growing along the Palliser Bay coast, especially between Whatarangi and Makotukutuku. Some groups may have returned by land, for in December 1841 Stokes met 14 people from Turanganui pa before the influx into Te Kopi took place, and the surveyor Kettle encountered people in a fortified settlement at the head of the Wairarapa valley in May 1842. Between this northern pa and the southernmost settlements, however, the 40 miles of valley possessed no permanent villages until 1844 (op.cit.:138-140).

The mobility of family and hapu groups during this decade made population estimates difficult and the unofficial counts of Halswell, Hunt, Hadfield, Grimstone and others ranged from 400 to 900. Kemp conducted an official census in 1848-9 and recorded a total of 604 persons in 10 villages in the whole of the Wairarapa valley (op.cit.:222-3; see also Figure 5).

When the first squatters drove their sheep into the valley from Wellington in 1844 the land on which they built their homes and grazed stock was leased from several hapu with rights along the eastern side of Lake Wairarapa and the Ruamahanga River. Maori desire to trade with these Europeans led to the positioning of the new Maori villages (for example Otaraia - N165/23) close to European homesteads (op.cit.:142). Other settlements expanded, for example those in the lower reaches of the Turanganui valley, while still others were abandoned, a situation often noted by the missionaries searching for their parishioners. All settlements were prone to great fluctuations in the numbers of their inhabitants (see for example figures in Mair, 1972:148).

It appears that during this re-settlement period, a hapu known as Ngai-tahu took up land rights in the Wairarapa. They initially settled at Horewai to the west of Whatarangi, and then temporarily in the Whakatomotomo valley (op.cit.:136, 143), before moving to sites in the main alluvial valley. During the site survey a settlement was found near Dyerville, which is locally known as Pa-nga-tahua (N165/26), and this probably relates to these people. Unfortunately it is not recorded where this group came from nor their lineage, but they may trace descent from Tu-ahu-riri and his followers who returned from the South Island in the 18th century (discussed above).

It is difficult to ascertain whether these settlements were fortified or not at this time. Mair found (op.cit.:149) that the prefix 'pa' seemed to have been applied to the name of every village. In the case of Otaraia, this village was founded in 1844, but was not fortified

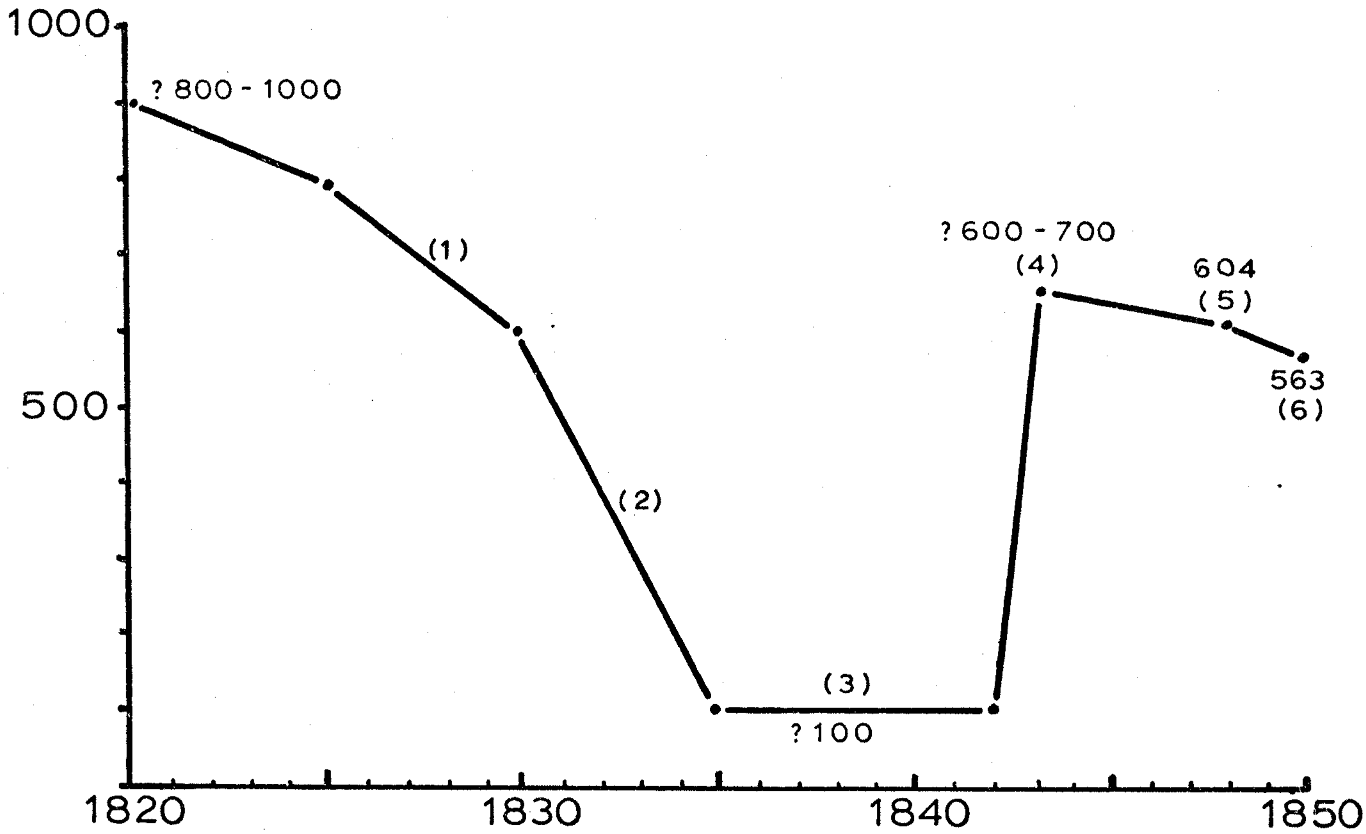


Figure 5: Wairarapa Population Figures (based on Mair, 1972)

1. Some losses reulting from raids by musket-armed Taranaki and Northern Maori war parties (Mair, 1972:62-4). First migration north of Ngati-kahungunu about 1825 (op.cit.:71-2). More warfare c.1830 with Taranaki settler and raiders (op.cit.:72-4)

2. A massacre of Ngati-kahungunu guests at a feast given by Te Rauparaha c.1830 initiated mass migration to Mahia (op.cit.:74). Completed by 1835 (op.cit.:76)

3. An unknown number remained to harrass Taranaki Maoris, possibly about 100 (op.cit.:77)

4. About 500-600 returned from Mahia, 1842-3 by canoe, possibly others overland (op.cit.:139-40)

5. Kemp's census 1848-9 (op.cit.224-5)

6. Kemp's census 1850. Between 1849 and 1850 Colenso recorded 46 deaths from measles in the valley (op.cit.:225, Tables 14 & 15)

until 1846 (op.cit.:153). Fox's sketch of it in 1847 shows a high palisade around the huts, complete with carved images, but without any ditch and bank earthworks. Despite the fortification of several other settlements as a result of rumours of Waikato invaders, by 1850 Maoris were more often found living in huts near their gardens than within the pa (op.cit.:153). These cultivation settlements were always distinguished from the larger villages, and so it appears that the term 'pa' applied to any settlement surrounded by a fence. No settlements were established on the western side of the lakes and it seems likely that the few western pa such as Battery Hill (N165/18), whose palisade post stumps and ditch and bank are still visible, belonged to the 1825 - 1830 period. Battery Hill may even have been built by Taranaki Maoris, an interpretation strengthened by the fact that it possesses a double ring ditch. As Groube has argued (1970:153), this type of defence is a late feature applied to the terraced pa by Taranaki Maoris. A nearby settlement known as Hume's pa (N165/37), with a double ring ditch, also has raised rim pits within the enclosed area, which are East Coast features (see H.Leach, 1976:Chapter 5), indicating that caution in interpreting the ring ditch feature as evidence of Taranaki influence is required.

Inter-Group Contact

As might be expected from the many records of mobility, inter-community contact was particularly frequent in the mid-nineteenth century. Furthermore, the Maori Land Court hearings as well as Captain Cook's observations give some indication that such contacts were common in the prehistoric and early protohistoric periods. There are traditional references to exchanges involving food, weapons, canoes, raw materials such as ochre, greenstone, and even land (op.cit.:209-210).

In general, gift exchange over land seems to have involved contact with neighbouring groups rather than transportation of goods over long distances by the donors. The nature of this contact reinforced the complex inter-relationships of the Wairarapa hapu and the actual transfers of goods sometimes became highly complicated. One case cited by Mair (op.cit.:213) began with a gift of peaches and set off a chain of exchanges involving sea-food, a cow, freshwater fish, birds, and pigs. Many of the preserved items were finally consumed at a large feast to which all the participant hapu were invited.

Shortland's South Island informants provided details of items which they traded to the North Island during the 1840s, and these included prepared cabbage-tree roots, potted mutton birds, greenstone, white-heron feathers, and speargrass oil. These exports were made to Maori groups living around Cook Strait, "and the Ngatikahungunu, for which preserved kumara, mats and canoes were received in return" (Shortland, 1844:125; Mair, 1972:213). The existence of this trade is partly confirmed by Weld who in 1844 saw a Wairarapa chief's wife whose hair was tied up with the fibres of a South Island plant (probably Celmisia sp.), and in 1846 by Colenso who described a chief adorned with white heron plumes (Mair, 1972:211-2).

News and rumours spread along these communication lines together with the various foods and other gifts. Mair (1972:215) argued for the importance of food preservation to this network:

> "Perishable foods were exploited by the hapus living in close proximity to these resources. The preservation of karaka berries, eels, mutton birds, and sea fish eliminated the problem of distance and allowed the extension of links

to distant hapus".

Although depopulation had caused many old tracks to become badly overgrown, the early European explorers were able to identify the more important ones. One major route ran up the Wairarapa Valley from the sea and joined up with an inland track to Hawkes Bay, and another to Manawatu. Several tracks were recorded crossing the Tararua and Rimutaka ranges. However, the most favoured route to Wellington was along the coast. This coastal track also continued around Cape Palliser and up the east coast (op.cit.:217-9). It seems then that the Palliser Maoris could have heard about Captain Cook's gifts of nails at Hawkes Bay in 1769 via the regular exchange network of either coastal or interior groups or both.

Economic Activities

It has been shown that economic behaviour of the Wairarapa Maoris began to be modified even before European exploration of the valley. By 1842 the valley was over-run by pigs (op.cit.:183), and the potato was the most important plant grown for food and trade. Kemp's census in 1850 recorded a total of 15 acres of wheat, 32 acres of corn, 102 acres of potatoes, and 12½ acres of other vegetables (op.cit.:195).

Apart from fish what are believed to have been the important prehistoric foodstuffs are only rarely described during this decade. The Maori Land Court hearings again give some clues; for example, autumn visits to the coast to collect karaka drupes were documented, and an early settler's wife described a gift of freshly prepared rats (op.cit.: 187-8). When potatoes were scarce, both Weld and Colenso encountered Maoris whose only food was fern root (op.cit.:190). Although there were many hundreds of acres of bracken-covered land in the valley, Mair noted that:

> "the Maoris obtained their fern roots from certain favoured places which were known to grow fern root of good quality ..."
>
> (op.cit.:189)

Explorers sometimes commented on the remains of old cultivations, but since these often possessed remnant potato plants, turnips or wild cabbage, they were obviously 19th century gardens. The Turanganui valley and the silty soils beside the Ruamahanga River were used extensively for contemporary gardens.

Kumara was not important during this period but is recorded as a feast-food at Turanganui in 1851 (op.cit.:193). There are only a few traditional references to kumara growing.

The practice of eeling, for which the Wairarapa was traditionally famous seems to have been continued in the mid-19th century with very few modifications in equipment or processing methods. The quantities available depended on the natural closure of the mouth of Lake Onoke in times of low rainfall, usually once a year at the end of December. Over the next few months the level rose and eels congregated behind the gravel bar waiting for a chance to get to sea and begin their spawning migration. The eeling season began in February when short-finned male eels attempted their migration, soon followed by the females of the same species. One month later the long-finned males reached the bar and then the largest eels, the long-finned females, began their seaward migration in two runs in April and May. Seasonal shelters were set up beside the lake and many groups who had no inherited rights to eeling positions were invited to participate as guests (op.cit.:198-203). Three methods were used: the setting of a group of traps made from vines beside the lake edge to intercept eels moving down to the bar, the construction of 'no-exit' ditches in the bar, down which the eels would swim, only to be stranded in a huge pit, and the interception of eels wriggling over the bar on stormy nights (op.cit.: 204-6). Catch estimates varied from 10 - 30 tons per season, and even in this century, when the lake is artifically opened at the instigation of farmers, "a good night's catch should yield between forty and sixty large sacks of eels" (Saunders, 1965:37). Dried eels could be stored for up to three years, and thus justified their place in the exchange system.

THE SITE SURVEY AND SITE DISTRIBUTION ANALYSIS

INTRODUCTION

The initial reconnaissance of the area (vide Fig.1) was undertaken in August 1969 when a party of four (B.F.Leach, H.M.Leach, D.G.Sutton & the late I.M.Cameron) spent 28 days in the field covering more than 2,500 miles by landrover, and many miles on foot. The decision to confine the survey to the area south of a line from Featherston to Martinborough, and covered by the New Zealand Map Series 1 (NZMS1) maps N161, N165, N168-9, was only partly arbitrary. These three maps cover the lower valley, characterised by large lakes, lagoons, waterways, swamps and dunes flanked by older river terraces and rolling hills, together with the strongly contrasting environment of rocky shores, raised beaches and exposed cliffs of the coastal area of Palliser Bay. In confining the survey in this way the expedition was exploring the two important environmental zones of the Southern Wairarapa. It was originally planned to include the area to the east of Martinborough and Cape Palliser, but it quickly became clear that this task was beyond the scope of the field research programme; also there appeared to be sufficient repetition of evidence along the parts of the coastline already known to suggest that further exploration would yield steadily diminishing returns.

A preliminary search of the New Zealand Archaeological Association Site Recording Scheme files revealed only 1 site previously reported in the area of map N161, 3 sites for N165, and 13 sites for N168-9. The majority of these were outside the particular zones considered in the August survey. One further source of recorded sites was Adkin's (1955) report on Eastern

Palliser Bay. Uneven knowledge of archaeological sites indicated that a systematic coverage was required. Although some local informants knew of sites and were able to pinpoint their position, additional sources of information were needed, especially aerial photography and ground reconnaissance.

A complete set of aerial photographs (1944 series) and a number of large mosaics were taken into the field. While these proved invaluable for site location, despite the high altitude from which they were taken, considerable changes in landform and vegetation were found to have occurred since 1944. Once correlation with present-day features was established however, these photographs enabled the survey party to identify former sites, now so obliterated that their status as archaeological features was in doubt. In some cases possible prehistoric sites appeared in freshly manufactured state in the early photos, thus establishing their European origin. It was originally hoped to have a set of high resolution low altitude photographs flown especially for the research programme for both site location and photogrammetric surveying. Unfortunately, bad weather delayed this survey by 6 months. These latter photos enlarged by 5 diameters subsequently formed the basis of much detailed mapping of archaeological features. It was even possible at times to plot alidade survey data directly on to permatrace mounted over these large prints on the plane table.

The reconnaissance was divided in two parts: firstly a systematic examination of the riverine-lakes complex and surrounding foothills by daily landrover trips from a base in Martinborough; secondly a similar procedure in eastern Palliser Bay with a base at Whatarangi Station. The fieldwork procedure adopted was as follows:

after initial consultation of a Farm Location map, permission was sought from each farmer to investigate his property. Landowners provided much useful information on previously discovered ovens or charcoal areas, as well as artefacts. Private collections of artefacts were later photographed, sketched, and details of lithology and technology recorded. After consulting the farmer, the party usually split up in order to search the property systematically, sometimes guided by local information. A card index was used for information storage; each 'site' was given a number, and details of precise location and field evidence recorded. In addition, a comprehensive photographic record was begun, using Ilford PAN F 35 mm, Agfa CT18 colour, and Agfa ISOPAN IF 120 films.

During the course of the fieldwork over 200 sites were located and records made. Slow initial progress necessitated a modified and somewhat unusual procedure. One person each day was stationed with the landrover, and was responsible for keeping written records up to date in the card index, and searching the relevant aerial photographs. The other three in the party searched on foot for charcoal horizons, oven stones, midden material, and structural evidence. Reporting back to the landrover was facilitated by short range transceivers. At intervals the landrover was moved to 'pick-up' points, thereby saving much time for those on foot.

A wide ranging definition of a 'site' was adopted for recording purposes: 'any evidence of pre- or protohistoric activity with a significant spatial separation from other evidence'. Such a definition avoids strict criteria as to what constitutes a 'significant separation', and this reflects the realities of above surface reconnaissance. If a pit was found 20 metres from another, in such a circumstance that re-discovery might prove difficult, each was designated a separate 'site', and details recorded separately. In other cases, complexes of evidence were found spread over areas as large as a square mile, and were recorded as single sites. This procedure was invariably followed if separation from other complexes correlated with a natural barrier, such as a river, or shingle fan.

It will be noted that the recording procedure adopted meant that not all members of the party were able to visit each of the sites, although the expedition directors were eventually able to revisit each locality. Initially, therefore, the emphasis was firstly on ensuring ease of re-location, and secondly on recording as much surface information as possible. The problem of 'site designation' was regarded as subservient to these aims. This procedure had the effect of producing more than 200 site cards for the month of reconnaissance. Ultimately these records were translated into two forms. Firstly a form suitable for the NZAA site recording scheme; this resulted in an additional 126 sites on file (6 for map N161, 47 for N165, and 73 for N168-9); and secondly the cards were modified to suit the detailed recording necessary during later intensive archaeological investigation. In some cases this meant subdividing 'card sites' into different areas, in other cases combining several together. The motive behind this re-shuffling of records was to avoid any implicit assumptions that either the same or different groups of people might be responsible for constellations of evidence, without first finding some genuine archaeological justification for such links. In any event, the concordance of either the card information or the site nomenclature later used during excavation, bears only an indirect relationship to the NZAA site records. No simple solution to such problems can be suggested.

In the following discussion of the archaeological evidence, the NZAA recorded 'sites' are followed as much as possible. A summary of the NZAA records is given in Appendix 12, and the distribution of the sites on Figures 6 and 7.

TYPES OF ARCHAEOLOGICAL FEATURES IN THE WAIRARAPA

Discussion

In the context of reconnaissance it is most difficult to avoid unwarranted functional assumptions or interpretations of the field evidence. This issue becomes of special importance when the planning of excavations begins, where hasty superficial judgement may unduly influence the excavation tactics and affect the interpretation of sub-surface stratigraphy and structure. Such excavation may positively uphold hypotheses or negatively reject them, but will not allow completely different interpretations to emerge. At the outset, therefore, it should be noted that the characterisation of site-types offered below is purely a vehicle for description and discussion of superficial evidence, and should not be examined too closely. Its patent deficiencies are well realised.

The Wairarapa field evidence can be broadly grouped into the following 'site-types':

HABITATION SITES

Defended Settlements

Undefended Settlements

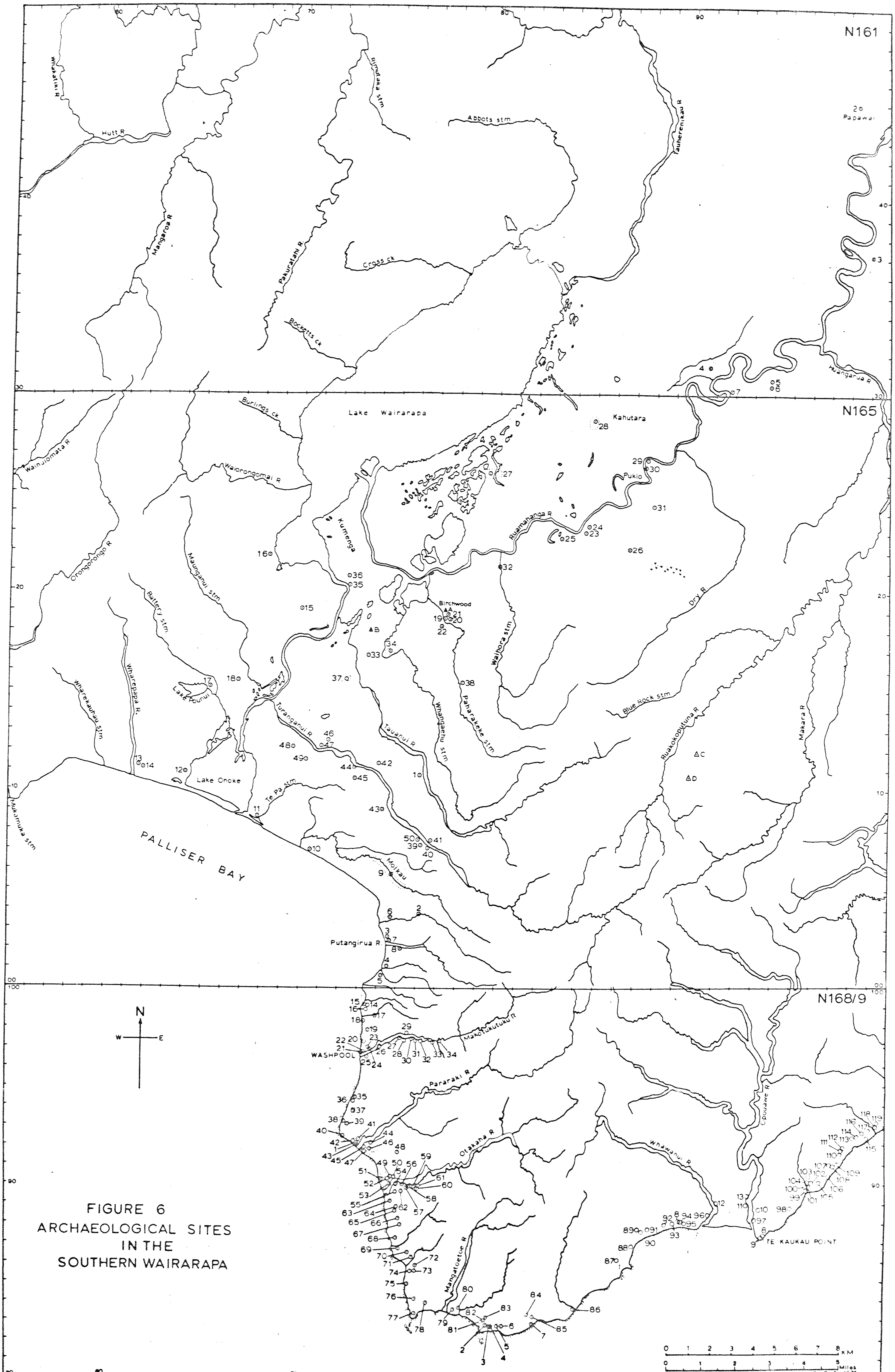


FIGURE 6
ARCHAEOLOGICAL SITES
IN THE
SOUTHERN WAIRARAPA

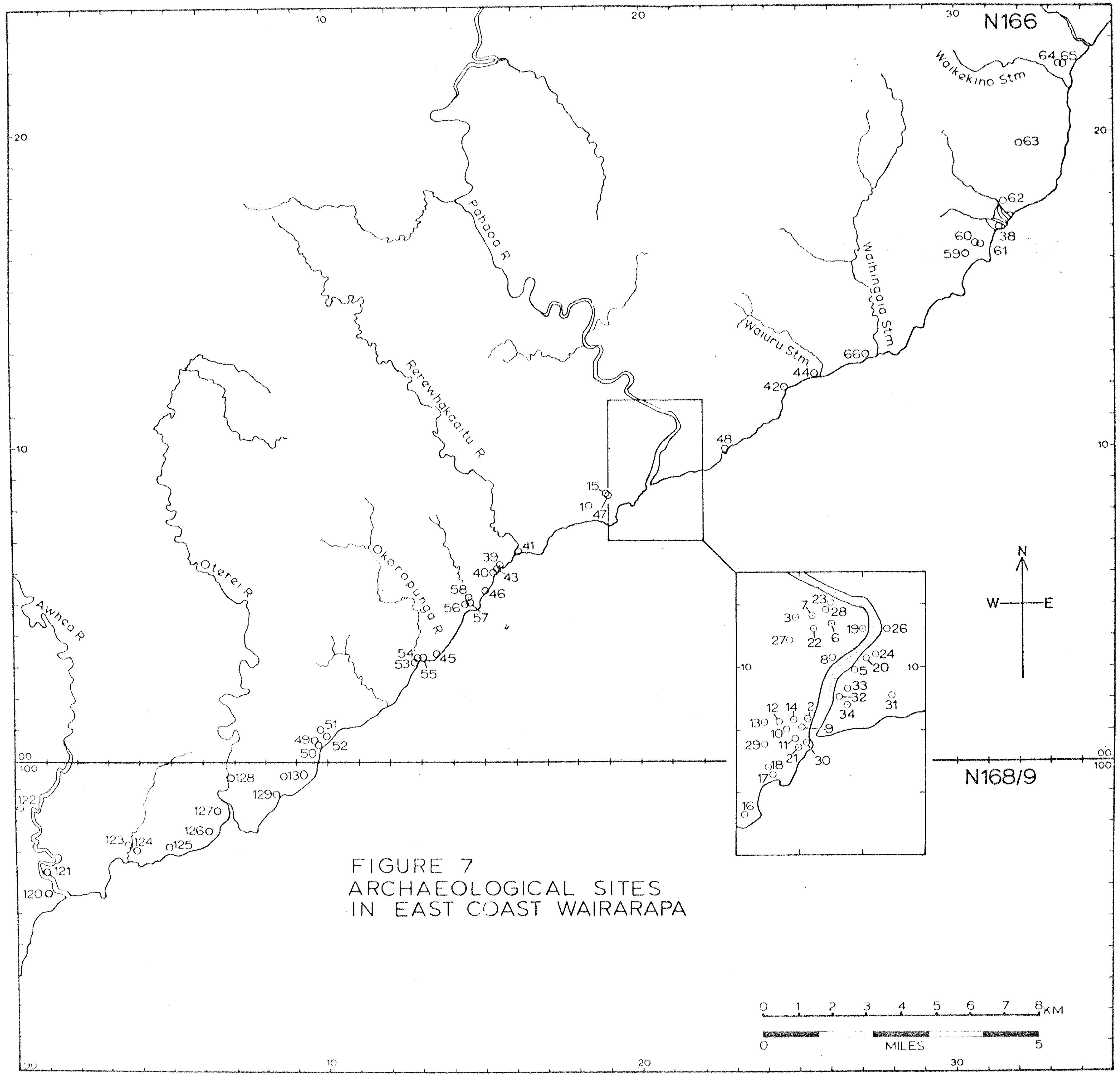


FIGURE 7
ARCHAEOLOGICAL SITES
IN EAST COAST WAIRARAPA

FOOD STORAGE SITES

Defended Pit complexes

Undefended Pit complexes

HORTICULTURAL SITES

Stone Wall - pit complexes

Stone Wall systems

Garden Soils

FOOD PROCESSING SITES

Middens and Cooking areas

SPECIALISED SITES

KARAKA GROVES

BURIAL GROUNDS

SPECIAL FIND SPOTS

Again, it must be stressed that the site categories devised are not at all exclusive, but perhaps plausibly inclusive. Thus the category 'Defended pit complexes' does not exclude the possibility that sub-surface evidence may exist indicative of habitation structures, for example, which may later transfer the site into the 'Defended Settlement' category. There are several cases where this has actually occurred, and these will be mentioned below; for the time being however, these sites are included in their earlier categories for the sake of consistency. Appendix 6 presents the results of this site classification.

Habitation Sites

Sites which had surface evidence of artificial terracing, or flattened rectangular platforms or depressions were categorised as dwelling sites. Many possessed stone slab hearths. Not all sites with such hearths, however, were associated with flattened surfaces, and these are not included as habitation sites. Thus, for the purposes of the survey, slab hearths are regarded as less conclusive evidence of dwellings than regular flattened areas. At least some of the so-called habitation sites may very well have contained structures of quite different function than dwellings, however, in the context of a site survey such issues cannot be resolved (vide, H.Leach, 1972).

The artificial terracing of slopes is a rare feature in Palliser Bay, and more commonly found in the main alluvial valley. Habitation sites in the former area for the most part were indicated by flat areas sometimes raised or depressed, and often surrounded by either low earthen 'walls' or small ditches. While slope-terracing does occur on the coastline, in several important cases other evidence argues against a habitation hypothesis. In one case the terraces are so large as to suggest another function; in another, they are so intimately related to stone walls and pits as to raise the possibility of terrace horticulture. The remaining 3 Palliser sites with terraced slopes were regarded as indicative of dwellings. These were the Kawakawa pa[1], the M4 'Cross Site', and the M3 ridge site.(See Appendix 14)

Defended Settlements

Only 11 habitation sites were found which were defended, either by fortification earthworks or strategic location or both. Applying the term pa to these sites is probably justified, and indeed many are known by proper names indicating this.

The number of terraces contained varies considerably from quite large sites such as Hume's pa - a magnificently preserved site with slumped palisade post holes - to quite small sites such as Wilkie's pa, which has only a few very indistinct enclosed features. In some cases modern erosion or farming activity has so modified the land that few useful details can now be recorded. This is especially

[1]The use of proper names for sites is discussed in Appendix 15.

the case for Te Kopi pa which has only a ditch and bank and one or two indistinct terraces and/or pits remaining after massive riverine erosion. Similarly, a pa site near Dyerville with the interesting local name of Pa Nga Tahua has been almost obliterated by farming. It is tempting to think that the famous Ngai Tahu (ancestors of the Kai Tahu of the South Island) may once have lived at this locality before their traditionally known migration (discussed above).

Because of the variable state of preservation of these pa, it is not possible to be certain in all cases of their association with pit features. One site however, Battery Hill pa, is outstanding with no pits at all within several miles. Apart from considerable damage caused by bulldozing tracks in the vicinity, this site is well preserved with many palisade butts still *in situ*.

Where their shape can be clearly ascertained, pits are invariably of the rectangular raised rim variety, which are typical of the East Coast of the North Island, but which also occur at least as far north as Anaura Bay, and as far south as Banks Peninsula (H.M.Leach, 1976:Chapter 5). Some of these pits in the Wairarapa were found to have ditch or drain features surrounding them (for example, Hume's pa and Parikarangaranga pa). This feature also occurs with rectangular raised rim pits in the Anaura Bay area.

The defensive arrangements of these sites take full advantage of natural features and may be easily grouped into four different forms. The first defence form utilizes naturally steep sides all round a knoll which terminates in a narrow area which may (in the case of Jackson's pa), or may not (as with Wilkie's and Kohunui pa) have a perfunctory ditch and bank fortification. The second utilizes a headland or ridge which is cut off by a well defined ditch and bank (Te Kopi, Whakatomotomo, and Matakitaki South pa). The third form takes advantage of steep sloping ground all around and does not have ditch and bank defences (Kawakawa and Pa Nga Tahua). The fourth type is similar to the so-called 'Ring Ditch pa', Type 3B of Groube (1970), in which a cliff edge is cut off by a massive ditch and bank on three sides (Battery Hill, Hume's pa, and Parikarangaranga pa). In the case of Hume's pa, a further ditch and bank occurs outside the main 'ring ditch', on the longest side, It is also notable that in this site a number of pits occur outside the main defences.

It is of further interest to consider briefly the local environmental setting of these various defended settlements. The Matakitaki South pa, Te Kopi, and Kawakawa pa, are situated in the scrubby forehills above the coastal platform. All other pa sites were apparently intimately associated with lowland podocarp forest. Relic stands abound in these areas today. Pa Nga Tahua, Whakatomotomo and Parikarangaranga pa are in defended locations above relatively well drained riverdeposited gravels and associated soils, while all other non-coastal pa are in the immediate vicinity of large low lying swamps and lagoons associated with the lakes complex. Jackson's pa, Kohunui and Wilkie's pa are each situated on consolidated sand dunes of estuarine origin (Leach and Anderson, 1974).

Undefended Settlements

A further ten habitation sites were found which show little if any indication of either fortifications or particular choice of localities for defence purposes. Of these sites, six were occupied during historic times. Jury's Island, for example, was once the home of the celebrated Te Whatahoro, contributor to the Lore of the Whare Wananga (Smith, 1913-15).

These historic sites are invariably closely associated with waterways, and when occupied would have been adjacent to podocarp forest, as relic stands attest. Jury's Island, Waitapu, and Otaraia pa are on the banks of the Ruamahanga river, and the Turanganui pa on a major tributary of that name. The settlements called Okorewa and Kiriwai are on either end of the present sand bar separating Lake Onoke from the sea. The present exit of the lake is to the east of this sand bar, but the 1944 aerial photos show clearly that before modern clearing of the exit it was even further east, past a fairly large lagoon in front of Okorewa. Similarly, on the western end of the sand bar (in front of Kiriwai) is situated another lagoon, and there seems little doubt that this also marks an old exit to the sea. Only one of these six historic sites, the Turanganui pa, may have had some minor ditch and bank feature. This is no longer present, but possibly indicated on the early aerial photos before the river changed course. None of these sites shows more than scattered occupational debris, having been built on relatively flat land and therefore subject to modification by modern farming.

The remaining three sites have no historic records, and are therefore possibly prehistoric. All are situated in eastern Palliser Bay. These sites, the Moikau, the M3 Ridge Site, and the M4 Cross Site on the banks of the Makotukutuku River, are in secluded river valleys. These few sites present a variety of surface features. All have rectangular raised rim pits, terraces or platforms, and some have stone wall systems close at hand.

Food Storage Sites

Evidence for food storage areas comes in the form of subterranean pits. The most widely held view of these features in New Zealand is that they functioned as specialised storage devices, especially for horticultural products, and in particular for the kumara (*Ipomoea batatas*). There is, however, a long standing controversy over these features among archaeologists which has yet to be completely resolved. On present evidence the most favoured view is that the majority of these structures were indeed for food storage; nevertheless, it is a wiser archaeological tactic to approach any individual pit feature aware that its actual function in the past may have been anything from a dwelling to a device for storing rainwater.

Pits found during the Wairarapa reconnaisance are broadly speaking of three types. The vast majority are of the rectangular raised rim variety, while two or three found were circular with raised rims; a further two or three were rectangular with no obvious rims. These latter pits, in the Whakatomotomo valley (N165/41) are locally claimed to have been used during the historic period for potato storage, an interpretation which might be in keeping with their unusual form. There were also many pits found of indistinct form, owing to damage by grazing, ploughing, or bulldozing. Present evidence suggests that the lower Wairarapa prehistoric pits are characteristically rectangular with raised rims, with only a few specialised forms such as circular with raised rims. Some indications of the presence of buttresses were also found, for example, in the Putangirua area (*vide infra*). The presence on some pit areas of ditches or drains has already been noted.

It was also noticeable from the field evidence that individual pits, or complexes involving several, were either on open ground in readily accessible places (undefended), or either fortified or hidden away in remote bush clad areas making them exceptionally difficult to find (defended). Some allowance must be made for modern deforestation, but in general the distinction between accessible and inaccessible was easy to apply. The efficacy of the 'hide-away pit-complex' may be easily appreciated considering that in the Washpool valley 2 further pits were found within a few hundred yards of excavation areas after 2 years of intensive research. No doubt many pit areas, defended in this way, remain undiscovered in the Wairarapa.

Defended Pit Complexes

Twelve concentrations of defended pit features were found in which evidence of other activities was lacking. Defence ranged from deliberate fortification with ditch and bank, as in the case of a site in the upper reaches of the Tauanui river, the advantageous use of natural escarpments and cliffs, as with both sites above the Putangirua river, to the simple hiding away of pit features in dense bush on small spurs or river terraces in the upper reaches of river valleys. This latter feature is especially common with the pits in both the Washpool and Kawakawa valleys.

Several of these defended pit complexes, especially the more elaborate, such as those at the Tauanui and Putangirua, would commonly be classified as pa sites; while such a term might loosely be applied, it is important to remember that evidence of sustained habitation in the form of 'house' platforms or terraces is absent on all these sites.

A further point should be noted concerning these defended sites, of greater relevance perhaps to coastal occupation areas. If the majority of these pit complexes are for kumara storage, the advantages of hiding the structures away in secluded areas must be gauged in relation to the disadvantages of storage in less suitable micro-climatic zones. On the coastal platform, ground frosts are extremely rare, and storage conditions would be assisted by the ameliorating effects of the sea. This maritime influence on local climate falls off very rapidly up the valleys, and is a subject which will be further explored later in this thesis.

Undefended Pit Complexes

Thirteen areas were found with one or more pits, in exposed localities, which were separated from other sites by considerable distances. All pits (apart from indistinct ones) were the common rectangular raised rim form. One large complex near Lake Ferry, was situated on flat river gravels, covering an area of 1 - 2 acres. Unfortunately this site has been partly destroyed by grazing and modern cultivation.

Only two areas of exposed pits were found on the Palliser Bay coastline - at South Kawakawa (N168-9/55) and at South Waiwhero (N168-9/70). All other undefended pit complexes were on the lower Wairarapa flood plain.

Horticultural Sites

There were two classes of site found in the Wairarapa which possibly relate to horticultural activities. These were 'made soils' and stone wall 'field systems'. Such indirect evidence is not very satisfactory, but then the certain recognition of gardens poses a number of problems for the archaeologist. Similar difficulties are encountered in identifying structures for storing horticultural produce. The survey team can record pits, stone walls, alignments of stones, terraces, and soils modified by incorporation of quantities of charcoal or gravel, under these specific descriptions, but this amounts to avoiding the issue when some interpretation is demanded, however superficial. Such interpretations must and should be advanced, so long as it is amply clear that they are tentative. If these general observations do not intrude too far into the process of excavation and analysis, then little damage can result.

It is unfortunately the case, however, that while the designation of a terrace as a garden may be disproved by finding house features such as post butts and hearths during excavation, interpretation relating to gardening cannot usually be proved. This variability in competence to prove and disprove hypotheses, has been noted before in other disciplines apart from archaeology. One way over this problem has been to apply Popper's procedure of 'conjecture and refutation' - emphasising the disproof of hypotheses, rather than the reverse (Popper, 1972). This conservative approach may have a lot to recommend it in archaeology.

Over the years, ethnographic analogy has played an important role in defining the criteria by which archaeologists recognise horticultural sites. Complexes of stone walls and boulder alignments have been observed in various parts of the Pacific marking the boundaries of actual garden plots, especially where the ground is stony and requires clearing. Terrace gardens are an even more common feature in the Pacific Islands in irrigated and dry forms. Within New Zealand, early observers recorded the practice of adding gravel and sand to heavy soils, and the addition of wood ash. Such examples give good grounds for calling walls, modified soils, and to a lesser extent, terraces, horticultural features. Factors of distribution reinforce this designation: wall complexes occur in Northland, Auckland (and the offshore islands), sporadically in Taranaki and the Bay of Plenty, and more commonly on the south east coast of the North Island, especially Palliser Bay. They reappear at isolated east coast localities as far south as Banks Peninsula, believed to be the southern limit of prehistoric horticulture in New Zealand. It is clear that wall complexes do not occur in the colder parts of New Zealand. Except in Northland, they are invariably coastal, and consequently frost-free. This factor becomes increasingly important from Hawkes Bay and Taranaki southwards.

It has been claimed (Law, 1969) that pits reach their southern limit in the Banks Peninsula area (although Temuka is often cited as the location of possible 'borrow pits'). Their relationship with stone walls and modified soils, however, is a complicated one. In much of the North Island they are the most common archaeological feature. The question of their proximity to gardens can only be answered in areas where soils are so heavy that gravel needs to be added, or so stony that walls or mounds have to be built. In areas of well-drained, warm and stone-free soils, not even indirect evidence of gardens may be available. It might be argued, however, that the presence of pits suggests gardens somewhere in the vicinity.

In the Wairarapa alluvial valley only one area of 'garden soil' was recognised (N165/45), but the abundant pit sites, both defended and undefended, argue for horticulture. There are several possible reasons for this absence of evidence, some of which have already been outlined; they are nevertheless negative arguments, however plausible. The absence of clearer evidence for garden areas in the main valley must therefore be regarded as a problem.

On the Palliser Bay coastline, gardens appear to be present in great numbers, sometimes in close association with pits (as around the Kawakawa and Washpool valleys), and sometimes several miles away (as at the Pararaki). Just as the gardens that are recognisable are not necessarily the only gardens to have been in use, pits too may occur in an undetectable form for example, in soft sand. Thus, arguments of association involving horticulture and storage features are at the mercy of the archaeologist's varying ability to identify various classes of site. At the same time, the occurrence of stone wall systems with and without pit features was noticeable in the field, and this distinction is maintained here. Similarly, areas of enriched soils were recorded separately as potential gardens.

It may be claimed that this distinction between 'stone walls' and 'stone walls and pits' gives a misleading impression of site component associations. It might be thought, for instance, that where pits are not included within the stone wall complexes, they are nevertheless in the same general area. However, the field situation is considerably more complex than this. Examination of Appendix 8 will reveal that areas with large numbers of 'stone wall and pit' complexes are not accompanied by a low number of spatially separate pit features; likewise, areas with numerous 'stone walls' are not correlated with high numbers of separate pit complexes. It would thus appear that the distinction suggested above does have some significance. At this stage it can only be suggested that the complexity of these associations may be a reflection of time-trends in the relationship between garden horticulture and produce storage. The simple analysis of existing field evidence, where several time-patterns may be superimposed, cannot be expected to reveal the nature of such relationships; this is a matter for intensive archaeology to elucidate.

Stone Wall - Pit Complexes

Eight areas were found which consisted of arrangements of stone walls with pits close at hand. These were all in Palliser Bay, and only two were not in the immediate vicinity of the coastal platform. These two sites were on high river terraces in the Kawakawa valley (N168-9/59,61), and situated in places which might be considered 'hide-aways'. All sites possessed rectangular raised rim pits, except the Washpool M1 area (N168-9/24) which had circular raised rim pits in association with artificial terraces as well as stone walls. The reason for exclusion of this site from 'undefended settlements' is discussed later. Apart from the three sites mentioned above it was most noticeable that the remaining five situated between the Kawakawa River and Ngawi, were located at the back edge of the coastal platform against the base of the 250 ft (76.2 m) marine terrace, and each directly associated with a small gully watercourse.

Stone Wall Systems

Strictly speaking the term 'walls' is a little misleading, for these are usually low ridges of mounded stones; only rarely do free standing 'walls' occur. The term is retained here, however, because of its widespread usage in previous discussions of such features.

These sites are by far the most common archaeological feature in Palliser Bay, and do not occur in the main Wairarapa valley. Twenty distinct areas of stone walls were found. Apart from four areas, all are situated directly on the coastal platform in very exposed localities. These four exceptions were in protected positions within a mile of the sea, but should not be regarded as 'hide-aways'. Many of these areas of stone walls are very complex and spread over an average of ten to fifteen acres each. With two exceptions (N168-9/52,81) all are on relatively flat ground, although sometimes on ancient and sloping consolidated shingle fans. The two exceptions, one at the Kawakawa, and the other at the Fishing Reserve, Cape Palliser, are on very steep ground. The former site extends up the hillside to a quite remarkable slope 21.5° near the top.

On two sites in the Washpool valley, numerous stone mounds were found related to stone wall systems. A horticultural function, other than simple 'stone clearing' can be suggested because they are concentrated inside the stone wall enclosures, rather than on the periphery.

Garden Soils

Soils enclosed by stone walls are invariably enriched with charcoal or shingle; only three sites were found showing such modification, but which had no definite stone walls in the immediate vicinity. Two of these sites were near Whatarangi and covered by recent alluvium, one fan being active in 1944 as attested by the early aerial photographs. Both areas may once have had stone walls associated now hidden by the overburden. The third site was in the Whakatomotomo valley, and its association with other sites in the area is uncertain.

Food Processing Sites

Thirty discrete sites were found with evidence of oven rake-out and/or midden material. Twelve of these sites were in the main Wairarapa valley area, widely scattered over the old estuarine sand dunes and flood sediments. The rest were on the Palliser Bay coastline within 400 metres of the sea, and greatly concentrated at the mouths of the main rivers. Only site M3 in the Washpool valley is exceptional in this respect, being 1.9 km inland. The main valley sites possess no identifiable midden material, whereas the coastal sites invariably have bone and shell exposed in the stratigraphy. This absence of midden material in the main valley may suggest a substantial vegetable diet with non-durable components being deposited with the oven material. The absence of bone from either bush birds or freshwater fish is nevertheless surprising.

Specialised Sites

Five sites were found which fit only awkwardly into the above categories, and these are discussed separately.

N168-9/48: A series of stone walls and single boulder alignments on a hilltop (approximately 200 mASL) above the south bank of the Pararaki River. It must be admitted that the discovery of this site was quite accidental, since it was in an area which was far from promising. The possibility cannot be ruled out that further high country sites exist in Palliser Bay which, because of their remoteness, have not been located.

N168-9/36: A complex of exceptionally large artificial terraces was found at Hamenga Station, Palliser Bay. Similar sites exist on the coastline but these are obviously formed by artificial in-filling behind old beach ridges. This procedure results in a series of very long terrace formations with modified 'natural' walls in front. Sometimes these sites are subdivided further by artificial walls and single boulder alignments. The terraces at Hamenga, on the other hand, appear to have been formed by the more normal method of terrace construction, by cutting away a slope and placing the fill in front to form a terrace up to twice the size of the excavated area. The terraces do not follow any obvious natural escarpment or beach ridge, and are fairly irregularly scattered over the foot of a consolidated fan. Terrace gardening may be a possible interpretation.

N168-9/80: Another unusual site, located at the mouth of the Mangatoetoe River, is a very large rectangular platform surrounded by a raised earthen 'wall'. This feature is quite out of character among Palliser Bay prehistoric features, and may in fact be of European origin.

N168-9/62: At the top of a hill (approximately 150 mASL) on the south side of the Kawakawa River was found a large flattened area which may be artificial. No other archaeological features were obvious. Again no comparable parallel exists in the Wairarapa.

N168-9/27: A site was found up the Makotukutuku valley (Site M3) which was first reported by Adkin (1955). Adkin's description of this site is a rather optimistic appraisal of the field evidence. The site will be discussed in detail later. At the moment however, it is sufficient to mention that no comparable site exists either in the

Wairarapa and perhaps in New Zealand. It is locally known as the 'Fort Site' and features a free standing stone wall which cuts off a small promontory in the valley. In front of the wall is a ditch interrupted by two causeways leading to the defended area. Inside the defended area is one possible pit, much modified by post-occupation tree growth. The entire area is covered by forest 'dimples' which make surface interpretation very difficult. Adkin's claim that some of these 'dimples' were rows of midden filled pits is quite at variance with the field evidence. Sparse midden does however occur in buried horizons.

Only one other free standing stone wall is to be found in the southern Wairarapa, and should be briefly mentioned. This is a few miles northeast of the Cape Palliser Lighthouse, and is known locally as 'The Stone Wall'. This is a substantial meandering construction similar to crofters' walls in Western Scotland; its status as a prehistoric feature, perhaps to mark a tribal boundary, invokes much public interest. The wall is situated on the earlier boundary between Whatarangi station (and later the Matakitaki Block) and Ngapotiki station. According to one informant (Mrs H.L.Scott, the daughter of the Cape Palliser lighthouse keeper 1919-21), the boundary wall may have been built by Mr Andy McNab who was still working for Ngapotiki in 1920. A series of prehistoric stone walls is also found in the immediate vicinity (N168-9/86).

Karaka Groves

Five of the previously recorded sites on maps N165 and N168-9 were groves of karaka trees (Corynocarpus laevigatus). A long standing argument exists in New Zealand as to the number of groves of these trees which were artificially planted in the vicinity of occupation sites. It has sometimes been claimed that natural regeneration of the trees is rare; thus a karaka grove is often taken as indicative of prehistoric evidence close at hand. In Palliser Bay, and the main Wairarapa valley innumerable groves of these trees occur; in many cases in areas quite unsuitable for habitation.

A karaka grove locally known as 'Dingley Dell' (N168-9/17) was added to the site list for two reasons. Firstly, there were indications of charcoal enriched soils in the vicinity; secondly, several of the trees had initials and dates carved on the trunks, some dating back as early as 1868. Under the direction of Dr R.McQueen of Victoria University of Wellington, research was undertaken to see if artificial planting of karaka trees could be determined by studying local regeneration in terms of the age structure of groves. The Dingley Dell trees proved invaluable in this respect, for they facilitated an assessment of ring growth by taking core borings on either side of the carvings. Unfortunately however, the relationship between yearly growth and ring formation was found to be extremely complex, thus hindering further research into this particular problem.

Burial Grounds

Four sites were found which could be best described as cemeteries.

N165/4: There is considerable confusion as to the exact location of an early European settlement called Te Kopi in Palliser Bay. The coastline in the general vicinity has been much changed by storms and earthquakes, and it is doubtful whether the position of the old Te Kopi anchorage and Maori settlement will ever be known with certainty. At the modern settlement of Ning Nong Bay, close to where Te Kopi is thought to have been, there are indications of earlier habitation in several of the road sections. A burial ground was also found during the road construction, and is now a Reserve.

N165/24: This is a historic burial ground which is fenced off in the vicinity of Otaraia pa, in the main Wairarapa valley.

N168-9/43: During a short visit to Palliser Bay in 1966 a very large burial ground was discovered at the mouth of the Pararaki River. An area of at least an acre contained abundant skeletal material, and even at that time the river was eroding burial pits in the riverbank section. The 'Wahine storm' of 1968 completely removed the top 2 - 3 metres of this deposit, taking with it the entire burial ground.

N168-9/53: On a visit to the Kawakawa mouth in August 1970, a burial was noted eroding from the river section following flooding. One individual was all but washed away, while the bulk of another remained in situ.

Find Spots

During the course of reconnaissance in the Wairarapa, several river canoes were found in paddocks beside the Ruamahunga river. These are most unlikely to be in the original place of either their construction or use. Local informants claimed that their position regularly changes with winter flooding. The first two mentioned below have been modified a little with European tools. Several people remembered canoes along the Western Lakes area, but these have since disappeared during flooding.

N161/6: This was a small river canoe on the Waihinga station near Martinborough. It has a rear seat carved from the trunk, and a kind of bulkhead carved out of the natural in the centre region.

N161/7: On the Mahaki property near Martinborough another canoe was found. It is substantially larger than the first. Notable features are again the carved seat at the stern, and a 'chine' carved hull. This canoe has since been taken to the National Museum.

N165/30: Mr R.Sutherland of Pukio, near Dyerville, drew our attention to a river canoe prow, washed up on the banks of the Ruamahunga on his property. The section has since been moved by flood waters.

N165/31: A river canoe was found on the property of Mr D.G.Rowland, near Dyerville, of about the same size as N161/7. This canoe is rather narrow and is unusual in being laterally curved, possibly to counteract the dragging effect of an outrigger, although no obvious attachment area could be detected.

AREAS OF ARCHAEOLOGICAL EVIDENCE IN THE WAIRARAPA

Discussion

From the foregoing it should be clear that archaeological sites in the lower Wairarapa are not continuously distributed across the landscape, but clustered in several environmental zones. Moreover, there are certain categories of site which are found in one area and not in others. In what follows, a brief description is presented of the more obvious spatial clusters of archaeological evidence (See Figure 8 and Appendices 7 and 8).

The clearest subdivision can be made between sites in the lower Wairarapa valley system, and those sites in Eastern Palliser

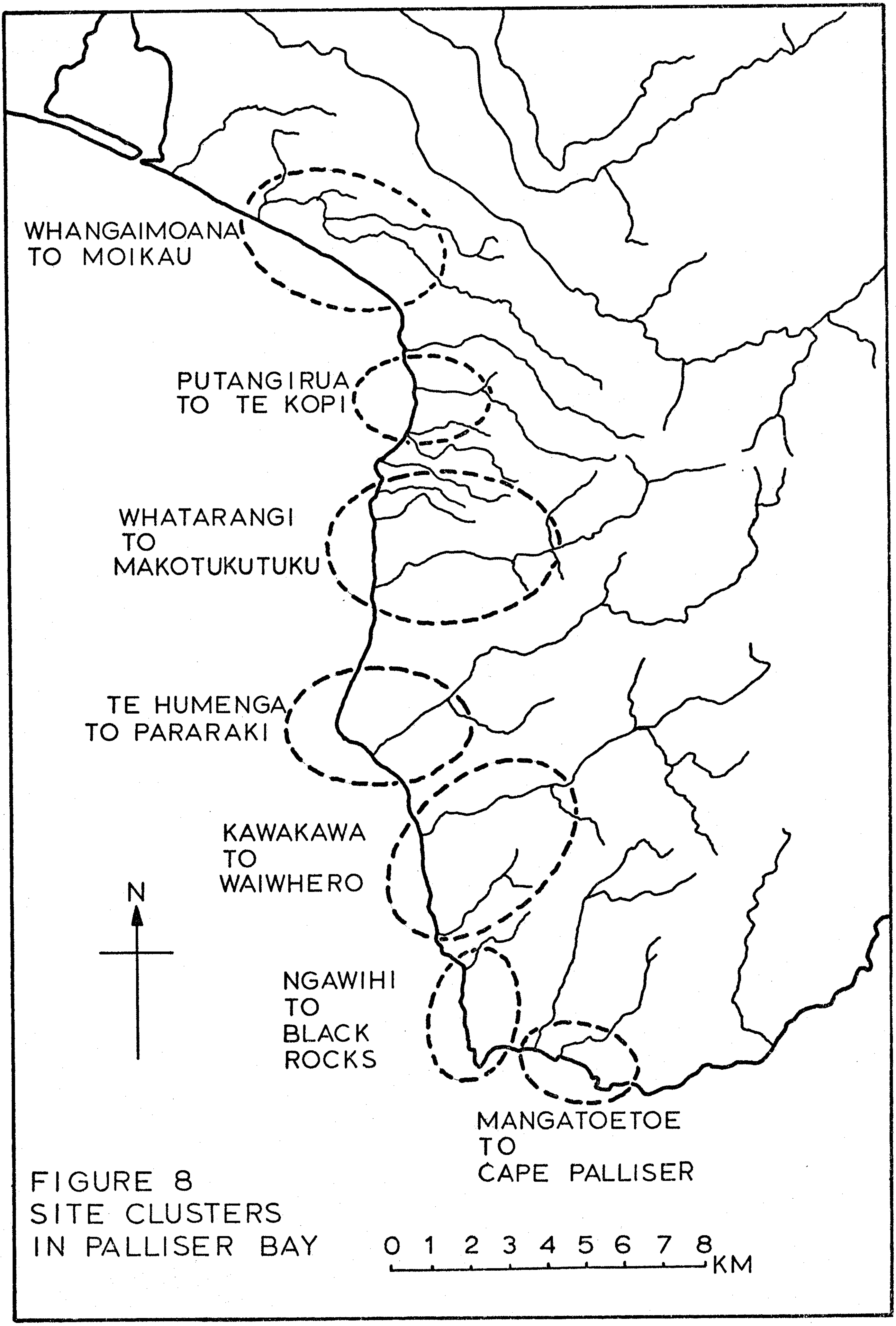


FIGURE 8
SITE CLUSTERS
IN PALLISER BAY

Bay. The most striking difference is the total absence of stone wall systems in the main valley. Whether this implies that different people were involved in the two areas is a question which can only be answered by intensive archaeology.

The Lower Wairarapa Valley

After only a few days in the field it became obvious that a representative selection of sites from the last thousand years of prehistory could not be located by an initial reconnaissance. This valley system is low lying, and prone to floods. The 5 ft (1.52 m) contour above mean sea level extends nearly 25 miles (40.2 km) inland. When the rivers are swollen by rainfall in the headwaters of the Ruamahunga and Tauherenikau drainage systems, coupled with a coastal storm which periodically closes the lakes' outlet, widespread flooding results. This situation has improved dramatically with recent water channels, drainage systems and spill-ways, but before this time, alluvium had spread across the valley floor, burying archaeological sites. Some farmers claimed that in certain areas deposits of silt of up to 15 ft (4.57 m) had built up during living memory.

It seems likely that recent alluvium would differentially cover sites according to their age, granted a similar settlement pattern in the area over time. Even on a chance basis the older a site is the more likely it is to have been covered by silt and gravels, which are far from evenly deposited from one flood to another. On high ground however, it might seem that the chances of discovery of sites of different age are roughly equal. On the other hand, in the North Island, high ground was particularly favoured during the later periods of New Zealand prehistory for defensive purposes.

As has been discussed elsewhere (Leach and Anderson, 1974), the main valley is by no means tectonically stable, being close to a major earthquake fault which runs up the Rimutaka foothills; and some complications in the representation of field evidence in the lowland areas should be expected from this. Sites found in the Kumenga area, for example (N165/35,36), can definitely be dated to a period after 1855 since this land was uplifted from the lake by the great Wellington earthquake of that year (MacKay, 1891).

It was, therefore, anticipated that the bulk of evidence found in the area during the reconnaissance would probably belong to the later periods of prehistory, and this is precisely the impression gained from the field evidence.

The following sections examine the evidence according to the several environmental zones in the main valley and lakes complex.

Western Lake

This includes the area down the western margins of Lakes Wairarapa and Onoke from Featherston to Cape Turakirae (the western extent of Palliser Bay). Only seven sites were found in this region. These include one pa (Battery Hill), with no pit features, and presumably a fairly late site, three areas of oven debris, two areas of pits, and one undefended historic settlement (Kiriwai). A few possible stone walls were located at the southwestern extremity of Lake Onoke near the Kiriwai settlement, but these were subsequently obliterated by bulldozing before they could be examined and recorded in detail. The area from Wharekauhau to Cape Turakirae is substantially covered in recent geological formations, and seems unlikely ever to have supported any great population, although scattered settlements may have occurred in several more sheltered and stable localities.

The cluster of sites found appear to be based on the more protected area from Papatahi to the Wharepapa peninsula. This area offers good access to fertile soils for agriculture, and also to lake, forest, and marine food resources.

Eastern Valley Sand Dunes

In several localities on the eastern shores of Lake Wairarapa are found consolidated sand dunes. Later research showed these to be related to former estuaries in the lower Wairarapa valley (Leach and Anderson, 1974). It is sufficient to note here that the aerial photographs show these sand dunes to be organised into a series of arcs, more or less continuously running from the northeastern area of the larger lake to Pirinoa. The dunes have been much modified by subsequent water action and European agriculture, and are only represented in patches south of Tuhitarata.

Considerable attention was given to finding sites in these consolidated dunes. Whether the formation of the dunes took place before or during the period of human occupation, they were more likely to contain surface evidence from earlier periods of prehistory, unlike the lowland areas. However, despite a great deal of effort in the field, few prehistoric sites were found.

Eight sites occur on or near these dunes: three pa sites, (Kohunui, Wilkie's, and Jackson's pa) showing perfunctory attention to defence, one area of pits, and four areas of oven material. All sites except one were found on the easternmost line of the dunes. The exception (N165/27) is on very low dunes close to the present lake margin. Further searching in the lower dune complexes between the lake and the eastern high dunes may yet reveal additional sites. This large area could not be covered fully on the site survey, especially since results were so unrewarding.

Eastern Valley Lowlands

In the lowlands area on the eastern side of the main valley twenty sites were identified. Two of these were pa - Pa Nga Tahua and Hume's pa. Five further sites have been categorised as 'undefended settlements', each being occupied during the historical period. Three undefended pit complexes were found, along with five areas of oven debris, and the four river canoes described above.

No obvious patterns can be observed in this evidence, except perhaps a predominance of modern material; this is in keeping with the problem of differential survival outlined above. Most of these sites are within easy reach of the main waterways leading to Lake Wairarapa; but this pattern is once again almost certainly heavily biassed by a failure to find sites in the great expanse of flat land between the Ruamahanga and the main lake. Although there are dry sandy areas throughout the maze of lagoons and swamps, much of the water level is only within 1 ft (30.5 cm) of mean sea level; this makes site surveying extremely difficult, even for the more recent sites which may not be covered with flood deposits.

Any sites which might be found in this region in future are likely to offer excellent preservation conditions for a wide range of cultural material. Later excavations of some of these deposits to clarify the environmental history of the area yielded faunal and floral material in a remarkable state of preservation after 3500 years of burial (See Leach and Anderson, 1974).

Subsidiary River Valleys of the Eastern Flood Plain

In the southern part of the main valley there are two subsidiary river valleys running east from the swampy lowlands into the steep Aorangi mountains. These are characterised by bush clad spurs and broad river terraces with alluvial soils. Only two sites were found in the first of these valleys - that of the Tauanui River - an impressive defended pit complex (N165/1), and a hide-away pit complex, a little to the north of the valley (N165/38). The second - the Whakatomotomo valley, with the Turanganui River - is somewhat larger than the Tauanui, and contains abundant archaeological evidence. The eleven sites found include two defended settlements and one undefended settlement (historical period), one defended and five undefended pit complexes, one garden area, and one area of oven debris.

In all it seems that the Whakatomotomo valley was once the scene of considerable activity. Historical records also attest this, and quite a few of the sites found may belong to an early European context. Farming activity seems to have destroyed many of the Maori gardens recorded in this area by early surveyors.

The Palliser Bay Coastal Zone

As indicated above, great difficulty was encountered in the field in deciding what constituted 'a site' in Palliser Bay. There were two complementary reasons for this difficulty: firstly, archaeological evidence is so dense throughout the entire coastal platform that deciding where one site ends and another begins (from purely surface examination) was often quite impossible or arbitrary; secondly, where spatial gaps between the surface evidence do exist, there is considerable ambiguity as to their significance. On many occasions the separation is clearly marked by now active shingle fans and other erosion phenomena, whose history is exceptionally complex. Whether these natural barriers to occupation existed during the prehistoric period is a question of some interest; it is quite possible that at least some were not, in which case many connecting links between sites have either been inundated by alluvium or washed out to sea. This problem was particularly acute in the area from the Hurupi to Whatarangi, where the coastal platform is particularly narrow. The Wellington earthquake of 1855 is known to have had a profound effect on this stretch of coastline, as have subsequent major storms such as the 'Wahine Storm' in 1968. Initial site recording therefore necessarily involved a certain amount of educated 'guesswork'.

Analysis of the distribution of the 83 sites found on the coastline as a whole, reveals some interesting patterns.

It was found that archaeological evidence was more or less concentrated around the six main river valleys, and in a seventh rather special area. The latter area is a strip of coastline between the modern European settlement of Ngawi and Black Rocks (Ngawi Point) immediately to the south. Palliser Bay is a most exposed strip of coastline, noted for its rough seas and tumultuous winter climate. The only areas protected from the southerly storms and northwest gales are the mouths of the few river valleys, and Ngawi Bay. No doubt it is this characteristic of Ngawi which initiated the small thriving settlement there today. The extent of the climatic change may be appreciated from the fact that it was possible at times to excavate 2 miles (5.2 km) up the Washpool valley in calm and warm weather, while the coast experienced high winds. On the basis of the general distribution of archaeological evidence and micro-climatic considerations, there is some justification in recognizing seven epi-centres of prehistoric activity in Eastern Palliser Bay.

Moreover, it is noticeable that a degree of site category repetition occurs from any one of these protected centres to another. If we consider that something more than transient occupation should be characterised by evidence for both dwellings and food refuse, then clearly each of these centres can be regarded as areas of more substantial occupation. It will also be shown later that at least 4 of the areas can be further characterised as having burial material. Both artificial terraces (putatively dwelling sites) and midden are actually rather rare in Palliser Bay, but they occur precisely in the vicinity of these protected localities.

This pattern of site-type repetition is only broken in three places. The Putangirua-Te Kopi complex has no midden material of note; but, as mentioned above, this strip of coastline appears to have been greatly reduced in post-European times by erosion. Midden material elsewhere in Palliser Bay, with one minor exception (M3 site) is invariably confined to the coastal platform near the mouths of the rivers. It is thus likely that midden material once existed near Putangirua-Te Kopi, but has since disappeared out to sea.

Secondly, no obvious evidence of dwellings was found initially at the mouth of the Pararaki river. Rescue excavations, however, prompted by bridge construction and earthmoving in the area revealed slab hearths and other evidence of dwellings. A similar problem of dwellings exists with Ngawi. In this case only a negative argument can be advanced to explain the discrepancy. The modern

Ngawi township has virtually covered the entire habitable area, and each time a new building is erected, archaeological remains are uncovered. It can only be suggested that what dwellings once existed in this favourable locality have since been destroyed or covered over by European occupation.

On the whole, therefore, it would seem that there are seven areas in Eastern Palliser Bay which may be functionally rather similar to each other.

The Moikau Valley

The Moikau valley, also known as both Omeikau and Omoekau, is one of the most striking complexes of archaeological features to be found in the Wairarapa as a whole. There are actually two areas of evidence in the valley: one at the mouth of the Whangaimoana stream (N165/10) in the sandy foredunes of the coast, which consists mainly of food processing evidence in the form of large oven mounds and sparse midden; and a second area 2-3 miles (3-5 km) further up the valley (N165/9) where the Whangaimoana stream follows a course parallel to the coast. Archaeological evidence in the second area is almost continuous over a distance of nearly a mile on the several old river terraces which exist in this valley. A search of the higher reaches of the river, beyond where it enters the narrow gorge into the Aorangi mountain block, revealed little definite evidence. The upper Moikau valley consists of several different areas of evidence. One area is characterised by a complex of large rectangular raised rim pits, another by stone wall systems, and yet another with platforms which probably indicate dwellings. Stone slab hearths abound in this latter area, and the rectangular platforms occur in a variety of forms.

In some cases they appear to be surrounded by drains, and sometimes raised earthen walls; in others the platform appears to have been slightly excavated into the river terrace. Combinations of these features also occur. No true 'terrace' structures were seen in the valley. On the whole, a strong impression is gained of some kind of village complex based on forest and horticultural resources, with a specialised area, at the mouth of the valley, for exploiting the local marine environment.

Putangirua Valley

There are few archaeological sites to be found on the small coastal strip between the cliffs on the north side of the Hurupi stream to the Twin Creeks Papa Cliffs to the south near Te Kopi. It seems likely however that this area of land was once far more substantial than it is today, and may well have had as many sites as other valley entrances in Palliser Bay. If the large number of pits found are indeed for horticultural storage, then the present coastal area in their vicinity seems entirely inadequate for the requisite degree of gardening activity. The nearest stone walls or charcoal enriched soils on the coastal platform are several miles distant from the Putangirua river area.

Sites found in this area are all on the first marine terrace with the exception of the much eroded area of burial (N165/4). These include one defended settlement (N165/5), one small area of stone walls (N165/6), and two complexes of defended pits (N165/7,8). One of these latter sites (N165/7), on the northern bank of the Putangirua river was first described by Adkin (1955) and is a most unusual site. It is in a good state of preservation but covered with very dense matted grass, making the interpretation of subsidiary features difficult. The site is apparently composed of very large rectangular raised rim pits, some of which may have buttresses. Between many of the pits run deep and very distinctive ditches quite unlike other pit complexes in Palliser Bay. Some flattish areas in the site may be terraces, as Adkin (1955) records; however, in view of the dense covering vegetation, this is hard to document by field archaeology alone.

Whatarangi to the Makotukutuku Valley

Twenty-one discrete sites were recorded in this area: two defended settlements, five defended pit areas, one complex of stone walls and pits, five further areas of stone walls, two areas of charcoal enriched soils, four areas of midden and oven debris, one specialised site, and one large karaka grove.

While these sites may well extend through time up to a thousand years, it seems that the Makotukutuku valley and its surrounding coastal flatland was an important centre of prehistoric activity. It was also noted during the site survey that post-occupational erosion in the area has caused the loss of a number of sites. In one case (N168-9/25), a large site was all but covered by a more recent shingle fan. This was certainly consolidated and colonised by scrub species some time before the 1944 aerial survey. The extent to which prehistoric man has influenced the course of erosion in Palliser Bay is an interesting question; slash and burn agriculture would have both immediate and far reaching effects on the general environment. In the case of the Fort site (N168-9/27), considerable dimpling over the archaeological features suggests at least three stages of deforestation, regeneration, and later forest damage. This is in keeping with Wardle's (1967) observations of successive phases of ancient burn-offs in the Aorangi mountains. The final dimpled ground could easily result from systematic removal of undergrowth accompanied by freak storms on the coast. Winds blowing directly into the valley during the 'Wahine storm' flattened large areas of Kanuka (Leptospermum ericoides) groves, leaving upturned root systems, which in a few years time will turn into 'dimples'. The Washpool valley would appear to have witnessed a long history of human interference with the natural vegetation cycle.

Of the sites found, nine were in the reaches of the Washpool valley, and twelve on the coastal platform. By and large it is the stone walls and food processing sites which are found on the coast, and the habitation sites and pit complexes which are on the river terraces further up the valley. There are, however, important exceptions: the M3 Fort site has some midden material, the M1 site at the mouth of the river has a few pits, and two areas of stone walls were found a considerable distance up the valley. The extent to which these deviations reflect changes in settlement pattern through time will be discussed later in this thesis.

The Washpool valley and the adjacent stretch of coastline is a typical example of site clustering around the main valley systems in Eastern Palliser Bay. The range of surface evidence is also typical, although the extent to which the sites penetrate into the valley (6.4 km) is greater than other areas except the Moikau.

Te Humenga to the Pararaki River

In many ways the sites in this area resemble those in the vicinity of the Makotukutuku valley, the main difference being a general absence of evidence further up the Pararaki valley. A search of both sides of the river system to a distance of about 6.5 km failed to locate any definite prehistoric evidence; a few patches of charcoal enriched soils were found, but all or some of these may represent European firing of gorse (Ulex europaeus) and other scrub. However, the mouth of the valley revealed large areas of midden and oven mounds and the adjacent coastal platform has abundant stone walls. A somewhat lesser number of single boulder alignments were found than at the Washpool, although several are present. One unusual and particularly striking example was found at N168-9/42, in which a long row of large boulders were set on end at spaced intervals of about a metre. Evidence of pathways with stone curbing was also found at the Pararaki.

The fifteen sites consist of six stone wall systems, five areas of oven mounds and midden, two specialised sites and two burial areas. One of these latter sites (N168-9/43) is no longer present, having been washed away by the Wahine storm. Prior to this there was abundant skeletal evidence scattered over an area of at least an acre. In the immediate vicinity is a most unusual stone structure in the form of an L-shaped enclosure. The loose appearance of the sand inside the feature, along with the absence of any obvious charcoal or other cultural debris makes it difficult to interpret. A recent newspaper item (Cairns, 1971) provides an explanation. The site had apparently been dug over some years ago. A published photograph shows a stone slab hearth in the centre of the structure - no further details are known.

Kawakawa to Waiwhero

The 23 sites found in this complex include one defended settlement, two areas of defended pits, two undefended pit areas, five complexes of stone walls and pits, nine further areas of stone walls, two areas of middens and ovens, one specialised site, and one burial area.

A number of the pit and stone wall sites were found some distance up river, but again not as far as in the Makotukutuku valley. These sites were invariably very heavily dimpled, and were initially discovered only after looking down on them from a height of 6-700 ft (183-213 m), where the patterns of surface evidence became clear. Thus, as with sites in the Washpool, some antiquity of forest disturbance must be proposed.

The number and range of the sites in and around this valley again suggest that it was once a significant area of prehistoric occupation. At the same time, there are only two rather small areas where obvious signs of food-processing were found. The great bulk of the evidence is provided by field systems of stone walls and pits. A search of exposed sections of the sites revealed little evidence of charcoal enrichment or other cultural debris, despite promising surface features. If one were to plan excavations in the area, there would be considerable difficulty in deciding which areas to open up. Where cultural soils exist, they form extremely thin layers.

One area with well developed cultural soils (N168-9/53) certainly appears to represent sustained occupation, but in the near future this site will be destroyed by projected bridge construction.

Ngawi to Black Rocks

Only seven sites have been found in this area of the coastline, and it was suggested above that the missing habitation areas may have existed under the present sheltered Ngawi township. The extant sites are represented by one pit and stone wall complex, one area of stone walls, and five areas of midden and ovens.

Of these sites two are worthy of special note at this stage: the Black Rocks stone walls (N168-9/76), and the Black Rocks midden sites (N168-9/77). Black Rocks is among the most exposed areas of the entire coastal strip from Lake Onoke to Cape Palliser, yet the substantial stone walls against the cliff area are a most impressive complex containing the longest walls to be found in Palliser Bay. Similarly, the many midden areas on Black Rocks point itself are the largest and densest refuse heaps to be found in Palliser Bay. A cursory examination of surface material on these middens reveals a very high proportion of limpets (*Cellana* sp.), although other rocky shore species occur as well.

Mangatoetoe to Cape Palliser Lighthouse

The last seven sites found on the coast are apparently related to the Mangatoetoe river valley system. These consist of one defended settlement, three areas of stone walls, one area of charcoal enriched soil, one small midden, and one specialised site (possibly European). The coastal platform is very narrow to the lighthouse area and shows much evidence of recent soil movement. It is suspected that relatively recent erosion and beach line encroachment has destroyed sites in the immediate vicinity of the Mangatoetoe valley.

PREHISTORIC SITES FROM CAPE PALLISER LIGHTHOUSE TO WAIKEKINO

Discussion

Although it was hoped initially that the field survey might cover parts of this coast, it was soon realised that the extra forty miles of coastline, from Cape Palliser to Flat Point, could not be covered thoroughly in the time available. Since then, aerial photographs of the area have been obtained, together with notebooks and cyclostyled reports of two earlier reconnaissances northeast of Cape Palliser by Michael and Maureen Hitchings and B.Mitcalfe. Correlation of the map references and photographic details was possible in many cases, and it was therefore decided to incorporate these records because of their high quality. The Hitchings had produced a number of sketch plans of the stone wall complexes, pits and pa, as well as perspective drawings emphasizing topographical relationships between sites. Most of the records result from a thorough on-foot survey undertaken by Michael and Maureen Hitchings, beginning in December 1963 at Cape Palliser and ending at Pahaoa early in February 1964, followed by several weekend visits to Glenburn until April 1964. The second set of records were cyclostyled accounts of the surveys conducted in 1968 by B.Mitcalfe and members of the Wellington Teachers' Training College (Mitcalfe, n.d., 1968a, b, c). The Flat Point-Glenburn coast was visited in June 1968, Te Awaite-White Rock in July 1968, and White Rock and Ngapotiki in August 1968. Only a few sites located by Mitcalfe at White Rock were filed in the N.Z.Archaeological Association site recording scheme (under map N168-9/8-13). Further north, 48 sites were on file (map N166) as a result of A.Cameron and C.Smart's intensive survey of Pahaoa in 1961-2, which yielded 34 sites, and P.Barton's more extensive coverage both north and south of Pahaoa in 1970. It was decided to put all the known sites between Cape Palliser and Waikekino on the NZAA files even though details of internal features of sites were not always recorded. In general the survey is most thorough from Cape Palliser to Te Awaiti (assisted by sets of early aerial photographs), and around Pahaoa and Glenburn. Between the latter two areas, sites have been observed on earlier visits, but no grid references were recorded.

The nature of the various surveys has had some influence on the proportions of site types in the area. The work at Pahaoa by Cameron and Smart, for example, made full use of Cameron's intimate knowledge of his own property. Accordingly site types often difficult to pick out on a one-way reconnaissance, such as individual midden heaps away from tracks and pathways, feature prominently in the site records for this area. It is certain that were other areas to be subject to the same intensive research, the number of middens, ovens, and perhaps pits would be considerably augmented.

In general, the site types recognised in Palliser Bay and the lower Wairarapa valley re-occur on the East Coast (see Appendix 9).Defended settlements are more common than in Palliser Bay and fall into three main types: headland _pa_ jutting out into the sea, or over the coastal flat, of which there are two rather striking examples: N168-9/9 (completely without pits), and N166/64 (with 12 pits, many terraces, and several transverse ditches); ridge or spur _pa_, with one to two short transverse ditches overlooking the coastal platform often with high ground rising behind them, or up to a mile (1.6 km) inland up river or stream valleys; pa without ditches occupying the same topographical positions as those of the second type. It seems that the ditch and bank was not an integral feature of defensive sites in this area, except perhaps for the pa at Te Kaukau which has two ditches (N168-9/9), the pa above Pukemuri stream with 3 ditches (N168-9/119), and Waikekino with 2 ditches (N166/64). There may be reasons to suggest that the idea of the ditch was a later fashion of fortification in the area, possibly added to terraced spur sites already in existence. Even the multi-ditch pa of this coast do not compare in earthwork size with Wairarapa valley ring-ditch pa; indeed this form of pa is completely absent on this forty mile stretch of coast. The most common coastal form is undoubtedly the terraced spur without ditch. The land falls off steeply on both sides of the spur into rough tree filled gullies, and the ridge itself is cut into between 3 and 20 terraced steps. Comparable sites of Palliser Bay and the lower Wairarapa valley include the South Matakitaki pa (N168-9/83), the Kawakawa pa (N168-9/49), the terraced ridges of M3 (N168-9/28), and M4 (N168-9/29), and the upper Whakatomotomo pa (N165/40). With high ground behind these sites, they would not be particularly suitable forts in times of large scale warfare. Sporadic, small-group skirmishes could probably be handled without difficulty. It must be remembered that initially pa are built in expectation of a certain kind of threat. Whether the danger materialises, in what form, and how frequently, must affect later designs. Without further research all that can be said of these terraced spurs is that their inhabitants probably did not anticipate or encounter large scale raids during the period of their construction. On a coast which was part of a natural route from Hawkes Bay to Cook Strait (suitable for both expeditions by foot and canoe) many of these pa were strategically located both to observe to-and-fro journeys and to protect local resources. In fact outlook may have been a more important factor in their positioning than defence. Those occurring up small valleys presumably fulfilled the desire for a refuge from harsh coastal winds or rumoured enemy visits.

There are few recognisable undefended settlements on this coast. N168-9/10 is a warm sheltered gully a short distance from the exposed Te Kaukau pa. The other six of this type consist of a few terraces lying at the base of the coastal hills. All are close to defended settlements of the terraced spur type. It is very likely that the gently sloping coastal platform was the site of many other undefended settlements. The need to use terracing or rectangular platforms or hollows as the chief diagnostic features of undefended settlements is frustrated by European activities. As in the prehistoric past the coastal platform has been a highway to farmers and fishermen. Low banks of earth and depressions cannot be expected to survive constant traffic of stock and vehicles, except where these prehistoric features occur at the base of foothills, in the mouths of gullies, or under groves of trees. The fact that these are precisely the localities where undefended settlements are recorded argues strongly for the loss of such sites from the open flats.

The association of pits and other forms of evidence such as terraces and stone walls is as complex on this strip of coast as in Palliser Bay. Pits, usually of the rectangular raised rim variety, occur in at least 50 locations along the coast, and for short distances up the river valleys. There appear to be 10 defended pit complexes, all of which utilize natural defences such as small plateaux above the coast or river terrace edges cut off by water-courses in the larger river valleys. A further 13 sites where defended pits occur can also be classified as defended settlements. These are generally terraced ridge pa and the approximate ratio of pits to terraces in these pa is 1:3. There are 11 undefended pit complexes, only 2 of which are isolated from other site types. Most lie quite close to settlement sites, and presumed horticultural sites, and should probably be considered jointly with the 15 areas where pits are in direct association with stone wall complexes. Again the implication appears that for part of the prehistoric period there was no strong need to store food in remote or defended places.

Stone wall systems without storage pits are found in 15 localities, but only 3 of these are more than half a mile distant from the nearest pit complex. Even with these it is impossible to say for certain that there were no pits in the vicinity.

One site type not found in Palliser Bay or the Wairarapa valley is the rock-shelter. Two have been recorded in the Aratikitiki and Waiura areas. It seems likely that others will be found in the limestone cliffs overlooking the coastal platform. Their absence elsewhere must be correlated with the lack of limestone in these areas.

As in both Palliser Bay and the main alluvial valley of the Wairarapa, the archaeological sites on the east coast occur in similar spatial clusters. In Palliser Bay the clusters appear to be centred around rivers and often separated by natural barriers such as shingle fans. While the East Coast displays similar clustered patterns, such as Ngapotiki (Whawanui group), Oroi, Pahaoa and Glenburn, the remaining areas exhibit a more scattered pattern. The pattern of site type repetition from one cluster to another is only broken in the Waiuru area, where only 3 sites are located, reflecting perhaps either transient occupation or inadequate survey.

Typically a defended settlement, pits, undefended terraces, stone walls and midden occur at the mouth of a stream. Perhaps half a mile along the coast at a similar watercourse another defended settlement will occur with its satellite sites. This pattern may continue for two to three miles (3.2-4.8 km) before a larger strip of unoccupied coast intervenes. In some cases this coincides with decreasing size of coastal platform or the absence of water supply adequate for summer months. The boundaries between the major areas have been drawn through the less occupied zones. In all, the East Coast area can be thus divided into nine groups of archaeological sites. The extent to which these clusters may reflect epi-centres of prehistoric activity remains to be established after concentrated research; nevertheless, the distribution and character of the groups is suggestive (see Appendices 10 and 11).

Ngapotiki

With the exception of the terraced truncated fan at Matakitaki North (N168-9/84) with its associated walls, and some poorly preserved walls at the mouth of the Waitetuna stream, apparently completely isolated from other site types, there is little prehistoric evidence on the five mile (8 km) strip of coast between Cape Palliser and Te Rakauwhakamataku Point. The coastal platform is very rough with active fans spilling out gravel and huge boulders from steep inhospitable mountains behind. North of this point an open bay receives finer sediments from two large rivers, the Whawanui and the Opouawe. South of White Rock, a hard limestone formation which bisects the bay, are six areas of stone walls, one of which utilizes a northward facing river terrace up the Waiarakeke Stream. At least five clusters of undefended pits are found close to the stone wall systems. A short distance up the Whawanui River are found about twenty raised rim pits grouped in clusters on truncated river terrace remnants. This constitutes the largest defended pit complex in the East Coast survey area. There is evidence for a defended settlement at Ngapotiki in the form of a ditch and bank cutting a ridge behind the homestead, but it appears that European modification and erosion has affected much of the suitable undefended settlement areas. The site of the Ngapotiki homestead complex is such an area. In general, the Ngapotiki area closely resembles the south Kawakawa to Waiwhero coast of Palliser Bay with its small wall complexes and undefended pit complexes. There is no strong orientation to a major river system.

Te Kaukau

With the exception of one isolated stone wall area along the rocky coast north of the Te Kaukau headland pa, all the sites are concentrated on the lower reaches of the Opouawe River. Small pit complexes of two or three pits occur on terrace remnants cut away by the river. This choice of location may be more suited to avoid flooding than to provide natural defence. Certainly the larger group of pits on flat land at the mouth of the river are undefended. The absence of stone walls in and around the river mouth may not be culturally significant. The Opouawe River catchment is formed of sandstone, siltstone, mudstone, and limestone, without the hard greywackes so characteristic of Palliser Bay, and the East coast as far as Ngapotiki. Little archaeological evidence has been found in this valley. It would appear that occupation was concentrated at the mouth where the headland pa and undefended terrace and midden filled gully appear to form complementary settlements.

Oroi

The three mile long coastal strip between Oroi stream and Pukemuri Stream is characterised by a profusion of archaeological sites: seven defended settlements, at least three undefended settlements, sixteen sites with pit features, six small areas of stone walls, karaka groves with dendroglyphs, and large areas of midden. It is tempting to attribute this concentration to the particular geological wealth of this area. Between White Rock and Hiwikirikiri (the mouth of the Hungaroa Stream) are the chert beds lying with flinty limestones and siliceous mudstones. These occur as large boulders in stream beds, especially Oroi and Pukemuri Streams, and are of excellent quality for tool manufacture. The distribution of this material includes the Palliser Bay coastal sites and its exploitation was later found to extend throughout the prehistoric period.

The seven defended sites at Oroi can be distinguished as one ridge top pa with three ditches lying parallel with the coast, two terraced spur pa with small single ditches, and four terraced spurs without ditches. The latter four are close to Oroi Stream, while those with ditches are further to the north. The profusion of middens, pits, and mounds on the coastal platform suggests that more undefended settlements may also be found. Three areas of undefended terraces still survive against the foothills where they are partially protected by karaka groves. Clearly the Oroi area was an important centre of prehistoric activity.

Hiwikirikiri

Although the Awhea River also contains chert boulders there are only a few sites to be found about its mouth and adjacent coastline. Two pa sites have been reported but no details of their features are known. Pits occur at two localities up the river, and also at the mouth of the Hungaroa Stream. Their position here is similar to that recorded at Oroi Stream: occupying ground on the gently sloping coastal flat immediately beside the stream. As at Oroi and Pukemuri, the pa is reported to be on a spur overlooking the stream mouth. The Hungaroa Stream marks the boundary of soft limestones and mudstones with the northern greywackes, and it is interesting to note that quite large stone walls re-appear on the coast north of this point. While walls are found in the Oroi area, they do not involve the quantities of stones found at Ngapotiki or Palliser Bay.

Te Awaiti

Four defended settlements are recorded on this three mile stretch of coast, although details of N168-9/128 and N166/49 are not available. The remaining pa, of terraced spur type, display an interesting separation of terraces and pits. In the case of N168-9/130, which lies half a mile up a stream, the spur widens to accomodate 10 or more terraces in seven steps. Three pits utilising natural defence occur 150 m further up the spur. N166/51 consists of a spur cut into at least 18 steps containing about 27 individual terraces but no pits. The pits are to be found with some terraces at the foot of the pa in an undefended position. The pa is very similar to those found at Oroi, but of greater size. It is believed that the terraced spur pa at Oroi Stream did not have pits on the terraces but in the accessible karaka groves at the foot of the spurs. It is possible that incorporation of pits into the terraced and defensive positions could reflect a greater uneasiness of land tenure, perhaps at a later period of time. Stone walls are usually found associated with these coastal pa. At the time of his survey, Mitcalfe commented that stone wall systems of this and the next area to the north (Aratikitiki) were concentrated around the mouths of the large streams. It is difficult to assess this relationship since walls may have been situated close to settlements, which naturally required fresh water. Also there are many places on the coastal platform where water seeps through the gravels and emerges as a line of springs (as at Waiwhero, N168-9/69, where the nearest permanent stream flows in a deep cut between high terraced banks). McFadgen undertook excavations and site mapping in the Te Awaiti area in 1973 at N166/133033, but no other details are yet available.

Aratikitiki

Prehistoric settlements on this five mile (8 km) strip appear confined to the coastal platform and foothills, especially where streams cut through the coastal hills. There are six areas of stone walls and three defended settlements. N166/56 appears to consist of terraces alone, and N166/40, a spur with 15 terraces cut into it, also appears to be without pits. N166/39, only 400 yards further north, consists of 5 terraces, with 9 pits close to the base. Whether these are defensively placed is not known. The pattern of terraced spur, walls, and pits, is strongly developed in this locality.

Pahaoa

To some extent the evidence at the mouth of the Pahaoa River and up to one and a half miles inland is similar to that found at the Opouawe mouth. Of the 36 sites only one is a stone wall system. The fact that this occurs where the greywackes terminate once more and are replaced by mudstones, suggests that absence of walls can often be correlated on this part of the coast with soils which by geological origin are composed of fine sediments without large stones. It is probable that horticultural activity flourished at Pahaoa although it has left few traces, because there are at least 9 clusters of pits adjacent to the river and overlooking broad river terraces composed of sands and silts brought down by the river from its largely greywacke and siltstone catchment. Five of the pit clusters occur a mile upstream separated from the coast by hills. In the same area are found a pa and a site containing midden. This is the only inland orientated settlement area reported for this coast. However, it should be remembered that the reconnaissance was concentrated on the coastal flat and adjacent foothills. The other pa are recorded overlooking the coastal platform, which is quite wide at this point. Both are associated with extensive areas of midden, especially concentrated around the south bank of the river outlet. Opposite, on the north bank, are remains of post European Maori occupation; a 'whare', cemetery, and a ditch and bank fence enclosure. These were recorded by the surveyor, T.M.Drummond, as being in use at 1891 (Smart, 1966:23).

Waiuru

Chert occurs on the coast one and a half miles north of Pahaoa and is also present in the Waiuru area between Pahaoa and Glenburn. However, there are far fewer sites recorded for this area than for Oroi. Of the possible explanations for this discrepancy, inadequate coverage in the site survey might be suggested. A number of sites reported near Honeycomb Rock cannot be filed because they are not properly localised. Nevertheless, it is doubtful whether pa of the Oroi type would be missed even by a rapid and superficial survey. It appears more likely that the cherts of this area were generally of inferior quality to those at Oroi and in less demand in prehistoric times. Only three sites are recorded for this area, a burial in which an 'archaic' tiki was included (Barrow, 1959), a rock shelter with midden, and an area of midden and ovens.

Glenburn

There are three defended settlements in the Glenburn area: N166/60 consists of 4 terraces on the enlarged end of a ridge, rather dissimilar to other terraced ridge pa; N166/63 is a spur one mile inland beside a stream and cut into approximately 6 small and irregularly spaced terraces and containing two large and one smaller raised rim pits; N166/64 occupies a narrow headland at the mouth of the Waikekino River. A narrow tongue of land joins it to the coastal hills. No ditch is apparent at this point, but the ridge climbs sharply to the highest point on the pa which is flattened into a platform. Separated from this area by two or possibly three ditches are other platforms each with a cluster of terraces. This treatment is unique in the whole area, belonging in style to fortification techniques in use in northern parts of the North Island. Waikekino pa appears to mark both a change in fortification style and one of the most northerly areas of stone walls. It is therefore convenient to terminate the survey at this area.

CONCLUSIONS

A total of 252 archaeological sites are now on record for the southern Wairarapa area; of these 47 are located in the Lower Wairarapa alluvial valley, 89 in eastern Palliser Bay, and 116 on the East Coast. The 'armchair' survey of sites in the latter area was undertaken, not because it was a likely candidate for later intensive research, but because it would help to add perspective to the coastal survey of eastern Palliser Bay.

On the basis of the site survey of August 1969 it was abundantly clear that the lower Wairarapa archaeological evidence was related to two environmental zones. On the one hand, the main alluvial valley of the Ruamahanga river and the associated swamps-lakes complex showed a predominance of defended settlements and early historic habitation areas, intimately related to the network of waterways. On the other hand, the coastal platform of Palliser Bay, and the several adjacent river valleys showed numerous stone wall field systems and midden sites. It also seemed that the Palliser field evidence involved a considerable degree of repetition from one valley complex to another. An analysis of sites recorded for the continuation of the coastline further north of Cape Palliser showed that this pattern of repetition continues up the East Coast, but that stone wall complexes become decreasingly important field features. It was mentioned above that during the site survey every opportunity was taken to examine artefactual material from the lower Wairarapa and it should be noted here that what artefacts were seen left little doubt that many of the sites in Palliser Bay at least, would belong to the prehistoric period. Numerous adzes were of the Archaic or Moa-hunter variety.

THE MARINE SURVEYS

The Palliser Bay marine environment was studied in the belief that prehistoric marine food exploitation can better be understood against the background of the available resources. Only part of this knowledge can be acquired from general ecological literature (such as Morton & Miller, 1968), and it is regarded as important that food gathering conditions be assessed in the immediate vicinity of major coastal middens subject to excavation. In the Palliser Bay programme, subsistence economics were studied intensively at two different midden areas, at the mouth of the Makotukutuku River, and at Black Rocks Point. Because both modern marine conditions and the general character of the middens differed substantially between these areas, two marine surveys were undertaken.

The Makotukutuku Area

The type of marine survey conducted here was largely determined by the discovery in the Washpool Midden Site (N168-9/22) of a number of anomalous shellfish species. These could not have been obtained locally if prehistoric conditions were comparable to those encountered today which are characterised by highly unstable sandy beaches. It became clear at a later stage of analysis that substantial changes had indeed taken place along this coast in the past 800 years; this marine survey was therefore undertaken to detect any remnant features of the earlier environment such as reefs which may once have protected the beaches from the southerly swell. In view of these changes, it was not considered relevant to undertake too detailed a survey of inter-tidal shellfish or fish.

There were three aspects to the survey: firstly, local fishermen were questioned about modern fishing conditions, the presence of any offshore reefs and any seasonal patterns of species abundance. Some of this information proved especially valuable (such as Crewe, n.d.), and will be discussed in Chapter 4 when interpretations are advanced from the archaeological material. Secondly, the beach was scoured for Macrocystis sp. holdfasts which had been uprooted during storms; these were dried, the shellfish adhering to them removed, and the species identified and counted (Leach and Mason, n.d.). This operation was undertaken to assess the sea-bottom conditions nearby, and also as part of a systematic search for local evidence of Perna canaliculus, Mytilus edulis, and Dentalium nanum, all of which were in middens, but are apparently absent today. Thirdly, a depth survey was conducted from Te Kopi to Te Humenga, about 3.6 km either side of the Washpool and 1.6 km out to sea. Sub-surface reefs were plotted and depth contours established which could serve as a guide to the presence of local fish species. This was achieved by anchoring 6 buoys with flags 1.5 km from the beach and setting up 7 stations inshore. With the aid of short range radios and two surveying instruments set up over any two land stations, it was possible to plot the path of the dinghy carrying the depth sounder, and thus correlate the iodine depth tracings and other notes on bottom conditions and fishing reefs with large aerial photographs of the coastline.

The salient results of this survey are presented in Figure 9. As can be seen from this map, the area is characterised by several zones of fairly fine sediments, although there are notable patches of rocky broken ground which are suitable for catching such species as Polyprion

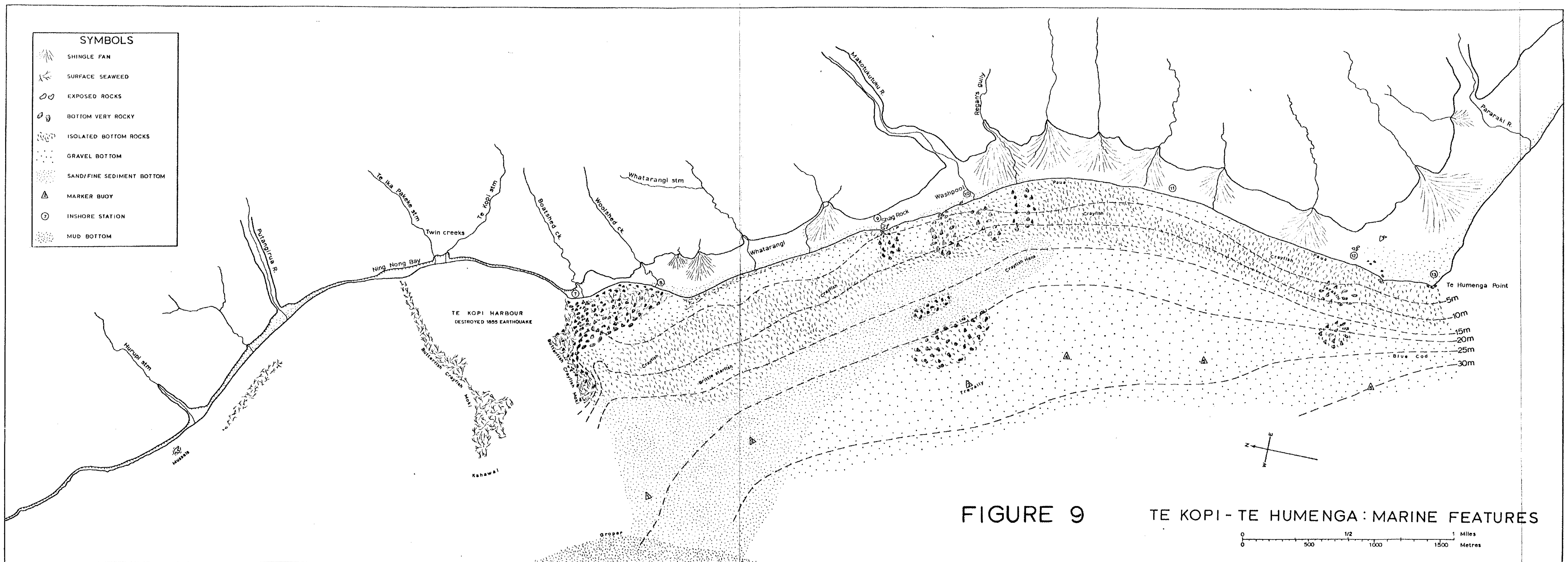


FIGURE 9 TE KOPI - TE HUMENGA: MARINE FEATURES

oxygeneios and Parapercis colias. One prominent reef was found 1 km off the Washpool, and this could have been an important fishing ground for the prehistoric inhabitants of the area. Neither Perna canaliculus nor Dentalium nanum were found in the survey, and the significance of this will be discussed in a later chapter. Possibly the only modern occurrence of mussels in Palliser Bay is a small bed of Mytilus edulis at the mouth of the Hurupi stream (see Figure 9), although there are unconfirmed reports of a similar isolated outcrop at the Pararaki River mouth. The position of the famous Te Kopi anchorage is also shown. This water is no longer suitable as a boat harbour. Local informants believe that the edges of the old anchorage were protected by two large boulder banks which were partly destroyed by the great earthquake of 1855 and even further obliterated by the 'Wahine Storm' in 1968. The shoreline area of Te Kopi shows major progradation and the early Maori settlements and whaling station referred to earlier appear to have been lost to the sea.

The Black Rocks Area

A very detailed marine survey at Black Rocks was conducted by A.J.Anderson as part of his research into food gathering behaviour. The results of this survey are fully described elsewhere (Anderson, 1973a:54-58, 71-74, 97-107, Figs 17, 18); however, a few salient features should be mentioned here. Anderson's study constitutes the main body of information about rocky shore faunal communities which provided a large proportion of marine foods of the prehistoric occupants of Palliser Bay. As might be expected Anderson found significant changes in density of the various shellfish species both in different parts of the Point and across the intertidal platform. It proved convenient to divide the zone into three sections: the upper shore area from MHWN to 10 m, a middle shore area from 10 - 20 m, and a lower shore area 20 - 30 m. The dominant shellfish species in each zone are listed below (for further details see Anderson, 1973a: 101, Fig.17).

Upper Shore: Melagraphia aethiops
Cellana sp. (mostly C.ornata and C.denticulata)
Haustrum haustorium
Zediloma sp.

Middle Shore: Chitons
Lunella smaragda
Haustrum haustorium
Cellana sp. (mostly C.ornata and C.radians)

Lower Shore: Lunella smaragda
Haliotis iris
Haliotis australis
Cellana radians

Smaller numbers of:

Evechinus chloroticus
Canthariđes sp.
Cominella maculosa
Eudoxochiton nobilis
Scutus breviculus
Cookia sulcata
Plagusa capensis
Jasus edwardsii

Beyond the sublittoral fringe the bottom was found to slope rapidly to 4 m below MHWN, and there were clear gravel patches between rocks. In this zone the commonest species were Pseudolabrus pittensis, P. celidotus, Aplodactylus meandratus, Latridopsis ciliaris, Coridodax pullus, Aldrichetta forsteri, Arripis trutta, Seriola grandis, Conger verreauxi and Jasus edwardsii.

A further 50 to 70 m out there was a further drop to a depth of about 10 m below MHWN, and in this zone reefs and large stacks appeared with gravel and sand channels. The same species as further inshore were noted, but they were accompanied by Parapercis colias, Navodon convexirostris, Pseudolabrus coccineus, Latris lineata, Chironemus spectabilis.

Further seaward again local fishermen report Physiculus bachus, Dasyatis brevicaudatus, Raja australis, Chelidonichthys kumu, Caranx lutescens, and by 600 to 800 m offshore Squalus sp., Peltoramphus novaezeelandiae, Genypterus blacodes, Cheilodactylus macropterus, Polyprion oxygeneios, Scorpis aequipinnis, make their appearance. Ranging throughout these zones are Chrysophrys auratus, and the fast predators such as Arripis trutta, Thyrsites atun, and occasional specimens of Galeorhinus sp. and Seriola grandis.

LANDSNAIL-VEGETATION CORRELATION SURVEY

Many indigenous species of landsnail are highly sensitive to their surroundings, and a detailed knowledge of their habitat enables precise palaeoenvironmental reconstruction from fossil remains of the shells. The habitats occupied by these animals are very wide ranging. Omphalorissa purchasi, for example, is "found in native bush in very moist situations, near creeks or swamps, under stones, rotten wood &c." (Suter, 1913:176), while "Lamellidea novoseelandica is arboreal, generally to about 2 m above ground level and usually on angiosperms" (Climo, 1975: pers.comm.).

The application of landsnail analysis to New Zealand archaeological problems is in its infancy, but pilot studies, such as that by B.G.McFadgen (1972), have already given valuable results. In addition, in some parts of the world the study of landsnail and vegetation zones is well advanced (q.v.Evans, 1972), but in New Zealand only broad ecological reconstructions are possible owing to the small amount of correlation research undertaken so far. Moreover, it is recognised that habitat preferences can change from one geographical area to another for the same species. This means that frequency distribution of landsnails from archaeological sites will be of far greater use if a correlation survey is undertaken close to the excavation. Such a study was undertaken as part of the Wairarapa programme. It concentrated on two major zones: the coastal platform from the mouth of the Putangirua River to 5 km north east of Cape Palliser, and two inland areas. The first of these was in the upper reaches of the Putangirua valley, where only a few quadrats were sampled, and the second was a more detailed survey in the Makotukutuku valley up to altitudes of 450 m and 6 km inland. The botanical work was undertaken by G.Hamel, the landsnail research by P.Cresswell, and the correlation analysis by the present author (q.v. Cresswell et.al., n.d.). The vegetation was divided into four major communities, and from 3 to 5 quadrats of 10 m by 10 m were laid out in each, as follows:

The Coastal Mosaic: Quadrats 7, 8, 9, 10
The Inland Succession: Quadrats 1, 6, 15, 16, 17
The Hardwood-Podocarp Forest: Quadrats 2, 3, 4, 5, 14
The Black Beech Forest: Quadrats 11, 12, 13

Within the communities, sampling covered the different aspects and slopes of the forested ridges, the important elements of the coastal mosaic, and the various stages of vegetation succession in the river valleys from bare alluvial gravels to tall stands of _Leptospermum ericoides_. The location of the various quadrats is shown in Figure 10. The vegetation

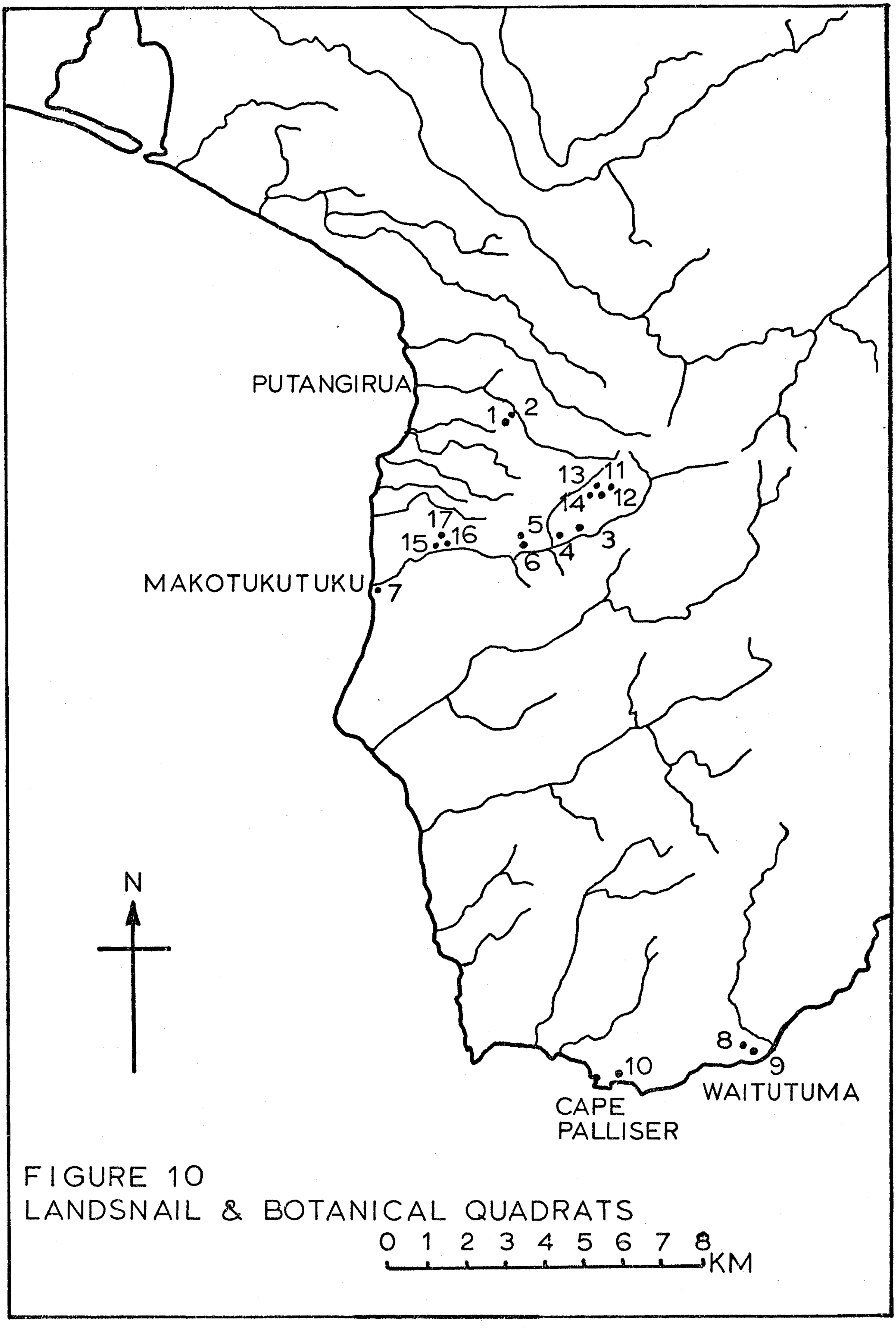


FIGURE 10
LANDSNAIL & BOTANICAL QUADRATS

study followed standard quadrat sampling techniques and is fully described by Cresswell et al (n.d.); landsnails were systematically collected by removing large bags of litter for later analysis, as well as searching the ground. Arboreal species were also collected.

An outline of some of the results appears in Appendix 46, from which it can be seen that the fauna of the four vegetation zones is substantially different. In general, the greatest diversity is to be found the closer the habitat is to climax forest. In contrast, the coastal zones had only fewer species and fewer numbers of each. It must be noted that this simplified table masks a number of significant environmental factors such as exposure to wind and amount of moisture. The expanded version of this table, where covariance between individual botanical and landsnail species can be detected in some cases, is too large for presentation here, but forms the basis of specific palaeoenvironmental interpretations advanced in Chapter 4 from archaeological remains.

CHAPTER 4

EXCAVATIONS AND ANALYSIS IN PALLISER BAY

THE MAKOTUKUTUKU VALLEY

INTRODUCTION

The Makotukutuku River is about 15km from Lake Ferry and a similar distance north of Cape Palliser. At the mouth of the river, shingle deposits are often built up by wave action to form a bar, and ponding occurs behind it. Because this pond has been used for many years for watering cattle and sheep, the locality is known as the Washpool, a name often loosely applied to the river basin as well.

At the present time the river consists of braided channels meandering across a shingle bed 50 to 100m in width. The river gradient is approximately 1 in 60, and the bed rises to 70mASL about 4km inland. With even a moderate amount of rain the river swells and changes its course bringing down large quantities of shingle. Inland, the valley walls are fairly steep, reaching 200mASL about 250 to 300m from the riverbank, with considerable slumping and erosion in open pasture. The present bush line occurs 3km inland on the north side and 6km on the southern side.

The south side is generally less steep than the north and this factor combines with a moderately low sun angle (a function of latitude - 41°30'S) to make the south side substantially warmer than the north. The midday solar illuminance is plotted across the valley near the Stone Wall Fort[1] in Figure 11. The illuminance varies with the cosine of the angle between the sun's direction and the normal of the ground surface at any point. It can be seen from the diagram that the solar energy per

1. To avoid possible confusion over site numbers, common site names are used wherever convenient. Appendix 15 lists the equivalent NZAA site numbers.

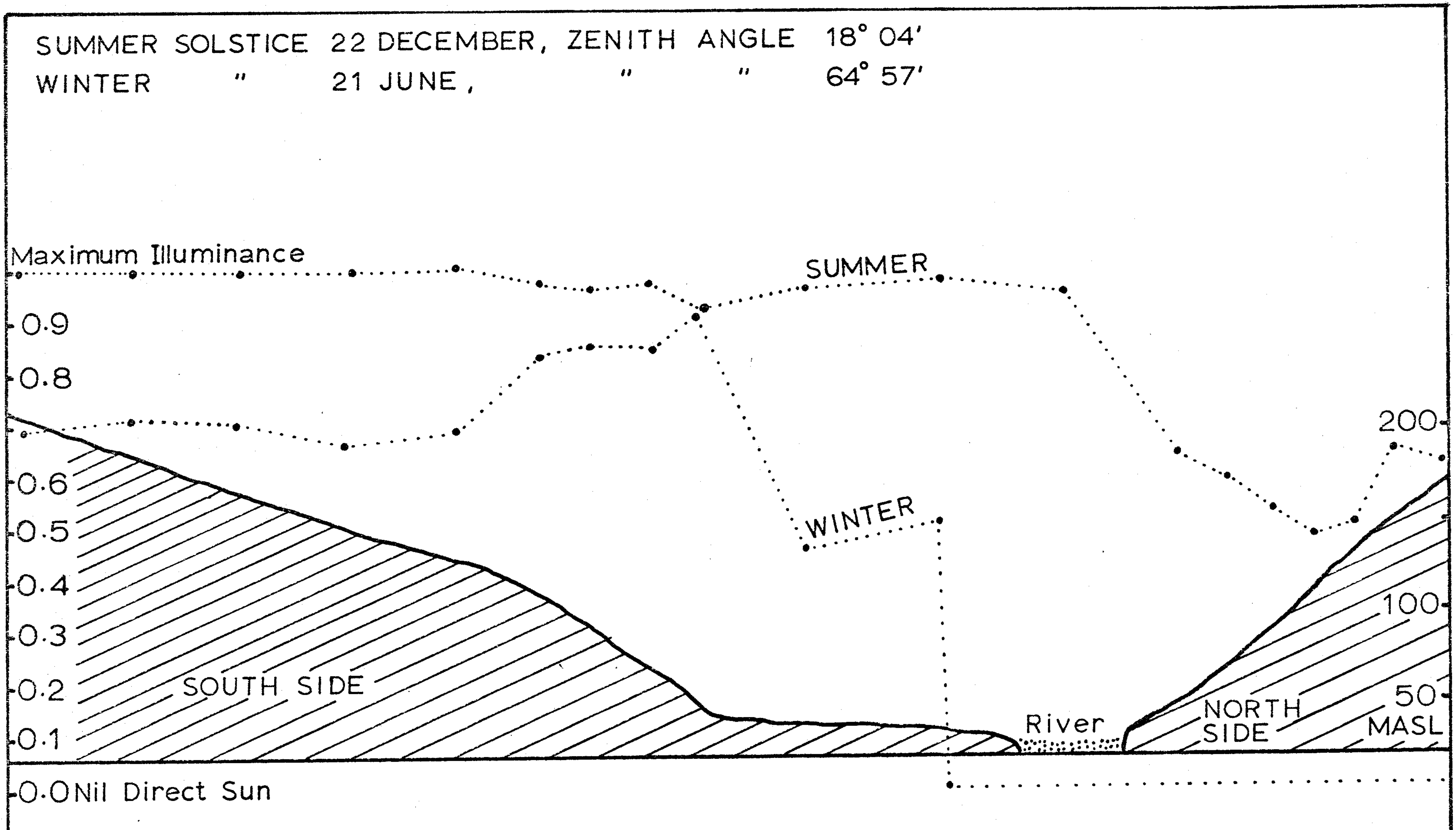


FIGURE 11
MIDDAY SOLAR ILLUMINANCE ACROSS WASHPOOL VALLEY

unit area is twice as high on the southern side in the height of summer than on the northern slopes. In the middle of winter the northern side receives no direct midday sunlight at all. It is not surprising therefore that with one exception, prehistoric activity was confined to the south side of the valley. The exception is the Cross Site, which is 2.3km inland. It is a rather flat area and its summer illuminance is very high (0.91 - 0.94 on the same scale). In mid-winter, on the other hand, the illuminance is low (0.32 - 0.38).

There are 9 areas of archaeological sites in the Makotukutuku Valley, extending from the mouth of the river (the Washpool) to about 4km inland (see Figure 12). The largest area of prehistoric activity was centred on the mouth of the river, and is designated M1 (Makotukutuku No.1). At this locality there are middens, stone walls and a variety of other archaeological evidence. This cluster of sites is spread over 20 hectares (49 acres) of the coastal platform, the width of which varies from 80 to 300m in this area. The actual stone wall complex (see Figure 13) covers approximately half of the coastal strip and occupies nearly 10 hectares (24.7 acres). Although much of the soil on the strip behind the low dunes has been culturally modified by the addition of charcoal, ash and burnt stones, actual midden refuse is concentrated in two areas on the north bank of the river: a small area next to the foothills, and a much larger area close to the mouth of the river. Between them occur 17 artificial terraces and the remains of 3 or 4 circular raised-rim pits.

Today there are only a few surface indications of prehistoric activity on the southern bank. However, a large archaeological site is present under a layer of overburden, formed of gravel from Regan's Gully, just to the south of the Washpool. It reaches a depth of more than a metre in places. The present line of active shingle movement is 100m to

MAKOTUKUTUKU RIVER VALLEY

ARCHAEOLOGICAL SITES

Contours in metres a.s.l. ---Water course ⊥⊥⊥⊥Scarp

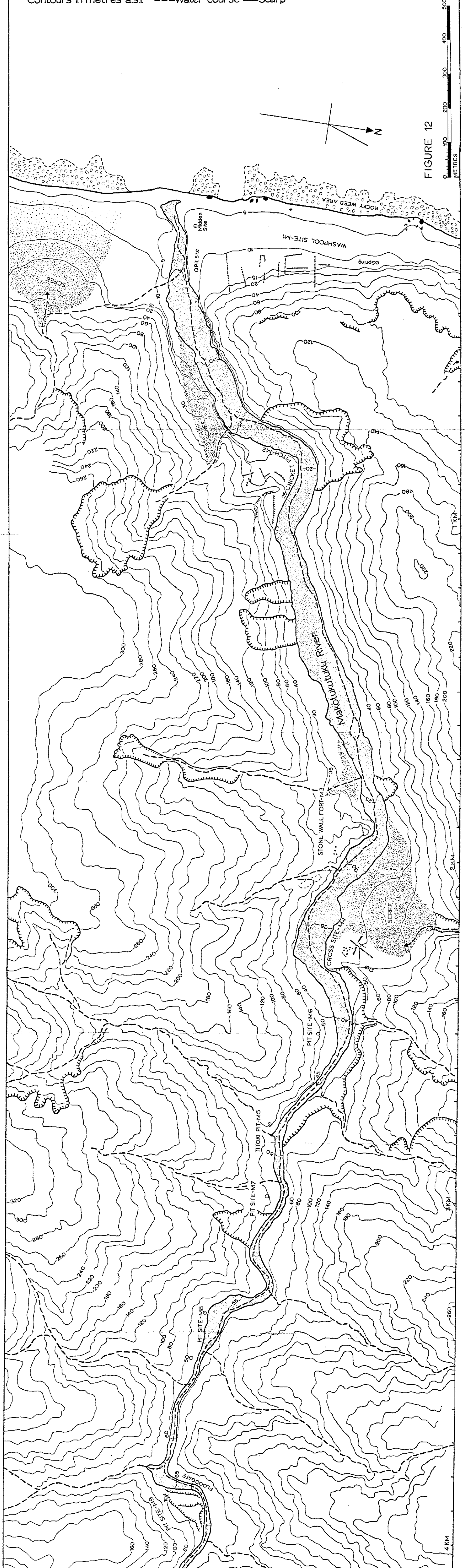


FIGURE 12

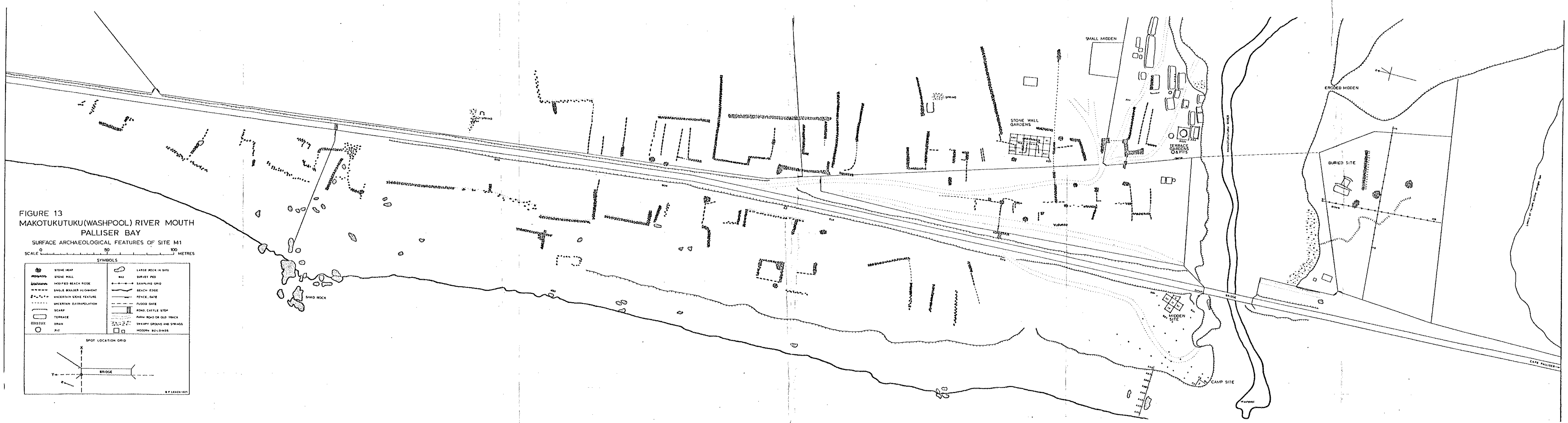


FIGURE 13
MAKOTUKUTUKU (WASHPOOL) RIVER MOUTH
PALLISER BAY
SURFACE ARCHAEOLOGICAL FEATURES OF SITE M1

the south of the site. The amount of consolidation exhibited by the overburden, together with the degree of humification of the topsoil suggests that the site was covered considerably earlier than the erosion phase induced by European deforestation. A series of testpits was excavated on two axes at right angles to try and establish the extent of the buried site. It is at least 4000 m^2 in area, but judging from the test pits it consists only of burnt stone and charcoal. The test pit axes are shown in Figure 13, and the stratigraphical sequence is shown in Figure 14. More substantial excavations at the Washpool were conducted at five localities on the northern bank.

Inland from the Washpool are found a further 8 sites, of which M2 is 0.8km up river, and is a stone wall complex. Site M3 is a habitation area with house terraces, a burial cleft, and a defended area approximately 1.9km inland. Site M4 is another stone wall system with additional habitation evidence and is found 2.3km inland. The remaining five sites each consist of a single pit, and are located up river at the following points: M5 at 2.8km, M6 at 2.5km, M7 at 3.0km, M8 at 3.3km, and M9 at 3.9km. Pits occur on other sites in the valley as well, but these five pits are noteworthy since they are isolated and particularly inaccessible. The pits M6 and M7 were not found until the end of the research programme, and this fact attests their remote location. It is possible that further examples remain undiscovered. Six excavations were conducted on these inland sites.

In this research in the Makotukutuku Valley, excavation squares were generally contiguously laid out and were 5m by 5m. Each was given a Roman numeral as it was opened up. Thus at the M1 site, the first area excavated was M1/I, and the last M1/XXXI. In addition, the larger squares were divided into 25 one m^2 units, and these were

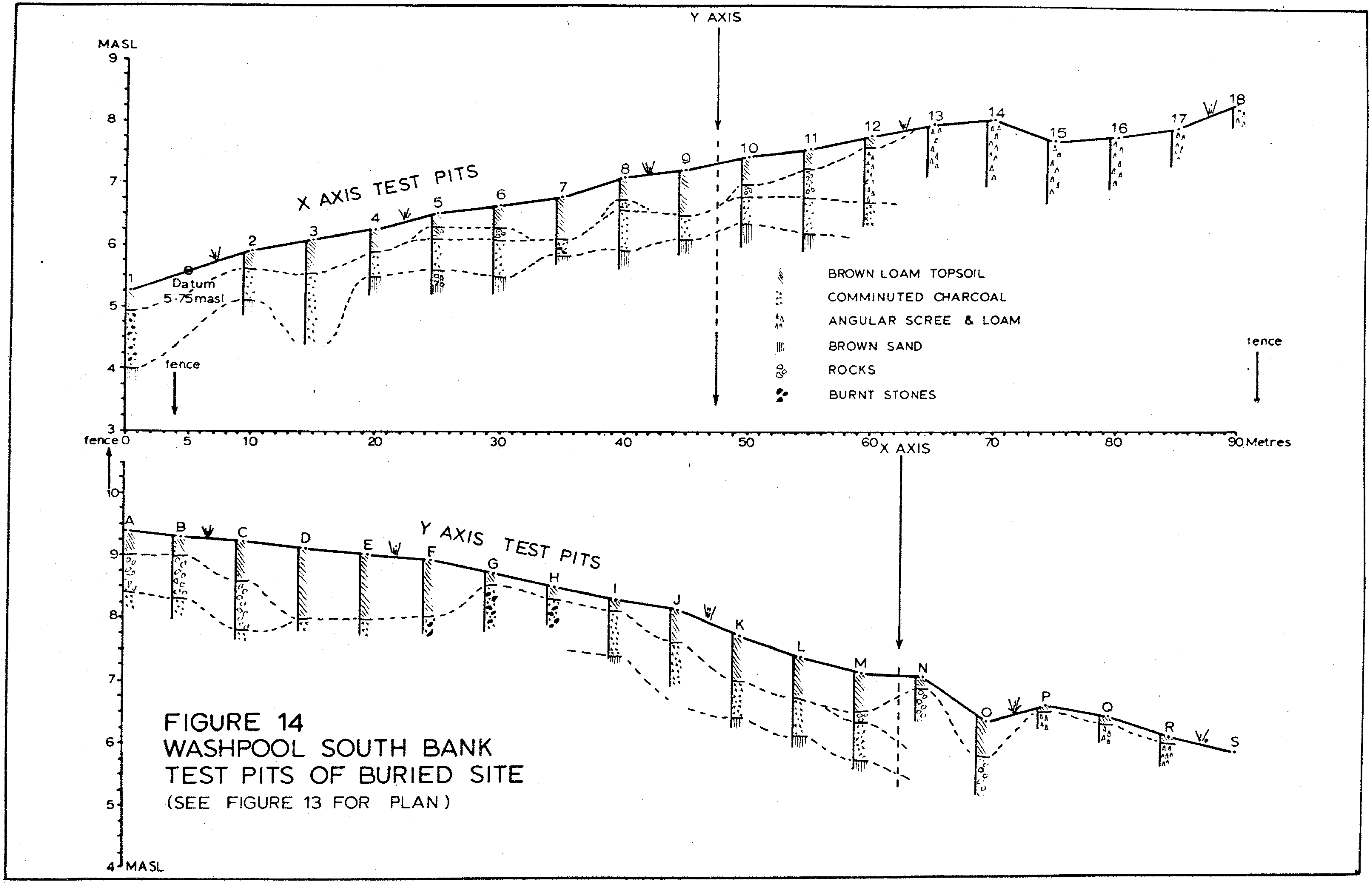


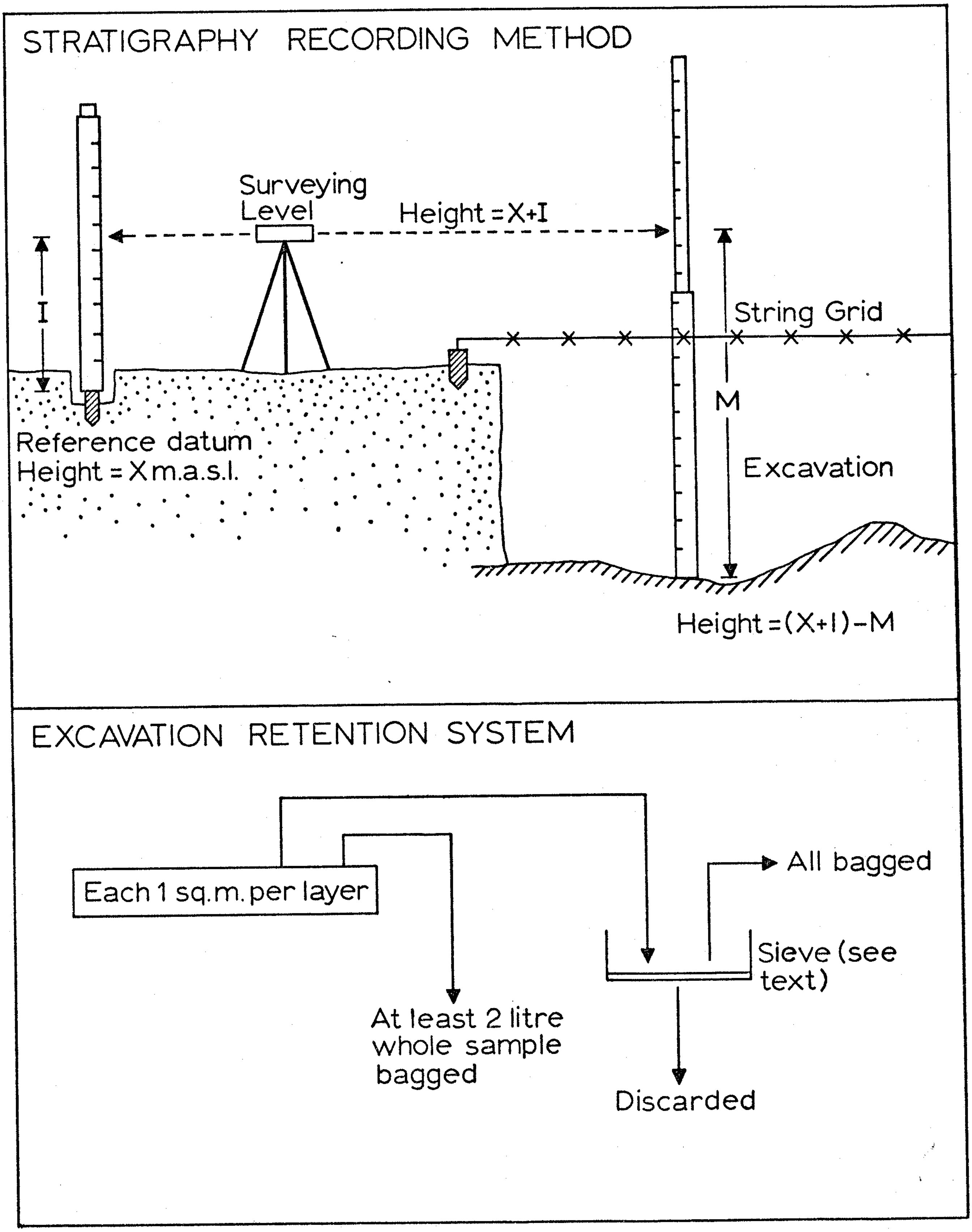
FIGURE 14
WASHPOOL SOUTH BANK
TEST PITS OF BURIED SITE
(SEE FIGURE 13 FOR PLAN)

numbered from 1 - 25, so that square 1 was in the SE corner and 25 in the NW corner. Thus the full areal and temporal accession of any item might be M1/XXI/24, Layer 3. With only slight variations, this system was also used in all other excavations in Palliser Bay.

Excavation was by stratigraphic layers, with the minimal recording unit usually being the square metre, except for any structural evidence or notable finds which were accurately recorded on quarto graph cards. Occasionally the metre square was itself subdivided into 100 smaller units for recording purposes with the numbering system again running from SE to NW. Thus an accession might be M1/XXI/24/86, Layer 3. This system was particularly suited to the subsequent laying out of finds on the gridded laboratory floor.

The recording of stratigraphical layers was unusual and should be described in full. As is well known the presence of regularly laid out baulks in areal excavations can be a handicap, particularly when they turn out to lie precisely over areas which need to be excavated in order to establish interrelationships. The two main functions of baulks are as a means of access around a site, and as a record of stratigraphic changes as excavation takes place. Unfortunately there is no guarantee in an excavation that the meaningful stratigraphical changes can be illustrated by section drawings taken from regularly laid out baulks. In fact it would be far more useful if sections could be drawn at convenient places and directions, on curved paths if required, perhaps far removed from a baulk. In addition, in total areal excavations, the baulks which remain after the excavation is completed should not contain any useful cultural information. Again, in areal excavation there is a real need for control blocks of layers to serve as a reference for assessing differences in the texture, compactness and content of

FIGURE 15


STRATIGRAPHY RECORDING METHOD
Surveying Level
Height = X+I
I
String Grid
M
Reference datum
Height = X m.a.s.l.
Excavation
Height = (X+I) – M
EXCAVATION RETENTION SYSTEM
Each 1 sq.m. per layer
All bagged
Sieve (see text)
At least 2 litre whole sample bagged
Discarded

layers as excavation is in progress. These are best located where stratigraphical transitions occur, such as at the lensing out of a particular deposit, rather than in some baulk arrangement laid out in an arbitrary fashion from the surface of a site.

With these factors in mind a more flexible system was devised for recording stratigraphical information. Baulks were laid out for general convenience of access, but as soon as they ceased to be useful were removed. No section drawings were made from any baulks, although photographs were taken. Control blocks were left in excavation squares where they served best to illustrate stratigraphic relationships and also to preserve some intact material for other references. The details of stratigraphical superposition were obtained by measuring the topography of the various prehistoric surfaces. These were accurately and quickly recorded for each square of 25 m^2 size when required, thus allowing section drawings to be constructed later for any part of the site. As soon as any new surface was exposed the areal distribution of any layers and other features was plotted on graph boards. A string grid was then set up over the area with either 50cm or 1m spacing depending on the complexity of topography, and accurate heights were taken at each intersection on the grid.

The success of the method entirely depends on how the heights are taken, and the following technique was used (see Figure 15). A surveyor's quickset level was set up at a convenient point near the site and accurately levelled. The instrument height above sea level (or some arbitrary fixed height, for example 100.000) was measured with the instrument from a staff on top of a buried peg. So long as 'I' is measured with the instrument, the height of the optical axis relative to the reference peg can be determined within 2 or 3mm whenever the level is set up. It should be noted that situating the instrument over the peg and measuring the instrument height is too imprecise. When the height of the optical axis is accurately known, heights are taken with a staff on the various grid points. All measurements are read to 1mm, and the heights of particular points = ((X + I) - M) mASL. Some days later when a new surface is exposed, the instrument is set up again on some other convenient spot, 'I' is measured again, and the new surface recorded. Layers of 5mm thickness can easily be recorded in this way. Heights can be measured and recorded at a rate of at least 10 per minute.

The system used for retaining archaeological materials was basically similar in all the Washpool excavations (see Figure 15). Whole samples were frequently bagged for detailed analysis in the laboratory. These samples were used for grain size analysis where required, and also for extracting small residues, such as land snails. Apart from these samples, all other excavated material was sieved, the sieve size depending on the size of the particular layer matrix. Thus in fairly stony soils ¼" (6.4mm) mesh was used. Usually, 1/8" (3.2mm) mesh was used, and this allows separation in most sandy soils. When fine ash deposits were being excavated 1/16" (1.6mm) mesh was used. Apart from large unutilised stones, all material not passing through the sieve was bagged and returned to the laboratory for analysis. It is considered that the circumstances of excavation are not optimal conditions for the sorting of archaeological materials. This retention scheme ensured that a large proportion of the cultural deposits of the sites was transported for detailed laboratory attention with good lighting and other facilities. Approximately ten tons of archaeological samples from Palliser Bay thus found their way to Dunedin for analysis.

THE WASHPOOL CAMP SITE - M1/I

On the northern side of the Washpool pond a charcoal stained layer is apparent at the base of the sand dunes at various points along the beach section where the low dunes are eroding. The layer is quite thin in places (1 - 2cm), but its continuity in level is striking and suggestive of a fairly extensive cultural horizon. Similar occupation layers occur about 80m to the east, but here they are on top of the sand dunes. It would be difficult to uncover these layers over such a distance since a detailed knowledge of occupation at the Washpool was an objective, however, it was clearly necessary to establish the temporal relationship between these two areas. It was decided therefore that the best way of achieving this was to expose an area of the site under the dune to determine its general character and obtain secure samples for C14 determination. In addition, test pits were dug at various points in the dune to try to follow the cultural layer. Major excavations were planned for occupation layers on top of the dunes, and the dating of these deposits would also help to link the two areas.

The excavation, therefore, was largely exploratory and restricted in size. If the return of information justified it, the dune sands could be stripped off to expose a much larger area. However, this would have been no small undertaking, and the occasion did not arise. The excavation took place in a few days in November 1969. Approximately 12 m^2 of the site were exposed (see Figures 13 & 16). Infilling sand, both by slumping and wind was a perpetual hindrance to operations, but it is believed that sufficient area was opened up to assess the site. The cultural layer excavated varied in thickness up to about 12cm but had no significant sub-components. It consisted of compacted black sand containing finely comminuted charcoal, charcoal pieces and ash. Fragmented oven stones were scattered through the layer as well as sparse midden and a few artefacts.

Three small scoop hearths containing burnt stones were found adjacent to a double row of postholes. The latter were indicated by soft disturbances in the compacted gravel surface under the cultural layer. The lack of decomposed wood in the holes suggests that the posts had been pulled out. Charcoal and other debris had slumped into the holes and the depth at which this was found varied from 8 to 18cm (as shown in Figure 16). Because of subsidence it was not possible to determine the original depth of the postholes. The two lines of posts were about 30cm apart and arranged in a fairly regular semicircle. Because this feature is near the erosion edge of the dune it is not certain whether this semicircle represents the entire structure. The most likely interpretation is that the postholes belonged to a shelter or wind fence consisting of a double line of posts and rails with the space between filled with brushwood. The orientation suggests that the north-west wind prevailed as much then as today. The enclosure at the same time is thoroughly exposed to southerly winds which today bring the most severe weather.

Sparse midden was recovered in the cultural layer, and the identifications are given in Appendix 37. The remains will be considered later when comparisons are made with other sites; in isolation however, the species indicate exploitation of an inshore rocky marine environment, but with some offshore fishing, probably with a trolling lure. The Pilot whale was probably a stranded individual.

Eighty-three cultural items were found, comprising 47 pieces

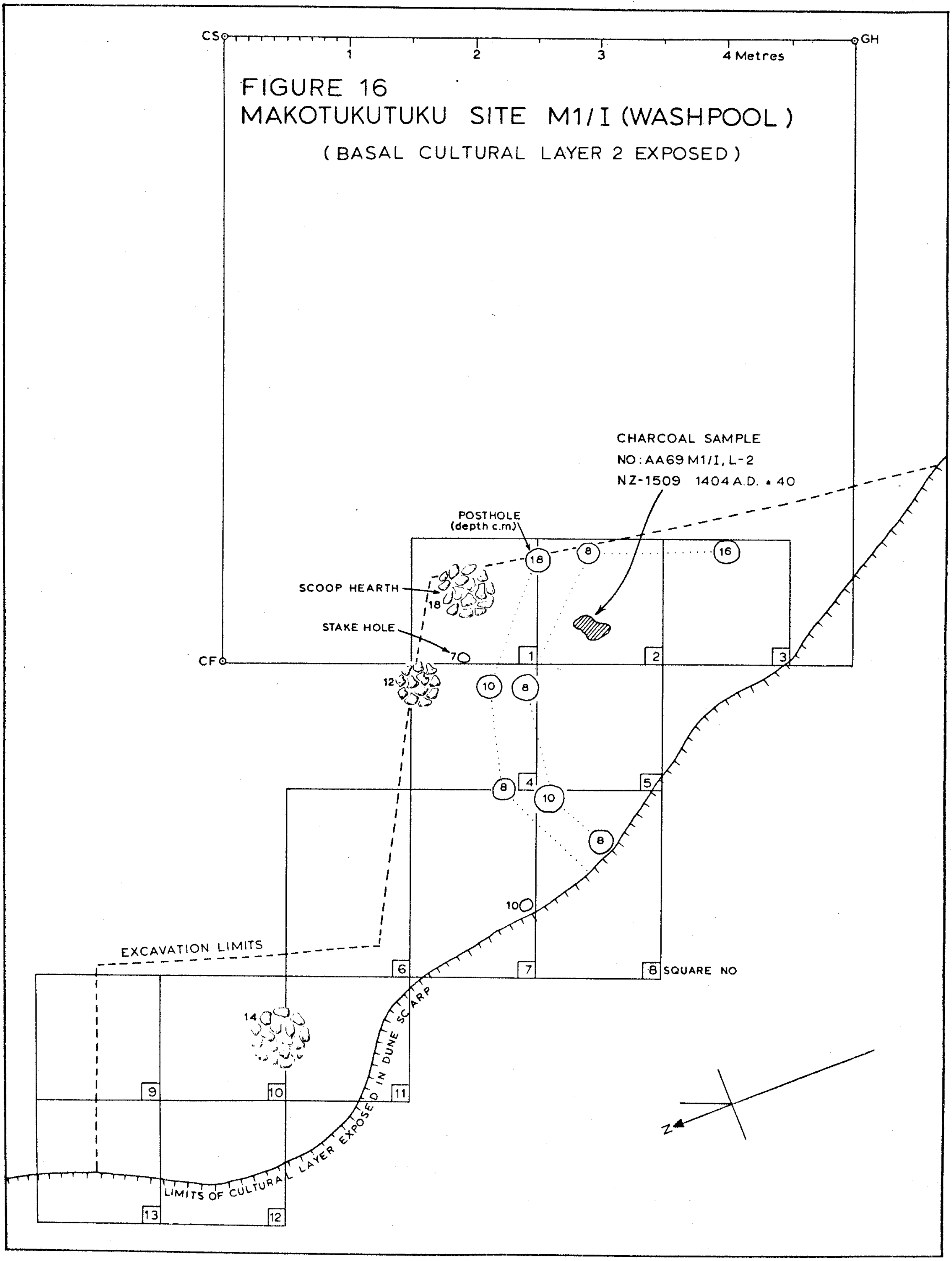


FIGURE 16
MAKOTUKUTUKU SITE M1/I (WASHPOOL)
(BASAL CULTURAL LAYER 2 EXPOSED)

of metasomatised argillite, 26 chert, 4 obsidian (all green), 4 greywacke, 1 schistose greywacke, 2 limestone and 1 piece of serpentine. The most notable finds are a schistose greywacke file, a hammerstone, 2 greywacke cutters, and 5 pieces of grindstone (see Figures 17, 18, 19, 20).

The cultural layers in these dunes are positioned on the boundary of a marked change in the general character of the sediments. Above them, the sand was found to be very fine and soft and judged to be aeolian in origin; below, the deposits consisted of rounded gravels and much coarser sand thought to have been laid down by water. A sequence of seven large test pits were dug through the dunes at various points (see Figure 21) to see whether this stratigraphical junction could be followed, and possibly the continuation of the cultural horizon exposed at M1/I. As can be seen from Figure 21, the cultural soil was found in five of these test pits, and precisely in the same stratigraphical position, but did not occur inland of the 80m mark. The dune stratigraphy as found under the Washpool Midden Site (M1/II-X) is shown in Figure 22. This section shows a series of surfaces preceding the site and marked by a crust of finer compacted sediments, believed to be weathering surfaces. Nothing was found in other test pits, apart from loose grey sand overlying the lower beach gravels.

A charcoal sample was dated from the Washpool Camp Site and this gave the following result (qv. Leach and Leach, 1971a):

NZ 1509 charcoal, M1/I/2, Layer 2. 546 ± 40 BP 1404 AD ± 40

It was later found that the Washpool Midden site was intensively occupied before this at about 1150 to 1300 AD, although the most recent layers may have been laid down as late as 1550 AD, thus the Washpool Camp Site was occupied relatively late in the sequence at the main Midden Site.

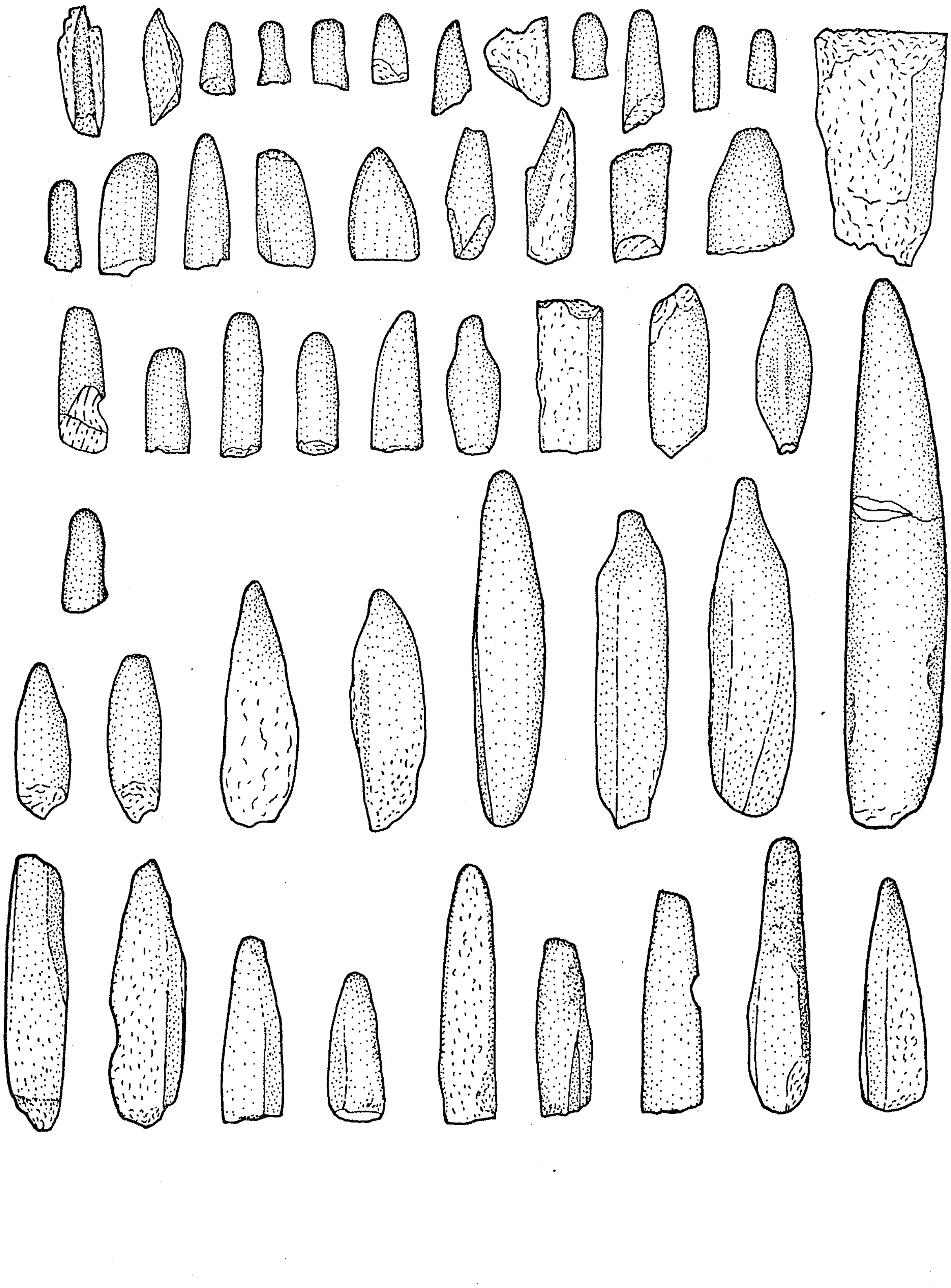


FIGURE 17
SCHISTOSE GREYWACKE FILES
PALLISER BAY

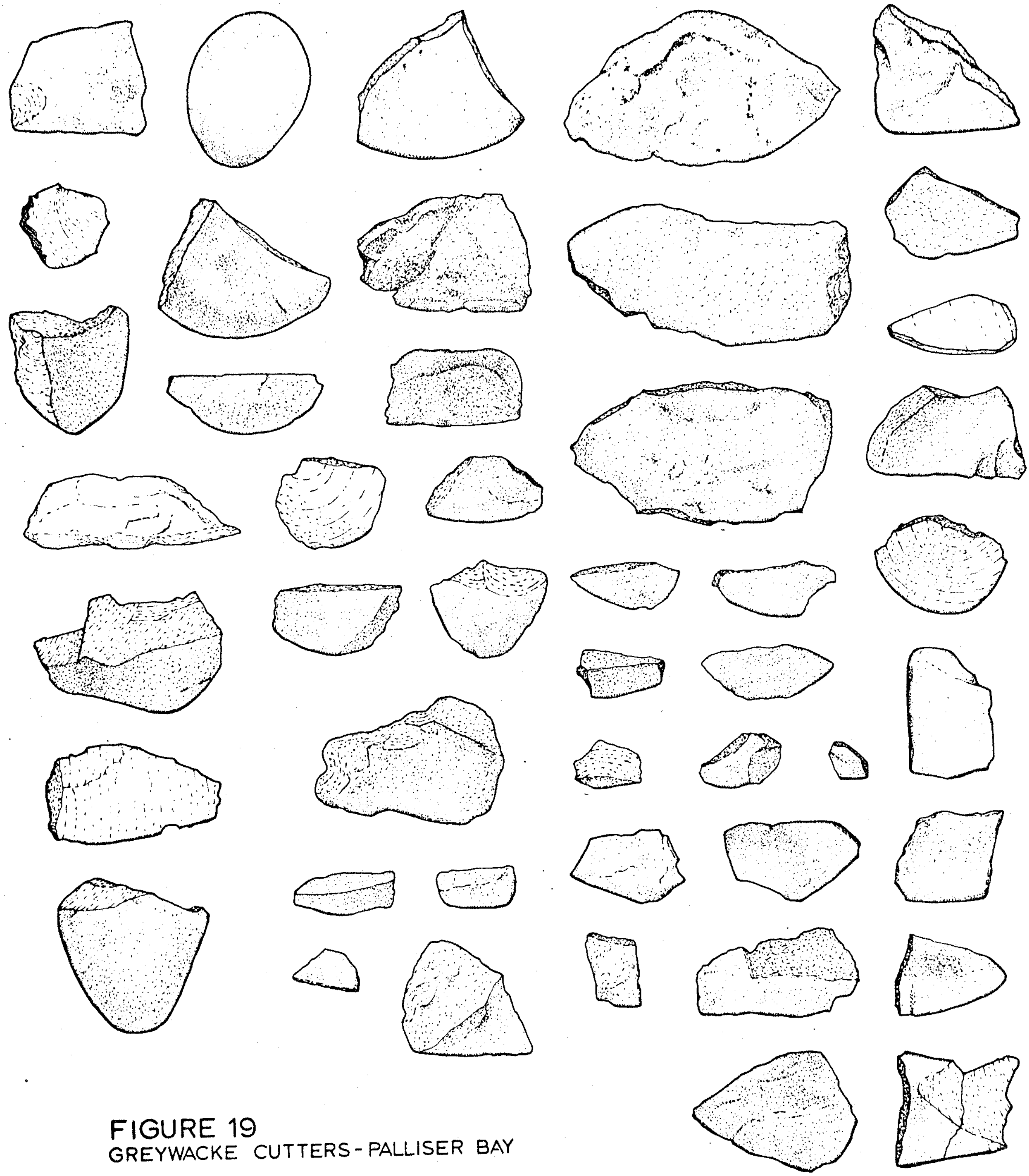


FIGURE 19
GREYWACKE CUTTERS - PALLISER BAY

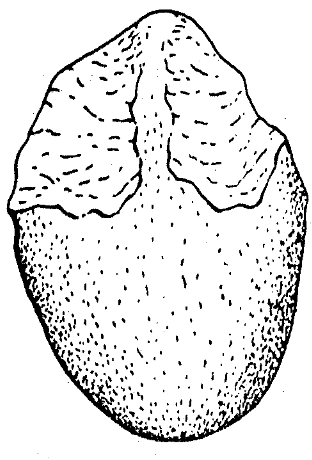


FIGURE 18
GREYWACKE HAMMERSTONE M1/I

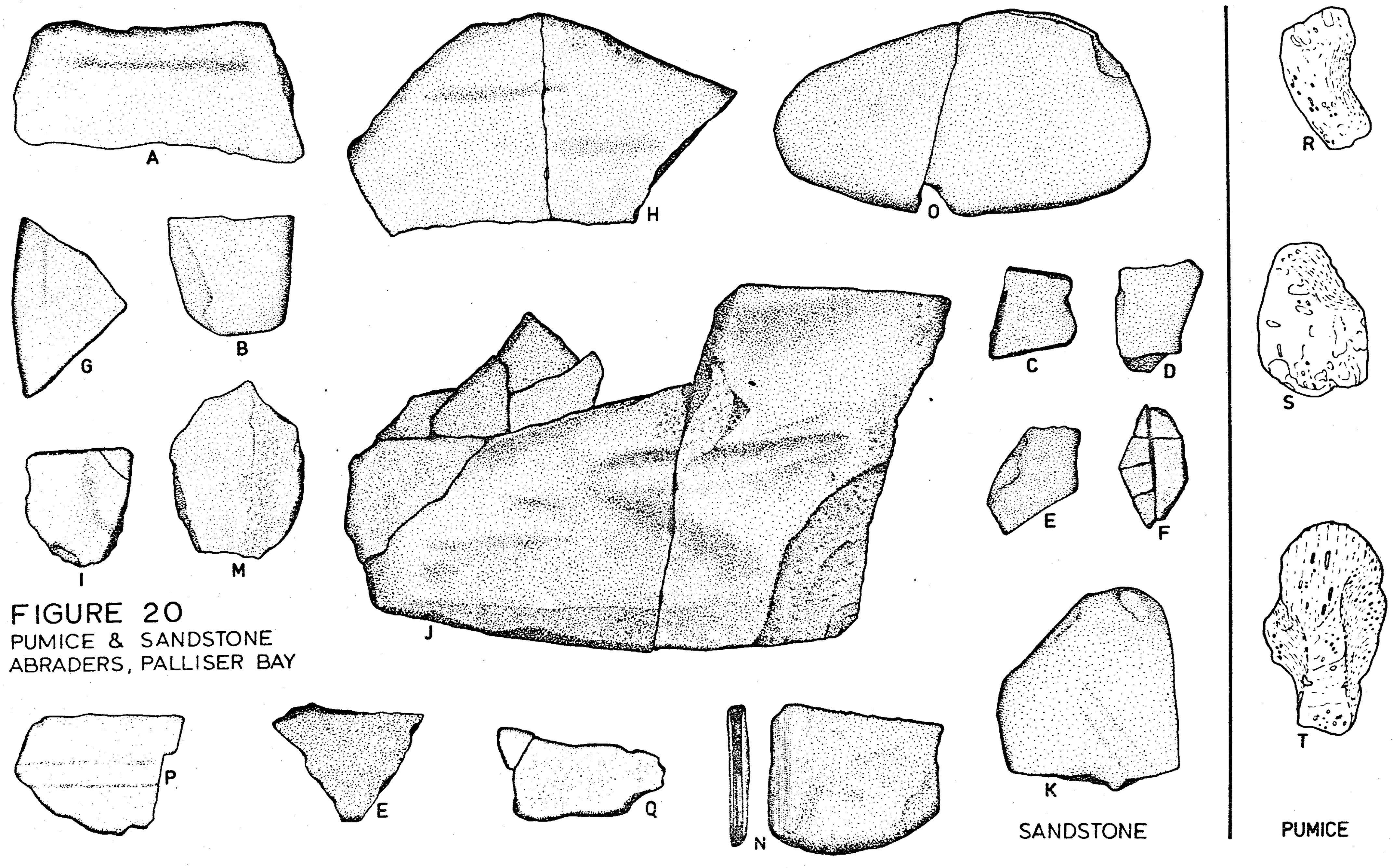


FIGURE 20
PUMICE & SANDSTONE
ABRADERS, PALLISER BAY

It is clear from these results that the initial hypothesis that M1/I was early in the occupation sequence by virtue of its apparent stratigraphical position was quite incorrect. The general sequence established is as follows (see Figure 21):

Phase A This is a horizon of beach gravel. The surface of this layer was very flat wherever found, and was a compacted surface such as occurs with water action. It is believed to represent an old sea bed. The absolute height variation was very small, and departed from dead level by about 50cm either way over a distance of about 100m. Little overall rise in height could be detected as the test pits proceeded inland from the present beach. The mean absolute height of the surface was 2.16mASL. When this is referred to accurate tidal levels using the figures outlined in Appendix 2 it is seen that the mean surface height is 2.64mAMSL, and the range is from 3.28-2.28mAMSL. In the absence of any faunal remains in the level it is difficult to estimate the sea level height this bed represents; however, it is obviously somewhat higher than about 3mAMSL. Two possibilities present themselves - either there was tectonic uplift, or this surface marks a higher post-glacial sea level. It is most difficult to decide between these two alternatives, but it may be significant that the magnitude of the displaced sea bed (circa 3m) is within the cluster of heights suggested for the hypothesised higher post-glacial sea level for New Zealand (see Figure 23, and also Leach and Anderson, 1974).

Phase B This is a dune layer formed before any occupation at the Washpool, and after sea level fell or tectonic uplift occurred. Apparently a number of dune surfaces stabilised before occupation commenced, and these are represented by the lenses shown in Figure 22. The most recent component of the dune, denoted as Layer 5 in Figure 22, is clearly recognisable under all sites at the Washpool except the Washpool Camp Site, and the following equivalences apply:
M1/II-X, Layer 5 = M1/XXX, Layer 3 = M1/XXXI, Layer 5 = M1/XI-XXVIII, Layer 3B

Phase C The bulk of the occupation sequence at the Washpool Midden Site occurs at this time - between about 1150AD to 1300AD.

FIGURE 21
MAKOTUKUTUKU RIVER MOUTH (WASHPOOL) DUNE PROFILE

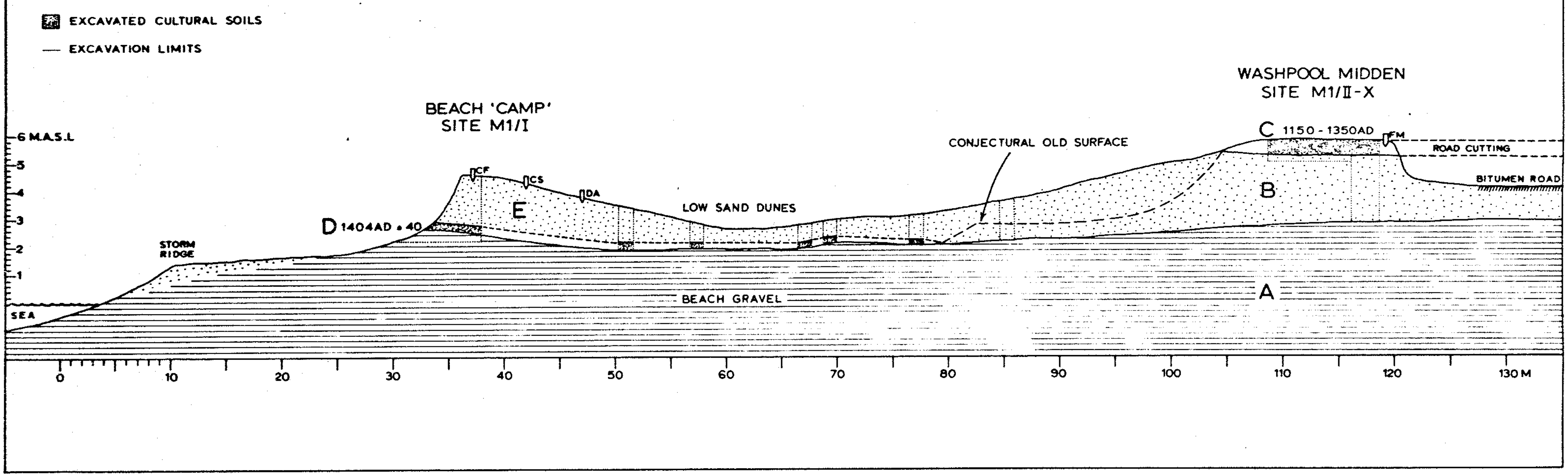


FIGURE 22- Section under Washpool Midden

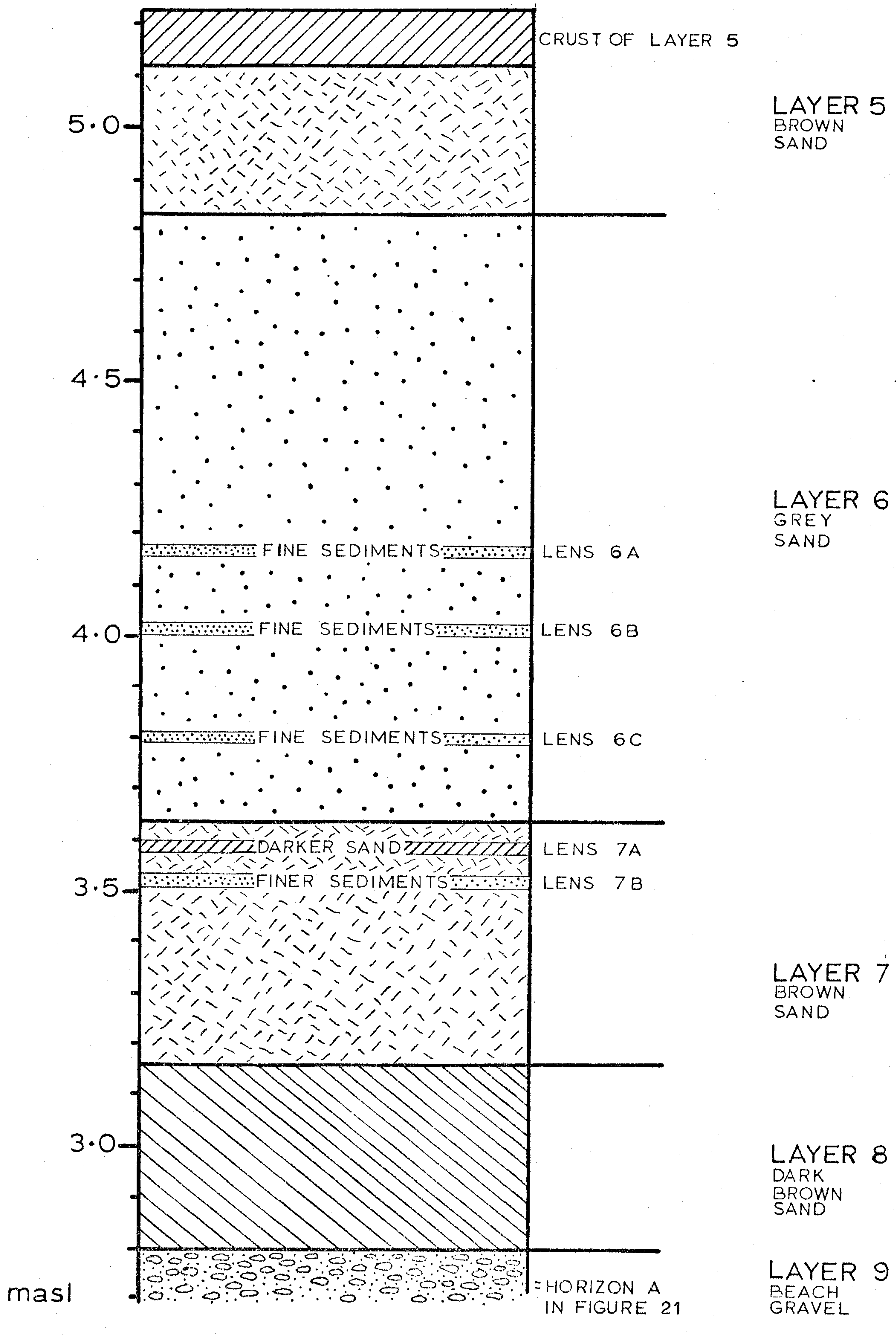
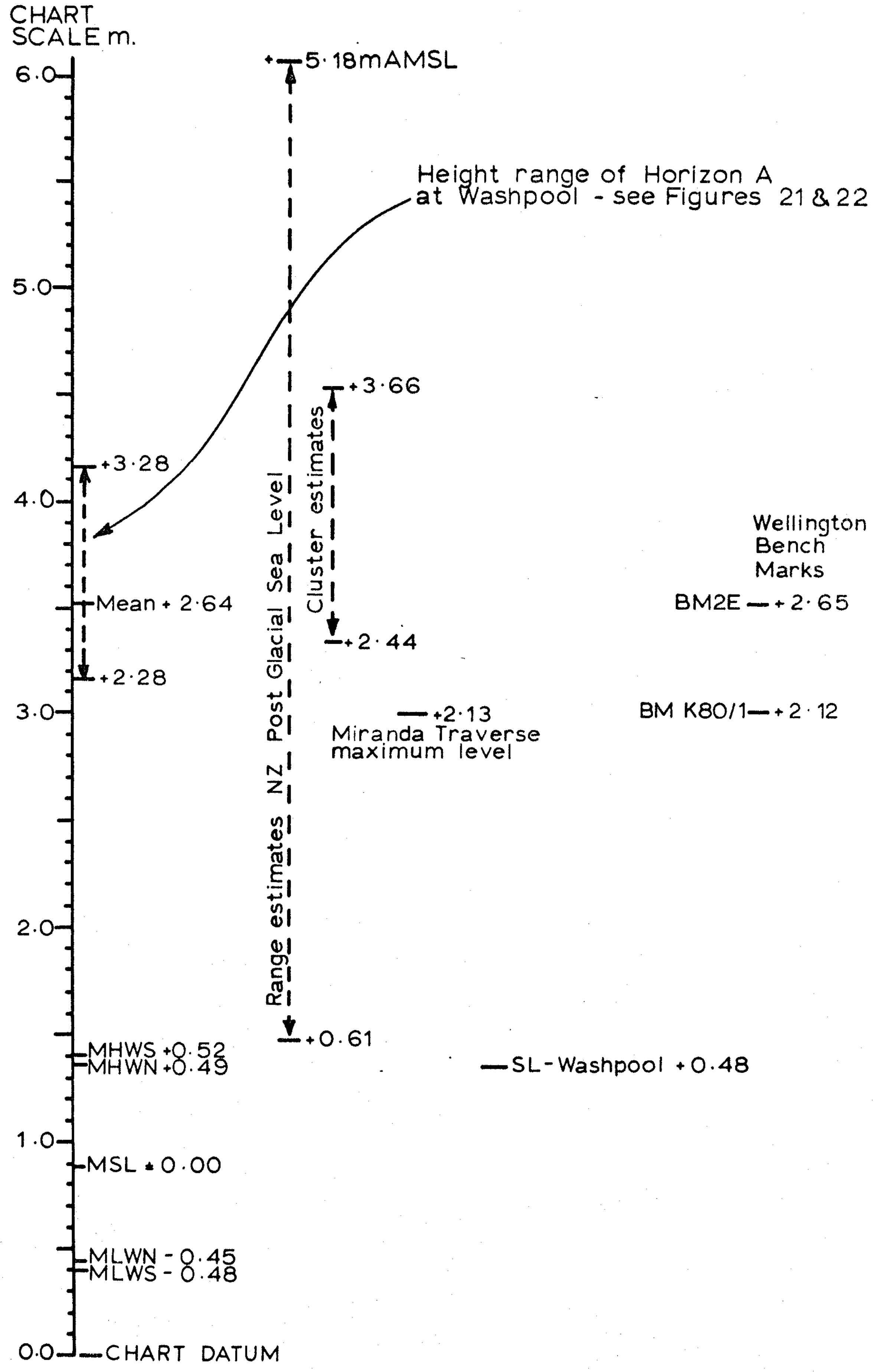


FIGURE 23 POST GLACIAL SEA LEVELS & THE WASHPOOL HEIGHTS



Phase D The occupation of the Washpool Camp Site occurs at about 1400AD. It is possible that the dune sands represented at Phase B covered a much greater area than shown in Figure 21, and were partly stripped away by wind some time prior to Phase D. However, there is no positive evidence to indicate this, and it seems more likely that until about 1450AD the gravel beach was at least 50m wider, and that dune sands during prehistoric occupation were somewhat further inland than today.

Phase E After occupation phase D, sand dunes developed closer to the shoreline.

The small excavation at M1/I did not reveal a great deal of cultural information, in part because of its size. The horizon apparently represents an extensive area of occupation at a period following the bulk of occupation at the main Washpool Midden Site. The particular area excavated was probably on the periphery of the occupied area, and is characterised by oven rake-out and sparse midden. The few structural features found at this part of the site are consistent with a small camp or shelter area on the bank of the Washpool. Further excavations of the horizon would probably illuminate cultural activities around 1400AD if an area of dense occupation could be found under the present dunes. Five of the test pits dug in the dunes for this purpose revealed a very similar cultural layer to that found at the Camp Site, and in view of the sparse remains were clearly all some distance from the main occupation area. Excavations were frustrated by infalling sand, and to be successful a very large area of the dunes would have to be stripped by bulldozer. In the end the search was abandoned and attention given to the occupation horizon higher in the sand dune and earlier in the sequence.

THE WASHPOOL MIDDEN SITE - M1/II-X

Introduction

As can be seen from Figure 13, the Washpool Midden Site is quite close to the present roadway and bridge over the Makotukutuku River. Many artefacts have been picked up in this general vicinity over the years by passing stock drovers and travellers. Four examples are shown in Figure 24. Their clear Archaic appearance was a contributing factor in the choice of this site for detailed study. Two are Type 4 adzes in the typology of Skinner (1974a:108); they are made from D'Urville Island argillite and are notable for their skilful preparation. One of these (Figure 24d) was found 370m north of the river mouth and has been previously illustrated by Barrow (1972:Figure 52), who erroneously attributed it to Cape Palliser (op.cit. :38; c.f. Bowie, 1972:pers.comm.). The other (Figure 24a) was recovered in the ford beside the site together with a third adze of Type 2A (Skinner, 1974a: 106) also illustrated (Figure 24b). The fourth is a Type 1B adze (op.cit.: 104), and was found near Shag Rock (Figure 24c).

The site itself was first described by Adkin as follows:

> "The shallow road cutting leading down to the ford has exposed a black layer, noted by the writer and found to be a lenticular layer of charcoal, varying from 12 inches to 18 inches in thickness and visible for 6 - 7 yards horizontally. The charcoal, obviously the discarded product of cooking ovens, is old, having been comminuted by decomposition into a fine-grained homogeneous mass.
>
> Even at this late date there remain abundant signs that the occupiers of this camping and food-cooking site combined the latter activity with the manufacture and production of the implements required in their everyday life. Above the charcoal layer a superficial cover of about 18 inches of blown sand still contains many by-products of the manufacture of stone artifacts - chips of black obsidian, flakes of grey flint veined with bluish chalcedony, flakes of red chalcedony, a fragment of a well-ground adze of blackstone, a damaged

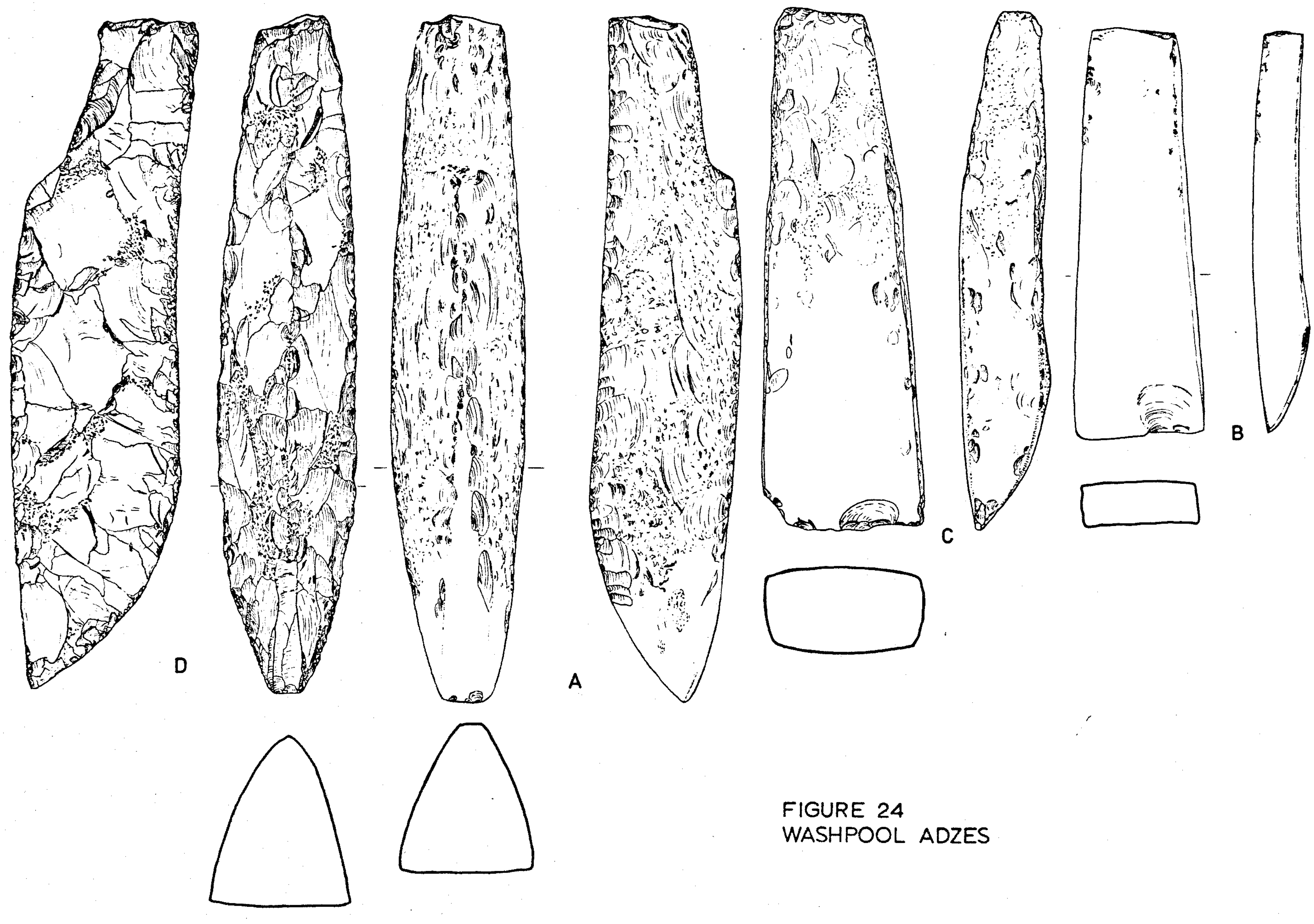


FIGURE 24
WASHPOOL ADZES

> specimen of a stone fish-hook shank of dark-grey semi-schistose slate; the sand also contains, as does the charcoal layer, a number of burnt and broken oven-stone fragments. These few items are undoubtedly the depleted residues of perhaps more significant objects collected from this very accessible spot by previous wayfarers."
>
> (Adkin, 1955:463)

Fortunately Adkin was wrong in his last observation - subsequent investigations revealed little disturbance. No doubt the artefacts which had been collected in the vicinity were those exposed by periodic phases of accelerated erosion brought about by storms.

One of the principal reasons for excavating at this site was to obtain evidence of prehistoric diet. The appearance of sparse midden in the road section indicated that this objective might not easily be fulfilled, for in contrast to many New Zealand midden sites, faunal remains were scattered through a matrix of sand, charcoal and burnt stone, and an impression of faunal impoverishment was gained. With the exception of the concentrated middens at Black Rocks (qv. Anderson, 1973a), Palliser Bay sites are all similar to this example at the Makotukutuku. It must be stressed, however, that appearances are deceptive: more than 200 species of plants and animals were represented at the Washpool Midden Site, and a similar range of species were recovered at other sites in Palliser Bay (see Appendix 1).

The excavation was laid out using the 5m by 5m squares as described for M1/I, and the square numbering is shown in Figure 25. The axis of the squares was laid out along magnetic north. Excavations commenced in the summer of 1969 - 1970, and over the 3 month period squares II, III, and V were taken down to natural. A trench was cut into square IV along the line of M1/IV/21-25 to see what relationship existed between the slight mound of this site and another to the west.

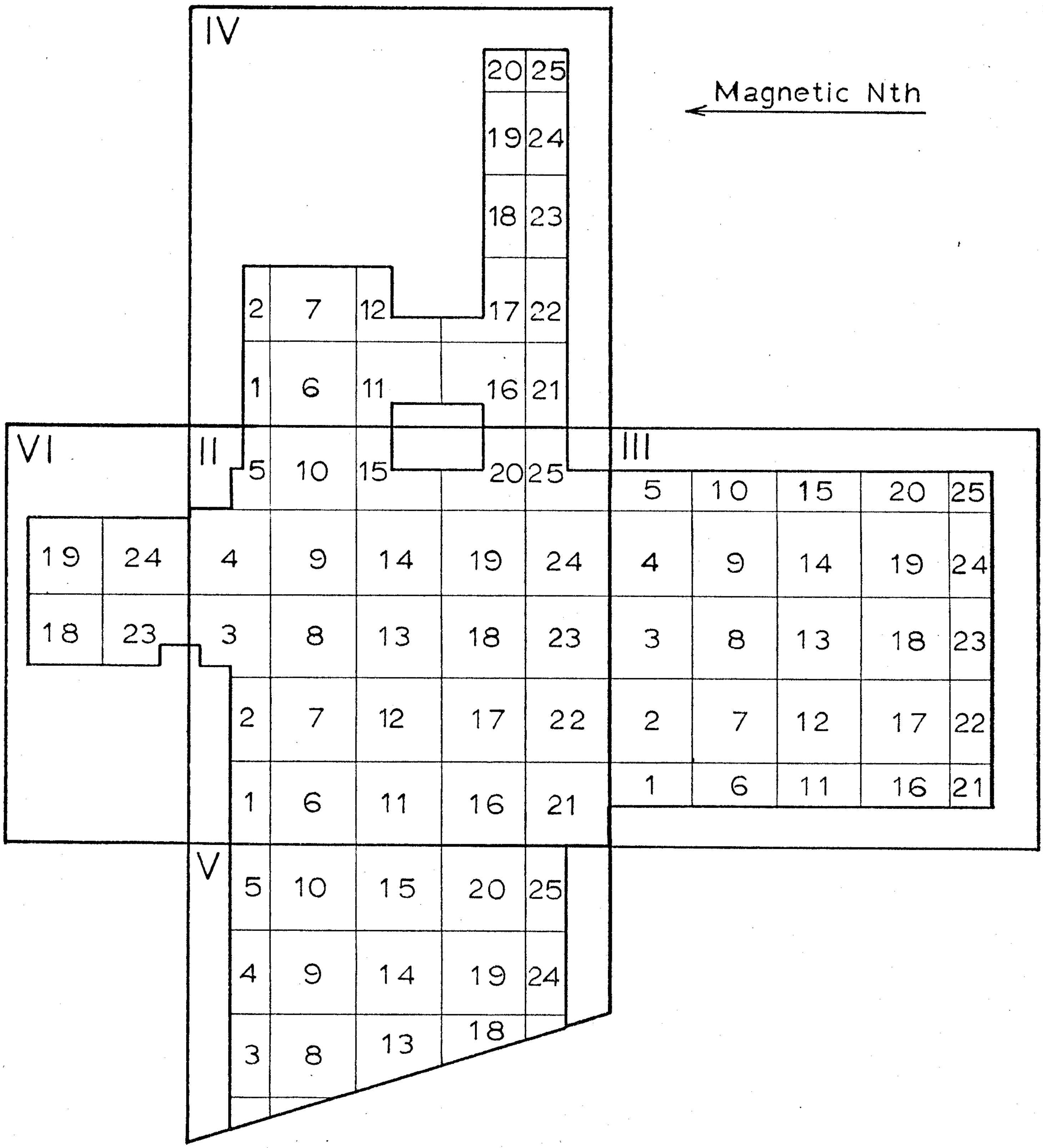


FIGURE 25 WASHPOOL MIDDEN SITE LAYOUT

It was clear from this trench that square IV was practically sterile, and also that the western mound was a natural feature. Human burials were uncovered towards the end of the first summer season in two areas: M1/II/4 and 10. This necessitated an extension of the excavation, accomplished in August 1970. These latter extensions account for the irregular layout in squares IV and VI as seen in Figure 25. In all, some 65m^2 were totally excavated.

Stratigraphical Units

The stratigraphy of the site consisted of 5 layers, with a number of separate components, and lenses in two of them. The stratigraphical relationships between the various components are best illustrated schematically, and are shown in Figure 26. The various layers are as follows:

Layer 1 Brown sandy loam. A horizon composed of turf and root hairs. Variable thickness and hardness (4 - 10cm).

Layer 2 Loose grey friable loamy sand of wind-blown origin. Charcoal-stained worm casts from lower levels and fewer root hairs. Quite compact in places. Waterworn pebbles and a few chert flakes (10 - 20cm).

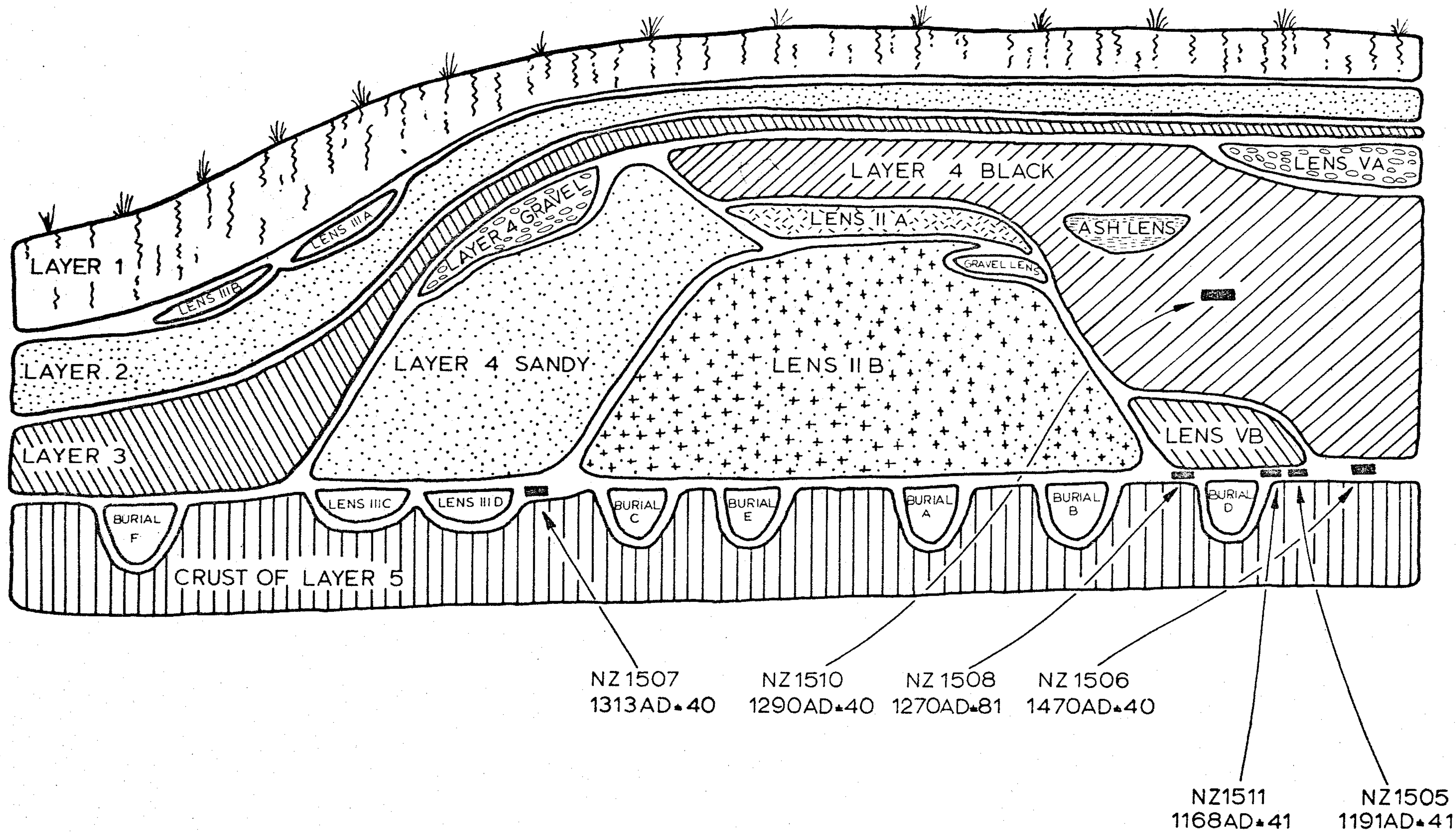
Layer 3 Grey-yellow silt layer of 2 - 10mm thickness. This layer apparently represents a period of weathering of the site while unprotected by vegetation. A number of denuded sites in Palliser Bay show similar thin, concrete-like silt layers formed by wind or rain action.

Layer 4 Black sandy layer heavily loaded with charcoal. Fairly soft and 'greasy' when first exposed. Charcoal pieces, stone flakes, artefacts, many burnt stones, some shell and bone remains (10 - 30 cm).

Layer 4 Gravel Charcoal stained waterworn gravel and sand, probably wind sorted, but of riverine origin. A part of the Layer 4 complex, but with relatively few cultural remains (10 - 30 cm).

Layer 4 Sandy Also part of the Layer 4 complex, similar to Layer 4 Black, but much more sandy and friable. Far less cultural material,

FIGURE 26 WASHPOOL MIDDEN SITE - SEMI SCHEMATIC SECTION



but fairly dense concentration of stone flakes (15 - 30cm).

Crust of Layer 5 The interface between Layer 5 and the layers above and this was generally stained with ash and other sediments. Considerable quantities of cultural remains occurred on this surface, and represented the earliest activity on the site. The material extended 20 - 30cm into Layer 5, where the stained appearance stopped.

Layer 5 Friable natural dune sand. This layer is the natural substratum (C Horizon) of the site, and the M1 area generally. It should be noted, however, that a limestone adze was found quite deeply buried in Layer 5 **(Figure 49a).**

In addition to these layers, various lenses were found of more localised occurrence; these were as follows:

Lens IIA Brown sandy loam, more or less confined to Square II, and part of the Layer 4 complex. Cultural material was quite abundant in the lens, which occurred immediately beneath Layer 4 Black as a somewhat harder lens of concentrated midden. It was found to overlie both Layer 4 Sandy, and Lens IIB described below.

Lens IIB Very fine clay-like matrix, probably ash in origin, more or less confined to square II. The lens appeared to be non-concentrated midden, but was rich in faunal and artefactual material.

Lens IIIA Very hard compacted brown sandy ash lens resting on Layer 2 in square III.

Lens IIIB A lens similar to Lens IIIA on Layer 2 in another part of square III.

Lens IIIC A lense of sparse midden and ash in square III resting on the Crust of Layer 5.

Lens IIID Similar in content and stratigraphical position to Lens IIIC.

Lens VA A lens of gravel occurring close to the road section in one corner of square V and resting on Layer 4 Black.

Lens VB A more compacted version of Layer 4 Black on the interface with the Crust of Layer 5. It is part of the Layer 4 complex and was found to overlie Lens IIB. Some midden was present in this lens.

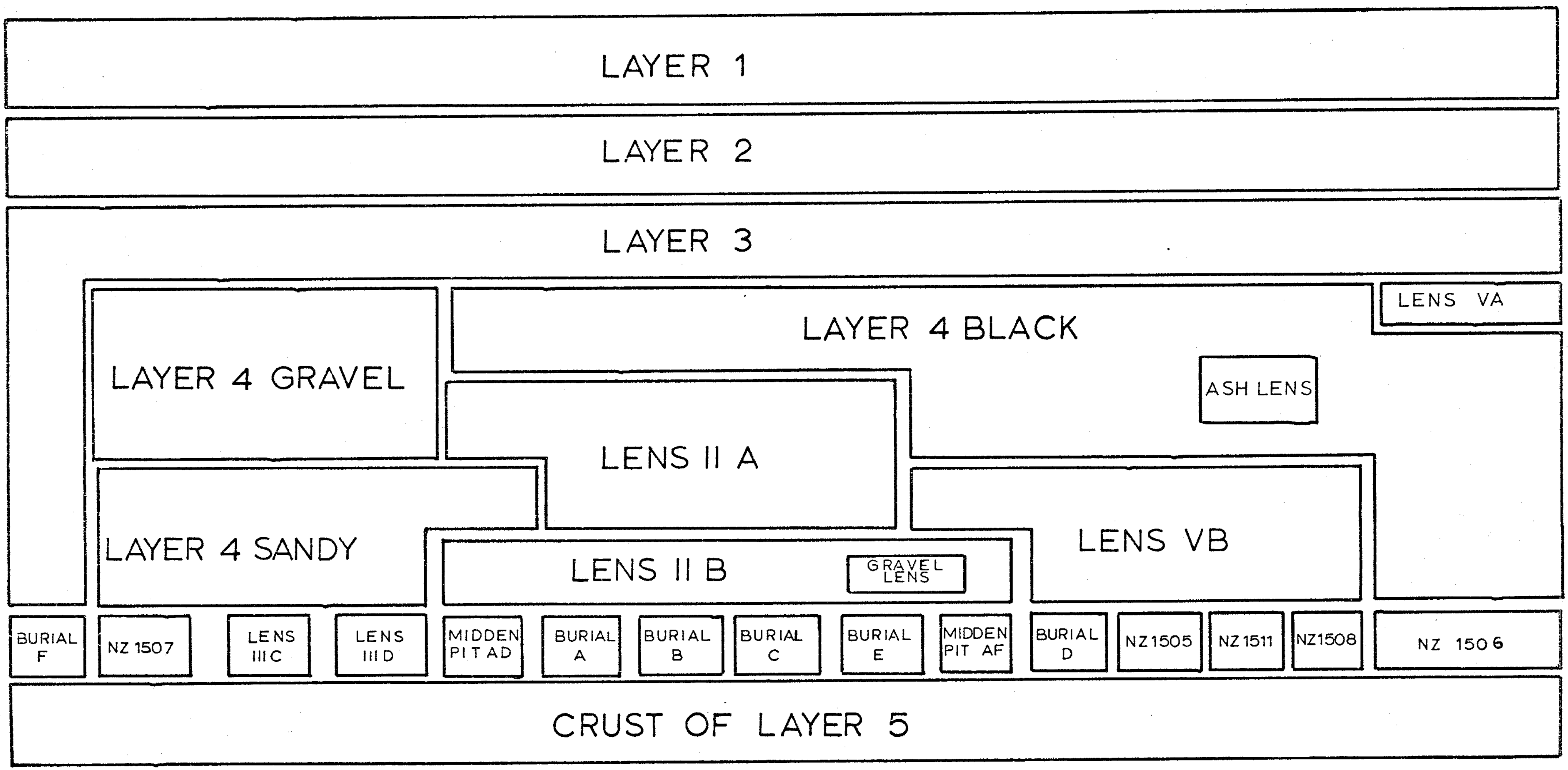
Chronology and Cultural Levels

A number of radiocarbon samples were taken during the excavation, wherever possible from structural features which could be related to the overall stratigraphy and the functional history of the site. In this way it was felt that the circumstances of the deposition of the samples would be more precisely known than if samples were taken merely from the body of a particular layer. This procedure in selecting samples for dating was also followed wherever possible in the other Makotukutuku Valley excavations. Only charcoal was used for radiocarbon dating. It was felt that in the interests of consistency it would be better not to enter the controversy concerning comparability of different types of samples. Some archaeologists have obtained widely varying results by dating combinations of shell, charcoal, bone, and organic and inorganic fractions of single materials (for example see McFadgen, 1972:53ff; Leahy, 1974:72). In contrast to the experiences of some (for example see Trotter, 1968; Grant-Taylor, 1974; McCulloch and Trotter, 1975) charcoal proved to be a thoroughly reliable medium for dating the events of Wairarapa prehistory. In the case of the Washpool Midden Site a series of 6 charcoal samples was dated at the Institute of Nuclear Sciences in Wellington (Leach and Leach, 1971a); full details are given in Appendix 4. The mean ages of the dates range from 1168AD to 1470AD, and fit well into the cultural chronology for the site which consists of three levels as follows (see Figures 26, 27, 28):

Level III - c.1538AD

The stratigraphic components of the level are turf, Layers 1, 2 and 3, and Lenses IIIA and IIIB. European items were found in this level as well as scattered prehistoric items. While the former were confined to the upper layers, it is possible that the latter were of secondary derivation from the site underneath.

FIGURE 27 WASHPOOL MIDDEN SITE IDEALISED STRATIGRAPHY



Level		Stratigraphical Units
Level III	1538 AD	Layer 1
		Layer 2
		Layer 3
		Lens IIIA
		Lens IIIB
Level II	1345 AD	Lens VA
		Layer 4 Black (& NZ1510)
		Layer 4 Gravel
		Lens IIA
		Lens VB
		Layer 4 Sandy
		Midden Pit AZ (& NZ1507)
		Scoop Hearth gamma (& NZ1506)
		NZ1508
		Circular Cooking Shed (& Lenses IIIC and IIID)
Level I	1180 AD	Lens IIB (& Gravel Lens)
		Burials A, B, C, D, E, F
		Scoop Hearth (& NZ1511)
		Midden Pit AE (& NZ1505)
		Midden Pit AD
		Midden Pit AF
		? Food Platform
		Rectangular Cooking Shed
		Drying Rack
		Crust of Layer 5

Figure 28: Washpool Midden Site - Cultural Levels

In view of the continuous nature of Layer 3, however, they are more likely to derive from later activities in the Washpool area subsequent to the principal occupation of this site. This interpretation is supported by excavations at the Washpool Garden Site - M1/XI-XXVIII, a site dated by 3 charcoal samples (NZ1512, NZ1513, NZ1514) which give a pooled result of 1538AD ± 49 (H.Leach,1976), using the method outlined by B.F.Leach (1972). The scattered nature of prehistoric items in Level III indicates that at that time the Washpool Midden Site was on the periphery of the occupied area.

Level II - c.1345AD

In this level are placed Layers 4 Gravel, 4 Black, 4 Sandy, and Lenses VA, VB, IIA, IIIC, IIID, and a number of structural features including an irregular pit (feature AZ) and a scoop hearth (feature gamma). All these features were rich in charcoal, and midden was very sparse throughout. As will be demonstrated later the composition of this midden differed somewhat to that in layers below. Four radiocarbon dates were obtained which relate to this level (NZ1506, NZ1507, NZ1508, NZ1510). These give a pooled age estimate of 1345AD ± 46. One of these samples (NZ1506) came from a small scoop hearth which had some flat stones placed evenly over the top of it. An inexperienced person was responsible for the excavation in this area and an error in interpretation was made in the field. The scoop hearth was originally assessed as being thinly covered by Lens IIB (a dense ash and midden lens with very little charcoal). The bags of material from the vicinity of the scoop hearth labelled Lens IIB are rich in charcoal stained sand, and with hindsight it is now clear that the margins of Lens IIB were incorrectly recorded during excavation. The material in question bagged as Lens IIB is clearly Layer 4 Black, and the scoop hearth (feature gamma) should not be placed as early in the sequence as previously thought. The date for the charcoal sample confirms this interpretation. The age (1470AD ± 40) affects the pooled mean for Level II by 50 years; that is, if only the three samples (NZ1507, NZ1508, NZ1510) are pooled, the result would be

1295AD ± 13. In contrast, if NZ1506 were assessed with Level I, the pooled date for that level would rise by 98 years.

A number of structural features are associated with Level II, and these are discussed more fully below. The most important were features interpreted as a cooking shed and many scoop hearths or ovens as well as areas of oven rake-out. The numerous surfaces within Level II used for scoop hearths and ovens indicate that this occupation phase extended over a period of time.

Level I - c.1180AD

The main components of this level are Lens IIB, Crust of Layer 5, Burials A, B, C, D, E, F, midden-filled pits AD, AE, and AF, a number of scoop hearths, a cooking shed, and what may be the remains of a drying rack for fish of some kind. There are two radiocarbon dates for this level: NZ1505 and NZ1511. These give a pooled age of 1180AD ± 12. The site at this time is believed to have been of some duration.

Architectural History

Only a few postholes and other structural remains were found in stratigraphical surfaces above the earliest (Crust of Layer 5); however, it is not believed that all of the numerous features of this lowest surface are contemporary. This raises an important archaeological problem which is sometimes overlooked in stratigraphical interpretations. It is relatively easy to distinguish chronologically between features belonging within different stratigraphical units (i.e. layers), but it is sometimes impossible to distinguish between chronologically different features which are cut into one surface. If one was fortunate enough to find half the post butts were made from one timber and half from another, then it would be plausible to suggest that two structures were involved. Even in this case, though, there is nothing to prevent the two structures from being either several hundred years apart in time, or contemporary.

At the present time there are only a few archaeological methods which help to clarify this kind of field problem. Not all are relevant in any particular instance, and some give only ambiguous results when applied. A common example is the classification of posthole fills (qv.Golson, 1969:110). In some cases various relative dating methods could be applied to material in the posthole fills. An example is conchiolin dating (Anderson, 1973b), which is easily capable of distinguishing between shells deposited as little as 50 years apart. However, even then the final evaluation of results will rest with strict stratigraphical interpretations - was the shell in the posthole fill from a period before of after the erection of the post, because clearly the shell infill and the post could not be exactly contemporary. In short, there are no hard and fast rules or established methods which resolve this kind of problem, and the fact that we cannot be fully sure, should be made quite clear when interpretations are advanced for such features.

In the present instance, it is believed that the structural evidence cut into the Crust of Layer 5 belongs to two separate periods and is associated with different overlying stratigraphical components. In one case there are about 70 structural features (hearths, fire pits, postholes etc.) found primarily in squares II and V. These are below Lens IIB or Lens VB, but are either filled with Lens IIB or the clearly identifiable brown stained Crust of Layer 5. These features are deemed to be associated with the activities of Level I and are thus related to the stratigraphical units Crust of Layer 5 and Lens IIB, dated to about 1180AD. In the second case there are about 25 structural features in square III, and all are overlain by Layer 4 Sandy and filled with that layer. These features were cut into the Crust of Layer 5 also, but none is filled with the brown stained material. In addition, two small midden lenses were found (Lenses IIIC and IIID) which were clearly related to a set of postholes in this square. The midden debris in these lenses was quite sparse and did not have the ash so characteristic of Lens IIB. These features therefore are believed to belong to Level II, and to be associated with the Layer 4 complex dated to about 1345AD.

Some of the main structural features may be described as follows:

Midden-filled Pits

In the lowest level of the site two shallow rectangular pits were found which had been dug in sand and filled with midden (see Figure 29). The sides of the pits were vertical showing that the pits had been deliberately dug out and were not simply midden-filled depressions. In addition, the midden in the pits included quantities of very fragmented Perna canaliculus and Paphies (Mesodema) subtriangulatum. In Palliser Bay sites these shellfish were invariably characteristic of the earliest horizons. The pits were 1.58m by 0.45m by 0.32m deep and 2.38m by 0.48m by 0.34m deep, and were thus quite similar in size. One of them, Pit AE, was dated to 1191AD ± 41 (NZ1505) and was surrounded by 9 postholes. Because the arrangement of postholes is not especially regular this is interpreted as some form of fence enclosure rather than a roofed structure. The second of these rectangular pits, pit AD, had no sign of postholes in its vicinity, and neither had any vestige of disturbance or evidence of postholes in its base. Two possible functional interpretations might be suggested. The first is that these pits are the remains of graves from which the body had been disinterred, and the hole later filled with midden. It should be noted that secondary burial is documented in a number of Palliser Bay sites including one individual from this site.

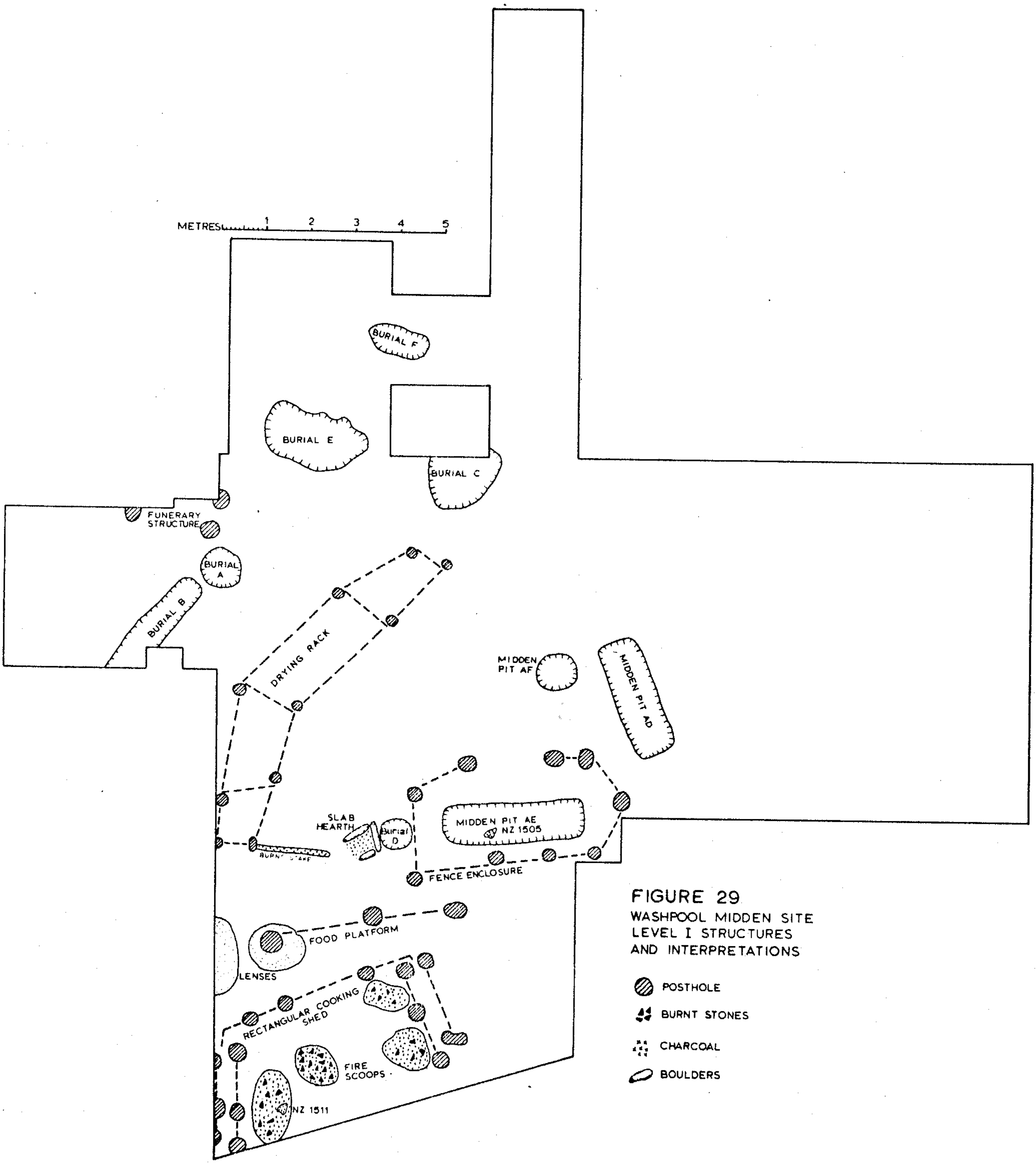


FIGURE 29
WASHPOOL MIDDEN SITE
LEVEL I STRUCTURES
AND INTERPRETATIONS

POSTHOLE
BURNT STONES
CHARCOAL
BOULDERS

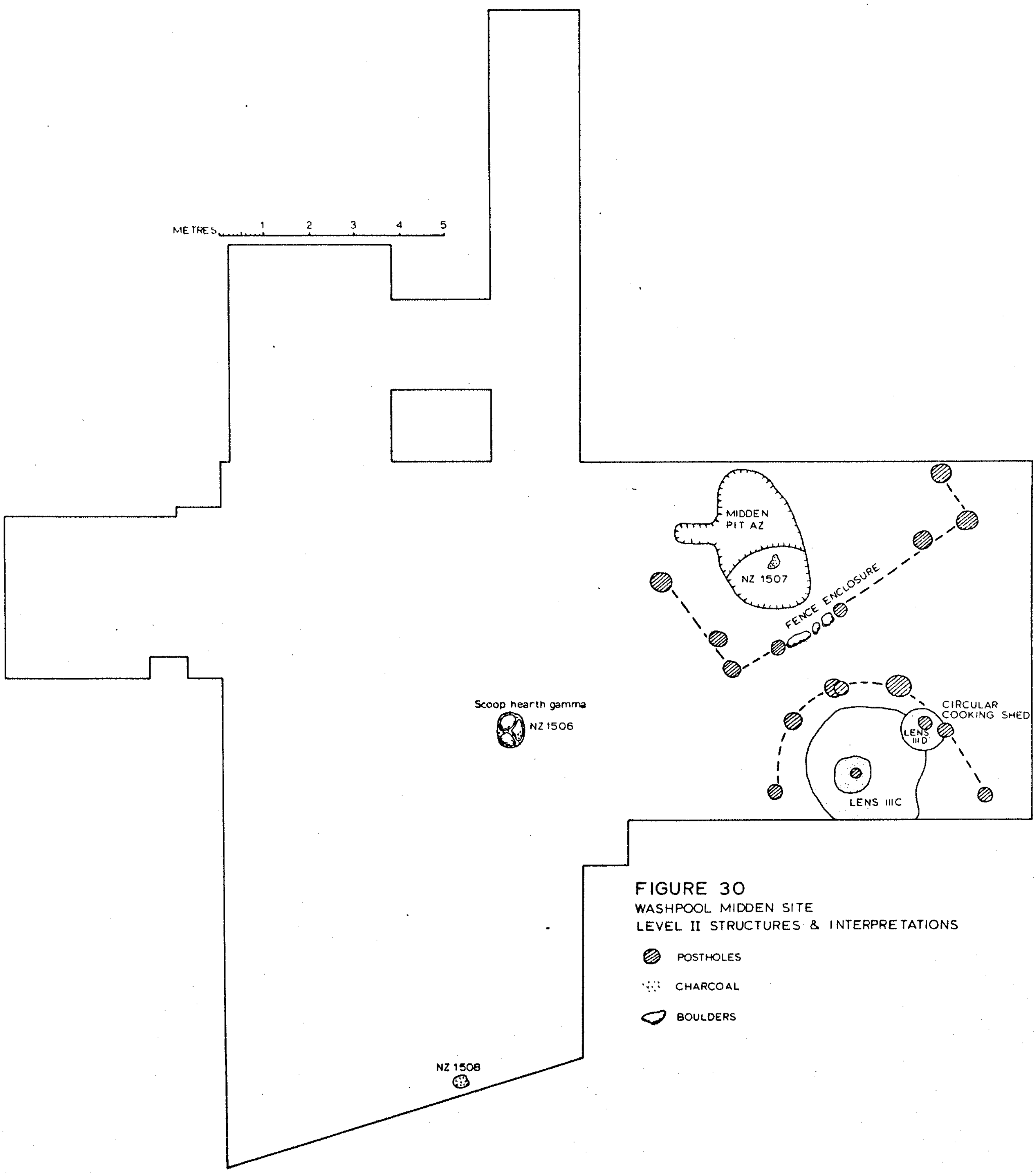


FIGURE 30
WASHPOOL MIDDEN SITE
LEVEL II STRUCTURES & INTERPRETATIONS

POSTHOLES

CHARCOAL

BOULDERS

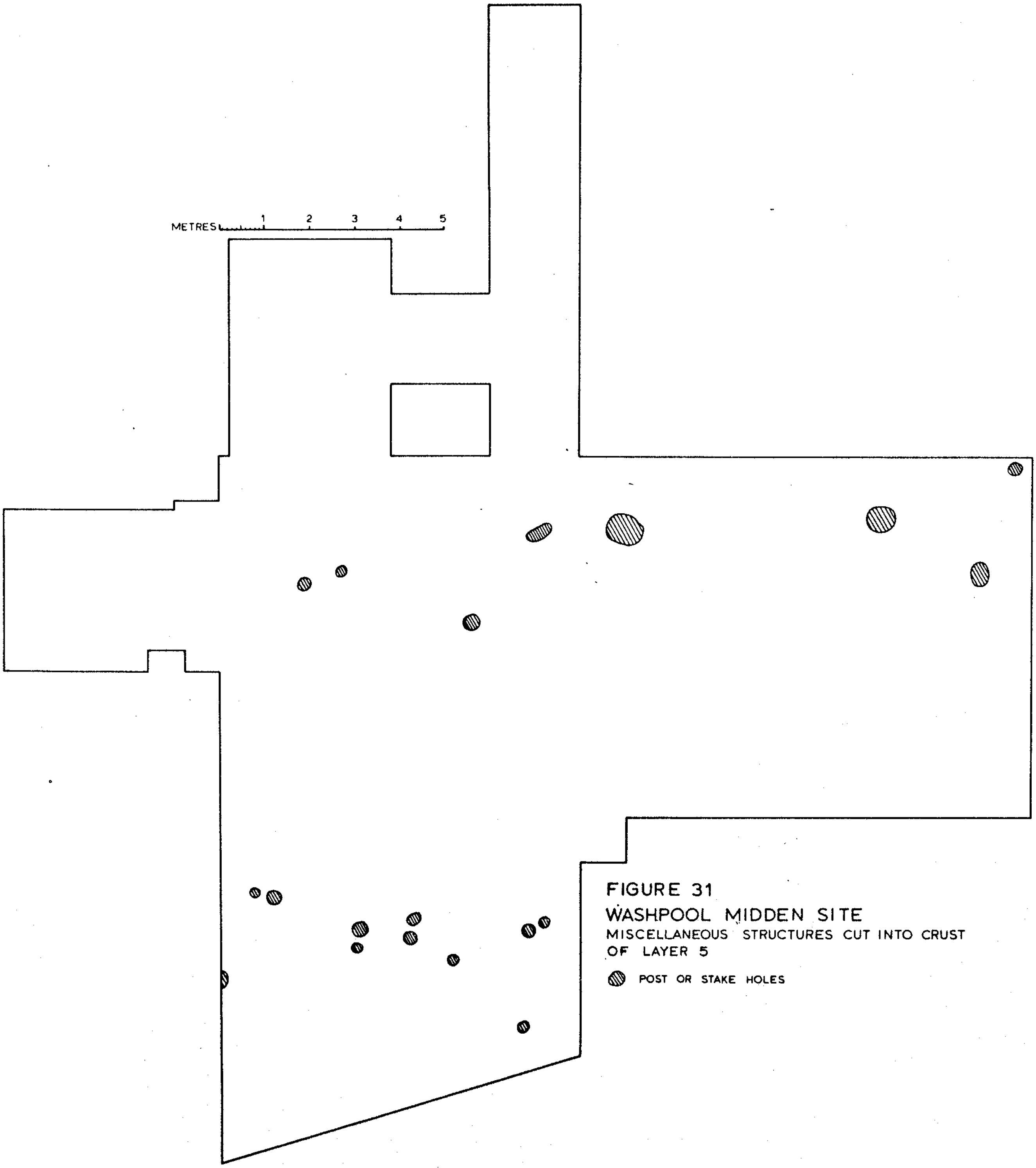


FIGURE 31
WASHPOOL MIDDEN SITE
MISCELLANEOUS STRUCTURES CUT INTO CRUST OF LAYER 5

It is not known where the bodies were decomposed before final burial, but this could have been achieved in shallow graves in sand. A second possibility is that the pits relate to food storage, perhaps of kumara. It is noteworthy perhaps that one of the few comparable pits, from the midden site at Sarah's Gully (N40/9), has been interpreted as relating to local horticulture (Green, 1972:30; see also Green, 1963b:66). Either of these interpretations might account for the existence of vertical pit walls in what is essentially a friable dune sand area. Presumably if either a burial or a supply of kumara was to be later uncovered, it would have been protected from the sand in some way - possibly by lining the pit with matting or similar material. H.Leach favours the view that these two structures relate to the earliest kumara storage practices in Palliser Bay (H.Leach, 1976:Chapter 9). It will be shown below that the occupants of the site buried their dead in a casual fashion in shallow scoops or circular holes quite unlike these carefully dug pits. This fact argues against an 'empty grave' interpretation.

The two pits described above are in contrast to a number of other disturbances at the base of the site which also contain midden material. These are generally oval or circular in shape (40 - 50cm in diameter) and were probably never more than casual rubbish pits. One of these, however, Pit AF (see Figure 29) was quite circular and had near vertical sides; it may have had a similar function to the rectangular ones. A somewhat larger structure was found in square III, which is more difficult to interpret. It is of oval shape about 1.65m by 0.95m, and has two distinct levels: the eastern half was over 40cm deep stepping up to the western half at about 20cm. In addition, on the southern side there was a small annex of 45cm by 20cm and about 15cm deep. This latter feature could have been some form of step and was quite regular. A certain amount of midden was found in this unusual feature, but the pit had not been deliberately filled in with midden the way the others had. It contained material very similar to Layer 4 Sandy and it is judged that the whole feature therefore belongs to Level II. A radiocarbon date of 1313AD ± 40 fits well with the sequence. The pit was surrounded on three sides with 8 large postholes, and some stones were placed along the line also. Some kind of fence or wind-break might be suggested.

Although this pit is somewhat irregular in shape with more sloping sides, this could be due to subsidence. In fact the pit could have originally been quite rectangular, and therefore similar to pits AD and AE, but in the process of uncovering what was contained in it, the sides collapsed inwards. H.M.Leach has argued elsewhere (H.Leach, 1976:Chapter 9) that this pit too is related to early food storage.

Green (1975, pers.comm.) has drawn attention to the similarity between these pits and some from Kaupokonui (N128/3), and H.Leach (1976: Chapter 5), has discussed the implications of this parallel.

'Drying Rack'

Directly under the main area of midden (Lens IIB), a series of 10 paired posts and stakeholes were arranged along a line 4.2m long with a bend in the centre. At one end of the structure, in M1/II/1-6, the remains of one of the stakes were found. This was contiguous with one of the postholes and measured 88cm long. If the interpretation of the structure as a fish drying rack is correct, the structure should have stood somewhat higher off the ground than the length of the stake implies, otherwise dogs might have removed fish hanging from it. This interpretation is based on the fact that the postholes are only about 10 - 15cm wide and average about 15cm deep, indicating a fairly flimsy structure, one made from stakes only just buried. Presumably it was held up in part by poles lashing the row of stakes together. The alternative, that the structure was a wind-break with brushwood lashed between the stakes, is more doubtful because normal wind strengths encountered in this area would require fairly solid posts set into the ground. Since the feature was found directly below Lens IIB it belongs with Level I very early in the sequence.

'Cooking Sheds'

There were two structures in the site which are interpreted as cooking sheds, one in Level I and the other in Level II. The posthole arrangements can be seen in Figures 29 and 30. The first structure in square V is composed of an arrangement of 14 postholes on three sides of a rectangle. The northern and southern sides were apparently a double line of posts, perhaps with brushwood between them. The rear wall was made from a single line of posts. Inside were found 4 ash and charcoal-filled fire pits, each about 50cm in diameter. Two of these had only a few broken oven stones, but in the other two, oven stones were abundant. It has been customary to refer to these stone and charcoal-filled pits as 'ovens', but Sutton (1971), in a discussion on prehistoric cooking methods, has urged caution in interpreting such structures. Actual cooking ovens, loaded with stones and relatively charcoal and ash-free, are apparently a fairly rare feature in New Zealand archaeological sites (see Cairns, 1959a). This may reflect the practice of removing the stones when cold for re-use, the pit being filled in with general refuse and even fire pit rake-out at times. In the enclosure under discussion, stone-heating fires seem to have been used, but this does not rule out the possibility that the pits had not been used as ovens also. Charcoal from one of the fire scoops was dated to 1168AD ± 41. The postholes and the fire scoops were all cut into the Crust of Layer 5, and overlain by Lens VB; they are thus stratigraphically early in the sequence and the features are placed in Level I.

The second structure interpreted as a cooking shed was found in square III, and is somewhat different to the first. Again the posthole arrangement suggests a partly open enclosure, but this time it is semi-circular in shape. It is composed of 7 fairly substantial postholes, and a smaller one in the centre of the structure, perhaps for supporting the roof. Inside the enclosure were 2 scoop hearths or fire pits, and 3 lenses of sparse midden. One of these lenses was located about the centre post. Although these features were cut into the Crust of Layer 5, and overlain by Layer 4 Sandy, the sparse midden was fairly rich in charcoal and in appearance closer to that of Level II than the denser ash-rich midden of Level I. In addition, the postholes were filled with material closely resembling Layer 4 Sandy. For these reasons the structure is interpreted as belonging to Level II.

'Food Platform'

Immediately behind the Level I cooking shed in square V were 3 postholes obviously belonging to a more substantial structure than a drying rack. These could possibly have been the uprights of an elevated food storage stage. Such structures were commonly seen in the vicinity of food processing areas in the 19th century, and were for protecting food against scavenging dogs. It is also believed that such structures were to discourage the native rat (Rattus exulans) which is claimed to be a poor climber. Indeed, with the introduction of the European black rat

(Rattus rattus), which is an able climber (Thomson, 1922:78), special everted cones were attached to the uprights of these platforms. Markham refers to this embellishment as a "rat extinguisher" (1963:43), and notes that these platforms had the additional advantage of keeping food out of the range of frosts during winter (Markham, 1963:43). It is probably more realistic to view such platforms as a protection against the combined attacks of dogs, rats, frosts and even children. Furthermore, the 'rat extinguisher' must have been in vogue long before Markham's observations in 1834 for, contrary to popular belief, Rattus exulans is perfectly capable of climbing this height (von Stermer, 1975:pers.comm.). The closeness of these postholes to both the cooking shed and the enclosed midden pit of Level I, makes it fairly likely that this structure also belonged to that Level.

Stone Slab Hearths, Fire Pits and Ovens

Scattered throughout the site are a number of structures related to cooking and heating. Layer 4 Black consists primarily of fire-pit and oven rake-out as well as sparse midden. The layer showed ample evidence of internal structuring involving the repeated use of fire-pits and ovens. However, their intercutting and continual re-use left stratigraphic remnants so complex that it was impossible to unravel the internal relationships with any confidence. Among these features are a few where specific function could be detected. A stone slab hearth, for instance, was found in M1/II/11. This was resting on the Crust of Layer 5 and was composed of three greywacke slabs. The small ash fill had spilled out of the open end suggesting that there had not been a fourth slab. The hearth is not associated with any structure such as a house, but it is in a small space between the drying rack, a dog burial, the fence-enclosed midden pit, and the food platform. It is overlain by Lens IIB and therefore belongs with Level I.

Two additional features are probably best termed 'scoop hearths', inasmuch as they are the remains of a small fireplace without stone slab surrounds. One of these occurred in M1/III/13-14 set into the surface of Layer 4 Gravel. It contained some burnt stones, and it may have been for heating stones for an oven. The other, in M1/II/17, was situated on the Crust of Layer 5 and was overlain by Layer 4 Black. A sample of charcoal from this feature was dated to 1470AD ± 40 (NZ1506). A number of other fire pits have already been mentioned in connection with the cooking sheds.

Miscellaneous Structures

A number of other structural remains were found in the site at various levels, which were either difficult to interpret, or of doubtful significance. For example, in the Crust of Layer 5 there are some postholes, stakeholes, and depressions of various kinds that appear to be unrelated to any identifiable constructions. In addition, there are occasional lenses of material perhaps related to the digging of postholes. All these features are shown on Figure 31.

Burials

The Washpool Midden Site revealed 6 burials, one of a dog, and the other 5 human. The physical anthropology of these human remains and others from the Wairarapa has been the subject of an intensive study by Sutton (1974), and some of the details of their pathology and life histories will be discussed later in this chapter. At this point, however, their archaeological context should be outlined.

Apart from the dog burial, the remains were in a fairly confined area of about $10m^2$ on the south west corner of the site. The dog burial was several metres to the north-east. All the remains were set into the Crust of Layer 5 and are believed contemporary with Level I. Four of the burials were covered by Lens IIB, while Burial D (the dog) was covered by Lens VB, and Burial F by Layer 3 (lower layers were not present in this part of the site). Both these latter burials however were definitely filled with the brown stained Crust of Layer 5, characteristic of the other burials. The precise positions of the burials can be seen in Figure 29. An unusual feature was the presence of 4 large postholes more or less enclosing Burials A and B. It seems likely that these belonged to some kind of structure related to the actual burials. As will be seen, exhumation followed by secondary burial was an established pattern in early Palliser Bay. Indeed, Burial A is an example of this practice. These postholes may therefore have belonged to an elevated platform either for displaying or decomposing the dead. Such structures were sometimes employed in the burial ritual in proto-historic New Zealand (see Best, 1905; 1952). Another possible interpretation for this set of postholes is as some kind of temporary shelter for the dying. In the 19th century such shelters were often made expressly to prevent a person dying in a house which would automatically incur a powerful death tapu. The only way of removing such a tapu was to burn the house down (see Buck, 1962:416; Best, 1905: 157). At Wairau Bar a similar set of 3 postholes was found enclosing Burial 15 (Duff, 1956:53); at this site also the practice of exhumation and secondary burial seems to have been fairly common.

None of these burials showed signs of an elaborate grave. They were all positioned rather close to the prehistoric surface in shallow scoops. In this respect the mode of burial recalls the image given by Best:

"One of the easiest and most effective modes of burial was adopted in some cases by coast dwelling folk. A body was placed at the base of a sand-dune and the loose sand rolled on to it; no burial was easier or more effective"

(Best, 1952:116)

In the case of the Washpool Midden Site a certain amount of midden also found its way into the burial along with the Crust of Layer 5 matrix, and this attests the close temporal relationship between the two activities. Burial so close to the general habitation area may be the cause of some surprise since certain late 19th century ethnographic accounts on the Maori stress the importance of a spatial separation between these activities (Oppenheim, 1973:25). However, it is a known Polynesian practice to bury the dead close to habitation. Burials on Tikopia, for example, were in strictly allocated positions beneath house floors (Firth, 1957:77). This close association between burials and houses can also be documented for Western Samoa (Ishizuki, 1968:53), and also in the Marquesas (Suggs, 1961:64-5). The ethnographic records in New Zealand which dispute this could well refer to post-European trends since the relationship between burials and houses can be documented at two sites as late as the 18th century at Motutapu (Davidson, 1970a:44; and Leahy, 1970:67).

Human Remains

In addition to the five human burials found in the site, the scattered remains of a further four individuals were located. None however was associated with any identifiable structure such as a burial scoop or grave. All were later studied in detail by Sutton (1974). A number of his conclusions are discussed at the end of this thesis where such topics as health, longevity, fecundity and genetic relationships

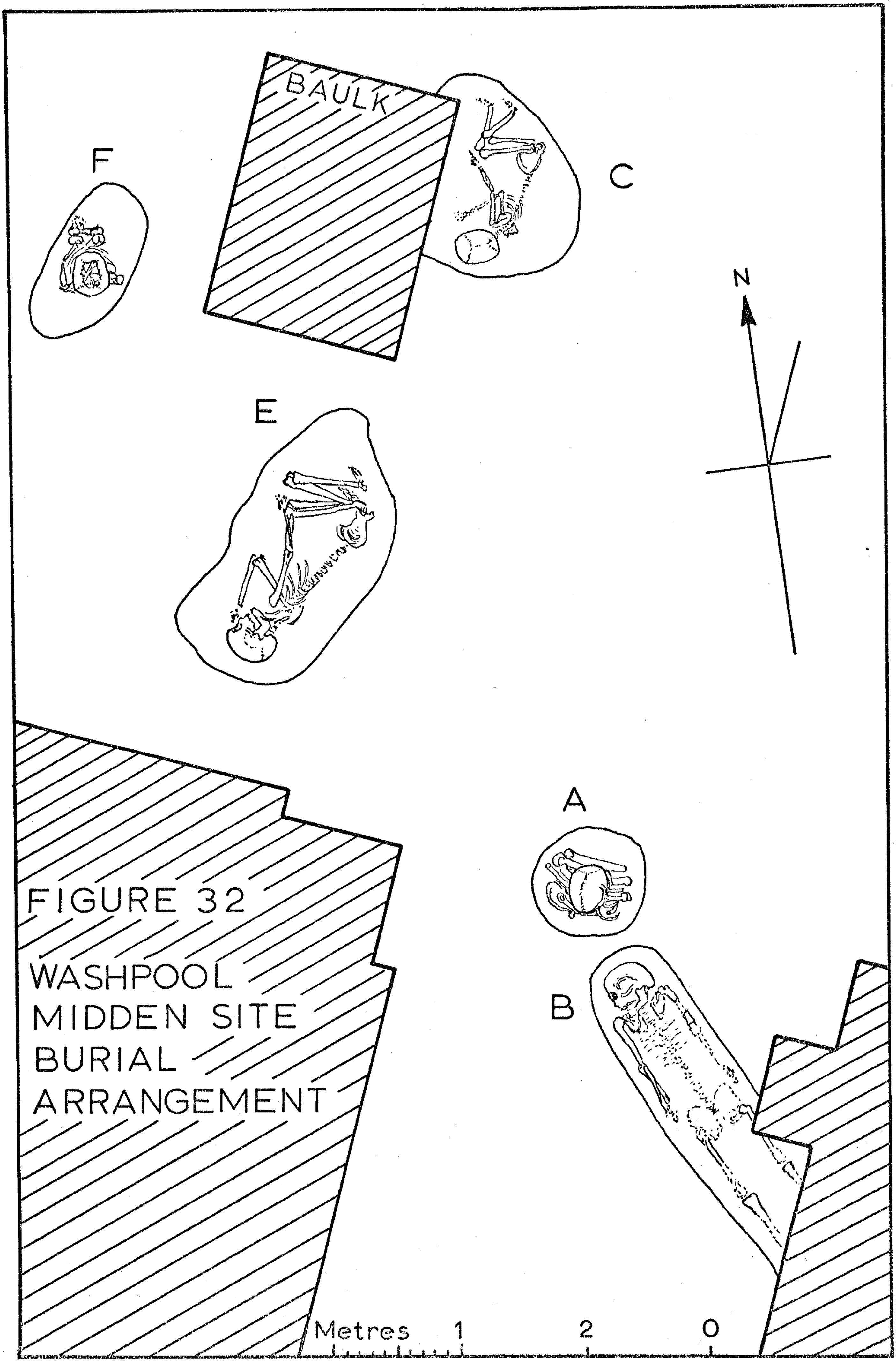


FIGURE 32

WASHPOOL MIDDEN SITE BURIAL ARRANGEMENT

are considered. The actual circumstances of the burial of these people including observations of burial ritual and any later disturbances of the graves will be presented here. The physical characteristics of each individual are summarized as these are fully discussed by Sutton (op.cit.) The disposition of the burials is shown in Figure 32.

Burial A (see especially Sutton, 1974:99ff)

This was the body of an adult female of about 40 years and 154.7cm tall, and was clearly a secondary burial (Figure 33). It appears that the body had been only partly decomposed because sesamoid bones were present in the knee joints which were still in articulation. On the other hand, sufficient dismemberment had taken place, so that a number of bones were missing, including most of the chest area and the right humerus. Best (1905:212) notes that Maori exhumation often took place after four years, but that the period was sometimes only one or two years. He describes a case of a child being exhumed after only a few months. In the case of Burial A, exhumation must have occurred within one or two years. The interment could be described as a bundle burial, with the remains placed in a fairly shallow oval scoop of about 50cm in diameter. In the top few centimetres of the burial fill, and slightly to the east, was found an adze of Skinner Type 1A (Skinner, 1974:103-4). The adze is illustrated in Figure 34a and is made from dark grey D'Urville Island argillite. The cutting edge, so sharp and unmarked by chips or scars, suggests that it had been sharpened immediately before burial, perhaps as part of the funeral ritual. This burial offering is unusual for two reasons: firstly, it is associated with a female burial, and secondly it was not buried with the actual corpse itself but as part of the material heaped on top. This latter point is particularly interesting and is paralleled by the findings in Burial F (see below).

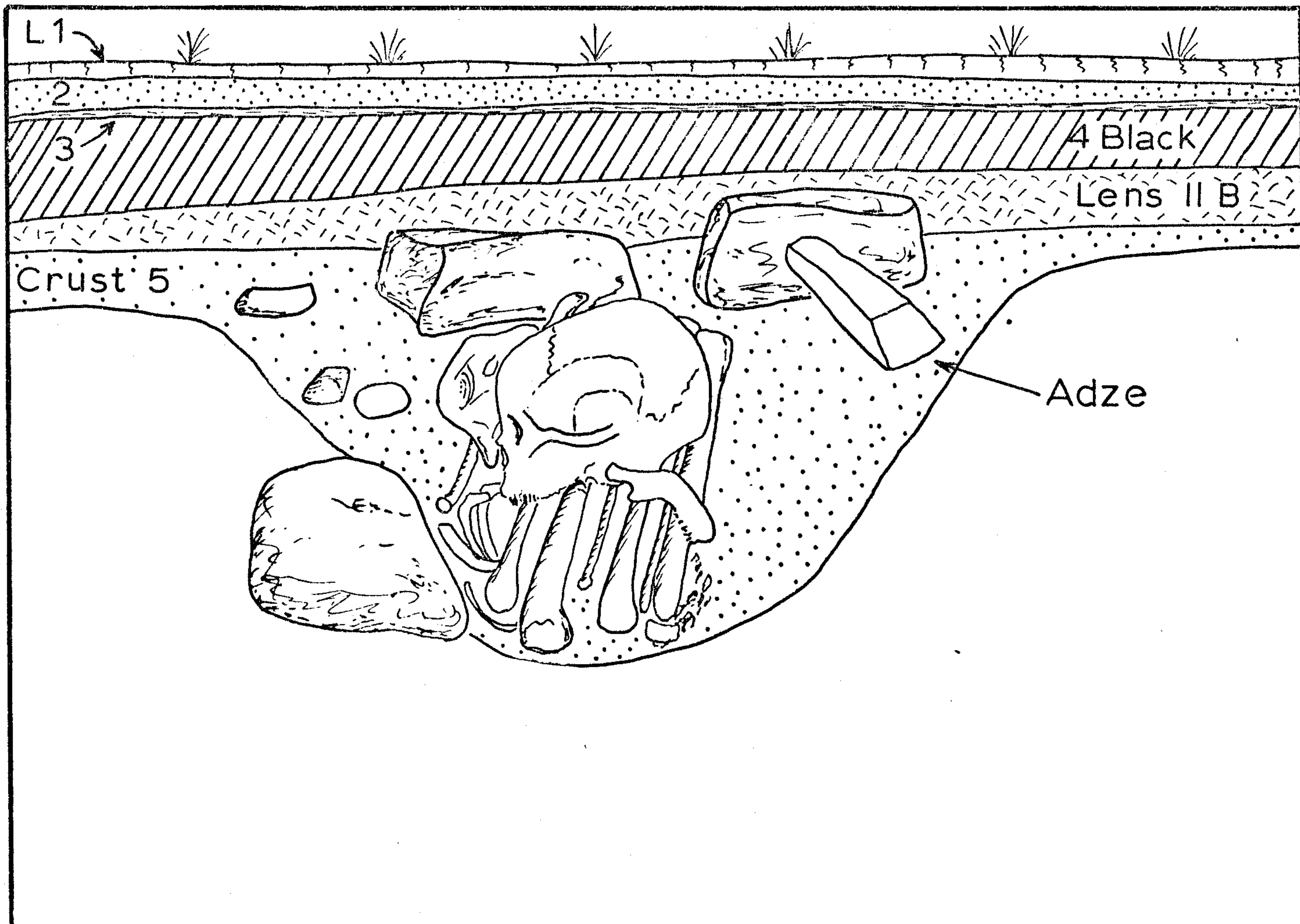
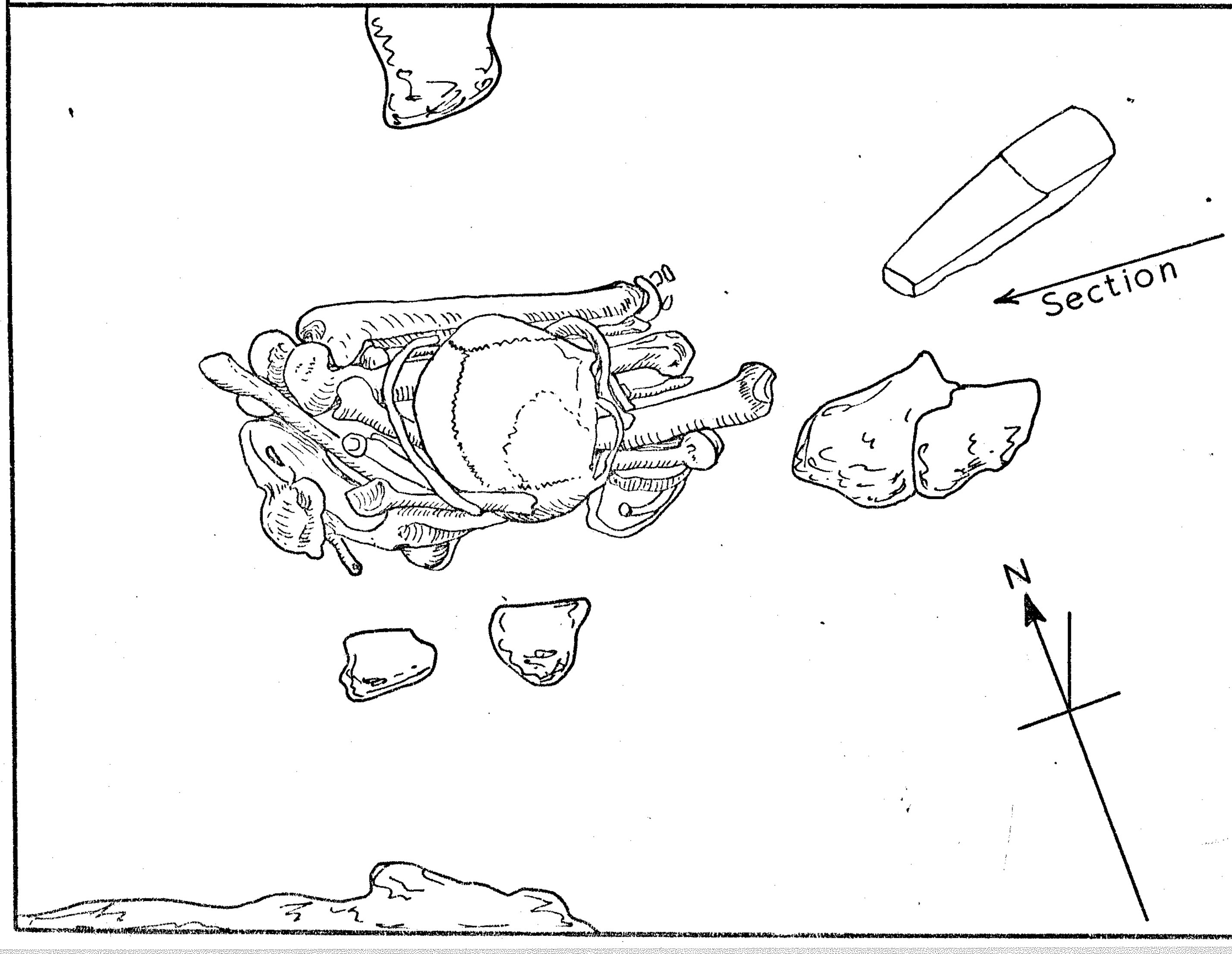


FIGURE 33 WASHPOOL BURIAL A



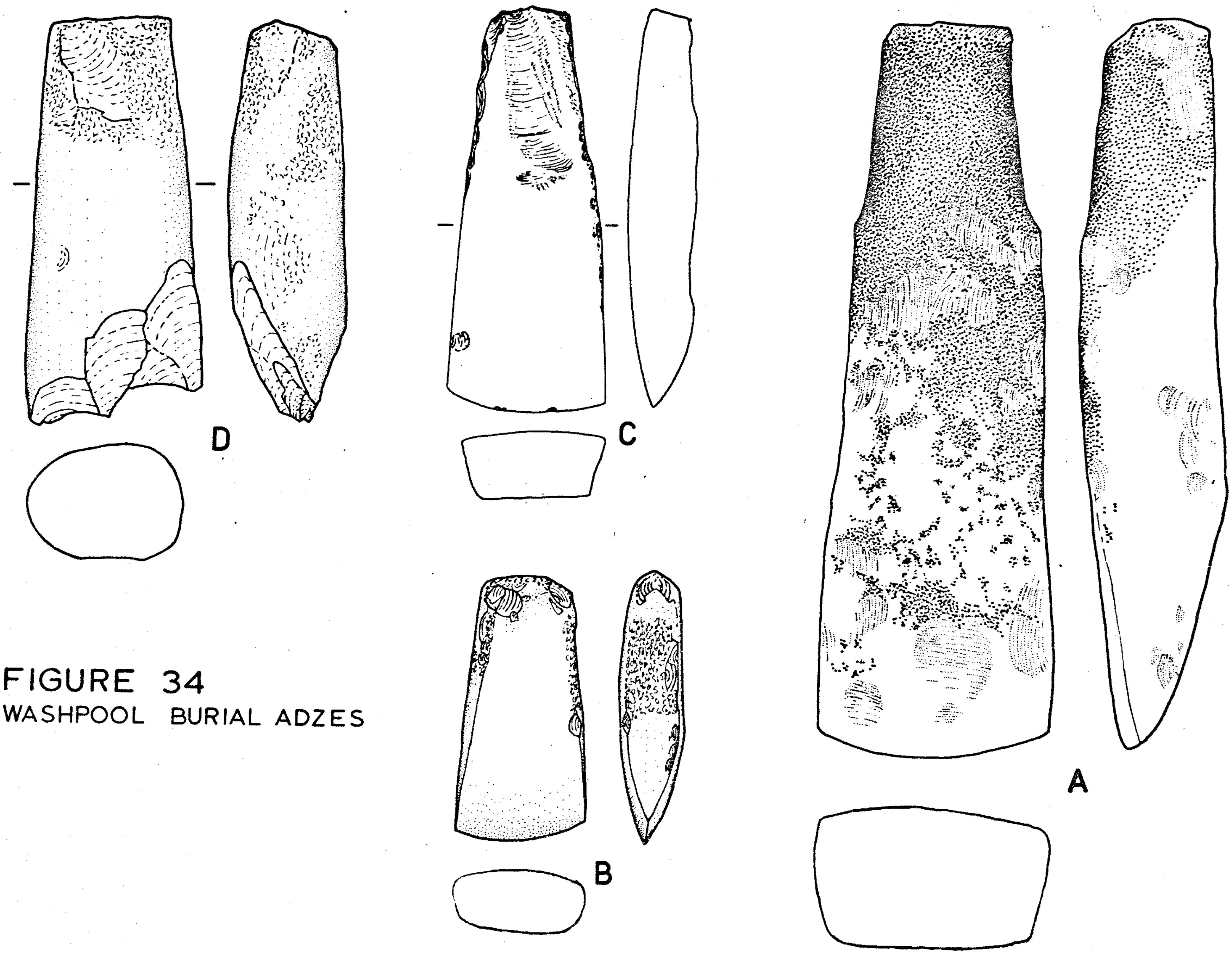


FIGURE 34
WASHPOOL BURIAL ADZES

It provides an intimate insight into the funerary process. Several waterworn boulders were placed on top of the burial.

The belief that only males of fairly high rank were buried with grave goods in prehistoric New Zealand (however c.f. Leach and Sutton, 1972), in large measure derives from Duff's observations about the important burial remains at Wairau Bar (Duff, 1956). He states, for instance:

> "Thus at Wairau they [moa eggs] were buried exclusively in cases where the other offerings suggested some superiority of rank of the deceased, as far as can be established, with adult males"
>
> (Duff, 1956:34)

and again:

> "It is generally not difficult in excavating to distinguish between the carefully placed bones of a male of rank, with his burial offerings, including the moa egg water-bottle, and the trussed bones of a woman or a young person of no particular rank, bundled without ceremony into the smallest possible grave"
>
> (Duff, 1956:58)

A comparison of Houghton's recent detailed analysis of the Wairau skeletal remains (Houghton, n.d.) and Duff's observations (op.cit.) reveals a number of areas of disagreement. Houghton's methods of sexing were rigorous and his results unquestionably more reliable, indicating important errors in Duff's records, which call into question that males were exclusively associated with certain grave goods. Houghton's study indicates that there are at least 10 females buried with grave goods at Wairau Bar. Duff identified 7 of these as male, and did not comment on the sex of the other 3 (see Appendix 13). Again, contrary to Duff's comments that moa egg water-bottles were found only with males (1956:34), they were present with 3 females (viz Burial 1 qv. Duff, 1942; 1956:32, Burial 30 op.cit.:64, and Burial 31 op.cit.:66). The comment that moa eggs occurred only with adults (op.cit.: 34) is challenged by Duff's own records (op.cit.:33) for Burial 32 which was a child (op.cit.:66). Other offerings found in female graves included a necklace made from moa bone and another made from human bone, a whale tooth pendant necklace with ivory reels (Anderson, 1940), argillite adzes of Duff Types 1A and 2A, and a nephrite 2A adze. Clearly the re-evaluation of sex and presence or absence of grave goods at Wairau Bar is necessary before they are employed for comparative purposes. Some details on this subject are set out in Appendix 13. At present the fact that the female in Burial A at the Washpool had a grave offering is not seen as unusual.

Two other details about Burial A deserve some mention. Firstly, this woman showed evidence of violent death. The pelvis had several wounds evident, consistent with perforation by a long sharp object such as a spear (see Sutton, 1974:152 & Appendix 10). One of these was especially severe and had passed right through the body of the ischium from the posterior surface. The angle of penetration and tunneling of the lamellar bone leaves little doubt that the weapon had been thrust with great force into the genital area. No parallel for this can be found in Maori ethnography (c.f. Smith, 1974:13). Secondly, the mandible, while still in articulation, had been forced open to an unnatural angle. Just how or why this was done is not known; however, the act of forcing the mouth open in this manner was obviously of some importance to the people living at the site because the same feature was present in both Burials C and F. It is also noteworthy that Duff (1956:46) illustrates a burial with mandible in a similar position at Wairau Bar. Whether in this case the position of the jaw is the result of slumping is not made clear. Such an explanation is not applicable at the Washpool site; in the case of Burial F, the act of forcing the mouth open resulted in considerable damage to the palatine and maxillary area. This fact might suggest that the operation took place during the period of rigor mortis when considerable force would be required. Rigor mortis is normally present between about 6 and 36 hours after death (Houghton, 1975:pers.comm.).

Certain ideological concepts recorded in New Zealand during the nineteenth century may be relevant to this discussion. When a person was close to death, he often ate a special article of food as a figurative provision for the 'long journey after death'. In some parts of Polynesia food was placed with the corpse for a similar purpose (qv. Buck, 1962: 415). Best records that earthworms were an esteemed choice for this 'food for the death journey' (Best, 1905:162). It might be suggested then that the mouth had been forced open shortly after death in order to place food in it. Another possibility relates to the concept of the spirit or soul of a person passing out of his mouth after death. There are records of unusual ceremonies being performed to try to encourage the spirit to leave the body (Best, 1905:165); perhaps the mouth was forced open to facilitate the spirit's departure. Lastly, Richard Taylor recorded a ceremony where teeth of a corpse were extracted only after a month of burial, for use in a ceremonial feast (qv. Taylor, 1870:217ff; Oppenheim, 1973:68). Such removal of teeth could well damage the maxillary area or account for a displaced mandible. Unfortunately the evidence is ambiguous for tooth loss around the period of death for these individuals (Sutton, 1974:339ff).

Prior to these events this woman had apparently led a fairly healthy and active life. The skeleton shows relatively strong muscle markings and X-ray examination showed no clear evidence of childhood illness. She gave birth to at least 2 but not more than 4 children, the last of whom was born several years before her death. The dental evidence suggests a coarse diet inducing tooth wear, misalignment, and eventual loss, as well as periodontal infection and subsequent mandibular resorption. At the time of death most teeth had been lost, but there is clear evidence of 'fern root planes' on the mandibular 3rd molar. The right maxillary 3rd molar has congenital peg form.

Burial B (see Sutton, 1974:101ff)

This was of an adult male about 40 years old and 169.6cm tall, buried extended in the prone position with the head on the right side and the palms of the hand uppermost (see Figure 35). Again there is little evidence of an actual grave. In this case a fierce fire had burnt over the top of the burial, and this caused problems in interpretation. For example, the remains of some wooden planking, almost completely decomposed, were found associated with the burial. In view of the close proximity of the later fire, it was impossible to determine precisely what this wooden item was, but it may have encased the body, since remnants were found on top and to the sides of the burial. In addition, there was a clear outline of a wooden artefact of some kind beside the body from at least the left ankle to the armpit. This may have been a paddle or a short wooden weapon comparable to a taiaha. The encasing structure might be interpreted as a coffin. Once again there is an obvious parallel with the Wairau Bar site, where Burial 6 was found with the badly decomposed remains of planking; Duff (1956:44) supposes it may have been a canoe burial. In the Chatham Islands it is recorded that small, specially-made canoes were used as coffins by the Moriori (Mair, 1870:312; Travers, 1876:24; Tregear, 1889: 75), and recently the remains of several small canoes with burials were

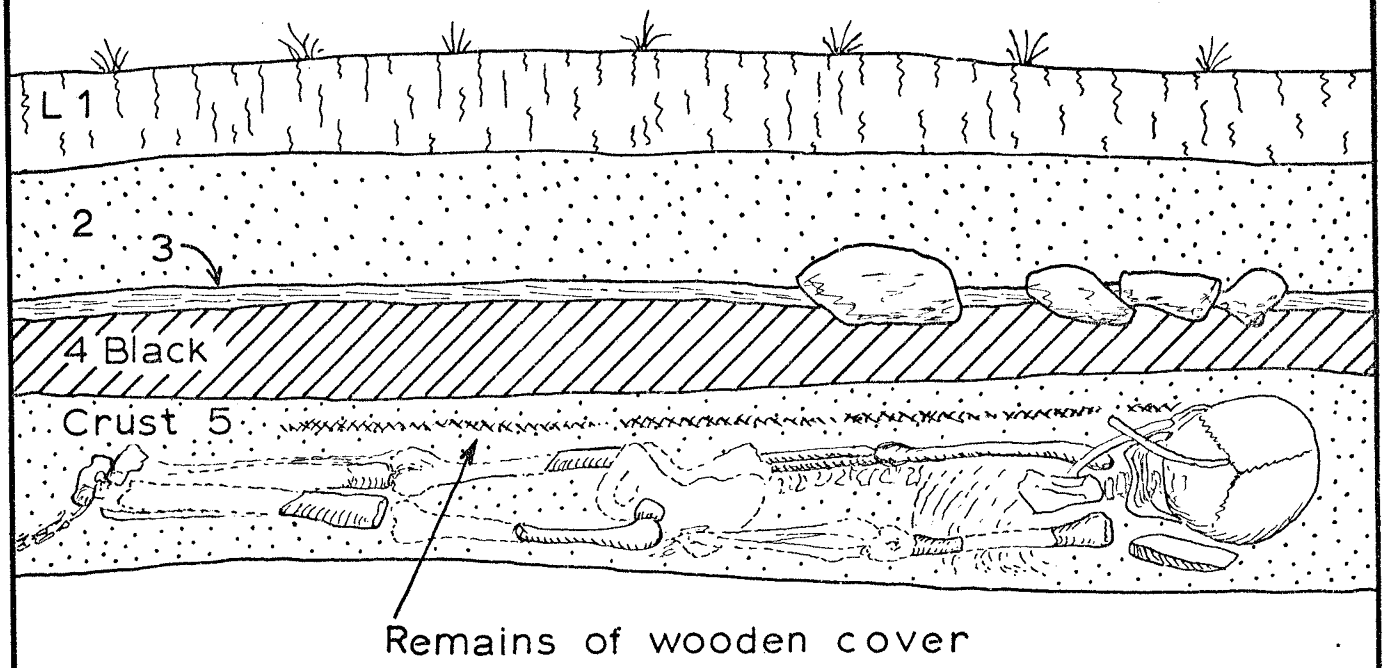
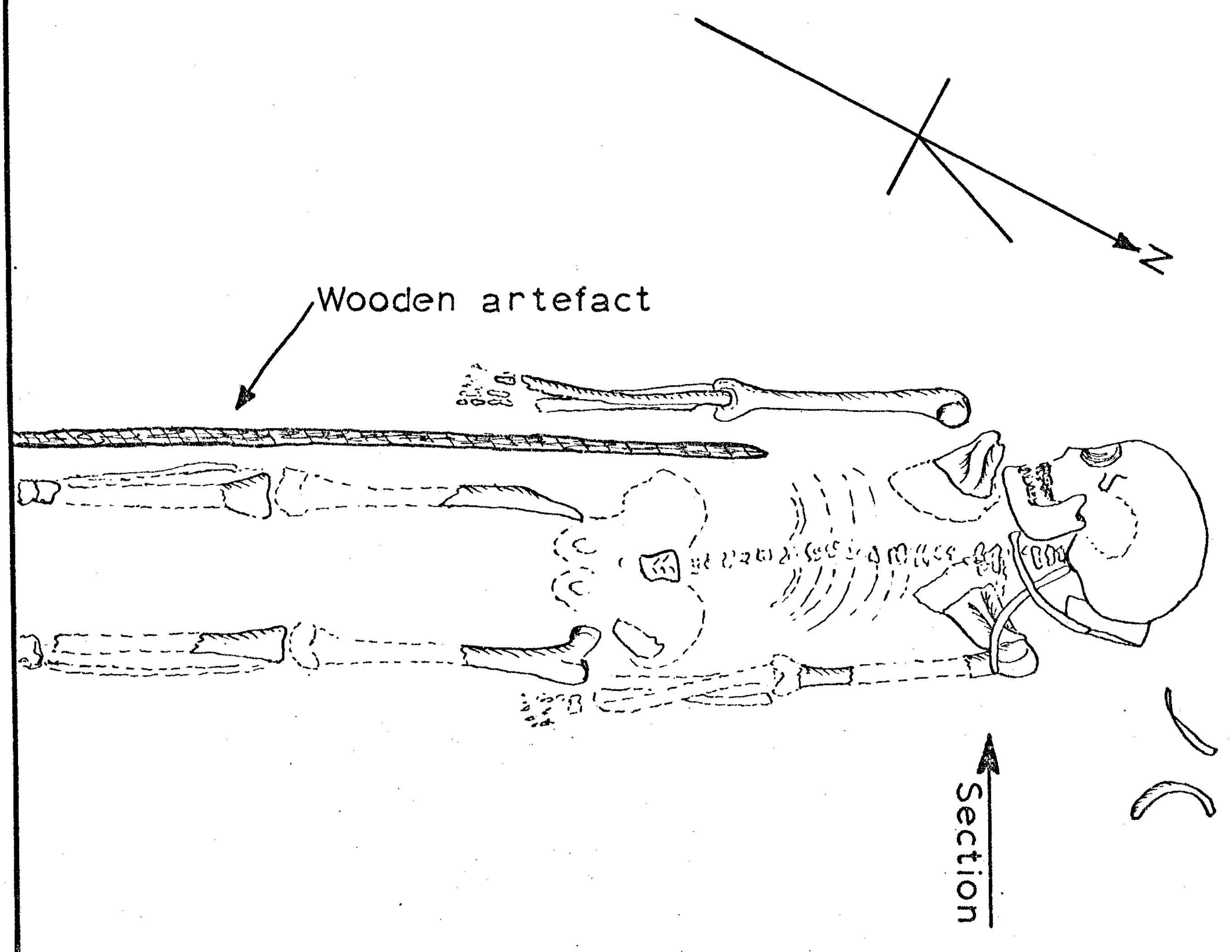


FIGURE 35 WASHPOOL BURIAL B



found there. Other wooden containers or coffins are recorded as having been used for high ranking Moriori (Shand, 1897:162) and this decomposed wooden structure associated with Burial B may likewise have been something other than a funereal canoe. Canoe burials are also known from Mo'orea (Green, 1967:200), and the Cook Islands. Because the lower half of the body was so damaged by the subsequent fire, the burial could not be completely excavated. A small D'Urville Island black argillite adze was found under the head (see Figure 34b). This was of Skinner Type 2B (Skinner, 1974a:107).

The axis and atlas in this burial were found in an unusual position of articulation and Sutton (1974:102) believes that the individual may have died of a ruptured spinal cord. As with Burial A, this individual showed few signs of childhood illness in the form of Harris lines, and the strong muscle markings attest a healthy active life. A certain amount of arthritic degenerative change has affected the cervical vertebrae, but this may not have been as severe as in other individuals from the Palliser collection especially Burial M3(1) from the Cleft Burial in the Makotukutuku Valley. Again, the evidence favours a largely non-functional dentition by the age of 40 years. There is tooth loss, over-eruption of non-opposed teeth, mandibular resorption, and generally severe dental attrition.

<u>Burial C</u> (see Sutton, 1974:105ff)

This was the skeleton of a 4 year old child about 105cm tall buried in a very shallow scoop between waterworn boulders and covered with the Crust of Layer 5 and Lens B. Boulders appear to have been placed over the skull. The bones of the left forearm were missing from the burial (Sutton, 1974:248). The body was in a crouched position on

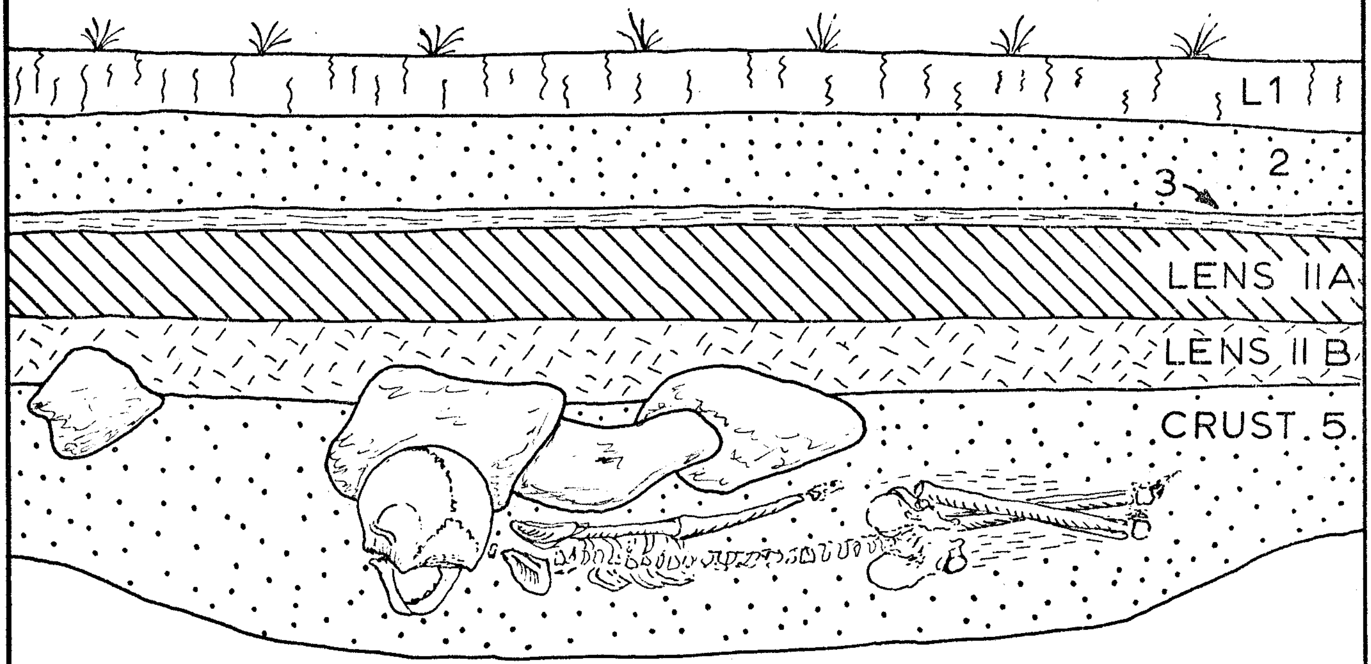
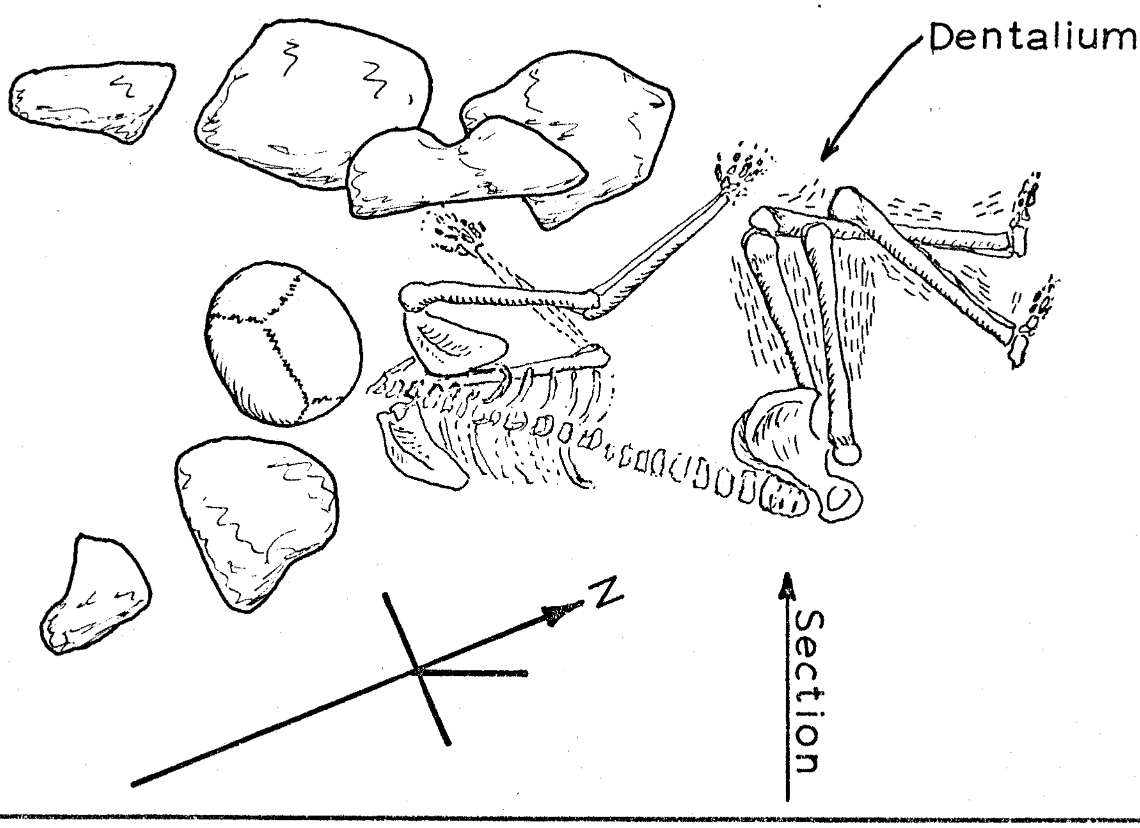


FIGURE 36 WASHPOOL BURIAL C



the left side (see Figure 36), and about 1400 specimens of Dentalium nanum were found covering the lower limbs. It is argued in Appendix 14 that the shells in this instance decorated some form of garment, an apron perhaps, and that they had been obtained by trade from some other area of New Zealand, possibly the Manukau Harbour. The centre piece drilled from a moa bone fish-hook during manufacture was also found associated with the Dentalium (see Figure 59t), and may have functioned as a toggle for the garment. The mandible of the child had been forced open to an unnatural angle in a similar way to Burial A.

X-rays of the skeleton showed no Harris lines indicating that the child had led a fairly healthy life, consistent with the dental evidence. Still, there was considerable attrition for someone only 4 years of age. This probably suggests early weaning and reliance on an abrasive diet at an early age. The cause of death could not be determined.

Burial D

This was a dog burial some distance from the main cluster of human burials and close to a stone slab hearth (see Figure 29). The remains definitely indicate primary burial followed by later disturbance when much of the skeleton was removed. The burial was in a circular scoop about 35cm in diameter and 22cm deep. Since the epiphysis of the iliac crest is nearly completely fused, and the ischial crest fully so, the dog must have been about 24 months old (Sisson and Grossman, 1953).

The metapodials, the vertebral column and ribs were still in articulation when the burial was excavated, but the rest of the skeleton had been disturbed and many of the bones removed. It is notable that the main limb bones and both mandibles had been removed - precisely those most useful for making artefacts. Presumably this was why the grave had been disturbed, probably some months after burial to allow decomposition. It indicates that the people responsible knew the location of the burial which in turn suggests something more than seasonal occupation of this site.

Another interesting feature of the burial is that the cranium is complete. All other dog crania found on the site are very fragmentary, probably broken for removal of the brain for food. The fact that this one was complete, and also that the animal had initially been so carefully buried probably argues that this dog was a 'pet'. The fact that certain of its bones were later excavated possibly to make bird spears does not discount this, for the use of the bones of a favourite birding dog would have been quite in keeping with Polynesian practices relating to the economic use of the bones of relatives. Dog burials are not unknown in other Polynesian archaeological sites: two were recovered in the Hane excavations in the Marquesas (Sinoto, 1966:293; Sinoto and Kellum, 1965:29). No os penis was found in the grave and it may therefore have been a bitch. In view of the removal of bones, however, this absence could also be fortuitous. The very rounded and gracile appearance of the cranium is rather better evidence for female sex. The 1st lumbar vertebra has an outgrowth of bone on the right side which is a supernumerary rib. This condition is certainly congenital (Houghton, 1975: pers.comm.), and therefore a potentially useful genetic marker.

<u>Burial E</u> (see Sutton, 1974:107ff)

This was the complete skeleton of a 35 year old female, 166.2cm tall. Again she was buried in a shallow scoop rather than a deep grave. A bone lure (Figure 57c) was found with the burial. The body was on the left side, the legs crossed, and the feet drawn up to the buttocks.

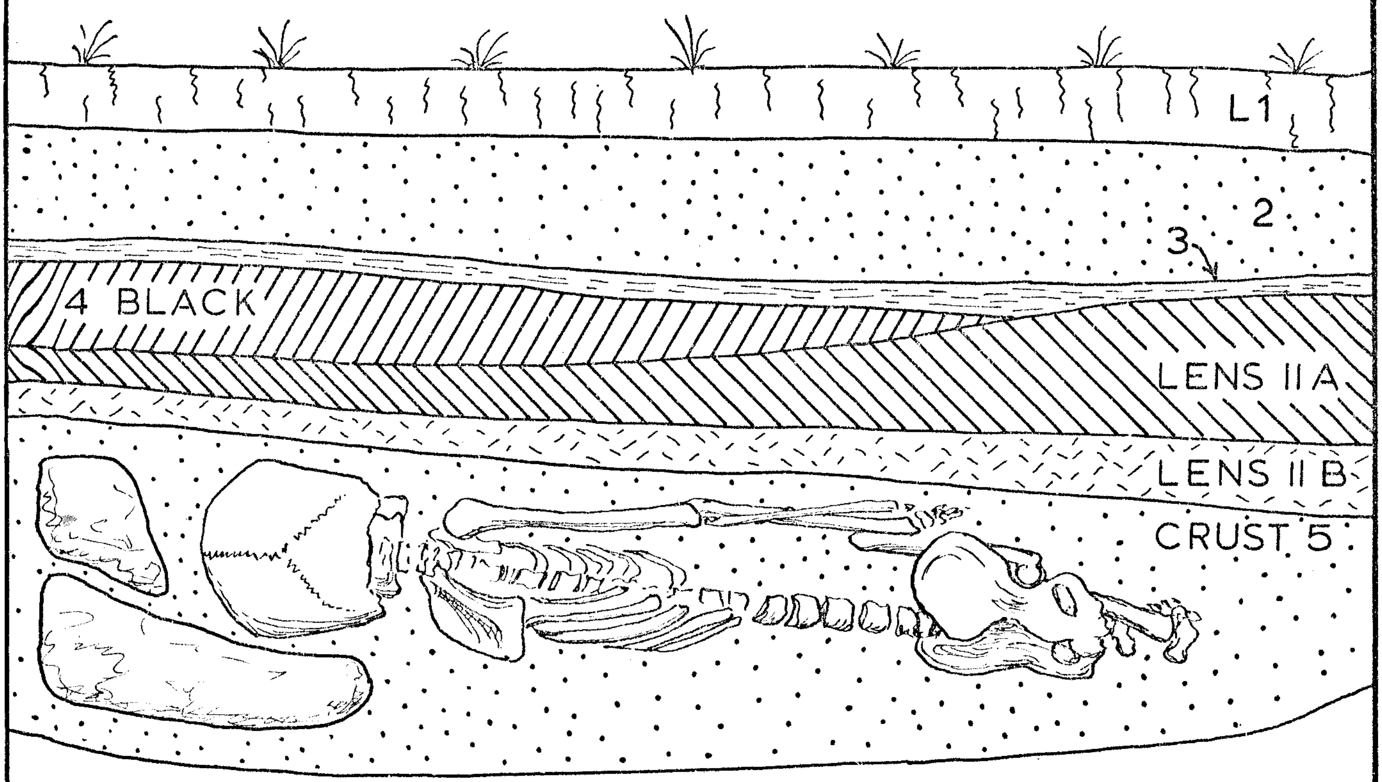
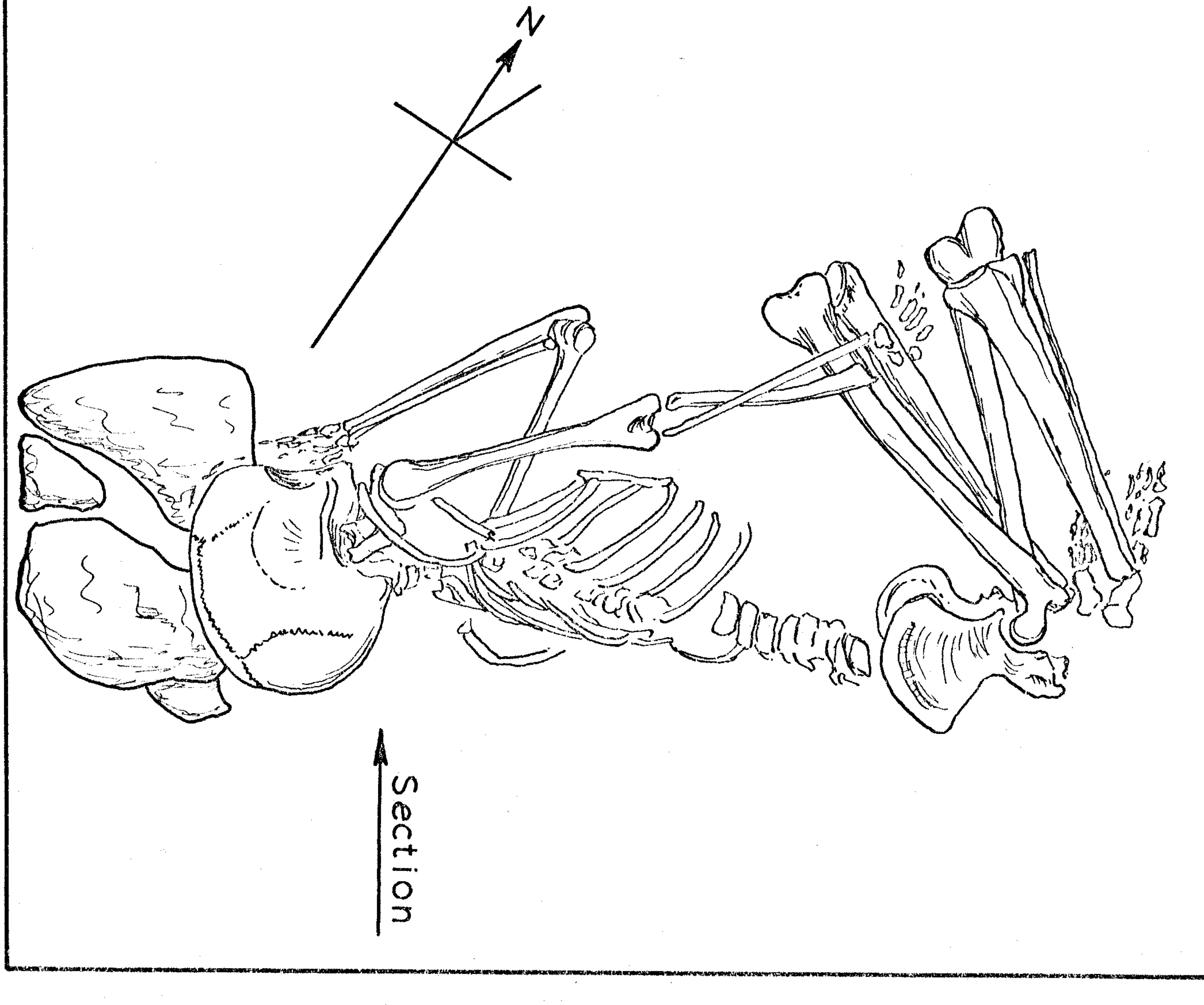


FIGURE 37 WASHPOOL BURIAL E



The right hand was on the left knee, and the left hand was next to the head. The body did not give the appearance of having been tightly trussed, but some tying may have been necessary to keep the legs and feet in position (see Figure 37). On the whole the burial position is strikingly similar to that of the child Burial C, and again several large boulders were placed over the head. Visual and radiographic examination of this individual showed no signs of significant ill-health or trauma. Her skeletal frame was fairly robust by comparison with other females from Palliser Bay, with strongly marked muscle ridges. She had given birth to at least 2 and not more than 4 children. Arthritic degenerative change was present in the vertebral column but was much less severe than in the males. Tooth attrition, though marked by modern standards, was the least dramatic of the Palliser remains for persons of this age. No evidence of periodontal disease or excessive mal-occlusion is evident. 'Fern root planes' did not occur. There is congenital absence of both the 3rd mandibular molars, and two peg 3rd molars occur in the maxilla. The atlas was broken on recovery and was rotated to an unnatural angle to the axis. It is suggested by Sutton (1974:107, 322) that death was caused by a broken neck in similar fashion to Burial B.

<u>Burial F</u> (see Sutton, 1974:109ff)

This consists of the much decomposed remains of a male of about 40 years who was 177.9cm tall. The excavation of the burial took place in wet weather and the very friable bones became so soft that normal excavation was impossible. Even a fine brush was sufficient to break down the bone to a sodden paste. The burial was in an upright sitting position and as much of the skeleton as possible was exposed in an advance-face method to gain a more precise idea of burial position. The technique proved only partly successful, and large blocks of sand with bones intact were removed to the laboratory, where they were slowly dried out over a period of a month or more before being excavated with a jet of compressed air. This proved an ideal method of removing the matrix and 5% PVA in acetone was brushed into the friable bone as it became exposed to add strength. By this laborious method much of the bone was extracted intact.

The body had been placed in a shallow pit in an upright sitting posture with the limbs tightly flexed. The body and head were facing north (see Figure 38) and the arms were bent with palms on the knees. The mandible had been forced open some time prior to burial with considerable damage to the palatine and maxillary areas. Several large boulders were placed over the head, and one of these had been thrust in with such force that the top of the cranium had imploded. The facial skeleton had also been crushed, and one of the molars had penetrated up into the orbit; whether this occurred during the fact of forcing the mouth open prior to burial, or with the act of crushing the cranium during burial cannot be established with certainty, although the former may be more likely. Two adzes were found as grave goods, both made from grey-veined D'Urville Island argillite. One of these (Figure 34c), a Skinner Type 2A (1974a:106) was placed between the body and the mid-left thigh with bevel away from the leg and poll facing down. In this position it could not have been hafted. The 2nd adze, which had an oval cross section similar to Skinner Type 8 (1974a:112), is shown in Figure 34d and was found in the upper part of the burial fill. Apparently during the burial ritual this adze had been broken down by flaking over the body while the grave was being filled in, and thus the pieces were incorporated in the burial.

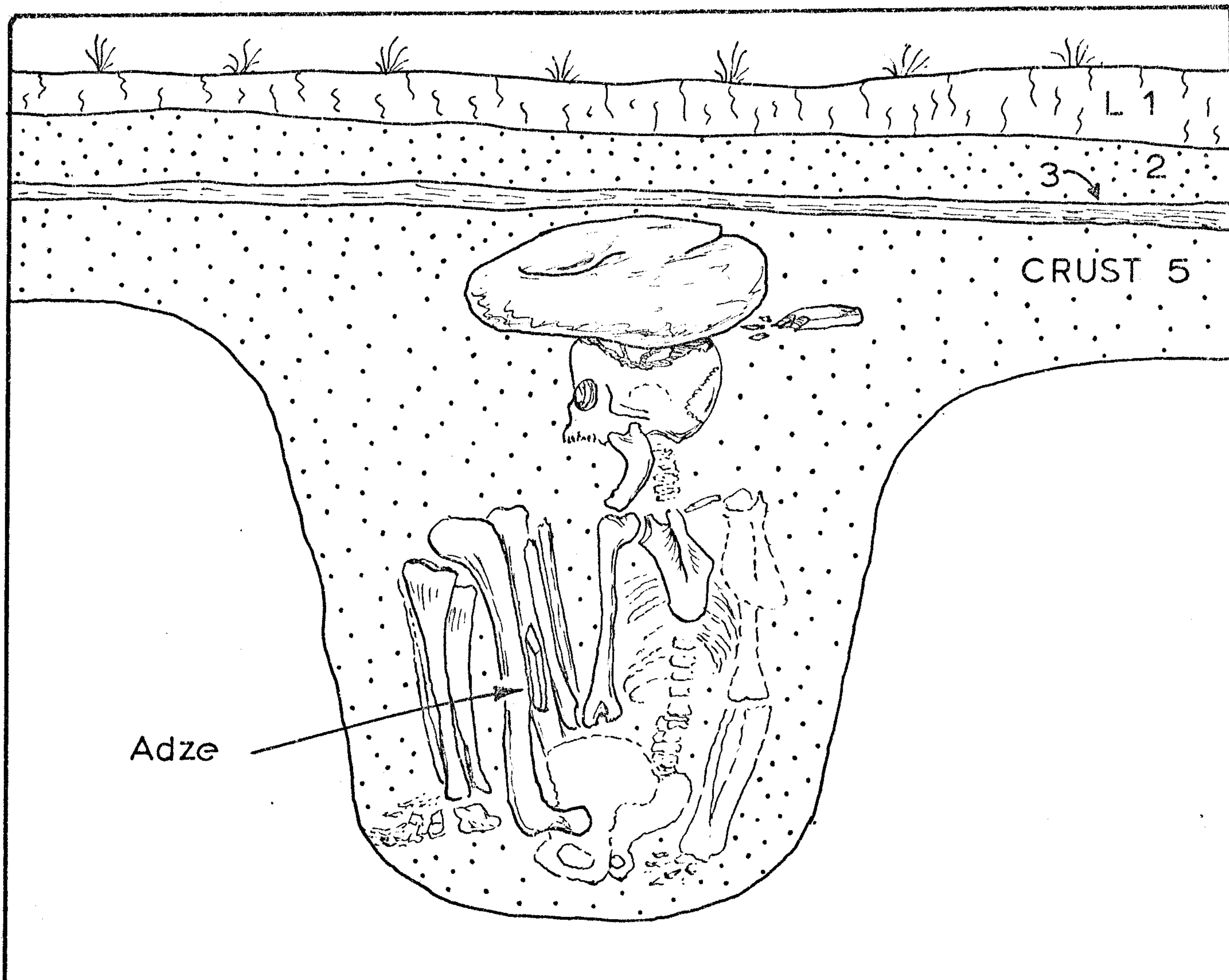
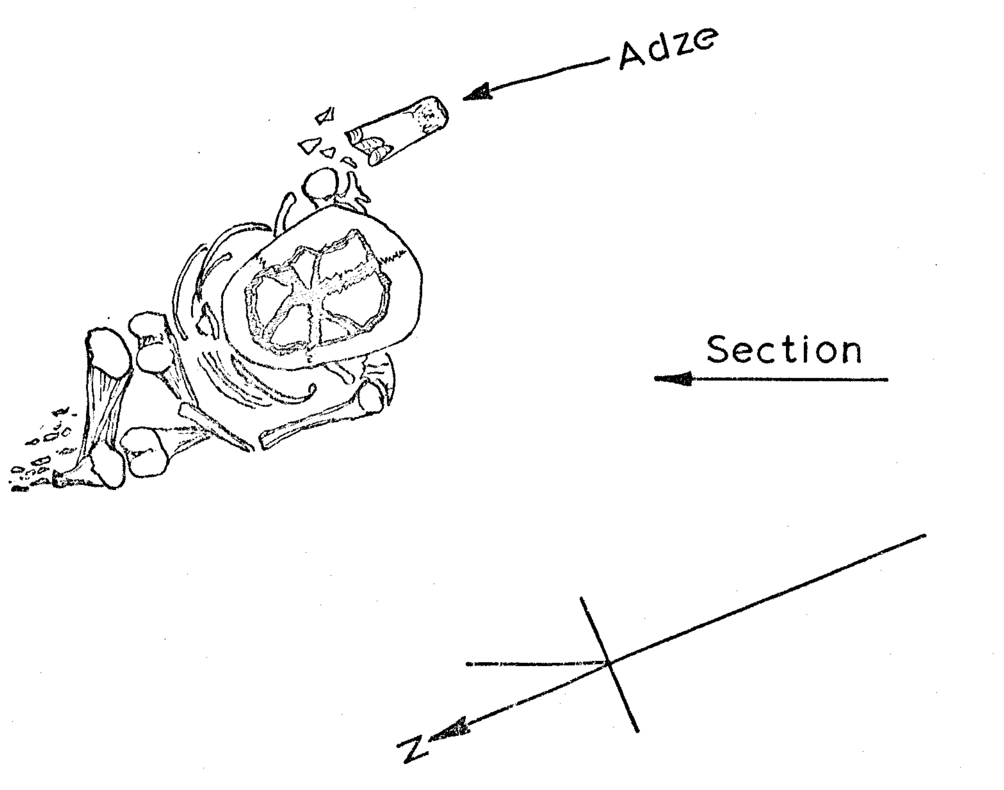


FIGURE 38 WASHPOOL BURIAL F



The long bones of this individual are very light in weight and rather smooth and rounded with only light muscle markings. Despite this they are massive for their length. Although the radiographs showed no Harris lines, the cortical bone is very thin and the cancellous bone strongly trabeculated. Sutton argues (1974:111) that their condition is a sign of osteoporosis, but that this condition is probably age-related rather than pathological. However, it seems rather advanced for an age of 40 years. The skeleton shows a high degree of spinal degenerative change involving vertebral fusion, osteoporosis, irregular exostosis and pitting. The dentition shows disease and early tooth loss. There is excessive wear from an abrasive diet, and 'fern root planes' were present on the left maxillary molars. It is difficult to be certain, but both upper and lower 3rd molars may have been congenitally absent (see Sutton, 1974:112, 220).

Sutton has suggested that this male would have been practically an invalid at this age, although a strong and active man in his youth. His immediate cause of death is not known.

Individual G (see Sutton, 1974:113ff, 174)

This consisted of about 20 cranial fragments and a few teeth scattered through the site which are believed to belong to one individual. Sutton argues that it was a female of about 25 to 35 years of age. The maxilla shows evidence of periodontal disease and also indicates that tooth wear had shifted from the now afunctional molars to the frontal teeth. In general the cranium and dentition was probably most similar to that of Burial E.

Individual H (see Sutton, 1974:115, 174)

This was represented by only the right femur of a child of about 3½ years and height about 100cm. Radiographic examination revealed no Harris lines.

Individual I (see Sutton, 1974:115ff, 175)

This was represented by only a few hand bones, but Sutton estimates that they are from a child aged 1 to 1½ years and height about 75 to 85cm.

Individual J (see Sutton, 1974:116, 175)

This was represented by a few hand and foot bones from another juvenile. Sutton estimates an age of about 2 years and height about 90cm.

Genetic Relationships between the Individuals

The possible genetic links between different people from the various sites in Palliser Bay have also been explored by Sutton (1974:141, 217-220). They include a number of interesting and specific conclusions. For example, congenital tooth loss, peg molars and a number of other cranial traits consistently occur in the remains from the Kawakawa, the Cleft Burial at M3, and at the Washpool Midden Site. From this Sutton concludes:

> "the overall impression gained from this pilot study is that the Washpool sample was composed of genetically, as well as socially related adults and that three of these individuals shared a high proportion of the observed traits. The other adult observed, Individual A, is less intimately related but she too shares a number of inherited traits with her companions. Our methods do not allow a very detailed

assessment of the distance between the Washpool sample and others that make up the Wairarapa collection. Evidence does exist however, which indicates that there is a considerable element of genetic continuity throughout the collection"

(Sutton, 1974:142)

The Exploitation of Lithic Materials

General Comments and Note on the Use of Percentages

The Washpool Midden Site produced approximately 11,000 worked stone artefacts. Their sourcing was the subject of intensive research by K.Prickett (1975), and her findings are used extensively here. The numerical counts used below are extracted from her tables (K.Prickett, n.d.). All figures, including percentages relate to numbers of individual pieces rather than weights. The technology of these artefacts, and the significance of their distribution in the site remains largely unstudied as this was regarded as a large and separate project demanding the full attention of another researcher. At this stage, therefore, only general observations can be made on the subject.

Among some 11,000 pieces from the site are adzes, grinders, files, abraders, drills, sinkers, minnow lures, flake tools, and general industrial refuse. More than 80% of the items were made of imported stone.

Apart from stone adzes, some of which were related to burials, the distribution of the stone tools in different parts of the site follows no obvious pattern. However, various pockets of stone tools were found, especially of obsidian, and this suggests that a closer study of distribution may prove useful. The significance of such a study has already been established for other New Zealand sites such as Tairua (qv.Jones, 1973:74ff). It is also noteworthy that clusters of obsidian were found close to the walls of the house excavated in the Moikau Valley (N.Prickett, 1974), and this, together with the similar isolated pockets in the Washpool Midden site, suggests that obsidian at least was kept in small bags of some kind.

In what follows, changing frequencies of stone types are for the most part discussed in terms of proportions (percentages), a practice which has its pitfalls. The 'percentage', as Kerrich and Clarke (1967) have pointed out, is a most dangerous statistic, for while it is generally used for outward comparisons it is essentially an inward-looking statistic. This problem is well realised by the author, nevertheless it is a valuable vehicle for comparisons and its use is unlikely to be curtailed. What is important is that conclusions drawn from comparisons of percentages should be accompanied by a suitable significance test. In this study, Rosenbaum's nomographic chart was extensively used for this purpose (1959), although exact probabilities were sometimes calculated when a more powerful test was required (see Appendix 35). Occasionally, two distributions below are compared using a Chi-square test for independent samples (Reyment, 1971:53).

Geological Sources

Of the 23 different types of rock used by the occupants of this site, 10 were imported, accounting for 80.7% of the total number of pieces; the remaining 13 rock types were classed as local, and account for the remaining 19.3% of the stone items (see Appendix 16). Obviously then, the importation of stone was a very significant factor in the economy of these people. The actual sourcing of the different rock types was undertaken by K.Prickett (see Appendix 18).

The imported stone came from as far north as Huruiki and as far south as Central Otago (about 600km in each direction from the Washpool).

The most numerous rock type in the site was obsidian, closely followed by chert. A comparable numerical relationship was encountered in most other sites in Palliser Bay. The obsidian and chert were used for a fairly similar range of small flake scrapers and knives. These do not fit easily into any formal shape categories (Shawcross, 1964b) with the exception of the fairly common chert drill points. From trace element analysis (see Appendix 5) the obsidian was found to be derived from 7 different North Island sources. Three of these are in the Bay of Plenty - Coromandel area (Mayor Island, Cooks Bay, and Purangi), three are in the central North Island area (Rotorua, Taupo and Ongaroto), and one in the Northland area (Huruiki). The chert on the other hand is probably all from one district in the south-east coastal Wairarapa near Te Oroi. A pilot study of the trace elements characterising these cherts and others from the South Island showed significant differences between sources (K.Walls, 1971); however, this work has not been followed up, and the sourcing of cherts here is based on hand examination. It is possible that other sources are involved apart from Te Oroi, such as those at Pahao for example (Sutherland, 1947; Keyes, 1970, 1972), or near the Ure River (Waima River) in Marlborough (K.Walls, 1971).

Metasomatised argillite occurs in the assemblages about half as frequently as obsidian or chert. This is believed to be of D'Urville

Island origin, most of it being the fairly characteristic unveined dark and medium grey material from Mt Ears, and veined light grey more certainly from Ohana. Again, sourcing relies on hand identifications by K.Prickett (1975: pers.comm.). The principal artefact made from argillite is the stone adze, although a few drill points were also found made from broken down argillite adzes. What is more interesting is that of the 1446 argillite flakes found on the site, 546 or 38% showed signs of polished planes and/or hammer dressing, indicating their removal from finished or partly finished adzes. The additional flakes cannot be proven to have come from adzes, but this is strongly suspected, particularly as only one argillite core was found. In short, while a great deal of industrial activity went on at this site, adze-making utilising high quality D'Urville Island argillite was not apparently part of this industry.

The next most numerous category of imported stone is a type of indurated limestone. There are a few drill points, polished flakes, and adzes of this material, and they may not all derive from the same source. Siliceous limestone occurs fairly widely about Cook Strait, especially the Amuri formation which outcrops from just south of Kaikoura to Cape Campbell, and the Manurewa formation and Kaiwhata and Mungaroa limestones which outcrop from north of Cape Palliser to just north of Flat Point. This material is washed up on Cook Strait beaches (Keyes, 1969), and some of it is quite suitable for adze making. Most pieces, however, are fraught with shearing lines which rule out conchoidal fracture and limit its value. In addition, known quarries of the good quality limestone where adzes were being manufactured do not occur on this coast, although working floors are plentiful where flake tools were being made. On the other hand, an adze industry, based on limestone, is known elsewhere in

New Zealand, and the Napier Museum has many examples of Type 1A and 4A adzes made from such material. Many are part of the large, well-known Simcox collection made from an indurated limestone which occurs just south of Cape Turnagain in the vicinity of the Akitio and Aohanga Rivers. In hand specimen the material is very similar to the limestone used for adzes at the Washpool, particularly in terms of patination. This opinion, however, has not yet been verified, and in the meantime, limestone from the Palliser sites is regarded as deriving from the closer source near White Rock.

About equal quantities of schist and a variety of schistose greywacke were found at the Washpool Midden site. The latter was being used for stone minnow lure shanks but the principal use of both materials was for making small abrasive files. The schist is believed to derive from the Nelson district, and the schistose-greywacke from the Kaimanawa ranges south of Taupo.

A few pieces of nephrite were found in the site, and these are thought to have been obtained from the large Arahura River source although there is a closer nephrite source near Nelson and another one on D'Urville Island. A study of nephrite densities (Ritchie, n.d.) suggests the Arahura source for the Wairarapa material. The few pieces of serpentine and talc in the Washpool site are judged to be from the Nelson area.

The last imported stone material was silcrete (orthoquartzite) of which only 5 pieces were found. In hand specimen the pieces are very similar to the source at Oturehua in Central Otago. In view of the distance involved, this was an unexpected occurrence.

The principal local stone was greywacke which is the main rock type found in the southern Wairarapa geological landscape. Greywacke is 12 times as numerous as any other local stone. Even so, it is only half as common as either obsidian or chert. A specially shaped tool with use marks consistent with sawing was commonly found in Palliser sites and this was invariably made from a spall of greywacke. In addition to these 'cutters', greywacke was found in the site as hammerstones and polished adze chips.

Pumice is also another 'local' material that was utilised. Though of sea borne origin it occurs on beach ridges in quite large pieces, and was apparently used for its abrasive properties. Most of the pieces found featured smooth hollows where an area had been used for grinding. Pumice was also used for net floats as is evidenced by finds at the Pararaki River mouth (Prickett et.al.: n.d.). Next in importance to pumice are various local argillites. These include unbaked argillite used for files and minnow lures, and both a volcanic argillite and a shale-like or slaty argillite used in a similar fashion to the greywacke cutters.

Other local rocks collected and used by the occupants of the site were spillitic lava, calcite, kokowai, various concretions, coral, quartz crystal, and fossil bivalves. Most of these were merely small pieces or flakes and were not used for any particular purpose. One or two rounded pebbles were found with kokowai stains indicative of the manufacture of red pigment. The fossil bivalves were Cucullaea (Latriarca) hamptoni, Glycymeris (Manaia) hurupiensis, and Dosinia (Kareia) cf greyi; it is very likely that these derive from the Hurupi formation, an Upper Miocene fossilferous blue mudstone which occurs in a small isolated outcrop 1300 metres north of the Washpool.

Changing Patterns of Utilisation

With such a large assemblage of stone material, and so many imported rocks it is to be expected that any changes in the pattern of communication of these people with communities outside Palliser Bay would be reflected in some numerical way in the stone material. The assemblage has been split into only 3 temporal units (Levels I, II and III) and there are a number of significant trends which stand out. First is the overall change in the proportions of imported to local stone between the three levels (see Figure 39). At about 1180AD just over 77% was imported and 23% local. By c.1345AD the imported stone had risen to 83%, and by Level III (c.1538AD) was 95%. In addition, the Pararaki Midden site, investigated by H.Leach (1976: Chapter 3), is dated to c.1249AD and has a correspondingly low figure of 63.13% for imported stone (discounting the large quantities of naturally occurring pumice on the beach ridge); this again fits reasonably well with the trend shown in Figure 39. The significance of this trend was assessed using Rosenbaum's nomographic chart (1959:47). The proportion of local stone falls significantly with time (p less than 0.01 comparing the figures of Level I with Level II, and Level II with Level III). Only 3 other assemblages from Palliser Bay are large enough to warrant comparison with these figures. These are unfortunately all from specialised house sites, and the figures uniformly show a much higher proportion of imported stone. Two houses at the Pararaki, the object of a salvage excavation (Pricket <u>et.al.</u>: n.d.) had 91.8% imported stone; this site was not radiocarbon dated, but on artefactual grounds is believed to be part of a 12th century settlement. The Moikau house (N.Prickett, 1974) was dated to c.1180AD and has 94.2% imported stone. Lastly, the Washpool house site at M4 was dated to c.1539AD and had 95.5% imported stone. It

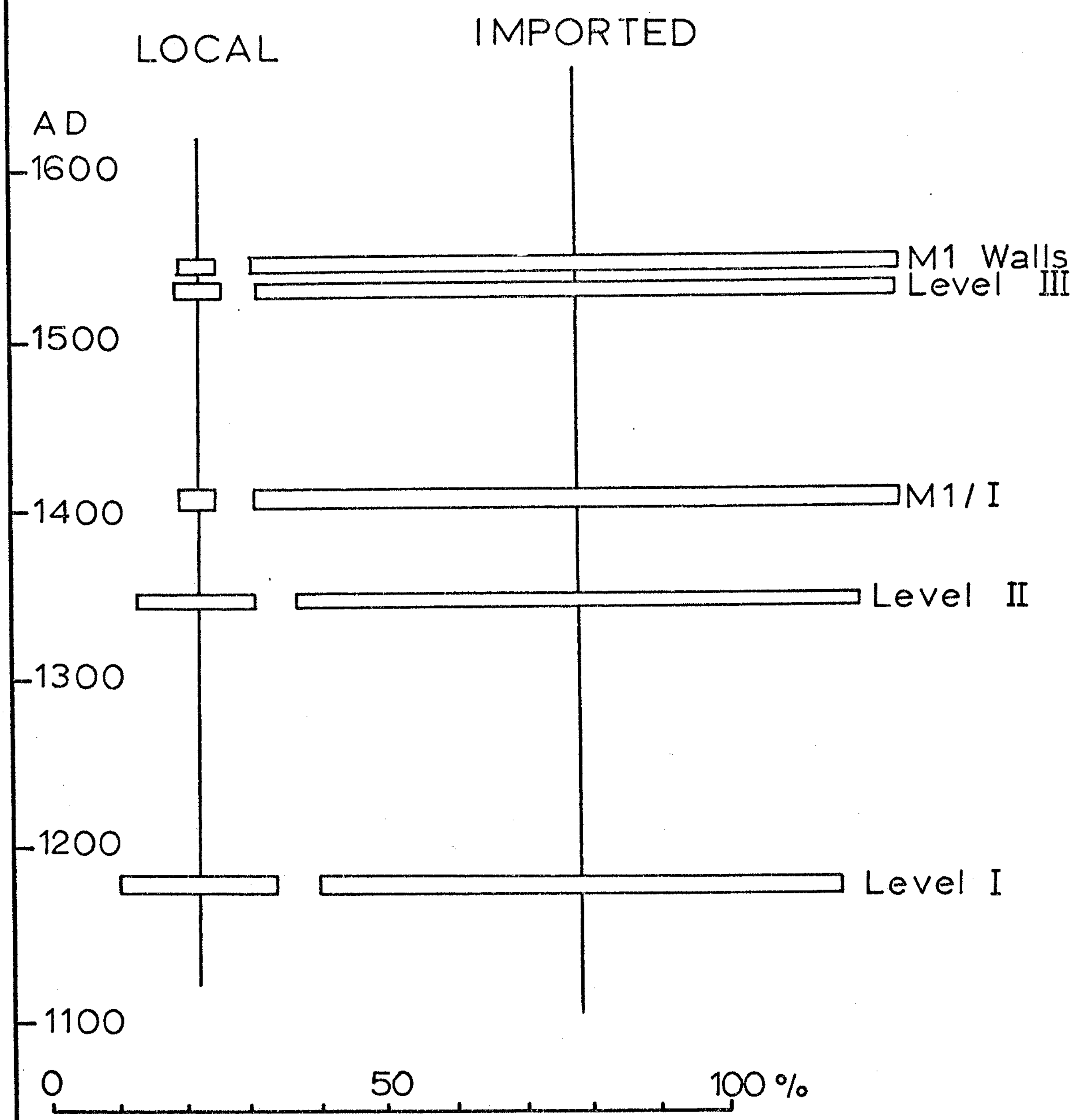


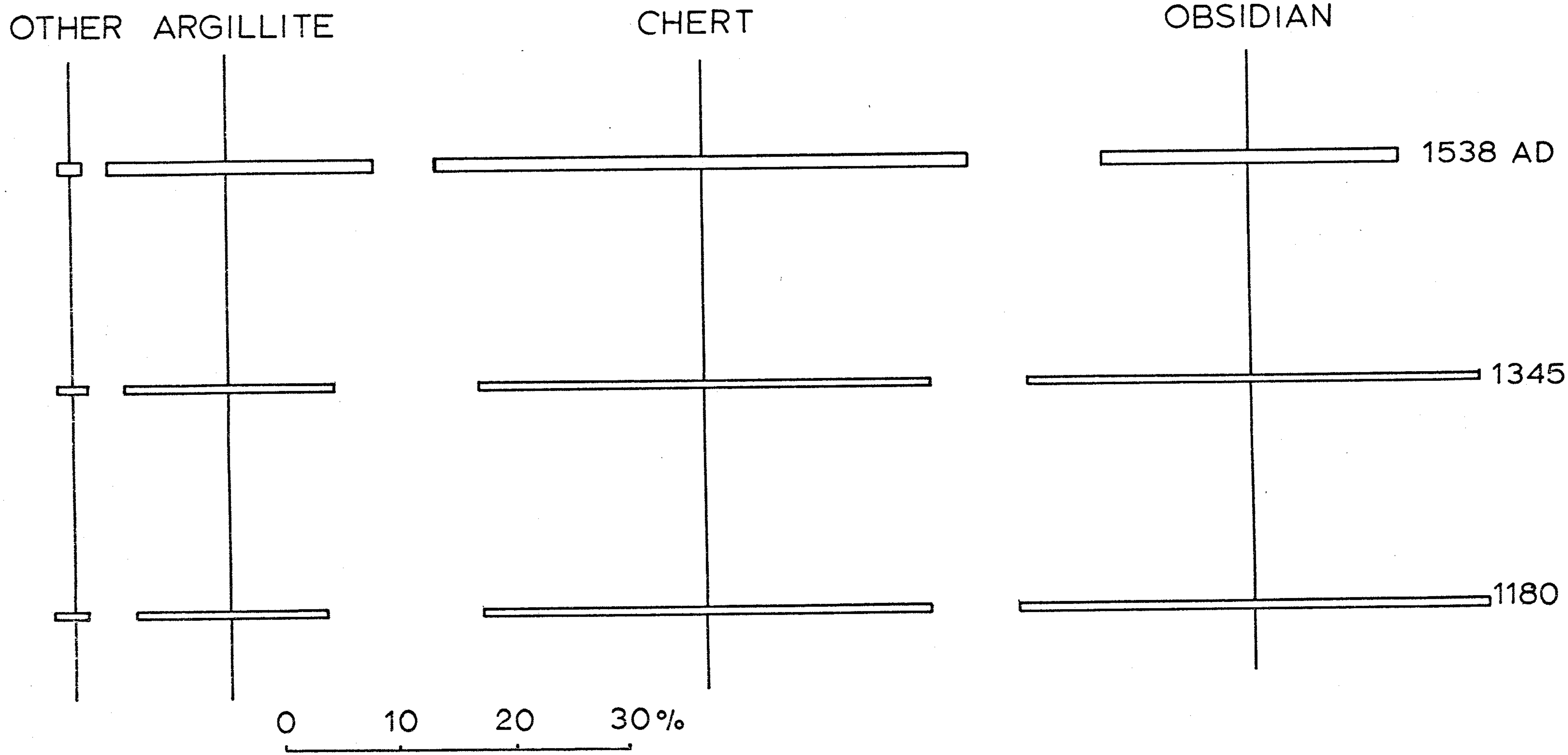
FIGURE 39 WASHPOOL IMPORTED & LOCAL STONE

would appear that house sites were not only the scene of specialised industrial activity, but were possibly used to store the more valuable imported materials. In contrast, the larger coastal middens contain evidence of a much broader range of technological activities, and the relative quantities of different resources on these sites are probably a closer reflection of the time and energy expended on each material by these communities. For this kind of site then, the proportion of imported stone appears to have some relevance for relative dating.

As Figure 39 shows, local rocks are never especially important, but were about 5 times as numerous in the early period as later. This may suggest that when the Palliser people first came to this area there was considerable experimentation with local materials. As time went by, however, exchange networks became stronger and more reliable, leading eventually to a situation of virtual dependence on imported rocks.

It should not be thought that the increasing reliance on external resources involved each rock type to the same extent. Of the 10 imported rocks, obsidian, chert, and meta-argillite account for more than 97% in each level at the Washpool. The different proportions of these through time are shown in Figure 40, and as is evident, there is a fall off through time in the quantity of obsidian, and a rise in both chert and meta-argillite. The amount of all other imported rocks remains fairly constant, and at a very low percentage. This shift away from the importation of obsidian is dramatic after c.1345AD. When the figures for Levels II and III are compared the trends are significant (p less than 0.01) for obsidian, chert, and meta-argillite. On the other hand, the slight shifts observed between Levels I and II, while in the same direction, are not significant (p greater than 0.05) for any of the

FIGURE 40 WASHPOOL IMPORTED ROCKS



3 main rock types.

Both the meta-argillite and the chert were obtained in the Cook Strait area, while the obsidian was obtained only in the northern half of the North Island. From these figures it could be argued that over a period of time, ties were strengthened in the Cook Strait area at the expense of communications further north. Conversely, they could be used to argue that in the earliest period, contact was stronger with the northern area. Whether this might imply that Palliser people originated further north will be discussed later. The main impact of this change apparently took place some time between about c.1345AD and c.1538AD.

At least seven different sources of obsidian were represented in the Washpool Midden site (Appendix 17), and all are represented in Level II. However, while they cannot be shown to have been used in the other two levels, the sample sizes are much smaller for these levels and the absence of some sources may be simply a product of sampling error. In all 137 pieces of obsidian from the site were analysed for trace elements, and while this information is very useful to determine the actual sources used, much larger samples than this need to be analysed to draw statistically significant conclusions about any trends in utilisation of minor sources. In the present instance it seemed wiser to group the obsidian into that from Mayor Island and that from 'other' sources, since this division has long been seen as an important one in other New Zealand archaeological sites. For instance Green (1964:139) argued strongly that Mayor Island obsidian was the dominant type in early North Island sites, and that later this obsidian declined in popularity among people some distance from the Mayor Island source. Some have thought that this conclusion holds throughout New Zealand but the figures from Palliser Bay do not support this notion, and a careful appraisal of the whole situation is clearly required. This was attempted using figures from 65 New Zealand sites, and the results are presented in Appendix 20. From this study it is evident that while a definite trend away from the utilisation of Mayor Island obsidian can be seen in New Zealand sites, there is wide variation around this trend during all periods of the prehistoric sequence. As a dating device, the proportion of Mayor Island obsidian would appear to have limited application at a very general level only. The predicted dates based on this regression analysis for the Washpool Midden site would be:

a) Based on the assumption that all green obsidian is from Mayor Island

Level III	1309AD
Level II	1340AD
Level I	1368AD

b) Based on the trace element analysis

Level III	1347AD
Level II	1395AD
Level I	1405AD

While these estimates are of the correct order of magnitude for the middle period of the Washpool sequence, they are nevertheless contrary to the established stratigraphic and radiocarbon chronology.

When the figures for the Washpool site are plotted (Figures 41 and 42) there is a clear trend towards greater use of Mayor Island obsidian through time. This trend is evident in figures based on both the trace element sourcing (Figure 42), and also on the assumption that green obsidian is from Mayor Island (Figure 41); however, the trend cannot be proven to be significant (p less than 0.05) in the case of Figure 42 because of the small samples involved. For the values in

FIGURE 41 WASHPOOL OBSIDIAN

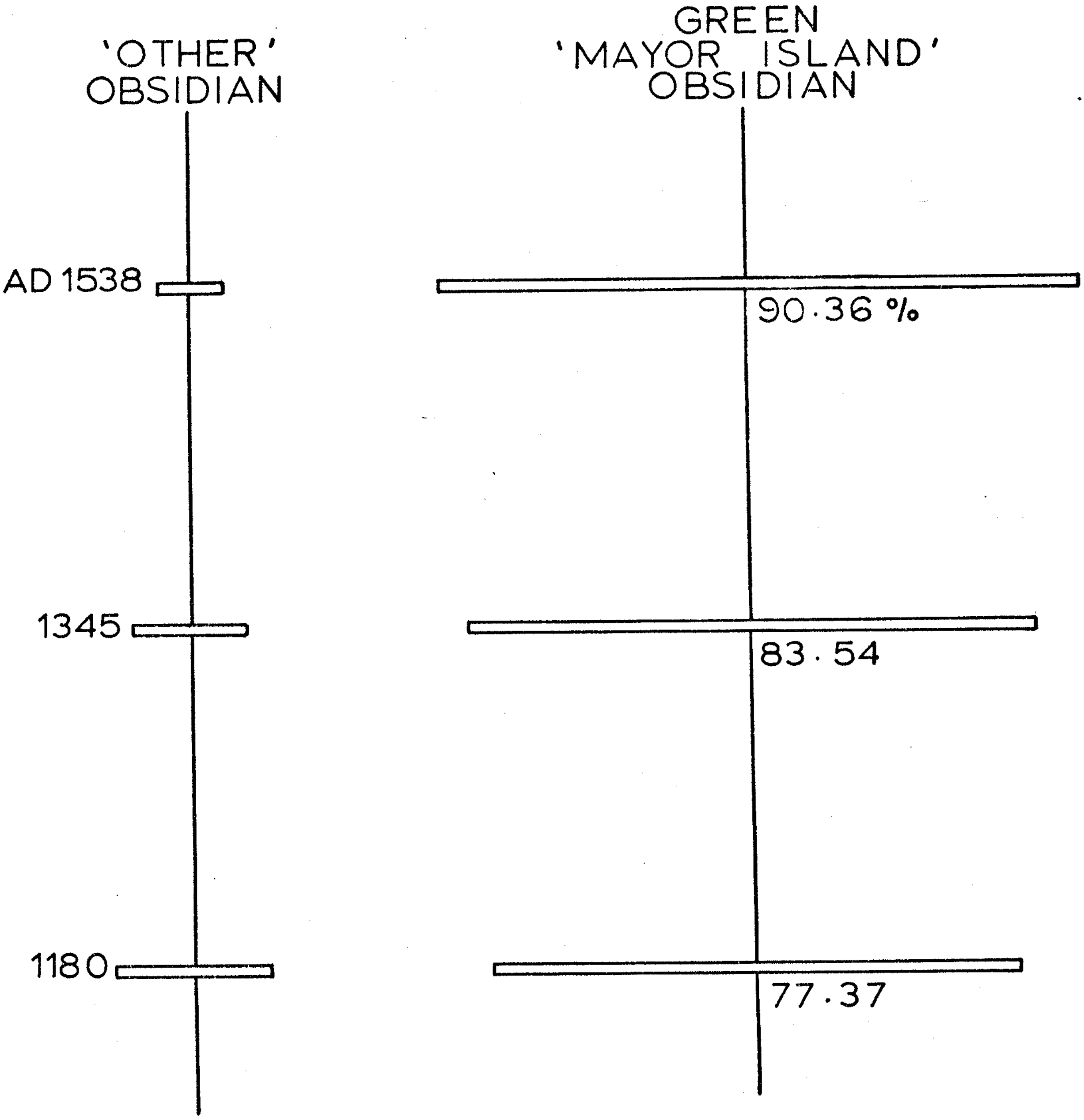


FIGURE 42 WASHPOOL OBSIDIAN

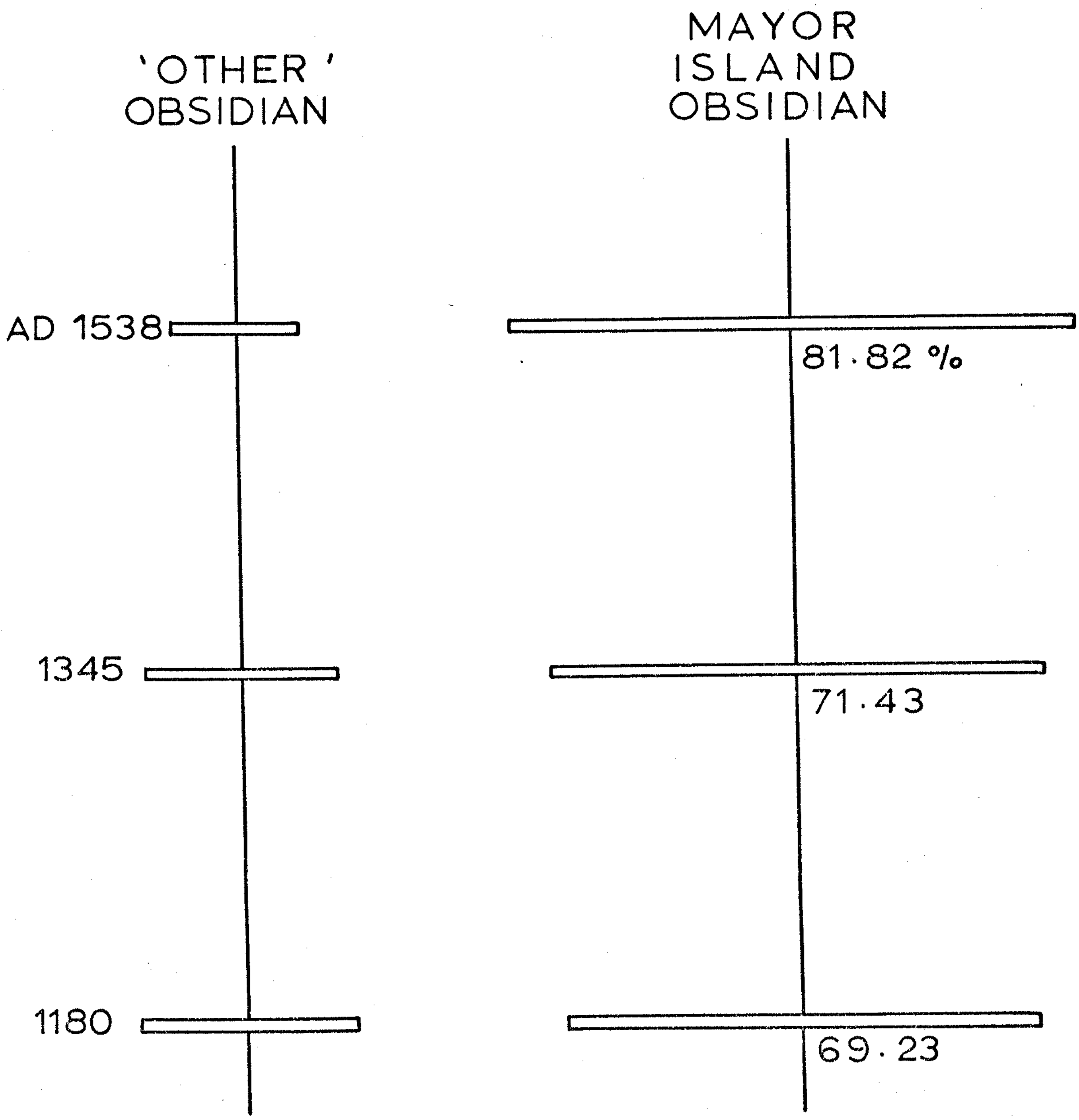


Figure 41, each step in the trend is significant (p less than 0.01). This comparison highlights the need to develop techniques capable of accurate sourcing of large samples of lithic material. Even though the present sample used for trace element analysis was 5 times larger than any other in New Zealand, the trends could not be proven significant. This only emerged from the less precise sourcing technique applied to the complete assemblage.

The results from the Washpool site indicate that while a general trend away from Mayor Island may be observed for New Zealand as a whole, the pattern of use in a particular area may be quite different to the cumulative trend. At the Washpool Midden site, the occupants relied increasingly on Mayor Island as a source, and other sites in the immediate vicinity fit reasonably well with this trend, although its positive assessment is hampered by smaller sample sizes. A different pattern, however, might well be encountered in sites around Wellington, the eastern Wairarapa coast, or even other areas of Palliser Bay itself. Until this subject is studied more intensively, relative dating from the proportion of Mayor Island obsidian should be applied with great caution, except where very local use patterns have been established. In the case of the Washpool, the lines of best fit are as follows:

a) Based on the assumption that all green obsidian is from Mayor Island

Date AD = 27.57 x % - 955 (SE Estimate = 4 Years)

b) Based on the trace element analysis

Date AD = 25.34 x % - 525 (SE Estimate = 78 Years)

There are unfortunately very few comparable figures for other New Zealand sites relating to the precise obsidian sources used. One recent study is of the Motutapu 'undefended site' (N38/37) and the results are published by Davidson (1974b) and Ward (1974b). The assemblage consisted of 132 pieces (see Appendix 20) and by proportional calculations on the published figures it would appear that:

21.2%	probably came from Mayor Island (green coloured)
55.8%	from Te Ahumata on Great Barrier Island
13.1%	from Awana on Great Barrier Island
9.9%	from Huruiki in Northland

These sources are not "within 75km of Motutapu" as Ward claims (1974b: 13); on the contrary, the Huruiki source is 165km in a straight line from N38/37. The Motutapu site is very late by comparison with the Washpool and is dated to the mid-eighteenth century. What these figures do show is that late in the prehistoric sequence considerable investment was still being made into raw materials from far afield. The same picture is shown at the Washpool.

An attempt to gauge the transportation 'cost' involved with these raw materials is made in Appendix 19. This clearly shows that the nett investment of energy in gathering rocks was practically constant in each of the 3 periods, represented by approximately 1,000,000 units; however, the distribution of this cost from one material to another is far from constant in the different periods.

The shifts in distribution are clearly brought out by considering several different resource zones. When the figures are separated for the North and South Islands for example (see Figure 43) it is clear that as time went by, far greater importance was attached to South Island lithic sources at the expense of North Island ones.

When the figures are separated out into the 6 main resource zones, several equally significant trends may be seen (Figure 44). For

FIGURE 43 WASHPOOL TRANSPORTATION COSTS

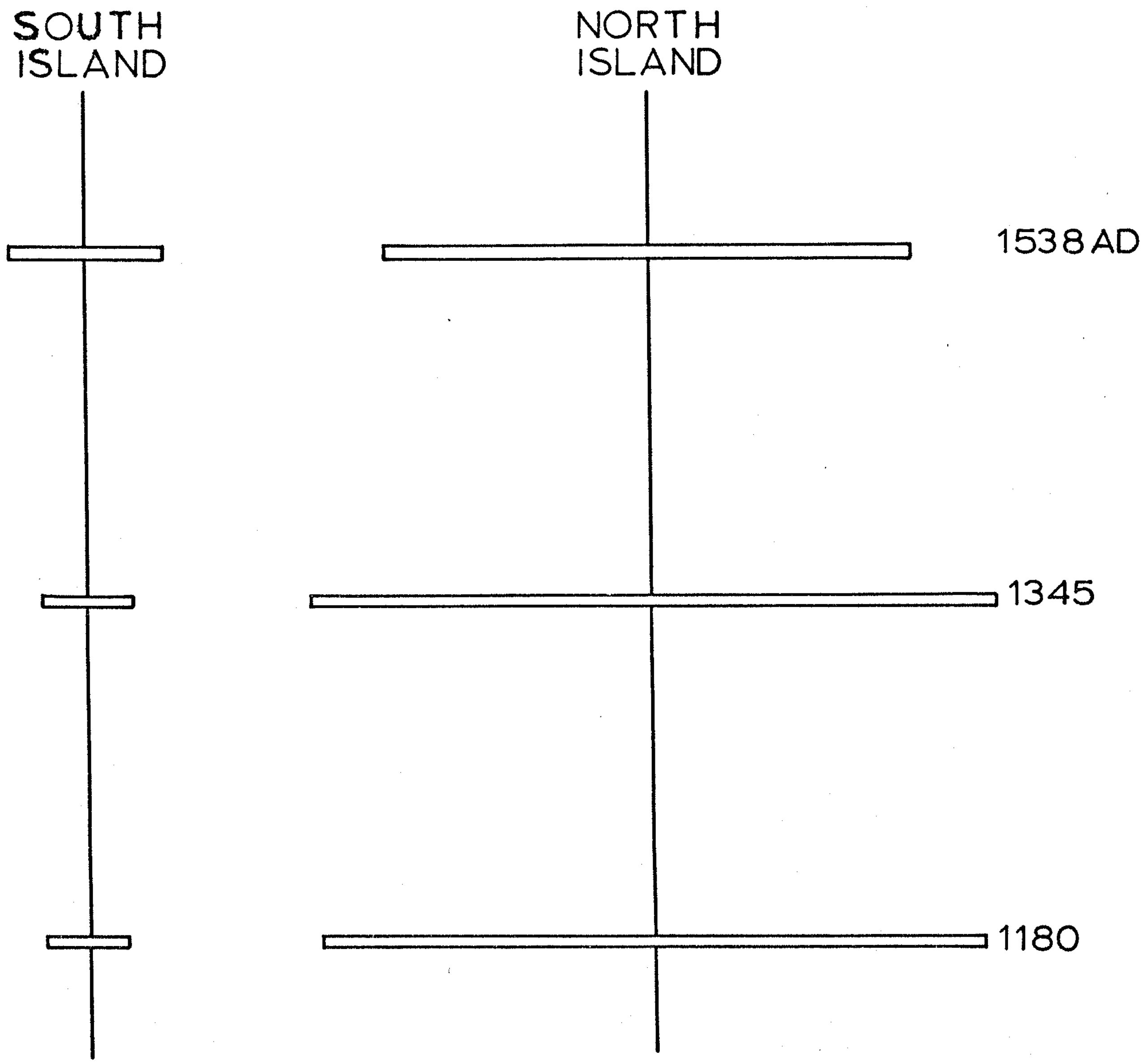
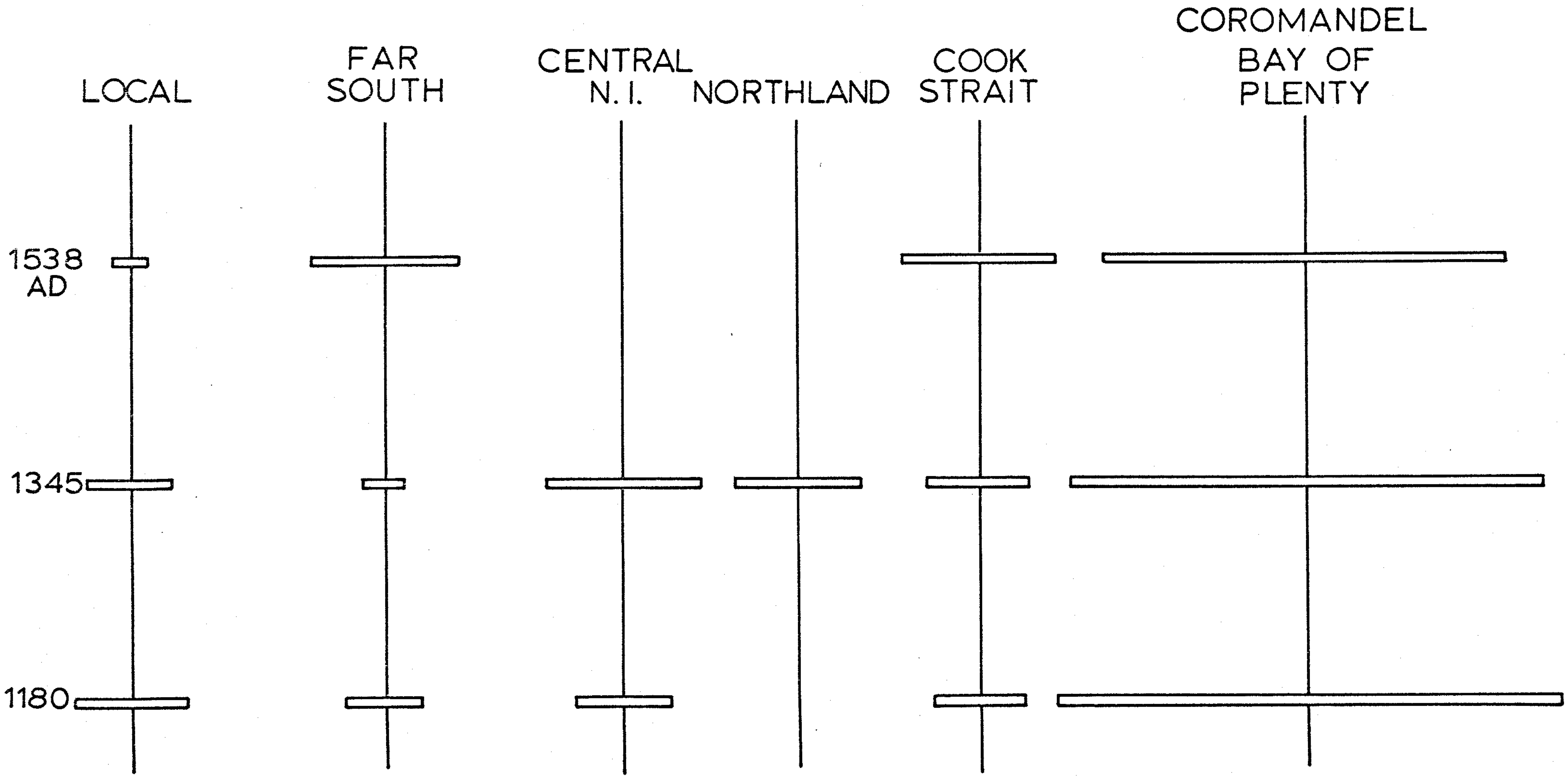


FIGURE 44 WASHPOOL TRANSPORTATION COSTS



instance, there is a steady decline in the material arriving from the Coromandel-Bay of Plenty area, and also a fall off in the utilisation of local materials. What rises substantially is the investment in imported materials from the Cook Strait area (from D'Urville Island, White Rock, Te Oroi, and the Nelson district).

One striking feature of these assemblages is the strong reliance on imported material rather than local rocks. H.Leach has argued elsewhere (1976:Chapter 3) that argillite became an especially valuable commodity in this respect, being continually re-used until only very tiny pieces remained. This dominance of external rocks suggests that the earliest people came into this geologically impoverished environment secure in the knowledge that they were backed by a flourishing exchange network which could provide them with essential raw materials from much farther afield. It is a pattern found repeatedly in nearly all the supposedly 'early' sites known from New Zealand, suggesting none are of initial settlement age.

From the point of view of communications, the figures presented argue that the earliest people at the Washpool were strongly reliant on the Coromandel-Bay of Plenty resources, if not in close contact with groups of people in that area. Moreover, people from the same area were also supplying Houhora and the Manukau Heads (S.Best, 1975) with stone materials. Over a period of time, however, contact with the resources and communities in the coastal areas of Cook Strait became more important and probably more reliable. There was also a significant communication link with the resources of the central North Island area, and this was especially strong in the middle of the prehistoric sequence. However, this channel apparently dried up sometime before the 16th century. Because the contact with the Coromandel-Bay of Plenty continued with only minor reduction at this time, it would appear that material from this area was not coming down through the centre of the North Island on an overland route. A seaward or coastal passage seems more likely. Thus, this community in Palliser Bay appears to have been involved with at least two distinct exchange networks in the North Island alone, and a case can be made that the strongest of these was maritime based. Ultimately a similar type of system strengthened ties closer to home in the Cook Strait area itself. Small quantities of other South Island rocks from further afield (such as silcrete) became incorporated into this traffic. Implicit in this suggestion is the notion that maritime technology was highly developed by c.1180AD.

A similar maritime system has been proposed involving the Northland and Coromandel areas, in which Tahanga basalt was a principal commodity (S.Best, 1975). Bay of Plenty obsidian and Coromandel sinters were also involved in the transfers. The fact that neither the Tahanga basalt nor the Coromandel sinters accompanied the Coromandel obsidian to Palliser Bay argues for some complexity in the overall exchange system, perhaps involving middle men specialising in particular materials. Far more information is needed from the actual source areas themselves to elucidate this problem.

Floral and Faunal Remains

Floral Remains

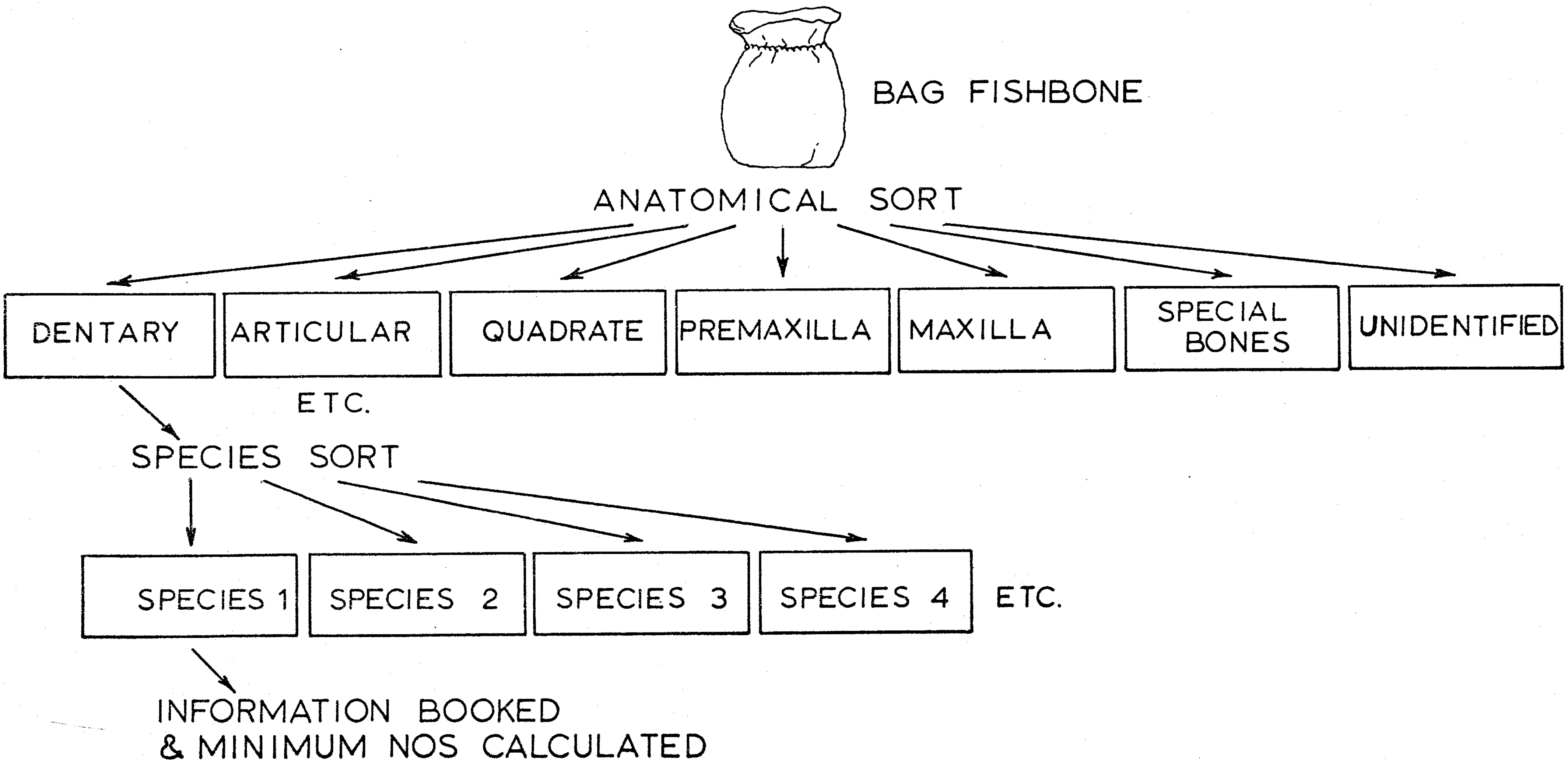
Quantities of plant remains were recovered in the excavations in the form of wood, charcoal and carbonised seeds. Most of the material was recovered by sieving, and this debris, along with soil samples, was eventually put through a flotation apparatus specifically designed to remove landsnails, as these were the subject of a research project. With the landsnails thus removed, the remaining samples are fairly concentrated floral remains. Vegetation residues from other sites, particularly the larger seed capsules, were sent to specialists for identification, and this yielded some valuable information. Such a task for the Washpool Midden site, however, would have been a very considerable undertaking, and was not attempted. There is an urgent need in New Zealand to establish suitable comparative collections to facilitate this kind of research on a routine basis.

Fish and Crayfish

Considerable quantities of fishbone were recovered from the midden and from this material 5 paired cranial bones were separated for identification. These were the dentary, articular, quadrate, premaxilla and maxilla. In addition, numerous individual characteristic bones were kept aside, such as the operculae of Chelidonichthys kumu and Helicolenus papillosus, the spines of Navodon convexirostris and various elasmobranchs, scutes from Scomber sp. and pharyngeal clusters of labrids and many others. In addition, quantities of fish were caught during the fieldwork periods and boiled down for comparative purposes. Once the various portions of the anatomy were sorted and re-bagged so as to preserve details of areal and stratigraphic provenance, the archaeological remains were identified and re-bagged according to species. This procedure allows the distribution of different kinds of fish to be studied later (see Figure 45).

A particular problem arises with the identification of fish remains since speciation of the infra-cranial anatomy such as vertebrae is notoriously difficult. This problem is complicated by the limited

FIGURE 45 FISH IDENTIFICATION SCHEMA



comparative collections available, since accurate speciation must involve exclusive identification rather than merely finding a comparable-looking bone in a comparative collection. Many New Zealand archaeologists may be quite unaware of the close similarity between the vertebrae of Thyrsites atun, for example, and those of Lepidopus caudatus and also of Jordanidia solandri. In the present analysis, as far as was possible, identifications rested on the more characteristic cranial bones, although even here particular attention must be paid to certain groups of species, such as the 3 mentioned above. Because identifications rest on cranial bones, the figures derived could be biassed by various practices related to preparation of the fish, such as filleting and also preservation techniques. No simple solution to this problem can be suggested. A constant watch was kept for obvious differences in frequency of vertebrae and cranial fragments. Fortunately no such discrepancies were seen. Various specialists were consulted over particular identification problems, and some of the material could only be identified after radiographic study as in the case of elasmobranch vertebrae. A few bones, belonging to perhaps as many as 8 species, remained unidentified at the completion of the analysis.

Minimum numbers were calculated in the usual fashion with little attention being given to the possibility of unpaired left and right bones. This means that the figures given in Appendix 23 are low evaluations of minimum numbers.

The remains of 434 fish were identified, and these belonged to at least 27 different species. This is a surprisingly large number of species compared with other New Zealand archaeological sites. In Appendices 23 and 24, Pseudolabrus celidotus and P.pittensis are not differentiated, nor Anguilla dieffenbachii and A.australis, although these differences were occasionally detected.

All these species are fairly common in Palliser Bay today (see Waite, 1909:trawls 72-75), particularly in the broken rocky ground, although some species are more common over open sandy bottoms such as the elasmobranchs. Publications relating to modern fishing techniques permit the linking of particular catching devices with individual species (see Appendix 27). From a study of these it can be established with some confidence that the activity represented at this site was concentrated around baited hook and line fishing for demersal fish, although significant catches of pelagic fish were also made with surface trolling lures. Other fishing methods probably included baited traps, set nets and probably diving and spearing. The different species and quantities of fish caught by these different methods are set out in Appendix 25. These figures indicate that some noteworthy changes took place between Levels I and II.

It is interesting that while the general species composition of Levels I and II is not significantly different (see footnote to Appendix 23), when the catching methods are considered there is a highly significant difference observed (see footnote to Appendix 25). For instance, deep water baited hook fishing has fallen in popularity (significant p less than .01), while crayfishing has risen significantly. The observed fall in eels may also be significant. When the different catching methods are related to fish zonation (Appendix 26), it is clear that what has occurred is a general decline in offshore fishing activities (presumably from canoes) in favour of inshore fishing around broken rocky ground (see footnote to Appendix 26).

As will be shown below there is no significant seasonal difference in occupation between Levels I and II, and this observed increase in inshore marine foraging must be related to some other factor.

This shift is in fact but one of a constellation of changes seen in Palliser Bay towards the end of the 14th century. It will be argued in Chapter 5 that the cause of these changes is related to an overall climatic shift in New Zealand at this time, augmented by local deforestation resulting from slash-and-burn horticulture.

Shellfish

As with most Archaic sites, a wide range of shellfish species are represented. Two of the 31 species may have been imported for ornamental purposes, namely Dentalium nanum and Pecten novaezelandiae novaezelandiae (see Appendix 14). Only about 10 of the remaining species occur in large numbers, and these must have provided the bulk of shellfish meat in the diet. The most important species were Haliotis iris, Melagraphia and Zediloma spp., Cellana radians, Lunella smaragda, Haustrum haustorium, Cookia sulcata, and Paphies spp. The minimum numbers for each level are given in Appendix 22, and the list indicates heavy dependence on communities from the rocky intertidal platform. Compared with the Black Rocks middens though, shellfish in this site are relatively sparse. For similar depths of excavation the Washpool Midden site yielded about 70 shells per m^2, compared to 3500 per m^2 at Black Rocks. In addition, although there are important changes through time in the functional status of the Washpool Midden site, the general fall in numbers in shellfish, evident in Appendix 22, is regarded as significant. The modern sublittoral fringe is practically bereft of shellfish, and although the midden does not indicate proximity to as rich an intertidal area as Black Rocks, there was clearly a relatively stable inshore environment close to the site 800 years ago. It is believed that the gradual fall in numbers of shellfish reflects progressive instability in the immediate coastline. It is noteworthy that there is a dramatic fall in Melagraphia aethiops (see Appendix 42) from Level I to Level II, which as shown by Anderson (1973a:99, Figure 17) is characteristic of the upper shore, and a correlated rise of Lunella smaragda, which is more often found in the lower sublittoral fringe (ibid). This suggests that shellfish were still present in slightly deeper water near the Washpool at c.1345AD when the inshore habitat had been broken up by wave action and the generally deteriorating marine conditions. As will be seen shortly there is no need to invoke climatic factors to explain this particular ecological change.

Of equal significance is the presence in both Level I and II of numbers of filter-feeding shellfish, some of which are not present in the modern marine environment. These include Mytilis edulis, Ostrea sp., Perna canaliculus, Paphies sp., Aulocomya maoriana, Pecten n.novaezelandiae and Dentalium nanum. The latter two were apparently used as ornaments as already discussed, and their precise origin is questionable; however, the remainder were certainly collected locally as they persistently occur in the earliest middens in Palliser Bay. Very small specimens of Paphies spp. are found and these are unlikely to have moved far from their source. The question of the origin of Dentalium nanum and Pecten n.novaezelandiae cannot be decided with certainty (this issue is discussed at length in Appendix 14), and both could have been locally obtained were the marine environment more favourable to filter feeders than today. That possibility is certainly indicated by the presence of at least 10 species of these animals in the earlier layers. In Appendix 41 the shellfish assemblage is split into browsing animals and filter feeders, and it is evident that the latter disappear from the sequence before Level III (c.1538AD). Because of the relatively small numbers it is difficult to be certain how pronounced the change was by Level II (c.1345AD). If the two 'ornamental' species are included in the assessment, the trend is highly significant by this time. It must be remembered that shellfish numbers generally had fallen by Level II, and this may relate to the same phenomenon.

Since filter feeders are quite intolerant of soil suspensions, the obvious explanation for these changes is a general rise in the sediment load of the Makotukutuku River. The river today is heavily loaded in periods of high rainfall which induces erosion and slumping, and there is little doubt this has been greatly accelerated by European deforestation and pasture development. It is suggested that this process began with the earliest Polynesian occupation and that its effects on the coastline, detectable by c.1345AD, had practically destroyed nearby shellfish communities by c.1538AD. A few filter feeders were found in the Washpool Cleft Burial, dated to 1480AD ± 70, so a date of about 1500 might be used to mark the final turning point in this significant change in coastal ecology.

Finally it should be noted that this change need not have affected areas of the coastline very far from the Washpool. Longshore drift is in a southerly direction, and sediments from the Makotukutuku River today affect areas as far as Te Humenga, about 3.5km away. H.Leach (1976: Chapter 3), has documented similar episodes of erosion from a study of dune formation, riverine flooding, and shingle fan development, and although local erosion is shown to have commenced at different times in different places, the process underwent acceleration in all areas at about 1450 to 1500AD.

Sea Mammals

Two factors combine to render the identification of sea mammal bones and their precise temporal provenance less secure than other remains. On the one hand identification of cetaceans in particular is very difficult due to the lack of comparative material (Baker, 1974: pers.comm.), and on the other, many of the bones were quite large pieces, and in some cases were thicker than the soil layers in which they were found. For example, while the limits of Lens IIB were clearly identified from the distribution of fine yellow ash, large vertebrae, such as those of *Globicephala melaena* belonging to this period of deposition, are most unlikely to have all been laid down *inside* the lens. Numbers of these vertebrae may easily have become incorporated in later layers. Some flexibility must therefore be invoked in interpreting the true provenance of many of these remains.

A small collection of vertebrae and other bones derived from a dolphin, either *Lagenorhynchus* sp. or *Delphinus* sp. Of the three possibilities, *L. cruciger* is unlikely on distributional grounds, but *L.obscurus* or *D.delphis* are both fairly common in Cook Strait. It is unfortunate that precise identification is not possible since *L.obscurus* is generally only present in winter (Gibb & Flux, 1973:337), while larger shoals of *D.delphis* appear in Palliser Bay in summer (Gaskin, 1968; 1972: 54, 135; Baker, 1972; Webb, 1973). A minimum number of 1 individual was present in the site, and while two of the bones were recorded as Layer 4 Black, these are believed to be derived since most were found in Lens IIB and the Crust of Layer 5. The animal is therefore judged as having been consumed during Level I.

A large number of bones were identified from the blackfish or pilot whale, Globicephala melaena. These were from medium sized specimens of about 2.4m to 3m (8-10ft) in length. This animal is fairly common in Cook Strait and is prone to mass strandings; it is more abundant in spring and early summer (Gaskin, 1968:117). At least 2 individuals were present and these belonged to Level II, although again some bones were displaced. The remains are concentrated directly over Burial B and many are carbonised. It is suggested that joints from these animals were cooked in this position over an open fire, and this accounts for the destruction of much of the underlying human remains as noted earlier.

Some fragments of baleen plates were recovered from Level I. These could not be identified beyond that of baleen whale, Order Mysticeti. They may have been collected for the bone which is very tough, although meat from stranded specimens could have been brought to the site.

The southern fur seal, Arctocephalus forsteri was represented by a minimum number of 2 adults and 1 immature specimen in Level I, and at least 3 adults in Level II. These animals are highly seasonal in their habits according to age and sex, but because the basic osteometric work on this subject has not been done (c.f. Bryden, 1972), they cannot be used as precise seasonal markers. The strongly diurnal pattern of activity - feeding at night time and hauling out to sleep during the day, especially in the mid-afternoon (Stirling, 1968) - suggests that they could have been taken on land by clubbing. A strong winter dominance of non-breeding herds on shore is a marked pattern in such areas as Kaikoura (Stonehouse, 1969:520), Cape Turakirae in Palliser Bay (Gibb and Flux, 1973:335), and the Three Kings Islands (Sorensen, 1969; Singleton, 1972); however, they are abundant in the summer months further to the south as breeding colonies. The actual distribution of these colonies varies, although the breeding habits probably reflect climatic factors. The hauling-out colony at Cape Turakirae was only established in 1950 (Gibb and Flux, 1973:338).

The remains of one sub-adult female sea lion, Neophoca hookeri were found in Level I. This is probably the most northern recorded presence of a living sea lion, although it is known as a sub-fossil find from Coromandel. The fragments in the site were notably fresh in appearance, discounting a fossil origin (Baker, 1974: pers.comm.). The sea lion is the most abundant marine mammal on many sub-antarctic islands, and straggles as far north as Stewart Island and very seldom to the South Island. Other sub-antarctic marine mammals occasionally move much further north in winter (Stonehouse, 1969:521; Gibb and Flux, 1973:334), and a similar explanation is offered for the presence of this individual.

At least 2 individual leopard seals, Hydrurga leptonyx were recovered from Level I. As with the sea lion, these specimens are a long way north of their normal distribution. Rare solitary visitors have been recorded in Canterbury and Marlborough (Stonehouse, 1969:521), and even Hawkes Bay in some winters (Baker, 1974: pers.comm.). Other large sea mammals such as the elephant seal, Mirounga leonina also fit into this pattern of a more extended distribution in winter, and with improved methods of identification could become valuable seasonal markers. The bones of elephant seals have been used as an indicator of autumn or winter occupation at Pleasant River (S155/2), on the assumption that the animals were killed when they hauled out to moult (Teal, 1975:35). The same conclusion might apply to the Tairua site on the Coromandel (N44/2) where elephant seal bones were identified from both occupation layers (Smart and Green, 1962: 256, 262, 263). This conclusion is reinforced by a recent study (Rowland, n.d.) of shellfish growth lines and the presence of certain bird species.

Polynesian Rat

Large numbers of rat bones were recovered from the excavations, accounting of a minimum number of 113 individuals. Some 94 were in Level I, falling to 18 in Level II and 1 in Level III. Other sizeable archaeological collections which have been studied include finds from the Polynesian outlier Nukuoro totalling 45 individuals (these are a different species, however, qv. Davidson, 1971a:91), and the Whakamoenga Cave Site near Taupo (Hosking, 1962) which has produced about 30 individuals. The species Rattus exulans has not been studied intensively in New Zealand partly because of the difficulty of locating live populations. Good evidence exists that the native species was quite rare at the time of European contact (Thomson, 1922:76) despite ambiguous references to plagues of rats in Marlborough in 1772. Indeed, the last reference may possibly have involved Rattus rattus introduced by Captain Cook only three years earlier. If so, this too is not without significance. The phenomenon of 'explosive' population growth is characteristic of adventive species, and is usually followed by a sharp fall in numbers as various environmental factors 'catch up'. The pattern has been observed for many other species introduced into New Zealand (qv. Thomson, 1922:78ff; Wilson, 1975). The large numbers of rats at the Washpool Midden Site about 1180AD could indicate that Rattus exulans had been introduced into the Wairarapa, possibly New Zealand as a whole some time during the previous century. An additional possibility relates to the marked seasonal redistribution of populations which has been recorded on Little Barrier Island (Watson, 1955), and which is believed to apply to the few surviving populations around New Zealand. Very few specimens could be caught near habitations from about September to February, yet they are numerous in the middle of the year, especially April to June. Trapping experiments in both climax and secondary forests, and near human settlement suggest that a movement takes place out of the forest from about March. Thus at the Washpool large numbers may have been caught around settlements in the autumn and early winter. Ethnographic records also suggest a strong seasonal pattern in the taking of rats. Best, for example, states that they were in good condition in late autumn and winter, and that this fell off greatly in summer (Best, 1942:426). In addition, Firth records that they were trapped and preserved in June, July and August (Firth, 1959:72).

In contrast to Pacific Island populations, the species is nocturnal in New Zealand (Best, 1942:451; Stead, 1937:179), and was therefore caught at night by setting snare pits and traps. There are many records of the inability of this rat to chew anything harder than soft vegetable matter in Island Polynesia (Gill, 1929; Marples, 1955; Fall, et.al., 1971; Stead, 1937). It is therefore significant that quantities of bird and fish bone in the Washpool Midden Site were found to have been heavily gnawed by very small teeth which could only have been rats. The resulting excessive dental attrition has been recorded from other archaeological sites in New Zealand (qv.Hutton, 1877; see also White and Hutton, 1879 for corrections to the former paper). These behavioural and perhaps anatomical differences between Pacific populations could be of use in tracing the settlement history of man who probably unwittingly transported these animals in canoes.

Metrical studies of Rattus exulans clearly show a gradual increase in size towards the eastern and southern parts of the Pacific (Tate, 1935; Watson, 1955; Marples, 1955), and a study of maxillary and mandibular tooth row measurements of the Washpool remains and others from New Zealand show that these are very large by Pacific standards (B.F.Leach, n.d.), and most similar to those from marginal eastern Polynesia.

Polynesian Dog

With the exception of the deliberately buried dog (see above) the remains of Canis familiaris in all three levels were highly fragmented, and this damage made the estimation of minimum numbers particularly difficult. Age assessment had to be made largely on the basis of mandible and tooth sizes since most of the limb bones had been broken into many pieces. Claws, teeth, and cranial fragments contributed substantially to a total of over 500 separate pieces of dog. Without a detailed analysis and matching of fragments, minimum numbers are only approximate (see Appendix 36), and have been established chiefly from the mandibles. Level I contained at least 14 individuals (including the dog burial). Seven of these were clearly immature, including two newborn or perhaps foetal dogs. In Level II there were approximately 7 individuals of which 3 were immature, while Level III contained only 1 dog. There is little doubt that this degree of fragmentation implies the use of dog in the diet of the occupants of the site. Subject to more intensive study, the mortality pattern might also prove deliberate butchering of sub-adult individuals. The number of dogs is comparable to the Archaic Pleasant River site (S155/2) where 15 or 16 dogs were killed including juveniles. Here too mandibles were found to have survived in the greatest numbers (Teal, 1975:40). In contrast the Pleasant River canid remains were relatively intact with limb bones fractured in only a few places and crania broken along suture lines.

Dog bones at the late Classic Maori Karitane site (S155/1) also possessed only simple fractures with the exception of the mandibles. These had been collected together and cut and split along various lines for the production of barracouta lure points and composite fish hooks (H.Leach, 1969:55; Coutts and Jurisich, 1973:78-9). It appears that this industrial use of the mandible may not be present in the early period. In fact industrial use of dog bone in Archaic sites is rarely documented, although the difficulties of determining the type of bone used in highly finished artefacts such as fish hooks and bird spears may be a contributing factor. At the Washpool Midden Site it is believed that several of the bird spears have been manufactured from dog limb bones, particularly those solid in cross section (see below). This type of utilization, however, does not explain why all parts of the skeleton are so fragmented at the Washpool Midden in contrast to Pleasant River or Karitane.

In her study of dog dentition, Allo (1971) found that extreme tooth wear (up to 5 on a scale of zero to 5) was restricted to South Island sites. She interpreted this as indicating that North Island dogs lived off a softer vegetable diet in both the Archaic and Classic phases (op.cit.: 37, 44). This conclusion is supported by the analysis of 8 mandibles and 11 maxillary tooth rows from Level I of the Washpool Midden Site which are only slightly worn (0.5 to 1.5 on the same scale of wear). The 26 individuals recorded by Allo from the site of Wairau Bar display a greater range of wear than this, but 23 of the sample have wear indices of 2 or less, and are thus very comparable to the Washpool dogs. The dichotomy between North and South Island dogs therefore is perhaps more appropriate to sites other than Wairau Bar. Coprolites from the Washpool Site have not been analysed in detail, but their fine texture is consistent with a soft diet, unlike those studied by Byrne (1973) from the Whakamoenga Cave Site.

The more complete Level I mandibles were also examined for genetic abnormalities which Allo found to be quite common in Polynesian dogs (Allo, 1971:40). Five of the abnormalities listed by Allo were present in Level I dogs: the supernumerary single rooted premolar, the single rooted P4, root fusion in M2, absence of M3, and the supernumerary root on M3. The last abnormality occurred in varying proportions in both North and South Island sites at all periods, and M2 root fusion was also present in many of Allo's sites. However, the supernumerary premolar, the single rooted P4, and the absence of M3 were quite rare features. The Washpool Midden Site and Wairau Bar are the only sites where the extra premolar has been recorded. Apart from the Washpool sample, the single rooted P4 is restricted to the Whangamata (Coromandel) site, and the congenital absence of M3 is shared with Marfells Beach near Wairau Bar, Shag River, and Long Beach. The similarities between the Marlborough and Wairarapa samples may be linked to the trade network which operated between the two regions. The same comment might apply to the Coromandel example.

Allo found that the index of tooth crowding was very low (75 to 81) in canid remains from Wairau Bar, Houhora, and Whangamata, consistent with the long muzzle of the Maori dog (op.cit.:33). The Washpool index, however, ranges from 74 to 99, with 16 of the measurements above 81, and only 4 within Allo's range. The relationship between muzzle length, tooth crowding and supernumerary teeth is obviously complex, and Allo cites a modern study that breeding for long jaw length is not accompanied by increased tooth numbers (idem). Tooth crowding on the other hand does seem to indicate relatively short muzzle length (Sisson and Grossman, 1953:503). If this is a correct assumption the Washpool dogs stand closer to the tropical Polynesian dog than those studied by Allo. The Hawaiian dog snout is described as short and rounded with a short broad palate (op.cit:35), and this description also fits the early Samoan dog (qv. Davidson, 1969:239). It should be noted that the dog burial in the Washpool Midden Site (the only specimen on which measurements could be made) has a cranio-facial index of 48.1, and this is considerably lower than the 12 specimens measured by Allo (1971:35) which range from 65.0 to 85.0. This is a clear indication of a shorter snout, a discovery of some importance in the light of the following comments by Allo:

> "Dogs of tropical Polynesia showed marked differences in skull and jaw formation, due to a soft vegetable diet. No dogs of this kind have been found in New Zealand, but presumably they existed, since the Maori came (with dogs) from this area. There is no way of telling how quickly the Polynesian dog in New Zealand responded physically to a new diet and environment, but certainly at least one generation would have had the broad palate and rounded skull typical of the tropical Polynesian dog. If such dogs were found on a New Zealand site, it would be strong presumptive evidence that the site represented one of the first New Zealand settlements"
>
> (Allo, 1971:36)

It is not claimed that the Washpool is such an early settlement, rather that the diet of the Washpool dogs, which appears to have been largely vegetable, may have preserved cranial and dental features of their tropical predecessors.

Avifauna

The Washpool Midden Site produced several thousand bird bones and most of these were processed according to the method outlined in Appendix 21. A minimum number of 273 birds was thus identified, belonging to 45 different species; the basic results are set out in Appendix 29. In Appendix 30 the same data is organised into taxonomic orders, and in Appendix 31 into habitat types. Size differentiation details are presented in Appendix 32.

These figures show a clear emphasis on the medium and smaller forest birds, and in particular the very mobile flocking birds which characterise mixed forest conditions. In this medium size range are 192 individuals including Callaeas cinerea wilsoni (the kokako), Ninox novaeseelandiae (the morepork), Prosthemadera novaeseelandiae (tui), Cyanoramphus novaezelandiae and C.auriceps (parakeets), Turnagra capensis tanagra (thrush), Philesturnus carunculatus rufusater (saddleback) Halcyon sancta vagans (kingfisher), and Anthornis m. melanura (bellbird). The kokako, thrush and saddleback are now locally extinct. There are only 20 forest birds in the larger size range and most of them are Hemiphaga novaeseelandiae (wood pigeon), although there are also a few Gallirallus australis greyi (weka), Nestor meridionalis septentrionalis (kaka), and Heteralocha acutirostris (extinct huia). Small forest birds include Petroica australis longipes (robin), Rhipidura fuliginosa placabilis (fantail), and account for only 5 individuals.

There are a number of surprises in the species composition of this assemblage. One unexpected result is that the huia is only poorly represented. Huia were quite numerous in the Aorangi Mountains in the 19th century, especially in the kanuka areas on spurs and ridges (Stidolph, 1971:17), and their tail feathers were highly prized as a trade item. The small numbers of these birds in the Palliser Bay middens may parallel the 19th century situation when they were apparently not eaten by the Maori (Best, 1942:221). Similarly 19th century records indicate that kokako and the saddleback were not prized as food (Best, 1942:378, 380) and these two species are also poorly represented in the site. On the other hand the robin was deliberately trapped by the 19th century Maori, and this bird is a more significant component of the midden. There are possible indications in these parallels of considerable conservatism in bird preferences over a period of seven centuries. The weka is comparatively rare in the assemblage and this is unexpected since it was common on the coastal strip in the 19th century and also a favoured item of food (Stidolph, 1971). Similarly, swamp birds are uncommon in the assemblages; there is only one harrier hawk (Circus approximans gouldi), one swan (Cygnus sumnerensis), one banded rail (Rallus philippensis assimilis), and only a few ducks (Anas s. superciliosa, and Anas rhynchotis variegata). Several other species such as the white heron are occasional visitors to the Washpool but are not represented in the midden. Again, from the present open ponding condition of the rivermouth bitterns, dabchicks, and crakes might be expected in the midden. Also birds common on shingle river beds such as the pied stilt, banded dotterel, paradise duck, and pipit are conspicuously absent in the site. These absences may indicate some environmental differences from today's conditions. In fact they may support the conclusion derived from the analysis of shellfish and landsnails that local hydrological conditions deteriorated markedly after a few centuries of human settlement (see Chapter 5). Another surprising feature is the relatively small number of sea birds such as black-backed gulls and shearwaters whose young can be easily taken from breeding colonies. It seems likely that modern colonies such as that at North Kawakawa have not been long established. Judging by modern instances, a number of the sea birds which are present in the midden were probably taken as sea-wrecks after the passage of cyclonic storms. In this category are the albatross, shy mollymawk and petrels.

Moa are represented by 10 individuals belonging to 3 species: Pachyornis mappini, Euryapterys geranoides and E.gravis. It is also possible that some of the fragments could belong to Dinornis sp. The identifications were made by R.Scarlett of the Canterbury Museum and his overall opinion was that the bone was in fresh green condition when broken rather than from sub-fossil deposits. The remains are very fragmentary, and are practically all from tibio-tarsus. Many of the bone artefacts from the site are made from moa bone, and all indications are that moa presence in the site was not the result of local exploitation of a living population. The most likely interpretation is that the bone was obtained from a population some distance from the Washpool, and was procured by trade or from hunting expeditions during visits elsewhere. A South Island source is a strong possibility since E.gravis was almost certainly not contemporary with man in the North Island. On the other hand it is the most abundant moa in South Island archaeological sites. This could not have been the only source of moa-bone, however, since E.geranoides, a strictly North Island moa, was also present. Clearly these people must have had access either directly or indirectly to a living population in the North Island as well.

The abundance of flocking, honey and berry-eating birds in this site indicates that the occupants of the Washpool had some particularly suitable catching methods. Ethnographic literature of the 19th century Maori shows that spears and nooses were used for taking the larger birds such as kaka, tui, and pigeon, and as will be seen below, bird spears are a prominent artefact in the site. There are a number of smaller birds, however, which could not have been caught with spears, such as the thrush, robin, parakeet, bellbird, saddleback and fantail. Some quite different method therefore must be suggested, such as snares, set traps, and nooses, and these are also recorded during the 19th century. In particular, an effective method of catching parakeets was obviously well developed. Members of this order are present throughout the high islands of Polynesia, and being social birds are attracted to a decoy. A knowledge of this behaviour, when combined with snares, can be used to advantage in catching the birds. Such a technique could well have been imported to New Zealand. Apart from tui, parakeet, and pigeon, most other birds were recovered in similar low numbers, and this probably reflects chance catching rather than specially adapted methods.

By far the greatest number of birds was found in Level I, and the sharp decline in Level II may indicate either a decline in fowling or perhaps modification of the environment and reduction in the bird population. The site at Level II still possesses much midden material, so the decline in numbers may be significant. The remains of only 2 birds were present in Level III. The proportions of different species were compared from Level I to Level II to see if any significant differences could be detected which might shed light on this issue.

When the raw data for the two levels is compared using the Chi-square test for two independent samples (qv. Reyment, 1971:53), the resulting difference is shown to be highly significant (see footnote to Appendix 29). If the data is reorganised into taxonomic orders (as in Appendix 30), there are only three proportions which appear to change significantly between the two levels. The Passeriformes (such as tui, bellbird etc.) have dropped from 44.5% to 25.0%, and this is significant ($p = .05$, as determined by Rosenbaum's statistic qv. Appendix 35). The main increases detected are the Columbiformes (such as pigeons) from 3.2% to 13.9% (significant p less than .01), and the Procellariiformes (most of the sea birds) which have risen from 2.7% to 11.1% (significant $p = .05$). The overall difference however, is rather subtle and not easily described in environmental terms. When the frequencies are related to bird habitat categories (Appendix 31), there appears to be a rise in coastal birds at the expense of both forest and forest fringe dwellers, but the significance of the change cannot be proven with the smaller sample size of Level II. Finally, the change may be examined in terms of bird size (Appendix 32). There is a clear change in emphasis in Level II towards the larger birds (significant p less than .05), and this largely reflects the dwindling numbers of Passeriformes. These detected changes are consistent with the gradual loss of forest conditions close at hand.

As shown in Appendix 21, the speciation of bird remains followed a procedure which reveals details of the fate of the bird once it was caught. The recorded information is very extensive and only 2 examples are illustrated here. These are particularly interesting because they may indicate preservation practices, and also the relative importance of meat and feathers to the fowlers. The examples chosen are the tui

(Prosthemadera novaeseelandiae) and the two parakeet species (Cyanoramphus novaezelandiae and C.auriceps). In Appendices 33 and 34 the minimum numbers are given for the major anatomical parts of each bird. The figures relate to Lens IIB and the Crust of Layer 5 from where most bird remains in Level I derive. As can be seen, the minimum numbers vary considerably for different parts of the body, but very little from the left to right side. The observed bilateral differences proved to be insignificant in the case of both tui and parakeet (see footnotes to Appendices 33 and 34). For easy comparison of the results, the various minimum numbers were standardised as a proportion of the maximum minimum number, and these are plotted out schematically in Figures 46 and 47.

Evidently there are major differences in the various parts of the bird represented. One obvious possibility is that this reflects either differential survival or uneven ability to identify the discrete parts of the body. However, close inspection of the figures shows that neither of these claims can be maintained. For example, tuis are well represented by such fragile remains as the mandible, which is relatively difficult to speciate, and are very poorly represented by the relatively durable and diagnostic femur. Again, the similar minimum numbers for each side argue that the observed pattern has some additional significance. Some comments must be made, however, on particular bones for which the minimum numbers may be somewhat misleading.

The most difficult bones to speciate are the phalanges, ribs, vertebrae, quadrate, scapula, furcula, carpometacarpus, radius, ulna and mandible. The carpometacarpus is not particularly diagnostic in shape while the furcula which is quite diagnostic is very small and

FIGURE 46 WASHPOOL TUI REMAINS

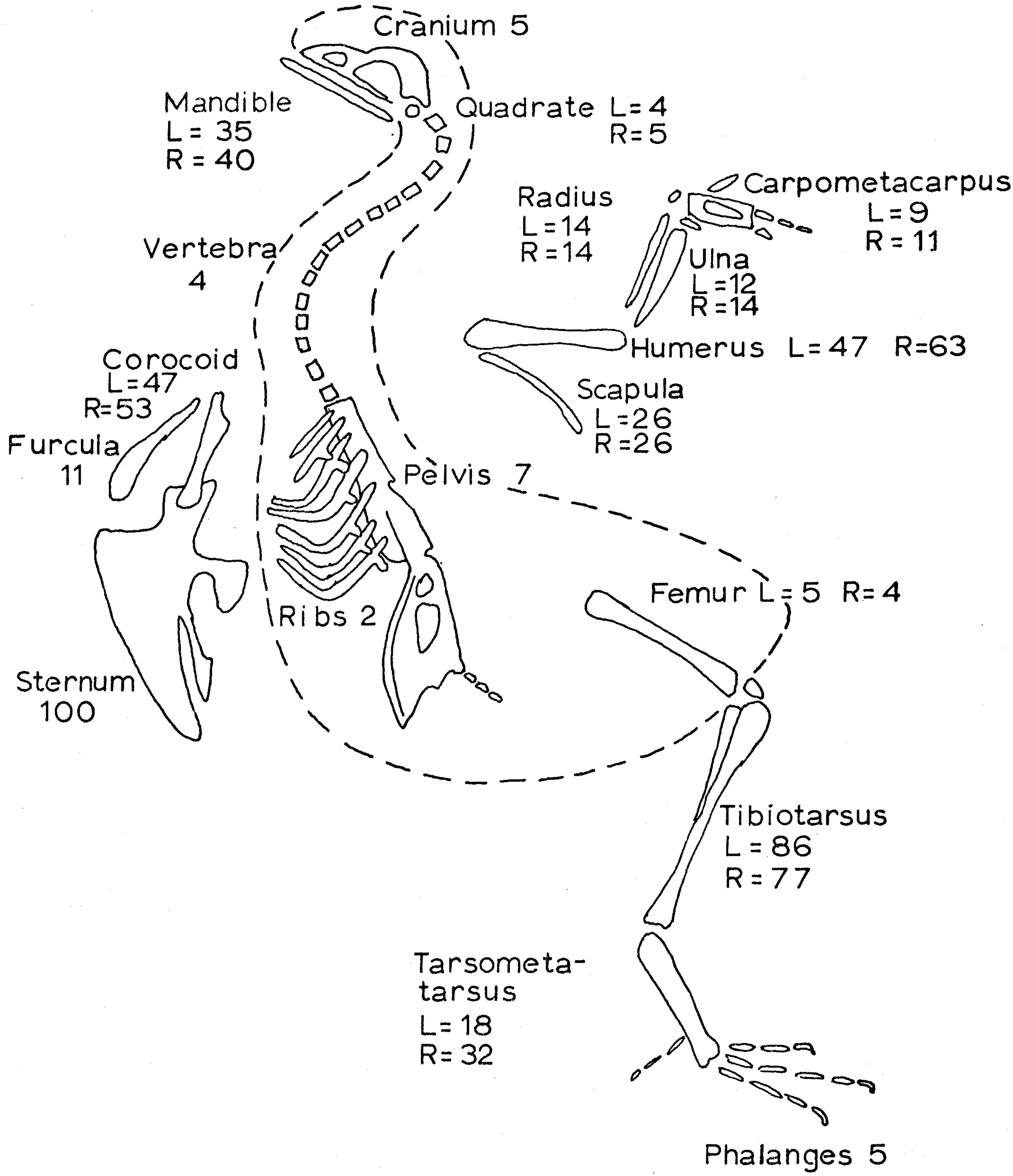
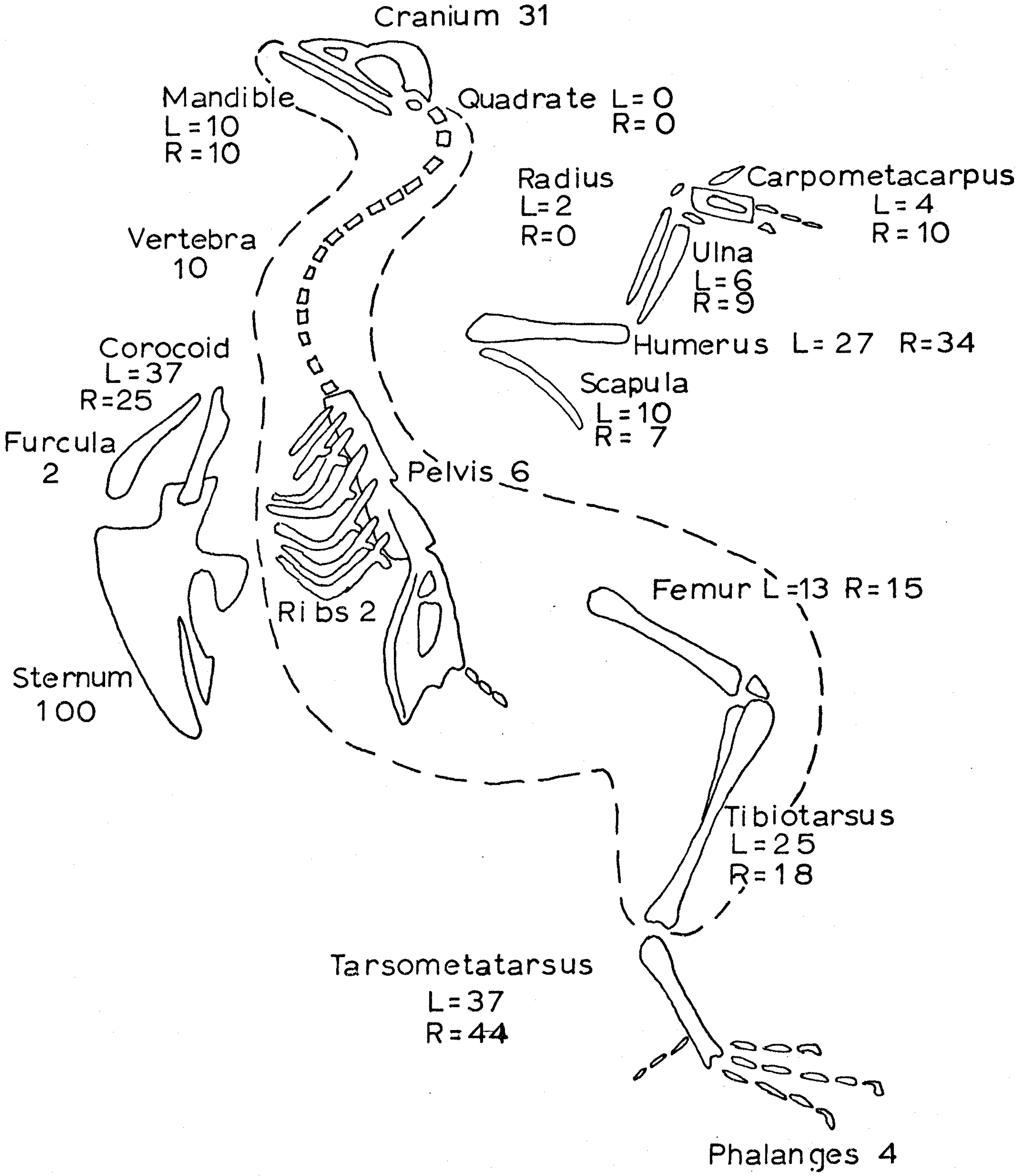


FIGURE 47 WASHPOOL PARAKEETS



seldom recovered whole for these small species. Speciation is relatively easy for the tarsometatarsus, tibiotarsus, femur, humerus, pelvis, sternum, corocoid, and cranium, although complications can arise with the sternum, pelvis and cranium due to fragmentation. These factors relating to speciation, however, cannot account for the discrepancy between the pelvis and sternum, which are represented by 6% and 100% respectively in the case of parakeets and 7% and 100% in the case of tui. Taking into account the few possibly unreliable figures, the main body area of each bird (Figure 46 and 47) is conspicuously absent. The line of demarcation between what is well represented, and what is under-represented is very similar for the two species, but there are two notable differences, one in the head region, and the other in the lower leg area. In the case of the tui the mandible remained at the site, but the cranium was removed with the body; in the case of the parakeet the exact reverse was found. It is precisely in these areas that the most valuable feathers on each bird are found. The male tui has a tuft of long curled white feathers under the mandible and these would be very easily removed by cutting the mandible and upper throat skin away in one slice, perhaps with a piece of obsidian. The skin could then be easily removed from the mandible. The beak area simply marks a convenient point for beginning the cut. The red and yellow-crowned parakeets, on the other hand, have what their common names imply, an area of red and yellow feathers on the top of their heads. Removal of these may have involved a similar process as in the tui (cutting at the back of the beak area) but this time removing the cranium from the rest of the body.

The second notable difference is in the lower leg region. The tui tibiotarsus (and the rest of the lower leg) stayed at the site, and the femora were removed with the body, whereas the demarcation line in the parakeet is a joint lower. Only the leg from the tarsometatarsus down remained at the site. This difference is explicable by reference to the outward appearance of each bird. The tui, a hopping bird, has practically no meat or feathers from the tibiotarsus down, and the obvious place to cut and discard the leg is at this point. The parakeet, however, is a walking bird, and has muscle and feathers on the tibiotarsus; thus the obvious dividing line is one joint below that of the tui. It is suggested then that one of the operations involved in preparing these bird carcasses was to 'top and tail' them, as is done today, and the appropriate parts saved and discarded were determined by the presence of valuable feathers in the head area, and the presence of meat in the leg region.

The following interpretation is offered as a likely explanation of the observed patterns. When the tui were processed at the site the useless lower leg portion was cut off and discarded on to the midden. Then the lower beack (of the males) was sliced off with the piece of throat skin to which the white tuft of feathers was attached. Taking the mandible with the skin was for convenience of cutting only, for it was then cut from the throat skin and also thrown on to the midden. The wings were removed next, along with the sternum and rest of the shoulder girdle. This contains a large portion of the meat of the bird and could only be removed with some tearing action as well as cutting. Presumably this part was eaten on the spot before discarding, for it also found its way on to the midden. The rest of the bird which includes the drum-sticks, and the remainder of the body cavity along with intestines, was removed from the site, perhaps preserved in fat for trading or eating elsewhere. The procedure applied to the parakeet must have been very similar except that the cranium was removed for its feathers and the skin presumably taken off separately and the bones discarded on the midden. The tibiotarsus was left on the body as having more useful meat than the tui.

Landsnails

The quantities of landsnails encountered in the excavation were systematically removed from the sediments in a flotation apparatus, and were later studied in detail by Wallace (1975). The minimum numbers are given in Appendix 44. It can be seen that 14 species were recovered, 6 of which were numerically dominant: Paralaoma pumila, Phenacharopa novoseelandica, Charopa (Ptychodon) buccinella, Therasia zelandiae, Charopa (Subfectola) caputspinalae, and Charopa (Charopa) coma. Some specific comments on these are necessary and draw heavily on observations made by Climo (1972, 1975: pers.comm.) as well as the modern ecological survey (Cresswell et.al., n.d.).

P.pumila prefers dry, open, maritime situations, such as sea air slopes, and is the only species on some Cook Strait rock stacks. It commonly lives in spray-soaked grasses where other species cannot survive. P. novoseelandica and C. coma on the other hand, are invariably found in or under decaying logs under an unfired canopy. C.buccinella and T.zelandiae are both fairly tolerant, but were found only in inland locations in the modern survey.

The number of species is fairly large in Level I, and indicates close proximity to undisturbed plant cover at this time. C.coma and P, novoseelandica in particular indicate the presence of larger trees, as does Lamellidae novoseelandica which is arboreal, generally to about

2m on angiosperms. Potamopyrgus sp. is a freshwater snail, and shows that the site was close to water.

In general terms then the level I landsnail fauna strongly suggests that the Makotukutuku Valley forest spilled out of the valley entrance onto the actual coastal platform close to the site at c.1180AD. The presence of large numbers of P.pumila implies that this denser cover did not extend far from the actual mouth of the river because this species is more tolerant of exposed drier harsher coastal environments. The fauna is consistent with the site being situated in an ecotonal or marginal position near a small patch of forest around the mouth of the Makotukutuku River, with low coastal scrub, similar to quadrat 9 near Cape Palliser (in the modern survey) on either side. In this quadrat the dominant vegetation was Phormium tenax and P.cookianum, Cordyline australis, Cassinia leptophylla and Juncus effusus; in other coastal quadrats Leptospermum ericoides and L. scoparium, various Coprosma spp, Muehlenbeckia complexa, Cyperus ustulatus, and Carex sp. were also common.

The suggested patch of denser trees around the Washpool mouth may have consisted of Corynocarpus laevigatus, Myoporum laetum, Sophora tetraptera, and perhaps a few stunted individuals of species more commonly found in the mixed-broadleaf podocarp forest in the valley itself such as Melicytus ramiflorus, Knightia excelsa, Hedycarya arborea, Griselinia littoralis and perhaps even some Podocarp spp.

It is important to note that by Level II both the numbers of specimens and species have fallen dramatically. The assemblage of Level III is very similar to Level II, and both indicate substantial botanical modifications nearby. Phenacharopa novoseelandica, which will not colonise open grass or flax-land or disturbed slopes, has the ability to survive in clumps of Phormium spp. long after the heavier plant cover has disappeared. Charopa buccinella, Therasia zelandiae, and Paralaoma pumila are all fairly tolerant of fluctuating environmental conditions and their presence in the later levels is consistent with removal of forest cover. Charopa prestoni is a lone survivor of the earlier more stable environment.

In summary, the landsnail evidence suggests that dense broadleaf-podocarp forest was close at hand in c.1180AD, but that by c.1345AD significant modifications had been made to the nearby vegetation, presumably through forest clearance. This is possibly related to expansion of horticultural activity.

Miscellaneous Remains

A few fragments of insects, lizards and sea urchins were found in the midden, and minimum numbers are given in Appendix 43. It is notable that only a few Evechinus chloroticus were recovered, most of them from Level I. This fits with the general decline in numbers of marine organisms. Cuticle fragments from at least 5 species of insects were recovered and were believed to be in situ. Many modern insect remains found their way into the site and into bagged materials, especially Uresiphita polygonalis maorialis (the lupin moth), but the remains listed in Appendix 43 were of quite different appearance, and in all cases were well sealed by later layers. The time of death of these has been assessed as during the spring, from about September to January (Dugdale, 1973:pers.comm.).

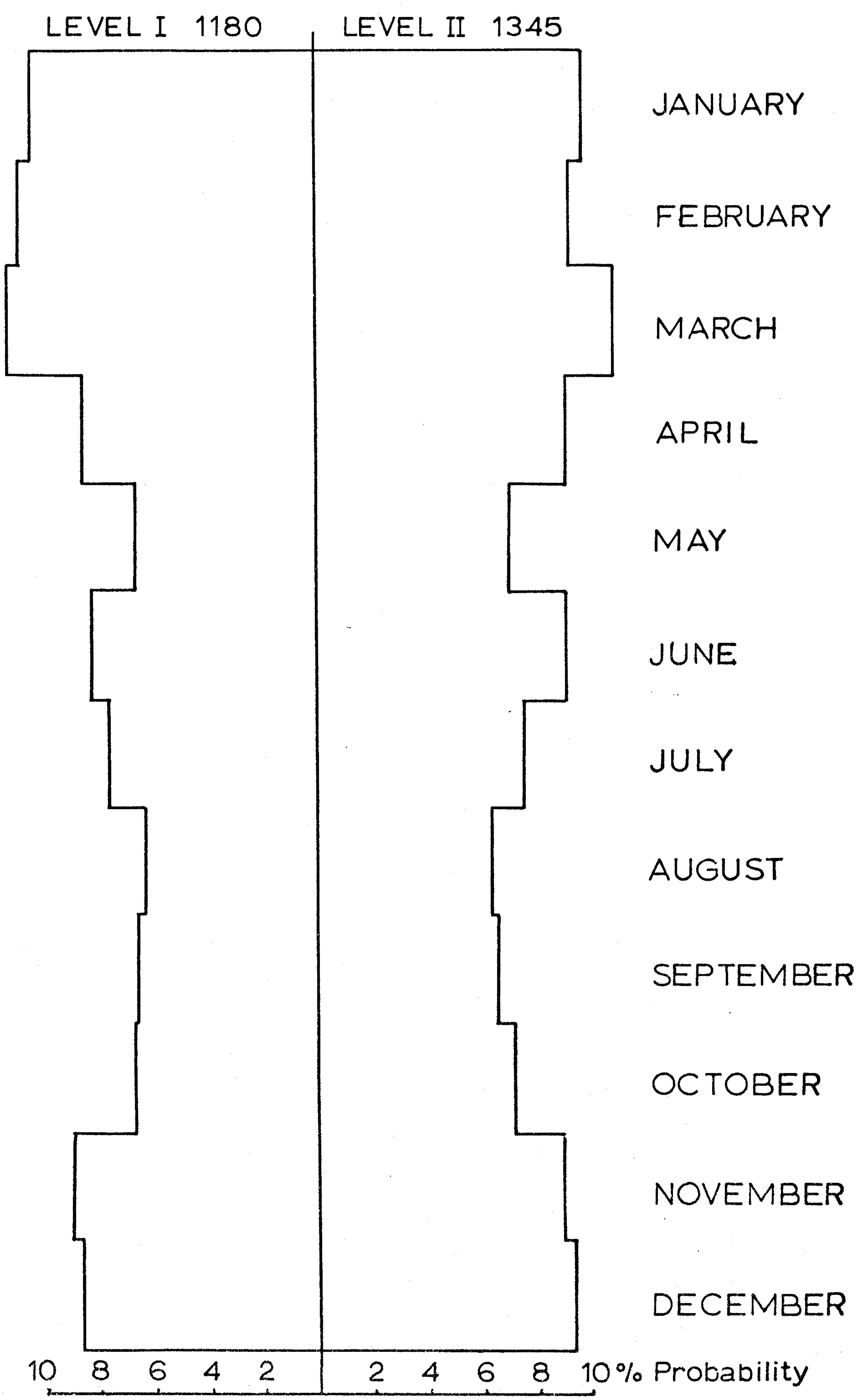
Seasonality

Assessing the season of occupation at the Washpool Midden Site is vital to the task of reconstructing the settlement pattern of the communities who exploited this region. The coastline today is bleak and stormy during winter, and there are strong indications from the protohistoric records that only summer fishing expeditions were made to Palliser Bay by people who overwintered in the main alluvial valley of the Wairarapa (see Chapter 3). Such a practice could have prevailed during the prehistoric period as well, and this would make the task of reconstructing settlement pattern from archaeological facts alone very difficult. Fortunately, evidence accumulated which suggested a somewhat different pattern. Even so, assessing seasonal occupation systematically is a very difficult procedure, particularly when winter markers are so rare (see Appendix 28).

Some individual seasonal markers should be mentioned at this point including some previously discussed (see also Appendix 43). Among these are the insect cuticles found in both Levels I and II which prove that the site was exposed if not occupied during spring and early summer (September to January). Similarly, it was argued that the seal remains probably resulted from winter exploitation of nearby bachelor herds, and that the remains of sea lion and leopard seal also indicated winter occupation. In addition, the large numbers of Rattus exulans were used to suggest autumn occupation. Again, the erect-crested penguin is known to be a winter visitor to this region. In short, there appear to be quite a number of strong signs of all-year-round occupation.

A probability model for assessing season of occupation is suggested in Appendix 28, and using the minimum numbers for fish remains (Appendix 23) combined with modern information on seasonal abundance of the different species (Appendix 27), a systematic assessment of the likely period of occupation is made for Levels I and II.

FIGURE 48 WASHPOOL SEASONALITY



The results are illustrated in Figure 48 and the raw figures may be found in Appendix 45. It can be seen that there is a remarkable similarity between Levels I and II. Both probability distributions are practically uniform from January to December, with slightly lower likelihood in August and September. The curves are in sharp contrast to seasonal occupations such as at Karitane pa (S155/1) which is also illustrated in Appendix 28. It is therefore concluded that the Washpool area saw periods of permanent settlement at the time of Levels I and II.

Stone Artefacts

Adzes

The excavations at the Washpool Midden Site produced only 4 complete adzes, three of which were from burials. Pieces of at least another 16 adzes were also found, but these were generally highly fragmented and had been used as a source of raw material for other artefacts. Nearly all the larger fragments were from Level I, and some are shown in Figures 49 and 34. For comparative purposes certain other Wairarapa adzes are figured (Figures 50, 51, 52, 53). The most common material used for adze manufacture was D'Urville Island-Nelson argillite. One adze was made from a local green siliceous greywacke (Figure 49b), and one of a highly indurated limestone (Figure 49a), perhaps from Akitio.

The variety of adze shapes is most marked. The male burial A had a Type 2B adze (Skinner, 1974a:107) under the head (Figure 34b), while the male burial F had an unusual oval cross-sectioned adze which

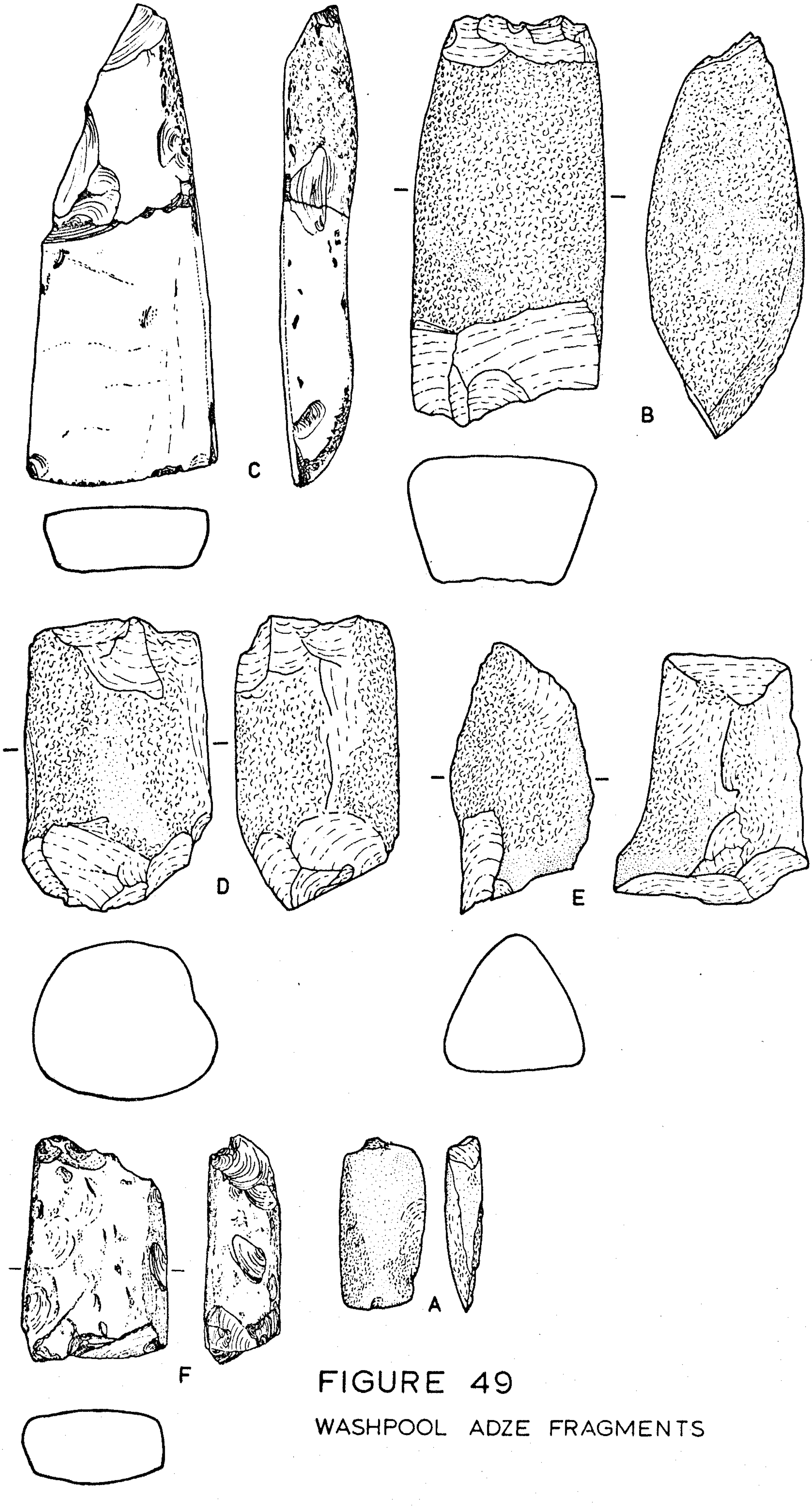


FIGURE 49

WASHPOOL ADZE FRAGMENTS

had been flaked into the burial fill (Figure 34d), as well as a Type 2A adze next to the thigh (Figure 34c). The oval adze is similar to another found in the site (Figure 49d). The female burial B possessed a large 1B adze in the grave fill (Figure 34a). The presence of the 'hogback' or Type 4 adze is attested by the butt end of one in Level I (Figure 49e).

From the form of these adzes and the flake scars, it is evident that the manufacturers were highly skilled; what is less certain is their identity. Most of the adzes in the Palliser sites, and those seen in surface collections, were made from D'Urville Island-Nelson argillite and examination of their surface characteristics indicates that two levels of technology had been applied to them. On the one hand there is the sophisticated initial workmanship involving high angle percussion, evidenced by adze blanks such as Figures 24a,d and Figure 52d, and on the other, there is the relatively crude re-shaping of damaged adzes by shallow angle percussion and hammer dressing (see for example Figures 49d, 51a). The latter techniques are more relevant to the working of greywacke, and it is suggested that an indigenous industrial tradition based on this material flourished in the Wairarapa at the same time as high quality argillite adze blanks were imported from South Island artisans. The latter adzes were hammer-dressed and polished in the Wairarapa, and when they were damaged accidentally the attempts to rejuvenate them were relatively crude. The greywacke adze industry was present at the Washpool by Level I as shown by the adze in Figure 49b. The example is very similar to many greywacke adzes from the Wairarapa, some of which are shown in Figure 50. Skinner (Skinner, 1974c:23ff) has recently argued that greywacke adzes with butt spirals

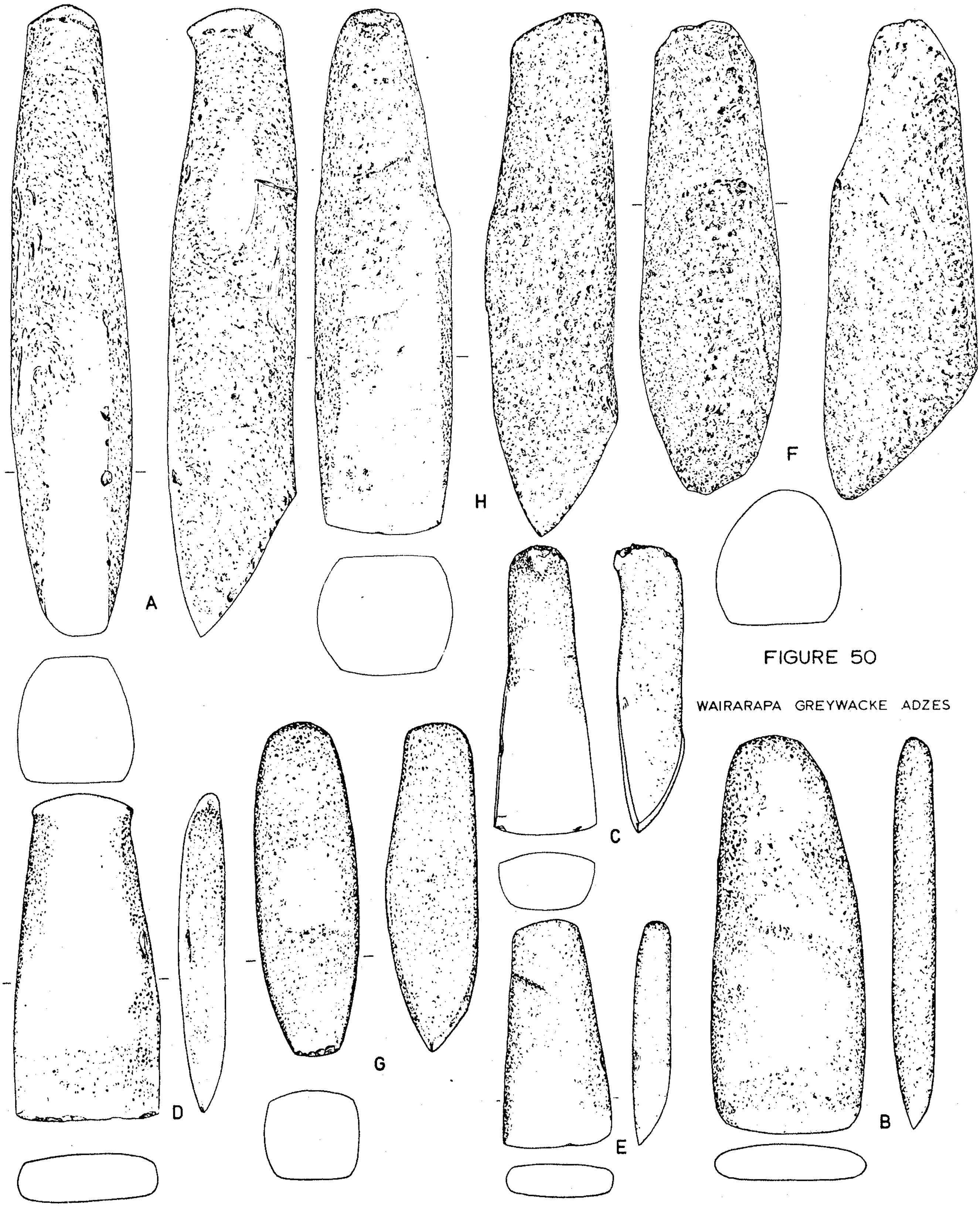


FIGURE 50

WAIRARAPA GREYWACKE ADZES

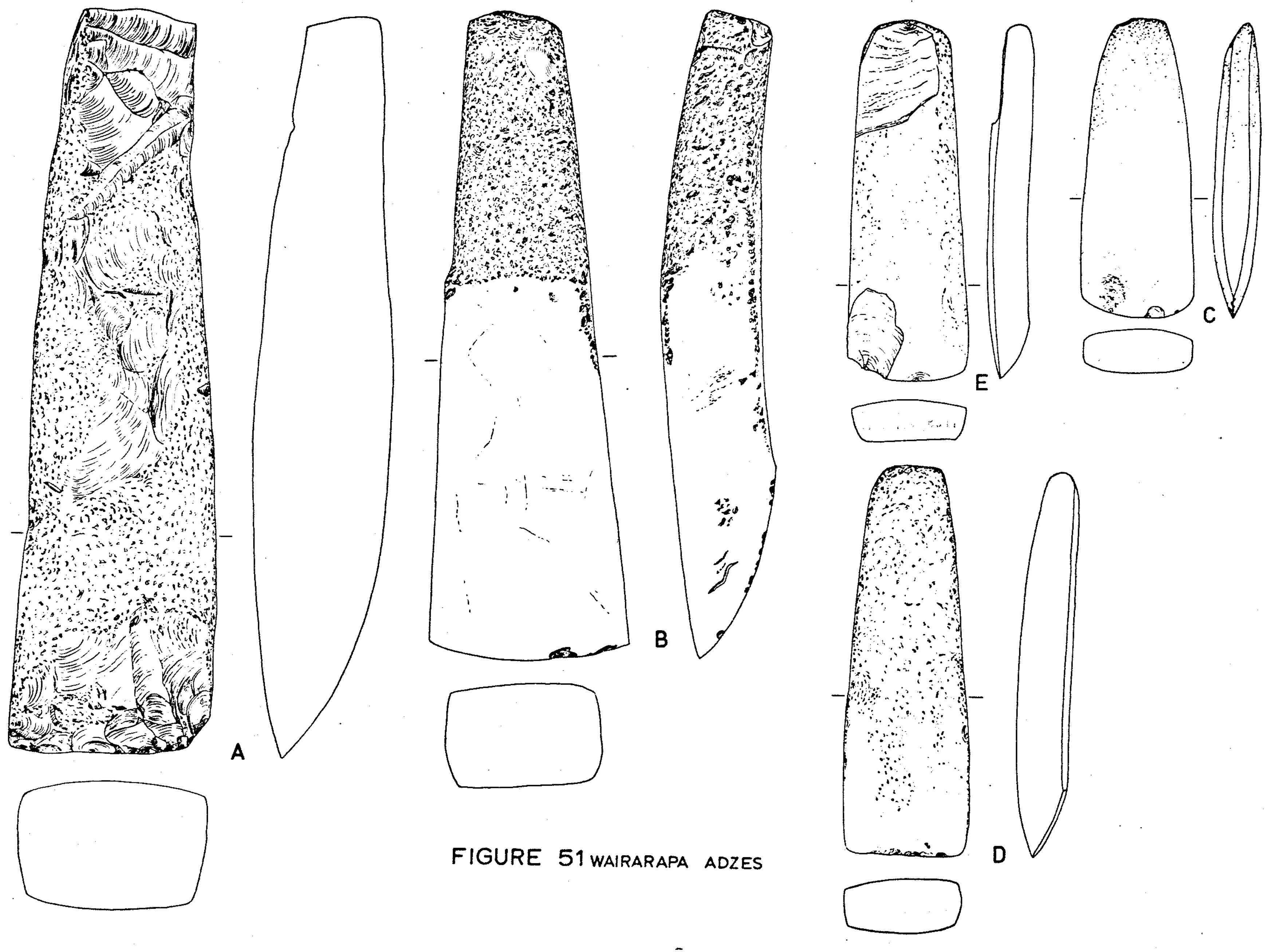


FIGURE 51 WAIRARAPA ADZES

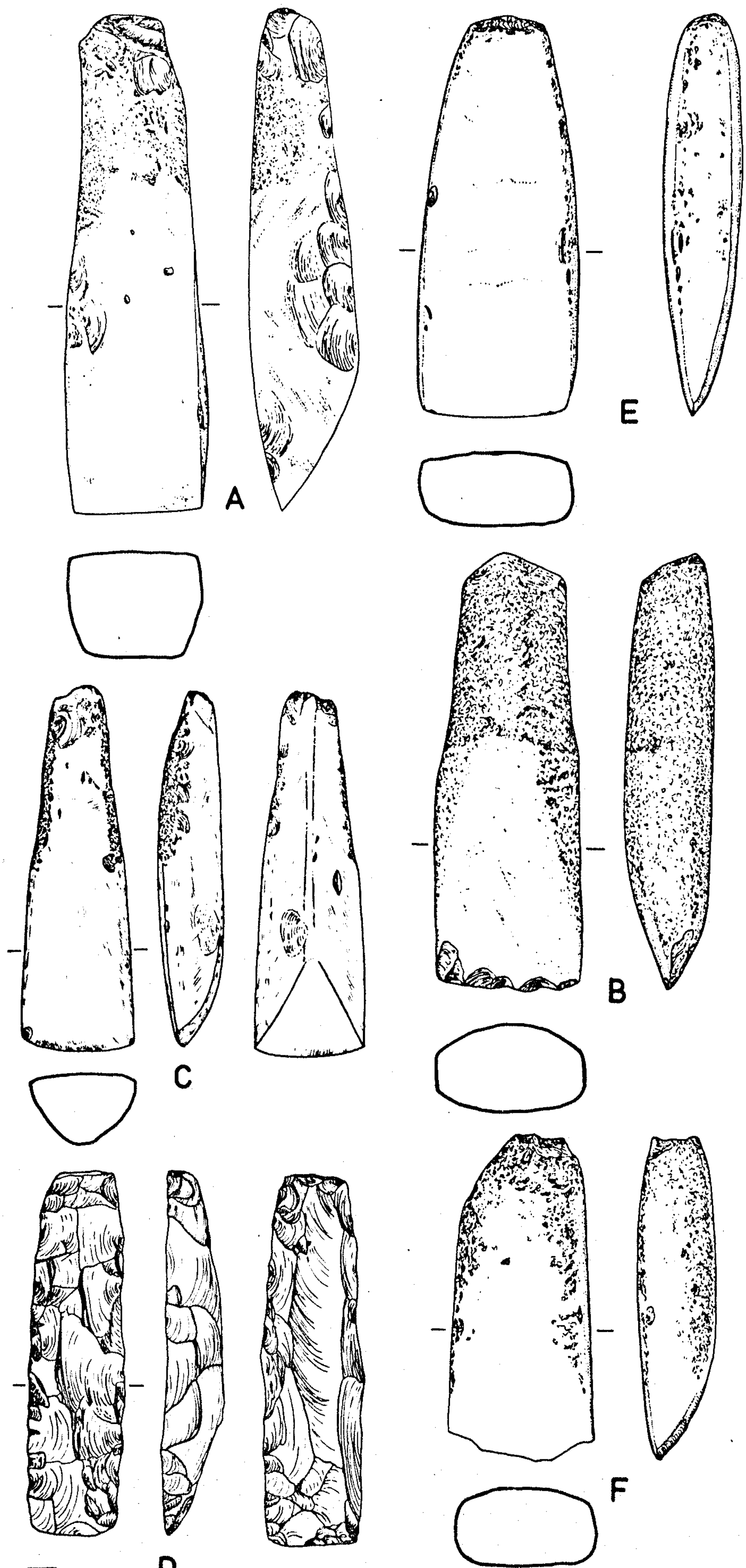


FIGURE 52 WAIRARAPA ADZES

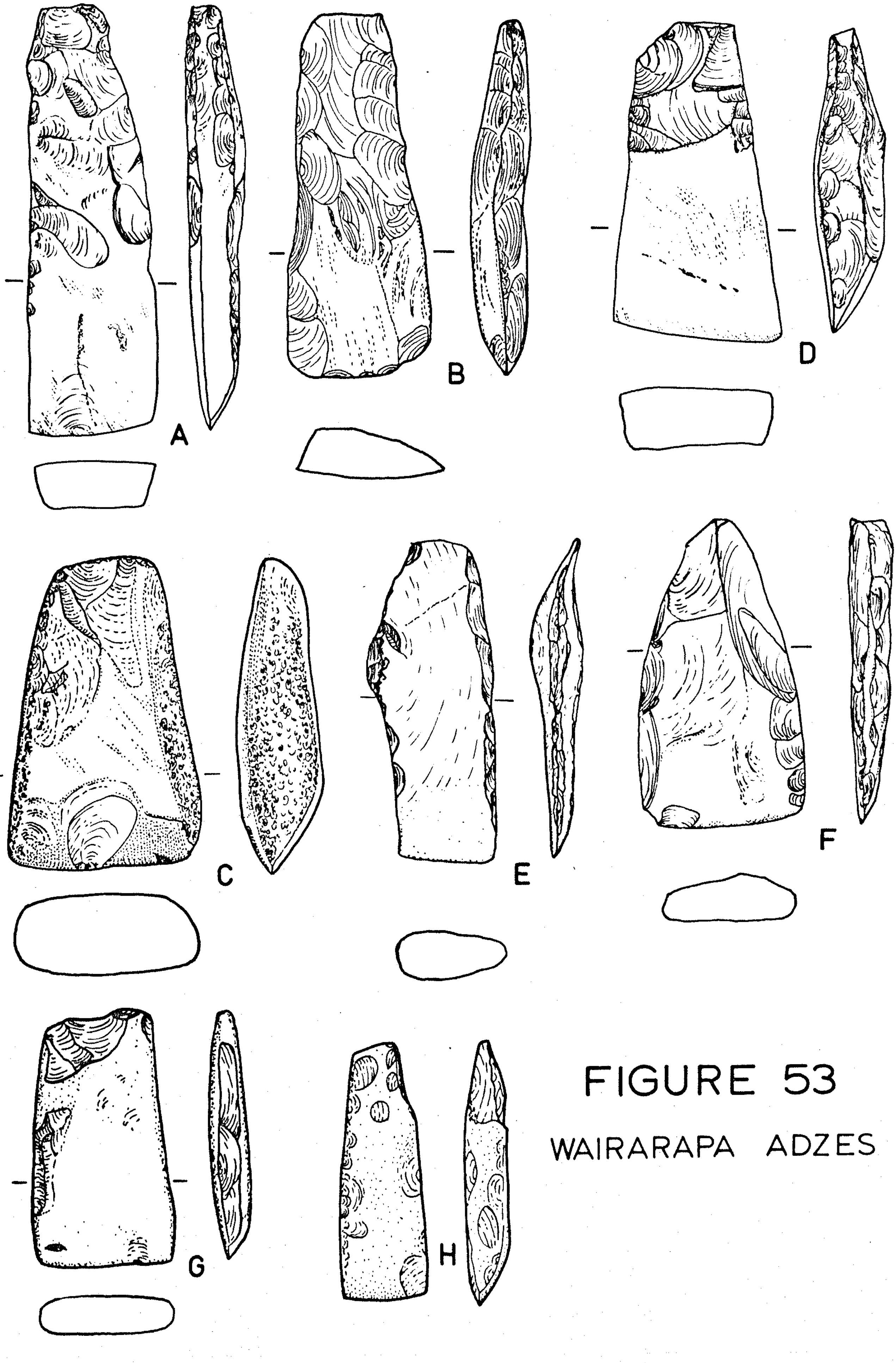


FIGURE 53

WAIRARAPA ADZES

are characteristic of the East Coast culture area. This decoration, however, is a much rarer feature than the greywacke adze type on which it appears, and which also seems to have an eastern distribution.

It is notable that the Wairarapa artisans attempted to manufacture 'hogback', as well as the Type 1B and 2A adze forms in greywacke (see Figures 50a, f; 50h; 50b, d, e, respectively). Because it would have been a difficult and lengthy operation, it suggests that these particular shapes were highly valued. The more easily made thick rectangular sectioned greywacke adzes were apparently also produced from the earliest period (Figure 49b), and they were occasionally ornamented with spirals further north (see also Figure 50g). In the process of pecking the tang, these adzes sometimes gained a small projection on the front of the poll (Figures 50a, c), a feature which should not be confused with the lugs of the horned 1A adze of the South Island and parts of Polynesia (qv.Skinner, 1974a:104). Greywacke was also expertly fashioned into other tools, and a shouldered beater (Figure 56a) was recovered from an early context at the Pararaki River mouth (Prickett, et.al., n.d.).

Industrial Tools

Practically all the industrial tools from the Washpool Midden Site relate to sawing, grinding, and drilling rather than percussion. For example, very few items could be clearly identified as hammerstones, although step fracturing occurred on a number of objects. Surface grinding tools are rendered in sandstone and more rarely in pumice, and a few of these are illustrated in Figure 20. The former were probably used for adze sharpening, and the latter which have rounded facets, may have been employed in smoothing something smaller and curved.

A very common tool type in the site was a saw or cutter made from a spall of greywacke. Generally these had only one edge with evidence of attrition, and must have been used as an abrasive saw (Figure 19). A likely function is for grooving and snapping bone and shell tabs for fish-hook manufacture; some were undoubtedly also used for grooving schist and other stone for making stone lure shanks (H.Leach, 1976:Chapter 3; see also below). It is likely that unperforated greywacke spalls, which are sometimes called ulu, and which are very common in South Canterbury sites, had a similar function (Skinner, 1974f: 120ff; see also Wilkes and Scarlett, 1967:203).

Many schist and schistose-greywacke files were also found. Some are illustrated in Figure 17 from which it can be seen that they often had a slightly narrower and more or less circular knob at one end, and except for the knob are characteristically oval in cross-section. Several of the files showed paired longitudinal grooves suggesting their manufacture from spalls by grooving and snapping. This interpretation has also been advanced by Law (1970:84), who has commented on the similarity with East Polynesian forms (qv. Suggs, 1961:119). In view of the small knob at the end, these files are likely to have been used for filing out the centre of shell and bone fish-hook tabs. Very similar tools have also been recovered at other sites in New Zealand such as the Heaphy River site (S7/1, Wilkes and Scarlett, 1967:203), Little Papanui (S164/1, Simmons, 1967:21), Harataonga Bay (N30/5, Law, 1972:93), and Ponui Island (N43/1, Nicholls, 1964:32).

Ninety eight drill points were found in the Midden Site, and this does not include many broken pieces which cannot be certainly identified as drills. They were made from chert (50), argillite (46), and rarely limestone (2). Some argillite **examples** seem to have been made from broken down adzes. H.Leach's study of drill points from the adjacent Washpool Walled Garden Site (H.Leach, 1976:Chapter 3) indicates that analysis of striations, diameters and differential wear can reveal information about the materials which were drilled. A similar study of this assemblage is regarded as an important project for the future, since the number of points is high in comparison with other sites (c.f. 61 points from N43/1 on Ponui Island, a site regarded as notable for the number of drill points, qv.Nicholls, 1964:30).

Similarly, edge analysis of the stone flakes from this site is seen as a distinct project. K.Prickett (n.d.) found that over a thousand flakes have edge damage and many of these have more than one utilized edge. Another category of artefact which could also be examined are the cores from which flake tools were struck.

Fishing Equipment

Of the stone items used for fishing, stone sinkers (Figure 54) can be interpreted as line and net weights; certainly a pumice net float from an early context at the Pararaki River Mouth (Prickett, et.al., n.d.) suggests that seine netting was practised by that community and possibly also by the occupants of the Washpool Midden Site (see Figure 54e).

The most important items, however, were stone lure shanks. Two were found in Level I and one in Level II; others were made from bone (see below). The various stone lures from the Palliser excavations, shown in Figure 55, comprise three types. Type A, triangular in cross-section, with laterally drilled attachment holes, is distinguished by two knobs on the underside of the point platform area (Figure 55a, b, e).

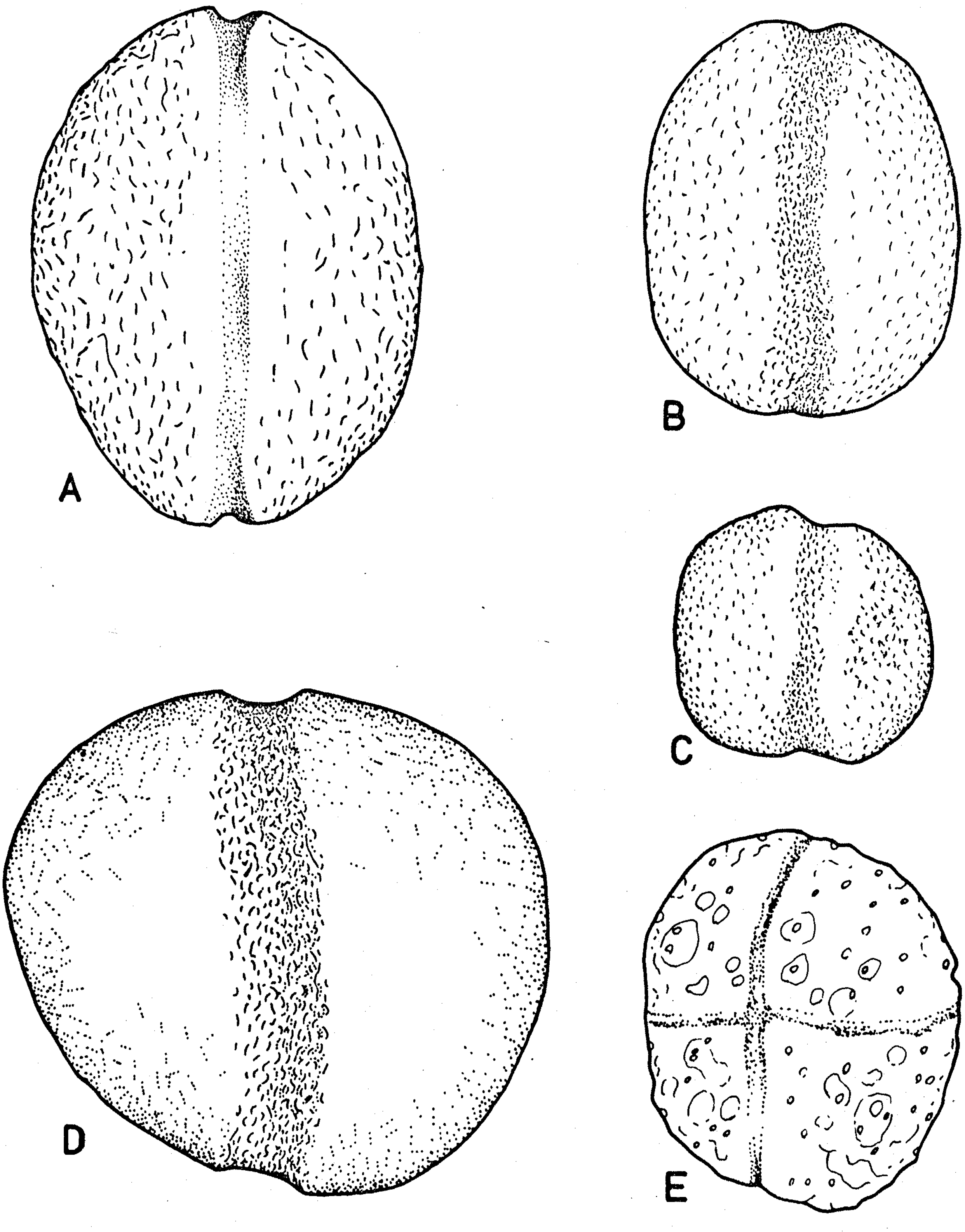


FIGURE 54 PALLISER BAY STONE FISHING GEAR

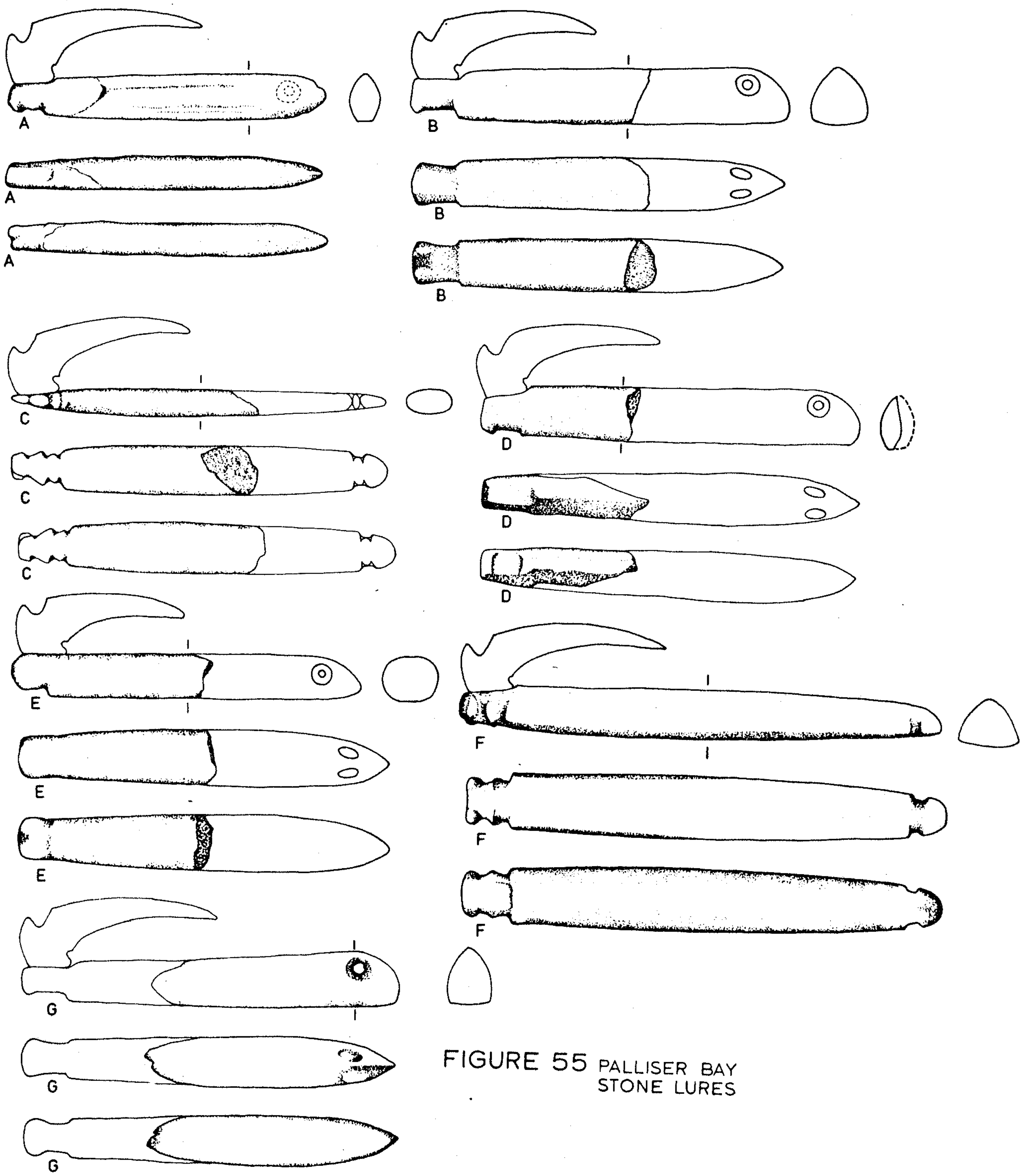


FIGURE 55 PALLISER BAY STONE LURES

Type B is very similar to A except that the underside of the point platform area is an undivided bar (Figure 55d). Type C has a laterally notched snooding arrangement, and is similarly notched beside the point platform for attachment of the hook (Figure 55c, f). It is notable that Types A and C are securely associated at the Moikau House Site dated to c.1180AD, and only Type B occurred in stone at Black Rocks, where it is there dated to c.1147AD. Thus the formal shape categories possess no chronological significance in Palliser Bay.

The distribution of the two main forms (Types A and C) is rather different, although neither appear to occur in Murihiku (Hjarno, 1967:19). The laterally notched variety (Type C), when smoothed or more worn would appear to possess a proximal and distal knob, and appears to be found far more commonly in the northern half of the North Island, and in particular around the Coromandel Peninsula and Hauraki Gulf (Law, 1972:87). One moa bone example from Harataonga Bay (N30/5) has a suggestion of two distal knobs like Type A (ibid), but this may be fortuitous. Occasionally the grooving appears to surround both ends of the northern lures (see for example Nicholls, 1964:32; Duff, 1956:201; Davidson, 1970c:25), and on others the proximal end is dorso-ventrally drilled (Davidson, 1971b:30-31). The cross section of the Type C lure varies greatly from circular to flattened oval or rectangular, and even triangular. Again, the contemporary Moikau Valley examples (Figure 55) discount any chronological basis for these differences.

Lure shanks of Type A with two distal ventral knobs are confined to the Cook Strait area. There are a number of examples at Wairau Bar, although it is not entirely clear what proportion have this embellishment. Duff remarks on the striking similarity with the poll of the horned 1A adze (Duff, 1956:210). The type is also found at the Tahunanui site in Nelson (S20/2, Millar, 1971:168), Midden 19 at Horowhenua (Adkin, 1948:Fig.13, 48), at a site near Cape Campbell (Robson, 1876); there are also several specimens in the Auckland Museum labelled 'Marlborough Sounds'. The method of manufacture of these and other stone lures in Palliser Bay was clearly by sawing, as is shown by unfinished pieces from elsewhere (Wilkes and Scarlett, 1967:201). The sawing marks are often quite visible even on finished specimens (see Robson's example 1876; also Figure 55a here). From partially completed fragments, it is possible to reconstruct the manufacturing process fairly accurately. It appears that a piece of unbaked argillite was sawn from two sides, probably using one of the greywacke cutters described earlier. Pieces discarded at this stage (see H.Leach, 1976:Chapter 3) resemble that described by Law (1970) in his study of the manufacture of files. Next, the distal end was scarfed in several directions for the lashing of the bone point. The object was then ground on all sides presumably with a piece of sandstone. The point platform requires grinding rather than sawing, and this process was probably undertaken at this stage. Finally, the snooding 'eyes' were drilled out from each side. Stone lure shanks thus required 3 tools in their manufacture: an abrasive saw, a flat grindstone, and a drill point plus suitable apparatus such as bow and string to operate it.

Miscellaneous

A series of 13 small ball-like concretions were found in Level II, within a few square metres. They have a very smooth surface, and even though they vary in size and shape, there can be no doubt

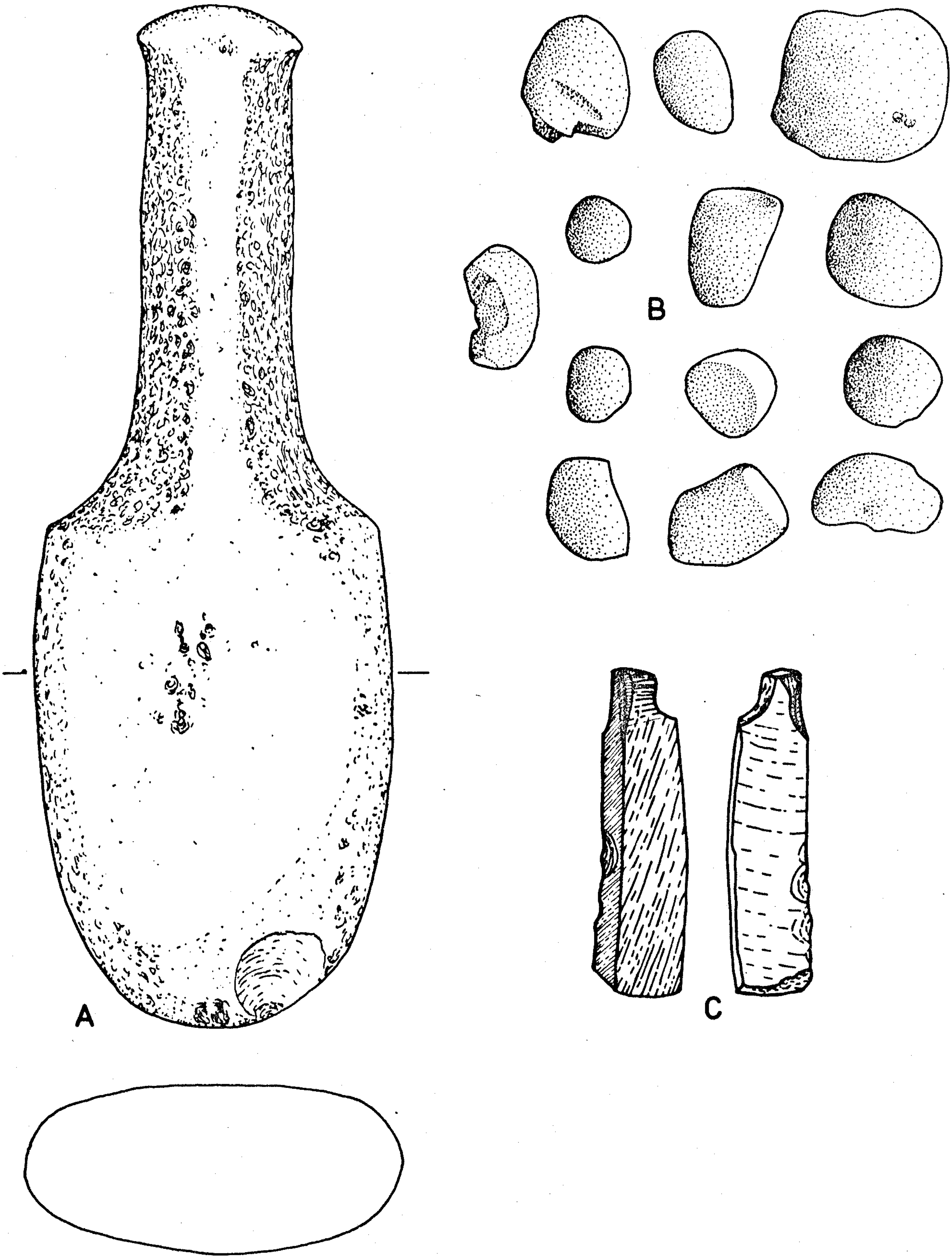


FIGURE 56 PALLISER BAY STONE ARTEFACTS

that they were deliberately collected from some as yet unknown source, perhaps for use in a game (Figure 56b). Similarly, 'curiosity' items were also found in the site and these included fossil bivalves of Cucullaea (Latriarca) hamptoni, Glycymeris (Manaia) hurupiensis, and Dosinia (Kereia) cf greyi, probably from the outcrop of the Hurupi formation 1300m north of the Washpool.

Figure 56c illustrates a small black argillite artefact from Level II which could have been fashioned as an ear pendant.

Bone Artefacts

Fishing Equipment

Fragments of 8 lure shanks in bone were found in the Washpool Midden Site (4 in each of Levels I and II). Most were oval in cross section, and one was sufficiently complete to be certain that the proximal line attachment was achieved by lateral drilling, and is thus basically similar to Type A or B of the stone shanks. Two other bone shanks, found at Black Rocks, and dated to c.1147AD, have a suggestion of the two basal knobs described earlier for the stone lures. The various fragments are illustrated in Figure 57. Most are made from moa bone, but some are definitely mammal, probably seal or whale.

As is well known, certain identification of lure points is very difficult since they are basically the same shape as those for two-piece hooks. In the Palliser hooks, however, the distinction seemed relatively clear. Points with barbs which appear to have the attachment surface rather rounded as if they fitted into a slight notch (see below) are believed to represent the two-piece bait hooks. Moreover, when placed on a lure platform there was practically no gap between the point and

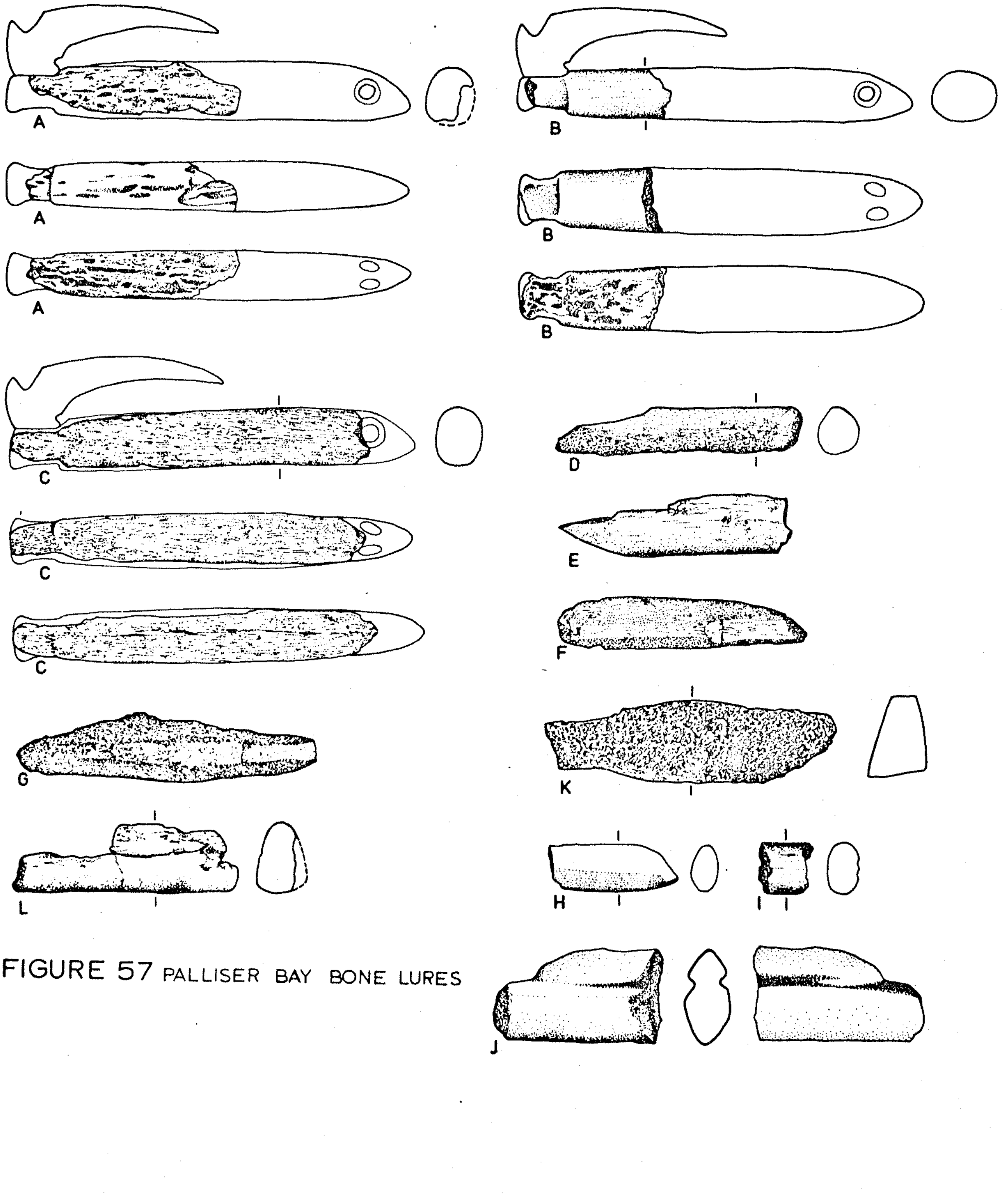


FIGURE 57 PALLISER BAY BONE LURES

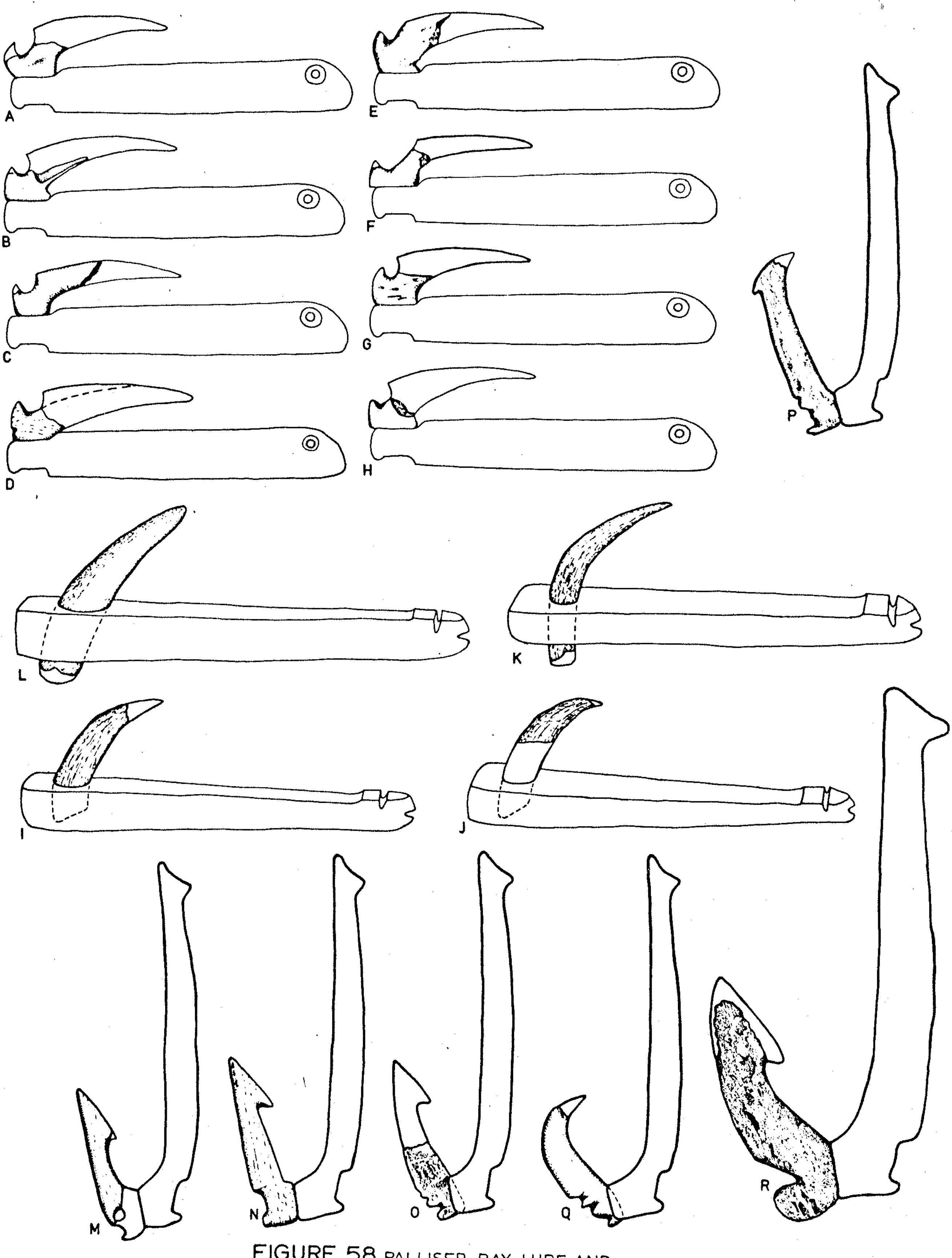


FIGURE 58 PALLISER BAY LURE AND TWO-PIECE HOOK POINTS

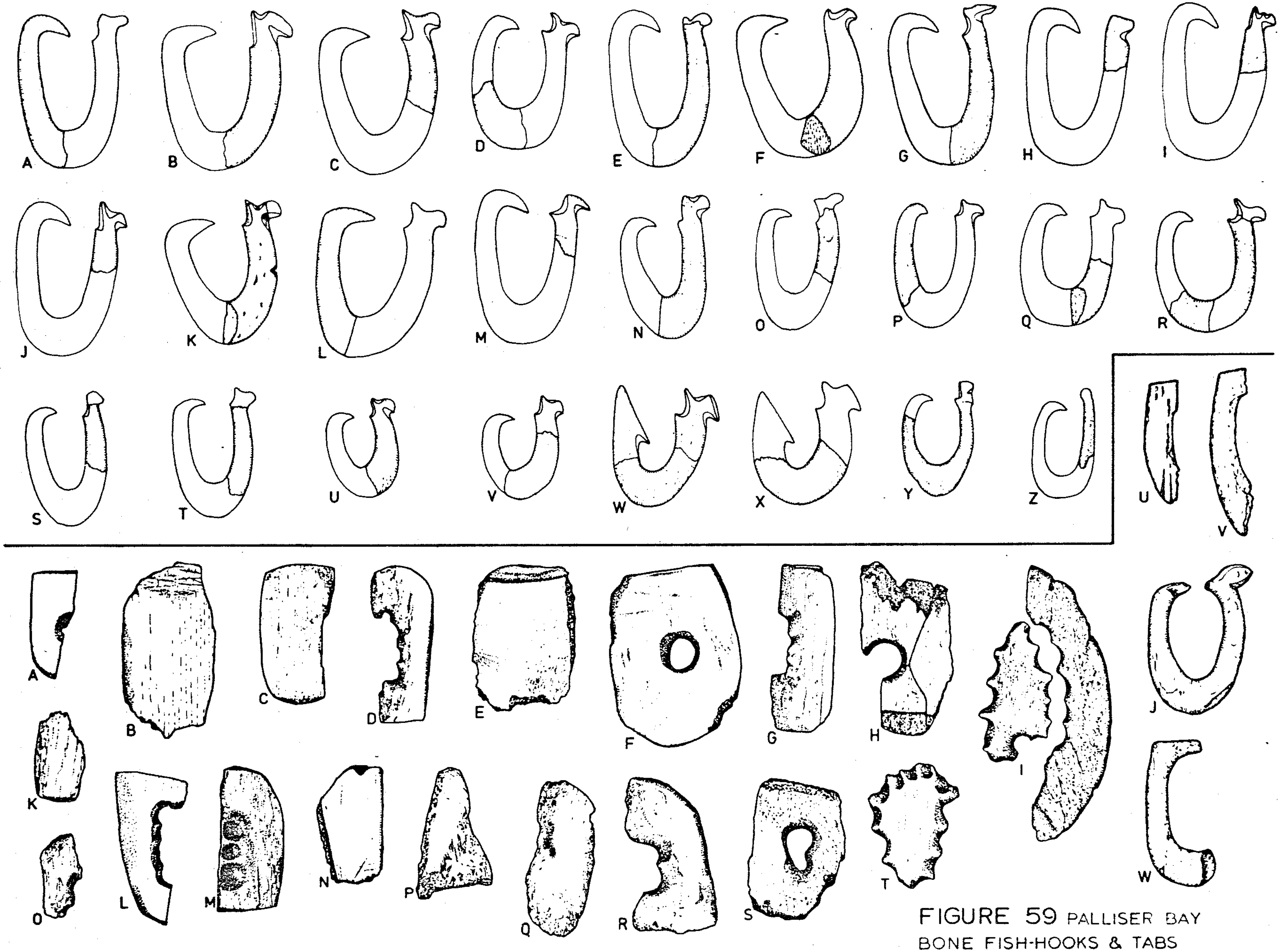


FIGURE 59 PALLISER BAY
BONE FISH-HOOKS & TABS

shank. There remained a selection of bone points which left a substantial gap, and also possessed a very flat attachment area, such as that required by the stone and bone lure shanks. Nearly all were made from moa bone and are illustrated in Figure 58. They are interpreted as lure points and apparently are of a type not known at Wairau Bar, where the identified examples are uni- or bi-perforate points (Duff, 1956:204ff). None is known from Murihiku, where again, perforated points occur (Hjarno, 1967:20), as well as a number of scarfed points (op.cit.: 21, 22). These may derive from two piece jabbing hooks. The uni-perforate point is apparently the common type further north on the Coromandel Peninsula (Law, 1972:87), and a single example is also known made from shell (ibid). In contrast, the Palliser lure points are identical to those found at Horowhenua (Adkin, 1948: Figures 24, 26) and Tahunanui (S20/2, Millar, 1971: Figure 2, items 857, 1003, and perhaps 620), although Millar does not interpret them as lure points.

A few points from two piece bait or jabbing hooks were recovered (6 from Level I, 2 from Level II, and 1 from Level III), and these appear in Figure 58. Most are made from moa bone, although the item in Figure 58o is made from a canid mandible. Four of the points are simple legs without attachment grooves and are interpreted as points for barracouta lures (Figure 58i-l). One or two call for individual comment: that in Figure 58m is unusual in that it has a perforation for attachment. Several of these hooks (including drilled shanks) have been found at Tahunanui (S20/2, Millar, 1971:165, 167), and probably give evidence that the breakage of one piece rotating hooks at the base was counteracted by lashing the shank and point together. But for the perforations, items 629 and 98 illustrated by Millar (op.cit.:165, 167) would fit together to form a perfectly ordinary one piece rotating hook.

The strongly barbed and very straight hook in Figure 58n is practically identical to one figured from Horowhenua (Adkin, 1948:Figure 25). The point in Figure 58p is unusual with an external incurving barb commonly referred to as the 'Oruarangi Point', and is close to the Oruarangi Type 2B (Shawcross and Terrell, 1966:417). This hook is made of moa bone and occurred in Level II (c.1345AD). Others found are at Horowhenua (Adkin, 1948:Figure 23), and the Pohutakawa Flaking Floor (N40/2, Green, 1963b:64). A list of these hooks from late North Island sites includes Oruarangi, Paterangi, Kiri Island, and Kopuarahi (Green and Green, 1963:31; see also Murdock, 1963:71; and Green, 1970:29). A few points with external barbs are known in the South Island (for example see Hjarno, 1967:29), but only a small and probably late collection from a cave in Jackson's Bay (S97/2, Otago Museum) demonstrates the characteristic external curvature of the Oruarangi Point. None is known from Wairau Bar (Duff, 1956:213). The Washpool Midden specimen is therefore amongst the earliest known examples of the hook, and suggests that it possessed a functional advantage which ensured its survival for at least 500 years. Other examples are known from a site at Paremata (N160/50), and may belong to early contexts (Green, 1975: pers. comm.). It is possible that the form was in use before the settlement of New Zealand, since a similar example has been recovered from the early Halawa Dune Site on Molokai in the Hawaiian chain (Kirch, 1971: Figure 4a, 5th from left in top row). Finally, a very large barbed two-piece hook point was found in Level I (Figure 58r) which has no parallel in New Zealand. It was made from the tibiotarsus of a medium sized moa, either Euryapteryx geranoides or Pachyornis mappini (Scarlett, 1973: pers.comm.). Although the point is badly decomposed, two scarfs were clearly visible proving the former existence of a large internal barb. A nearly identical hook is figured by Wallace and Wallace (1969: Figure 9) from the Pinao Bay site on Hawaii.

Various fragments of completed and partially made one piece fish hooks from the Washpool Midden Site are shown in Figure 59. They indicate that the snooding arrangement on hooks of this type was very uniform and was usually made by cutting 3 scarfs, leaving at least 2 and sometimes 3 raised projections. Only two types of one-piece hook were recovered. Type A has a simple incurved point on a strongly U-shaped hook with near circular cross section of the leg and shank; these are usually made from moa bone, and are found in both Levels I and II. One example from Black Rocks had a shank notch probably for attaching the bait. Type B in contrast possesses an internal barb, has a flat cross section, and is considerably wider through the base than the first type. Apart from the barb the hook closely resembles the shell one piece hooks discussed below. The two examples of these hooks are both from Level II and again are made from moa bone. The form seems to be unique to the site, while the first type is widespread in New Zealand. As can be seen from the tabs and incomplete hooks (Figure 59), a particular manufacturing procedure was followed. Nearly all the pieces are of moa bone and several of these show that the first step involved making a rough tab shape with a chopping action, presumably using a sharp stone adze on relatively fresh bone. Next, the edges of the tabs were ground to a rounded shape at one end, and squared off at the other. The rounded end later became the U base part of the hook, and the squared area evolved into the strongly incurved leg point. The third step was drilling out the centre, and depending on the hook size, involved either a single hole or as many as a dozen. Next, the fish hook blank was smoothed, presumably with the schist files described earlier, and finally the delicate snood scarfs were sawn. The greywacke cutters would have been suitable for this. From illustrations in Law (1972: 86) it would seem that this distinctive tab shaping was not confined to Palliser Bay.

Birdspears and Harpoons

Fragments of the birdspears were fairly common in Palliser Bay, and are illustrated in Figure 60. Several different kinds appear to be present and are classified as follows: Type A, usually made of mammal bone (some human) is solid oval in cross section, and appears to have had 4 barbs. Type B is also solid and oval in section, and again with 4 barbs, is embellished with notches. Again mammal bone is the preferred material. Type C is crescentic in cross section and has only 3 barbs. This type is nearly always made from bird limb bones. Type D is a shorter version of Type C and has more than 3 barbs closely spaced. Type E, usually made from mammal bones, has 5 or 6 barbs, and is considerably larger and thicker, with a flattened edge away from the barbs. Finally Type F, made from mammal bone, is oval in cross section, and possesses two rows of from 5 to 8 barbs.

This is a sizeable collection of birdspears from a single site. As Duff has noted (1956:224), these artefacts are not only confined to New Zealand and the Chathams, but are generally rare in archaeological sites. They occur more commonly late in the New Zealand sequence, sometimes in highly decorated form. Examples with barbs on both sides are even rarer, but have been recorded from the Chathams (see Duff, 1956:226, E.138.1171), and Horowhenua (Adkin, 1948: Figure 56). An unusual form with alternating barbs on both sides is recorded from Little Papanui (S164/1, Simmons, 1967:27). There are also several

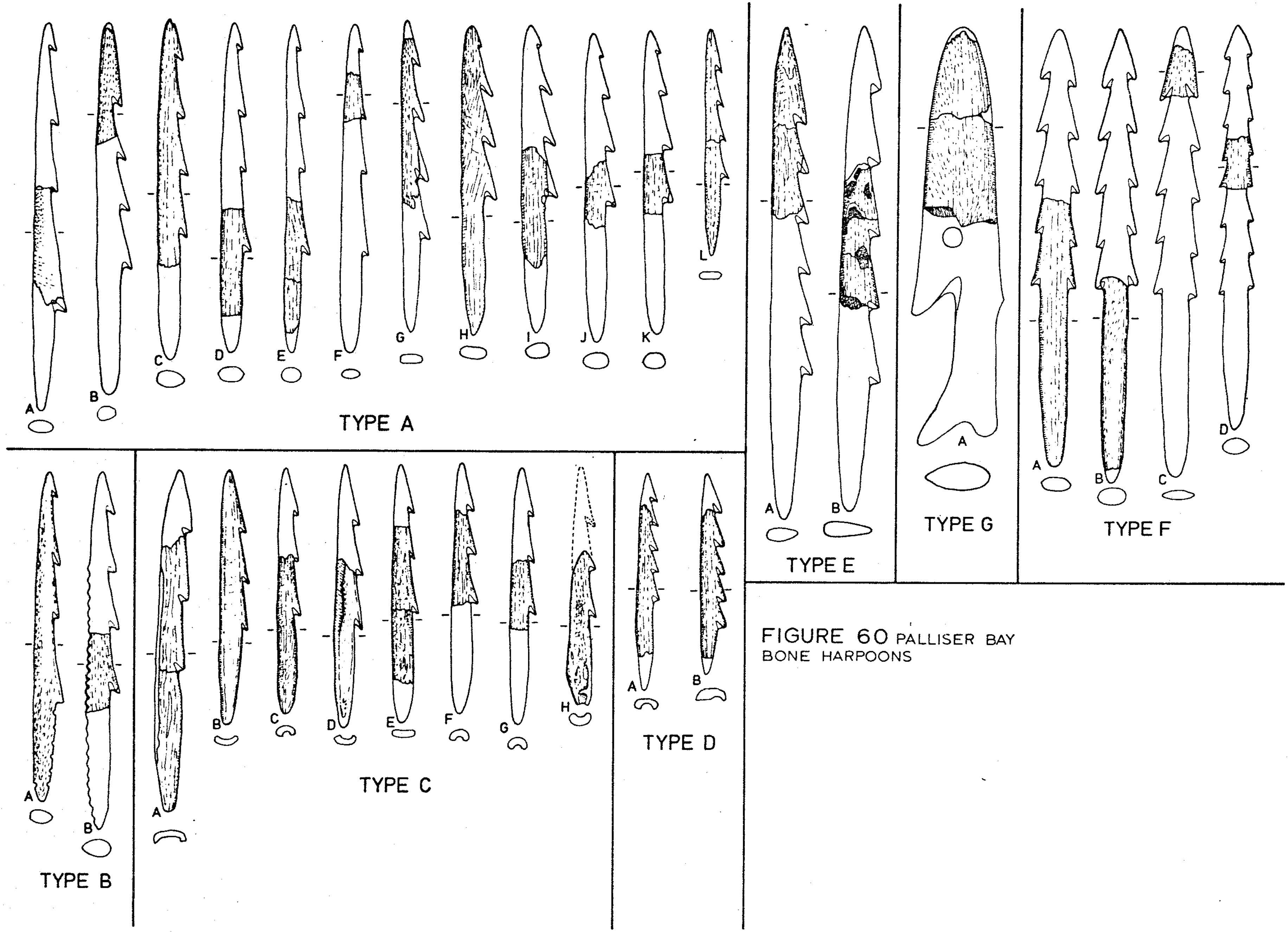


FIGURE 60 PALLISER BAY
BONE HARPOONS

in a collection of birdspears from Oruarangi, made from whalebone (Skinner, 1974g:145). The one birdspear recovered at Wairau Bar (Duff, 1956:226, item 1463) is unusual in possessing only 2 barbs on a long shaft. Other examples with a single row of barbs are recorded from the Chathams (op.cit.: 226), Monck's Cave (idem), Horowhenua (Adkin, 1948:Figures 53,54,55), False Island (Lockerbie, 1959:90), Shag Point (Trotter, 1970:477), and the Rakautara Cave Site (S49/3, Eyles, 1975:134, 138). Simmons (1967:48) lists birdspears from the additional South Island sites of Tarewai Point (13), Murdering Beach (5), Long Beach (64), Kaikai's Beach (80), Cannibal Bay (25), Sandfly Bay (20), Shag River (6), and Little Papanui top layers (33) and bottom layers (21); elsewhere Little Papanui is said to have 21 from the top layers and 10 from the early layers (Simmons, 1967:27-30). In the North Island there is a single example from Harataonga Bay (N30/5, Law, 1972:88), and one from Whiritoa (N53/4, Crosby, 1963:48). In late North Island sites 1 is known from Kopuarahi, 2 from Kiri Island, 4 from Paterangi, and 6 from Oruarangi (Green and Green, 1963:32; see also Shawcross and Terrell, 1966:426). A few early examples are notched, presumably for embellishment (Figure 60: Type Ba, b) such as the Whiritoa example (Davidson, 1974: pers.comm.), and one at Shag Point (Trotter, 1970: Figure 4.19).

Skinner (1974g:138) believed these points were only loosely secured into a wooden spear, and had a hand-held cord fastened to the bone point on a notched area of the base. This view is based on a description by Heaphy (1879:35) of bird spearing in 1839 (see also Duff, 1956:225). Although this ingenious method might avoid breakage of the point, the presence of basal notches for this purpose appears to be very rare. In fact many are far too smooth in this area for successful attachment of cordage. Only one of the Washpool examples is grooved in this fashion (Figure 60: Type Ba); another is recorded from the Chathams (Duff, 1956:226). This method was commonly employed throughout the Little Papanui sequence (Simmons, 1967:27, 29). Skinner's point is important, because while bone has considerable strength in both tension, torsion and compression, it has rather low beam strength. Consequently, bending forces applied to bone spear points are liable to result in breakage. This can be partly overcome in two ways: firstly by converting the forces (of a fluttering bird) to tension in the manner suggested by Skinner, and secondly by altering the cross section of the point, since beam strength varies greatly with shape. The crescentic section of Types C and D above is the most suitable. In addition, the use of very fresh bone would ensure somewhat greater beam strength since collagen fibres add elasticity to the bone.

The end of what is believed to be a female harpoon point was found in Level I (Figure 60: Type Ga). This artefact, well established as an archaic form in New Zealand, is also found in several parts of tropical Polynesia, especially the Marquesas (Skinner, 1974g). The function of these points has never been satisfactorily resolved, although a case can be made for their use in the capture of porpoises and dolphins which are fairly common in the Marquesas as well as New Zealand. Seals, on the other hand, are not normally found in tropical waters. Furthermore the remains of porpoises and small whales occur in early levels of archaeological sites in the Marquesas (Sinoto, 1970:107). This association of harpoons and porpoises has also been noted by Kirch (1973:33).

Tattooing Chisels

Two tattooing chisels were found in Level II (c.1345AD), both made from bird bone (see Figure 61). Phillipps in his study of Maori tattooing chisels (1948) identified 6 different types of chisel, and the two from the Washpool belong to his Type 4, with 2 notches at the proximal end for hafting. These formal categories would appear to be all fairly well represented in New Zealand archaeological collections, although what are assumed to be prototypes from the Marquesas are slightly different. Three pearl shell examples and 2 bone chisels were found at the Hane site, apparently from both early and late levels (Sinoto and Kellum, 1965: Table 1; Sinoto, 1966:Figure 4b; 1970:107).

Phillipps noted that the tattooing chisels with a centrally drilled proximal hole were exclusively from North Auckland (1948:115), but archaeological finds since 1948 show that while they are dominant in northern areas, they also occur in the South Island. The single example from Harataonga Bay (N30/5, Law, 1972:Figure 22), another from Hot Water Beach (N44/69, Leahy, 1974:43), the 4 from Houhora (Rowe, 1969:Plate 18), and 1 from the Motutapu Undefended Site (N38/37, Davidson, 1970a:48) are all square on the proximal end with a central perforation. The two most convincing Wairau Bar specimens (Duff, 1956: Figure 58 items 1469, 1222), are identical to these northern examples. In their paper on late artefact forms, Green and Green (1963:32) list tattooing chisels from Oruarangi (75), Paterangi (14), Kiri Island (7), and Kopuarahi (3). Some of the Paterangi examples are illustrated by Shawcross and Terrell (1966:426), and most appear to be the proximal notched variety, or Type 4, like the Palliser Bay examples. Other examples similar to the Washpool ones are from Horowhenua (Adkin, 1948: Figure 48) and Shag River in the South Island (Skinner, 1924;

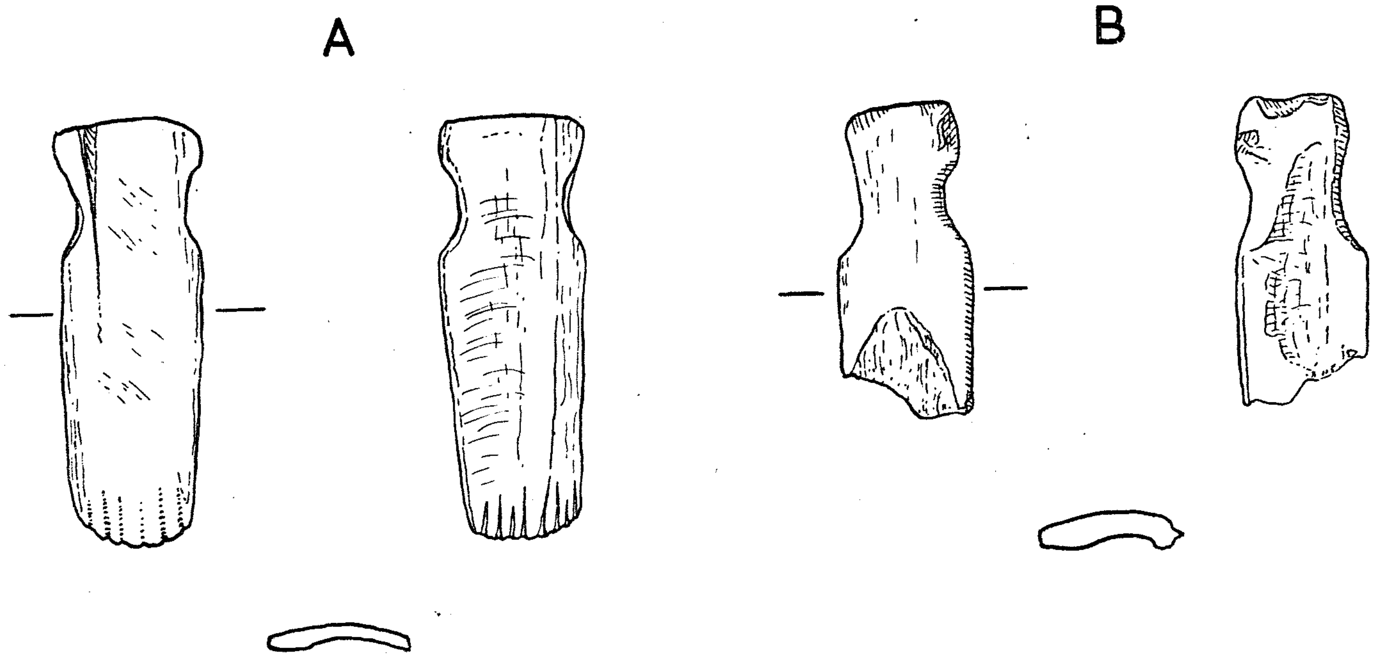


FIGURE 61 WASHPOOL
TATOOING CHISELS

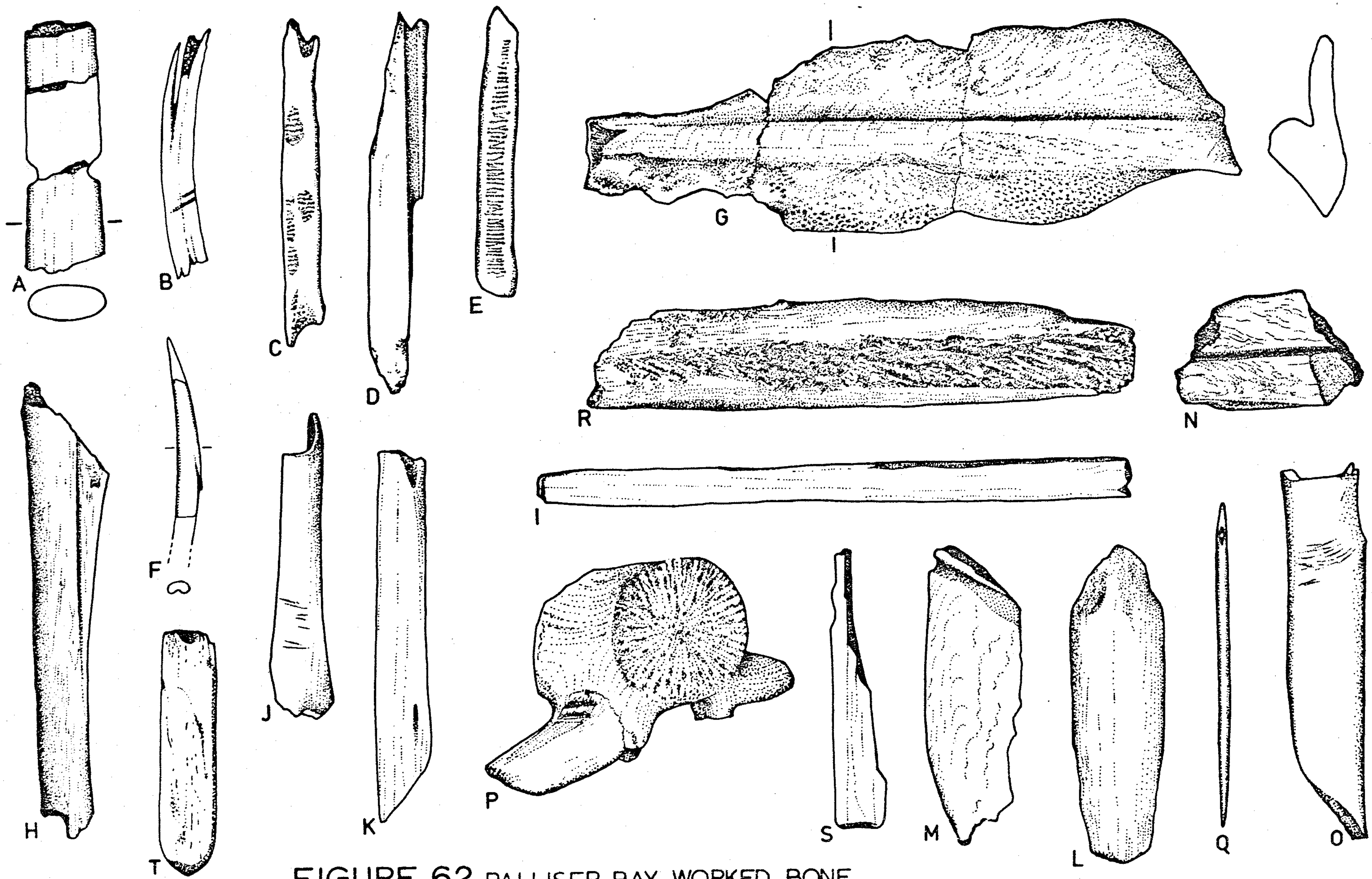


FIGURE 62 PALLISER BAY WORKED BONE

Teviotdale, 1924:Figure 10). A range of tattooing chisels has been found in a number of other South Island sites at Shag Point (Trotter, 1970:Figure 4.17), Rakautara (S49/3, Eyles, 1975:139), and several from the upper layers only of Little Papanui (S164/1, Simmons, 1967: 53, 57; 1973:Table 12). Simmons has also listed several chisel finds from Murihiku sites: Long Beach (5), Kaikai's Beach (5), Murdering Beach (5), Tarewai Point (3), Pahia (3), Onepoto (4), Purakanui (3), Moeraki (2), False Island (2), and Papanui Inlet (3), all of which may be late sites.

Miscellaneous

Many pieces of worked bone were found with did not belong to any formal category, or were artefacts in the process of manufacture. Some of these are illustrated in Figure 62. It will be noticed that many show evidence of abrasive sawing, and the ubiquitous greywacke cutter is suggested as one of the basic tools in bone working. Of particular importance are lumbar vertebrae of the pilot whale (Globicephala malaena) shown in Figure 62p. The transverse processes both ventrally and dorsally show adze marks, and similar but less clear signs were seen on other remains of these animals. This suggests that the difficult task of butchering these animals was undertaken with a sharp adze. Once the animal had been skinned the two main back muscles could be fairly easily removed with an adze. These are the large back steaks of erector-spinae (sacrospinalis) and the tender undercut steaks of the psoas muscles.

Shell Artefacts

Fishing Equipment

Fragments belonging to 19 one piece shell fish hooks (Figure 63) and a further 16 in the process of manufacture (Figure 64) were found in the Palliser excavations. All but 11 of these artefacts came from the Washpool Midden Site, while the remainder were from the Black Rocks middens. What species of shell was used is uncertain, indeed several may have been tried. The fragments are fairly nacreous and Haliotis australis is strongly suspected, although Paphies sp. and Cookia sulcata are possibilities. The fish hooks are of very uniform size and design with moderately incurved points. They are somewhat thicker and rounder in shape than bone one piece hooks. Apparently they were made by drilling a single hole in a rough tab and then completing the hook with a file. This is unlike the process of bone hook manufacture described earlier. Of the more complete hooks, 7 came from Level I, and 6 from Level II; of the incomplete fragments 10 were from Level I and only 1 from Level II. No similar finds were made in Level III. The Black Rocks pieces all derive from the Crescent Midden (BR4) dated to 1269AD ± 52 and 1276AD ± 52. Apparently, shell fish hooks were present in Palliser Bay from c.1180AD through to c.1345AD, and illustrate conservatism in manufacture throughout this time.

The distribution of shell fish hooks in New Zealand requires some comment. Hjarno's study of Murihiku fish hooks (1967) fails to mention a single example, and Duff comments that "the Wairau hooks were fashioned from rounded tabs of bone and ivory" (1956:216). It appears that with the exception of a single small example from Tahunanui (S20/2) made probably from the operculum of Neothais scalaris (Millar, 1971:167), and the large number at the Rakautara Cave near Kaikoura (S49/3),qv. Eyles (1975), shell fish hooks are very rare in the South Island. At the latter site, Eyles (op.cit.: 136-8) mentions Perna canaliculus, Cookia sulcata, Lunella smaragda and Haliotis spp. as having been used, although he does not comment on how or by whom the difficult task of identifying the material as to species was accomplished.

In the North Island, shell hooks are less rare. At the Pohutakawa Flaking Floor (N40/2) at Opito on the Coromandel at least 4 shanks from two piece hooks, and 2 one piece hooks have been recovered made from Cookia sulcata and apparently associated with Archaic adzes and moa bone (Murdock, and Jolly, 1967:160, Plate 1; Jolly and Murdock, 1973:66, 69). The Whiritoa Midden (N53/4) has also produced a few pieces of one piece hooks made from Cookia sulcata (Crosby, 1963:47). At Hot Water Beach (N44/69), again on the Coromandel, a rather thin shank of a one piece hook made from Hyridella sp. was found (Leahy, 1974:37, 38, 40), and the level in which it occurred is dated to about 1500AD. A unique uniperforate lure point made of shell has been recovered from the Harataonga Bay Western Midden (N30/5), and is dated to about 1250AD (see Appendix 20; also Law, 1972:87). Rowland has argued recently that in the Coromandel region the earliest hooks are commonly manufactured from moa bone, and only later in shell (Rowland, n.d.:11-12); however there appears to be only slight evidence for this. On the contrary it might be expected that the first settlers in New Zealand would have attempted to copy the shell fish hooks, so entrenched in the cultural assemblages of tropical Polynesia, in local shell. Green has raised the interesting point that in the process of conversion from pearl shell to moa bone, these early inhabitants were required to produce counterparts with more substantial bases to offset the inferior material (Green, 1974:26).

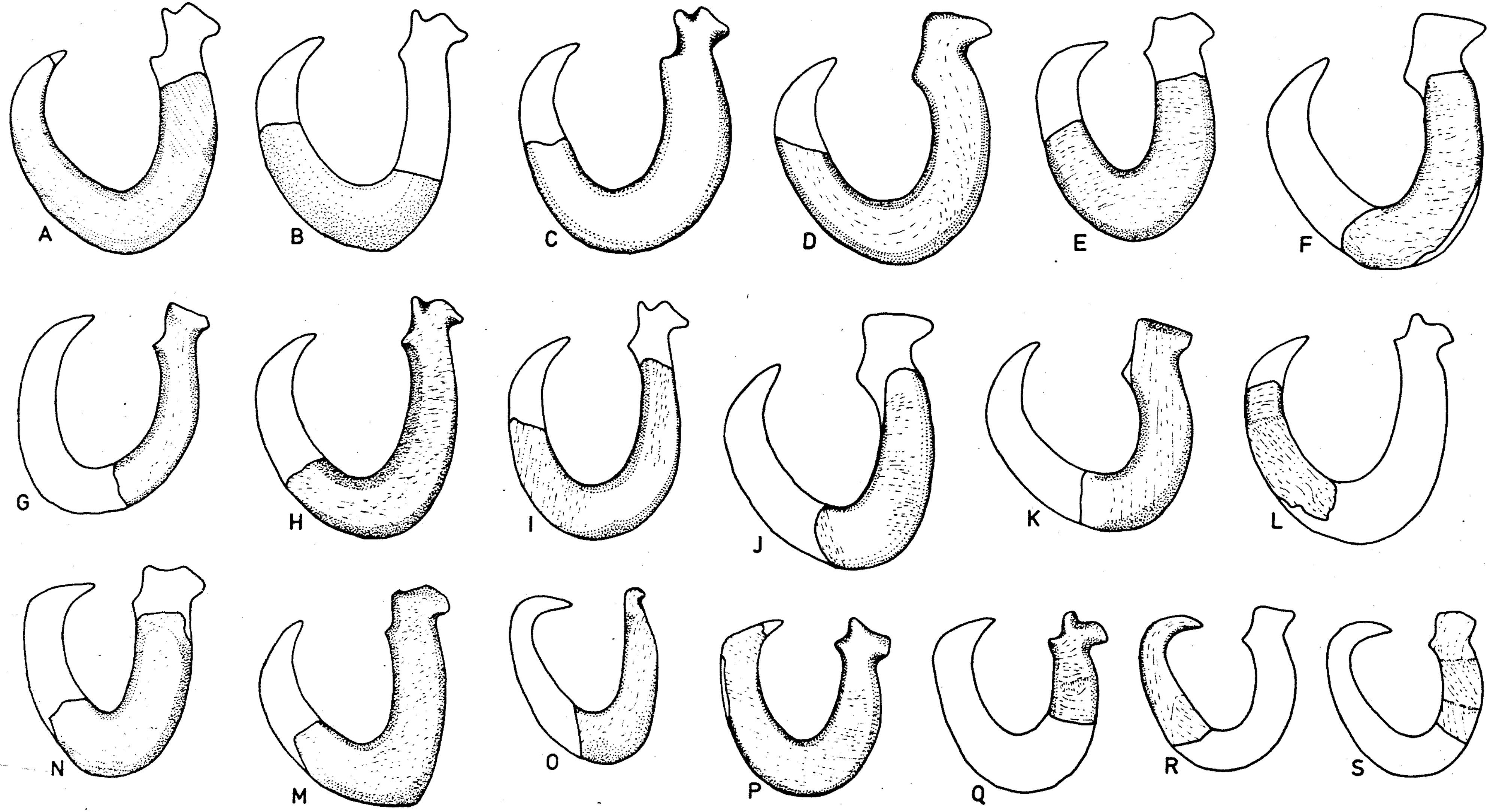


FIGURE 63 PALLISER BAY
SHELL FISH-HOOKS

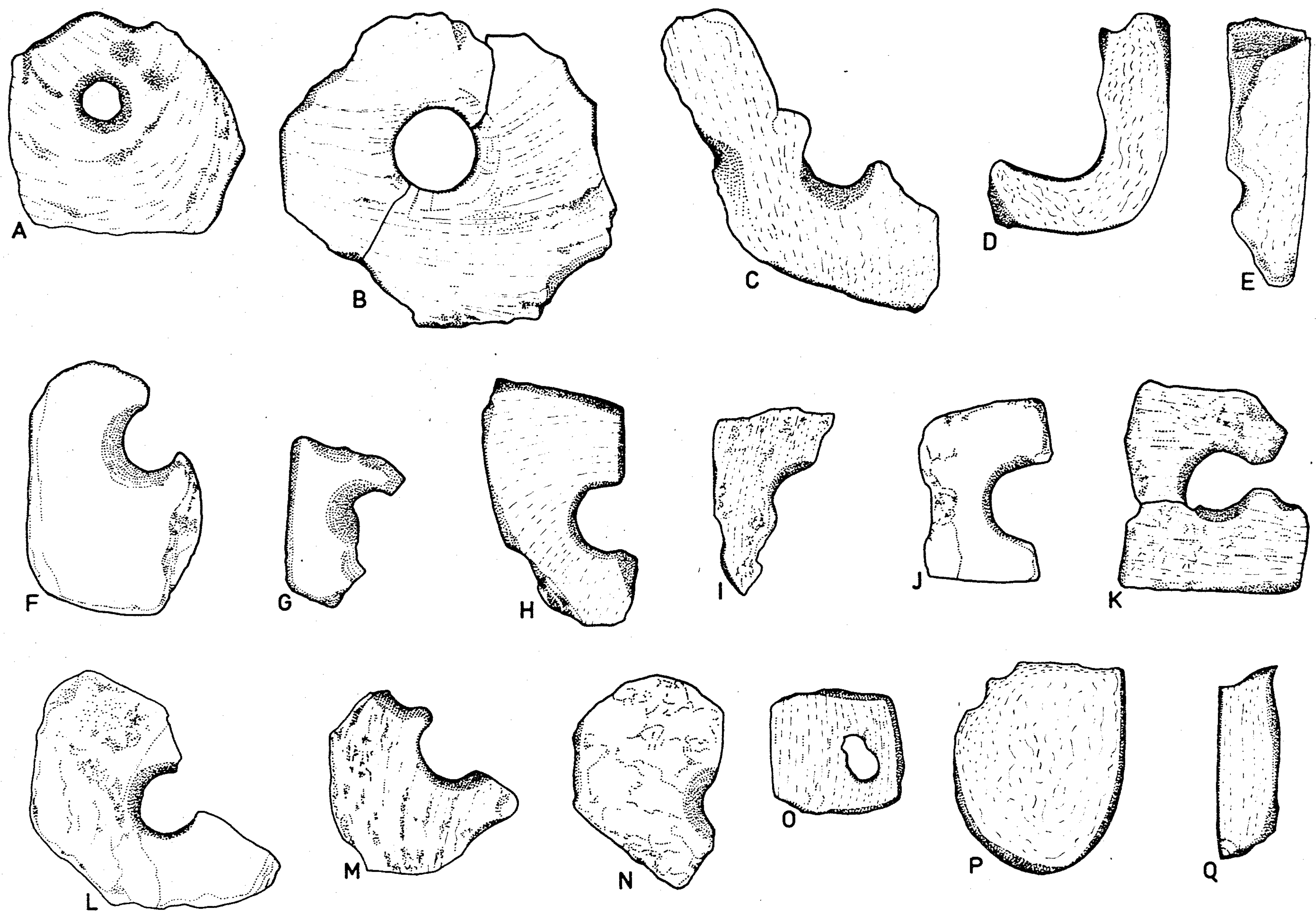


FIGURE 64 PALLISER BAY
WORKED SHELL

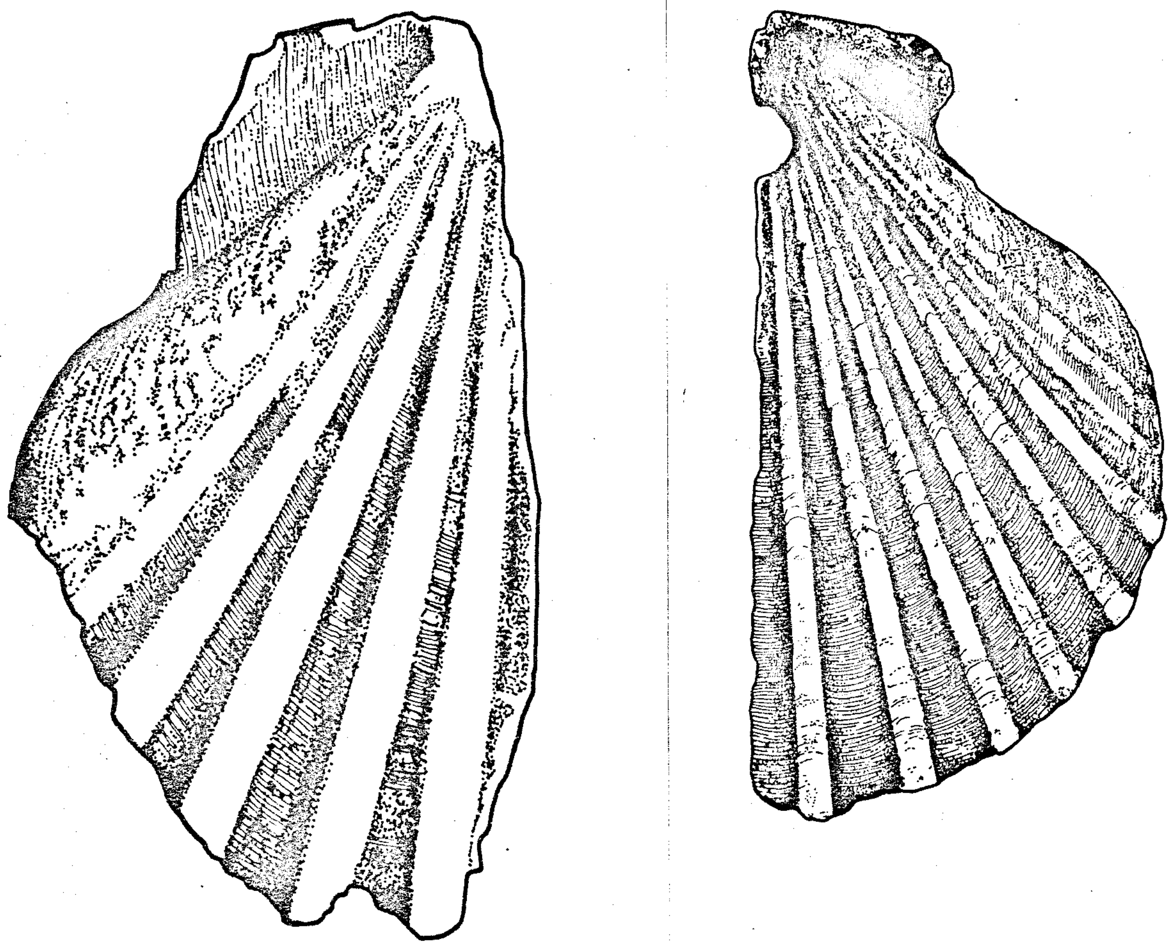


FIGURE 65 WASPOOL SCALLOP PENDANTS

The Palliser Bay evidence suggests quite the reverse. The base width was measured for the Palliser shell hooks (Figure 63), the moa bone hooks (Figure 59), excluding Type B, and a sample of early pearl shell hooks from the Marquesas (Sinoto, 1970:107) with the following results (all measurements are in mm).

	Marquesas	Palliser Shell	Palliser Moa Bone
Mean	6.90	9.33	7.58
Standard Deviation	3.30	1.11	0.86
N	9	15	18

A two tailed t test for independent means was performed as follows:

	t	v	Significance
Marquesas/Palliser Shell	3.50	22	Highly significant
Marquesas/Palliser Moa Bone	1.12	25	Not significant
Palliser Shell/Palliser Moa Bone	5.10	31	Highly significant

These results suggest that the earliest occupants of New Zealand did attempt to copy their pearl shell hooks in local shell species, but found that comparable strength could only be attained by increasing the basal width; however, upon experimenting with the tough and relatively isotropic tibiotarsus of moa species they discovered that similar strength could be achieved to tropical hooks without the undesirable increase in thickness. The fact that the earliest Palliser sites possess the more gross shell hooks as well as the thinner moa bone specimens suggests that this is truly an 'Experimental Phase'.

Miscellaneous

The pieces of two left valves of *Pecten novaezelandiae n.* were found in Level I; at least one of these was drilled near the umbo, and presumably functioned as some form of pendant (see Figure 65). A similar example, drilled in identical fashion, is recorded from Wairau Bar (Duff, 1956:Plate 23, 131, 134, 368). The subspecies used for the Washpool example proves its origin in the Cook Strait area (see Appendix 14). The use of drilled shells for single pendants or necklace units appear to be relatively common in the Cook Strait area. Also reported at Wairau Bar is a single drilled Crassostrea glomerata shell (ibid), and a set of 14 units of drilled Myadora striata (Duff, 1965: Plate 24, 131, 134, 368). Small serrated discs of Haliotis iris are reported for a site near Kaikoura (S49/3) by Eyles (1975:136) and interpreted as 'eye discs' from carvings. This need not be their function, however, as a set of 8 identical drilled units were found with a child burial near the mouth of the Mataikona River (Dominion Museum B11587, KF2) north of Castlepoint. Perforated Pecten novaezelandiae subsp. are reported for both Mangakaware and Lake Ngaroto (Peters, 1971:136) and two similar perforated valves of Pecten spp. have been recovered from a site in the Marquesas (Suggs, 1961:129) indicating the antiquity of this ornament form.

Some Functional Interpretations of Artefacts

In many sites devices used in hunting and fishing are only poorly represented and associated middens contain only a few individuals of each bird and fish species. In such cases correlation between the artefact form and a particular species can never be more than tentative. The Washpool Midden Site, however, produced a large number of bird spears and fish hooks as well as certain bird and fish species which were numerically very dominant. In particular, the correlation between bone spear points and tui and parakeet catching seems significant. In terms of bird size this interpretation is realistic since the spears are of appropriate dimensions to impale and also hold a medium sized bird. The pigeon might have proved too heavy for these slender points. In fact the number of bird spears is proportionately much greater than the number of pigeons found in the midden. On this evidence and that of strength, the widely held view that the New Zealand bird spear is a pigeon spear requires **reconsideration.**

When fish species represented in the Washpool Midden are grouped according to the fishing technique most likely to capture them (Appendix 25) a close correspondence with the fish hook types is notieable. The following figures illustrate this.

Demersal fish caught by hook and line	257 (80.1%)
Bone and shell one piece hooks	39 (79.6%)
Pelagic fish caught with trolling lure	64 (19.9%)
Bone lure points	10 (20.4%)

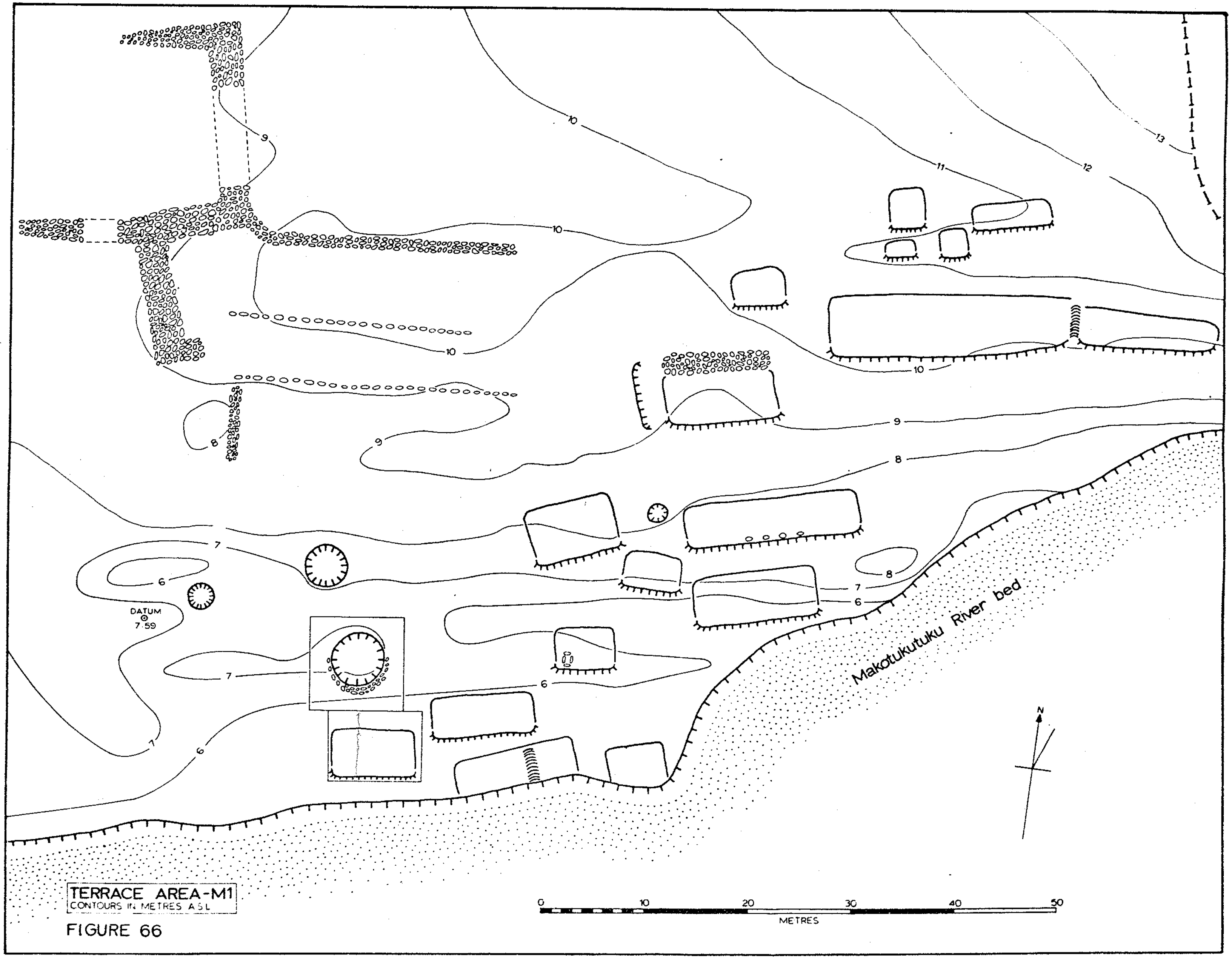
In addition, although the figures are low, the correspondence between the proportions of 'barracouta' points in the total collection of lure points (4/10, or 40%), and Thyrsites atun in the total number of pelagic fish (21/64, or 32.8%) is also striking. The difference in proportions of both these comparisons are insignificant (Rosenbaum's exact test: qv.Appendix 35). It would thus appear that the stone lure and associated bone points were primarily used for catching kahawai (Arripis trutta), since this is the principal pelagic fish in the midden. Furthermore, the existence of a discrete barracouta lure is evident. No functional difference can be suggested for the shell and bone one piece hooks.

THE WASHPOOL GARDEN TERRACE - M1/XXX

On the northern river bank of the Washpool close to the foot of the coastal hills is an area of about 0.3 hectares on which there is a cluster of 17 terraces, together with the remains of 3 possibly 4 circular raised rim pits (see Figure 66). The terraces are only low features on the gently sloping ground and are very variable both in absolute sizes and length-breadth ratios. Their sizes are given in Appendix 38.

Other excavations around the Washpool had failed to yield any structural evidence which could definitely be interpreted as houses. This cluster of terraces was an ideal location for a group of house platforms, particularly since they were situated close to water and in a relatively unexposed position. Any forest which may have once existed in the lower reaches of the main valley may have extended far enough on to the coastal platform to afford additional protection to this area. This question of protection from the weather is very important on this coastal strip which is frequently lashed by storms. The area's advantages as a dwelling spot are attested by the presence of several European structures in the near vicinity. Perhaps the most convincing surface feature suggesting the presence of houses as a stone slab hearth situated on the edge of one of the smaller terraces (see Figure 66), as this feature has been shown to be frquently associated with house structures (H.Leach, 1972).

An area of 9m by 7m was laid out on one of the smaller terraces close to the river bank and immediately in front of the best preserved of the circular raised rim pits, which was itself later excavated. The area was divided into 4 quadrants with 1m baulks (see Figure 67).



TERRACE AREA-M1
CONTOURS IN METRES A.S.L.
Makotukutuku River bed
DATUM
7.59
N
METRES
0
10
20
30
40
50

FIGURE 66

WASHPOOL GARDEN TERRACE - M1/XXX

EXCAVATION LAYOUT

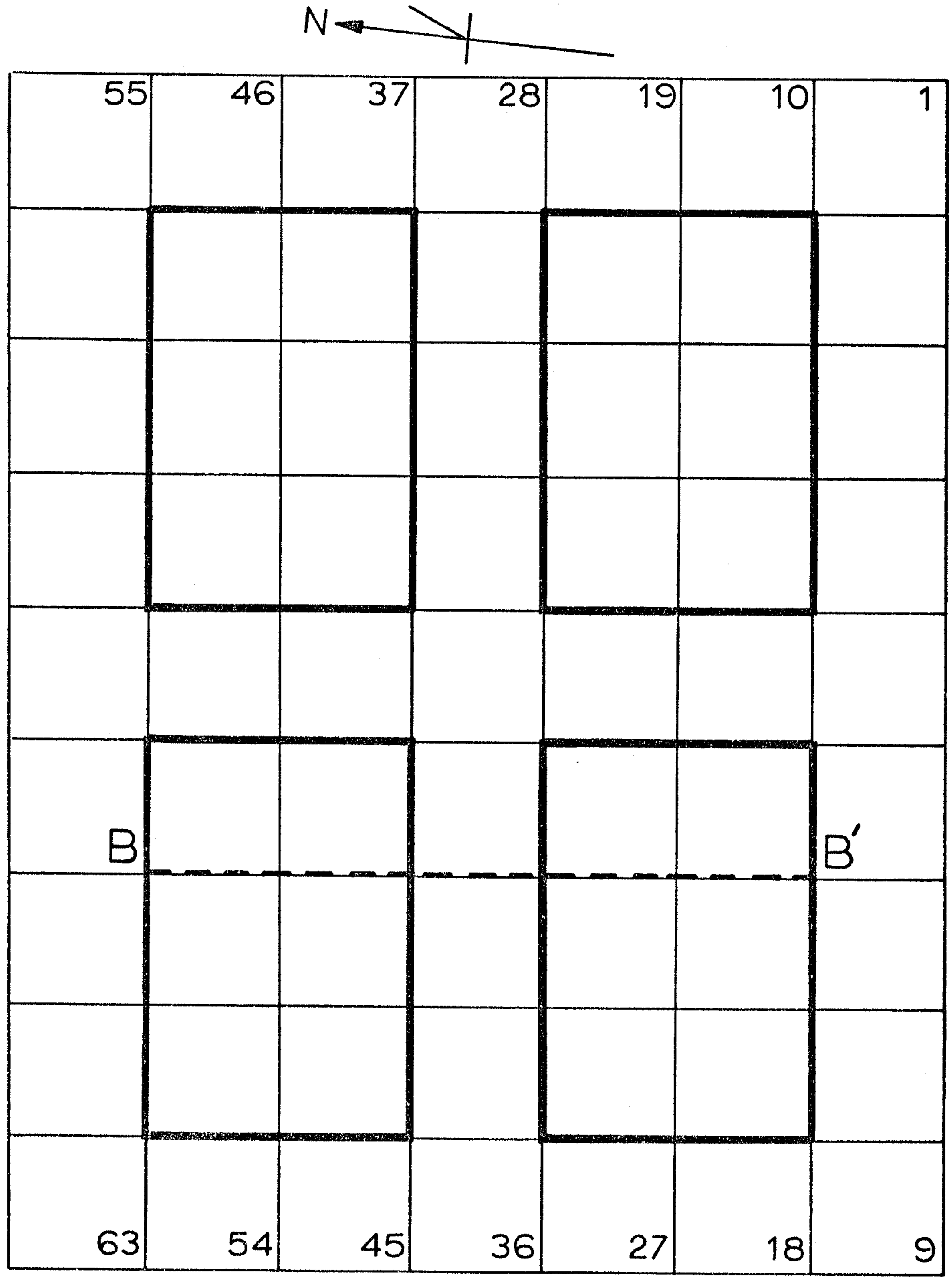


FIGURE 67

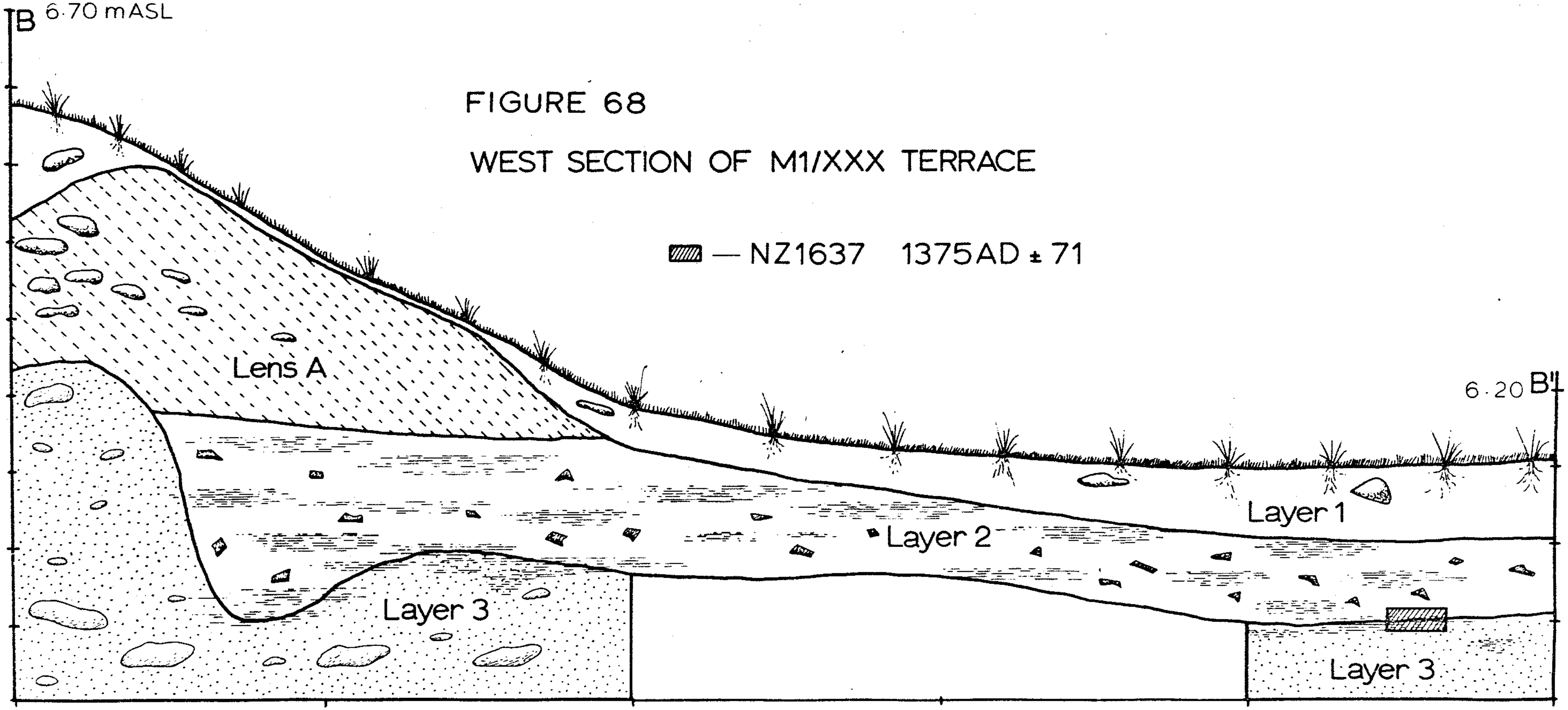
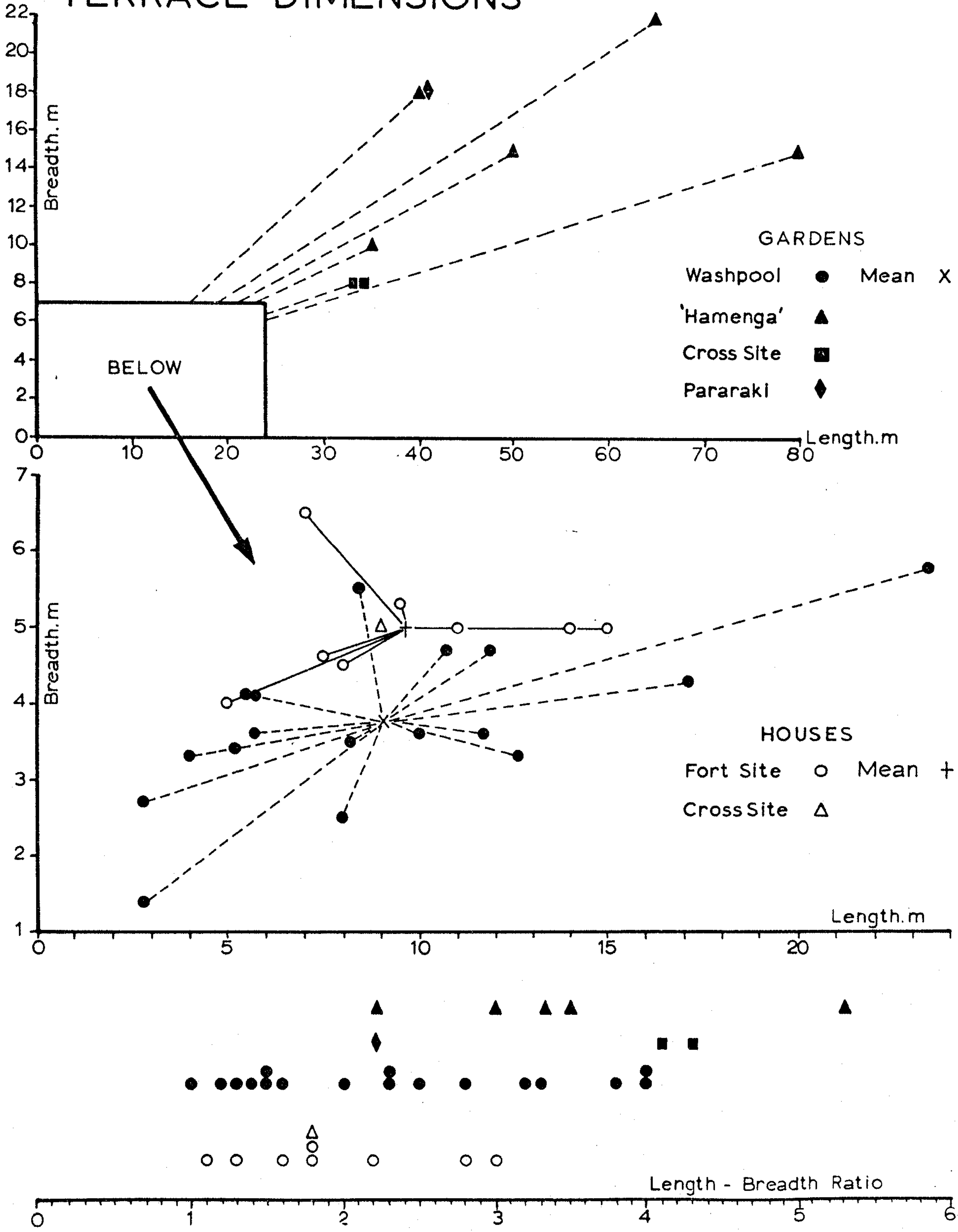


FIGURE 68

WEST SECTION OF M1/XXX TERRACE

FIGURE 69
TERRACE DIMENSIONS



Excavation, which commenced in the two western quadrants, was eventually taken down into the natural in only 9 m^2, in the SW quadrant and squares 33, 42, 51 (see Figure 67). The stratigraphical sequence was as follows (see Figure 68):

Layer 1 Black humified sandy loam. A little derived cultural material such as burnt stones and finely divided charcoal.

Lens A Brown sandy loam. A patchy layer of variable thickness similar to Layer 1, but with less charcoal. The origin of this lens is unclear, but it is either an erosion lens from up-slope near the pit, or was dumped on the terrace by cultural activity between the two features. The lens seals in the main cultural soil of the terrace. In the section illustrated (Figure 68) this lens appears to contribute to the terrace back-scarp; this is only true at this point where the lens is quite thick.

Layer 2 Friable black sandy loam with abundant ash, charcoal, and small fragments of burnt stones. The layer was fairly homogeneous and some time was spent investigating pseudo-structures and possible sub-components at the base of the layer. The situation was clarified when test pits were cut into the next layer, and it was shown that Layer 2 in fact is simply a modified version of the natural layer beneath it. The point is discussed further below.

Layer 3 Brown dune sand with occasional waterworn pebbles or boulders. This layer occurs as the natural substratum to all archaeological sites at the Washpool except the Washpool Camp Site, which is situated on a much older beach surface.

No compacted surfaces or structural features such as would be expected for a dwelling area were found on the terrace. In fact nothing remotely resembling a habitation surface was found. The cultural layer (Layer 2) was unusual both in appearance and structure, but is simply the result of a mixture of ash, charcoal and burnt rock with the natural sand horizon Layer 3, and there is no well defined stratigraphical break between the two. Indeed, patches of Layer 2 penetrated to depths in excess of 40cm into Layer 3. The mixing resulted not from solifluction, leaching, or other natural process, but from a deliberate turning over of the sand layer, to which charcoal and ash were added. The 'tongues' of mixed soil which extended into Layer 3 suggest a pointed digging stick was used for this purpose during cultivation. In short, the site has all the features which would be expected from a horticultural plot.

It will be noticed from the section drawing (Figure 68), that a small ditch feature occurs at the back of the terrace. This was rather shallow, but fairly uniform in depth. Several reasons might be advanced for its presence. For example, it may have been dug to facilitate drainage or run-off for surface water coming down the slope during heavy rain, and has since filled up with garden soil. On the other hand the trench may indicate an attempt to mark off the back boundary of the terrace when it was first dug over. If a rectangular plot was laid out on a gentle slope and dug over in the manner suggested, it would sooner or later result in such a terrace feature, and perhaps also the ditch where the back-scarp was cut. A sample for radiocarbon dating taken from the junction of Layers 2 and 3 gave the following result:

NZ 1637 Charcoal M1/XXX/15, Junction Layers 2 & 3 575 BP ± 71
1375 AD ± 71

These conclusions were so unexpected that test pits were dug in a number of adjacent locations. The same friable cultural soil (Layer 2) was found on other terraces, and in places between them as well. Later it was also found to underlie the circular raised rim pit which was excavated. Therefore the conclusion that these terraces were the focal points of plot cultivations inside a more extensive area of horticultural activity seems well supported. A few stone walls and single boulder alignments were found close by, but do not mark off this area in any obvious way (see Figure 66). One interpretation of the stone hearth noted on the edge of one of the terraces is that it represented a hearth constructed for the ritual cooking of a few seed kumara during planting, such as described for the 19th century Maori (qv.Best, 1925:93ff).

Very little cultural material apart from the ash and charcoal was found. In total only 11 flakes were recovered, 9 of chert and 2 of obsidian. Both pieces of obsidian were green and one was determined for trace elements and found to derive from Mayor Island (see Appendix 5). This dearth of industrial debris contrasts with the considerable quantity which derived from H.Leach's excavation of the Washpool Stone Wall Gardens (vide H.Leach, 1976:Chapter 3).

Because terraces of any kind are relatively rare in Palliser Bay, it is useful to compare those at the Washpool with others which have been recorded. A rather similar group about 2km south of the Washpool, have been fully described by H.Leach (1976:Chapter 2, 'Hamenga Area'). They consist of 5 long low terraces covering an area of about 90 by 70 metres (0.63 hectares), which are also believed to have had a horticultural function. Again only a few stone walls are found in the close vicinity. The length-breadth ratios of this terrace set are very large, a feature shared with some of the Washpool Garden Terraces, and also with those in the garden area at the Washpool Cross Site (M4). Such high length-breadth ratios are not found for terraces shown to have functioned as house platforms. Perhaps more important, the Hamenga terraces are very much larger in overall size than anything recorded elsewhere (see Figure 69), as the various dimensions in Appendix 38 show. Included in these dimensions are those of three other garden terraces: two from the Washpool Cross Site, and one from the Pararaki

River mouth. The latter is described in conjunction with other horticultural evidence at North Pararaki by H.Leach (1976:Chapter 2), and the former is discussed below with other features at the Washpool Cross Site.

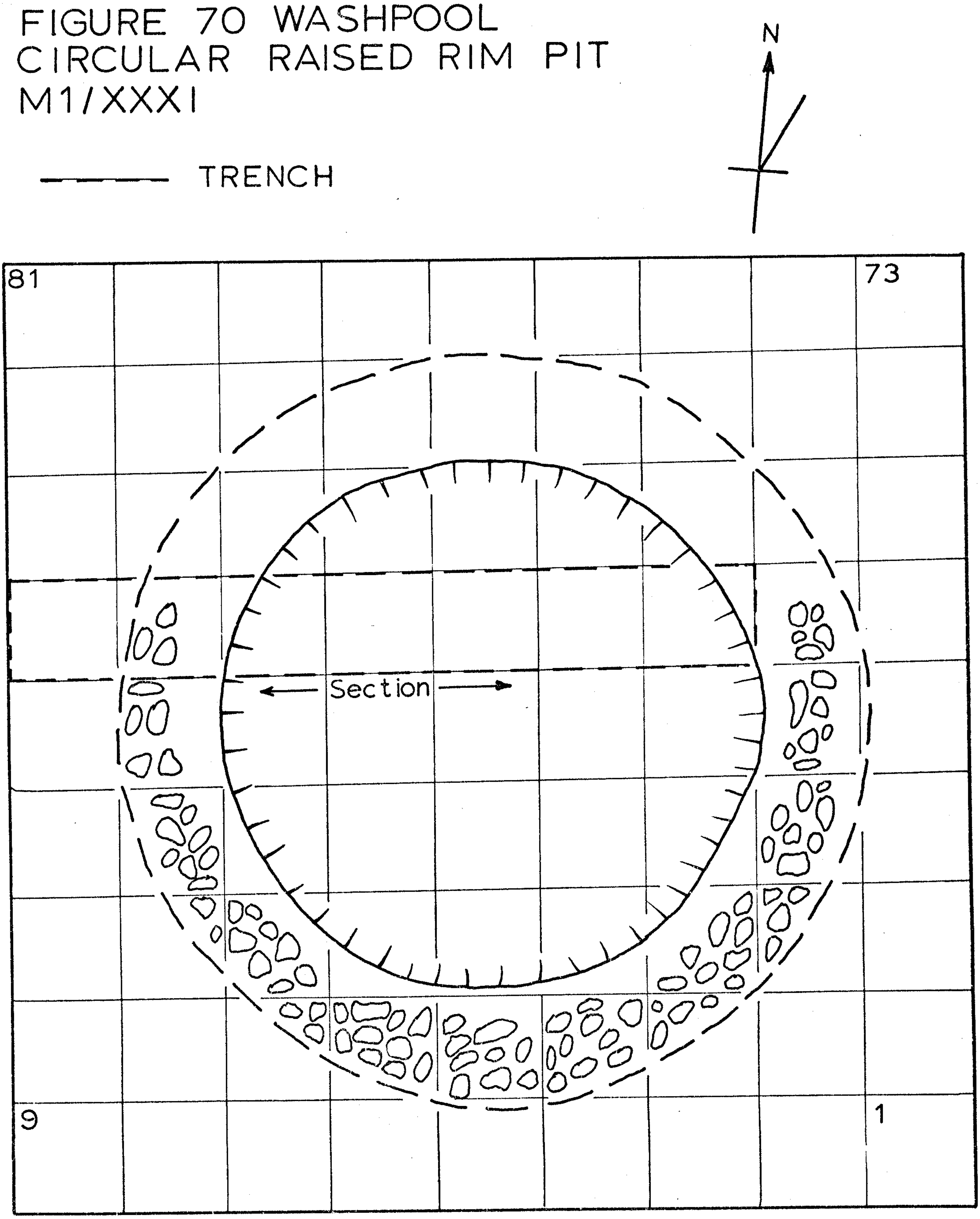
When the available terrace dimensions with known functions are plotted (see Figure 69), a difference in relative dimensions between house terraces and those suggested to be garden plots becomes apparent. On the whole, the garden terraces appear to be rather narrower (higher length-breadth ratio), although the difference is only slight. The most notable feature is that the garden terraces are a great deal more variable in shape than the other. The more constrained proportions of houses and house platforms has been discussed at length by Prickett (1974).

THE WASHPOOL CIRCULAR RAISED RIM PIT - M1/XXXI

This pit is situated on the north bank of the Washpool within the area of garden terraces discussed above (see Figure 66). It appears to have been one of a group of 4, the other 3 being observable now only as slight circular depressions. These few pits are the sole examples of any type in the entire Washpool River mouth area, and if they functioned as stores for garden produce their number seems out of proportion to the area covered by stone walls thought to outline garden areas. The circular shape is very unusual in the Wairarapa; yet they share the raised rim, characteristic of many East Coast pits.

The pit had a diameter from rim to rim of approximately 5m, and a raised rim about 1m in thickness and about 20 to 25cm in height. It had been cut into a gentle slope on the river bank which consisted of a sandy loam. The lower half of the rim contained a number of large

FIGURE 70 WASHPOOL
CIRCULAR RAISED RIM PIT
M1/XXXI



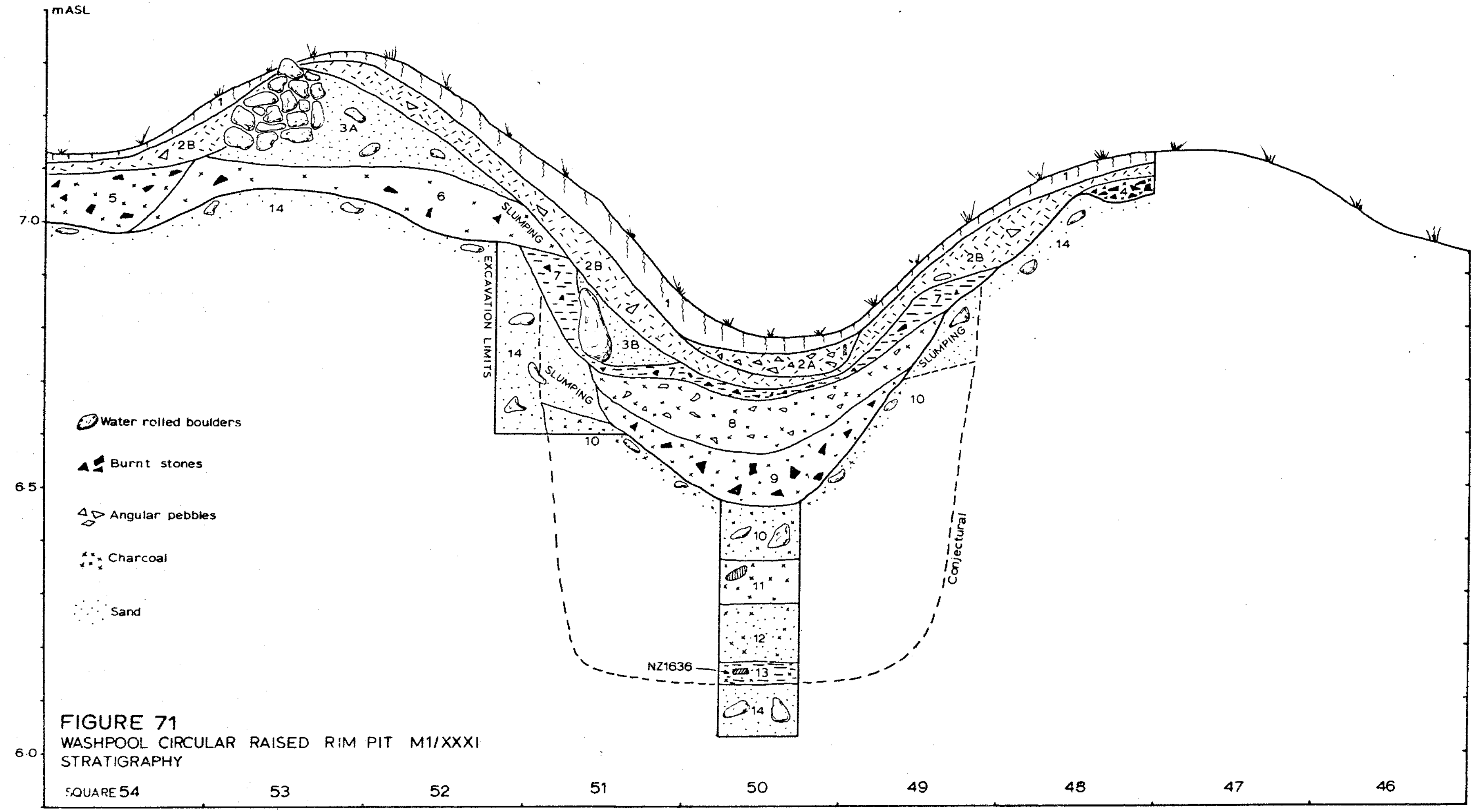


FIGURE 71
WASHPOOL CIRCULAR RAISED RIM PIT M1/XXXI
STRATIGRAPHY

stones presumably recovered from the original excavation. Where exposed they gave the pit the appearance of having a stone facing on one side.

A square 9m by 9m was laid out with a 1m baulk running east-west across the centre. It quickly became clear that the very friable sandy soils had gone through a complex history of erosion and slumping. As soon as this was discovered it was realised that the excavation of the whole area laid out would achieve very little. Consequently, attention was focussed on a trench 9m by 1m in the northern half, to try and establish the relationship between the pit construction and other cultural soils in the vicinity (see Figure 70), in particular the garden soils associated with the terraces. The stratigraphical sequence was as follows (see Figure 71):

Layer 1 Brown loam with no cultural evidence

Layer 2A Brown loam with angular pebbles

Layer 2B Grey-brown sandy loam with angular pebbles; a humified and eroded version of layer 3

Layer 3A Brown friable sand similar to layer 14. The stone facing to the pit is part of this wall layer

Layer 3B Brown friable sand. A slumped part of layer 3A.

Layer 4 Small black sandy lens with much charcoal and waterworn pebbles. This may have been part of a scoop hearth feature

Layer 5 Black sandy loam with charcoal and a few burnt stone fragments. This layer is widely found at the Washpool associated with the main gardening complex

Layer 6 Grey sandy loam. Somewhat less charcoal than layer 5 but basically the same layer. Its stratigraphical position under the wall shows that the pit postdates the garden soil. Layer 6 has slumped on the eastern side and covers some of the later pit layers.

Layer 7 Grey sandy loam. Much charcoal and angular stones. Is overlain by layer 6, but is almost certainly more recent

Layer 8 Compacted black sandy loam. Much charcoal, small stones and ash

Layer 9 Soft sandy black mixed soil. Lumps of charcoal and stones

Layer 10 Grey-brown sand with rocks

Layer 11 Dark grey friable sand with much charcoal and small twigs

Layer 12 Brown sand with charcoal and ash staining

Layer 13 Abundant charcoal. Also fern stems. C14 sample taken from this layer

Layer 14 Brown stony sand. This is the natural basal layer to the whole area.

The small area exposed by this excavation clarified little except the relationship between the pit construction and the already familiar general garden soil represented by layers 5 and 6. The difference between these two layers is not stratigraphical but is a product of differing charcoal density and humification. Elsewhere the garden soil does vary in this way, but in this case the change probably also relates to poorer humification under the wall. There is little doubt that the pit was constructed after considerable gardening activity had taken place. This stratigraphical interpretation was verified by the C14 result which shows that the pit was constructed later in the sequence.

The only artefacts were some 20 stone flakes scattered through the deposit from Layer 1 to Layer 11. The flakes comprised 11 of chert, 4 of obsidian (all from Mayor Island qv. Appendix 5), 2 of metasomatised argillite, 2 of greywacke, and 1 of limestone. In addition, one large lump of very fine pure white kaolin was found in Layer 11. None of these finds, however, can be directly related to the construction and use of the pit. Although stratigraphically later than the pit's construction, they could easily derive from the earlier period represented by the garden Layers 5 and 6 which were cut through in making it.

A large number of circular raised rim pits have been recorded on Banks Peninsula, and for some of these burnt stones in the rim are reported (qv. Harrowfield, 1969:100; Jones, 1962:114). It would seem, therefore, that at least some of these pits functioned as ovens; indeed, their unusual location away from habitations might support the interpretation of *umu ti*. The pit excavated at the Washpool contained a considerable amount of charcoal, but no more burnt stones than in the cultural soils surrounding the pit. Moreover, the charcoal was in the fill layers and therefore not directly related with any certainty to the pit's use. The large stones in the rim had not been fired. Thus, the parallel with the Canterbury pits, while striking, is apparently quite superficial.

The most significant find at the Washpool site was a layer of fern stalks and *Macropiper excelsum* (Molloy, 1974:pers.comm.) on the floor of the pit. This is reminiscent of the lining described by Best (1916) for kumara storehouses. Fern has also been detected in prehistoric pits interpreted as kumara stores (qv. Law, 1972:116). A few uncarbonised seeds of *Calystegia tuguriorum* and *Sophora* sp. were also recovered. Sufficient charcoal was recovered from this thin layer (4cm) for C14 dating, and this gave the following result:

NZ1636 Charcoal M1/XXXI/50, Layer 13 <210BP >1740AD

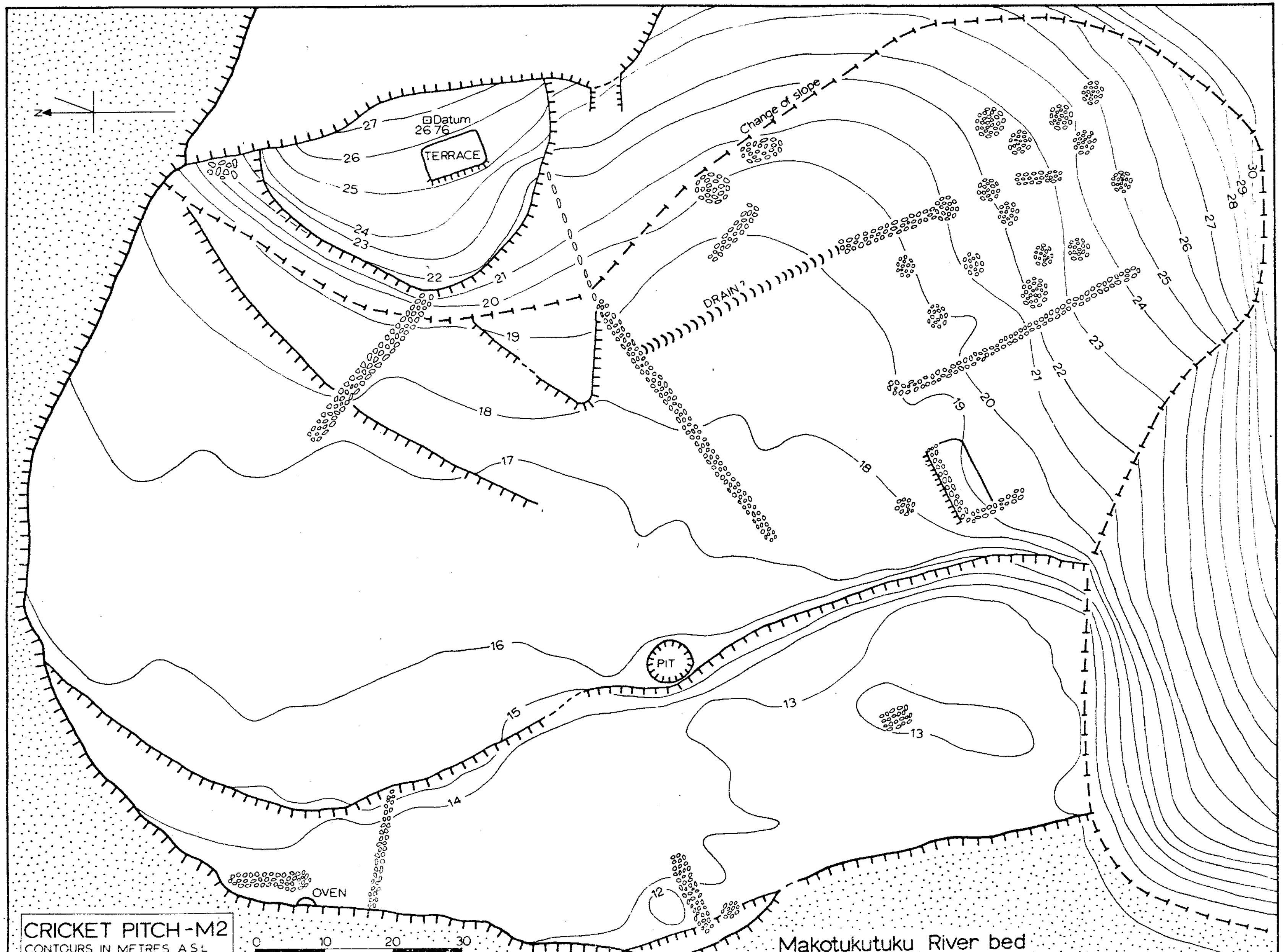
In view of the late age, and the pit's stratigraphical position late in the sequence at the Washpool, the pit itself is interpreted as a potato store, probably in use during the re-settlement of the Ngati-kahungunu in 1840 when it is recorded that potatoes were being grown around the Makotukutuku area (discussed in Chapter 3). The use of fern as a floor covering suggests a continuation of an earlier practice designed to keep tubers off the damp floor of storage pits.

THE WASHPOOL CRICKET PITCH - M2

This site, approximately 1km inland, is spread over three consolidated river terraces and its local name the 'Cricket Pitch' reflects the flat topography. It comprises a number of stone walls and mounds occupying an area of about 1.76ha (see Figure 72). Test pits dug to find culturally modified soils between the walls indicated that the top soil was considerable truncated, as was a very similar site immediately inland of the mouth of the Kawakawa River (N168-9/54). One oven site was located on the extreme western edge at the Cricket Pitch. It may be suggested that the area had been severely deflated by either winds or surface water or both.

One intact feature was a terrace (9m by 5m) on the higher ground overlooking the river terraces. It was very regular in shape with a front and rear scarp, and quite flat in appearance except for a longitudinal depression running along the rear scarp. Only a small quantity of charcoal was recovered in preliminary test pits, but the surface indications of a possible house site were sufficiently strong that the terrace was laid out for excavation in plan.

Until this time the search for house structures in Palliser Bay had been unsuccessful. The excavations at the Washpool had revealed a variety of structures, none of which could be interpreted as substantial houses, while the terraced area at the Washpool had been



Datum
26.76
TERRACE
Change of slope
DRAIN?
PIT
OVEN
Makotukutuku River bed
N
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
0
10
20
30
METRES
CRICKET PITCH-M2
CONTOURS IN METRES A.S.L.

FIGURE 72

shown to be horticultural in function. After removing several erosion layers on the M2 terrace and failing to find any positive evidence of occupation attention was turned to another terrace at the Cross Site (M4). When this latter excavation revealed the remains of a house, excavations at M2 were resumed, and still no structural evidence was located. Clearly this terrace did not serve as a house platform. Because very few cultural items were found, the terrace may have resulted from cultivation in a similar fashion to the Washpool Garden Terraces described above. Like these terraces it shares a ditch feature at the back scarp, and unlike the Washpool site the amount of charcoal in the soil at the Cricket Pitch is very small. In view of the suggested deflation of the whole site, however, this apparent absence may be modern. A horticultural interpretation for the Cricket Pitch terrace is strengthened by the presence nearby of regularly laid out stone walls and mounds.

THE WASHPOOL STONE WALL FORT - M3

A large site which can be considered as having three different areas (see Figures 12 and 73) is found on the south bank of the Makotukutuku River about 2km inland. The principal feature is a platform defended by a ditch and stone wall, and is locally known as the Stone Wall Fort. Immediately to the west is a rocky outcrop with burials in a cleft, and to the southeast is an area of pits and terraces.

The Pits and Terraces

Approximately 200m to the southeast of the stone wall defences is a long leading spur on which is a cluster of 8 terraces and 3 pits (see Figure 73). Two of these pits are of the familiar rectangular

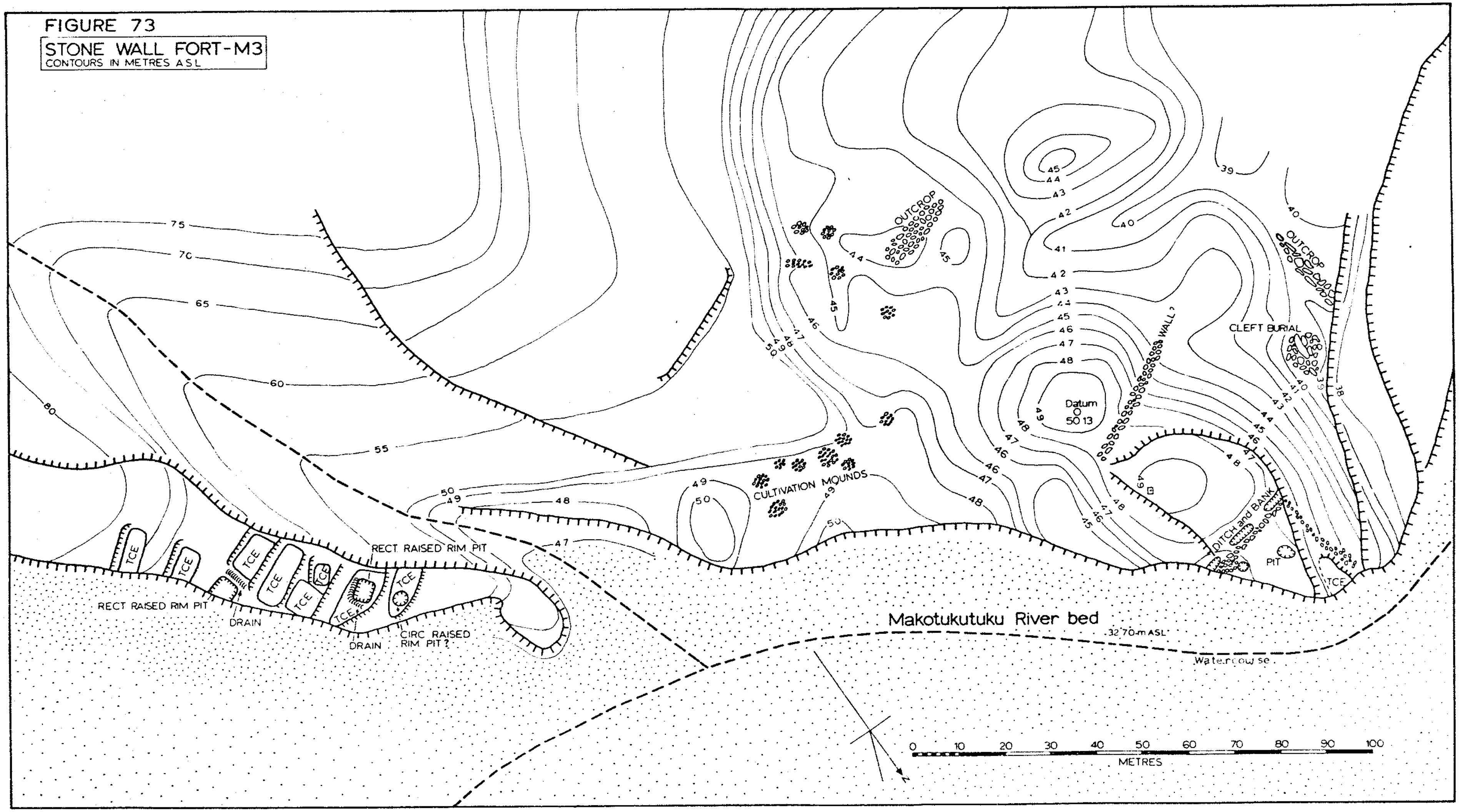


FIGURE 73
STONE WALL FORT-M3
CONTOURS IN METRES ASL
OUTCROP
CULTIVATION MOUNDS
WALL ?
CLEFT BURIAL
Datum
50.13
DITCH and BANK
PIT
TCE
RECT RAISED RIM PIT
DRAIN
CIRC RAISED RIM PIT ?
Makotukutuku River bed
32.70 m ASL
Watercourse
N
METRES
0 10 20 30 40 50 60 70 80 90 100

raised-rim type with apparent external drains, while the third is more square in outline, but also possesses a raised-rim. Subsequent erosion and tree growth has considerable damaged the pits, but the dimensions may be estimated as 3m by 3m, 5m by 4m, and 6m by 5m. The last is only approximate since the end is eroded and only 4.6m remains. The terrace dimensions are given in Appendix 38.

Because of their size, these terraces are believed to represent the house and living platforms of a small community, although not all the terraces may have been occupied at any one time. It is interesting that apart from a few stone mounds mid-way between the defended area and the terraced ridge, the nearest evidence of horticultural activity is the Cross Site across the river. It is possible that the activities represented by these two sites are related components of the same group. Because the terraces here were rather disturbed by post-occupation forest growth and windthrow, no excavations were undertaken. The M3 terraced ridge might be considered naturally defended; although this is not believed to be the reason for the choice of location. As is argued above, the Makotukutuku Valley was heavily forested during the initial occupation period, and habitation anywhere other than on exposed platforms or ridges would be exposed to damp and cold air.

The Cleft Burials

Burials were found while surveying the main Fort area, in a cleft which consisted of an irregular gap a few cm wide between a pile of large boulders about 30m west of the stone wall defences of the Fort. The boulders are part of a local outcrop of sandstone, and the gap between them widened to about 50cm under a pile of heaped-up debris. It was impossible to excavate the site in the normal sense of the term,

FIGURE 74 CLEFT BURIAL SCHEMATIC SECTION

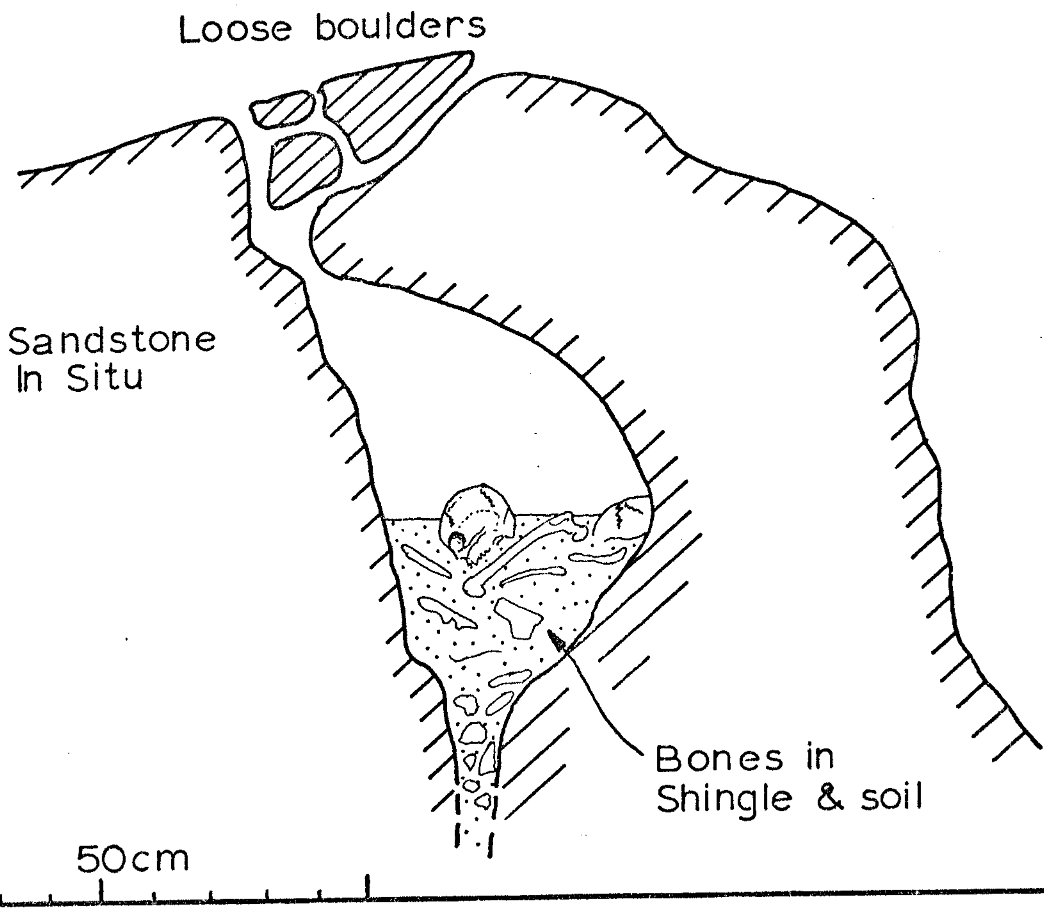
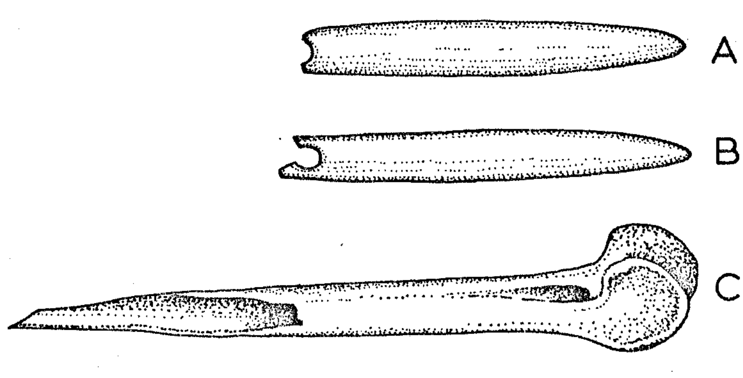


FIGURE 75 CLEFT BURIAL ARTEFACTS



since the opening to the cleft was vertical and very narrow. Instead the human bones were removed along with soil, shingle and other material, by leaning down head first into the crevice with a trowel (see Figure 74). Inside the cleft the skulls and limb bones of several individuals were found, partly covered by leaves, opossum skeletons and rock fragments. In one case limb bones appeared to be laid together suggesting a secondary interment. While some of the vegetable material was obviously recent, seeds and charcoal were obtained from soil surrounding and stratified below *in situ* human bones. The charcoal used for dating derived from a charred stick found beside partly charred lim bones. The result obtained was:

NZ 1638 Charcoal M3 470BP ± 70 1480AD ± 70

Of course without a substantial protective soil matrix the charcoal could have been introduced into the cleft at another time. The alternative of dating the bones directly, however, would have resulted in the destruction of material valuable for studies of pathology. The position of the charcoal suggests that the stick was in primary association with the burial or at least can be used as a *terminus ante quem*.

Some faunal and floral material was directly associated with the human bones, although as mentioned, some definitely is post burial in origin. Nevertheless, the majority of the finds are believed to have been deposited during the prehistoric period (see Appendix 39).

A close parallel exists between this site and the burial remains from the Washpool Midden Site since a quantity of *Dentalium nanum* was found in the cleft along with infant human remains. In this case though, a much smaller quantity was present (only 160 shells) and thus these units are more likely to have belonged to a necklace than another garment (see Appendix 14). Two bone needles were also recovered, both made from bird bone. One was identified as the radius of a petrel. A needle case was also found, made from the distal end of the left tibiotarsus of Hemiphaga n.novaeseelandiae, the native wood pigeon (see Figure 75). In addition, two pieces of obsidian were recovered, one of which was determined by trace elements to have derived from the source at Purangi (see Appendix 5). The presence of a few marine shells in the cleft is difficult to explain, though they could have played some part in the burial ritual.

The remains of five individuals were found in the cleft, one adult and four infants. These were studied in detail by Sutton (1974: 116ff), and one of his main conclusions may be outlined as follows:

> Individual 1 This was the complete skeleton of a male aged over 50 years. He was very tall (178.2cm) and robust, and possessed a very large cranium. Two hereditary conditions, marked platybasia and occipital wurmian bones, were present on the skull. He had a large maxilla with highly developed arthritis on both mandibular condyles. He had apparently lost most of his teeth before death, but very little bone resorption had taken place indicating failing health. Indeed, X-rays of the femora showed that he had suffered frequent periodic illness or trauma. There is severe vertebral arthritis. Five of the lumbar vertebrae are fused, and a number of both thoracic and cervical vertebrae show pronounced lipping. Both the right radius and right humerus had been fractured, but the absence of remodelling of the cortical bone may indicate that these fractures did not occur during life. A number of limb bones had been partially burnt, and this took place before bone fracturing. This is further evidence for the association of the charred wood with the burials.

Individual 2 This was the complete skeleton of a 5 to 6 year old girl about 110cm tall. Again the lower left limb bones show evidence of fire. She had sustained an injury to the left frontal bone above the eye, and this was a likely cause of death. She showed considerable molar attrition for her age, and is comparable in this respect to the infant burial at the Washpool Midden Site. The forearm bones were rat-gnawed.

Individual 3 This was the complete skeleton of a 3 to 4 year old of unknown sex and about 90 - 100cm tall. The limb bones showed dense and frequent Harris lines, indicating poor health.

Individual 4 This was the complete skeleton of a 9 month old baby (60 - 70cm in length) of unknown sex. The femora of this individual were also heavily rat-gnawed, and X-rays showed dense and frequent Harris lines. These lines are separated by normal bone and are suggestive of periodic illness alternating with reasonable health. For a baby of only 9 months this is remarkable. The Harris lines extend backwards in time up to but not before birth; thus there is no evidence of inter-uterine privation. This contrast between general health before and after birth is quite striking and presumably relates to fluctuations in the intake of milk. On the other hand, whatever privation or illness was involved, it was not sufficient to prevent mineralisation of the milk teeth which are quite normal.

Individual 5 This was the cranial fragments of a three year old child.

The faunal and floral remains from the cleft combine to give clear indications of stable forest conditions. For example, the land snails Phenacharopa novoseelandica and Charopa coma are rarely found anywhere except in or under decaying logs beneath an unfired canopy (Climo, 1972: pers.comm.). Allodiscus sp. is also a good indicator of more substantial cover than coastal scrub. The seeds found in the cleft and the bird remains are consistent with the landsnail indications. At the present time the area is open pasture with patches of kanuka (Leptospermum *ericoides*) and the occasional ngaio (*Myoporum laetum*) and cabbage tree (*Cordyline australis*).

It is noteworthy that the obsidian determined was from Purangi. The only other pieces from this source recovered in the Palliser Bay excavations are from the earliest phase at the Washpool Midden Site from about 1150AD to 1350AD. Again, finds of *Dentalium nanum* and *Paphies* sp. are characteristic of this early period. These various markers combine to indicate that the burials in the cleft belong to a period of relatively stable environmental conditions before the onset of the massive erosion which now characterises the area.

The Defended Area

Adkin first drew attention to this site in 1955 claiming that it "functioned as a place of occult or religious rites and was in fact of the nature of a *wahi tapu* or *tuaahu* - a sacred place here plainly, in its day, one of long use and permanence" (Adkin, 1955:467). The evidence for this imaginative interpretation was the finding of 32 pits filled with midden and carefully covered over with rock slabs. Neither his evidence nor the interpretation can be substantiated. Nevertheless, the site is unusual. The partly free-standing stone slab wall employed as part of a defence system has no exact parallel elsewhere in New Zealand. The site consists of a small flattish area on a high river promontory, cut off from the surrounding ground by a ditch with two entrance platforms, and a stone wall serving in place of the more normal 'bank' (see Figure 76).

An area 4m by 4m was opened up to see whether any significant stratigraphy could be found which might help to clarify either the function or history of the site. However, apart from a scatter of charcoal

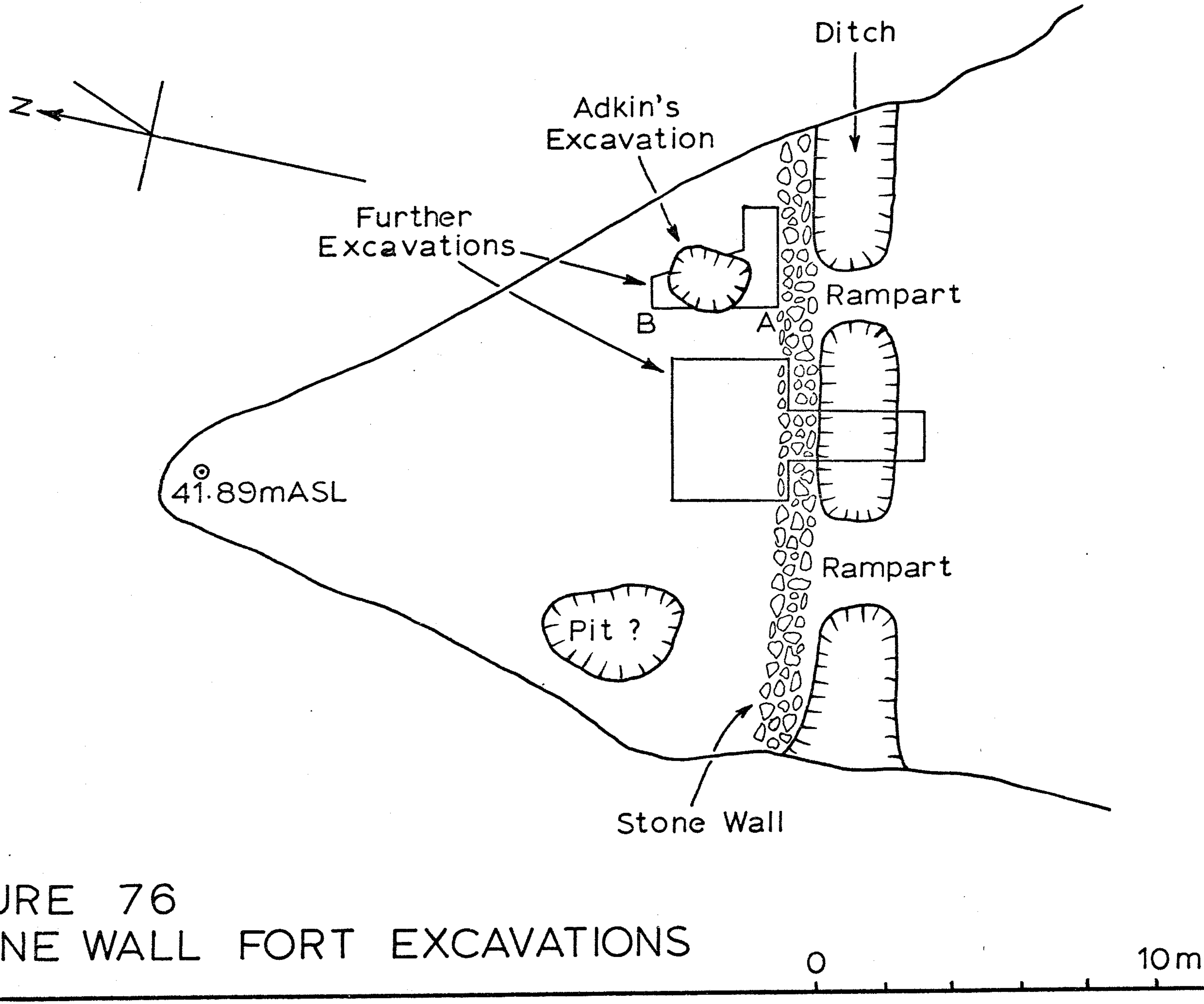


FIGURE 76
STONE WALL FORT EXCAVATIONS

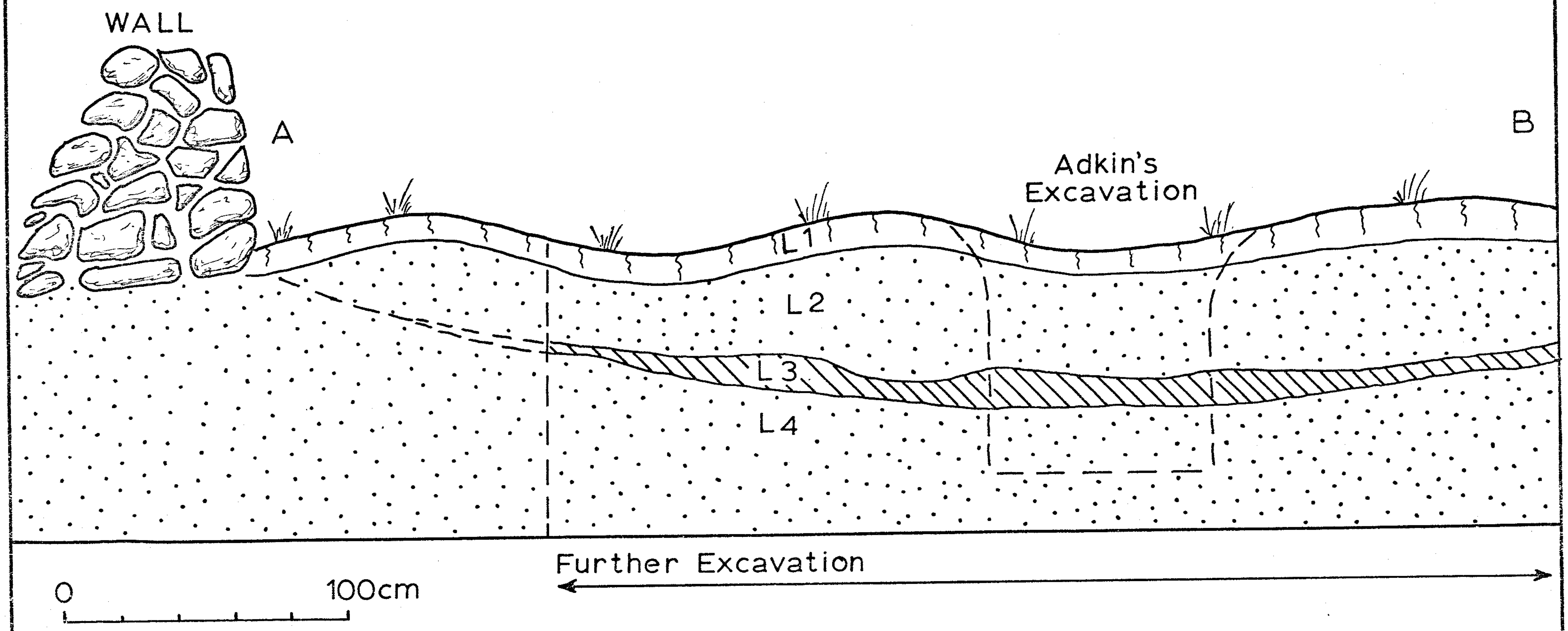
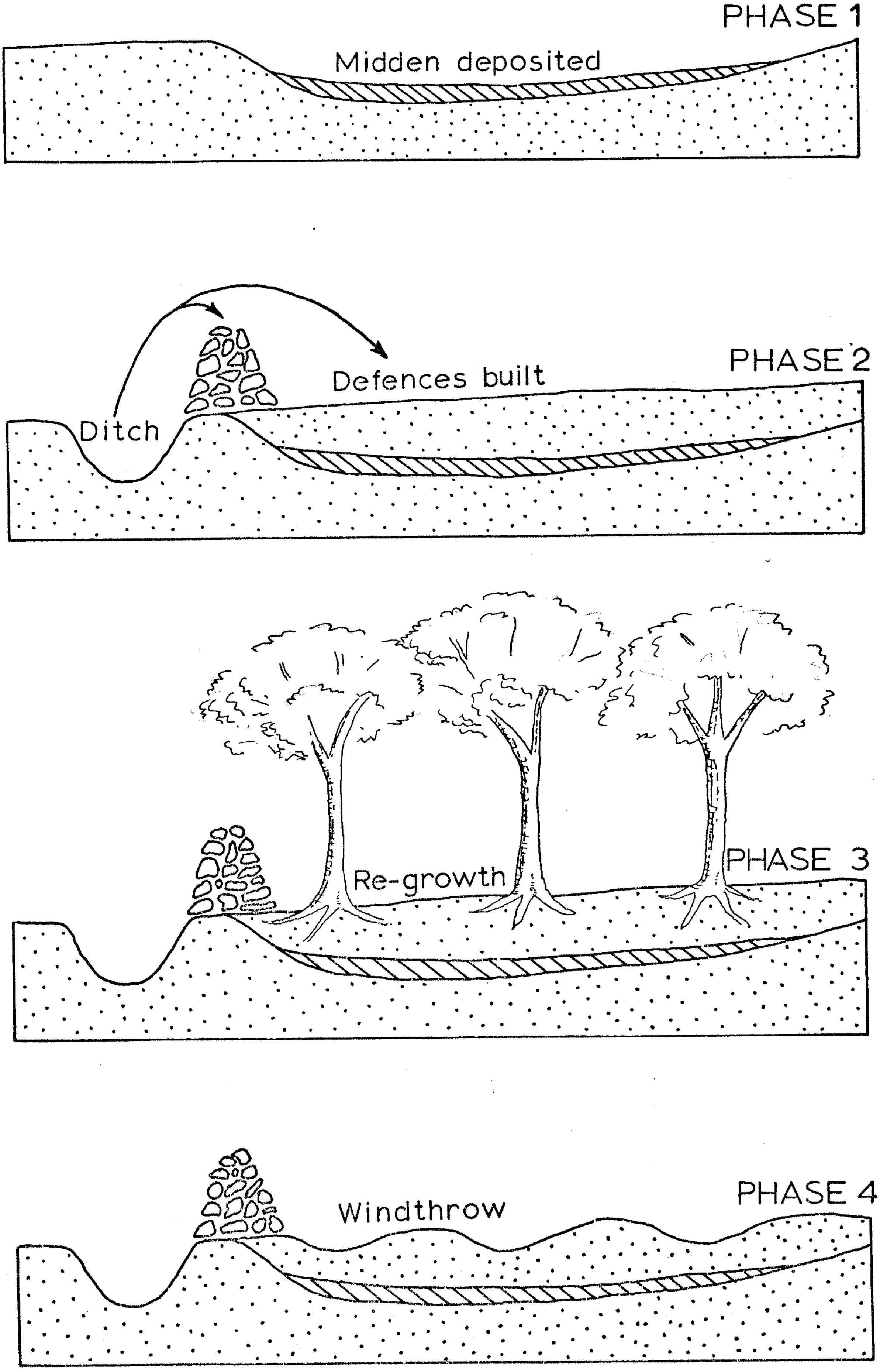


FIGURE 77 STONE WALL FORT - SECTON

FIGURE 78 STONE WALL FORT STRUCTURAL HISTORY



and a few chert flakes and cores, the area was devoid of useful information. No palisade postholes were found behind the stone wall. The matrix of the site consisted of angular sandstone fragments and large rocks, and apart from a thin layer of midden (10 - 15cm) at a depth of between 25 and 45cm, no significant separation of layers could be detected. The coarse rock fragments made stratigraphic interpretations difficult.

It was considered essential to obtain a sample of the midden material excavated and described by Adkin (1955:469), particularly as it is unusual to find marine food refuse in quantity so far inland in New Zealand, and its recovery would provide an opportunity to assess the link between the sites on the coast with those up the Makotukutuku Valley. Moreover, Adkin had identified frostfish (Lepidopus caudatus), which is well known to strand itself in late winter or early spring (Graham, 1953:307ff), and is therefore a valuable seasonal marker for archaeological sites. The significance of Adkin's identification of frostfish provided yet another reason to check the midden material.

Adkin's claim that the midden came from filled-in pits neatly laid out in rows was not consistent with the surface evidence. Although a layer of midden was found in the large excavated square, this too was so sparse that a small area around Adkin's excavation, which was easily located (see Figure 76) was also examined. His excavation in fact consisted of a roughly circular hole approximately 80cm in diameter, filled in with rocks. Its edges showed a sparse midden layer present around its entire circumference thereby falsifying Adkin's interpretation. Furthermore, the plan of the site given by Adkin (1955:Figure 5), has not less than 32 regularly aligned midden filled pits, a lateral stone wall, and an artificial ledge, all of which are also unsubstantiated. Rather the area enclosed by the ditch and stone wall, as well as several hectares outside is covered with 'dimples' resulting from windthrow of trees during severe storms. Such a phenomenon still occurs occasionally and can affect patches of vegetation, often the seral succession of kanuka, several km inland. Evidence of such dimpling also occurs on other prehistoric sites in Palliser Bay, especially in the Kawakawa Valley. Here a number of stone wall systems were so pock-marked with ancient windthrow dimples that the sites, while obvious from the hillsides above them, were all but invisible at ground level. Exactly the same dimples occur in and around the Stone Wall Fort in the Washpool.

An excavation near Adkin's area revealed the sequence of events quite clearly (see Figure 77). The midden proved not to be associated with the use of the defences, and in fact preceded the Fort platform construction (Layer 2). Large irregular blocks and slabs occurred throughout layers 2 and 4, and nowhere could be said to cover the midden in a deliberate fashion. An area 30m to the south of the Fort also showed scattered midden amongst rocks, and a calcite sinker was recovered here along with several shells of _Haliotis iris_ (see Figure 54a). The suggested sequence for this site is shown in Figure 78, and may be described as follows:

Phase 1 The deposition of a patch of midden in a natural hollow at some time before the construction of the defences. The charcoal layer shown by Adkin (_op.cit._:Figure 5) is coterminous with the midden layer.

Phase 2 The ditch was constructed. Some of the larger boulders dug up were used to construct the wall, and the remainder, together with smaller fragments and soil, were used to flatten the enclosed platform, thus covering the midden.

Phase 3 The site was abandoned and forest regeneration took place, probably initially with Leptospermum ericoides.

Phase 4 A severe storm caused extensive windthrow in the area, and when the uprooted trees rotted, dimples were formed. Some midden may have been laid bare in the deepest of these dimples, and subsequently covered by humus.

The species identified by both Adkin and the present author are detailed in Appendix 40, from which it can be seen that there is reasonable agreement between the two collections, considering the small numbers. The '12 limy bone objects' found by Adkin were almost certainly the mandibles of Jasus edwardsii. A dozen similar fragments belonging to 3 individuals were found in the 1970 sample. Their size is notable in both cases. Adkin gives a range of 5/8" to 1" (1.59 - 2.54cm) and the sample range noted in this study was similar. This corresponds to crayfish with a tail size between 16cm and 22cm (Anderson, 1973a:Figure 6). Anderson has shown (op.cit.:74) that prehistoric crayfish in Palliser Bay were a great deal larger than the present mean tail size of 15cm, and that they gradually became smaller over the last 800 years. The Fort Site crayfish, while a very small sample, are in the size range found at Black Rocks between 1150AD and 1350AD. The identification of Perna canaliculus at the Fort, while not confirmed by the later excavation, likewise suggests a fairly early date for the midden. This shellfish is characteristic of earlier periods at the Washpool Midden Site, and is not found in Palliser Bay today.

The identification of the frostfish, Lepidopus caudatus, remains unchecked. Unfortunately Adkin's midden sample is no longer in existence. Yet the matter is important enough to deserve further comment. Frostfish remains are very difficult to distinguish from those of the barracouta Thyrsites atun. In fact the task is quite impossible when a few of the characteristic cranial bones are fragmented. In addition barracouta is reasonably common in New Zealand sites, while frostfish is extremely rare. Certainly the 1970 analysis showed the barracouta to be the most common of the fish remains present, and frostfish were not detected. Because it is widely believed by New Zealand archaeologists that barracouta is most abundant during the summer months, it could be argued that a single deposit with both barracouta and frostfish would be most unlikely. However, as argued in Appendix 27, barracouta may be most abundant in this area in winter or spring and the association with frostfish is therefore not so unusual. Adkin does not state his authority for the identifications. It is likely that J.Moreland and Y.M.C.McCann of the Dominion Museum were responsible, since a colleague, J.B.Palmer, who worked closely with Adkin at this period, published similar identifications by these experts in the same journal (Palmer, 1956:351, 355). At Palmer's midden No.2 in eastern Wellington Harbour, barracouta and frostfish were found in the same site (op.cit.:351). It may be concluded therefore that at the Washpool Fort Site there is reasonable evidence of winter occupation during the period represented by the layer and before the construction of the defences.

Extended excavation of this site was not considered advisable. Little further information, apart from the possibility of more full midden description, could be obtained, This deposit, as has been learned already, was not contemporary with the construction of the defences. Care was taken not to disturb more of the site than necessary to clarify the questions raised by the midden. The very coarse gravel and rock matrix of the site would greatly handicap any attempt to reconstruct a more detailed history of the site by further excavation. The same strictures would apply to the possible pit features enclosed by the ditch and stone wall. Accordingly, only a tentative interpretation of the site's prehistory can be offered.

There is no doubt that a substantial part of the enclosed platform has eroded into the river and it may well be that on this lost ground were the features which could transform an enigmatic site into a more familiar New Zealand type. As it is, the site is rather perfunctorily defended with a shallow ditch and low stone wall, and is not easily explained. Habitation areas in Palliser Bay are rarely defended in the manner common with pa sites further north; indeed, the few defended sites on this coast are all related to storage pits. The possible pit enclosed by the defences at M3 may be the last clue as to the site's original function, and be the sole survivor of a more extensive pit complex removed by erosion.

THE WASHPOOL CROSS SITE - M4

The Cross Site, about 2.3km inland, was first recorded by Adkin (1955), and described as a 'Presumed Cultivation Ground'. The area is known locally as the Cross Site because when viewed from a track on the south side of the valley the site appears to be a large cross made from two intersecting stone walls. On the inland side of the cross is a long narrow leading ridge. This view is oblique to the surface of the site, and has the effect of perfecting the cross shape which is in fact composed of only one stone wall intersected obliquely by two large terraces (see Figure 79).

The lower part of the site, situated on an old consolidated fan, consists of one massive stone wall and 5 or 6 smaller ones. The large stone wall is intersected near its centre by the two artificial terraces. A third smaller terrace is found on the southwest corner of

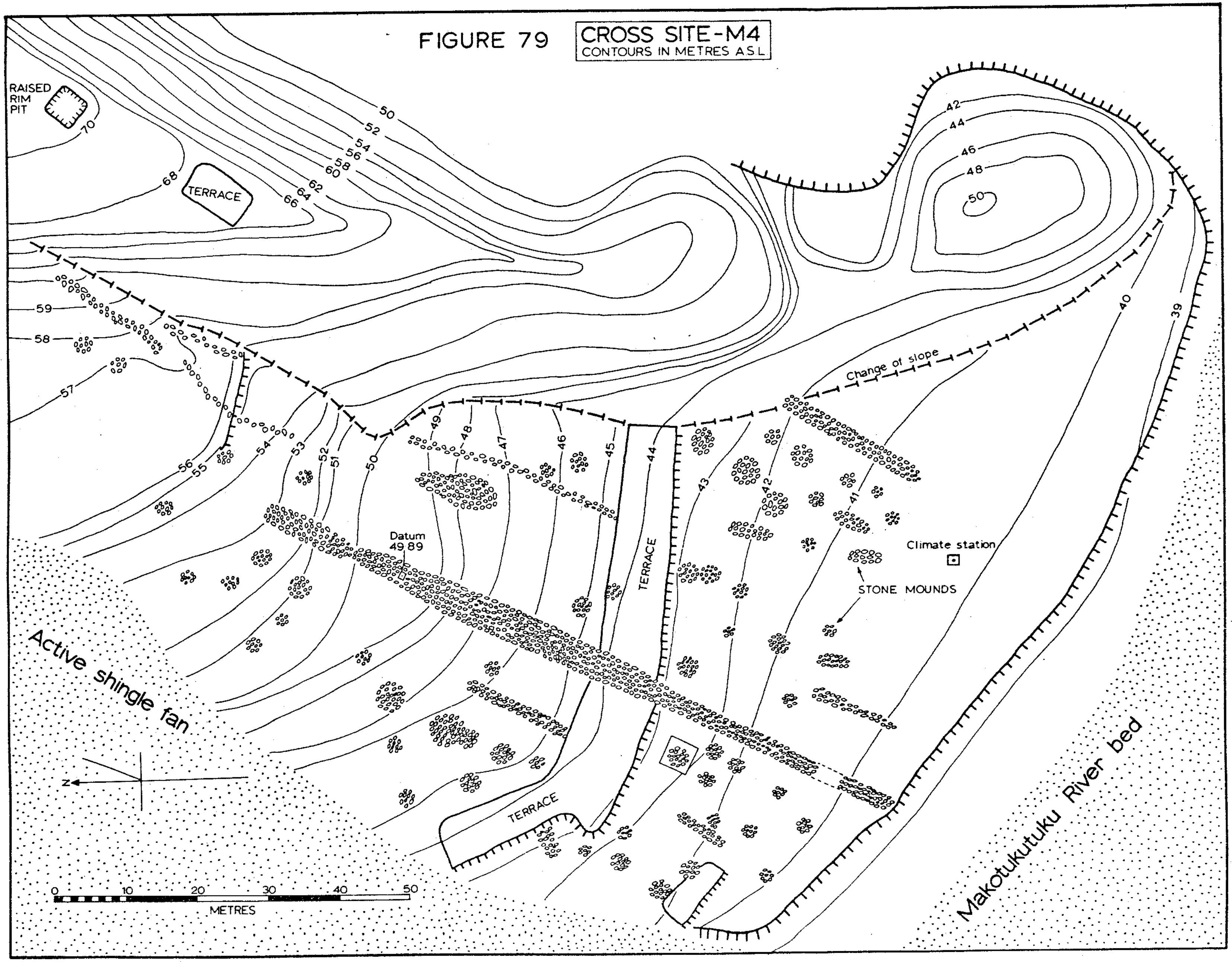


FIGURE 79
CROSS SITE-M4
CONTOURS IN METRES A.S.L.
RAISED RIM PIT
TERRACE
Change of slope
Datum 49.89
TERRACE
TERRACE
Climate station
STONE MOUNDS
Active shingle fan
Makotukutuku River bed
N
METRES
0
10
20
30
40
50

the area, could be a natural feature. The large wall and the two terraces thus divide the area of the fan, about 0.87ha, into four more or less equal areas. Spread over these four areas are more than 50 stone mounds. Adkin records the remains of a circular pit on the southeast corner, but no trace of this feature could be found. On Adkin's map (1955:Figure 6) it is marked within an area still intact, although a certain amount of river-induced erosion affects the general area. Judging from his photograph of the site (op.cit.:Figure 1) there may have been more consolidation near the actual site since his visit. The area immediately to the south of the river scarp shown in his figure has since been colonised by Cassinia leptophylla and Leptospermum ericoides. The process of scrub colonisation and consolidation has brought about quite significant changes in certain areas. They can be seen by comparing the aerial photographs of 1944 and 1970. For example, just west of the Cross Site is a very large gravel fan of up to 300m in width. In 1944 (263/3 S.N.180) this was clear of vegetation and quite active. In fact the margins of the Cross Site may have been inundated by gravel about this time. However, by 1970 (202111) the fan has been colonised by Cassinia leptophylla, Leptospermum ericoides and L.scoparium as well as occasional juvenile Myoporum laetum. This area was subjected to landsnail and botanical survey (Quadrants 15 and 16) described above.

Overlooking the area of walls and mounds is a narrow spur on which is located a single rectangular raised rim pit and an artificial terrace. Neither of these was recorded by Adkin. In contrast to the lower terraces, the one on the ridge had been cut into a surface which was clearly close to the parent rock. For this reason a function other than horticultural was strongly suspected.

Two excavations were conducted at the Cross Site. The unusual stone mounds demanded investigation, and one of these, just south of the western terrace (see Figure 79) was excavated (M4/II). In addition, the terrace on the ridge was also excavated (M4/I).

The Cross Site Stone Mound - M4/II

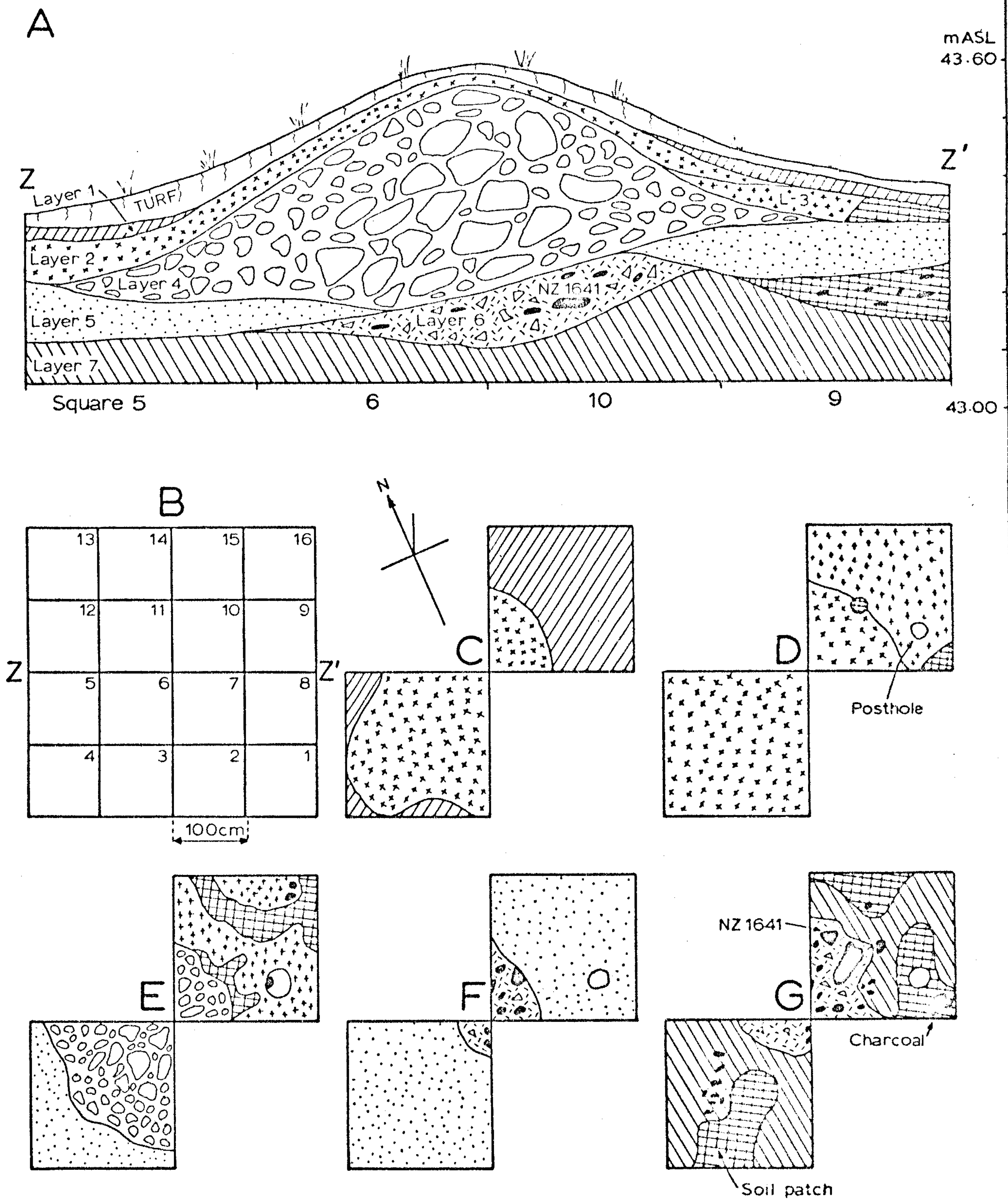
The mound was approximately 3m in diameter, and a square 4m by 4m was laid out on it. Only 2 alternate quadrants were excavated as it was thought that this would amply illustrate its construction. As can be seen from the plans and sections (see Figure 80) the feature had quite a complicated stratigraphical history with disturbances of various kinds. The layer sequence was as follows:

Layer 1 Dark brown loam. Much humus with only a few stones and charcoal. Together with the turf this layer makes up the modern A horizon.

Layer 2 - Layer 3 Dark brown loam with much gravel and a few larger stones and some charcoal. The layer appeared to have two stratigraphical components, and the second was designated layer 3. This was confined to the north-east quadrant and had several dark patches and charcoal concentrations. In addition, a definite posthole had been cut from this surface (11cm diameter, 41cm depth). The dark patches and disturbances are reminiscent of the mottled Layer 2 at the Washpool Garden Terrace (M1/XXX) and were here also interpreted as being due to cultivation with a digging stick. This disturbance continued to the base of Layer 5.

Layer 4 Grey-brown loose sandy matrix of the mound. Gravel and many large rocks. This constitutes the lenticular arrangement which makes up the mound shape. There is a tendency for larger rocks to be concentrated towards the centre, but it is equally significant that patches of sandy soil and charcoal were found in the centre of the mound as well as on

FIGURE 80 CROSS SITE MOUND M4/II



the periphery.

Layer 5 Brown sandy gravel and soil. Fewer stones than Layers 2 and 3, and as much charcoal. This is a disturbed zone, which together with Layers 2 and 3, is believed to constitute a garden soil.

Layer 6 Grey sandy gravel lying in a hollow directly beneath the mound (Layer 4), but also covered by Layer 5. This was a large depression filled with charcoal and burnt stones. It is best interpreted as a lens component of Layer 5.

Layer 7 Yellow compacted clay and silt with large stones and gravel. Very little charcoal was found, and this is believed to have leached down from higher layers.

A charcoal sample was taken and submitted for radiocarbon dating. Its position is projected onto the section given in Figure 80, and was actually in the square adjacent to that shown. The result was as follows:

NZ 1641 Charcoal M4/II/15, Layer 6 694BP ± 72 1256AD ± 72

The sample was situated close to the natural surface and directly below the mound. It is believed to relate to the earliest horticultural activity at the Cross Site, perhaps during a phase of initial forest clearing and burning.

From the excavation it is clear that the mound only came into existence after cultivation had started in the area. The general horticultural soil is represented by Layers 2, 3, 5 and 6, and the stone mound itself (Layer 4) overlies the earlier part of this culturally modified soil (Layers 5 and 6). Thus at least this particular stone mound does not represent 'initial clearing' and piling up of stones before gardening as might be thought. A similar conclusion is suggested by the incorporation of the garden soil (including charcoal) in the mound itself. While the prior existence of the garden soil might be inferred from the presence of this soil in the mound, the question of why it is in the mound at all is of some interest. If the mounds functioned merely as heaps for unwanted boulders cleared from a garden then it is surprising that so much actual soil and charcoal ended up in the mound. Two further points should be noted. Firstly, the ground between the mounds (Layers 2, 3 and 5) is very nearly as stony as the mound itself (Layer 4). Secondly, as can be seen from Figure 79 the mounds are more or less randomly distributed in the four areas separated by the walls and terraces. In places the area covered by the mounds actually exceeds the area between them and is not consistent with a simple 'clearing' interpretation. In the two southern areas of M4, and also the southern area of the Cricket Pitch the mounds in fact are so dense that there is practically no room between them. This raises the possibility that the plants cultivated were grown on the mounds instead of, or as well as, between them.

The mounds described here should not be confused with the small earthen mounds called puke which were a ubiquitous feature of later Maori cultivations (Best, 1925:78, 79, 80, 88, 89), and also seen in 1769 (Monkhouse, 1968:583). Puke were quite small heaps of soil, not mounds of stones and soil 3 metres in diameter. Suggestions that these large mounds were built to assist drainage must also be ruled out in an area which is naturally as stony and well drained as this. Mound cultivation is not unknown in Polynesia, although the various ethnographic descriptions of its practice are somewhat ambiguous. For example, Handy (1940:147) describes a process of mound cultivation in Hawaii that sounds more like the construction of a modern compost bin with the walls made of stone. It is doubtful whether these Hawaiian structures would resemble the mounds in question. Again, from a description recorded by Lewthwaite

(1964:18) it would appear that in stony areas in Tahiti the soil was mounded up to build a more favourable bed for plants. Just such a process may well have occurred at the Cross Site since the area is very stony and was formed by shingle fan consolidation. The gardeners may have mounded up the top few cm of humified soil and grown their plants on the mounds. The centuries of subsequent exposure, following the abandonment of the area, would result in some of the soil being washed out of the mound. In short, the mounds may once have been far richer in soil than they appear now. The large posthole in the mound could possibly be interpreted as a post to support a climbing plant. This could indicate cultivation of Lagenaria siceraria (gourd). Stone mounds on Hawaii have recently been indirectly dated to the mid-sixteenth century AD and interpreted as gourd beds (Newman, 1972:89).

It was noted that the large stone wall at the Cross Site was composed of considerably larger pieces of rock than the mound, and also had little soil included. This was clear without excavation, although with more time available a cross section through the wall would have been worthwhile. On the whole, it seems that 'stone clearing' may be a more applicable explanation in the case of the wall than of the mounds.

Stone mounds are not peculiar to the Cross Site, but they are certainly far more numerous here than elsewhere in Palliser Bay. The following comparable circular mounds were recorded during the site survey:

Pararaki North	N168-9/41	10 mounds
Waiwhero North	N168-9/69	9
Waiwhero South	N168-9/72	4
Cricket Pitch	N168-9/26	18
Fort Site	N168-9/27	12
Cross Site	N168-9/29	53
Black Rocks	N168-9/76	2

South Kawakawa	N168-9/66	5 mounds
North Kawakawa	N168-9/52	4
Washpool	N168-9/20	6

In addition, there are many more mounds of various kinds in Palliser Bay, but they are generally irregular or elongated, and could be part walls or oven mounds. The mounds listed above are quite distinctive from these. They are clustered and quite circular; they are all about the same height (50cm) and diameter (1 - 3m). The mounds from the last 4 sites named are less securely placed in this category.

When a size frequency histogram shown below was drawn up for the Cross Site mounds there appeared to be some tendency to cluster into two size groups. No explanation can be offered for this bimodality.

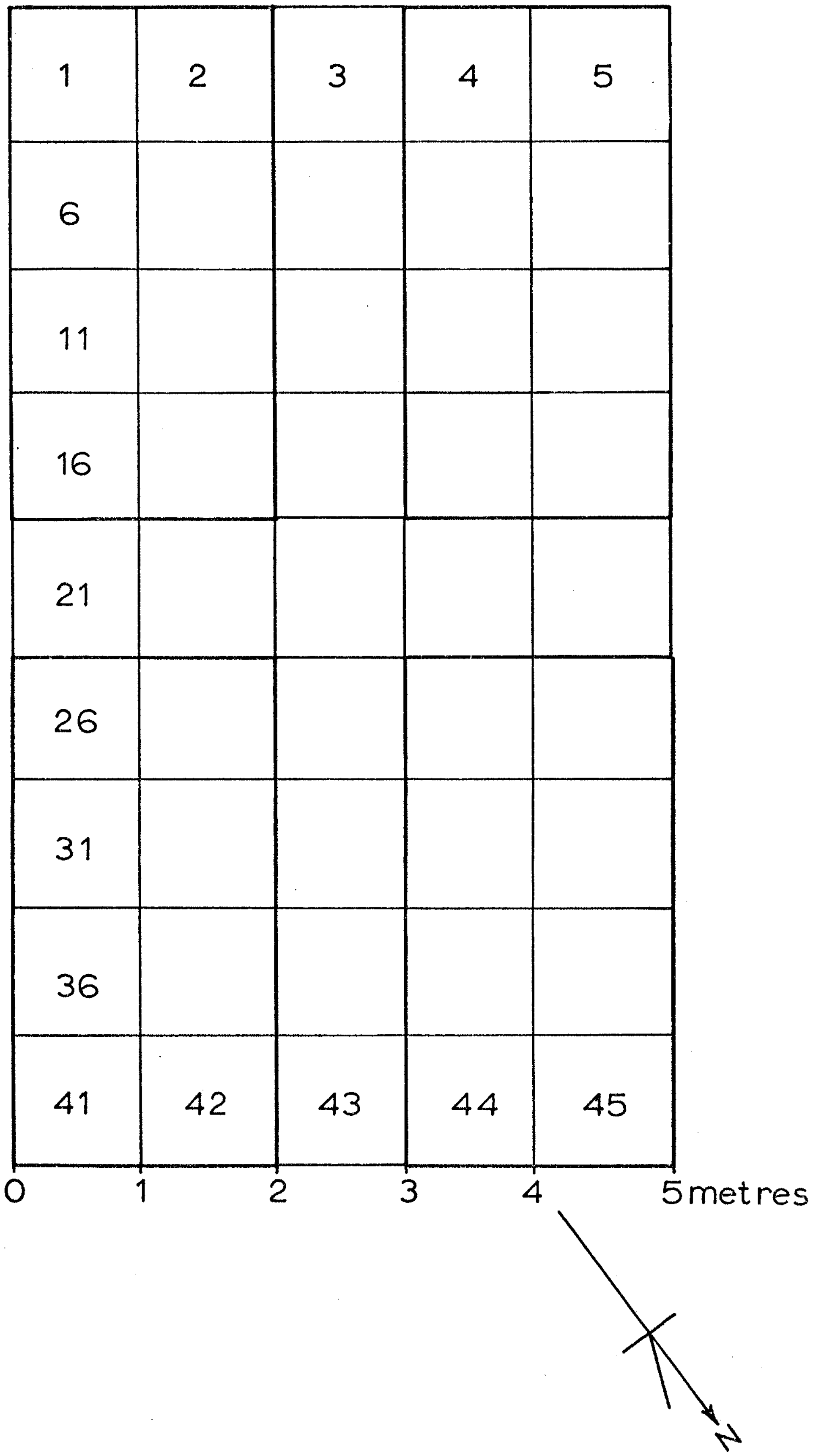
Size	1.0 — 1.5	1.5 — 2.0	2.0 — 2.5	2.5 — 3.0	3.0 — 3.5	3.5 — 4.0	4.0 — 4.5	4.5 — 5.0
Number	10	16	5	18	2	1	0	1

Number of Mounds = 53
Mean size = 2.39m diameter

The Cross Site Terrace - M4/I

This terrace was an artificially flattened area of about 9m by 5m on a long and narrow steep-sided spur immediately above the flat gardening area (see Figure 79). The choice of this area for occupation is believed to be due to two factors. On the one hand it is certainly the warmest location on this side of the river close to the garden area; on the other, it has a strategic view of the Makotukutuku Valley. From the terrace one can see as far as the Washpool river mouth and the sea. About 17m further up the ridge from the terrace is a well preserved rectangular raised-rim pit with nearly equal sides of about 4.5m each. These two features constitute the only surface evidence of prehistoric

FIGURE 81 CROSS SITE TERRACE EXCAVATION SQUARES M4/I



activity on the ridge. The ground appeared to be rather sterile, and in places the parent rock showed through the surface. No signs of charcoal or stone flakes were seen in any exposed soils. However, it was clearly artificially flattened, and the proximity to the pit reinforced this view. The chief concern prior to excavation was that erosion might have removed the cultural layer.

An excavation was laid out 9m by 5m divided into 4 quadrants with two 1m baulks across the centre (see Figure 81). These baulks were convenient while removing the superficial soil layers, but as soon as a cultural surface was found they were removed. Stratigraphy was recorded by the height recording method described earlier. The layers found were as follows:

Layer 1 Soft brown loam consisting of the turf and root zones, of patchy occurrence and about 1cm thick. Much of the layer consisted of cow dung and occasional pieces of charcoal were found presumably from European scrub fires. In square 45 a few limb bones of domestic sheep were found.

Layer 2 Hard, fine-grained homogeneous grey loam with little humus. Up to 3cm thick with rare flecks of charcoal and a few tiny chert flakes believed to derive from Layer 3. A lens of fine ash was found in square 27 and this is thought to have been a European camp-fire.

Layer 3 Compacted yellow clay and angular stones grading into parent rock. The surface of this layer was the level upon which the prehistoric activities took place. The post holes were cut from this surface, and embedded in it up to a depth of 2cm were the few cultural items recovered from the site including the carbonised seeds.

Lens A This was a 10cm fill layer in the stone-edged hearth with ash, carbonised seeds and charcoal.

Lens B A second fill layer (5cm deep) in the hearth consisting of fine ash.

It will be appreciated from this description that there was no 'terrace construction layer', as commonly found in New Zealand platforms of this kind. The terrace was apparently formed merely by flattening the existing ridge and presumably throwing any spoil over the sides. Only one cultural surface was found, and this was on the interface between Layers 2 and 3. The surface was very hard, and great care was needed to expose the carbonised slab-posts when they were eventually discovered.

A total of 24 postholes and a stone-edged hearth made up the structural features of the uncovered house (see Figure 82). All but 5 of the postholes had a thin carbonised cap, and sufficient wood remained in some to indicate that the posts had originally been carefully dressed slabs. The size of the carbonised portions of the butts along the sides of the house varied from 6cm by 2cm to 15cm by 4cm, with an average of about 10cm by 3cm. Thus although the original posts were quite rectangular, and appeared to have been dressed with an adze, they do not seem to have been fashioned to a particular size. The side postholes which contained the butts were also rectangular slots, and again variable in size, ranging from 7cm by 7cm by 13cm deep to 17cm by 9cm by 30cm deep, and averaging about 13cm by 7cm by 20cm deep. The figures demonstrate that the structural supports were not deeply embedded in the ground. The four centre-line postholes were considerably larger than those on the sides, as were the carbonised butts found within them.

Six of the carbonised butts were identified as "Podocarpus cf totara/hallii group, almost certainly P. totara" (Molloy, 1972:pers. comm.), an unexpected identification, as P.totara is rare in the Aorangi Mountains today. In Wardle's intensive study of vegetation in this area no example is recorded (Wardle, 1967), and Druce (1971:12), noted only the rare occurrence of a few specimens. No other explanation apart from recent and major ecological change would account for a local increase in P.totara numbers during the period of occupation. The alternative then is that the people who built the house went to some trouble to obtain supplies, even to the extent perhaps of importing totara posts from the nearest abundant source in the lowland forests of the main Wairarapa Valley, some 20km away.

In Molloy's opinion the anatomical features of the wood suggest, but do not prove, that outer or sap wood was used. The growth rings are narrow and uniformly spaced, consistent with the outer wood of fairly large trees or retarded smaller ones. The carbonised butts were therefore judged to be suitable for radiocarbon dating, and samples of the rear median post and another of the centre-line posts were submitted for dating. The following results were obtained:

NZ 1642	Charcoal	M4/I/8-13	rear median post	333BP ± 69	1617AD ± 69
NZ 1643	Charcoal	M4/I/18	centre-post	484BP ± 70	1466AD ± 70

These two determinations are unconfortably far apart for a single period of occupation, missing an overlap by 12 years at one standard error. However, the difference is judged to be statistical rather than a real indication of different age. The two results were therefore pooled to give the following 'best estimate':

M4 House 411BP ± 76 1539AD ± 76

The rear median post of the house revealed an interesting feature during excavation. Under the carbonised cap of the slab post, partly decomposed wood occurred in somewhat greater quantity than in most of the other postholes. At a depth of 14cm below the charcoal cap a dog's jawbone had been inserted into a recess in the actual post during the construction of the house. The bone was the right mandible of a young dog of about 6 months (see Figure 83), judging from the partial

FIGURE 82 CROSS SITE HOUSE PLAN M4/I

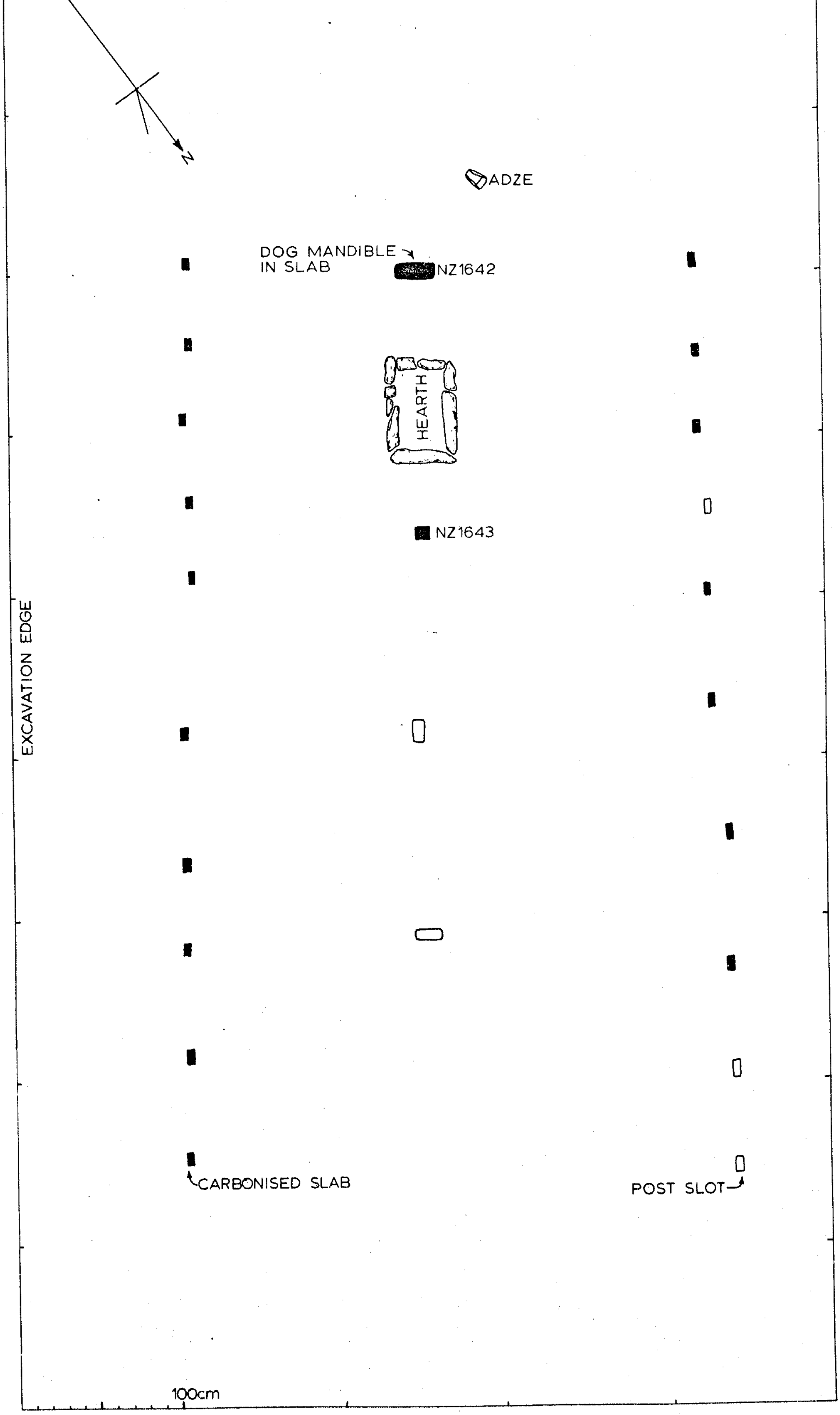
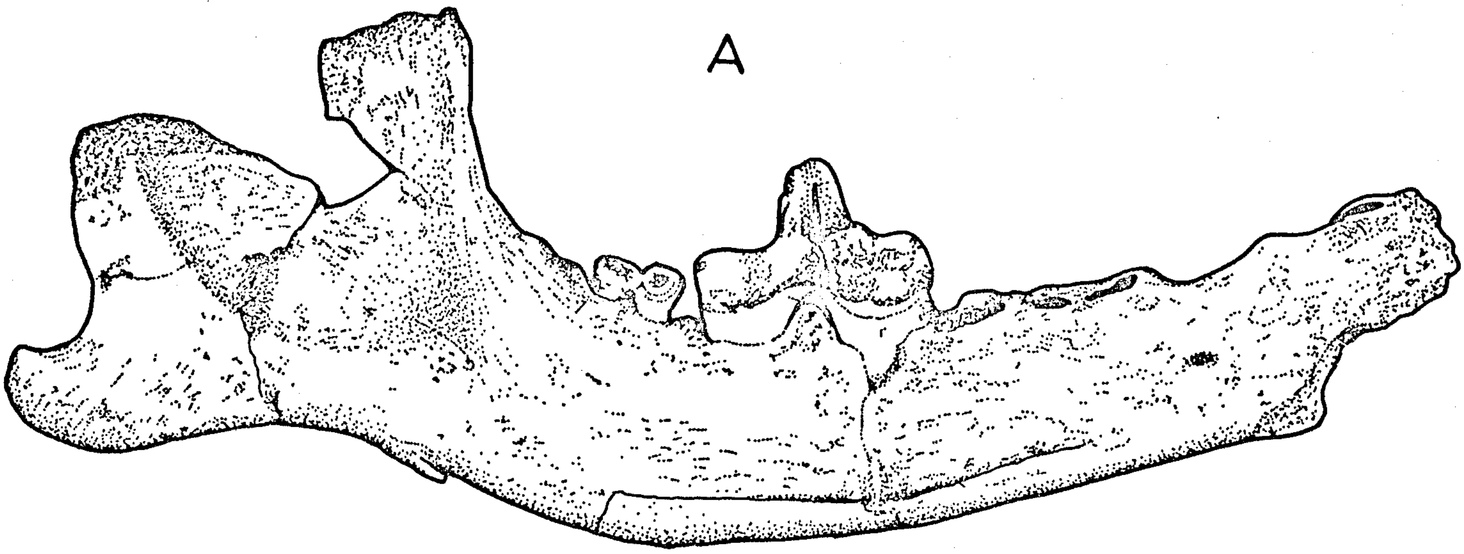
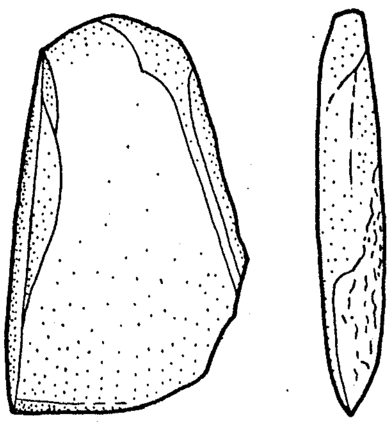


FIGURE 83 M4 HOUSE ARTEFACTS

A



B



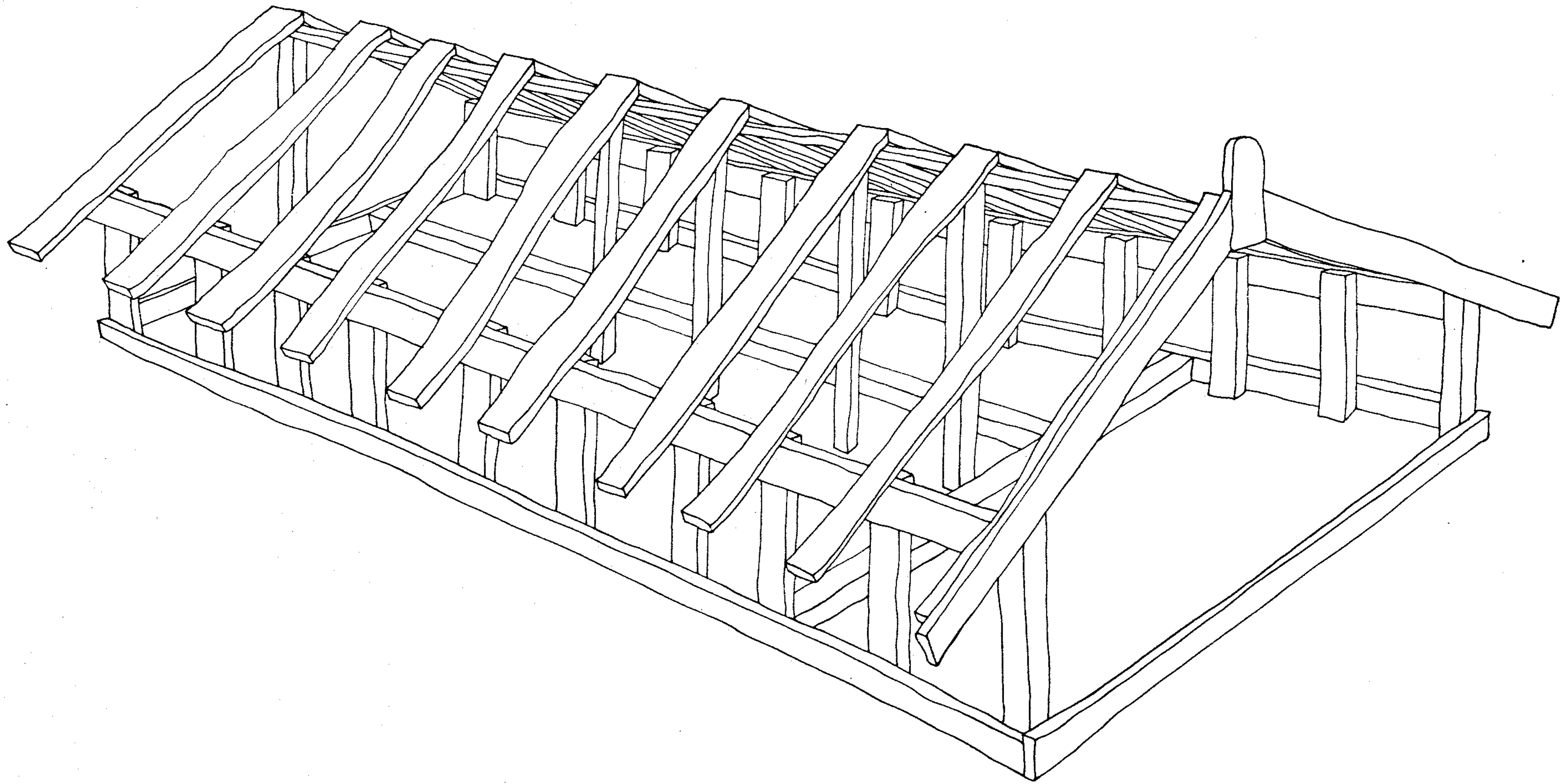


FIGURE 84 CROSS SITE M4 HOUSE - RECONSTRUCTION

eruption of the 3rd molar (Sisson & Grossman, 1953:503). Because the jaw was in an unburnt part of the post, it must have been charred before burial, and relate to some ritual process at the commencement of the house building.

Throughout Polynesia the erection of substantial houses was frequently marked by ceremonial including human sacrifice. However, the use of young dogs in this fashion has not been recorded previously. At the site of Elletts Mountain (N42/23), 8 dog canines were recently found in the fill of a posthole, but could not be related to any meaningful structure (McKinlay, 1975:pers.comm.). This find, however, could indicate a comparable ritual.

It is also noteworthy that the stone-edged hearth was set into the living surface, rather than sitting upon it. Thus the fire would have burnt in the hearth slightly below the level of the floor. The hearth was made from 10 rather irregular pieces of greywacke. It measured 42cm by 58cm and contained 2 lenses of ash as described above. Charcoal from Lens A was identified by Molloy (idem):

dominant	Myoporum laetum (ngaio)
sub-dominant	Hebe sp. ? salicifolia (Koromiko)
minor amounts	Metrosideros cf robusta (rata)
"	Pseudopanax cf colensoi-arboreum (five-finger)

Outside the hearth, charcoal from near the centre-post was also found to contain Pseudopanax sp. Little is known of the uses to which various New Zealand timbers were put by the 18th or 19th century Maori, and even less of those by earlier populations. A poem collected by Sir George Grey alludes to 'moa' being roasted with koromiko. This much quoted reference (see for example Colenso, 1879:87; Duff, 1956:298) has resulted in a widespread belief that Hebe salicifolia/stricta was commonly used for cooking purposes. The above identification is the only archaeological evidence to support the claim, and it is at present an isolated find.

It is worthwhile comparing the results from this hearth with a few other recorded identifications from prehistoric ovens or hearths. From an oven in the Tararua Range dated to the 13th century AD charred wood was identified as Podocarpus cf totara/hallii group probably P.hallii (Park, 1970:193-4). At the Weka Pass or Timpendean Shelter in North Canterbury, probably dated to the early 16th century, timber burnt on the site included Podocarpus sp., Sophora sp., Hebe sp., and Discaria sp (Trotter, 1972b:47-49). In the Moikau Valley in Palliser Bay charcoal was identified from three ovens closely associated with a house excavated by N.Prickett (1974), and dated to the late 12th century AD. The following results were obtained (Molloy, 1973:pers.comm.):

Oven 1	Dominant	Dacrydium cupressinum (rimu)
	Minor amounts	Coprosma sp.
	"	Coriaria arborea (tutu)
	"	Pittosporum sp.
	"	Hebe sp.
Oven 2	Dominant	Dacrydium cupressinum (rimu)
Oven 3	Dominant	Dacrydium cupressinum (rimu)
	Minor amounts	Nothofagus truncata (hard beech)
	"	Leptospermum scoparium (manuka)
	"	Pseudowintera sp. (horopito)

These few identifications cited show that a great range of woods were used for cooking, even in a single fire, and that the belief in the importance of Hebe salicifolia is not necessarily supported by the finds at the Cross Site House.

A number of seeds were recovered from the soil samples, and a representative number of these were identified as follows (R.Mason, 1973:

pers.comm.):

<u>Calystegia</u> sp. (pohuehue)		1
<u>Sophora</u> sp. (kowhai)		1
<u>Myoporum laetum</u> (ngaio)		7
<u>Ripogonum scandens</u> (supplejack)		1
<u>Corynocarpus laevigata</u> (karaka)		2
<u>Elaeocarpus hookerianus</u> (pokaka)		2
<u>Elaeocarpus dentatus</u> (hinau)		63

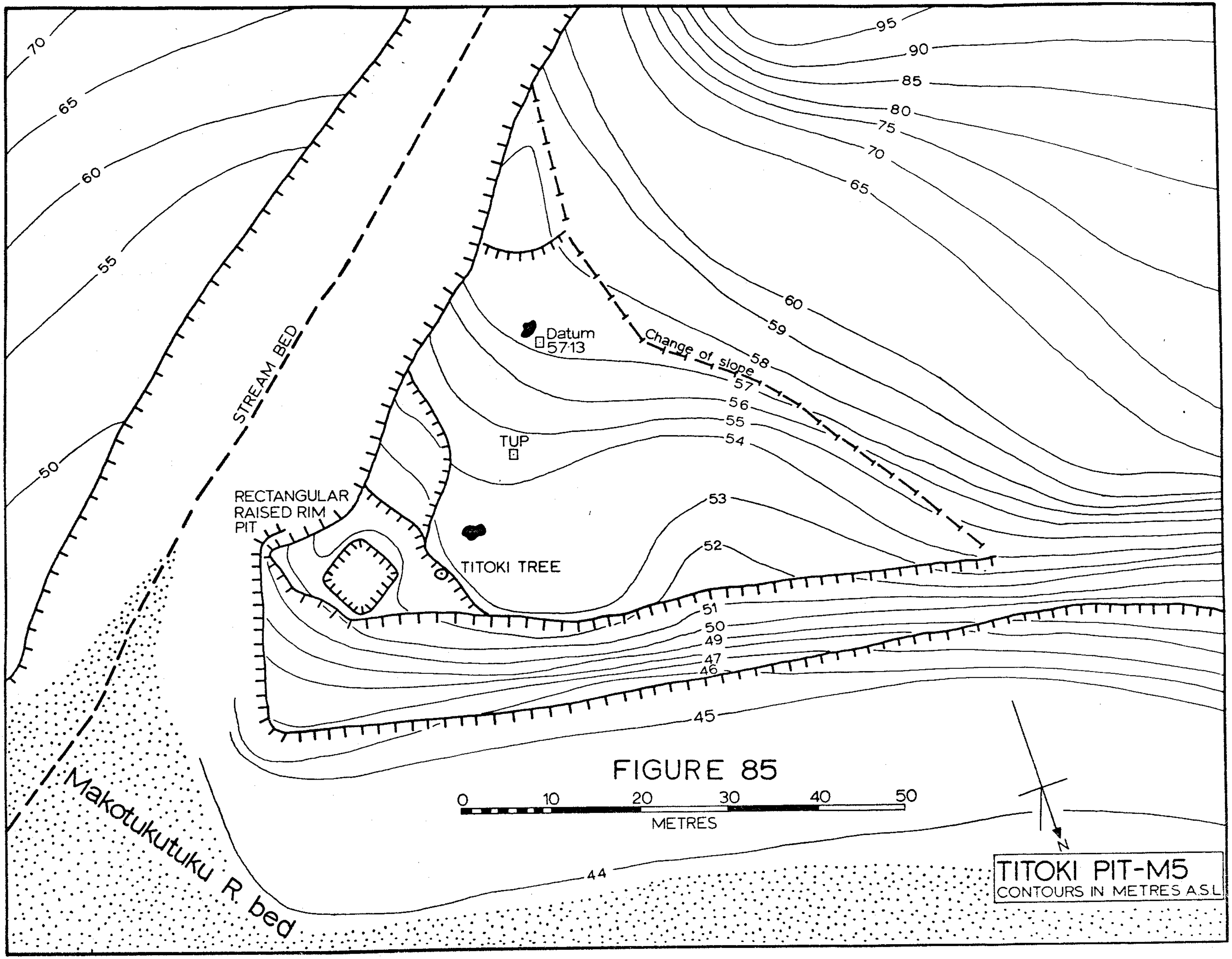
Only the last two species were carbonised, but most specimens were found firmly embedded in Layer 3, and are therefore securely associated with the prehistoric dwelling. Of the species present, the karaka, hinau, pokaka, and perhaps the ngaio, were probably brought into the house as food. Hinau is rare in the Aorangi Mountains today. Pokaka was not recorded by Wardle (1967) and only a few specimens were noted by Druce (1971:12). Hinau berries have been identified from other New Zealand archaeological sites (for example see Trotter, 1974:9), and the berries were an esteemed food of the Maori (Best, 1942:43). The carbonised seeds were found concentrated about the hearth, although only a few were recovered from the hearth fill itself. The majority of the hinau seeds came from a patch of Layer 3 within a few cm of the centre-post. Since the carbonisation of seeds requires a reducing atmosphere, such as a choked or stifled fire, the quantity of seeds found outside the hearth might argue for their carbonisation inside a storage bag during the fire which razed the house. Apart from the seeds next to the centre-post, nearly all the remainder were found close to the walls of the house, and this possibly indicates they too were in food containers suspended from the walls at the time of the fire. As in the case of the Mangakaware houses (Bellwood, 1971:121), seeds provide a clue to the season of occupation of this house. Specimens found near the hearth suggest that the ripe fruit were brought to the house where, as the fleshy covering of the seed was bitten off and eaten, the discarded seeds were consigned to the fireplace. This particularly applied to the hinau, the dominant type. Clearly, however, some of the seeds were in storage at the time of the fire which burnt the house. It may be argued then that the fire took place after the ripening time of the hinau fruits, and within the period that they were stored and eaten. According to Allan (1961:333) the hinau flowers between October and February and the purple fruit ripens between December and May. Since the Aorangi Mountains are in the southern part of the distributional range of hinau the ripening time is probably closer to March-April. The smaller pokako fruits ripen between November and March. Karaka fruit ripen between January and April (Allan, 1961:407), and in this area ripening is again towards the end of the period. The ngaio drupes mature between December and June (op.cit.: 958). The most likely collection time for this assemblage of drupes is about March or April. Assuming that they could still be used as food for 3 to 4 months after collection, if kept in dry surroundings, the house fire could have occurred between March and July. This suggestion of autumn to winter occupation is not inconsistent with the hypothesized link between the house and adjacent pit, which probably would have been filled with kumara in April or early May for winter storage and use.

A few artefacts were found embedded in Layer 3. These include a small sawn and polished nephrite adze (see Figure 83) which derived from the Arahura River source (Ritchie, n.d.), 84 tiny chert flakes, probably from Te Oroi, 1 pumice fragment and 1 piece of rock crystal (K.Prickett, n.d.). In addition, 1 small piece of grey obsidian was found, and this was determined by trace element analysis to derive from Cooks Bay (see Sample GU300, Appendix 5). Cooks Bay obsidian occurs in moderate amounts at the Washpool Midden Site throughout the sequence from c.1150AD to c.1550AD (see Appendix 17).

As can be seen from Figure 82, the house was supported by two rows of posts, ten on each side, and four centre-posts. The outer walls were slightly out of parallel, an arrangement which N.Prickett (1974) has argued was a deliberate practice to destroy symmetry. At the northern end of the house the centre line of posts terminated some 1.7m from the end, and the last centre post slab was set at right angles to the line of the house. This is a strong indication of a verandah similar to those recorded for 19th century Maori dwellings. The entrance to the house therefore faced uphill towards the raised rim pit. The main structural features of the house are reconstructed in Figure 84, and its design is discussed further in a later section where comparisons are made with other archaeological structures found in Palliser Bay.

THE WASHPOOL TITOKI PIT - M5

The intersection of the Makotukutuku River and a tributary stream 2.8km from the coast (see Figure 12) has left a triangle of land on the south bank divided by scarps into gently sloping terraces. On one of the outermost terraces a rectangular raised-rim pit of 5.5m by 4m was located (see Figure 85). It occupied a position very similar to a series of pits discovered on the edges of high terraces on the south bank of the Kawakawa River, where surrounding ground bore stone walls and mounds (N168-9/58-61). No walls were present at M5, however. The terraces are mantled by a friable gravelly loam believed to have been formed under forest. This overlies a very stony deposit of riverine origin in a clay matrix. The site is locally known as the Titoki Pit because of a large Titoki (<u>Alectryon excelsus</u>) tree nearby.



TITOKI PIT-M5
CONTOURS IN METRES A.S.L
RECTANGULAR RAISED RIM PIT
STREAM BED
Datum 57·13
TUP
TITOKI TREE
Change of slope
Makotukutuku R. bed
0 10 20 30 40 50
METRES
N
95
90
85
80
75
70
65
60
59
58
57
56
55
54
53
52
51
50
49
47
46
45
44

FIGURE 85

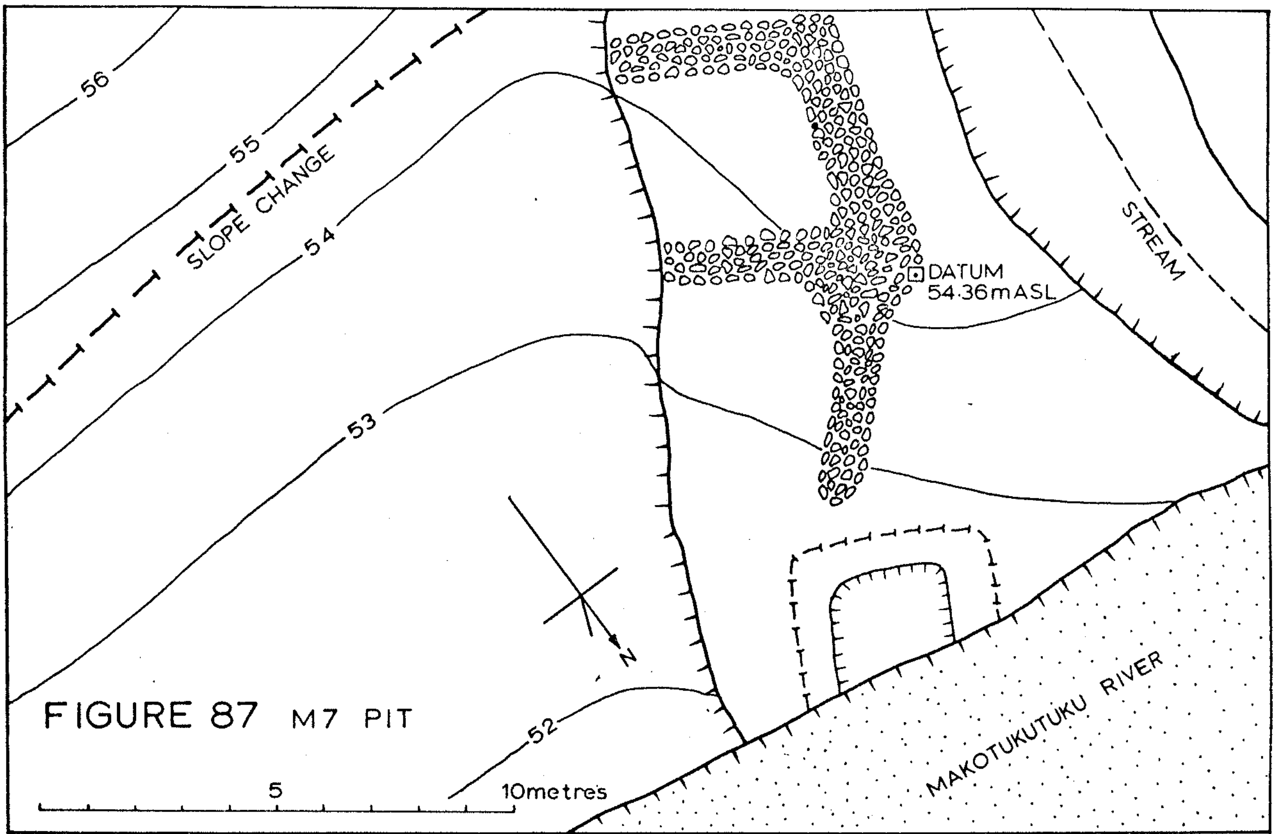


FIGURE 87 M7 PIT

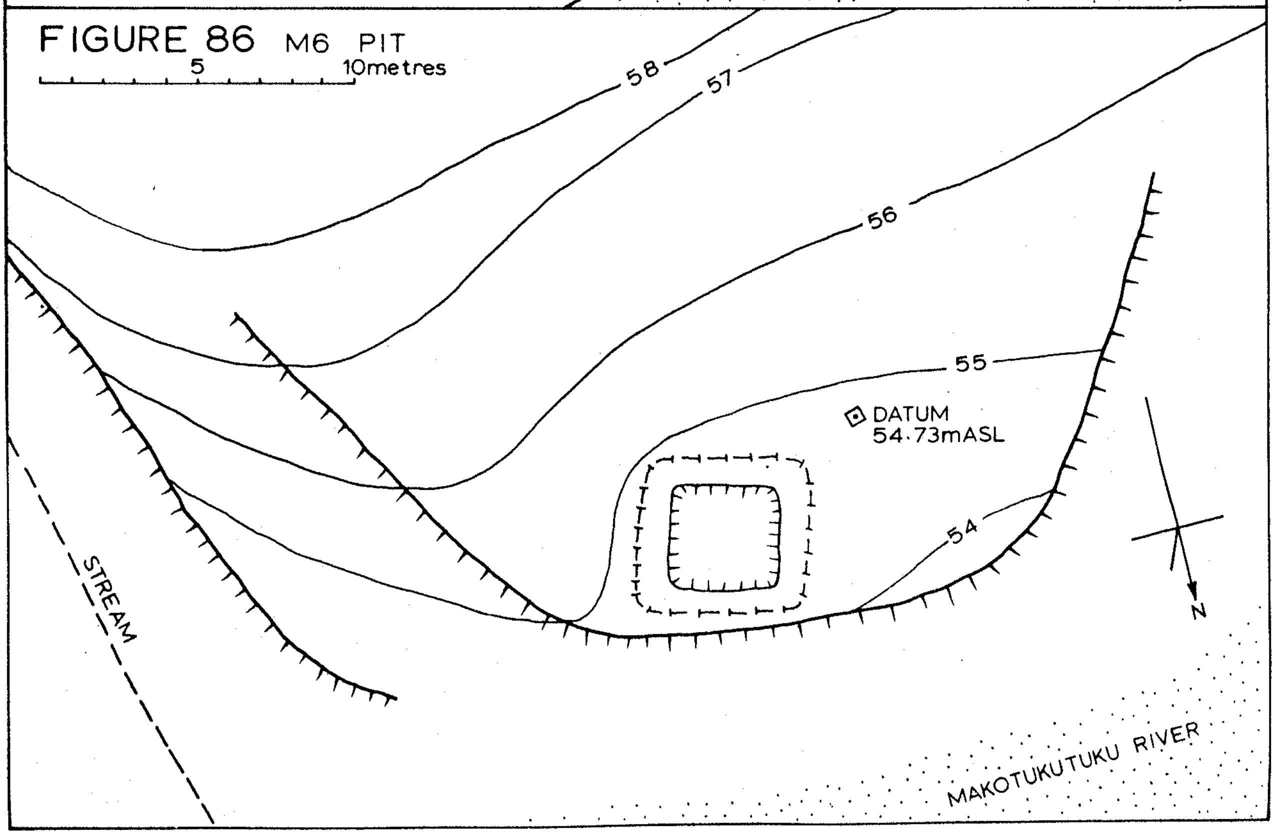


FIGURE 86 M6 PIT

Similar raised-rim pits were discovered on the south bank further upstream. The pit M6 (4.5m by 4.5m) is located on the edge of a river terrace on the west bank of a small gully, while the partly destroyed pit M7 (?5m by 3.5m) was found on the east bank of another tributary stream (see Figures 86 and 87). The pits M8 and M9 are much disturbed by subsequent forest cover but were perhaps 5m by 4m. Good accessibility resulted in the selection of the M5 pit for excavation. It appeared to be well preserved with a substantial rim evident on all sides. In neither this pit nor any others in Palliser Bay could an entrance in the rim be detected.

A rectangle of 7m by 6m was excavated with a central 50cm baulk which bisected the pit from east to west. Beyond the rim, 3 layers were found:

<u>Layer 1</u> Brown loam containing much humus

<u>Layer 2</u> Grey-brown friable loam, constituting the lower portion of the topsoil.

<u>Layer 3A</u> Hard stony yellow disturbed natural

Beneath Layer 2 the first prehistoric material was obtained from the surface of Layer 3A. Patches of charcoal and relatively loose soil were visible on this surface and several small obsidian flakes were recovered. Later investigation of two soft patches revealed root holes left by small to medium sized trees and this shows that regeneration had occurred after the abandonment of the area. Obsidian flakes were also found on the rim of the pit which was composed of stones and clay, almost certainly derived from digging out the bottom of the pit.

Under the topsoil in the pit was a series of fill layers, all of which could be ascribed to natural erosion into an open pit after its use ceased:

Layer 3B A recent soil which included some pig bone and an obsidian flake, thought to have been washed down from the rim

Layer 4 Friable shingle loam possibly formed under vegetation

Layer 5 A grey-brown friable stony loam which may represent a renewal of erosion from the rim

Layer 6 Like Layer 4 this also contained humus consistent with vegetation cover

Layer 7 This was the uppermost fill component with patches of charcoal, and consisted of thick dark brown shingly loam

Layer 8 This was a mixed layer of shingly loam, charcoal, and clay. It was the primary erosion layer deposited by slumping and rainwash from the walls and rim

Layer 9 The uppermost floor surface, consisted of a thin brown gritty soil surrounding stones in the centre of the pit

Layer 10 This was similar to Layer 9 but contained pieces of yellow clay. It was found in the centre of the pit only

Layer 11 This probably represented the fresh surface of the pit floor soon after it was dug. The upper 2 to 3cm are a compacted brown shingly soil with clay inclusions. Along the northern and eastern edges of the pit it overlay a natural yellow clay and stones, but in the centre and western portions of the pit it was clearly not a trampled natural, but was itself a modified fill layer

Layer 12 This occurred at the base of this deliberate infill (Layer 11), and was similar in composition to the fill but substantially less compacted. This was covering the floor of an earlier pit (A).

Layer 13 The natural substratum exposed in the floor of the earlier Pit A. This was a very hard stony layer with clay matrix, and the same deposit as the natural surface around the pit (Layer 3A)

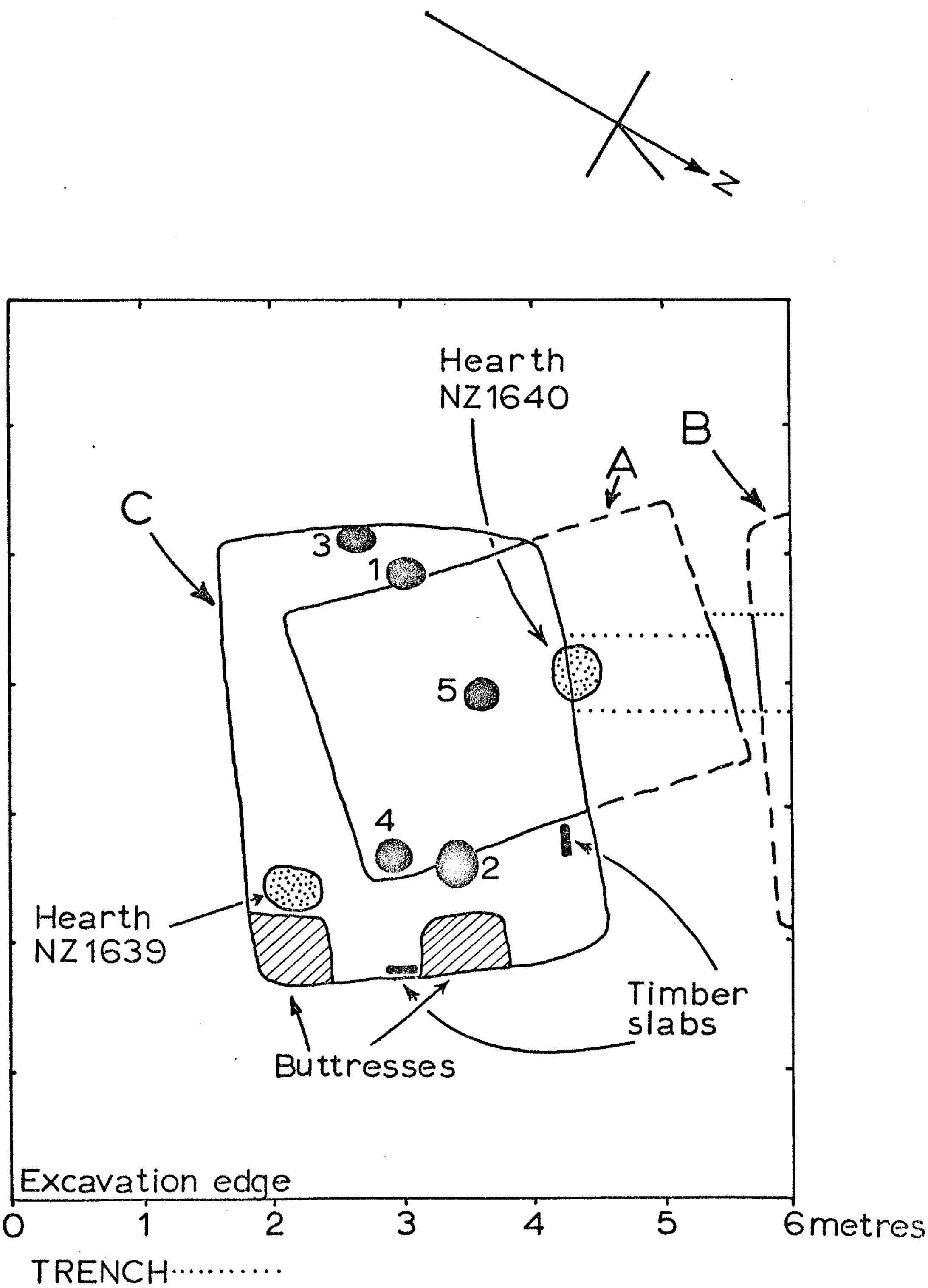
The unexpected discovery of an earlier pit floor made the interpretation of some of the structural features in the later Pit C more difficult than anticipated (see Figure 88). However, the two buttresses found on the northern wall definitely belonged to the later pit. One was situated in the northeast corner, while the second was slightly offset from the centre line of the pit. At the foot of the corner buttress, a small circular hearth was discovered in Layer 11, and this furnished charcoal for a radiocarbon sample:

NZ1639 Charcoal M5/17, hearth Layer 11 <178BP >1772AD

Beside the central buttress, portions of a timber plank were uncovered which may have been part of a door frame. Another piece of similar timber occurred in an upright position a small distance out from the western wall, and this could have been part of a wooden wall or perhaps from a storage rack.

The floor of Pit C possessed at least 3 postholes which could not have belonged to Pit A since they occurred beyond its walls. Two are positioned close to the centre line at the southern end, while the third is in front of the central buttress. Within the depth range of these holes (35cm to 48cm) is another posthole which was not noticed until the slightly lower Pit A floor was scraped down. It was 35cm deep compared with a posthole of 16cm (Post No 5) which is believed to have been part of a centre line of posts of Pit A. If the former posthole (No 4 in Figure 88) is assigned to Pit C, it appears that the roof was supported by two ridge posts, and that the structure was reconditioned at some time when these were being replaced with two new posts positioned parallel to the first two, but slightly offset. The two pairs of supporting posts then are represented by Posts 1 and 2, and at some other time by Posts 3 and 4. Such re-framing and mis-alignment of centre posts is not uncommon in pits (qv.Fox, 1974:143), and probably

FIGURE 88
TITOKI PIT M5 EXCAVATION



indicates that the reconditioning took place with the older rotten framing intact, and only removed after new posts had been erected beside them. Pits A and C appear to conform to Fox's Type 1 (ibid).

A section of the wall of Pit C was removed in order to determine the length of the earlier pit. A large quantity of charcoal was found on the floor of Pit A under the deliberate infill, and this showed as a black lens in the wall of the later Pit C. It was from a hearth similar to that found in the corner of Pit C. A charcoal sample which was collected from this hearth dates the use of the earlier pit:

NZ1640	Charcoal	M5/33, Hearth A	371BP ± 69	1579AD ± 69

The relatively homogeneous fill material of Pit A into which Pit C was dug terminated abruptly 25 - 35cm from the western edge of the excavation. Here another fill layer was discovered belonging to a third Pit B, also deliberately infilled. Chronologically it was definitely later than Pit A and probably earlier than Pit C, if as seems likely, material dug out of Pit C was later used to fill it. Insufficient time precluded the examination of this pit, or the full exposure of Pit A. It is probable that further excavation would reveal still additional pits. From the section it is evident that Pit B also had a raised rim.

The discovery of 3 pits in the course of excavation of a single, apparently isolated pit is not unusual in North Island pit excavations. The use of fill from one in the construction of the next makes the interpretation of any artefactual material very difficult. Stone material from this site included 6 obsidian flakes, some found inside and outside the latest pit. They could have been deposited at any time before the use of the latest pit ceased. Two pieces of the obsidian were sourced to Huruiki in Northland (see Appendix 5,Samples GU 392, GU 393), and one green piece to Cooks Bay, Coromandel (Sample GU 394).

The Huruiki source was most frequently represented in the Level II obsidian collection from the Washpool Midden Site at about 1345AD (see Sppendix 17). Two chert flakes were found, probably from the source at Te Oroi, and 1 flake of D'Urville Island argillite. The 5 identified Calystegia tuguriorum seeds were from the modern topsoil Layer 2, and natural fill Layer 6, and were probably deposited under light forest conditions after the abandonment of the site.

This excavation demonstrated that the raised-rim pit with buttresses, central postholes, and hearth was in use as late as the 18th century AD in this location at least, and probably during the preceeding two centuries.

COASTAL HORTICULTURAL SITES

During the site survey, over 80 hectares of the coastal platform were found to have been modified by the construction of stone walls, stone mounds, and single boulder alignments. Where these stone structures were sectioned by the road or eroding river or stream banks they were often found to contain quantities of charcoal. As well, the ground between the stone structures frequently displayed a characteristic thick, blackened sandy layer which on stratigraphic grounds was contemporary with the stone structures.

The aim of H.Leach's study of the stone walls was to identify the various activities associated with wall building and use, and to assess whether this constellation of evidence was consistent with a horticultural interpretation (H.Leach, 1976). Her fieldwork consisted of mapping each of the major wall complexes, followed by a series of excavations. All except one of the excavations were designed to obtain a clear profile of a stone structure and the adjacent soil layers, and to recover soil and charcoal samples. The exception was at the Washpool where the interrelationships of a single boulder alignment and a stone wall were investigated in plan, by exposing 150m^2.

The northernmost wall complex on the coastal platform (N168-9/16) was spread over 600m between Woolshed Creek and Whatarangi Stream. Prehistoric occupants had taken advantage of hollows on both sides of a well marked stony beach ridge to clear ground and modify the sandy loam soil to their requirements. Excess stones had been built into a number of short walls running out from the beach ridge. Where this beach ridge is actively eroded by the sea at its northern end (N168-9/15), artefacts of Archaic forms have been recovered, including moa bone tabs and a small polished Duff Type 2A adze. A 3m by 1m trench was excavated across a stone wall at the southern end of the complex. This revealed that 4 discrete silt layers had built up against this wall as a result of flooding of the Whatarangi Stream. The uppermost was certainly post-European, while the lower silts were interpreted as prehistoric. Beneath the silt layers the original A horizon was located. This was a beach sand modified by humus and charcoal. H.Leach noted the following features of this layer which were also encountered at most other wall sections:

> "This was unquestionably modified by man by the incorporation of quantities of charcoal, by the removal of the larger waterworn stones to the wall, and by what seemed to be artificial deepening of the A horizon away from the wall"
>
> (H.Leach, 1976:Chapter 3)

A charcoal sample from this sandy loam gave the following result:

NZ1309 Charcoal N168-9/16 545BP ± 68 1405AD ± 68

This age estimate is most useful for it provides some indication of when a stable environment existed before the serious erosion which still affects the Whatarangi area began. H.Leach believes that the presence of charcoal in the first silt layer indicates that the burning of forest cover on the hills behind the coastal platform during the prehistoric period may have initiated this erosion (ibid).

Stone structures at the Washpool cover nearly 10 hectares and both walls and stone alignments are common. Judging from the layout of walls, this complex (N168-9/20) actually consists of several sections laid out separately, some of which are characterised by a predominance of precisely positioned boulder alignments with fewer walls, while others have mainly broad walls laid out less carefully. Of particular interest were some lengths of single boulder alignments which seemed to run parallel to portions of stone walls, turn corners and merge with other walls. H.Leach opened 6 squares each of 5m by 5m in an area where the construction details and the relationship between these alignments and walls could be examined. As well as exposing the structures in plan, sections were cut at several points. This excavation showed clearly that the jumbled heap of stones which seem to constitute this wall actually concealed the remains of a neatly constructed low wall, faced on one side by up to 3 layers of large boulders, behind which the smale stones had been dumped. The alignment was also constructed of quite large waterworn boulders, placed on edge in a contiguous arrangement. A small fire had been lit up against the alignment and extinguished by placing another stone over the ashes. The stone had cracked in situ.

Charcoal pieces were found both within and outside the stone structures. There appeared to be more pieces within the stone wall, but this probably reflects the greater protection from physical attrition there. Charcoal samples were submitted for dating from the wall matrix (Layer 2A), the charcoal enriched soil (former A horizon) adjacent to the wall (Layer 2B), and from a lens of charcoal which had become incorporated in the original B horizon before or at the time the wall was built. These gave the following results:

NZ1513	Charcoal	M1/XX/7-8, Layer 2A	342BP ± 78	1608AD ± 78
NZ1514	Charcoal	M1/XX/6-7, Layer 2B	508BP ± 79	1442AD ± 79
NZ1512	Charcoal	M1/XX/15, Layer 3	388BP ± 79	1562AD ± 79

These were combined to give a single pooled estimate:

Washpool Stone Wall Garden 412BP ± 49 1538AD ± 49

This excavation demonstrated that the row and alignment were contemporary features, laid out and constructed within a single programme of wall building. They also showed that the former topsoil adjacent to the structures was in many places artificially deepened and darkened with charcoal. It was found that soon after this soil modification took place, the natural hollow through which the alignment passed, was used as a workshop, resulting in the accumulation of over 400 pieces of stone material, most of which were obsidian and chert flakes. Examination of edge-use indicated that the majority had been used as scrapers. Drill points and various cutters and abraders were also identified. Only one piece of bone was found and H.Leach suggests that the stone tools had been employed in the finishing of small wooden objects (H.Leach, 1976: Chapter 3).

Between the Washpool and the major wall complex at Te Humenga, stone structures occur on the few portions of coastal platform which are not covered in shingle and stones from active or semi-active fans (for example: N168-9/35, 37). Only about 10 stone walls are visible; however a series of very long artificial terraces have been recorded on one of the more consolidated fans (N168-9/36). These were assigned a horticultural function earlier in this chapter. At Te Humenga, stone walls cover an area of 9.3ha on the third, fourth and fifth raised beach ridges and intervening hollows (N168-9/39). At least two separate sections have been identified, composed chiefly of long stone walls which meet the beach ridges at right angles. Where the ground is stony, walls predominate; these give way to contiguous alignment and even spaced boulders in more silty areas. From such situations, H.Leach argues that the primary purpose of stone walls was to mark land boundaries; in very stony ground they fulfilled the secondary function of containing stones cleared from adjacent surfaces. Two small excavations were conducted at Te Humenga (op.cit.: Chapter 3). In both sections removal of overlying recent topsoil and silt layers revealed a black sandy loam enriched with charcoal. This in turn covered the natural brown sand of which the beach ridges are composed. The surface of this sand dipped down on both sides of the wall, just as at Whatarangi, and the Washpool Site. A charcoal sample from the black wall matrix gave the following result:

NZ1310 Charcoal N168-9/39 777BP ± 56 1173AD ± 56

It is interesting to note that at Te Humenga increased fan activity also followed the wall building phase.

On the north bank of the Pararaki River a further 9.3ha of walls were recorded. These were built on the beach ridges, swales and on the river terrace (N168-9/41). As well as the walls, mounds of burnt stone, middens, burials, artefacts and houses have been located in this area (N168-9/42, 43). The usual range of stone structures was present but their layout gave the impression that the land was cleared in smaller sections and possibly over a longer period than at Te Humenga (op.cit.: Chapter 2). Two large stone walls were sectioned, one of which had been used as a midden dump during its construction. This feature had been built directly over a stone-filled trench which was interpreted as an alternative form of boundary marker. Charcoal from the trench was dated:

NZ1312	Charcoal	N168-9/41	731BP ± 70	1219AD ± 70

A sample from the matrix of the stone wall gave a date of:

NZ1311	Charcoal	N168-9/41	671BP ± 72	1279AD ± 72

A further sample from the matrix of a stone wall on the inner beach ridge confirmed the period involved with the following result:

NZ1313	Charcoal	N168-9/41	708BP ± 72	1242AD ± 72

There was evidence from the excavations and from a series of test pits that erosion in the form of river flood silts and wind blown sands followed prehistoric occupation of this area. However, this activity began only after a period of abandonment during which normal soil build-up occurred (op.cit.: Chapter 3).

Archaeological sites at the South Pararaki were as abundant as on the north bank, and the walls covered some 11.7ha (N168-9/46). Three major and three minor groups were identified (op.cit.:Chapter 2), and these included stone walls and single boulder alignments. A double alignment spaced 46cm to 60cm apart was excavated at several points, and the ground between was found to have been paved in one area. Charcoal from the contemporary black sandy loam gave the earliest date from Palliser Bay:

NZ1314	Charcoal	N168-9/46	809BP ± 73	1141AD ± 73

H.Leach argues that this feature was a pathway between two garden plots (op.cit.: Chapter 3).

The stone walls at North Kawakawa (N168-9/52) are characterised by long straight rows which rise to a slope of 21.5° on the flanks of a terraced ridge (N168-9/49). They cover 8.9ha of consolidated sandy loam soils. The upper sections of the walls are composed of angular fragments eroded from the ridge above rather than the usual beach boulders (op.cit.:Chapter 2). On the flat ground some quite small enclosures were recorded as well as single boulder alignments. Another stone-filled trench was discovered here beneath a stone wall, and the trench was dated as follows:

NZ1315	Charcoal N168-9/52	687BP ± 66	1261AD ± 66

H.Leach believes that erosion in this area was accelerated during this wall building phase, but declined after prehistoric activities were transferred elsewhere (op.cit: Chapter 3).

Between North Kawakawa and the next major wall complex at Waiwhero Stream (N168-9/69), several small groups of walls were discovered on some old consolidated or semi-consolidated fans (N168-9/63, 64. 65, 66, 68). These were not dated but H.Leach has commented on differences between them and the Pararaki, Te Humenga, and Kawakawa walls (op.cit.: Chapter 2). They are invariably associated with rectangular raised-rim pits and form larger and simpler enclosures. Less care seems to have been taken in layout, and H.Leach argues that their construction took place later in the prehistoric sequence.

On the north side of the Waiwhero Stream another major wall complex of 7.5ha is situated on several raised beach ridges and hollows (N168-9/69). Stone walls, single boulder alignments, pathways, stone uprights, and mounds make up several sections which can be separated on the grounds of orientation and parallelism (op.cit.:Chapter 2). One row gave the following radiocarbon date:

NZ1316	Charcoal N168-9/69	477BP ± 56	1473AD ± 56

H.Leach suggests that fan build-up in the area began to obliterate the upper section of walls only a short period after abandonment (op.cit.: Chapter 3).

Several minor wall complexes occur on consolidated fan slopes along the coast between Waiwhero and Black Rocks Point (N168-9/70, 71, 72). It is noteworthy that all are associated with pits and are of a simple layout. They are in direct contrast to the 16.2ha Black Rocks wall complex which includes the longest and straightest walls in Palliser Bay (N168-9/76). The long walls here occupy a steep consolidated fan at the northern area of Black Rocks and range from 178m to 212m in length. Eleven clusters have been isolated, some on fans, others on the upper raised beach ridges. One of the long walls was dated, from a sample associated with midden dumped into the row during its construction.

NZ1317 Charcoal N168-9/76 560BP ± 71 1390AD ± 71

The charcoal enriched soil on either side of the wall is regarded as artificially deepened, and H.Leach has drawn attention to the presence of waterworn pebbles within it, probably brought up from the beach.

No other excavations were carried out, although the recording of stone wall complexes continued as far as the Cape Palliser Lighthouse. East of Black Rocks Point the coastal platform is narrower and more exposed, and so opportunities for cultivation were restricted. On the south bank of the Mangatoetoe River an area of 3.6ha of walls were recorded (N168-9/79) which had similarities in layout to those at North Kawakawa (op.cit.: Chapter 2). West of the lighthouse a few walls were found on consolidated fans in Kirikiri Bay (N168-9/81). These H.Leach describes as comparable to the simple, rather irregular walls of South Kawakawa and South Waiwhero.

Drawing on the results of the field surveys and excavations

H.Leach commented as follows:

> "In summary, it has been shown that the walls of Palliser Bay result from a pattern of behaviour which also includes burning vegetation, clearing rubbish, modifying the topsoil, and marking plot boundaries and access routes. Furthermore these activities have been shown to be restricted to areas with a coastal climate, and a developed, friable, well-drained topsoil. There are also a few indications that the activities were concentrated in the warmer part of the year ..... The one interpretation which accounts for all the evidence without strain is that the wall complexes are enclosed garden plots, and that the behaviour pattern is typical of horticulture"
>
> (H.Leach, 1976:Chapter 4)

On physiological grounds the most likely cultivar is shown to be kumara. It is argued that the coastal kumara gardens were for some centuries concentrated on the raised beach areas at the mouths of major rivers and streams adjacent to habitation sites. The stone structures associated with these plots are carefully laid out according to various principles of land use. On the other hand, the large simple enclosures which were often built on fans and river terraces are regarded as belonging to a separate, possible later, cultivation style. These are not associated with middens, but are invariably close to large rectangular raised-rim storage pits, and sometimes terraced ridges (op.cit.: Chapter 4).

COASTAL MIDDEN SITES

Eight midden sites were excavated in the course of the Wairarapa research. Two of these (the Washpool Camp Site N168-9/21 and the Washpool Midden Site N168-9/22) were directly related to the programme in the Makotukutuku Valley and have been fully described above.

The third site was near the mouth of the Pararaki River (N168-9/41) and was excavated by H.Leach as part of her study of coastal wall systems (H.Leach, 1976). The midden, actually incorporated within the stone walls, raised questions which were explored archaeologically. The same situation, encountered at one of the walls at Black Rocks, led to the fourth midden excavation being conducted there (N168-9/76). Four middens were intensively examined by A.J.Anderson (1973a) at Black Rocks as part of his analysis of economic behaviour in that area. These four belonged to a group of 22 middens at Black Rocks (all are designated N168-9/77), and conveniently pinpoint selected points over the whole span of the prehistoric period. These middens are individually known as the Small Midden or BR1, the Pond Midden or BR2, the Black Midden or BR3, and the Crescent Midden or BR4 (qv.Anderson, 1973a:53).

These latter excavations are fully described by H.Leach (1976: Chapter 3) and Anderson (1973a); still, it is necessary in this section to outline the salient features, because they contribute to the overall picture of economic behaviour described in Chapter 5.

THE PARARAKI MIDDEN WALL (N168-9/41)

An area of 4.75m by 2.25m excavated by H.Leach on the north bank of the Pararaki River, about 220m northwest of the new bridge exposed a stone wall in which the midden lay. The wall was situated on the crest of the 3rd beach ridge. H.Leach argues that a system of boundaries marking individual garden plots, was initially set up at the Pararaki and other places in Palliser Bay by digging small trenches. Over a relatively small period the areas thus isolated were cleared of stone and debris which was piled up in these trenches. Continuance of these activities eventually turned them into stone walls. Thus midden in the trench at this point is intimately associated with initial garden clearing activity. Two charcoal samples from the wall and the trench gave similar radiocarbon results, confirming this interpretation of a close temporal relationship.

NZ1311	Charcoal N168-9/41	wall matrix	671BP ± 72	1279AD ± 72
NZ1312	Charcoal N168-9/41	trench	731BP ± 70	1219AD ± 70

These are pooled to give an overall estimate of 1249AD ± 30. A considerable range of stone tools was included in the midden and studied in some detail by H.Leach. She found that although some of the tools related to fishing activities, the bulk were primarily industrial for working stone, bone and wood (H.Leach, 1976:Chapter 3). The midden itself consisted of 4 forest bird species (6 individuals), a little industrial moa bone of _Euryapteryx geranoides_ or _Pachyornis mappini_, along with 11 species of fish (40 individuals), 13 species of shellfish (557 individuals), and some mammalian bone. This included sea lion (_Phocarctos hookeri_) which, as argued earlier, is a strong indicator of winter occupation in Palliser Bay. In common with many middens in Palliser Bay, the dominant fish was _Pseudolabrus_ spp.; but other rocky shore and offshore sandy bottom species were also recovered. The shellfish species are evidence of a strong preference for collecting from a rocky shore, in sharp contrast to the present marine environment which is an exposed and unstable sandy coastline with very few molluscs at all. In this respect the Pararaki evidence is reminiscent of the species range from the Washpool Midden Site. It has been argued previously that in the Washpool area the early marine environment was much more stable than today, and a similar explanation may be advanced for the Pararaki as well. The finding of _Paphies subtriangulatum_, _P.australe_, _Protothaca crassicosta_, and _Micrelenchus huttoni_, which are soft protected shore species, supports this interpretation.

THE BLACK ROCKS SMALL MIDDEN (BR1 or N168-9/77)

This small isolated midden, situated on flat ground near the 4th beach ridge, was only revealed by the tailings of rabbit burrows (Anderson, 1973a:75-6). Anderson excavated only $2m^2$ of thus shallow single layer site and the midden appeared to be related to an area of burnt stones. Every indication was of a very short-lived camp where local marine resources had been cooked and eaten. Anderson estimated (op.cit.: 119) that the total resources represented by the site could have been collected by one man in 10 days (based on the modern environment). Largely on the basis of negative evidence, he argues that the contents suggest collection during summer to autumn (op.cit.: 118) by a small group of people.

In view of the good state of preservation of the midden, Anderson believed that the site was fairly modern, and because of a lack of charcoal in the site did not submit a sample for radiocarbon dating. A sample of Cellana denticulata was assessed by the conchiolin method of relative dating, however, and provided an interesting result of about 1.63% compared with 1.41% for a modern sample. This finding parallels a study of Perna canaliculus at the Fox River site (S37/1) where samples from the 19th century appeared to contain more conchiolin than local modern specimens (Anderson, 1973b). It is suggested that because of surface attrition the outside carbonate packages do not have an encasing layer of conchiolin, and that chemical degradation in an archaeological site involves an initial rapid attack on the exposed carbonate, thereby inflating the conchiolin proportion. After this initial burst, decomposition settles down to attack the protective layers at a slightly faster rate than the carbonate. Thus, the figure of 1.63% for the Small Midden suggests strongly that the sample was deposited during the protohistoric period. It has been shown in Chapter 3 that Palliser Bay was visited on a seasonal basis by Ngati-kahungunu people upon their return to the Wairarapa in 1840, and this site probably belongs to that period. The remains of 604 animals were recovered from the midden, of which the dominant species were Lunella smaragda and Cellana radians. No bone material nor artefacts were recovered (see Anderson 1973a:Appendix E).

THE BLACK ROCKS POND MIDDEN (BR2 or N168-9/77)

This was also a small midden, but appeared to be very dense and undisturbed (op.cit.:53). It was close to the 2nd beach ridge and also to a small brackish pond which may once have been connected to the sea. A gap in the rocks immediately to the seaward led Anderson to suggest that this could have been used as a canoe landing in more remote periods (op.cit.:110). Only 2m^2 were excavated, but this produced 10 times more remains than in the Small Midden excavation; all belonged to a single layer. Anderson makes the interesting observation that although the quantity of Haliotis iris was an impressive feature "the proportion of paua to other species is almost exactly the same as the Small midden, where paua is barely noticeable" (op.cit.:76-7); this is a strong argument in support of his quantitative approach. The main shellfish species represented (qv.op.cit.: Appendix E) were Melagraphia aethiops, Cellana denticulata, Cellana radians and Haliotis iris of the total of 6502 shell-fish. There were also significant quantities of crayfish (101 individuals Jasus edwardsii), and also of inshore rocky species of fish (158) such as Coridodax pullus and Pseudolabrus spp. For such a small midden quite a few species of birds (12 species and minimum number of 15) were represented; of the landsnails recovered there were 36 Therasia cf zelandiae, 14 Charopa (Charopa) coma, and 1 Helicella cuperata. This latter is particularly important since it is an adventive species (Wallace, 1975). Caution is required in its use, however, because sand and other debris was continually being blown into the squares during excavation making its association with the midden doubtful. On the other hand, the conchiolin ratio for a sample of Cellana denticulata was as high as 0.64%, which is consistent with a relatively recent site, although somewhat older than the Small Midden (op.cit.: Figure 19). A charcoal sample was dated to less than 200 years, confirming this overall impression (op.cit.:87).

NZ1649 Charcoal BR2/2, Layer 1 <200 BP >1750AD

No artefacts were found in the site, and Anderson (op.cit.:116) again suggests that the site was occupied during summer and that one man could have collected the contents of the site from the modern environment in 176 days (op.cit.:119). As with the calculations for the other Black Rocks sites this figure is compensated for the proportion of the site excavated and other factors such as double low tides (qv.Anderson, 1973a: 118-9). The figure then is a best estimate of the effort involved in collecting the total contents of the midden.

BLACK ROCKS BLACK MIDDEN (BR3 or N168-9/77)

This larger midden was situated between the 3rd and 4th beach ridges. It appeared to be relatively unconcentrated, rich in charcoal, and was found to contain 2 distinct layers in the $8m^2$ excavated. Layer 1 was a black sandy loam, and layer 2 a dense grey ash with abundant bone and shell remains. A charcoal sample from Layer 2 yielded a 12th century date:

NZ1646 Charcoal BR3/3, Layer 2 803BP ± 54 1147AD ± 54

Samples of Cellana denticulata from each layer gave indistinguishable results of about 0.42% confirming the early status of the site (op.cit.: Figure 19). The minimum number of shellfish and crustaceans in the excavation was 21,323, along with 146 fish, and 59 birds (op.cit.: Appendix E). Of these the dominant shellfish species were Lunella smaragda, Melagraphia aethiops, Cellana radians, and Cellana denticulata. The remains of nearly 500 crayfish (Jasus edwardsii) were found, and amongst the 12 species of fish, Pseudolabrus spp. was the most common. Birds were well represented by 18 species but more than half the individuals were Cyanoramphus n.novaezelandiae (the red crowned parakeet); the remains of only 1 moa (Euryapteryx ? gravis) were recovered. Several artefacts were found, and these included a small one piece bone (moa tibiotarsus) fish hook (Figure 59), two moa bone lure shanks (Figure 57a, b), one stone lure shank (Figure 55d), and not surprisingly, 3 bone bird spears (Figure 60 Type A c, d, and Type C f). Anderson argues for two periods of occupation of about 3 months duration (op.cit.:117) during both summer and autumn. He also estimates that it would take one man 1232 days to collect the midden in the site (op.cit.:119)

THE BLACK ROCKS CRESCENT MIDDEN (BR4 or N168-9/77)

This crescentic shaped mound was one of the largest middens at Black Rocks, and from the surface seemed to be one of the deepest. An area of $8m^2$ was excavated in the undisturbed centre and four separate layers were identified. Layers 2 and 3 in particular were characterised by complex microstratigraphy, consisting of nebulous lenses which were more apparent in section than plan, and had to be sacrificed in preference to accurate bagging of the main stratigraphical units. The four recorded components were all dense midden layers, differing mainly in humification, sand or ash content. Two charcoal samples were submitted for dating and gave the following results:

NZ1647	Charcoal BR4/1	Layer 1	681BP ± 52	1269AD ± 52
NZ1648	Charcoal BR4/1	Layer 4	674BP ± 52	1276AD ± 52

Clearly, the difference is insignificant and suggests that the 4 layers were laid down over a relatively short period. The two results are therefore pooled to give 1273AD ± 4. Four samples of <u>Cellana denticulata</u> from the different layers possessed similar proportions of conchiolin and also show that the site is of roughly comparable age to the Black Midden (Layer 1 0.41%, Layer 2 0.42%, Layer 3 0.36%, and Layer 4 0.32%), although there are some grounds for suggesting a moderate time interval for the trend observed in the four layers. Anderson's overall assessment is perhaps two visits by a group of people for 6 months each, again over the summer and autumn seasons (Anderson, 1973a:118). Based on his figures for modern shellfish densities, Anderson estimates that the site's contents would take 1484 man-days to collect, or only about 250 days more than the Black Midden.

Several artefacts found may be listed as follows: Layer 1 only produced 2 shell fish hook tabs (Figure 63 g, m), Layer 3 one shell fish hook (Figure 63 b), and Layer 4 one piece of worked shell (Figure 63 q). However, Layer 2 contained several artefacts including a shell disk (Figure 63 p), 2 shell fish hook tabs (Figure 63 d, e), 5 shell fish hooks (Figure 63 a,c,g,h,i), a moa bone lure point (Figure 58 d), and a moa bone point from a composite bait hook (Figure 58 n).

The remains of about 43,000 animals were removed from this site for analysis. The bulk of this sample were shellfish remains

(40,541 minimum number), and the dominant species were Cellana radians and Melagraphia aethiops, with slightly smaller numbers of Cellana denticulata and Zediloma spp. These were followed by Lunella smaragda, Haliotis iris and Haustrum haustorium. Some of the crustaceans included 8 grapsid crabs, 27 red rock crabs (Plagusia capensis), and 949 crayfish (Jasus edwardsii). The remains of 600 fish were recovered and of the 14 species, Pseudolabrus spp. were the most common, followed by Coridodax pullus and Cheilodactylus macropterus. Bird remains of 12 species were found, but none were especially common, except Puffinus gavia/huttoni. Moa species included Euryapteryx gravis and perhaps Dinornis sp.

THE BLACK ROCKS WALL MIDDEN (N168-9/76)

This small excavation is fully described by H.Leach (1976: Chapter 3), and consisted of a section examination of a stone wall on a large shingle fan immediately to the north of Black Rocks. A charcoal sample was dated as follows:

NZ1317 Charcoal N168-9/76 560BP ± 71 1390AD ± 71

Shellfish were represented by 9 species, and fish by 8. Although the midden sample was small, indications are that the walls were constructed "towards the end of a period of human occupation at Black Rocks, when pressure on marine resources was becoming very marked"(H.Leach, 1976: Chapter 3).

DISCUSSION

The 8 midden sites excavated in Palliser Bay all indicate reliance on a rocky intertidal environment. In the case of 5 of these, in the vicinity of Black Rocks, this is in keeping with the modern marine environment. Three sites, however, at the Pararaki Mouth and the

Washpool, produced evidence quite out of character with modern conditions for some distance on either side of the river mouths. The suggested change in coastal conditions towards unstable beaches and impoverished fauna is most likely to have been brought about by a chain of events beginning with the initiation of Polynesian slash and burn horticulture. Even at Black Rocks, an area extremely rich in rocky shore marine life, the earliest sites have a significant component of soft, protected shore species, such as Paphies australe and Paphies subtriangulatum as well as other filter feeders. Loss of dense forest nearby may have begun quite early at Black Rocks as shown in the following observation by Anderson:

> "It can be seen that from fairly broad-based exploitation of all the resource areas in the Black midden, there has been a narrowing of interest to almost entirely marine resources in the Crescent midden. For example, the percentage of birds from bush habitats drops from 74% in layer 2 of the Black midden to 14% in layer 1 of the Crescent midden, and the percentage of offshore fish species rises from 10% to 29% between the same layers"
>
> (Anderson, 1973a:161)

Because of the change in coastal conditions adjacent to the Washpool and Pararaki River mouths, it is not possible to assess food gathering strategies and preference patterns in any great detail. At Black Rocks, however, where marine conditions have clearly remained relatively stable in the last millenium, it was possible for Anderson to explore the subject in detail. In addition, the concentration of middens in this area meant that a close study could be made of the effects of human predation on coastal resources. In carrying out this study Anderson found that a clear pattern of 'fine-grained' exploitation characterized the initial occupation phases for each major period, and that through time there was a progressive shift towards a 'coarse-grained' approach to the environment. In other words, initial collecting behaviour was more closely aligned with the natural proportions of different kinds of food, but that for a set of complex factors this behaviour changed to one of increasing specialisation through time. Despite the observed changes, Anderson fluently argues that throughout these shifts there was "a common collection strategy which involves maximal exploitation of small areas, and a common preference for both the largest species, and the largest individuals of any species" (Anderson, 1973a:157). In short, the depleting effects of any one period of human predation on the environment become the causes for the character of the next phase of food gathering.

A number of explanations may be offered for the observed underlying similarity in behavioural strategy towards the environment, and while Anderson implies 'nature rather than nurture', cultural continuity in communities from Palliser Bay visiting Black Rocks is the interpretation preferred here.

COASTAL DWELLING SITES

Structural evidence consistent with substantial dwellings was recovered in three of the excavations carried out in Palliser Bay. One of these excavations (at N168-9/29 in the Washpool Valley) has already been described, and produced a ground plan of a large rectangular house. Prickett's field survey in the Moikau Valley suggested the presence of several houses in a 'village' of which one was selected for excavation. In addition, a salvage project at the mouth of the Pararaki River revealed signs of two other dwellings. These excavations are reviewed here because they contribute to a discussion of settlement pattern and architecture in Chapter 5.

PARARAKI STONE SLAB HEARTHS (N168-9/41)

The construction of bridge approaches at the Pararaki River mouth after H.Leach's excavations and field survey in this area led to the discovery of two stone slab hearths immediately behind the 3rd beach ridge, 120m northwest of the new bridge. These remains were 100m closer to the river than the midden wall (also designated N168-9/41) excavated by H.Leach. The two hearths were 10m apart and lay on an old beach sand surface which after occupation had been mantled by river silt. When the bulldozer stripped this area for the bridge approach, not only the silt layer but most of the cultural layer was removed. Although no post butts could therefore be detected, there appeared to be a significant clustering of artefacts and other cultural debris about these hearths, prompting the salvage excavations (qv.Prickett, et.al., n.d.), and the identification of the hearths as house fireplaces. Fireplace no.2 consisted of waterworn boulders unfortunately scattered by the bulldozer, but Fireplace no.1 was intact with 7 rounded stones set into a rectangle of 80cm by 60cm. Clustered about Fireplace no.1 were a nephrite chisel, pieces of rectangular adzes, various industrial tools such as greywacke abraders and schist files, and several moa-bone artefacts such as fish hooks and bird spears (see Figure 59 g, o, p and Figure 60 Type B b). Two very important finds were a greywacke beater (Figure 56 a), and a triangular adze, apex to the rear (Figure 52 c) some 20m north of Fireplace no.1. This unusual adze is practically identical to one from a burial at Horowhenua (Adkin, 1948:Figure 60). Around Fireplace no.2

were 2 Dentalium nanum shells, a moa-bone lure point (Figure 58 c), parts of 4 bird spears (Figure 60 Type A a, j, Type C d, Type F b), parts of stone minnow lures, and a complete bone needle (Figure 62 q).

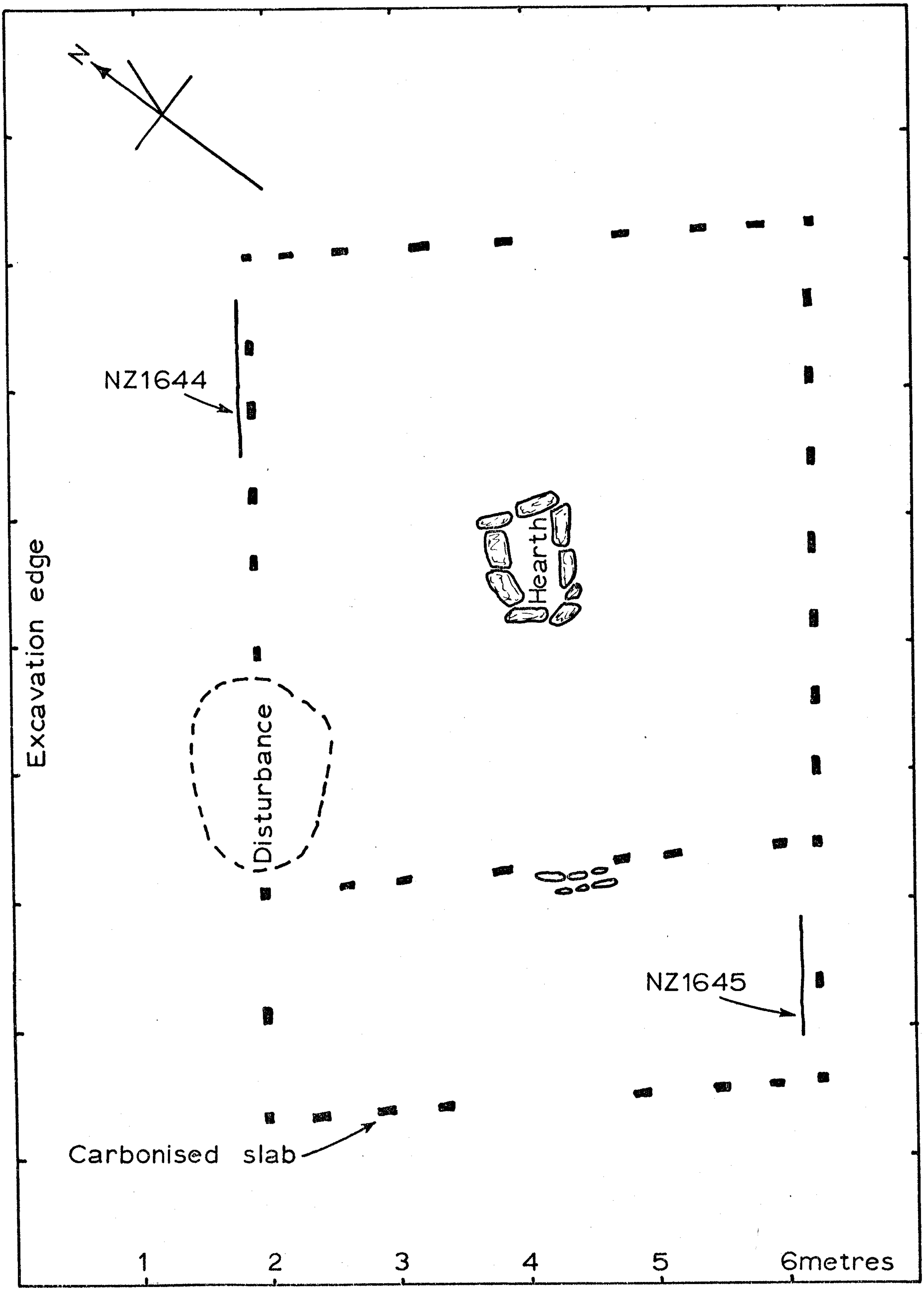
Many of these artefacts are very similar to those in the early levels of the Washpool Midden Site, and the finding of Dentalium nanum here also lends support to a fairly close temporal if not cultural relationship between communities in the two areas. Because of the disturbed nature of the area around these fireplaces, and also the advance of bulldozers, radiocarbon dating was not attempted, still, the immediate area is well known for its evidence of Archaic occupation and at least four radiocarbon dates in the 12th and early 13th centuries AD derive from excavated sites in the close vicinity (H.Leach, 1976: Chapter 3).

Just over 100m southwest of the two hearths, another possible house was found. This (N168-9/1 and 42) was excavated by T.Barrow and others in 1958, and revealed an 'L-shaped' enclosure of stones about 4.5m by 2.5m with an internal stone-edged hearth made of 6 waterworn slabs. Nearby was a circle of stones enclosing a burial accompanied by a shark tooth necklace. In 1964 K.Cairns recovered an unusual whale tooth pendant close by (qv. Cairns, 1971). Houses outlined by stones are a rare feature in New Zealand. Yet in view of the extensive use of stone at the Pararaki for boundary marking, this most Polynesian trait is not completely out of character. It might be suggested that the stones were placed about the outside of the walls, either as decoration or to hold brushwood or mats in place. In short, this find and the two hearths nearer the river give strong support to the existence of substantial dwellings at the mouth of the Pararaki River, early in the prehistoric sequence and occupied by people of similar culture to those at the mouth of the Makotukutuku.

THE MOIKAU VALLEY HOUSE (N165/9)

One house and its surrounding area at this village site was excavated by N.Prickett in 1971. The evidence from the site and the valley as a whole has been presented elsewhere (N.Prickett, 1974). Because of the importance of these finds to later discussion the evidence is briefly reviewed here. The excavation squares were laid out near the edge of a broad flat river terrace. Slightly raised banks appeared on either side of the 11m by 7m area selected for excavation, with a more substantial bank at one end, near the cliff edge. A rectangular slab hearth consisting of 9 waterworn boulders was visible in the centre. A shallow stratigraphy of 3 layers was revealed, including a modified stony subsoil from which large stones had been dug, the occupation layer, and subsequent erosion and turf layers. A rectangular arrangement of 39 post butts was discovered, and a further 2 are presumed to have been present in the original structure but were removed soon after the fire which destroyed the house in an effort to recover artefacts deliberately buried in the floor (see Figure 89). The wall post butts were well dressed slabs, averaging 9cm by 3.2cm, while the corner posts were dressed square and considerably smaller (1.5cm to 2.5cm square). Clear evidence of a doorway (80cm wide) was recovered in the form of two parallel rows of stones which made up a groove in which a sliding door is believed to have been placed. The ground in front of this was much more compacted than elsewhere and was clear of cultural debris. Beside this was the largest post butt (14cm by 6cm) which in the absence of a line of ridge posts in the house structure, would have taken much of the weight of the roof. The posts were made from <u>Podocarpus cf hallii</u>/

FIGURE 89 MOIKAU HOUSE



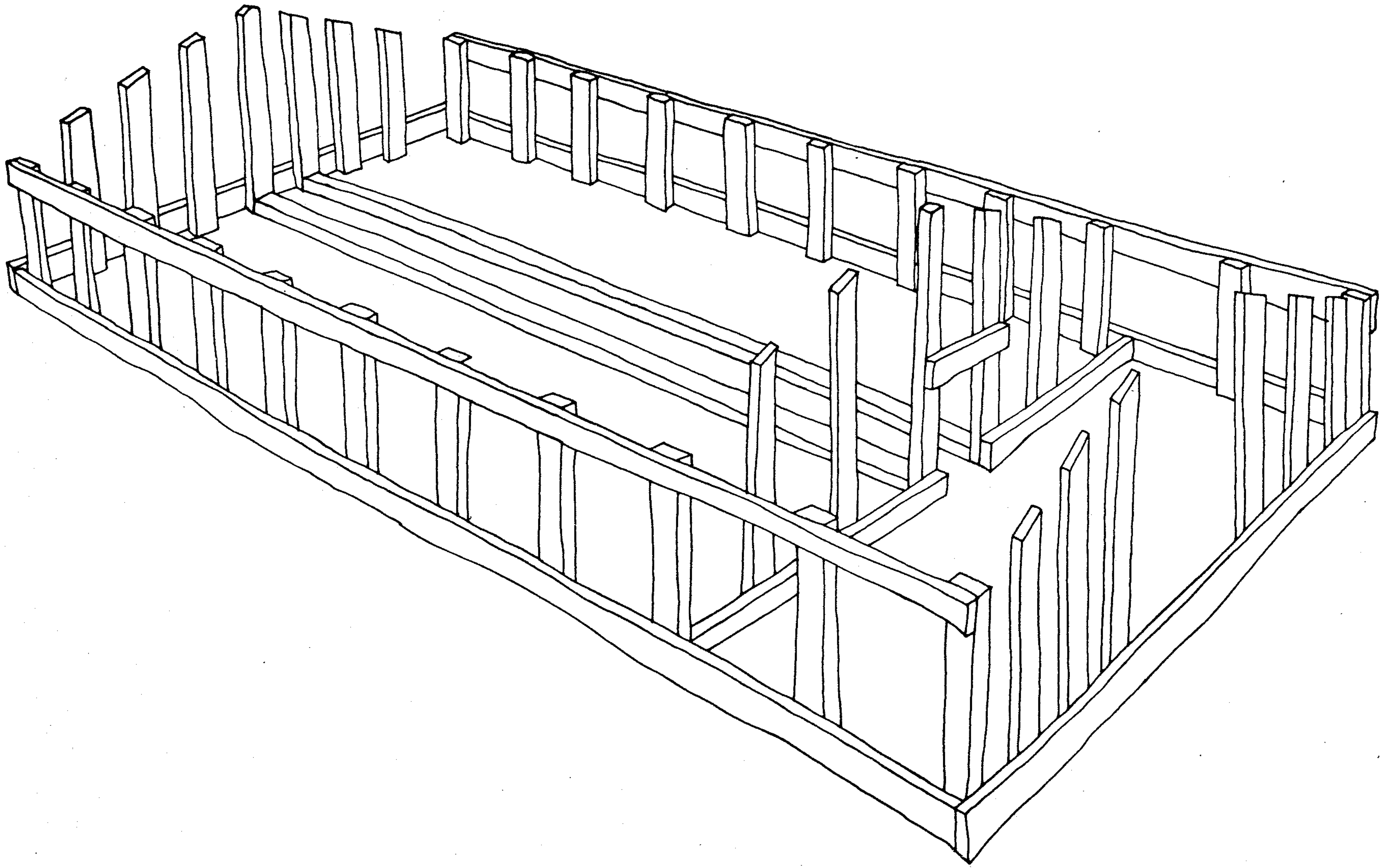


FIGURE 90 MOIKAU HOUSE RECONSTRUCTION

totara. Those along the inner porch wall were dressed in a much rougher fashion. The porch area was closed in at the front by a row of solid posts with an entry gap of 1.52m. The entire structure measured about 6.7m by 4.3m. The two sets of walls were very similar in size but the whole house plan was displaced by nearly 5° to a trapezium shape. A reconstruction of the house is given in Figure 90. The hearth was positioned in the centre of the inner room. Along the base of the side walls were the remains of sticks and branches laid horizontally, and these produced two charcoal samples for dating:

NZ1644	Charcoal	W1/D6-E6, Layer 2	769BP ± 54	1181AD ± 54
NZ1645	Charcoal	W1/I11, Layer 2	771BP ± 54	1179AD ± 54

The large number of chert and obsidian flakes were concentrated on the north side and rear of the house. The floor was very compacted from the doorway to the hearth. This suggests that the sides and rear sections were covered with bedding or mats through which the flakes filtered. A number of drill points, adze flakes, greywacke cutters (Figure 19), and schist files were found, and also 3 stone minnow lures (Figure 55 a, c, f). These artefacts are closely similar to those from the Washpool Midden Site occupied at the same period.

DISCUSSION

Despite intensive excavation in a number of likely areas in Palliser Bay, clear evidence for substantial rectangular houses was found only in two sites. This experience is not new in New Zealand archaeology. The Palliser excavations, however, suggest some of the reasons for this scarcity. In both the Moikau and Makotukutuku houses the post holes were very small (8cm to 25cm deep, and as little as 5cm by 5cm in plan). Many of these would not have been found but for the carbonisation of wood to form a cap of charcoal less than 1cm thick in many cases. Beneath this was an even thinner layer of wood. In an archaeological site with many patches of charcoal, the recognition of each post butt depended upon exposing the clump in plan with a fine brush to detect any evidence of shaping or dressing. Undoubtedly, one careless trowel movement could destroy this slender evidence. Such shallowness of the post holes outlining the perimeters of dwellings becomes a critical factor in sites with sand or shingle matrix. Under these conditions the smaller postholes such as were encountered at both these sites would not have been recognisable. Thus in less consolidated sites the rectangular stone slab hearth surrounded by artefact debris may be the only surviving evidence.

Although the two excavated houses are separated by nearly 4 centuries, they are basically similar in design and when considered alongside 18th and early 19th century houses demonstrate great conservatism in domestic architecture over a period of 800 years. Nevertheless, minor differences may prove to be sensitive culture markers of regional or temporal styles as they did in the 18th and 19th century (N.Prickett, 1974). Until more houses are excavated the significance of differences between these two houses is uncertain, but some of them should be discussed.

Aspect may be the least culturally significant difference, because in the case of the M4 house the ridge on which it was situated was so narrow that the long axis could only have been oriented NE to SW. The porch of the M4 house was placed on the NE side facing in the sun and towards the pit structure up the ridge (36° to true North). The Moikau house also faced away from the view across the valley, but in the SW direction (231° to true North), and in this instance the porch would have received little direct sun. Thus the two houses almost faced opposite directions (195° difference). It is possible that the closed porch of the Moikau house was an attempt to compensate for the resulting lack of warmth.

The most notable difference is probably the absence of a central line of posts in the Moikau house; this lack of structural support was made up for by increasing the number of posts on the end walls. The Moikau house doorway was positioned on the right side of the house (looking in), and although no door slot was discovered at M4, the slightly offset position of the ridge posts suggests that this house also had its doorway on the right. This is contrary to the bulk of ethnographic evidence from the 19th century. Some dimensional differences are listed below, and others appear on Figure 91.

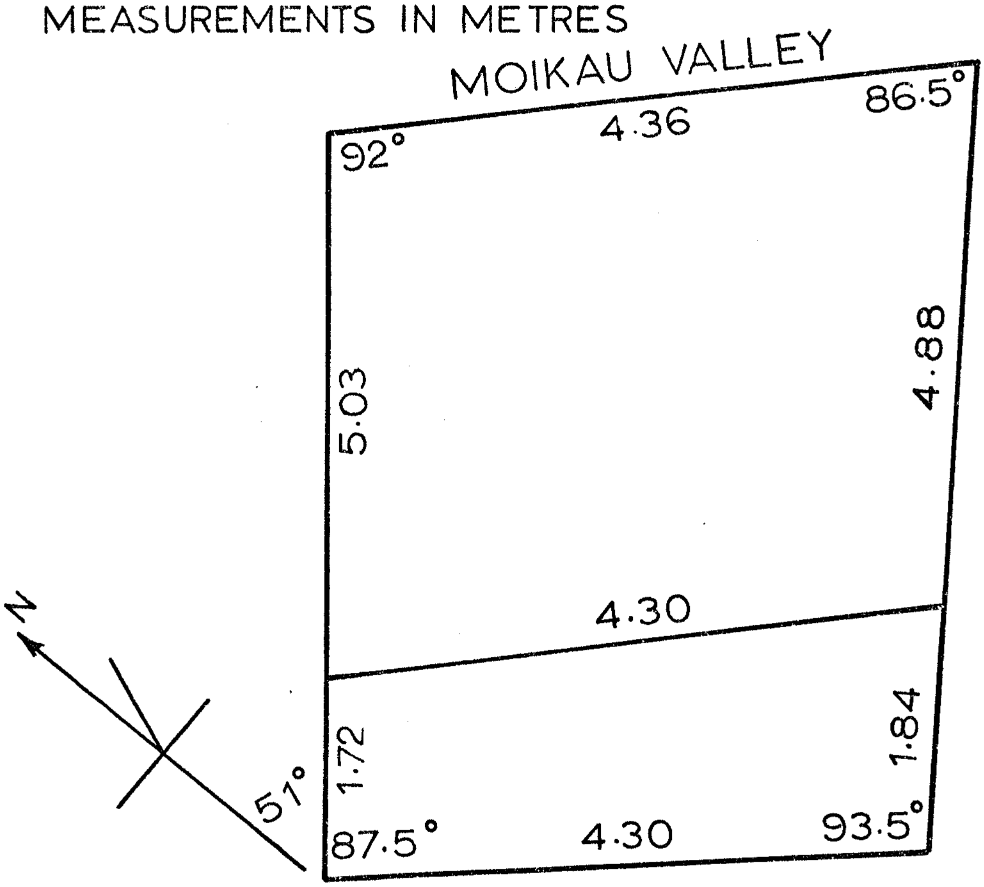
	Moikau House	Washpool M4 House
Average width	4.33m	3.26m
Average length	6.74m	5.58m
Total area	29.16m^2	18.18m^2
Length-breadth ratio	1.56	1.72
Porch average depth	1.78m	1.47m
Porch average width	4.30m	3.37m
Porch area	7.65m^2	4.95m^2
Area of inner room	21.51m^2	13.23m^2
Porch of total house area	26.2%	27.2%
Offset of side walls	6.0cm	26.3cm
Offset of end walls	3.0cm	6.6cm

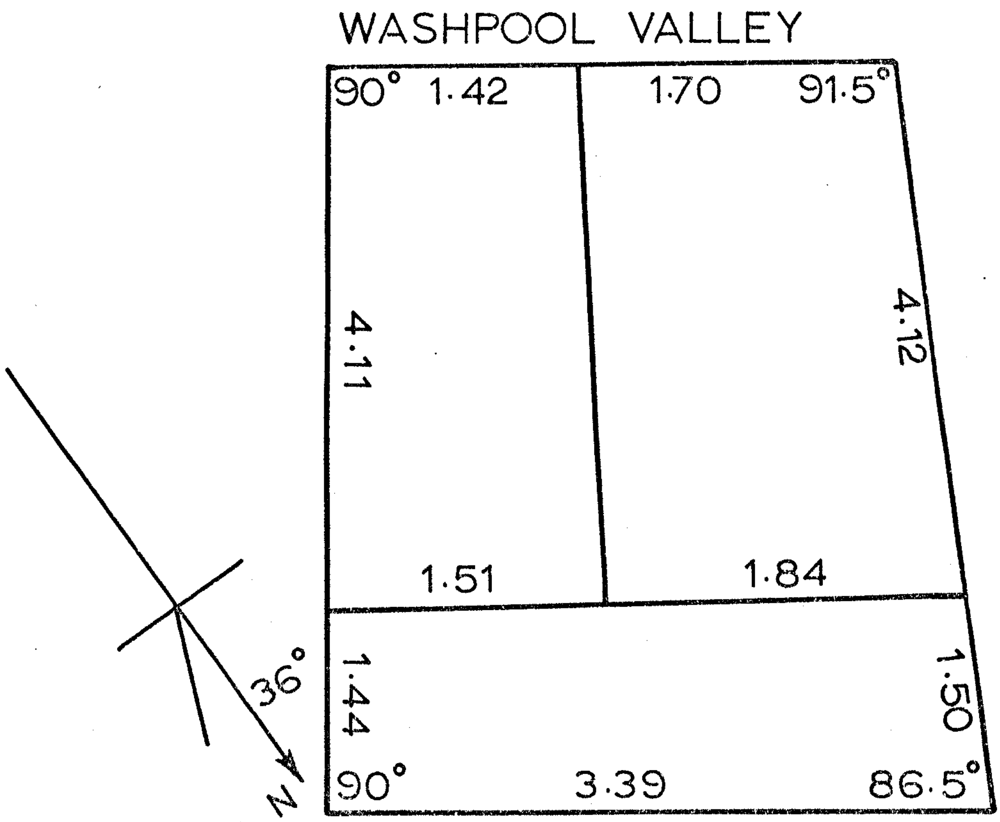
The departure from symmetry, evident in both these houses (see Figure 91), has been discussed by Prickett (1974) who claims that this was a deliberate act of magico-religious significance. In the case of the M4 house the walls are all of different lengths, but have clearly been laid out according to a 90° plan. In the Moikau house, the pairs of walls

FIGURE 91

COMPARISON PALLISER BAY HOUSES

MEASUREMENTS IN METRES





are of practically identical lengths, but have been displaced relative to one another to form a trapezium.

The evidence for continuity in house construction in the Wairarapa over several centuries complements the archaeological findings on other types of site. It has been shown that stone walled gardens were built on the coast from c.1150AD to c.1600AD, while middens were deposited at river mouths and other coastal zones right through the prehistoric period. Differences in the content of these sites are certainly present, but it will be argued in the next chapter that these are largely due to local environmental changes and external cultural influences upon a set of related communities which occupied Palliser Bay for at least five centuries.

CHAPTER 5

PREHISTORIC COMMUNITIES IN EASTERN PALLISER BAY

THE IDENTIFICATION OF COMMUNITIES

In Chapter 1 it was observed that the community is the easiest social unit for the archaeologist to reconstruct out of the archaeological components of layers and sites, and that this unit of organisation may involve evidence from several archaeological sites. Now that each excavation conducted during the Wairarapa programme has been described in some detail, it is possible to weld the site components together into a synthetic account of one or more resident communities.

The question of the number of communities which can in fact be recognised at any one time is a complex one and dependent on a combination of factors, chief of which are site distribution data and dated sites. However, the number of synchronic reconstructions which can be made with any reliability depends primarily on the quality of the archaeological evidence recovered from any one of them. It is suggested below that at least 6 contemporary prehistoric communities lived in the eastern Palliser Bay region soon after initial settlement. A synchronic picture will be constructed for one of these, centred on the Makotukutuku Valley, where the information is most detailed.

The site survey revealed seven clusters of archaeological sites in eastern Palliser Bay with a high degree of site-type repetition. These were the Moikau Valley and Whangaimoana, the Putangirua Valley and Te Kopi, Whatarangi and the Makotukutuku Valley, Te Humenga and the Pararaki Valley, Waiwhero and the Kawakawa Valley, Ngawi and Black Rocks, and Cape Palliser and the Mangatoetoe Valley. As a result of the excavations and dating of sites along this coastline, it is now possible to discuss possible contemporaneity of people living in five of these areas. The two exceptions are the Putangirua Valley-Te Kopi area and the area about Cape Palliser as far as the Mangitoetoe Valley. No excavations were undertaken in either of these areas. At the Putangirua severe erosion has removed much of the land and possible archaeological sites. One pa site and two 'hideaway' pit complexes survive, which suggest a somewhat later period. Furthermore, this strip of coast as far as Te Kopi was closely settled during the protohistoric period. In short, there is little if any evidence of early prehistoric occupation near Te Kopi and the Putangirua Valley. In the case of the area about the Mangatoetoe Valley the coastal platform is very narrow and only a few, small garden sites were encountered. These limitations make it clear that only a small community could have been sustained in the area. Because excavation and dating resources were concentrated on larger complexes with a greater variety of field features, no accurate age estimate is available for this area. Nevertheless, surface evidence at the Mangatoetoe mouth is in keeping with the other larger valleys in Palliser Bay, and it is not unreasonable to treat it as a similar community base. The five areas,where intensive studies have been made of the site clusters,exhibit considerable similarity in evidence from the earliest period, especially in stylistic details on stone lure points, the types of stone utilised, and garden layout and stone wall construction. Archaeological remains are dated to as early as c.1179AD at the Moikau (NZ1645), c.1168AD at the Washpool (NZ1511), c.1141AD at the Pararaki (NZ1314), c.1261AD at the Kawakawa (NZ1315), and c.1147AD at Black Rocks (NZ1646); and the bulk of dated remains in all sites fall before 1500AD. This implies that there was considerable activity along sections of the coastal strip adjacent to valley mouths during the period 1150AD to 1500AD. Depending on the settlement pattern and economic cycle, it is possible that all this evidence was left by one community, based at different areas in different seasons. This is very unlikely, however, in view of the strong evidence, at the Washpool in particular, for all-year-round occupation in one locality. It will be remembered that the rocky intertidal platform at Black Rocks Point was apparently exploited mainly during the period of summer to autumn, and certainly such an exposed locality would be very inhospitable during winter. It is believed that the people responsible for these middens over-wintered at nearby Ngawi, which is more protected, and has clear evidence of long-term settlement in the form of deep occupation layers similar in character to those at the mouths of the Kawakawa, Pararaki, and Washpool rivers. Unfortunately, however, a modern township in this locality has all but destroyed these sites. Between Ngawi and Black Rocks is a large area of stone walls. It is a reasonable inference that these 3 complexes of evidence are different components of the activities of a single community.

At the Pararaki, and adjacent Te Humenga Point, all dated evidence falls before 1300AD, and a constellation of different components may be identified, including burials, houses, midden, and gardens. The presence of Neophoca hookeri in at least one of the sites is good evidence of winter habitation in this area. This pattern of components which potentially belong to a single settlement and economic system is clearest at the Washpool. Moreover, it is mainly from the Washpool evidence that suggestions may be made relating to time-trends in this system, and its ultimate success or shortcomings evaluated. In the Moikau Valley, the lack of economic evidence is a major drawback and, in addition, some of the surface features probably relate to the recorded protohistoric community. Even so, the house site and adjacent cooking area is dated to the 12th century and again there is evidence of gardening, as well as more specialised cooking areas and middens at the mouth of the valley. An intensive search for middens in the higher reaches of the valley was unsuccessful, and it is thought that refuse must have been dumped over the river terraces to be washed away. In view of the complications imposed by the later evidence, it is more by implication from other valleys, than direct evidence in the Moikau itself, that year-round occupation is suggested for this area as well.

Several questions arise relating to social and economic relationships both between these communities and with others further afield. There are good reasons for thinking that these 6 communities were the main components of a larger social aggregate. To the west of the Moikau Valley, evidence of early prehistoric activity falls off sharply, with the exception of an area at the lower end of the Turanganui River, from which a very large collection of Archaic artefacts was obtained (the Holmes Warren collection - nearby sites are N165/46, 47, 48). To the east of Cape Palliser, there is likewise a rapid fall-off in site density (see Figure 6), and although stone walls occur further up the east coast, they are far less common as field features. Research by B.G.McFadgen (1975:pers.comm.) into one of these northern wall complexes at Te Awaiti has produced a date of c.1540AD, indicative of gardening activity of a somewhat later community than those which occupied Palliser Bay.

While an aggregate of communities may indeed have been present in eastern Palliser Bay, it is not thought that its members were isolated from other groups in other than spatial terms. There is ample evidence of exchange networks of raw materials, and one of the most significant involved the chert sources of Te Oroi and Tora. Early occupation of this area might be invoked from the importance of the raw material to the people of Palliser Bay.

It is not thought that any of these valley-based communities was large, probably not more than several related extended families. If this is a correct assumption, then given the basic Polynesian prohibition concerning marriage between first or second cousins, these people must frequently have been obliged to seek their partners outside their immediate community. It is likely then that the different communities were closely linked through kinship and marriage, cemented by gift exchange. In later periods of New Zealand prehistory such kinship-linked communities frequently combined their resources for defence (Vayda, 1960:32); it might be suggested that were the members of the Pararaki community, for example, threatened by an external group, the Washpool and Moikau residents might come to their aid. Thus characterized, this aggregate in eastern Palliser Bay could be described as tending to be an endogamous social unit, while the component valley-based communities tend to be exogamous.

One of these communities might be chosen as representative of early occupants of the region and described in as much detail as the archaeological data permit. A strictly synchronic picture of this type, however, would have to be accurately positioned in space and time. Such a procedure would eliminate much valuable data from other sites, however, and would result in a sketchy and impoverished reconstruction. A more rewarding procedure is to set up a model community, place it in a familiar environmental setting, and describe its life style over a given span of time, using data from as many sites as appropriate. It is not a real community in the sense that individual members can be identified within in. However, the picture of its life style, as presented below, is believed to be a realistic reflection of the range of everyday activities and environmental conditions in the region. This model community is located in the Makotukutuku Valley. Although its 'history' is traced from 1150AD to 1750AD, most of the contributing evidence dates to before 1350AD, and therefore the picture is most appropriate to the period 1200 - 1300 AD.

THE PREHISTORIC ENVIRONMENT

In any discussion of prehistoric environment it is important to distinguish between natural and cultural induced changes. The contentious problem of climatic change in New Zealand was reviewed in detail by Gorbey (1967), and as an hypothesis it was more or less discarded by most New Zealand archaeologists at that time. Quaternary scientists were more cautious, however, and have continued to contribute to an impressive body of evidence from both overseas (Bray, 1971), and New Zealand (Wardle, 1973) which indicates that there have been significant climatic fluctuations during the past millenium. The subject has been explored in detail by H.Leach (1976: Chapter 8) and her main conclusions are cited here since they affect interpretations advanced in this chapter. In brief, she concludes that there is a strong measure of agreement between the episodes of glacial advance and retreat in New Zealand (Wardle, 1973), the mean annual temperature revealed by New Zealand speleothems (qv. graph by Wilson, 1973: pers.comm.; see also Wilson and Hendy, 1971; Hendy and Wilson, 1968), and the postulated 'Little Climatic Optimum' and 'Little Ice Age' in Europe (Bray, 1971). In New Zealand, the main episodes may be described as follows: the period from 900AD to about 1140AD, which may be referred to as the Little Climatic Optimum, was characterized by more settled weather than today, relatively lower wind strengths, and summers possibly a little longer, with fine weather lasting for more consecutive days. The period from 1600AD to 1850AD may be referred to as the Little Ice Age in which the passage of cold fronts would have been a recurrent weather pattern in both winter and summer; wind strength and in most districts rainfall increased during this period. Between these two main episodes there appears to have been a short and somewhat less pronounced deterioration in climate about 1450AD, followed by a recovery of similar magnitude about 1550AD.

One of the more significant effects of this changing climate on communities in Palliser Bay was probably felt through the associated modification of sea conditions. Anderson (1973a:126) estimates that at Black Rocks in a summer season of 120 days, only about 60 days on average would be suitable for collecting shellfish in the intertidal area. The main factor is wind swell which creates very uncomfortable conditions for foraging or putting to sea in a canoe. Hand line fishing inshore would be all but impossible on most of these days of swell. Needless to say, for other months of the year sea conditions are worse. It is important to note that this swell occurs on locally 'fine' days, when cold fronts are affecting weather elsewhere. In addition, the swell lasts for some days after the passage of frontal systems. In a period characterized by shorter time intervals between cold fronts, such as in the Little Ice Age, or even the slightly earlier deterioration of 1450AD, this would have had a dramatic effect on marine foraging in Palliser Bay.

When Polynesians from elsewhere in New Zealand (see below) first settled at the Washpool, perhaps at about 1100AD, the climate was characterized by more settled weather and relatively stable sea conditions. The landsnail fauna from the Washpool Midden site indicates that a patch of mixed forest occurred around the mouth of the river. On either side of this patch of bush the vegetation would have been dense low shrubs and flax, with occasional patches of salt tolerant trees such as ngaio and karaka. An absence in the midden, at the time, of birds characteristic of shingle river beds, and the dominance of mobile forest flocking birds suggests that the river valley was fairly heavily forested to the water's edge and had stable grassy banks. Because the greywacke landform, even under dense vegetation, is rather unstable, some small shingle fans may have existed. With a low sediment load from the river, calmer seas, and a generally stable shoreline, areas of boulders and gravel along the coast would have been colonised by seaweeds, which in turn would foster shellfish communities of both gastropods and rocky shore filter feeders such as mussel species. In sandy patches between these areas, populations of pipi and tuatua could be found.

Despite what might be expected from the bird remains of the Martinborough Caves, flightless birds appear to have been rare, or not present in the region by this period. The result is a noticeable lack of birds such as notornis, aptornis, kakapo, kiwi, flightless duck, and moa species. This implies that the Martinborough Cave deposits were formed well before the arrival of man, and that in the interval significant habitat changes had taken place in the Aorangi Mountains. The modification may be related to climatic changes associated with one of the earlier glacial episodes (for example from 440AD to 855AD, or from 620BC to 210BC) suggested by Wardle (1973). Its local effects may have operated through increased incidence of north-west winds, windthrow, and subsequent denudation of the understorey vegetation, so important to flightless birds.

By 1900AD, environmental conditions at the Washpool were markedly different, and there are good indications that the process which caused the change began to take effect as early as 1350AD, but accelerated from about 1450 to 1500AD. This accords well with the climatic chronology outlined above; however, New Zealand-wide climatic change may not have been the primary cause. Instead, slash-and-burn horticulture is seen as the initial step in this process, perhaps accentuated by increased winds. The result was dessication and windthrow about 1450AD, which was accelerated from 1600AD onwards. Thus by 1650AD the climate was generally less favourable to marine foraging, and under the more turbulent marine conditions, coupled with higher sediment loads from the river, the seaweed and shellfish beds in the vicinity of the Washpool were decimated. In the Washpool Valley itself, the forest had been removed from all except the damper gullys. The resulting erosion caused many slips, initiated gravel fans and transformed the river from a quiet grassy banked narrow stream into a wide shingle river with braided channels. Given only scant evidence of occupation anywhere in Palliser Bay later than 1600AD, this situation may suggest an emigration in the face of widespread deteriorating conditions. It is tempting to think that the destination of some of these emigrants may have been the South Island, and that they were part of the Ngai-tahu migration discussed in Chapter 3.

THE PEOPLE

The remains of about 15 people were recovered at three different localities during the excavations in Palliser Bay. While this sample is admittedly small, it nevertheless provides some insight into the living conditions of this early community. A range of ages is represented from childhood to old age, and both sexes are present. The presence of congenital peg molars from the Washpool to the Kawakawa gives additional weight to the notion that these valley-based communities were linked by kinship and formed a largely endogamous unit.

Members of the 1100 to 1200AD Washpool community appear to have been very healthy until early adulthood, and it is notable that no Harris lines were detected in the 8 individuals represented at the Washpool Midden. It is clear that their coarse and abrasive diet by the age of 35 resulted in serious tooth attrition and loss, mal-occlusion and misalignment, periodontal disease and mandibular resorption. They also had marked 'fern root planes'. This is in direct contrast to the dental conditions of people living at Wairau Bar at about the same period, whose diet is thought to have included much moa. Their teeth were far less worn and generally had very good occlusion (Houghton, n.d.; 1975: pers. comm.). The Washpool community had achieved a more or less non-functional dentition by the age of 40. Osteo-arthritis was also a significant disorder in this community from the earliest period, and affected men far more than women. The back was the most severely affected area, particularly the lower part of the spine.

Beyond an age of about 35 to 40 years people in this community must have been a considerable burden on the extended family. Many daily activities such as gardening, food transportation, and shellfish gathering required stooping and load carrying, and advanced arthritis would have made these tasks all but impossible. In addition, advanced dental attrition and tooth loss would mean special and time consuming food preparation techniques. In short, the people led a vigorous and healthy early life but advanced rapidly into a state of near dependence on their younger relatives. Most died before 50 years.

It was found that each woman had from 2 to 4 children, which is not a large number for women of 35 to 40 years. If their first pregnancy occurred by about 15 to 16 years, this small number of children argues for an extended period of nursing each child, which would operate as a moderately effective contraceptive. Even if weaning was delayed as late as 4 years for each child, there is still a significant discrepancy, which may be explained by either active contraceptive measures or early loss of fertility.

There are a few indications that over a period of time the physical condition of this community deteriorated. This is especially suggested by the presence of numerous dense Harris lines in the limbs of the people in the Cleft Burial dated to about 1480AD. These lines signify episodes of malnutrition or moderately severe illness throughout the early years, and the situation is in sharp contrast to the earlier people at the Washpool Midden. Because osteo-arthritis, dental attrition and dental disorders were of similar magnitude at both periods, it would appear that some factor entered the lives of this community which caused a general deterioration in health. An obvious possibility is a combination of the dwindling supply of nearby marine foods and forest birds, attributable primarily to deforestation, and perhaps increasingly unreliable yields of kumara resulting from worsening weather conditions. Under these circumstances lean periods in the year would ensue, especially in early spring when winter supplies had run out, and forest products were immature. At that season, moreover, turbulent sea conditions would have all but prevented fishing and shellfish collecting.

The resulting bouts of periodic malnutrition could have produced the observed Harris lines.

THE CULTURE

SUBSISTENCE ECONOMY

It is useful to distinguish several environmental zones from which the community obtained its food. The contents of the middens clearly show that those zones clustered on and about the coastal strip were by far the most important, for it was here that shellfishing, fishing, the bulk of gardening, and general foraging for such items as sea birds and seals took place. In addition, in the earliest period, patches of forest extended on to the coastal platform from which bush birds, rats, berries and other forest products could be taken relatively close at hand.

Least accessible of the coastal zones was the offshore area from which many species of fish were obtained. To exploit it canoes would have been required, which could only have been used successfully during calm weather. Archaeological evidence relating to exploitation of this zone is present in most of the sites in the form of trolling lures and pelagic fish, and also significant quantities of species most commonly found in deeper water such as blue cod and groper. It was suggested earlier that porpoises were caught by harpooning, and this probably also took place in offshore waters from canoes, since these animals avoid shallow water and are seldom stranded.

The intertidal platform was the zone from which the majority of fish and shellfish were obtained. A surprise was the high proportion of Pseudolabrus spp. (spotty and banded parrotfish) and Coridodax pullus (greenbone) in all the early midden levels throughout Palliser Bay. This was unexpected as the most common fish in North Island middens is Chrysophrys auratus (for example see Smart and Green, 1962:262; Shawcross, 1967; Law, 1972:98). It is interesting to note that fish of the group that includes the labrids and odaciids (such as spotty and greenbone) appear to be very common in archaeological sites in tropical Oceania. This is shown, for example, on Nukuoro (Davidson, 1971a:94), in the Marianas (Reinman, 1967:166; see also Spoehr, 1957:165), Fiji (Gifford, 1951:210), Raroia (Reinman, 1967:158), in the Marquesas (Skjølsvold, 1972:50; Kirch, 1973:33), on Easter Island (Mulloy, 1961: 327) and the Chatham Islands. The odaciids have fused teeth specially adapted for browsing on seaweeds and small organisms, and the labrids are capable of crushing quite large shellfish such as paua, and are fairly omnivorous. Both are found in large numbers in inshore rocky weed-infested habitats. Thus the Palliser Bay communities appear to have followed the ancestral fishing pattern more closely than other early North Island groups. Also important were crayfish, paua, and a number of other larger shellfish.

Because this zone occupied the interface between land and sea it proved the most vulnerable to changes initiated by man on land, and also to those related to climatic factors. Because of the community's reliance on such littoral resources these changes must have had a profound effect on subsistence economy. The effects are manifest in the middens primarily by an overall decline in the number of species and the quantities of each.

The strip of land between the sea and the foothills was used extensively for gardening, especially where the oldest raised beach ridges had developed adequate topsoils. This activity involved a great deal of effort in clearing the ground of vegetation and unwanted stones at regular intervals as each plot became exhausted. Ultimately the continuation of these practices encroached on and led to the destruction of the immediate forest zone and indirectly the intertidal area. Contrary to the accepted New Zealand model of Yen (1961) and others, horticulture in Palliser Bay did not become more successful nor more widely practised over time. In fact H.Leach has shown (1976:Chapter 9) that the largest and most meticulously laid out gardens were the earliest, and it is apparent that by about 1400AD a decline in activity had already begun. Soil exhaustion was undoubtedly a contributing factor.

The distribution of sites shows that access to the forest was through the river valley. The community systematically used the forest zone for birding, in particular to obtain parakeets and tui. These bird remains, together with carbonised berries and timbers, show that activity was concentrated in the mixed broadleaf-podocarp forest. There is little evidence for the exploitation of bush of the higher altitudes where red and silver beech predominate. Finally, the rivers and streams could be considered an economic zone since they supplied such items as eels and ducks, and probably freshwater crayfish, although there is no direct evidence for the latter.

As in most parts of New Zealand, seasons are strongly marked in the Wairarapa, both in terms of climate and food availability. Studies of the 19th century Maori have shown that in both the far north of the North Island and in the South Island, their adaptation to seasonal change in natural resources involved food storage and periods of intense food accumulation. Seasonal calendars have been constructed for these protohistoric groups and it is believed that these give a useful viewpoint on subsistence economies (H.Leach, 1969). It is equally possible to present the varied and abundant Palliser Bay economic data in calendar form. Although the archaeological evidence covers a very wide range of activities, establishing how they interlock throughout the annual cycle requires the use of now widely available ethnographic and natural history data. The following reconstruction therefore draws freely on these sources and presents a hypothetical account of how the inhabitants' activity pattern varied throughout the year.

Spring From August until the middle of November unsettled weather is common. During this period the dwindling supplies of stored products collected the previous summer and autumn were consumed as the community waited for the new season's crops and wild foods to become available. In general, fresh food would have been very scarce, especially if sea conditions were rough. If previous seasons were poor then spring could have been a very lean period indeed, and any malnutrition would probably have occurred during these months. Economic activity was probably wide-range foraging, fishing and shellfishing when the weather permitted, and perhaps catching a few sea birds. Forest birds may not have been hunted since they too were in poor condition. It was probably the main season for gathering fern root and other edible roots and leaves, and also perhaps for eating dogs, especially if sea conditions were bad. In dry weather some garden preparation may have taken place, such as clearing and firing scrub and piling up boulders and charred logs along garden boundaries.

Summer Cultivation, planting and weeding of kumara gardens would have begun in earnest in late November and continued until the close of summer at the end of February. No garden produce would have been available at first, but by the end of January a few immature kumara could have been eaten if required. Most shellfish gathering and offshore canoe fishing would have taken place in summer, and perhaps the harpooning of an occasional porpoise. Cabbage trees, which have their maximum sugar content in early summer, may have been cooked in ovens. Nectar-eating birds such as the tui would be in good condition in December and January, and much effort must have been made in summer to secure these birds for immediate consumption and also presumably for preservation for later use and for trade. Calm seas during this season would have facilitated any coastal trading expeditions to the South Island or elsewhere.

Autumn Of all the seasons, this period from March to May must have been characterized by greatest activity and abundance of food. Berry-eating forest birds, such as pigeons, would be in good condition, while the berries they feed upon, such as hinau and karaka, could also have been collected. Many activities related to gardening and storage would also have to be undertaken. Old storage pits would have been cleaned out and repairs made to roofs and racks. Some new pits would have been dug. Horticultural produce was harvested, sorted and stored away, and gourds dried for use as containers. In periods of settled weather, fishing continued to assume an important role.

Winter The two months of June and July are today characterized by stormy weather and heavy rains. During this period, when outdoor activities were restricted, stored products such as kumara, dried berries and fish, and potted birds, would have been a vital source of food. It appears that hauling-out bachelor seals were caught during winter, along with wrecked sea birds, such as penguins and large gulls. Significant catches of such fish as tarakihi imply that winter conditions occasionally allowed canoe parties to put to sea. Their presence may in fact be an indication that during the 'Little Climatic Optimum' the sea was less turbulent at this and other times of the year. Winter was also the traditional time for catching large numbers of rats which are known to invade human settlements at that time.

As with many other Archaic communities the Washpool residents were wide-ranging and opportunist in their quest for food, and this led to great diversity of species in their middens. On the one hand this illustrates an explorative attitude towards the environment; on the other hand, the signs of specialised food gathering and concentration on a few key species are observable in the earliest sites - indicative of some knowledge of habitat and animal behaviour gained before settlement in this area. This latter view is supported by evidence of intensive catching of tui and parakeet, the community's success at crayfishing, and perhaps also their specialised garden layout and stone wall construction. Conspicuously absent in the middens are quantities of moa bone, and it appears that at the time of settlement these birds were all but extinct in the general area.

The community seems to have maintained a reasonable balance between protein and carbohydrate foods, although there is strong seasonality in both, requiring specialised techniques to overcome temporary shortages. In this type of economy, dogs could play a significant role. As has been indicated, great efforts seem to have been directed towards horticulture in this area. This is surprising in view of the relatively poor soils, and the generally unfavourable climate.

At c.1180AD the latter factor may have been less significant, although in the long term it played a crucial role in the overall decline of this economic system.

Finally, it should be observed that poor dental health and fern root planes were a fact of life for this early community. The fern root planes are somewhat anomalous considering the rarity of Pteridium esculentum in the Aorangi Mountains. These people may have considered the root a delicacy and obtained supplies from the main alluvial valley of the Wairarapa where fern root was abundant in the 19th century. Alternatively, the 'fern root planes' may have been caused by chewing and stripping fibrous rhizomes of other species of fern, such as Blechnum minus, Phymatodes scandens or P.diversifolium, or Asplenium bulbiferum, which are present in the local flora. The latter possibility seems more likely, and suggests that on the one hand more caution must be used in interpreting this type of tooth wear, and on the other that members of this community, even in the earliest period, were unable to sustain themselves all the year round on less damaging food such as kumara.

This group then possessed an economic system which was a compromise between hunter-gatherer activities and horticulture. On the one hand, the absence of both large land mammals in New Zealand and moa species in Palliser Bay meant that more reliance had to be placed on gardening activities in this marginal area, while on the other, the relatively poor yields of kumara meant that general foraging for food from the sea and forest had to occupy a great deal of time. It is possible to view this multi-faceted economy as a strong and adaptable system able to cope with environmental change. The ultimate test of a system's adaptability lies in the question 'was it successful?'. Of basic importance is biological success, which can be judged from the vitality of the members of a population. In this respect the adaptability of the Palliser Bay economic system proved of limited value, since the physical condition of the people appears to have deteriorated. The horticultural basis to the economy made such demands on the environment that continued fishing, fowling and shellfish gathering became impossible. A small climatic recession about 1450AD, which gathered momentum after 1600AD, must have been devastating to the communities which in the face of dwindling wild foods were becoming increasingly reliant on ever poorer kumara horticulture. In the long run, therefore, the economic system of these foraging horticulturalists proved quite unsuited to the Palliser Bay environment.

TECHNOLOGY

There are of course large gaps in the available information on technology, something which is particularly true for woodworking, the details of house construction, and many techniques and tools connected with gardening and clothing. It is also true of a number of elements of fishing technology, such as cordage, the materials and design of nets and hand lines, not to mention knots and net-making tools. Still there are many indirect lines of evidence for these facets of technology through surviving artefacts and midden components. The greywacke beater (Figure 56), for instance, has a marked glaze on both edges, probably indicating its use for fibre preparation of flax or cabbage tree leaves for mats or clothing. Similarly, delicate bone needles (Figures 62 and 75) probably attest clothing manufacture.

Overall the technology of this community does not appear to have changed substantially over the period of occupation. As far as can be judged, basically the same kinds of fishing equipment, fowling gear, houses, wood working equipment, and other tools, were used throughout the prehistoric sequence. Changes in the natural environment did not evoke corresponding changes in technology, rather alterations in settlement pattern (discussed below), and to this extent the community's technology displayed stability and conservatism.

The best represented aspects of technology are those concerned with fowling and fishing. A fairly wide range of artefacts was recovered relating to these activities, and it seems that some experimentation in design and materials was underway. For instance the rather thick and clumsy shell fish hooks made in the earliest period were eventually superseded by moa bone counterparts. Consistent fracturing at the base of even bone hooks very likely promoted the development of two piece bait hooks. Drilled points (Figure 58 m) were found which are comparable to the transitional hooks at the Tahunanui site in Nelson, where the shank and leg of essentially one piece hooks were drilled and lashed. Similarly, there is evidence of experimentation with trolling lure design. Both bone and stone were used, as well as a variety of attachment methods. One puzzling feature is the presence of the 'Oruarangi Point' by about 1345AD. This highly characteristic artefact must have possessed a subtle functional advantage which ensured its survival for the next 500 years. In the technology of fowling, spears feature prominently although the presence of bones of smaller birds such as the passeriformes strongly suggests the use of snares. Again considerable experimentation was underway in this area since spear points were made in a variety of different designs.

The number of offshore fish in the middens is indicative of a fishing technology involving the use of canoes. If these were made from totara, then they were either fashioned by specialists elsewhere and traded to the Washpool community, or expeditions were occasionally made to the nearest source of the timber in the main Wairarapa Valley. In any event, these canoes would also have performed a valuable function in transporting raw materials and facilitating contact with other communities both in Palliser Bay and the South Island.

The technology of food preparation and storage is well represented in the archaeological evidence. Numerous scoop hearths, and fire pits were found, although rather few structures which could easily be interpreted as earth ovens. The presence of these is attested by ubiquitous burnt stones, most of which were heat fractured greywacke beach boulders. Experiments in the field showed that local greywacke fractures rather easily in fire, and there does not appear to have been any attempt to use more durable oven stones which were a notable trade item during the 19th century. The absence of stone-filled ovens may simply reflect the fact that all ovens had been 'opened'. Stone slab hearths were probably more important as a focal point of social relations than as a source of heat for cooking. The cooking shed was in use from the earliest period, and also the rack for sun-drying split fish or eels for preservation. Evidence relating to presence and absence of different parts of birds has been presented, and this argues that portions were potted in fat perhaps for winter consumption or trade. The only other direct evidence of food preparation relates to the butchering of large sea mammals. Here a sharp adze was used for dissecting the main musculature of the animals.

Food storage was obviously important to lessen the effects of seasonal shortages. As well as sun-drying of fish, and the potting of birds, berries were probably partly dried for out-of-season relishes, as evident in the M4 house. The kumara was probably the most difficult and yet the most crucial item to be stored. Evidence for this is notably sparse in the earliest period, and it is in this area that significant technological change may have taken place. The earliest direct evidence for the characteristic rectangular raised rim pit is dated to c.1579AD (see NZ1640), although in general, knowledge of pit construction and use is rather scant. H.Leach has argued (1976:Chapter 9) that these pits are a later imported technique and closely associated with gardens constructed along more simple lines which may have been in use about 1450AD to 1650AD. She claims that in the earliest period kumara were stored within the actual settlements. Thus the curing of the skins of the tubers, essential for successful over-wintering could have been achieved in the ideal warm and moist atmosphere of houses. The unusual midden-filled pits at the Washpool Midden site may mark the first attempt at separate structures for kumara storage.

The stone industry of this community is clearly related to the manufacture of artefacts by abrasive rather than percussive techniques. This illustrates a technological framework in close harmony with that of the 'Classic Maori', and in marked contrast to that of the Archaic communities of the South Island in particular. Of the two, early Archaic technology of the South Island is marked by specialised flaking procedures such as prepared core blade manufacture, shallow low angle alternate flaking, and high angle trimming; the Classic technology is traditionally linked with nephrite tool manufacture, and stresses unsophisticated but time consuming grinding procedures and hammer dressing.

The community at the Washpool possessed very little nephrite at any period but spent many hours with tools designed for abrasive work. A single artefact may have involved a sequence of scarf-sawing and snapping, filing and grinding, and finally drilling - all of which are abrasive techniques. Similarly, many of the flake tools appear to have been scrapers. Very few hammerstones were found, although hammer dressing was practised by these people. The most significant difference was probably the time involved in stone tool production. For example, using skilful flaking techniques a useable adze can be made in a few minutes, whereas the manufacture of an adze by hammer dressing and abrasion could be a very lengthy procedure indeed. In short, this community apparently lacked the technical knowledge evident in South Island stone industries, even though they acquired many artefacts manufactured using these skills. To this extent the community could be said to have been in a situation of technological dependency on other groups. No doubt a reciprocal relationship existed whereby such items as food and other local raw materials were exchanged for partly finished stone adzes; however, the extent of the imported technology placed the Palliser Bay community in a more vulnerable position than their trading partners. It is interesting to speculate on the effects of more turbulent seas after c.1450AD on this trading relationship. Whereas the South Islanders may have become short of the luxury of kumara (the likely trade item), this gap could have been filled with other foods. The Palliser people, however, required stone adzes in many important constructional activities, and a deterioration in their supply would involve them in the task of making new adzes using their more onerous manufacturing techniques and inferior raw materials. It was noticed earlier that hammer dressed greywacke adzes closely copied the shapes of these South Island prototypes. This trading relationship may have influenced the destination of the suggested emigration of about 1600AD, since the South Island had been supplying high quality adzes for the previous 5 centuries. Although nephrite was always a very scarce commodity in Palliser Bay, the emigrating community had a long technological history based on stone working by abrasion, and this would require little modification for systematic application to nephrite. In fact the Ngai-tahu were renowned for their skill in this field.

SETTLEMENT PATTERN

Inferring settlement pattern directly from archaeological evidence can be one of the most difficult tasks in archaeology. To achieve it in New Zealand the different component sites representing the seasonal activities of a single community for a short interval in time have to be identified. It is in this area more than any other that the deficiencies of current archaeological methods in New Zealand are felt. Of particular relevance is the concept of seasonal dating. Fortunately in the case of the Palliser excavations, enough evidence was found to clarify the cycle of occupation, and this greatly assists the reconstruction of settlement pattern. The Washpool Midden site for instance, showed that at two different periods - c.1180AD and c.1345AD - people were resident in the general vicinity and collecting marine foods during all months of the year. Thus it can be inferred that this community maintained a permanent settlement at the Washpool. Further inland in the same valley, berries at one site and frostfish and barracouta at another strongly suggest late autumn to winter habitation there after c.1450AD. It was argued above that all year round residence could also be inferred for the other communities in Palliser Bay, though with less certainty.

There is good evidence that the Washpool community changed their pattern of settlement about three hundred years after occupation. The two configurations will be outlined below - one based on the early community of about 1200AD to 1300AD, and the other based on the period about 1450AD to 1600AD.

Because the coastal platform allowed easy access to all the environmental zones exploited by the early community, it is logical to expect that habitation there would nearly always have occurred during those seasons when fishing was good and gardens were being prepared. At this season gardens were also established some distance inland, which gives grounds for arguing the existence of dwellings there also. Such dwellings, however, may have varied from temporary shelters and huts to substantial rectangular houses. Unfortunately, no form of residence has been identified in the Washpool Valley during the early period. Substantial houses were present, however, in the inland and coastal zones at this time, in the Moikau and Pararaki valleys respectively. At the Washpool, therefore, dwellings of some form may have been located in either or both zones.

The burials, cooking sheds, and a host of activities related to food preparation, preservation and consumption which took place at the mouth of the Washpool argue that a base village with rectangular dwellings existed there. It is suggested that temporary camps were located further inland near small bush gardens such as at the Cross site, and these would also have served as birding camps. Towards the end of the early period, as the forest was encroached upon by gardening and fires, these inland camps would probably have become more numerous, and occupied more often. There was clearly some variability in this early settlement pattern because in the Moikau Valley it appears that the nuclear village was inland and the more specialised camps on the coast. At the same time the Moikau Valley and Whangaimoana area is a somewhat different environmental complex than other valleys in Palliser Bay, and the fact that settlement was organised on a slightly different basis may simply reflect this fact.

The later pattern in the Washpool Valley can be outlined with more confidence. By this time deforestation and climatic deterioration had become significant factors affecting subsistence, and supplies of marine foods had dwindled with coastal and riverine erosion. The coastal platform, now devoid of its patches of forest and scrub, would have been far too exposed for winter dwellings. Such residences have been identified archaeologically further inland in the form of terraced ridges. Only temporary shelters and camps were located on the coast to take advantage of the good summer fishing and to service gardening activities which were still primarily based on the warmer and more friable coastal soils. A significant development by this time was the placing of rectangular raised rim pits near inland houses or in hide-away locations well inland. Burials were now situated in hidden clefts away from habitations, and the first attempts made at fortifications.

Several causes might be suggested for this change in settlement pattern, of which deforestation and climatic change are certainly significant factors. In particular they would have had the effect of forcing settlement further inland towards forest products and away from the deteriorating marine environment. At the same time, a new factor has become noticeable - an increasing concern with security for the living and the dead members of the community, and for their food and property. This must indicate an external social threat such as warfare. Other communities in Palliser Bay would have been facing similar economic problems at this time. Whether the threat related to antagonism between these communities fostered by shortages, or to a common threat from further afield, cannot be determined, however, from existing evidence in Palliser Bay.

SOCIAL RELATIONSHIPS

The midden and occupation sites all suggest small communities with close genetic ties. Anderson (1973a:127) estimated that groups of about 10 to 25 people are represented by the main early levels at Black Rocks, and H.Leach argues for communities of about 30 to 40 on the basis of areas under cultivation at any one time (H.Leach, 1976:Chapter 9). The small complex of pits and terraces at the Washpool Fort site consists of 8 terraces, probably representing a similar number of people. Given kin-based groups of such size, status differentiation may not have been as marked within them as it was in later periods of prehistory when in parts of New Zealand Maori society became clearly stratified. This is borne out by the early burials in which grave goods are few but are found with both females and children as well as males. Tattooing, practised by this early community, because of the small group size presumably indicated age status rather than class of birth.

In New Zealand it is almost impossible to gain direct archaeological evidence of division of labour. If this community followed the basic Polynesian pattern, then men would have been responsible for canoe and house building, hunting and fowling, and heavy garden work such as forest clearing. Women on the other hand were traditionally involved in gathering intertidal sea foods, food preparation, the transport of wood and water, weeding of gardens, and clothing and mat manufacture. One possible clue from the archaeological evidence is the persistent occurrence of miniature specimens of the main shellfish species in sites, particularly paua. Unlike soft shore species these cannot be collected in handfulls. Thus the inclusion of tiny shells must have been deliberate. This may imply that young children were present during intertidal foraging and were emulating their elders in collecting these tiny specimens. Traditionally small children would have been in the care of womenfolk.

Social relationships outside this community may have involved regular meetings with other valley-based groups and the exchange of food, tools, and raw materials. The type of contact, together with intermarriage, preserved local fashions such as the similar snooding arrangements seen in fish hooks throughout Palliser Bay. At another level, this aggregate of communities interacted with neighbouring people situated in both the main Wairarapa Valley and on the East Coast, and presumably it was through these less frequent contacts that such raw materials as chert and obsidian were obtained. It was shown in Chapter 4 that the inland trade route was frequently followed in the early period, but apparently fell into dis-use sometime between c.1345AD and c.1538AD (see Figure 44 and also Chapter 4, p.174). Close social links maintained over at least 5 centuries with the South Island, are not only reflected in trade items, especially adzes, but also in genetic markers in dogs.

IDEOLOGY

It is possible in some cases to gain impressions of the concepts and values which prevailed in this community, through chance discoveries and attention to minute details of spatial organisation of evidence. The small yet significant discrepancies in the layout of the rectangular house provide a good example. Traditional evidence suggests that destruction of symmetry in house layout was deliberate and of special ritual and symbolic importance. In Palliser Bay this has been shown to have achieved in one case by slight angular displacement, and in another by linear offsetting in the walls. The alterations were small enough to have been easily overlooked among the normal errors in archaeological recording, were it not for the close attention given to plotting structural evidence.

From its treatment of the dead, this community revealed a few details of its system of values. There appears to have been a definite concept of group burial both at c.1180AD and c.1480AD, and a strong supposition is that members of the family unit were buried close to one another, in that way maintaining social proximity after death. The fact that a dog was buried nearby at the Washpool may indicate that as a pet it was considered a member of the family. It is clear that this early community buried their dead within the village, close to structures connected with their daily activities. This knowledge of proximity must have operated as a reminder of their deceased relatives and the links between life and death. A sense of continuity with one's ancestors is a characteristic of Polynesians, and the attitude of this community is closer to the pattern in island Polynesia than to that of the later Maori who abhorred proximity with the dead (see Chapter 4: page 149). If so, the Cleft Burial of c.1480AD may attest to a change in attitude. However, there were also external threats to this community operating at this time, since their food was hidden away as well as the dead. No sense of insecurity is apparent in the earlier group.

A wide range of burial positions were employed. These included crouched, and extended in both the prone and supine positions. Exhumation and secondary burial were practised and in some cases coffins may even have been used. This variability suggests that burial posture was related to personality and characteristics of the individual, although the actual reasons in any one case can only be guessed at. The lack of polarisation into stereotyped burial postures may reflect therefore a relatively non-stratified society. The same feature is suggested by the grave goods. These were usually a valuable imported item such as an argillite adze or Dentalium shells, and were present with children and females as well as males, though not always. In one case an adze was ritually smashed during the filling of the grave, in another it was deliberately sharpened and placed with the body. Again such variation may be an expression of individuality.

This community made extensive use of stone walls, alignments, trenches, and natural linear features such as beach ridges to 'close off' areas of activity, and this suggests strong concepts relating to 'within' and 'without'. The village at the Moikau Valley is cut off by a low wall, gardening areas generally are enclosed, the early midden pits at the Washpool are fenced, a house at the Pararaki and a burial area are both enclosed by boulders, pathways were marked with boulders in gardens, and even a freshwater spring at the Washpool is circled by an alignment of stones. In this respect it is noticeable that the Moikau and Washpool rectangular houses are oriented 'away' from the wide expanse of the valley and 'towards' other human structures. Such spatial response would not be unexpected in any society colonising an unfamiliar territory. Even so, these people were clearly inquisitive about their environment and collected such curiosities as fossil bivalves, and probably other 'useless' items. Thus a collection of unusual spherical stones may be interpreted as belonging to a game of some kind, or it may simply reflect this general curiosity about the environment.

The focus of human activities appears to have often been the stone slab-fireplace. These are located in the centre of the inner room in the main dwellings; they were found in several gardens, and in the centre of the structural features at the Washpool Midden site. Above all, the house itself was obviously extremely important as a spiritual home and setting for human relationships. It was built with considerable care, and in one case the remains of a young dog were specially buried in a slot in the large rear centre post as a ceremonial observance.

CONCLUSION

In some respects such as size, relative isolation, and relationship to the environment, the prehistoric communities of Palliser Bay were similar to those resident there in the 20th century. Life was shorter and once adulthood was achieved, little more than two decades of useful labour were left before physical degeneration reduced the oldest members to dependence on others and then death. Nevertheless, for the first few generations after settlement, food supplies were abundant throughout the year and until old age set in members of the group were healthy and active. A round of activities prevailed that covered many square miles of forest, beach and sea. The education of a child must have involved the acquisition of a range of skills of artefact manufacture, a detailed knowledge of plant and animal distribution and behaviour, and familiarisation with a complex maritime technology. Although the community was not as reliant in imported items as the 20th century farmer or fisherman, the supply of adze blanks from the South Island was probably vital to community efforts such as canoe and house building. Even so, the technological value of an argillite adze did not over-ride the spiritual necessity to inter an individual's most valued possession with his body. In many other respects, mastery of the range of non-specialised technology required for survival was possible for every family unit. This must have been an important factor in the successful settlement and occupation for several centuries of eastern Palliser Bay.

The residents of early Palliser Bay did not possess the mechanical aids or manpower to modify the environment drastically to suit their economic requirements as did later Europeans. Thus, the building of roads and bridges, and the rapid conversion of forest to pasture and crop land was not possible. Yet, given time, and the assistance of fire and weather, prehistoric man none-the-less transformed the local environment by his horticultural practices to the point that it could no longer supply his needs. Today the population is probably not significantly larger, and economic activities of the modern communities are even more dependent on imported materials. None of the modern sheep stations is profitable, and ancillary fishing and shellfishing enterprises have resulted in a rapid exhaustion of the crayfish and paua resources. It seems that no human community has been able to be self-supporting nor exist in ecological equilibrium since the first settlement of the region about 800 years ago.

CHAPTER 6

CONCLUSIONS

SUMMARY

The concept of regional variation in New Zealand's prehistoric culture has often been invoked in reconstructions of its culture history. An examination of the several treatments given to this theme and the reasons underlying the various approaches was undertaken in Chapter 1. It was concluded there that the regional frameworks that had been advocated involved too few subdivisions, and that there had been a tendency to explain prehistoric variation in temporal terms such as progressive divergence in isolation, when many of the differences may have been synchronic, reflecting cultural variations current among separate yet contemporary groups, possibly even of different origin. It was argued that a more satisfactory understanding of the differences would emerge if the referrent of archaeological reconstructions was the prehistoric community rather than the sequence, and the description of them was based less on 'assemblages of types' and more upon the human behaviour which produced them. Given this approach, the primary objective of a regional research project should be to reconstruct a conjunctive picture of community activities in their ecological context, and only later to explore evolutionary developments or other historical processes as secondary goals where appropriate data permits.

In Chapter 2 a number of reasons were outlined for choosing the Wairarapa region for such a project. It was observed that the area was centrally placed to balance the established prehistoric sequences of the North and South Islands, and that it was strategically located in relation to the traffic of raw materials between the two. Although early occupation of the Cook Strait area was widely accepted, including Palliser Bay itself, many aspects of the Archaic life style were unexplored, especially settlement pattern and economy. A research programme was therefore initiated to examine a wide range of issues, from the health of prehistoric communities to their economic relationships, both locally and further afield. Several discrete projects were devised which maintained a balance between areally intensive and extensive research, and these are described in Chapter 2.

The results of the research were surveyed in Chapters 3 and 4. In Chapter 3, events and conditions in the protohistoric period were described and the traditional history was outlined. It was observed that the traditional Ngai-tahu migration into the South Island probably involved only small groups and that some of these may have come from Palliser Bay. The results of two marine surveys and a study of modern landsnails and vegetation were also presented in this chapter. In Chapter 4 evidence from excavations at 27 separate sites was discussed. Since many of these had been described in detail in other works, they were only summarised here, but in the case of the Washpool Valley sites, full reports were given.

Finally in Chapter 5 the information gained from these excavations and subsequent analyses was used to reconstruct a synchronic picture of a putative community living in Palliser Bay during the period of about 1200 to 1300AD. It was observed that at this time there were perhaps as many as 6 resident communities, and that they may have formed part of a larger social aggregate linked by kinship. The health and life histories of these people were described, together with their technology, subsistence economy and settlement pattern. Various aspects of their ideology and social relations were also outlined. The integration of this reconstruction with the changing environment of eastern Palliser Bay revealed several important time trends, thereby enabling a number of diachronic observations to be made. For example, it was suggested that prehistoric occupation became steadily more untenable, and that emigration may have occurred after about 1600AD, which could possibly be related to the tradition-based Ngai-tahu migration of that period.

LIMITATIONS

In retrospect, it is not surprising that the research programme displayed some deficiencies of organisation. It is, of course, always true that archaeologists are dissatisfied with the amount of excavation accomplished, or with the quality or quantity of material analysed - the Wairarapa programme is no exception. However, as indicated in Chapter 1 a set period of time was allocated for the fieldwork, and priorities dictated that efforts be concentrated rather than dispersed on a multiplicity of problems. Consequently, knowledge of the later period from 1600 to 1800 is noticeably poor. It is believed that excavations of some of the pa in the main alluvial valley would fill this gap. In addition, insufficient attention was given to excavation and analysis of storage pits, so the conviction that many of these date to the period after 1450AD rests on rather slender archaeological evidence. Again, more details of the settlement pattern, especially of the change from a coastal to an inland orientation, would be available were excavations to be conducted on the terraced ridge at the Washpool Fort site.

Several other limitations might be ascribed to inadequacies in archaeological method. In general, continued frustration with this has provided archaeologists with an incentive to develop new methods. In this programme there was a particular awareness of deficiencies in dating techniques, both absolute and relative. In particular there seems an obvious need for further improvements in the field of seasonal dating. Developments in absolute dating too, and such areas as obsidian dating and remnant magnetism will greatly assist future archaeology in New Zealand. A number of innovations are also urgently needed in midden analysis. For instance, poor comparative material makes the identification of marine mammals very difficult. An even greater problem is the processing of the fine components of midden refuse. For example, the only durable remains of elasmobranchs are denticles, yet there is no method available for their systematic recovery or identification. This is a serious deficiency since elasmobranchs figured prominently in the 19th century Maori economy, and may have been equally important in the prehistoric period.

At this stage the stone technology of the Palliser Bay communities has not been intensively studied. More than 15,000 flakes and other industrial debris were recovered and very few have been examined for use striations or searched for patterns of edge modification. This is a major area of research, which could not be undertaken in the time available. Similarly, knowledge of how man utilised his botanical environment is incomplete, and identification of the many bags of charcoal recovered from the excavations would greatly enhance this.

With the exception of obsidian, identification of likely sources of most of the rocks utilised by the Palliser communities was accomplished reasonably satisfactorily without resort to complex geological methods such as trace element analysis; however, the ascription of limestone adzes to the White Rock - Tora source is made with less certainty. A sophisticated stone industry based on indurated limestone is known from the Akitio area further north, and it may later be found that the Palliser people had trading partners in this area too.

IMPLICATIONS

Palliser Bay is remote from other centres of detailed archaeological research such as the Coromandel - Hauraki Gulf region, and until more is known of prehistoric communities of Marlborough, western Wellington, and the whole of the east coast of the North Island, its role in the overall development of Polynesian culture in New Zealand will remain uncertain. Nevertheless, the early Palliser Bay communities did not exist in isolation, and a number of implications concerning their external relationships warrant some discussion.

The 12th and 13th century residents lived in an environment showing few signs of previous modification by man. Climax vegetation and ecologically stable marine conditions prevailed. It is therefore unlikely that the region was inhabited before about 1100AD. However, there are indications that their ancestors had not been long in New Zealand. For example, signs of experimentation in one-piece fish hook design have been documented and these were interpreted as indicating the transition from manufacture in pearl shell to moa bone. It was suggested that in certain osteological features the dogs were closer to their tropical forebears than previously studied New Zealand examples. Again, the large numbers of rats in the earliest levels may be a typical sign of an adventive species fairly recently introduced. Possibly the most suggestive evidence may be the importance of labrid and odaciid fish species in the early economy. This appears to be out of character with most other groups in New Zealand, and closely similar to the reef fishing habits of the inhabitants of Island Polynesia. This bias cannot be related to any environmental factor peculiar to Palliser Bay, since these fish are amongst the most common inshore species in all parts of New Zealand. In addition, many other fish species occur in Palliser Bay, and therefore lack of choice is not the reason for this predominance. This is reflected in the large early middens where about 25 species were represented. The significance of this selective fishing can be properly assessed only when more detailed information is obtained from other early New Zealand sites. However, it may reinforce Green's claim (1970:19) that the earliest New Zealand communities favoured exploitation of rocky shores, in keeping with their earlier Polynesian experience. These observations do not suggest that the Palliser communities came directly from Polynesia; on the contrary, their immediate origin was clearly elsewhere in New Zealand. It is believed that the South Island may be excluded because of the magnitude of the difference in the respective stone technologies. Early South Island communities are noted for their mastery of stone flaking techniques, whereas the Palliser people belonged to an entirely different stone working tradition. Perhaps the clearest signs of the immediate origin of these people are to be found in the different sources and amounts of imported lithic material. As was previously shown, contact with the Coromandel - Bay of Plenty area was very important in the earliest period, and that this link later declined in favour of closer contact with other Cook Strait communities. This suggests a northern origin; still it would be premature to favour the north east coast when so little is presently known of the area between Palliser Bay and the Coromandel. There are signs that a significant early settlement existed in the area from Akitio to Porangahau (see for example Duff, 1956:117), and it may ultimately be shown that the Palliser people originated from just such an intermediate area, rather than further north.

Although the concept of separate origins for people on either side of Cook Strait is implicit in this argument, the evidence in Palliser Bay shows that they became progressively united by trading relationships. Throughout this study many parallels and similarities were noted between artefacts from Palliser Bay and such sites as Wairau Bar and Tahunanui in the South Island, and in the Horowhenua area in the North. Comparable features ranged from distinctive knobs on stone lure shanks to genetic markers in dogs, and combine to suggest that Cook Strait might be thought of as a distinctive 'culture area' during the early period of New Zealand prehistory. Although later contact between the two islands is documented in Chapter 2, there is little suggestion that such a large and integrated unit existed in the 18th or 19th century when New Zealand had become clearly divided into 'tribal areas'. When the change took place is open to question, but it is possible that the same agency which contributed to the depopulation of Palliser Bay by about 1600AD affected other areas about Cook Strait also. If this resulted in the widespread breakdown of social and economic ties which had been built up in previous centuries it could have had the postulated effect. Climatic factors alone, for example, might have wrought such a change by promoting increased turbulence in Cook Strait and thereby hampering the regular passage of canoes.

One of the most interesting aspects of this project has been the unravelling of an economic system which balanced the pursuits of hunter-gatherers and horticulturalists. It was earlier noted that this could be thought of as giving a certain adaptive advantage, and that in the face of environmental changes, one or the other activity could be stressed to ensure continued survival. In this instance, it would seem that these people were more conservative than experimental, and that ultimately the changes they affected on their environment by the practice of horticulture were so dramatic that forest and marine foraging alone would not support the population. In addition, these communities appear not to have been able to adapt their technology successfully to local stone, and one of the key factors in tilting the balance towards depopulation must have been an over-reliance on imported raw materials and manufactured tools. In such a situation the proportion of imported to local material could be a valuable yardstick of the stability of external social relations, for under conditions of inter-group antagonism and warfare, a community will be forced to rely far more on local material. This is demonstrated by the large number of local lithic materials at such late fortified sites as Huriawa and Mapoutahi in Otago (qv. B.F.Leach, 1969:62-3; Anderson and Sutton, 1973:112). If the Palliser Bay evidence is an adequate reflection of social relationships further afield, New Zealand must have been relatively stable until after c1538AD (see Figure 39).

DISCUSSION

A commonly advocated view that has guided New Zealand archaeologists for many years is that diachronic studies should precede the synchronic. This study follows the strong conviction that epistemologically this order is back to front and has obscured important and significant regional differences. It was argued that in the circumstances of marked regional variation an 'aggregate' prehistory could be highly misleading; a particular cultural process might trend in one direction in one region, and in the opposite direction in another. The thesis was advanced that in situations of marked regional variation, field research programmes should be formulated to construct 'aspects' first and 'phases' at some later stage when more is known of the extent and meaning of regional differentiation in terms of meaningful prehistoric groups such as communities. It was argued that even though the two processes were essentially interactive, if phases took precedence over aspects this would be wasteful of archaeological resources. In examining a collection of communities in eastern Palliser Bay, little has been discovered to modify this thesis and at least two historical trends have been documented which strengthen it. Firstly it was shown that contrary to the New Zealand wide decline in use of Mayor Island obsidian, the community resident in the Washpool Valley significantly increased their use of this resource. At the same time the more general conclusion of the overall decline was substantiated by an aggregation of the evidence. Secondly, the widely accepted economic model of New Zealand prehistory has been shown to be inapplicable in this area. The typical view is that over a period of time prehistoric people exterminated the flightless avifauna, and came to rely increasingly on kumara horticulture. Closely tied to this model are a number of implications relating to progressively more sophisticated kumara cultivation and storage, and increasing social aggregation and sedentary life, in contrast to the earlier more free-ranging 'moa-hunters'. The Washpool community could not be said to have moved along this particular economic trajectory. On the contrary, kumara horticulture appears more sophisticated in the early period than later, while at no time could these people be referred to as moa-hunters. Thus in quite major respects this regional synchronic approach has exposed the dangers of documenting the course of prehistory solely by means of generalisations and the aggregation of evidence, or relying on it for the source of primary field objectives.

It may be noticed that in this thesis it has been necessary to refer to spatial units of various sizes, and depending on the context, discussion has been related to the Cook Strait region, the Wairarapa region, and the region of eastern Palliser Bay. This reflects the fact that prehistoric communities as much as 20th century men, recognised the existence of geographical areas at various levels. Strictly speaking therefore, not one regional prehistory but several are possible. In this study there was sufficient archaeological evidence to infer a kinship-linked set of communities which was spatially separated from other groups outside eastern Palliser Bay. This became the region for which the reconstruction of the Washpool community was regarded as representative. If additional evidence had been available from Wairarapa Valley sites, or the east coast, the number of recognised communities would have been enlarged and several distinct groupings of these communities might have emerged. It would be expected too that the area covered by sets of communities would vary at different periods as trade and kinship links were forged or dissolved. Thus the notion of region must always be qualified by the archaeologist while the community can be used as a basic organisational unit.

An emphasis on community reconstruction within the regional framework is not only basic to a sound general prehistory but is capable of revealing intimate details of the human condition. Of course, archaeological methodology and the processes of physical decay combine to blur the total picture of community activities, but enough survives to permit an appreciation of the continuity of settlement and land use in New Zealand over a much longer period than the 200 years of European occupation.

Appendix 1: Floral and Faunal Remains from Archaeological Sites in Palliser Bay

There is no overall system of nomenclature and taxonomy for indigenous New Zealand species of plants and animals. Moreover in a number of areas, in the animal kingdom in particular, changes in terminology and taxonomic status are rather rapid in this country. For this reason the following organisation of floral and faunal remains is based on an unfortunate marriage of a number of different systems. The following sources were used in arriving at this organisation: nomenclature and organisation in the Plant Kingdom is largely after Allan (1961) and Moore & Edgar (1970). In the Animal Kingdom terminology and taxonomy up to and including Phylum Echinodermata is based on Morton & Miller (1968) and Powell (1961) and Fleming (1966) with the exception of Class Insecta which is based on Tillyard (1926); from the Class Elasmobranchii to Class Reptilia is based on Parker and Haswell (1960, 1962), Rothschild (1961), and Whitley (1968); the Class Aves is based on Parker and Haswell (1960, 1962) and Kinsky (1970); the Class Mammalia is based on Rothschild (1961).

Occasionally there is a departure from the above quoted nomenclature, and where this occurs a numbered footnote is given along with the explanation. Any adventive species are marked with an asterisk*. Some of the species listed below were not found in archaeological sites in the Makotukutuku valley, but were found in sites in some other part of Palliser Bay discussed in the text. These are indicated with a numbered footnote and further details may be found as follows: flora or fauna found at the Moikau Valley consult Prickett (1974), at the Pararaki consult Leach, H. (1976), at Black Rocks consult Anderson (1973a).

I THE PLANT KINGDOM

CLASS SPERMATOPSIDA	
SUB-CLASS GYMNOSPERMAE	
Order Coniferales	
Family Podocarpaceae	
Dacrydium cupressinum[1]	Rimu
Podocarpus cf totara/hallii	? Halls Totara
SUB-CLASS ANGIOSPERMAE	
1. DICOTYLEDONES	
Order Magnoliales	
Family Winteraceae	
Pseudowintera sp.[2]	Pepper Tree
Order Piperales	
Family Piperaceae	
Macropiper excelsum	Kawakawa
Order Violales	
Family Violaceae	
Hymenanthera ? crassifolia	Shrub
Order Coriariales	
Family Coriariaceae	
Coriaria arborea[3]	Tutu
Order Pittosporales	
Family Pittosporaceae	
Pittosporum sp.[4]	Pittosporum
Order Myrtales	
Family Myrtaceae	
Leptospermum scoparium[5]	Manuka
Leptospermum ericoides	Kanuka
Metrosideros cf robusta	North Island Rata
Order Tiliales	
Family Elaeocarpaceae	
Elaeocarpus dentatus	Hinau
Elaeocarpus hookerianus	Pokaka

Order Leguminales	
Family Papilionaceae	
Trifolium sp.*	Clover
Trifolium subterraneum*	Subterranean Clover
Sophora sp.	Kowhai
Order Fagales	
Family Fagaceae	
Nothofagus truncata[6]	Hard Beech
Order Celastrales	
Family Corynocarpaceae	
Corynocarpus laevigata	Karaka
Order Sapindales	
Family Sapindaceae	
Alectryon excelsus	Titoki
Order Umbellales	
Family Araliaceae	
Pseudopanax cf colensoi/arboreum[7]	Five Finger
Order Rubiales	
Family Rubiaceae	
Coprosma sp.[8]	Coprosma
Galium aparine*	Bedstraw
Order Solanales	
Family Convolvulaceae	
Calystegia sp.	Convolvulus
Calystegia tuguriorum	Climbing Convolvulus
Order Personales	
Family Scrophulariaceae	
Hebe sp.	Koromiko
Order Lamiales	
Family Myoporaceae	
Myoporum laetum	Ngaio

2. MONOCOTYLEDONES

Order Liliales	
Family Smilacaceae	
Ripogonum scandens	Supplejack

Order Agavales

Family Agavaceae

Cordyline australis — Cabbage Tree

II THE ANIMAL KINGDOM

PHYLUM BRACHIOPODA

CLASS ARTICULATA (TESTICARDINES)

Terebratella (Waltonia) inconspicua[9] — Lamp Shell

PHYLUM ANNELIDA

CLASS POLYCHAETA

SUB-CLASS SEDENTARIA

Polychaete tubes ? genus[10] — Polychaete Worms

PHYLUM MOLLUSCA

CLASS AMPHINEURA

Family Lepidochitonidae

Eudoxochiton nobilis — Chiton

Family Chitonidae

Amaurochiton glaucus — Green Chiton

CLASS GASTROPODA

SUB-CLASS PROSOBRANCHIA

Order Archaeogastropoda

Family Haliotidae

Haliotis iris — Paua

Haliotis australis — Silver Paua

Family Fissurellidae

Scutus breviculus[11] — Shield Shell

Family Acmaeidae

Patelloida corticata corallina — Limpet

Atalacmea fragilis[12] — Fragile Limpet

Family Patellidae

Cellana denticulata — Limpet

Cellana ornata[13] — Limpet

Cellana radians subsp. — Limpet

Family Trochidae (Trochinae)	
Cantharidus opalus subsp.[14]	Opal Top Shell
Cantharidus purpureus[15]	Top Shell
Micrelenchus huttoni[16]	Top Shell
Anisodiloma lugubris lenior[17]	Knobbed Top Shell
Melagraphia aethiops	Spotted Top Shell
Zediloma sp.	Dark Top Shell
Zediloma arida[18]	Dark Top Shell
Zediloma atrovirens	Dark Top Shell
Zediloma digna	Dark Top Shell
Family Turbinidae	
Lunella smaragda	Catseye
Modelia granosa[19]	Pink Catseye
Cookia sulcata	Cooks Turban
Order Mesogastropoda	
Family Cerithiidae	
Zeacumanthus subcarinatus[20]	Small Horn Shell
Family Turritellidae	
Maoricolpus roseus roseus	Turret Shell
Family Calyptraeidae	
Sigapatella novaezelandiae[21]	Circular Slipper Shell
Family Cymatiidae	
Argobuccinum tumidum	Swollen Triton
Family Struthiolariidae	
Struthiolaria sp.	Large Ostrich Foot
Order Neogastropoda	
Family Muricidae	
Zeatrophon ambiguus[22]	Large Trophon
Family Thaisidae	
Neothais scalaris[23]	White Rock Shell
Haustrum haustorium	Dark Rock Shell
Lepsiella scobina subsp.[24]	Oyster Borer
Lepsithais lacunosus[25]	Rock Shell
Family Buccinulidae	
Buccinulum sp.[54]	Whelk
Buccinulum lineum[26]	Whelk
Penion adustus subsp.	Large Whelk

Family Cominellidae	
Cominella sp.	Whelk
Cominella maculosa[27]	Spotted Whelk
SUB-CLASS OPISTHOBRANCHIA	
Order Pulmonata	
Family Siphonariidae	
Benhamina obliquata	Limpet
Siphonaria zelandica	Limpet
Family Flammulinidae	
Allodiscus sp.	Landsnail
Therasia zelandiae	Landsnail
Therasia sp.[28]	Landsnail
Family Charopidae	
Phenacharopa novoseelandica	Landsnail
Charopa (Charopa) coma[29]	Landsnail
Charopa (Ptychodon) buccinella[30]	Landsnail
Charopa (Ptychodon) colensoi[31]	Landsnail
Charopa (Subfectola) caputspinale[32]	Landsnail
Family Laomidae	
Laoma (Laoma) marina[33]	Landsnail
Paralaoma pumila	Landsnail
Family Paryphantidae	
Delos coresia	Landsnail
CLASS SCAPHOPODA	
Family Dentaliidae	
Dentalium nanum	Tusk Shell
CLASS BIVALVIA (PELECYPODA)	
SUB-CLASS PTERIOMORPHIA	
Order Arcoida	
Family Cucullaeidae	
Cucullaea (Latriarca) hamptoni	Fossil Bivalve
Family Glycymeridae	
Glycymeris (manaia) hurupiensis	Fossil Bivalve
Order Mytiloida	
Family Mytilidae	

Mytilus edulis aoteanus	Blue Mussel
Perna canaliculus	Green Mussel
Aulacomya maoriana	Ribbed Mussel
Order Pterioida	
Family Pectinidae	
Pecten novaezelandiae novaezelandiae	Scallop
Chlamys sp.[34]	Fan Scallop
Pallium convexum[35]	Grooved Fan Shell
Family Ostreidae	
Ostrea sp.[36]	Oyster
Ostrea cf charlottae	Oyster
SUB-CLASS HETERODONTA	
Order Veneroida	
Family Carditidae	
Cardita aoteana[37]	Nesting Cockle
Family Veneridae	
Dosinia (Kereia) cf greyi	Fossil Bivalve
Protothaca crassicosta	Ribbed Venus Shell
Family Tellinidae	
Zearcopagia disculus[38]	Round Wedge Shell
Family Mactridae	
Scalpomactra scalpellum[53]	Small Trough Shell
Zenatia acinaces[39]	Scimitar Mactra
Family Amphidesmatidae	
Paphies (Mesodema) subtriangulatum[40]	Tuatua
Paphies (Paphies) australe[41]	Pipi

PHYLUM ARTHROPODA

CLASS INSECTA	
SUB-CLASS PTERYGOTA	
DIVISION ENDOPTERYGOTA	
Order Coleoptera	
Super-Family Scarabaeoidea (Lamellicornia)	
Family Scarabaeidae	
Sub-Family Scarabaeinae (Coprinae)	
Onthofagus granulatus*	Dung Beetle

Sub-Family Melolonthinae	
Odontria smithi	Grass Grub
Odontria sp. nr. striata	Grass Grub
? Odontria/Costelytra sp.	Grass Grub
Costelytra sp.	Grass Grub
Sub-Family Dynastinae	
Pericoptus sp.	Sand Dune Scarab Beetle
Super-Family Curculionoidea (Rhynchoptera)	
Family Curculionidae	
Sub-Family Rhyparosominae	
Phrynixus sp.	Timber-boring Weevil
Sub-Family Cryptorhynchinae	
? genus, Cryptorhynchinae sp.	Timber-boring Weevil
Order Hymenoptera	
Super-Family Sphecoidea	
Family Crabronidae	
Crabronine sp. (? Rhopalum sp.)	Burrowing Wasp
Super-Family Apoidea (Anthophila)	
Family Colletidae	
? genus, Colletid sp.	Colletid Bee
Order Lepidoptera	
Super-Family Pyraloidea	
Family Pyralidae	
Uresiphita polygonalis maorialis	Lupin Moth
CLASS CRUSTACEA	
SUB-CLASS CIRRIPEDIA	
Order Thoracica	
Chamaesipho ? columna	Acorn Barnacle
SUB-CLASS MALACOSTRACA	
Order Decapoda	
Sub-Order Macrura	
Family Palinuridae	
Jasus edwardsii	Rock Lobster (Crayfish)
Sub-Order Brachyura	
? genus Grapsidae sp.[42]	Upper Shore Crab
Plagusa capensis[43]	Red Rock Crab

PHYLUM ECHINODERMATA

CLASS ECHINOIDEA

Order Echinoida

Evechinus chloroticus	Sea Egg

PHYLUM CHORDATA

SUB-PHYLUM CRANIATA (VERTEBRATA)

SUPER-CLASS GNATHOSTOMATA

CLASS ELASMOBRANCHII (CHONDRICHTHYES)(SELACHII)

Family Galeorhinidae	
Galeorhinus australis	School Shark
Family Squalidae	
Squalus sp. ? blainvillii	Northern Dogfish

SUB-CLASS BRADYODONTI

Order Holocephali

Family Callorynchidae	
Callorhynchus millii	Elephant Fish

CLASS PISCES(OSTEICHTHYES)

SUB-CLASS ACTINOPTERYGII

Super-Order Neopterygii(=Teleostei +Holostei)

Family Anguillidae	
Anguilla dieffenbachii	Long-Finned Eel
Anguilla australis	Short-Finned Eel
Family Leptocephalidae	
Conger verreauxi	Conger Eel
Family Gadidae	
Physiculus bachus	Red Cod
Family Centrolophidae	
Seriolella brama	Warehou
Family Epinephelidae	
Polyprion oxygeneios	Groper
Family Carangidae	
Caranx lutescens	Trevally
Trachurus novaezelandiae	Horse Mackerel

Family Arripididae	
Arripis trutta	Kahawai
Family Sparidae	
Chrysophrys auratus	Snapper
Family Aplodactylidae	
Aplodactylus meandratus	Marblefish
Family Cheilodactylidae	
Cheilodactylus macropterus	Tarakihi
Family Latridae	
Latridopsis ciliaris	Blue Moki
Family Odaciidae	
Coridodax pullus	Greenbone (Butterfish)
Family Labridae	
Pseudolabrus celidotus	Spotty
Pseudolabrus pittensis[44]	Banded Parrotfish
Family Parapercichthyidae	
Parapercis colias	Blue Cod
Family Scombridae	
Scomber japonicus	Common Mackerel
Family Acinaceidae	
Thyrsites atun	Barracouta
Family Ophidiidae	
Genypterus blacodes	Ling
Family Scorpaenidae	
Helicolenus papillosus	Sea Perch
Family Triglidae	
Chelidonichthys kumu	Red Gurnard
Family Aleuteridae	
Navodon convexirostris[57]	Rough Leatherjacket

CLASS REPTILIA

SUB-CLASS LEPIDOSAURIA

Order Squamata

Sub-Order Lacertilia (Sauria)

Family Gekkonidae	
? genus. *Gekkonid sp.*	Gecko

CLASS AVES

SUB-CLASS NEORNITHES

Super-Order Palaeognathae	
Order Dinornithiformes	
Family Anomalopterygidae	
Sub-Family Anomalopteryginae	
Pachyornis mappini	Moa
Sub-Family Emeinae	
Euryapteryx geranoides	Moa
Euryapteryx gravis	Moa
Family Dinornithidae	
Dinornis sp.	Moa
Super-Order Impennae	
Order Sphenisciformes	
Family Spheniscidae	
Eudyptes pachyrhynchus pachyrhynchus	Fiordland Crested Penguin
Eudyptes pachyrhynchus sclateri	Erect Crested Penguin
Eudyptes sp.	Penguin
Eudyptula minor subsp.	Northern Blue Penguin
Super-Order Neognathae	
Order Procellariiformes	
Family Diomedeidae	
Diomedea cauta ? cauta	White-Capped (Shy) Mollymawk
Diomedea ? exulans / epomorpha	Albatross
Diomedea sp.	Mollymawk
Family Procellariidae	
Halobaena caerulea	Blue Petrel
Pachyptila sp.[45]	Prion
Pachyptila turtur[46]	Fairy Prion
Petrel ? sp.	Petrel
Puffinus ? sp.	Shearwater
Puffinus gavia gavia[55]	Fluttering Shearwater
Puffinus ? gavia/huttoni	Shearwater
Puffinus griseus[47]	Sooty Shearwater (Muttonbird)

Puffinus tenuirostris[48]	Short Tailed Shearwater
Family Pelecanoididae	
Pelecanoides urinatrix urinatrix[49]	Northern Diving Petrel
Order Pelecaniformes	
Sub-Order Pelecani	
Family Phalacrocoracidae	
? Phalacrocorax sp.	Small Shag
Order Anseriformes	
Sub-Order Anseres	
Family Anatidae	
Sub-Family Anserinae	
Cygnus sumnerensis	Extinct Swan
Sub-Family Anatinae	
Anas ? sp.	Duck
Anas superciliosa superciliosa	Grey Duck
Anas rhynchotis variegata	New Zealand Shoveler
Order Falconiformes	
Sub-Order Falcones	
Family Accipitridae	
Sub-Family Circinae	
Circus approximans gouldi	Australasian Harrier
Order Galliformes	
Family Phasianidae	
Sub-Family Perdicinae	
Coturnix novaezealandiae	New Zealand Quail
Order Gruiformes	
Sub-Order Grues	
Family Rallidae	
Gallirallus australis greyi	North Island Weka
Rallus philippensis assimilis	Banded Rail
Capellirallus? sp.	Small Extinct Rail
Gallirallus minor	Small Extinct Rail
Order Charadriiformes	
Sub-Order Lari	
Family Laridae	
Larus dominicanus	Southern Black-Backed Gull

Larus novaehollandiae scopulinus[50]	Red-billed Gull
Larus bulleri[56]	Black-billed Gull
Family Sternidae	
Sterna striata[51]	White Fronted Tern
Order Columbiformes	
Family Columbidae	
Sub-Family Treroninae	
Hemiphaga novaeseelandiae novaeseelandiae	New Zealand Wood Pigeon
Order Psittaciformes	
Family Nestoridae	
Nestor meridionalis septentrionalis	North Island Kaka
Family Platycercidae	
Cyanoramphus novaezelandiae novaezelandiae	Red-crowned Parakeet
Cyanoramphus auriceps auriceps	Yellow-crowned Parakeet
Order Strigiformes	
Family Strigidae	
Sub-Family Striginae	
Ninox novaeseelandiae novaeseelandiae	Morepork
Order Coraciiformes	
Family Alcedinidae	
Sub-Family Daceloninae	
Halcyon sancta vagans	New Zealand Kingfisher
Order Passeriformes	
Passeriformes ? genus	Passeriform
Sub-Order Tyranni	
Family Muscicapidae	
Sub-Family Muscicapinae	
Rhipidura fuliginosa placabilis	North Island Fantail
Petroica australis longipes	North Island Robin
Family Meliphagidae	
Anthornis melanura melanura	Bellbird
Prosthemadera novaeseelandiae novaeseelandiae	Tui
Family Callaeatidae	
Philesturnus carunculatus rufusater	North Island Saddleback

Heteralocha acutirostris	Huia
Callaeas cinerea wilsoni	North Island Kokako
Family Turnagridae	
Turnagra capensis tanagra	North Island Thrush
CLASS MAMMALIA	
SUB-CLASS THERIA	
INFRA-CLASS METATHERIA	
Order Marsupialia	
Trichosurus vulpecula subsp.*	Opossum
INFRA-CLASS EUTHERIA	
Order Lagomorpha	
Oryctolagus cuniculus	Rabbit
Order Rodentia	
Rattus exulans	Polynesian Rat
Rattus rattus[52]	Ship Rat
Order Cetacea	
Sub-Order Odontoceti	
Delphinus delphis	Saddleback Dolphin
Lagenorhynchus ? obscurus/cruciger	Dusky/Hourglass Dolphin
Globicephala melaena	Pilot Whale/Blackfish
Sub-Order Mysticeti	
Mysticeti ? genus	Baleen Whale
Order Carnivora	
Canis familiaris	Polynesian Dog
Order Pinnipedia	
Arctocephalus forsteri	Southern Fur Seal
Neophoca hookeri	Sea Lion
Hydrurga leptonyx	Leopard Seal
Order Artiodactyla	
Sus scrofa*	Pig
Ovis aries*	Sheep

Footnotes

1-6,8 Found only in sites in the Moikau Valley

9-15, 17-22, 25, 28, 34-38, 42, 43, 45-56 Found only in sites at Black Rocks

16, 26, 39 Found only in sites at the Pararaki

23, 24, 27 Found only in sites at the Pararaki and Black Rocks

7 Nomenclature after Molloy (1972: pers.comm.), cf Neopanax sp. Allan (1961:434-5)

29 Nomenclature after Climo (1972: pers.comm.), cf Powell (1961:111)

30, 31 Nomenclature after Climo (1972: pers.comm.)

32, 33 Powell (1961:112)

40, 41 Nomenclature after Climo (1974: pers.comm.), cf Fleming (1966:31) and Powell (1961:124)

44 cf Pseudolabrus fucicola qv Doak (1972:74 ff)

57 A typographical error of 'Novodon' seems to have become common usage (Doogue et.al.,1966:294, 315; Morton & Miller, 1968:361; Witter, 1969:51). The correct spelling is 'Navodon' (Moreland, 1975: pers.comm.; cf Whitley, 1968:90 and Doak, 1972:107).

Appendix 2: The Washpool Height Datum

All height surveying in the Makotukutuku valley was referred to a datum at the mouth of the river. This is a cross incised in the top of the large concrete post at the NW end of the bridge over the Washpool (H20-S16-44, 1963). The height of this point was surveyed from a peg situated at the estimated mean high water mark during November 1969. The peg was labelled zero m ASL, and the datum was therefore determined as 5.43 m ASL. The Wellington high tide figures for November 1969 were averaged at plus 4.46 ft (1.36m) using Anon.b (1969). Mean sea Level (MSL) for Wellington is plus 2.90 ft (0.88m), thus the Washpool zero peg is situated at 0.48 m AMSL (1.36 - 0.88), or 1.64 m below the Wellington Bench Mark BM k80/1. To convert any height figures given here to fixed points elsewhere they should be related to BM k80/1. For any height point in the Makotukutuku valley (e.g. x m.ASL), the tidal relationships are as follows (see also Figure 23):

$$x \text{ m ASL} = x + 0.48 \text{ m AMSL}$$

In addition,

MHWS	=	MSL + 0.52 m
MHWN	=	MSL + 0.49 m
MLWN	=	MSL - 0.45 m
MLWS	=	MSL - 0.48 m

Appendix 3: Conventions and abbreviations which apply in this thesis

1) Relating to faunal and floral identifications

? *Puffinus* sp.	Genus uncertain but perhaps one of the shearwaters.
Puffinus sp.	Species uncertain, but certainly a shearwater.
Puffinus ? *gavia/huttoni*	A shearwater, perhaps either *P.gavia* or *P.huttoni*.
Puffinus ? *gavia*	A shearwater, probably *P.gavia* on grounds of known distribution of species, rather than osteology.
Odax vittatus ?	Some reservations about the original species definition.
? *Euryapteryx geranoides/Pachyornis mappini*	A medium sized moa, such as either *E.geranoides* or *P.mappini*.
Pseudolabrus cf *pittensis*	Most similar to *P.pittensis* but somewhat inadequate comparative material of other species.
Pseudolabrus nr.*pittensis*	as above.

fr.	fragment
juv.	juvenile
ad.	adult
ind.	individuals
f.	female
m.	male
nr.	near

2) Relating to Radiocarbon Dates

In various parts of this thesis radiocarbon dates are combined to give a pooled estimate. The method used is described by Leach (1972). See also Appendix 4.

Appendix 4: Radiocarbon dates from the Wairarapa

Most of these dates have been published elsewhere, but only as preliminary results. In each case a footnote is given with the relevant references. This list includes only one sample not processed by members of the Wairarapa expedition. The ½ life used was 5568 Yrs. The dates are given as AD/BC rather than BP (1950) because where referred to in the text, discussion tends to be in calendrical years. Locations are given as Map No/NZAA site No-Grid Ref.

	Description	Date
NZ1057	Charcoal. N161/1-714548. Oven site in Tararua Range with obsidian flakes.[1]	1209 AD ± 54
NZ1309.	Charcoal. N168/16-736988. Stone wall system at Whatarangi.[3, 4]	1405 AD ± 68
NZ1310.	Charcoal. N168/39-727930. Stone wall system at Te Humenga.[3, 4]	1173 AD ± 56
NZ1311.	Charcoal. N168/41-732924. Stone wall system at North Pararaki.[3, 4]	1279 AD ± 72
NZ1312.	Charcoal. N168/41-732924. Stone wall system at North Pararaki.[3, 4]	1219 AD ± 70
NZ1313.	Charcoal. N168/41-733925. Stone wall system at North Pararaki.[3, 4]	1242 AD ± 72
NZ1314.	Charcoal. N168/46-736922. Stone wall system at South Pararaki.[3, 4]	1141 AD ± 73
NZ1315.	Charcoal. N168/52-748902. Stone wall system at Kawakawa.[3, 4]	1261 AD ± 66
NZ1316.	Charcoal. N168/68-752871. Stone wall system at North Waiwhero.[3, 4]	1473 AD ± 56

	Description	Date
NZ1317.	Charcoal. N168/76-760844. Stone wall system at Black Rocks.[3, 4]	1390 AD ± 71
NZ1505.	Charcoal. N168/22-734967. M1/II/21/ structure AE. From midden pit cut into Crust of Layer 5. Washpool Midden site.[5]	1191 AD ± 41
NZ1506.	Charcoal. N168/22/734967. M1/II/17/ structure gamma. Scoop hearth overlain by Lens IIB. Washpool Midden site.[5] (see discussion Chapter 4 p.138)	1470 AD ± 40
NZ1507.	Charcoal. N168/22/734967. M1/III/9-10/ structure AZ. From midden pit cut into Crust of Layer 5. Washpool Midden site.[5]	1313 AD ± 40
NZ1508.	Charcoal. N168/22-734967. M1/V/18/ structure 17. Small depression cut into Crust of Layer 5. Washpool Midden site.[5]	1270 AD ± 81
NZ1509.	Charcoal. N168/21-733967. M1/I/2. From body of Layer 2. Washpool Beach Front Camp site.[5]	1404 AD ± 40
NZ1510.	Charcoal. N168/22-734967. M1/V/19. From body of Layer 4 Black. Washpool Midden site.[5]	1290 AD ± 40
NZ1511.	Charcoal. N168/22/734967. M1/V/8/ structure 5. Scoop hearth cut into Crust of Layer 5. Washpool Midden site.[5]	1168 AD ± 41
NZ1512.	Charcoal. N168/20-735969. M1/XX/15. From body of Layer 3. Washpool Garden wall system.[4, 5]	1562 AD ± 79
NZ1513.	Charcoal. N168/20-735969. M1/XX/7-8. From body of Layer 2A. Washpool Garden wall system.[4, 5]	1608 AD ± 78
NZ1514.	Charcoal. N168/20-735969. M1/XX/6-7. From body of Layer 2B. Washpool Garden wall system.[4, 5]	1442 AD ± 79

	Description	Date
NZ1634.	Shell. N165-736181. Date for estuarine environment in Lower Wairarapa. Kumenga area.[2]	1520 BC ± 50
NZ1635.	Shell. N165-736181. Date for estuarine environment in Lower Wairarapa. Kumenga area.[2]	2170 BC ± 50
NZ1636.	Charcoal. N168/24-735967. M1/XXXI/50. From body of Layer 13. Washpool Circular Raised Rim Pit.[6]	>1740 AD
NZ1637.	Charcoal. N168/24-735967. M1/XXX/15. Interface Layers 2 & 3. Washpool Terrace Garden.[6]	1375 AD ± 71
NZ1638.	Charcoal. N168/27-753976. M3. Charred wooden ? artefact. Washpool Rock Cleft Burial.[6]	1480 AD ± 70
NZ1639.	Charcoal. N168/31-761975. M5/17. Hearth in Layer 11 next to north east buttress. Washpool Rectangular Raised Rim Pit.[6]	>1772 AD
NZ1640.	Charcoal. N168/31-761975. M5/33. Hearth 'A' in west wall from earlier construction phase of pit. Washpool Rectangular Raised Rim Pit.[6]	1579 AD ± 69
NZ1641.	Charcoal. N168/29-756978. M4/II/15. From body of Layer 6. Washpool Cross Site, horticultural stone mound.[6]	1256 AD ± 72
NZ1642.	Charcoal. N168/29-756978. M4/I/8-13/ structure 40. Charred rear-post of terrace house with dog jaw inserted in slot below ground level. Washpool Cross Site Terrace.[6]	1617 AD ± 69
NZ1643.	Charcoal. N168/29-756978. M4/I/18/ structure 33. Charred centre post of terrace house. Washpool Cross Site Terrace.[6]	1466 AD ± 70

	Description	Date
NZ1644.	Charcoal. N165/9-742063. W1/D6-E6 Layer 2. Base plate beside posts H and AE of Moikau House.[7, 8]	1181 AD ± 54
NZ1645.	Charcoal. N165/9-742063. W1/I 11 Layer 2. Base plate beside post AC of Moikau House.[7, 8]	1179 AD ± 54
NZ1646.	Charcoal. N168/77-762843. BR3/3. Burnt brushwood patch, base of Layer 2. Black Rocks Midden site.[7, 9]	1147 AD ± 54
NZ1647.	Charcoal. N168/77-762843. BR4/1. Burnt brushwood in middle of Layer 1. Black Rocks Midden site.[7, 9]	1269 AD ± 54
NZ1648.	Charcoal. N168/77-762843. BR4/1. Burnt brushwood at base of Layer 4. Black Rocks Midden site.[7, 9]	1276 AD ± 54
NZ1649.	Charcoal. N168/77-762843. BR2/2. Burnt brushwood near top of Layer 1. Black Rocks Midden site.[7, 9]	>1750 AD
NZ3105	Shell. N165-736181. Date for estuarine environment in Lower Wairarapa. Kumenga area.	2380 BC ± 90
NZ3106.	Shell. N165-736181. Date for estuarine environment in Lower Wairarapa. Kumenga area.	2560 BC ± 80
NZ3107.	Shell. N165-736181. Date for estuarine environment in Lower Wairarapa. Kumenga area.	2650 BC ± 60
NZ3108.	Shell. N165-773191. Date for estuarine environment, Lower Wairarapa. Birchwood area.	1480 BC ± 70

Footnotes

1. This date is incorrectly published by Park (1970) as from N161/1-710545 and 1227 AD ± 40.
2. Leach and Anderson, 1974.
3. Leach and Leach, 1971b.
4. H.M.Leach, 1976.
5. Leach and Leach, 1971a.
6. Leach and Leach, 1972a, 1972b.
7. Anderson and Prickett, 1972.
8. Prickett, 1974.
9. Anderson, 1973a.

Appendix 5: The Prehistoric sources of Wairarapa Obsidian

This research was conducted jointly with Mr A.J.Anderson and has been written up for publication in a Monograph on Wairarapa Archaeology (Leach and Leach, nd). However, the information is central to discussion on prehistoric trade networks in this thesis, and is therefore given here in full. The full details of the method of determining the source of artefact obsidian are given in Ward (1972, 1974a). In brief, Ward sampled 42 geographical sources of obsidian in New Zealand (q.v. Ward, 1973), and trace element concentrations determined for each set of samples. After statistical analysis these 42 geographical sources were grouped into 18 petrographic source groups. Any subsequent trace element analysis of artefact obsidians can be statistically related to these 18 New Zealand sources. The method has been tested with archaeologically derived obsidian with great success (Ward, 1972: 188-193; Leach, B.F., 1973).

In the present case various circumstances demanded the adoption of somewhat different machine conditions than those stipulated by Ward (1972), but the modifications affect only the precision of determinations and not at all the overall matching of trace element concentrations to those of obsidian sources. However, because Ward's differentiation of sources is so clear, the loss of precision at low concentrations in the present analysis is academic. Nevertheless, the modifications are not recommended as a general practice, and a comparison of conditions is given below.

	Present Analysis	Ward's Analysis
Machine	Philips PW 1051	"
Standard	U.S.G.S.Standard granite G2	"
E.H.T.	900 eV	"
Generator	40KV, 20mA	"
Optical Path	atmospheric pressure	2 mm Hg.
Analysing crystal	LiF	"
X-Ray Source	W	"
Spectral line	K alpha 1 (all elements)	"
Counting Procedure	A 30 secs, B1 15 secs, B2 15 secs	"
Elements	Zr, Mn, Sr, Rb	Zr, Mn, Sr, Rb, Ti
Counter Type	Scintillation (all elements)	Flow Proportional Ti, scintillation for others.
Pulse Height Discrimination	none	Rb, Sr
Sample Preparation	1) Crushed to sand size steel mortar 2) Pulverised with agate ball vibrator 3) Reduced to powder agate mortar & pestle 4) Boric Acid Pellets at 4 tons	1) Reduced to powder in Tema tungsten carbide mortar 2) Boric Acid pellets at 4 tons

The results were converted to parts per million concentrations for the four elements and statistically compared with Ward's results for the 18 sources using a linear discriminant function based on Mahalonobis D^2. Details of the allocations of artefacts to geographical source are given below.

Sources of Obsidian artefacts from the Wairarapa

Probabilities are uniformly very high, and the notable exceptions (less than 0.5) are indicated with an asterisk.

Mayor Island

GU290	BR4/2/8
GU291	BR3/1/7
GU293	BR3/1/2
GU294	BR3/2/5
GU295	BR3/2/5
GU296	BR2/1/1
GU299	BR2/1/2
GU301	W1/2/K15/L-1A
GU302	W1/2/G15/L-1
GU303	W1/2/H15/L-1
GU306	M1/V/14/Lens VB
GU309	M1/II/11/Lens VB
GU311	M1/V/9/Lens VB
GU313	M1/V/Lens VB
GU314	M1/V/10/Lens VB
GU315	M1/II/6/Lens VB
GU316	M1/V/5/Lens VB
GU317	M1/V/9/Lens VB
GU319	M1/V/10/Lens VB
GU321	M1/V/4/Lens VB
GU324	M1/II/16/Lens VB
GU325	M1/V/4/Lens VB
GU326	W1/64/Turf
GU327	W1/6/L-2
GU328	W1/84/L-2
GU329	W1/10/L-1
GU330	W1/73/L-1
GU332	W1/76/L-1
GU336	W1/102/L-1

Mayor Island

GU339	W1/77/L-1
GU340	W1/Fireplace
GU341	W1/74/L-2
GU343	W1/11/Q
GU345	W1/113/L-2
GU346	W1/73/L-1
GU347	M1/XVIII/23/L-2
GU349	M1/XVIII/7/L-2
GU350	M1/XVIII/17/L2-L3A
GU351	M1/XIX/16/L-2
GU352	M1/XVIII/12/L-2
GU353	M1/XVIII/12/L-2
GU354	M1/XVIII/18/L-2
GU355	M1/XVIII/17/L-2
GU356	M1/XVIII/10/L-2
GU357	M1/XVIII/6/L-2
GU358	M1/XVIII/13/L-2
GU359	M1/XVIII/10/L-2
GU360	M1/XVIII/22/L-2
GU361	M1/XVIII/22/L-2
GU362	M1/XX/25/L-2
GU364	M1/XVIII/17/L-2
GU365	M1/XVIII/18/L-2
GU366	M1/XVIII/12/L-2
GU367	M1/III/2/4 Black
GU368	M1/XXXI/51/
GU369	M1/XXXI/49/L-2B
GU370	M1/XXXI/50/L-8
GU371	M1/XXXI/L-9
GU344	W1/7/L-1

Mayor Island

GU372	M1/V/4 Black
GU373	M1/V/25/4 Black
GU374	M1/V/19/4 Black
GU375	M1/II/1/4 Black
GU376	M1/II/7/4 Black
GU377	M1/V/4 Black
GU379	M1/V/15/4 Black
GU381	M1/II/4/4 Black
GU382	M1/VI/24/4 Black
GU384	M1/V/13/4 Black
GU385	M1/V/4/4 Black
GU386	M1/V/14/4 Black
GU390	M1/II/18/4 Black
GU391	M1/XXX/17/L-2
GU395	M1/III/9/4 Gravel
GU396	M1/III/8/4 Gravel
GU397	M1/III/20/4 Gravel
GU398	M1/III/23/4 Gravel
GU399	M1/III/24/4 Gravel
GU400	M1/III/25/4 Gravel
GU402	M1/III/20/4 Gravel
GU403	M1/III/18/4 Gravel
GU404	M1/III/19/4 Gravel
GU405	M1/III/17/4 Gravel
GU406	M1/III/16/4 Gravel
GU407	M1/III/7/4 Gravel
GU408	M1/III/14/4 Gravel
GU409	M1/III/5/4 Gravel
GU410	M1/III/8/4 Gravel
GU411	M1/III/9/4 Gravel
GU412	M1/III/10/4 Gravel
GU414	M1/III/13/4 Gravel
GU415	PN1/I/L-2
GU416	PN1/II/L-1

Mayor Island

GU417	PN1/I/L-1
GU418	PN1/II/L-1
GU419	PN1/I/L-1
GU420	PN1/I/L-1
GU421	PN1/I/L-3
GU422	PN1/I/L-3
GU423	PN1/I/L-3
GU425	PN1/III/L-1
GU427	M1/II/12/Lens B
GU428	M1/III/2/Lens B
GU429	M1/II/10/Lens B
GU430	M1/II/1/Lens B
GU431	M1/II/5/Lens B
GU432	M1/II/13/Lens B
GU433	M1/II/6/Lens B
GU434	M1/II/7/Lens B
GU435	M1/IV/16/Lens B
GU436	M1/II/17/Lens B
GU437	M1/II/14/Lens B
GU439	M1/II/18/Lens B
GU441	M1/II/10/Lens B
GU444	M1/II/4/Lens B
GU446	M1/II/25/Lens B
GU448	M1/III/11/4 Sandy
GU449	M1/III/10/4 Sandy
GU450	M1/III/15/4 Sandy
GU453	M1/III/20/4 Sandy
GU454	M1/III/2/4 Sandy
GU456	M1/II/24/4 Sandy
GU457	M1/III/3/4 Sandy
GU459	M1/III/11/4 Sandy
GU461	M1/III/13/4 Sandy
GU462	M1/III/16/4 Sandy
GU465	M1/II/22/4 Sandy

<u>Mayor Island</u>

GU466 M1/III/11/4 Sandy
GU467 M1/III/7/4 Sandy
GU469 M1/III/4/Crust 5
GU471 M1/II/16/Crust 5
GU472 M1/III/14/Crust 5
GU473 M1/III/17/Crust 5
GU474 M1/III/25/Crust 5
GU477 M1/V/10/Crust 5
GU479 M1/III/13/Crust 5
GU480 M1/V/4/Crust 5
GU482 M1/V/8/Crust 5
GU485 M1/III/12/Crust 5
GU486 M1/III/22/Crust 5
GU487 M1/II/14/Crust 5

<u>Huruiki</u>

GU307 M1/II/21/Lens VB
GU312 M1/V/3/Lens VB
GU323 M1/V/15/Lens VB
GU333 W1/90/L-2
GU334 W1/13/Turf
GU342 W1/68/L-2
GU383 M1/V/13/4 Black
GU392 M5/15/L-2
GU393 M5/19/1A-2A

<u>Rotorua</u>

GU338 * W1/71/Turf
GU442 M1/II/7/Lens B
GU452 * M1/III/3/4 Sandy
GU463 * M1/III/10/4 Sandy
GU470 * M1/II/11/Crust 5

<u>Purangi</u>

GU292 M3 Cleft Burial
GU297 M1/III/4 Structure 65
GU310 M1/V/5/Lens VB

<u>Ongaroto</u>

GU318* M1/V/Lens VB

<u>Cooks Bay</u>

GU300 M4/I/22/L-3
GU304 M1/XVIII/L-2
GU305 M1/XVIII/L-2
GU308 M1/V/14/Lens VB
GU320 M1/V/10/Lens VB
GU322 M1/V/10/Lens VB
GU331 W1/7/L-1
GU335 W1/77/L-2
GU348 M1/XVIII/4/L-2
GU363 M1/XVIII/L-2
GU378* M1/V/20/4 Black
GU380 M1/V/3/4 Black
GU387 M1/II/17/4 Black
GU388 M1/V/10/4 Black
GU389 M1/II/1/4 Black
GU394 M5/29/L-2
GU401 M1/III/23/4 Gravel
GU424 PN1/III/L-1
GU426 M1/II/Lens A
GU438* M1/II/13/Lens B
GU440 M1/II/7/Shingle in Lens B
GU443 M1/II/15/Lens B
GU445 M1/II/14/Lens B
GU451 M1/II/24/4 Sandy
GU455 M1/III/9/4 Sandy
GU460 M1/III/14/4 Sandy
GU468 M1/V/23/Crust 5
GU475 M1/III/Crust 5
GU476 M1/II/24/Crust 5
GU478 M1/II/21/Crust 5
GU481 M1/II/6/Crust 5
GU483 M1/V/3/Crust 5

<u>Taupo</u>

GU413* M1/III/9/4 Gravel

One or two purely technical conclusions are worthy of note. Firstly, the results further confirm Ward's strong argument that sourcing by colouration alone is unreliable. The strongest correlation occurs between green obsidian and Mayor Island, but this is not without exception. It is well known that Mayor Island possesses obsidian of colours other than green, indeed some non green material above derives from Mayor Island (for example the grey sample GU461). What is a mistake however, is the commonly held belief that all green obsidian does come from Mayor Island. Colours were recorded for 190 of the 192 specimens, and of these 144 were noted as green in transmitted light. However, 6 of these (4.2%) were found to belong to sources other than Mayor Island with high probabilities; GU394 and GU443 deriving from Cooks Bay, and GU323, GU333, GU334, GU342 from the Huruiki source.

Of the four pieces of red obsidian analysed, GU297 came from Purangi, a source at which Ward located red material; but the other three, viz: GU304, GU305, and GU426 originated in Cooks Bay where no red obsidian has been previously recorded.

Secondly, mention should be made of Ward's previous analysis of 19 pieces of obsidian from one of the sites included in the preceding table (M1 Midden Site Lens IIA). Ward's results (1972: 188 ff, Appendix 3.9) show 13 pieces from Mayor Island, 1 from Cooks Bay, and 5 from Taupo. The present analysis of a sample from a similar provenance (Layer 4 Black) gave rather different results, viz: 13 from Mayor Island, 5 from Cooks Bay and 1 from Huruiki. Moreover, in the analysis of 192 pieces from the Wairarapa, only 1 could be allocated to the Taupo source, and then only with a low probability (0.43). It was originally suspected that perhaps the lack of Ti analysis contributed to a statistical confusion between the Taupo and Cooks Bay sources, since these two are most clearly differentiated by their Ti concentrations. This possibility was very carefully assessed, and it is now clear that no such confusion has taken place. The trace element distributions for the specimens allocated to Cooks Bay form very coherent clusters for all four elements, and are quite separate from the Taupo distributions in the case of Zr, Rb and Sr. The concentrations of Mn for these two sources is of little use in discrimination. It must be concluded therefore, that while Taupo obsidian did find its way to Palliser Bay, the relative proportions in Ward's grab sample may have an inflated value by chance. It should be remembered that his sample was taken purely to illustrate an analytical method, and not at all to ascertain the relative quantities of different obsidian in the site in question. In the latter case, random sampling is the only justifiable method, and was followed here.

Thirdly, it will be noted that 8 pieces of obsidian were related to sources with relatively low probabilities, and an additional piece in the list which follows from Ward's analysis. These samples may actually belong to some source not sampled by Ward in his original study rather than those stated in the lists. Recently a new source of workable obsidian was found at Hahei N44/-278631, and nearby were sites with similar obsidian flakes in them (Moore, 1975: pers. comm.). Samples have yet to be characterised with trace element analysis, but this example shows that for some time yet source allocations from archaeological sites should be viewed with caution.

The following is a list of the source allocations made by Ward (1972:188-193, Appendix 3.9) from the Washpool Midden site.

Mayor Island

M1 000	M1/II/5/Lens II A
M1 001	M1/II/5/Lens II A
M1 002	M1/II/7/Lens II A
M1 003	M1/II/7/Lens II A
M1 006	M1/II/9/Lens II A
M1 007	M1/II/9/Lens II A
M1 009	M1/II/13/Lens II A
M1 010	M1/II/13/Lens II A
M1 011	M1/II/13/Lens II A
M1 012	M1/II/14/Lens II A
M1 016	M1/II/18/Lens II A
M1 018	M1/II/20/Lens II A
M1 020	M1/II/25/Lens II A

Cooks Bay

M1 004	M1/II/8/Lens II A

Taupo

M1 005	M1/II/8/Lens II A
M1 014	M1/II/15/Lens II A
M1 015	M1/II/15/Lens II A
M1 017	M1/II/20/Lens II A
M1 019*	M1/II/25/Lens II A

Appendix 6: Archaeological Site Types in the Wairarapa

	Site Type	Previously recorded and/or not visited	New Sites
A	Defended Settlements		N165/5,18,20,25,26,34,37,40,42 N168-9/49,83
B	Undefended Settlements	N165/2	N161/4 N165/9,11,12,23,32,47 N168-9/28,29
C	Defended Pit Complexes		N165/1,7,8,38,46 (20,25,37,40,42)[1] N168-9/30,31,32,33,34,58,60 (49,83)[1] " /(59,61)[2]
D	Undefended Pit Complexes		N165/13,14,22,29,33,39,41,43,44, " /48,50(9)[1] N168-9/55,70(28,29)[1] (24,64,66, " /68,72)[2]
E	Stone Walls & Pit Complexes		N168-9/24,59,61,64,66,68,71,72
F	Stone Wall Systems		N165/6 N168-9/5,16,18,20,25,26,35,37, " /39,41,44,46,50,52,54,56, " /57,63,65,68,69,76,79,81
G	Garden Soils	N168-9/6	N165/45 N168-9/14,19
H	Ovens & Middens	N168-9/3	N161/3,5 N165/10,15,16,17,19,21,27,28,35, " /36,49 N168-9/15,21,22,23,38,40,42,45, " /47,51,67,73,74,75,77,78,82
I	Specialised Sites		N168-9/27,36,48,62,80

	Site Type	Previously recorded and/or not visited	New Sites
J	Karaka Groves	N165/2,3 N168-9/2,4,7	N168-9/17
K	Burial Grounds	N168-9/1	N165/4,24 N168-9/43,53
L	Special Find Spots	N161/1	N161/6,7 N165/30,31

Footnotes: 1 - Pits associated with habitation sites
2 - Pits associated with stone walls

Appendix 7: Areas of Concentrated Archaeological Sites in the Wairarapa

	Area	Sites
	Wairarapa Alluvial Plain	
1	Western Lake	N165/12-18
2	Eastern Valley Sand Dunes	N165/19-22,25,28,34
3	Eastern Valley Lowlands	N161/3,5,6,7 N165/4,11,23,24,26,27,29,30,31,33,35 " /36,37,45,48
4	Subsidiary River Valleys	N165/1,38-47,49,50
	Palliser Bay	
5	Whangaimoana Stream (Moikau Valley)	N165/9-10
6	Putangirua River (Hurupi to Te Kopi)	N165/4-8
7	Makotukutuku River (Whatarangi to Washpool)	N168-9/14-34
8	Pararaki River (Te Humenga to Pararaki)	N168-9/35-48
9	Kawakawa River (Kawakawa to Waiwhero)	N168-9/49-71
10	Ngawi to Black Rocks	N168-9/72-78
11	Mangatoetoe River (Mangatoetoe to Cape Palliser Lighthouse)	N168-9/5-6,79-83

Appendix 8: Numbers of Wairarapa Archaeological Sites - in Different Areas and Categories

Area

Site-Types	Alluvial Valley				Palliser Bay							Totals
	1	2	3	4	5	6	7	8	9	10	11	
A	1	3	2	2		1			1		1	11
B	1		4		1		2	?		?		8
C				3		2	5		2			12
D	2	1	3	5	present				2			13
E							1		6	1		8
F					present	1	5	6	9	1	3	25
G			1	1			2				2	6
H	3	3	5	1	1	?	4	5	2	5	1	30
I							1	2	1		1	5
J						2	1				3	6
K			1			1		2	1			5
L			4									4
Totals	7	7	20	12	2	7	21	15	24	7	11	133
Totals		46					87					133

Appendix 9: Archaeological Site Types of the Wairarapa East Coast

Site Type	Site Number
A Defended Settlement	N166/1,4[3],23,39,40,49,51,56,60[3],63,64[3] N168-9/9[3],84,90[3],102,103,105,107,111[3],113[3],119[3],120, " /123,126,128,130
B Undefended Settlements	N166/58 N168-9/10,110,116,117,127,129
C Defended Complexes	N166/3,6,7,25(39,4[3],63,64[3])[1] N168-9/12,13,108,112,121,122(84,105,107,111[3],113[3], " /119[3],126,128,130)[1]
D Undefended Pit Complexes	N166/8,19,20,24,31,61(51)[1],(15,50,54,59,62)[2] N168-9/87,94,96,97,101,115,124(110,116,117,129)[1], " /(11,88,92,93,100,109,114,118)[2]
E Stone Walls & Pit Complexes	N166/15,50,54,59,62 N168-9/11,88,92,93,100,109,114,118
F Stone Wall Systems	N166/43,46,52,53,55,57,65 N168-9/85,86,89,91,95,98,106,125
G Garden Soils	N166/29
H Ovens & Middens	N166/9,10,11,12,13,14,16,17,18,21,22,30,34,38,41 " /42,47 N168-9/8,99
I Specialised Sites	N166/2,5,33,44,45,48 N168-9/104
J Karaka Groves	N166/26,27,28
K Burial Grounds	N166/32,66

Footnotes: 1 - Pits associated with habitation sites
2 - Pits associated with stone walls
3 - Use of one or more ditches

Appendix 10: Areas of Concentrated Archaeological Sites on the East Coast of the Wairarapa

Area	Sites
12 Ngapotiki (Cape Palliser Lighthouse to White Rock)	N168-9/8,12,84-96
13 Te Kaukau (Opouawe River to Oroi Stream)	N168-9/9-11,13,97,98
14 Oroi (Oroi Stream to Pukemuri Stream)	N168-9/99-119
15 Hiwikirikiri (Tora to Te Awaiti	N168-9/120-125
16 Te Awaiti (Oterei River to Hapukura Stream)	N166/49-52 N168-9/126-130
17 Aratikitiki (Hapukura Stream to Rerewhakaaitu River)	N166/39-41,43,45,46,53-58
18 Pahaoa (Rerewhakaaitu River to Glendhu Rocks)	N166/1-34,47,48
19 Waiuru (Glendhu Rocks to Honeycomb Rock)	N166/42,44,66
20 Glenburn (Honeycomb Rock to Waikekino)	N166/38,59-65

Appendix 11: Numbers of East Coast Wairarapa Archaeological Sites - in Different Areas and Categories

Area

Site-Types	12	13	14	15	16	17	18	19	20	Totals
A	2	1	7	2	5	3	3		3	26
B		1	3		2	1				7
C	1	1	2	2			4			10
D	3	1	2	1			5		1	13
E	3	1	4		1	1	1		2	13
F	5	1	1	1	1	5			1	15
G							1			1
H	1		1			1	14	1	1	19
I			1			1	4	1		7
J							3			3
K							1	1		2
L										0
Totals	15	6	21	6	9	12	36	3	8	116

Appendix 12: Checklist of Southern Wairarapa Archaeological Sites

Site Number: this refers to the New Zealand Archaeological Association numbers relevant to the New Zealand Map Series No:1 (NZMS1) maps.

Grid Reference: the North-South coordinate followed by the East-West coordinate on NZMS1 maps.

Site Type: this is listed under a variety of categories, and results from superficial examination and assessment in the field.

Comments: a few subsidiary comments are given throughout.

A) Rimutaka Area Map NZMS1 N161

Site Number	Grid Reference	Site Type	Comments
1	710545	route camp?	find spot of obsidian, Oven dated to 1227 ± 40 AD. See Park, 1970.
2	984450	historic kainga	Papawai pa. (Anon,b, 1965)
3	991372	ovens	in karaka grove.
4	907315	historic kainga	'Jury's Island' settlement in ox-bow of Ruamahunga River. Home of Te Whatahoro.
5	939308	ovens	Waihinga settlement ?
6	938304	river canoe	find spot only.
7	918302	river canoe	find spot only. Now in the National Museum.

B) Lake Onoke Area Map NZMS1 N165

Site Number	Grid Reference	Site Type	Comments
1	761107	headland pa	large complex of rectangular raised rim pits.
2	761038	karaka grove	
3	745027	karaka grove	
4	744012	burial ground	Te Kopi settlement ?
5	742007	headland pa	
6	746037	stone wall complex	
7	746025	? pa	large complex of rectangular raised rim pits and ditches.

N165 continued.

Site Number	Grid Reference	Site Type	Comments
8	752021	pits	large complex rectangular raised rim pits
9	737066-754051	settlement	large complex rectangular raised rim pits, stone walls, house sites? Moikau area. Excavated N.J.Prickett.
10	705071	ovens	Whangaimoana area
11	678087	historic kainga	Okorewa pa, Lake Ferry.
12	641109	historic kainga	Kiriwai pa ?
13	618112	pits	filled in with bulldozer
14	620111	pits	rims indistinct
15	700191	ovens	signs of occupation found over Papatahi peninsula
16	683218	ovens	Matarua bush
17	654152	ovens	Lake Pounui
18	668155	historic pa?	Battery Hill
19	773186	ovens	Birchwood dunes
20	776186	headland pa	'Jackson's pa'
21	774188	ovens	Birchwood dunes
22	771183	? pits	Birchwood dunes. Visible on 1944 aerial photographs
23	843230	historic pa	Otaraia pa
24	845233	burials	Otaraia burial ground ?
25	832227	pa ?	several pits
26	866222	pa ?	known locally as 'Pa Nga Tahua' - totally ploughed
27	795260	ovens ?	dune occupation ?
28	848287	ovens ?	dune occupation ?
29	875268	pits	Pukio pa ?
30	874263	river canoe	find spot only
31	879244	river canoe	find spot only
32	801212	historic kainga	Waitapu settlement ?
33	735168	pits	filled in with bulldozer

N 165 continued.

Site Number	Grid Reference	Site Type	Comments
34	745170	historic *kainga*	Kohunui settlement
35	724204	ovens	dune occupation.Kumenga area uplifted in 1855 from lakebed.
36	723208	ovens	dune occupation, post 1855.See comments N165/35
37	723156	ring ditch *pa*	'Hume's *pa*'. Several large rectangular raised rim pits with drains
38	782155	pits	covered in gorse
39	762073	pits	rectangular raised rim pits
40	766071	ridge *pa*	few pits, indistinct rims
41	767075	pits	no rims. Locally claimed to be early potato phase
42	740113	ring ditch *pa*	locally known as 'Parikarangaranga *pa*'
43	742091	pit	rectangular raised rim
44	728111	pits	filled in with bulldozer
45	728106	gardens ?	charcoal enriched soils
46	714125	pits	filled in with bulldozer
47	711122	*kainga* ?	late site? See 1944 aerial photographs
48	697121	pits	very large complex of rectangular pits. Rims indistinct - ploughing.
49	703116	oven	rest of site cut by road
50	761076	pits	rectangular raised rims

C) Eastern Wairarapa Coastal Area Map NZMS1 N166

NB: Sites 35-37 are outside the survey area and are not mentioned in text

Site Number	Grid Reference	Site Type	Comments
1	183082	? *pa*	on coastal ridge
2	202089	ditch & bank	enclosed by feature. Post-European agricultural?
3	203108	pits	inland
4	197092	*pa*	above river mouth, 1 ditch, pits, terraces
5	209100	ditch & bank	post-European enclosure?
6	205107	pits	inland
7	204108	pit	Orepu stream
8	206102	pits	river bank near mouth
9	200087	midden	river mouth
10	198089	midden	river mouth
11	198085	ovens	river mouth
12	198090	midden	beside stream at river mouth
13	196089	midden	foot of coastal hills
14	200090	midden	beside stream at river mouth
15	187085	stone walls,pits	on coast
16	191077	midden	near coastal rocks
17	196083	midden	on coast
18	194085	midden	on coast
19	212107	pits	near river mouth
20	211103	pits	near river mouth
21	199084	midden	at river mouth
22	205107	midden	inland
23	207110	? *pa*	inland
24	211103	pits	beside site 20
25	205108	pits	inland
26	213107	karaka grove	
27	204107	karaka grove	
28	206111	karaka grove	

N166 continued.

Site Number	Grid Reference	Site Type	Comments
29	194086	'made soil'	river mouth
30	201087	midden	at river mouth
31	215095	pit	base of coastal hills
32	207096	cemetery	river mouth, post-European
33	208097	'whare', midden	?post-European, structure near cemetery
34	208095	midden	at river mouth
35	350245	pits	on ridge above coast
36	381265	pits	on river terrace near mouth
37	378265	midden	in sand dunes near stream
38	313169	ovens	at stream mouth
39	154060	pa	terraced spur with pits, above coast
40	153058	pa	terraced spur above coast
41	160066	ovens	on coast
42	245118	ovens,midden	in sand dunes
43	154060	stone walls	on coast
44	255123	rock-shelter	with midden, in limestone cliff overlooking coast
45	135033	rock-shelter	in limestone cliff above coast
46	150053	stone walls	on coast
47	188084	midden	on coast
48	227098	chert source	?quarry, on coast
49	095006	? pa	on spur above coast
50	097005	pits,stone mounds	on coast
51	098010	pa	terraced spur with pits, midden, ovens, above coast
52	099008	stone walls	on coast
53	128031	stone walls	on coast
54	129032	stone walls,pits	on coast
55	130032	stone walls	on coast
56	144050	pa	terraced spur above coast

N166 continued.

Site Number	Grid Reference	Site Type	Comments
57	146051	stone walls	on coast
58	146052	terraces	on seaward slope
59	302158	stone walls	also pits, midden, ovens, ? terrace, on coast
60	305162	? pa	terraces on ridge top
61	307165	pits	on coastal flat
62	314177	stone walls	also pits, near stream mouth
63	320196	pa	terraces and pits on inland spur
64	333222	pa	2 ditches, terraces, pits, on headland above stream
65	334222	stone walls	on coast
66	271129	burial	in sand dunes, also find-spot of 'archaic' tiki

D) Eastern Palliser Bay Area Map NZMS1 N168-9

Site Number	Grid Reference	Site Type	Comments
1	731922	burial	excavated Barrow & Cairns
2	797829	karaka grove	
3	780828	midden	? Wellman's site containing *Euryapteryx geranoides*. See Wellman, 1962 a
4	800828	karaka grove	
5	803828	stone walls	rectangular enclosure
6	805828	gardens ?	charcoal enriched soils
7	821830	karaka grove	
8	895883	oven	in stream bank on coast
9	937878	headland pa	terraces,midden, ovens, no pits - Te Kaukau pa - 2 ditches
10	935888	midden	possible terraces. In gully
11	929891	pits	also 2 stone ridges, on river terraces
12	910890-920900	pits	inland ridge and river terrace

N168-9 continued.

Site Number	Grid Reference	Site Type	Comments
13	929900	pits	also oven, on inland river terrace
14	736993	gardens	charcoal enriched soils, possible stone walls
15	735994	midden	
16	736990	stone walls	locally known as the 'Great Wall of Whatarangi', excavated H.M.Leach
17	740987	karaka grove	'Dingley Dell'
18	734985	stone walls	much disturbed by farming
19	737980	gardens	charcoal enriched soils, possible walls. Now covered with post 1944 shingle fan.
20	735974	stone walls	part of site M1, includes M1/XI-XXIX, excavated H.M.Leach
21	733967	beach camp	M1/I, excavated B.F.Leach
22	734967	settlement	M1/II-X, excavated B.F.Leach
23	737971	midden	part of site M1, near cliff
24	735967	pits & gardens	circular raised rim pits, and terrace gardens. Site M1/XXX,XXXI, excavated B.F.Leach
25	736966	stone walls	also terraces, now partly covered by shingle fan. Part of site M1
26	743971	stone walls	locally known as the 'Cricket Pitch'. Also stone mounds and a terrace. Site M2, excavated B.F.Leach
27	753976	? pa	ditch and bank enclosure made with free standing stone wall. Also rock cleft burial. Site M3, excavated B.F.Leach

N168-9 continued.

Site Number	Grid Reference	Site Type	Comments
28	755975	terraced ridge	also rectangular raised rim pits
29	756978	settlement	stone walls, house terrace and rectangular raised rim pit. Site M4. Excavated B.F.Leach. Locally known as the 'Cross Site'
30	759976	pit	rectangular raised rim pit. Site M6
31	761975	pit	rectangular raised rim pit. Locally known as the 'Titoki Pit'. Site M5. Excavated B.F.Leach
32	763975	pit	rectangular raised rim pit. Site M7
33	770974	pit	badly eroded,possible stone walls M8
34	773975	pit	badly eroded, possible stone walls M9
35	731946	stone walls	partly buried by recent alluvium
36	729943	terraces	on consolidated shingle fan
37	729938	stone walls	also oven mounds. Damaged by farming
38	724933	ovens	also sparse midden
39	727932	stone walls	Te Humenga point
40	723926	middens,ovens	Te Humenga point
41	732924	stone walls	also middens.Pararaki North.Excavated H.M.Leach
42	729923	middens,ovens	also site known locally as 'the L shaped house', excavated by Cairns
43	731921	burials	'Wahine' storm removed entire area

N168-9 continued.

Site Number	Grid Reference	Site Type	Comments
44	738923	stone walls	also possible pits
45	735921	midden	very similar to site 22
46	737919	stone walls	excavated H.M.Leach
47	735918	middens, ovens	very similar to site 42
48	752918	stone walls	200 metres ASL
49	748905	ridge pa	above Kawakawa river, some pits
50	750905	stone walls	in gully behind site 49
51	743904	middens, ovens	Kawakawa lagoon site
52	747904	stone walls	run up to pa site 49 up to angle exceeding 21.5° Excavated H.M.Leach
53	748901	midden, burial	Excavated H.M.Leach
54	752902	stone walls	also cobbled pavement
55	751898	pits	rectangular raised rim pits
56	755901	stone walls	near modern river 'groynes'
57	757899	stone walls	also burial. Partly covered with recent shingle fan
58	758900	terraces, pits	much forest 'dimpling'
59	760900	stone walls	also rectangular raised rim pits. Covered with forest 'dimples'
60	762899	pits	rectangular raised rim pits. Covered with forest 'dimples'
61	763900	pits	rectangular raised rims, also stone walls. Site is covered with forest 'dimples'
62	754898	terrace	? artificially flattened hill top
63	748893	stone walls	partly covered by recent alluvium
64	752890	pit	also stone walls. Rectangular raised rim
65	751888	stone walls	recent alluvium partly covers

N168-9 continued.

Site Number	Grid Reference	Site Type	Comments
66	753884	pit	rectangular raised rim. Also stone walls
67	754881	midden	
68	751874	pits	rectangular raised rims. Also large area stone walls.
69	753868	stone walls	Waiwhero
70	757867	pits	rectangular raised rims
71	759864	pits	rectangular raised rims, also stone walls
72	761860	pits	rectangular raised rims, also stone walls and terraces
73	761857	midden	under house foundation
74	759857	midden	under house foundation
75	757851	midden	near Ngawi woolshed
76	762843	stone walls	large complex, excavated H.M.Leach
77	762835	middens	sites BR1-4.Excavated A.J.Anderson. Black Rocks
78	768841	terrace,midden	much slumping and erosion
79	782837	stone walls	Mangatoetoe River area
80	784838	platform ?	enclosed by earth wall
81	795831	stone walls	on steep slope
82	797832	midden	
83	798833	ridge pa	ditch and bank and rectangular raised rim pits
84	819835	settlement	rectangular raised rim pits, terraces, midden
85	822834	stone walls	
86	842837	stone walls	a large European free standing stone wall known locally as 'The Stone Wall' overlies prehistoric walls
87	864863	pits	on coast

N168-9 continued.

Site Number	Grid Reference	Site Type	Comments
88	872869	stone walls	also pits, on coast
89	874878	stone walls	on inland river terrace
90	877877	ditch & bank	pa ? on ridge
91	879878	stone walls	stream mouth
92	887881	stone walls	also pits, on coast
93	892882	stone walls	also pits, on coast
94	896882	pits	rectangular raised rims
95	898881	stone walls	on coast
96	910886	pits	river mouth
97	933883	pits	river mouth
98	952889	stone walls	on coast
99	960898	middens, ovens	Oroi stream mouth
100	960899	stone walls,pits	Oroi stream mouth
101	961900	pits, midden	Oroi stream mouth
102	962902	pa	terraced spur, Oroi stream mouth
103	961905	pa	terraced spur, near 102
104	961902	dendroglyph	in karaka grove between 102 and 103
105	965902	pa, pits	terraced spur on coast
106	972904	stone walls	rectangular enclosure
107	971911	pa	terraced ridge with pits
108	973910	terrace & pit	on plateau above coast
109	975912-975914	stone walls,pits	on coast
110	976916	terrace & pit	on coast near hills
111	977918	pa	single ditch, terraces, pits, on spur above coast
112	978919	pits	on hillside plateau
113	983925	pa	single ditch, terraces, pits, on spur above coast
114	985925	stone walls,pits	base of coastal hills
115	990924	pits,middens	also ovens and Maori cemetery

N168-9 continued.

Site Number	Grid Reference	Site Type	Comments
116	987927	pits,terraces	base of coastal hills
117	991929-993931	stone walls,midden	also middens and terraces on coast
118	994931	stone walls,pits	also midden at river mouth
119	995933	<u>pa</u>	3 ditches, terraces, pits (?) on coastal ridge
120	010958	? <u>pa</u>	on spur above river mouth
121	009964	pits	on river terrace
122	003985	pits	inland
123	035972	? <u>pa</u>	at stream mouth
124	037972	pits	on coast
125	048972	stone walls	on coast
126	063977	<u>pa</u>	terraced spur, pit, midden, oven above coast
127	065984	terrace	at river mouth
128	070995	? <u>pa</u>	inland ridge with pits
129	084989	stone walls,pits	also midden and terraces on coast
130	085995	<u>pa</u>	pits and terraces on inland ridge

Appendix 13: Burials and Grave Goods at Wairau Bar

The sexing established by Houghton's intensive study of the Wairau remains is taken to be accurate (Houghton, n.d.a). His method is based on discriminant analysis of long bones, and has been shown to be thoroughly reliable when used on prehistoric New Zealand material (Houghton and Souza, 1975).

NB1. Duff's sexing of the remains is given in brackets, and where there is an error apparent the page reference to Duff (1956). (O) implies that no mention could be found of sex in Duff's text.

NB2. In a number of cases no mention could be found in Duff's text as to whether there were or were not grave goods with a particular burial. This is denoted as ? grave goods. It is presumed that there were none in these cases, as it seems likely they would have been mentioned had they been present.

NB3. 'Not Seen' means that the material was unavailable for study by Houghton.

Males with Grave Goods

Burial 2 (M)
Burial 3 (M)
Burial 4 (M)
Burial 5 (M)
Burial 6 (M)
Burial 7 (M) Not Seen
Burial 12 (M)
Burial 14 (M)
Burial 15 (O)
Burial 20 (O)
Burial 21 (O)
Burial 25 (M)

Males with Grave Goods (cont'd)

Burial 27 (F p.62)
Burial 28 (M)
Burial 29A(M)
Burial 33 (?)
Burial 35 (M)
Burial 36 (M)

Males without Grave Goods

Burial 19 (M)
Burial 23 (M) ? grave goods.Not Seen
Burial 24 (?) ? grave goods
Burial X13(O) ? grave goods

Females with Grave Goods

Burial 9 (M p.47)
Burial 16A (O)
Burial 16B (O)
Burial 22A (M p.62)
Burial 22B (M p.62)
Burial 26 (M p.62)
Burial 29B (O)
Burial 30 (M p.66)
Burial 31 (M p.66)
Burial 1 (M p.32)

Sex Unknown with Grave Goods

Burial 34 (?) Not Seen

Females without Grave Goods

Burial 8 (F) Not Seen
Burial 11 (?)
Burial 11A(?)
Burial 13 (?)
Burial 17 (?)
Burial 18 (F)
Burial 37 (O) ? grave goods

Infants and Sub-Adults

Burial 10 (?) ? grave goods.Not Seen
Female Burial 13 (?) no grave goods
Female Burial 26 (M p.62) with grave goods
Burial 32 (?) with grave goods.Not Seen

Summary

		% of Sexed Remains (n=39)
Number of Males	22	56.4%
Number of Females	17	43.6%
? Sex	3	
Total	42	

Number of Adults	38	
Number of Infants/sub-adults	4	
Total	42	

		% of Sub-Totals
Males with Grave Goods	18	81.8%
Males without Grave Goods	4	18.2%
Sub-Total	22	
Females with Grave Goods	10	58.8%
Females without Grave Goods	7	41,2%
Sub-Total	17	
? Sex with Grave Goods	2	
? Sex without Grave Goods	1	
Sub-Total	3	
Grand Total	42	

Number of adults with grave goods	28
Number of adults without grave goods	10
Sub-Total	38
Number of infants with grave goods	2
Number of infants without grave goods	2
Sub-Total	4
Grand Total	42

Appendix 14: Dentalium Shell in New Zealand Archaeological Sites

It is widely known that dentalium shells occur in some archaeological sites in New Zealand; what is not generally understood is what species are found, where these shells can be obtained, whether the shells used were fossil or modern, what kinds of artefacts the shells may have been used for - necklaces, anklets, woven bands etc - at what different periods the shells were utilised, and so on. There is a variety of opinions about each of these points, based on a scattered literature. One frequently-quoted work on artefact chronology is Golson's paper (1959) in which he notes that Dentalium nanum was found at both Opito Bay and Sarah's Gully on the Coromandel Peninsula in sites of the 'North Island Archaic' (Golson, 1959:45); however, there is no mention in this important work of dentalium having been found in either the South Island Archaic or either the North or South Island Classic. Similarly, Groube in a summary of artefact distributions through time shows dentalium only in the Archaic (1969:6). This view is countered in a recent paper by Law who states: "Certainly they [dentalium sections] mostly occur in early assemblages but Green suggested their use persisted quite late (Green, 1963,p.58)" (Law, 1972:110). In fact Green only mentions dentalium as being used in the Developmental phase from about 1100 to 1350 AD (1963a:51), but he notes that the "use of Dentalium narum (sic) sections as ornaments is common" (1963a:58) during the Experimental phase which lasted to about 1450 AD (1963a:100), just before the development of Maori culture. Law's comment therefore presumably does not imply that dentalium was used in Classic Maori times, and this view is fairly widely held. In the South Island at least, most archaeologists would not be surprised to find dentalium in early Archaic sites; indeed, some are surprised not to find dentalium when excavating an Archaic site (Wilkes and Scarlett, 1967:201). Orchiston's recent paper on ornaments in the 1770s has done much to redress the imbalance by pointing out a number of descriptions of the use of dentalium during the protohistoric period (1972:104; see also Mead, 1969:83).

As well as misunderstandings on the use of dentalium at different periods in New Zealand, there is also widespread confusion over the species involved, and how they may have been obtained. The species Dentalium giganteum has been identified from a sizeable number of archaeological sites by Duff (1956:97-8), Lockerbie (1959:104), and Hutton (1875:105); however, with the exception of the designation given by Hutton (who first systematically described the species in 1873), all the remaining identifications must have been made without expert advice because the genus was re-evaluated as early as 1914 by Suter (1914:33) and a new species - Dentalium solidum - set up. The archaeological literature relating to dentalium is rife with misidentifications. For example, Duff (1956:97) refers to a necklace found at Manapouri by Hamilton (1892) as being Dentalium giganteum, whereas it is clearly one of the smaller scaphopods, perhaps Dentalium nanum (Hamilton, 1892:492). The same error is repeated by Dawson and Yaldwyn (1952:285), which suggests that they had consulted Duff (1956) on the point rather than Hamilton (1892). Inaccurate speciation appears to be more common in the case of the smaller scaphopods. Scarlett (1958:75) took the precaution of consulting an expert in identifying Dentalium nanum from a site on the Coromandel Peninsula, but this does not appear to have been repeated with the many later identifications. Leahy has identified shell reel units as "the large fossil Dentalium nanum" (Leahy, 1974:42)! She also describes the units as ranging from 9 to 12mm in diameter (ibid:42), which clearly is impossible for this species. Any finds of small scaphopods are usually identified as Dentalium nanum, but it would appear that some of these finds are other species. Judging from plates given by Murdock and Jolly (1967) for finds from Opito, and Dawson and Yaldwyn (1952) for a necklace from Long Beach (neither of which are identified to species level), species other than Dentalium nanum do occur in archaeological sites. These two illustrations show dentalium which appear both too smooth and too large in diameter to be Dentalium nanum. They may be Fissidentalium zelandicum which is much more finely ribbed and grows up to 2 inches long. Simmons (1973: Table 12) includes 'Dentalium beads' in a distribution table of ornaments in South Island sites; however, the specimens are not identified as to species, and the results are therefore of only limited use.

The problem of prehistoric sources of dentalium is most intriguing. Dentalium solidum occurs only as a fossil and is fairly common in Miocene mudstones (Fleming, 1966:35). It ranges in quality from extremely hard and well suited for manufacturing artefacts, to extremely fragile (as a result of multiple shearing) and quite useless for artefacts. The smaller scaphopods, such as Dentalium nanum, also occur as fossils in marine sediments from as early as the Miocene (Fleming, 1966:35); however in this case they are always quite unsuited to artefact manufacture as they are always found in a soft chalky state (G.Mason, 1975: pers.comm.). This means that prehistoric people must have obtained them directly from living communities. This would not have been an easy undertaking because the family of shells is only found in deep water communities. Because of the technology required, not to mention precise knowledge of deep-water communities and their locality, the accurate speciation of dentalium from archaeological sites is clearly a matter of some consequence. A synopsis of the modern species in this family is as follows. The nomenclature and distributional information has been extracted from Powell (1961:115-6), and the depth figures are from Dell (1956b,1963).

NB1. Marine Provinces are as follows:

A	Aupourian
C	Cookian
F	Forsterian
M	Moriorian
An	Antipodean
K	Kerguelenian

NB2. All the species except Dentalium ecostatum are obtained only by dredging in deep water. The exception is known to live in deep water because it has been dredged at 530m (Dell, 1956b); however, the type specimen (a juvenile) was recovered from Waikanae Beach (Suter, 1913: 821). Powell (1961:115) also notes that the species is found in shallower waters.

Fissidentalium zelandicum	ACFM	18 - 549 metres
Dentalium (Dentalium) tiwhana	M	238 - 604
Dentalium (Antalis) diarrhox	A	402 - 1280
Dentalium (Antalis) glaucarena	M	358 - 604
Dentalium (Antalis) nanum	ACF	27 - 293
Dentalium (Antalis) suteri	CFM	33 - 375
Dentalium (Laevidentalium) ecostatum	C	0 - 530

The Use of Dentalium during the Protohistoric Period

The earliest references to the possible use of Dentalium are to be found in the journals of Captain Cook's party. Some of the passages may be quoted as follows:

> "In the Canoe were two women & a girl besides three or four Men, one of whom had a bracelet round his ankle which seemed to be of a kind of cylindric white shells strung upon a thread - the Woman's lips were tattaoued - one of them was very jolly & had large breasts."
>
> (Monkhouse, 1968:575)

> "the Women wore sometimes Bracelets and anclets made of the Bones of Birds, shells, &c...."
>
> (Banks, 1963:17)

> "the women sometimes wear necklaces of shark teeth or bunches of long beads which seem to be made of the leg bones of small birds or a particular shell;...."
>
> (Anderson, 1967:810)

Additional evidence of the use of Dentalium is to be found in William's Maori Dictionary (1971) which has a number of entries relating to the subject. The implications of this were first noticed by Duff (1956:99), who noted the modern Maori use of the term pipi taiari referred to a necklace made from Dentalium.

> "Pipi-komore, pipi taiari, Dentalium nanum, tusk shell; a univalve mollusc which Grey states was used to make necklaces"
>
> (Williams, 1971:282)

Unfortunately the details of the reference to Grey are not given anywhere in William's text, however, a further entry under komore is interesting:

> "Komore n. 1. Bracelet, or ornament for the ankle......
> 2. Dentalium nanum, a tubular mollusc."
>
> (Williams, 1971:132)

Hamilton makes a suggestive comment about the word komore as follows:

> "these komore must have resembled strings of Dentalium shells strung together by Natives of the west side of the Auckland peninsula, which were bartered with the inland tribes and worn as necklaces or bracelets."
>
> (Hamilton, 1901:307)

Hamilton also refers to a species of dentalium called hangaroa and a belt called tu-hangaroa (ibid). The entry from William is:

> "Hangaroa n. 1. Some kind of sea-shells which were strung together and worn as an ornament round the neck, waist, or ankle.....
> 2. Also applied to ornamented belts or anklets of other materials."
>
> (Williams, 1971:34)

Elsewhere, Hamilton notes that:

> "Dentalia [sic] were collected on the north-west coast, between Mount Egmont and Raglan, and threaded together carefully into a necklace of either six or nine strands. These white tusk-shells are mentioned in a saying used if you wish to compliment a lady on the perfection and whiteness of her teeth: 'Your teeth are like the pipi-taiari.' "
>
> (Hamilton, 1908:11)

Additional information is supplied by Best as follows:

> "Anklets were occasionally worn by young women, and the same may be said of bracelets; it was by no means a common practice. A favoured form in some parts was a woven band worked in different colours in taniko style. These adornments were called tauri komore. In some cases shells were so used, but these were more commonly worn as necklaces; shells of Dentalium and Turritella [Maoricolpus or Zeacolpus] were so employed."
>
> (Best, 1924:535)

A similar comment occurs in a later work by Best, but is worth quoting in full:

> "Anklets, termed tauri komore were occasionally worn by women. These were formed of a woven band of Phormium fibre, adorned with coloured patterns (taniko) in some cases. Others were of plaited grass, or strings of shells. Sometimes a young woman would have bands of tattooing to resemble anklets ..... the hangaroa with which anklets and belts for young women were adorned were probably Dentalium shells."
>
> (Best, 1952:226)

Again an entry in Williams is instructive:

> "Tauri komore, (a) wristlet or anklet of plaited grass, or of flax, ornamented with feathers or shells, worn by girls of rank.....
> (b) A tattooed band round the wrist or ankle."
>
> (Williams, 1971:402)

Two points are worth noting from these references. Firstly, dentalium shells were apparently threaded together and sometimes plaited into a band, for use as a necklace, wristlet, or anklet. With the single exception of Monkhouse (1968:575) women are often specifically mentioned as the wearers of these ornaments, and in one case the question of superior rank has been mentioned. Secondly, there is a suggestion that these ornaments were sufficiently valued to have been items of trade to communities away from the sea. It is interesting that Hamilton (1901:307) should refer to the west side of the Auckland peninsula, because Powell notes that Dentalium nanum are most abundant in the Manukau harbour (Powell, 1961: Note Plate 16).

It seems reasonable to conclude that if these shells are found in a small number in an archaeological site they probably belonged to an ornament threaded on to a string, but if a large number are found it may indicate a woven belt of some kind. In any event, their presence in an archaeological site raises the question of prehistoric trade, and this should be carefully examined in each case.

Dentalium and the Different Ornament Forms

The following is a comprehensive list of examples of dentalium used as ornaments from archaeological sites, together with references to any protohistoric literature describing artefact forms.

A) Made from Dentalium ? solidum

Artefacts made from this species are apparently of at least two main types, so called 'shell reels' and 'grooved sections'. The species is only obtained from fossiliferous Miocene mudstones, but these are fairly common through New Zealand. However, the extreme variability of the quality of these shells in different deposits means that they may well have been traded from one place to another.

1) Shell Reels Duff first drew attention to the similarity of many of the sections of Dentalium solidum to the stone and ivory reels of Wairau Bar. They consist of a worked section of the shell with only three strongly marked ridges - one in the centre and one at either end. Duff suggests that this artefact is early in New Zealand and illustrates a number of specimens under the heading "Reels from fossil Dentalia [sic] mainly Wairau" (Duff, 1956:98). The shell reel has been recovered at the following localities:

Wairau Bar (Duff, 1956:97-99)

Curio Bay, Southland (ibid; Skinner, 1974b:86)

Ohana, D'Urville Island (Duff, 1956:97-99)

Opito Bay, Coromandel (ibid)

Hot Water Beach, Coromandel (Leahy, 1974:40)

NB The description of the bone and dentalium reel necklace from Curio Bay by Skinner (1974b:86) is inaccurate. There are three units of dentalium, the central unworked piece, and the two reels on either side (Park, G.S., 1975:pers.comm.).

2) Grooved Sections These are sections of dentalium which are grooved to leave ridges considerably closer together than in the case of the shell reels. There are usually 4 ridges in each unit. Duff (1956:97-8) refers to these as being common in North Otago, including Katiki, and other beaches in Otago. In view of the problem of speciation in some of Duff's comments (mentioned above), and the fact that the Katiki example referred to by Duff is undoubtedly the *Dentalium nanum* necklace figured by Skinner (1974b:96), some caution is needed in including specimens in the following list. Only examples where the author has been able to check speciation from illustrations or first hand are therefore included.

Wairau Bar (Duff, 1956:97-8)

Spring Creek female burial, near Wairau Bar (ibid)

Motunau, North Canterbury (ibid)

Pounawea, Southland (Duff, 1956:99; Lockerbie, 1959:104)

Shag River, Otago (Duff, 1956:97; Hutton, 1875:105)

Dunback, North Otago (Duff, 1956:97; Skinner, 1974b:86)

Pahia, Foveaux Strait (Skinner, 1974b:86)

B) Made from Dentalium ? nanum (and possibly other species)

These shells were apparently strung together to make necklaces, anklets, wristlets and woven bands. There are obvious difficulties in determining which ornament form was represented in the archaeological remains; however, this is possible in some cases, and the various discoveries are listed below.

1) Strung Necklaces There are a number of these in museum collections, and also a few published illustrations. Sometimes the dentalium pieces were interspersed with other objects, and examples are given below:

Lake Manapouri (Hamilton, 1892; Duff; 1956:97; Dawson & Yaldwyn, 1952)

Katiki Point, Otago (Skinner, 1974b:96)

Long Beach, Otago (Dawson & Yaldwyn, 1952)

Gable Point, Mahia (Skinner and Phillipps, 1953)

North Cape (ibid)

Descriptions from protohistoric period: Anderson (1967:810), Best (1924:535,544; 1952:226-227), Hamilton (1901:307, Plate 50)

NB1 The illustrations in Best (1924:544; 1952:227) and Hamilton (1901:Plate 50) are identical specimens. The necklace appears to consist of 3 lengths of about 21, 25, and 26 shell units. Interspersed between the shells are black elements which cannot be identified from the illustrations; however, they strongly resemble Dentalium sp., and it is possible that these are stained elements, perhaps from immersion in swamp mud or bark extract such as that described by Best as a dye for fibres (Best, 1924:516-517).

NB2 The North Cape example (Skinner and Phillipps, 1953:174) is a lengthy necklace of about 89 elements, which may have been comparable to the Lake Manapouri example reputed to be 2 yards long. The find of a greenstone hei matau with this latter specimen has led a number of people to regard it as late in time (Duff, 1956:99; Orchiston, 1972:104). It should be noted that although Orchiston remarks "the discovery at Lake Manapouri of a long necklace of these units associated with a hei matau .... proves its Classic Maori association ...." (ibid), in the same paper he remarks: "Until a thorough study of this type of pendant [the hei matau] is completed its chronological status must remain in doubt"(op.cit: 102). In confusing the species used for this necklace with Dentalium solidum, Duff remarks that it must have been "a remarkably unaesthetic and clumsy necklace" (Duff, 1956:97). Why there should be a continuing confusion over this necklace (see for example Dawson & Yaldwyn, 1952:285) is hard to understand. Hamilton clearly states that from "the neighbourhood of Lake Manapouri, there is a necklace nearly 2 yards long composed of a small dentalium, or tusk shell." (Hamilton, 1892:492). He goes on to describe the "large fossil shells, Dentalium giganteum" as having been found at the Shag River site (ibid).

NB3 The necklace from Long Beach was interspersed with Zediloma sp. (Dawson and Yaldwyn, 1952).

NB4 The Gable Point necklace illustrated by Skinner and Phillipps (1953) was interspersed with human teeth. The actual locality is in doubt as Gable Point is not known anywhere near Mahia. The National Museum catalogue for the item (Bollons collection 5126) is no more specific on the point (B.I.McFadgen, 1975:pers.comm.).

2) Anklets Only one of these has been found archaeologically and this was in a site at Makara, near Wellington. Davis states: "Both [burials] were of the crouch type and one with a bracelet of dentalium shell around the ankle bone" (Davis, 1962:145). The shells were not identified as to species, and it can only be a guess that they are of the smaller scaphopods. This discovery is especially significant since part of the site at least is clearly of Moa-hunter provenance. There is much moa bone and Archaic adzes are in indirect association. The two radiocarbon dates, however, conflict somewhat - 1558 AD ± 84 and 1070 AD ± 84 (op.cit.:147, 148), and perhaps confirm the suggestion of several periods of occupation in the area - clay pipes were found in four of the 9 squares excavated.
Descriptions from the protohistoric period: Banks, 1963:17; Best, 1952:226; Monkhouse, 1968:575; Williams, 1971:132).

3) Wristlet Unfortunately the references to wrist bracelets made from dentalium are ambiguous, and may either refer to wristlets made from some other item or dentalium used around the foot. These have not been found in archaeological sites. Descriptions may include: Banks, 1963:17; Best, 1924:535; Williams, 1971:132.

4) Woven Bands Best describes dentalium being woven into a band and used as an anklet or bracelet (Best, 1924:535; 1952:226). Some form of similar garment may have been found in an early site in the Wairarapa (see below).

5) Dentalium fragments - Ornament type unknown. Pieces of Dentalium cf nanum have been found in quite a number of archaeological sites, and these are generally accepted as some form of ornament. Most of the following sites are in the Coromandel - Great Barrier area:

Hotwater Beach, Coromandel - N44/69 (Leahy, 1974:42)

Pohutukawa flaking floor, Opito Bay, Coromandel - N40/2 (Murdock and Jolly, 1967:162)

Mahinuapua Bay, Coromandel - N40/5 (Scarlett, 1958)

Sarah's Gully Settlement, Coromandel - N40/9 (Golson, 1959:45; Green, 1963b:66)

Opito Beach site, Coromandel - N40/3 (Golson, 1959:45)

Harataonga Bay, Great Barrier Island - N30/4 (Law, 1972:106, 110)

Karitane Pa, Otago - S155/1 (H.Leach, 1975:pers.comm.)

Paremata Burials - N160/50 (Smart, 1962:141)

NB1 There were a number of dating problems at Hotwater Beach (Leahy, 1974:71-72), but if we reject the two modern dates, the remaining 5 samples give a pooled result of 1500 AD ± 34.

NB2 Scarlett's recovery of large numbers of Dentalium nanum eroding from a dune site at the north end of Mahinuapua Bay led to the site's acceptance as a 'workshop' (Scarlett, 1958; Green, 1963b:58), where necklaces and perhaps other ornaments were made. Scarlett refers to several hundred shells being found "including the non-perforated, curved ends of the shells" (op.cit:75). The conclusion that it was a workshop was based on the large numbers of the shells, and the presence of non-perforated ends, implying that the shells were collected locally and these non-functional pieces removed. The important point is that a local derivation is implicit in this idea of a workshop. However, one should be careful about accepting this because there are several misunderstandings involved in the argument: a) large numbers do not imply a workshop - over 1400 specimens found with a burial in a site in Palliser Bay are believed to represent a garment of some kind (see below).

b) Dentalium nanum do not possess a non-perforated end. In fact, all scaphopods have a shell which is open at both ends; some even have secondary shell tubes projecting through the narrower opening (Parker and Haswell, 1960:578). The complete shells are easily strung together, and in fact were thus assembled in the Palliser Bay sites. This factor does not support a local origin as is implicit in Scarlett (1958). In short the functional status of this site should be re-assessed.

NB3 Sarah's Gully has 6 radiocarbon dates (Law, 1974:3), and if we exclude the modern sample the other 5 give a pooled estimate of 1292 AD ± 40.

NB4 The Opito Beach site has a radiocarbon date of 1310 AD ± 50 (Law, 1974:3). It is interesting that as well as Dentalium nanum being used for what are thought to be necklaces, a number of bird bone tube units are believed to have functioned similarly (see Green, 1963b:60; and Golson, 1959:45).

NB5 About 6 shells were recovered in Groube's excavations on the lower terrace, Area B at Karitane in apparent association with a drilled human tooth. The site is believed to date to about 1800 AD.

NB6 The *Dentalium* on the Paremata site was not speciated but was in association with a child burial.

Dentalium from Excavations in Palliser Bay

During the course of archaeological research in Palliser Bay, a total of 1577 examples of *Dentalium nanum* were recovered. These were found in a variety of temporal provenances ranging from 1180 AD to about 1750 AD. The method of obtaining these shells (suggested below) argues that there was considerable cultural continuity in Palliser Bay throughout this time. The individual finds are as follows:

Washpool Midden site - N168-9/22	1407	specimens
Washpool Cleft Burial - N168-9/27	160	"
Black Rocks Pond Midden - N168-9/77	6	"
Black Rocks Black Midden - N168-9/77	2	"
Pararaki House site - N168-9/41	2	"

Dating the Remains

At the Washpool Midden site (M1) a total of 11 of the 1407 specimens were found in Lens B - the remainder were recovered in the Crust of Layer 5 in intimate association with a child burial (C). Thus these shells belong to Level I, for which a date of c.1180 AD has been estimated elsewhere in this thesis.

The Washpool Cleft Burial (M3): these remains were dated with a charcoal sample (NZ1638) to 1480 AD ± 70.

Black Rocks Pond Midden (BR2): the specimens were found in Layer 1 (Anderson, 1973a:Appendix E) and there is an associated charcoal sample (NZ1649) which was dated at > 1750 AD. The conchiolin ratio confirms this later period (*op.cit.*:Fig.19).

Black Rocks Black Midden (BR3): the shells were found in Layer 1 (Anderson, 1973a:Appendix E). A charcoal sample (NZ1646) from Layer 2 was dated at 1147 AD ± 54 (op.cit.:87). The conchiolin ratios for these two layers were practically identical (op.cit.:Fig.19), therefore this date is a good estimate for Layer 1 also.

The Pararaki House site: this excavation was part of a salvage operation at the mouth of the Pararaki River. The artefacts found are of Archaic type and are discussed by Prickett et.al. (n.d.). Other parts of this large site complex have been dated to 1279 AD ± 72, 1219 AD ± 70, 1242 AD ± 72, and 1141 AD ± 73 (NZ1311 - NZ1314). This gives a pooled mean of 1221 AD ± 29 and is probably a fair estimate of the age of the find of Dentalium nanum.

Function of the Dentalium

The function of the specimens from both the Pararaki and Black Rocks is uncertain. The remains merely indicate that the residents of these areas were obtaining the shell from some source at the various periods represented; nevertheless, there is every reason to suppose that the shells were used for some decorative purpose. At the Washpool, however, the associations of the find give a clearer indication of function. Practically all of the specimens in the Washpool Midden site were found covering the lower limb bones of the child burial and the sheer quantity of the shells indicates they belonged to a garment, rather than a necklace. Quite a few of the shells were found with the smaller end thrust into the larger hole of another shell indicating that at least part of the manufacturing process involved threading of shells together. If the dentalium formed part of a woven garment, it is difficult to see how the shells could have been part of the main warp-weft design. A fibre suitable for stringing dentalium would have to be quite fine - a single strand of flax for example - presumably finer than the warp of even a delicate woven garment. An alternative explanation is that the shells were threaded on to a fine strand and then attached to the main warp structure by the weft. Whatever technique was employed, it seems likely that the shells belonged either to a skirt or an apron worn by the child, or perhaps a cloak placed over the lower body at the time of burial. The centre drilled-out piece of a moa-bone fish-hook tab was found near the right knee and could have functioned as a toggle for securing the garment.

Some idea of the area covered by the dentalium might be obtained using Suter's dimensions for Dentalium nanum of 38 mm x 3 mm (Suter, 1913:818). The 1406 specimens if laid side by side would cover 1603 cm^2. Only a few of the specimens are complete, but on the other hand many of the shells were so broken down as to preclude recovery. The figure of 1600 cm^2 is therefore probably a fair estimate of the original area the shells would have covered. This is about 1/5th of the total area of the Lake Hauroko shoulder cape as an example (96.5 cm x 84 cm = 8106 cm^2 - Simmons, 1968:4), and might indicate that these shells originally formed part of an embellished border rather than covering the entire garment. It should be remembered that the garment is associated with a child of about 4 years, and presumably any cape would be much smaller than normal. Whatever the explanation, far too many shells were found to belong to either a necklace or a decorated belt. Unfortunately the garment that these shells belonged to is difficult to parallel with known Maori examples (Mead, 1969).

It is interesting to note that the other dentalium pieces found in the Washpool Valley were also found with infant burials; but here only 160 units were included, and these presumably belonged to some kind of strung necklace. The correlation with infant burials has also been suggested at Paremata (Smart, 1962:141).

The Source of the Wairarapa Dentalium nanum

For several reasons it is suggested that these shells were collected from a living community, though not necessarily by Palliser Bay people. The species certainly do occur as fossils in the blue fossiliferous upper Pliocene mudstone cliffs from Lake Ferry to Whangaimoana (King, 1934; Beu, 1967), but as mentioned above, fossil remains of Dentalium nanum are always so soft and chalky as to preclude their use in necklaces and garments - these local fossils are no exception. In addition, the shells from the Washpool sites still possessed a pronounced periostracum, again indicative of collection from a living population. As was detailed above, Dentalium nanum is primarily a deep water species found between 27 and 293 metres, and recovery from these depths would require dredging of a kind not previously recorded for the Maori. Dentalium nanum was not found at any of the 4 dredge stations in Palliser Bay recorded by Dell (1956b), nor in the sediments brought up in the 4 trawl stations in Palliser Bay by the Government Trawling Expedition in 1907 (Waite, 1909). A recent analysis of shellfish species attached to offshore algal holdfasts of the Macrocystis sp. from Palliser Bay did not record a single occurrence of Dentalium nanum (Leach and Mason, n.d.). The nearest recorded find of living Dentalium nanum is from near Flat Point 89 km along the coast from the Washpool in 191 metres (Suter, 1909:130).

On the other hand Dentalium nanum is known to occur in certain areas of New Zealand in quite shallow water. The 1907 Government Trawling Expedition located a population in just over 16 metres of water near Porangahau 217 km up the coast from the Washpool (Suter, 1909:13). In addition, the species is recorded in the relatively shallow water of the Manukau Harbour (Powell, 1961:note Plate 16), precisely where Hamilton saw Maoris making up necklaces of Dentalium nanum and trading them with inland people (Hamilton, 1901:307). On present evidence therefore, there seems no need to suggest that either the Palliser people or other group were dredging in very deep waters for these shells. What seems more likely is that in select places in New Zealand, where populations existed in shallower waters, groups were collecting these obviously prized shells for trade. In the absence of more definitive information on present shallow water distribution, the only sources which can be suggested are the Manukau Harbour and Porangahau. It is possible that problems like this may be solved in future by trace element characterisation of shells. The element intake of shellfish could be expected to vary according to the character of local sediments as well as species metabolism. Other indirect indicators may also prove useful. In the Washpool site, for example, 2 specimens of Pecten novaezelandiae subsp. were also found. This shellfish occurs in a series of isolated populations around New Zealand, as relics of a once wider distribution (Fleming, 1957:46). The two subspecies of these shells have very discrete distributions, and if a combination of Pecten novaezelandiae rakiura and Dentalium nanum were to occur in one archaeological context it would be strong presumptive evidence that both came from the Manukau Harbour which contains an important relict population of the former species. In the case of the Washpool remains, these were identified by G.Mason (1975: pers.comm.)

as Pecten novaezelandiae novaezelandiae and were probably obtained by trade from some other prehistoric community in Cook Strait.

Finally mention should be made of the notable absence of Dentalium solidum in Palliser sites. This shell is found as a fossil in the local Hurupi formation (King, 1934). This upper Miocene fossiliferous blue mudstone occurs as a small isolated outcrop 1.3 km north of the Washpool, but the main block stops 2.2 km to the north at Woolshed Creek (Bates, 1969). Numerous specimens of Dentalium solidum were found both at Woolshed Creek and in the Putangirua River; however, all specimens were extremely fragile with many shearing planes, and therefore quite useless for manufacturing artefacts.

Appendix 15: Site Names and their NZAA Site Number Equivalences

Several archaeological sites in the Wairarapa have local names, and where possible these are used in this thesis in preference to the less easily remembered NZAA Site Recording Scheme Numbers. The equivalences for these are given below, and full details can be found in Appendix 12.

Site Name	NZAA Site Number
Battery Hill Pa	N165/18
Black Rocks Middens (BR1,BR2,BR3,BR4)	N168-9/77
Dingley Dell	N168-9/17
Great Wall of Whatarangi	N168-9/16
Hume's Pa	N165/37
Jackson's Pa	N165/20
Jury's Island	N161/4
Kawakawa Pa	N168-9/49
Kiriwai Settlement	N165/12
Kohunui Settlement	N165/34
M1	N168-9/20-25
M2	N168-9/26
M3	N168-9/27
M4	N168-9/29
M5	N168-9/31
M6	N168-9/30
M7	N168-9/32
M8	N168-9/33
M9	N168-9/34
Matakitaki South Settlement	N168-9/84
Moikau Valley Settlement	N165/9
Okorewa Settlement	N165/11
Otaraia Pa	N165/23
Pa Nga Tahua	N165/26
Papawai Pa	N161/2
Parikarangaranga Pa	N165/42

Site Name	NZAA Site Number
Putangirua Pits	N165/7
Tauanui Pa	N165/1
Te Kopi Pa	N165/5
Te Kopi Settlement	N165/4
Waihinga Settlement	N161/5
Waitapu Pa	N165/32
Washpool Camp Site	N168-9/21
Washpool Cleft Burial	N168-9/27
Washpool Cross Site	N168-9/29
Washpool Garden Terrace	N168-9/24
Washpool House Terrace	N168-9/29
Washpool Midden Site	N168-9/22
Washpool Ridge Site	N168-9/28
Washpool Stone Wall Fort	N168-9/27
Washpool Stone Wall Garden Site	N168-9/20
Washpool Titoki Pit	N168-9/31
Wilkie's Pa	N165/25
Whakatomotomo Pa	N165/42
Whangaimoana Ovens	N165/10

Appendix 16: The Different Lithic Materials at the Washpool Midden Site

NB: These figures are extracted from K.Prickett (n.d.) and are the number of pieces.

	Totals	Level 1	Level 2	Level 3
1. Obsidian	3525	1467	1975	83
2. Chert	3504	1392	1964	148
3. Argillite (metasomatised)	1589	601	906	82
4. Limestone	160	75	81	4
5. Schist	31	6	24	1
6. Schistose greywacke	35	16	19	-
7. Nephrite	4	3	-	1
8. Serpentine	7	2	4	1
9. Talc	1	-	1	-
10. Orthoquartzite	5	2	3	-
Total Imported	8861	3564	4977	320
1. Greywacke	1713	920	778	15
2. Sandstone	135	30	104	1
3. Pumice	99	53	45	1
4. Unbaked argillite	78	41	36	1
5. Slaty argillite	23	1	21	1
6. Volcanic argillite	18	5	13	-
7. Spillitic lava	23	6	17	-
8. Calcite	5	2	3	-
9. Kokowai	14	2	11	1

	Totals	Level 1	Level 2	Level 3
10. Concretions	8	-	8	-
11. Coral	2	2	-	-
12. Quartz crystal	1	1	-	-
13. Fossil bivalves	4	-	4	-
Total Local	2123	1063	1040	20
Grand Totals	10984	4627	6017	340

Appendix 17: Proportions of Different Obsidians in the Washpool Midden Site Based on Trace Element Analysis

NB: These figures have been compiled using the data in Appendix 5.

Source		Level 1	Level 2	Level 3*
Mayor Island	N	27	70	18
	%	69.23	71.43	81.82
Cooks Bay	N	10	14	4
	%	25.64	14.29	18.18
Huruiki	N		4	
	%		4.08	
Taupo	N		6	
	%		6.12	
Rotorua	N	2	2	
	%	5.13	2.04	
Purangi	N		1	
	%		1.02	
Ongaroto	N		1	
	%		1.02	
Totals	N	39	98	22
	%	100	100	100

* No samples from Level 3 were subjected to XRF analysis; the figures given here are those from the site M1/XI-XXVIII, the Stone Wall Garden site nearby. It is argued in Chapter 4 that this site belongs to the Level 3 period at the Washpool. The suggested pattern of increasing dominance of the Mayor Island source above is strengthened by K.Prickett's figures (n.d.) for different coloured obsidians. These are given below and assume that the bulk of the green obsidian derives from the Mayor Island source.

Colour		Level 1	Level 2	Level 3	Garden Site
Green	N	1135	1650	75	202
	%	77.37	83.54	90.36	85.23
Other colours	N	332	325	8	35
	%	22.63	16.46	9.64	14.77
Totals	N	1467	1975	83	237
	%	100	100	100	100

Appendix 18: Sources of Lithic Material from the Washpool Midden Site

With the exception of the obsidian, the sources named below follow the suggestions made by K. Prickett (1975, pers. comm.). The obsidian figures are calculated as the product of the proportions established in Appendix 17 with the raw figures given in Appendix 16. The distances given for each of the sources away from the Washpool were calculated as point to point distances using latitudes and longitudes. The local materials are assessed as deriving from a 3 km radius. Numbers given below are the number of pieces found.

Rock Type	Source	Distance from Washpool-km	Level 1	Level 2	Level 3
Obsidian	Mayor Island	472	1016	1411	68
"	Cooks Bay	520	376	282	15
"	Huruiki	685	-	81	-
"	Taupo	335	-	121	-
"	Rotorua	358	75	40	-
"	Purangi	523	-	20	-
"	Ongaroto	352	-	20	-
Meta-argillite	D'Urville Is.	139	601	906	82
Limestone	White Rock	21	75	81	4
Schist	Nelson	159	6	24	1
Schistose-greywacke	Kaimanawa	244	16	19	-
Nephrite	Arahura	352	3	-	1
Serpentine	Nelson	159	2	4	1
Talc	Nelson	159	-	1	-
Orthoquartzite	Oturehua	584	2	3	-
Chert	Te Oroi	22	1392	1964	148
All other Rocks	Local	3	1063	1040	20
Totals	10,984	N.A.	4627	6017	340

Appendix 19: 'Transportation Cost' of Lithic Materials at the Washpool Midden Site

It is difficult to bring into perspective the changing patterns of reliance on different sources used by the people at the Washpool, bearing in mind the varying distances involved. An attempt to do this is given below and is based on the product of the distance from the source to the Washpool with the number of pieces found at the different periods, and this crude statistic may be referred to as the 'transportation cost'. H Leach has argued (1976: Chapter 3) that in some cases the size of flakes decreases away from their source, and in the following table this factor may tend to inflate the apparent importance of imported materials above those based on weight alone. However, this factor will not mask changing patterns of exploitation of different sources. In addition, it was felt that precisely because material far away from its source takes on additional value with distance, figures based on numbers found may in fact be more appropriate.

The numbers in the following tables are scaled to the largest sample size (Level 2 equals 6017 pieces) so that all figures are directly comparable. The distances were calculated from the particular places named, but the actual point localities (for example Oturehua) are rather tenuous.

NB:The figures below are the product of the number of pieces with the distance in km from their source.

Net Transportation Costs (Scaled so that sample sizes are the same as Level 2).

Rock Type	Level 1	Level 2	Level 3
Mayor Island Obsidian	623393	665865	567708
Cooks Bay Obsidian	254403	146711	137867
Huruiki Obsidian		55472	
Taupo Obsidian		40528	
Rotorua Obsidian	35080	14318	
Purangi Obsidian		10451	
Ongaroto Obsidian		7044	
D'Urville Argillite	108910	126180	202082
White Rock Limestone	2030	1678	1471
Nelson Schist	1271	3812	2859
Kaimanawa Schistose-greywacke	5124	4636	
Arahura Nephrite	1409		6340
Nelson Serpentine	477	635	2859
Nelson Talc		159	
Oturehua Silcrete	1751	1751	
Te Oroi Chert	39583	42951	57275
Local Rocks	4772	3591	1222
Total Transportation Costs	1078203	1125782	979683

Area Breakdown of Transportation Costs

Zone	Level 1	Level 2	Level 3
Far North Island (Huruiki)		55472	
Bay of Plenty-Coromandel (Mayor Island, Cooks Bay, Purangi)	877796	823027	705575
Central North Island (Rotorua, Taupo, Ongaroto, Kaimanawa)	40204	66527	
Local	4772	3591	1222
Cook Strait (D'Urville Is., White Rock, Te Oroi, Nelson)	152270	175415	266546
Far South Island (Arahura, Oturehua)	3159	1751	6340
Totals	1078201	1125783	979683

Zone	Level 1	Level 2	Level 3
North Island Sources	964386	993246	765543
South Island Sources	113817	132536	214140
Totals	1078203	1125782	979683

Appendix 20: The Changing Proportions of Mayor Island Obsidian in New Zealand Archaeological Sites

In 1964, on the basis of information collected from the archaeological sites listed below, Green predicted that when more was known of the different obsidian sources in New Zealand, and a method for sourcing the archaeological material was perfected, a relative chronology of sites could be advanced based on seriation analysis. Furthermore, Green argued that "if a site is not too close to Mayor Island, one sign of an early date is a high percentage of Mayor Island obsidian" (Green, 1964:139).

Since this paper appeared, definitive methods for sourcing obsidian have become a reality (Green, et.al., 1967; Armitage, et.al.,1972; Ward, 1972; 1974a), and many more sites containing obsidian have been excavated. However, these advances have not been accompanied by widespread sourcing of archaeological obsidian, nor indeed by re-evaluation of Green's original hypothesis. Both tasks are long overdue. It was felt that the obsidian flakes from the Wairarapa sites could provide a suitable test case for these ideas, particularly the question of changing poroportions of Mayor Island obsidian. Although trace element analysis has disclosed which actual sources were being used, so little comparative information of this type exists that the re-assessment had to be made using the original assumption that all green coloured obsidian came from Mayor Island. Green's obsidian sample consisted of 2800 pieces from 29 sites to which a further 11778 pieces from 26 new sites can be added. The two largest samples comprise 3525 pieces from the Washpool Midden site and 3150 from the site of Houhora (Best, 1975). Thus information is currently available for 65 sites and a sample of 14578 pieces of obsidian.

In his pilot study Green did not fully discuss the highly variable probability both of his suggested ages for sites or the true proportion of Mayor Island obsidian. Some of the samples used were very small and the sample proportions are therefore highly suspect. The first task of the present study therefore, was to assess the probable errors associated with each site. In the case of the dates, C14 ages were used wherever possible in the site list below. Where good comparative artefactual evidence existed without a C14 date, an estimate was made, and with the exception of a few very late sites an error of ± 100 years was allowed. In the case of proportions, the confidence limits are related to both the proportion and the sample size and were determined following Snedecor and Cochran (1967:210ff) as:

$$C = K.(P.(1-P)/N)^{0.5} + 1/2N$$

C is the confidence limit, P is the sample proportion, N the sample number, and K is a constant related to the chosen probability level (= 1.96 for 95% limit, and 2.58 for 99% limits etc.). The factor 1/2N is added as a correction for continuity which is important for small samples. A number of cases were found where P was either 1.0 or 0.0 and confidence limits cannot be assessed in these cases. However, for the sake of consistency an arbitrary 0.01 was added to both the Mayor Island and the 'other' figures (that is 1%), in these cases.

At this point then each site can be plotted with a surrounding equiprobability ellipse which indicates the uncertainty of its position on the two axes of time and proportion of Mayor Island obsidian (q.v. Jackson, 1956). This is shown in Figure 92. The confidence limits are 95%; that is 2 standard errors were used for each site's age and K in the formula above was 1.96. As can be seen from the figure there are only a few sites whose position is reliably fixed in two dimensions.

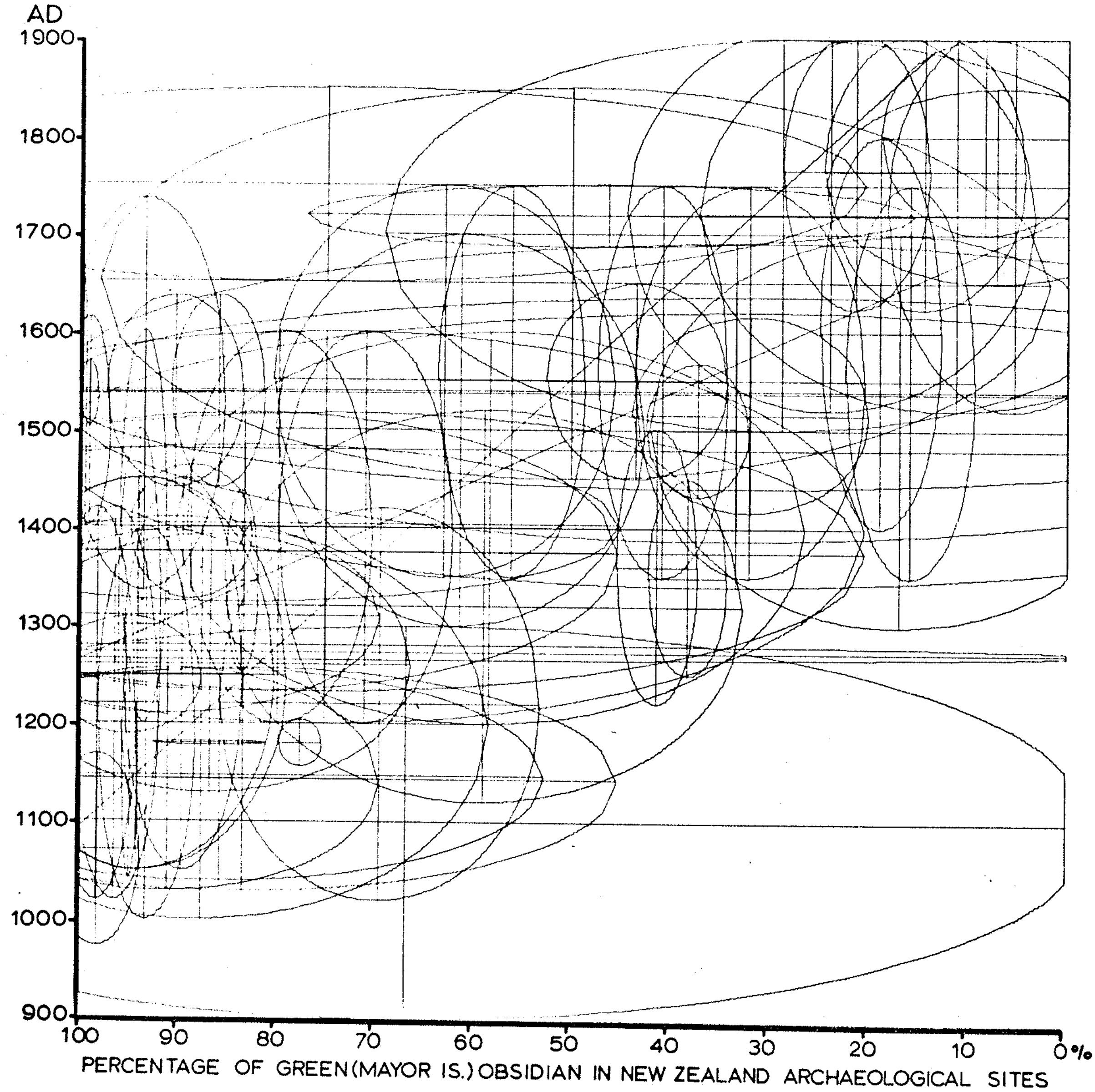

AD
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
100
90
80
70
60
50
40
30
20
10
0 %
PERCENTAGE OF GREEN (MAYOR IS.) OBSIDIAN IN NEW ZEALAND ARCHAEOLOGICAL SITES

FIGURE 92

Nevertheless, a trend is evident in the points, confirming Green's original hypothesis. The additional task, however, was to quantify this relationship so that age estimates may be made with controlled probability. There appeared to be two main obstacles. Firstly, there is no simple way of rendering proportions into a form analogous to continuous measurements such as time. One possibility is a double logarithmic transformation, but an added problem arises as to how to treat the associated errors of proportion. Similarly current statistical techniques are of little help in coping with uncertainty of observation when undertaking linear regression analysis. Snedecor and Cochran (1967:164ff) suggest an approach when one dimension is subject to varying error, and this method may be extended to two dimensions when error distributions in both axes are identical. This is clearly not the case in the present example. It would appear therefore, that while a suitable modification of standard techniques is both possible and desirable, there is at present no method available (Manley, 1975: pers.comm.).

A first step, however, was to perform simple linear regression on this data. This was done on the first 64 samples and gave the following result (the figures for sample 65 were not obtained until after the analysis):

Correlation coefficient 0.700

$Y_{\%} = -0.1077X_{yrs} + 217.9$ SE Estimate = 21.7%

$Y_{yrs} = -4.5512X_{\%} + 1719.8$ SE Estimate = 140.8 yrs AD.

It is doubtful whether an improved statistical technique would substantially alter the equations suggested; however any method which adequately accounts for variations in the uncertainty of X and Y would raise the standard errors of the estimate considerably. The standard errors suggested above, therefore, should be regarded as absolute minima. It would appear that the second equation could be used to estimate the age of a site from a knowledge of the percentage of Mayor Island obsidian it contains. The 68% confidence limits are ± 141 years.

While this equation may be applied as a rather general rule of thumb, it is obvious from the data that the degree of exploitation of Mayor Island and other sources at different periods is quite variable. For instance the present data shows conclusively that 'other' sources were being used in the earliest documented sites, but that on an average Mayor Island was more important in earlier periods than later. The actual sociological reasons for departure from the rule are probably more significant than the rule itself. This point is particularly relevant in interpreting the Wairarapa sites where time trends run contrary to the overall model, showing the importance of examining local prehistoric sequences. Some of the intercepts of this regression model can be identified as follows:

A) Given the time.

1) a site dated to 1095 AD has a 68% chance of having 100% Mayor Island obsidian (± 21.7%)
2) a site dated to 2023 AD has a 68% chance of having 0% Mayor Island obsidian (± 21.7%)

B) Given the %.

1) a site with 100% Mayor Island obsidian has a 68% chance of being dated to 1265 AD (± 141)
2) a site with 0% Mayor Island obsidian has a 68% chance of being dated to 1720 AD (± 141)

These intercepts are illustrated in Figure 93. As Moroney has pointed out "the regression applies within the range of the observed data, and we extrapolate at our peril, always" (Moroney, 1956:295). Thus it is nonsensical to ask what percentage of Mayor Island obsidian would be found in a site dated to before 1095 AD. The raw data (but not necessarily the regression model) supports the notion that Mayor Island obsidian was discovered at some time before 1071 AD (the date for sample 13 from Tairua). Similarly, common sense dictates that the settlement of New Zealand must have been some time before this again. These points are shown schematically on Figure 93, but it is important to realise that the regression analysis <u>per se</u> is an unrelated issue.

In what follows an attempt is made to document the information for each site used in the analysis. All figures are based on the assumption that green obsidian derives from Mayor Island. Non-green obsidian is classified as from a different source. The single exception to this is the sample from under the Rangitoto ash at the Sunde site (q.v. Davidson, 1972:7) which is grey and identified by Reeves as Mayor Island in origin. Nearly half the figures derive from Green's synthetic study (1964), however, each point raised in his table is given full documentation below. Unless otherwise stated any proportions of Mayor Island obsidian derive from Green's paper (1964:141).

<u>Site 1</u>: <u>Kauri Point Swamp</u> (N53-54/5) The date of 1536 AD ± 16 is a pooled estimate of the two given by Law (1974:4).

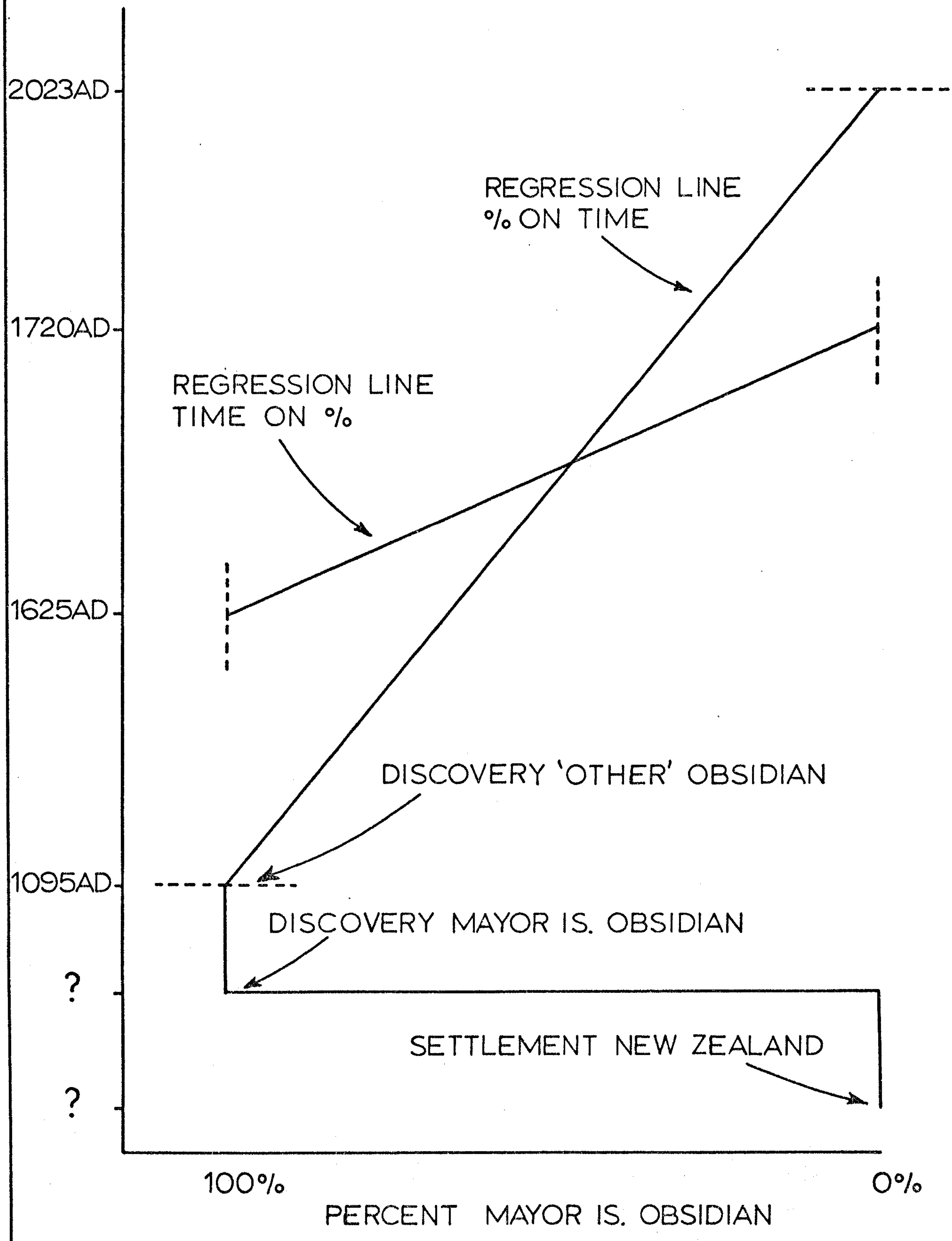
<u>Site 2</u>: <u>Kauri Point Settlement</u> (N53-54/6) The date of 1805 AD ± 60 (Law, 1974:4) is not considered reliable. The site is thought to be contemporary with site 1 (Green 1963c:152). Increasing the standard error to 100 years seems reasonable.

<u>Site 3</u>: <u>Kauri Point Beach Midden</u> (N57/1) There are no C14 dates for this site, but Green (1963c:146) argues that it is an early site since it contained a hog-back adze. An estimate of 1200 AD ± 100 is probably reasonable.

<u>Site 4</u>: <u>Whiritoa Beach Midden</u> (N53-54/4) The dating of this site is difficult. Green (1964:141) places the site in his 'Experimental Phase',

FIGURE 93

MAYOR ISLAND OBSIDIAN –
A REGRESSION MODEL



as does Crosby (1963:48); an estimate of 1400 AD ± 100 is used here.

Sites 5, 6, 7: Skippers Ridge (N40/7) The figures given in Green (1964:141) relate to layers 2-4. The following equivalences are extracted from Green (1963b:60) and Davidson (n.d.:10): Level I = Layer 4 and beneath, Level II = Layer 3, and Level IV = Layer 2. Green placed the obsidian assemblages on three of his successive phases from 1100 AD to 1650 AD (1964:138). However, Davidson in her recent re-evaluation of this site (n.d.:45) argues that Levels I-II were occupied continuously through only a short period of time. She gives 1143 AD ± 57 as a mean date for the two levels. The 'Proto Maori' status of Level IV is probably acceptable. An estimate of 1550 AD ± 100 is therefore used.

Site 8: Curry and Moore Gate Beach Midden (N40/1) There is some confusion in the literature relating to this site. Green (1964:141) gives figures of 21 Mayor Island and 113 other sources for N40/1, while in Green (1963b:62) the figures for the same site (?) are 4 Mayor Island and 9 other sources. Trower, however, states that only 2 flakes of non-Mayor Island source were found (1963:45). Reference has been made to a collection of flakes from another midden at N40/1 called the 'Lower Midden' which was completely removed by the sea (Jolly and Green, 1963:42). Perhaps this collection is the source of the figures given by Green (1964:141). Green places the site as 'Proto Maori' from about 1450 to 1650 AD (1964:141), but the argument advanced for this dating apparently relates to the 'Upper Midden' (Green, 1963b:62). In the meantime a date of 1550 AD ± 100 is accepted.

Site 9: Pohutakawa Beach Midden (N40/2) In the absence of C14 dates, Green's assessment of 'Experimental Phase' is used (Green, 1964:138).

Site 10: Fisher's Beach Midden (N40/4) The Archaic status of this site is based on artefacts (Green, 1963b:58), and a date of 1220 AD ± 100 is used.

Sites 11 and 12: Opito Beach Midden (N40/3) There are two Archaic levels in this site consisting of an earlier Layer 4c, and a later Layer 4a (with the nearly sterile Layer 4b included). A C14 date from Layer 4c is 1310 AD ± 50 (Green, 1972:28). Green places the later level between 1350 and 1450 AD (1964:138), and a date of 1400 AD ± 100 is used here.

Site 13: Tairua Beach Midden (N44/2) The obsidian derives from Bed 2 (Layer 2), the earliest occupation on the site. One of the C14 dates is considered reliable at 1071 AD ± 49 (Jones, 1973:146). A recent result from shell of 1380 AD ± 60 (Rowland, n.d.:8) suggests that the age of the Tairua site is still debatable.

Sites 14, 15 and 16: Ponui Island Beach Midden (N43/1) There are 3 levels on this site, the third being the earliest. Nicholls places these in Green's 'Developmental, Experimental, and Proto-Maori' phases (Nicholls, 1964:36), and the following estimates are used here: 1220 AD ± 100, 1400 AD ± 100, 1550 AD ± 100.

Site 17: Tokoroa Moa Hunter Camp (N75/1) Slightly different obsidian figures are reported by Green (1964:141) and Law (1973:158); however Green's figures are adhered to. The date of the site was believed by Green (1964:138) to be very early (900 to 1100 AD); however, Law argues for a date of about 1100 to 1400 AD (1973:159-60). This range is used here.

Site 18: Harataonga Bay Ridge Pa (N30/3) Slightly different obsidian figures are given by Green (1964:141) and Law (1972:115); however, Green's numbers are used here. The site has been radiocarbon dated to 1509 AD ± 55 (Morwood, 1974:96; Law, 1975) using a burnt post at the base of the fill of a pit structure. Practically all the obsidian derives from the upper layer of this pit (Law, 1972:114), and is therefore somewhat later than the dated feature. An estimate of 1600 AD ± 100 is used.

Site 19: Harataonga Bay Eastern Beach Midden (N30/4) This site is dated by two C14 samples (Law, 1975:48) which are pooled here as 1719 AD ± 16.

Site 20: Harataonga Bay Western Beach Midden (N30/5) Law argues that this site is reasonably fixed in the 13th century AD (Law, 1975:48; 1972:100). A date of 1250 AD ± 100 is used.

Site 21: Awana Midden (N30/19) Although there are no C14 determinations, Green estimates the age of this site as falling within the 'Experimental' Phase (1964:138). A date of 1400 AD ± 100 is followed here.

Sites 22, 23 and 24: Sunde Site (N38/24) Only 1 piece of obsidian was found under the Rangitoto ash at this site. Green (1964:141) states that this was non-Mayor Island type, but lists it as Mayor Island elsewhere (ibid: 138). Davidson clearly identifies this as the grey piece with the rather thick hydration rim identified as from Mayor Island by Reeves (q.v.Davidson, 1972:6). There are 5 C14 dates from reliable samples taken below this ash (Law, 1974:6). These give a pooled estimate of 1322 AD ± 70. It was previously thought that this level was somewhat earlier (Scott, 1970:13), and the problem has been discussed at length by Davidson (1972:6). It now seems that nearby Rangitoto was active until a considerably later time. Thus the pre-ash occupation level at the Sunde Site may need to be updated from the suggested pre-1188 AD ± 50 (Scott, 1970:16), even though the dates provide only a terminus ante quem for the occupation. The pooled date of 1322 AD compares favourably with AD 1340 suggested by the recently published C14 date NZ1898 (Davidson, 1974a:9). Clearly, the chronology expressed by Green (1964:138) must be viewed with caution. It is suggested here that the sequence should be moved up at least a century, and the following estimates are therefore used for the 3 Sunde Site samples described by Green (1964:138): 1100 AD ± 100, 1320 AD ± 100, 1500 AD ± 100. Precise details are now known of the sources of Sunde Site obsidian (Davidson, 1972:14).

Sites 25 and 26: Mt Roskill Pa (N42/11) Green's dating is accepted here as approximately 1550 AD ± 100, and 1720 AD ± 100.

Site 27: One Tree Hill (N42/6) Green's estimate of dating is used: 1720 AD ± 100.

Site 28: Taylors Hill Pa (N42/84) As with Site 27, the date is put at: 1720 AD ± 100.

Site 29: Manukau Head Midden (N46-47/16) This site clearly belongs in the Archaic (Green, 1970:22), and Green's suggestion of 'Developmental' age seems appropriate. A date of 1220 AD ± 100 is used here.

Sites 30, 31 and 32: Hotwater Beach (N44/69) The obsidian numbers are totals for Layers 3b, 4 and 5 published by Leahy (1974:53). The 7 C14 dates for the site present some problems. All are from Layer 4 (ibid:72). Two of these (a grease fraction, and a fish bone fraction) gave very modern results and appear to be quite unreliable. The remaining 5 are of the same order of magnitude and give a pooled estimate of 1500 AD ± 34. Leahy argues persuasively that Layer 5 has an age of about 1350 AD ± 50 on the basis of waterworn Loisels pumice (ibid:73). An estimate for Layer 3b is 1550 AD ± 100.

Site 33: Heaphy River (S7/1) The obsidian figures and C14 date are published by Wilkes and Scarlett (1967:207, 210).

Site 34: Otakanini (N37/37) The obsidian figures are given by Bellwood (1972:286). This sample cannot be directly related to dated features (ibid:287); however, an estimate age is 1500 AD ± 100.

Site 35: Huriawa Pa, Karitane (S155/1) The obsidian figures relate to Gathercole's excavation of Area A and were calculated by H.Leach (1975, pers. comm.). A date of 1800 AD ± 50 is a close estimate.

Site 36: Mangakaware I (N65/28) The obsidian figures are given by Bellwood (1971:136). On artefactual grounds the age is definitely late, and an estimate of 1700 AD ± 100 is used here.

Site 37: Rakaia River (S93/20) Unfortunately Trotter's test excavation yielded very little obsidian, but he argues that the C14 dates he obtained are fairly reliable for the site as a whole (Trotter, 1972a:144). Two samples of obsidian were obtained from surface collections, and these are pooled here (q.v.Trotter, 1972a:145, 149). There are 5 C14 dates (ibid:135), but 3 of these are clearly unreliable. The two collagen dates give a pooled estimate of 1395 AD ± 34.

Site 38: Shag Point (S146/5) The obsidian figures and date derive from Trotter (1970:473, 479).

Site 39: Tiwai Point (S181/16) The obsidian figures were calculated by H.Leach (1975: pers.comm.; see also Armitage, et.al., 1972); the C14 date is published by Park (1971:176).

Site 40: Mapoutahi Pa (S164/13) The obsidian figures are published by Anderson and Sutton (1973:114-5) and a date is estimated (ibid:107-8) as 1750 ± 50.

Site 41: Tahunanui (S20/2) The obsidian figures and date are given by Millar (1971:163, 170).

Site 42: Motutapu Undefended Site (N38/30) Obsidian figures are given by Leahy (1970: 78), and the age is discussed by Davidson (1972:9, 10). It is probably comparable to N38/37 (see site 43 here), and the same C14 date is used as an assessment for this site. The actual sources of the obsidian are now known and are discussed by Davidson (1972:13; 1974b; see also Ward, 1974b).

Site 43: Motutapu Undefended Site (N38/37) Obsidian figures are given by Davidson (1970a:47, 53), and the C14 age appears in Davidson (1972:5). Actual sources of the obsidian are discussed by Davidson (1972:13; 1974b; see also Ward, 1974b).

Site 44: Houhora Midden (N6/4) The obsidian figures are derived from Best's study (1975:22), and the C14 date is taken from Law (1974:3).

Sites 45, 46 and 47: Washpool Midden Site (N168-9/22) The dates for the three levels of this site are discussed in Chapter 4 of this thesis, and the obsidian figures appear in Appendix 17.

Site 48: Washpool Garden Walls (N168-9/20) The obsidian figures and date for this site are given by H.Leach (1976: Chapter 3).

Site 49: Washpool Terrace Garden (N168-9/24) The obsidian figures and C14 dates are discussed in Chapter 4 of this thesis.

Site 50: Washpool Circular Raised Rim Pit (N168-9/24) As with Site 49.

Site 51: Washpool Cleft Burial (N168-9/27) As with Site 49.

Site 52: Washpool House Terrace (N168-9/29) As with Site 49.

Site 53: Washpool Titoki Pit (N168-9/31) The obsidian figures are given in Chapter 4 of this thesis. Two phases of the pit's history are dated, and an estimate of the age of this small sample of obsidian would be 1650 AD ± 100.

Site 54: Washpool Camp Site (N168-9/21) As with Site 49.

Site 55: Great Wall of Whatarangi (N168-9/16) The date is discussed by H Leach (1976: Chapter 3), and the obsidian figures are derived from K.Prickett (n.d.).

Site 56: Moikau House (N165/9) The obsidian figures are the combined totals for the house and cooking area excavations by N.Prickett (1974), and a small surface collection by K.Prickett (n.d.). The two C14 dates are published by Anderson and Prickett (1972) and are pooled here.

Site 57: Whangaimoana Midden (N165/10) The obsidian figures derive from

K.Prickett (n.d.); the date is estimated on the basis of artefact finds comparable to other 13th century sites in Palliser Bay. An estimate of 1250 AD ± 100 is used here.

Site 58: Black Rocks Midden BR2 (N168-9/77) Obsidian figures are from K.Prickett (n.d.) and the date from Anderson and Prickett (1972).

Site 59: Black Rocks Midden BR3 (N168-9/77) As with Site 58.

Site 60: Black Rocks Midden BR4 (N168-9/77) As with Site 58 (two C14 dates pooled).

Site 61: Pararaki Houses (N168-9/41) The obsidian figures and the age are discussed by Prickett, et.al. (n.d.).

Site 62: Pararaki Midden Wall (N168-9/41) As with Site 48.

Site 63: Kawakawa River Mouth (N168-9/51, 53) The obsidian figures are combined totals for a small excavation by H.Leach (n.d.) and a surface collection by K.Prickett (n.d.). The date is from a stone wall believed to be part of this site complex (see H.Leach, 1976: Chapter 3).

Site 64: Pararaki Oven Area (N168-9/42) The obsidian figures are given by K.Prickett (n.d.) and are from a surface collection. Many Archaic artefacts have been found in this area, and an estimate age would be 1250 AD ± 100.

Site 65: Foxton Midden Site (N148/1) The obsidian figures and the date were provided by B.G.McFadgen (1975: pers.comm.).

List of Figures Used for the Regression Analysis

Sample	No of Flakes	Date AD	95% Limits	% Mayor Is	95% Limits	km to Mayor Is
1	500	1536	32	99.2	0.9	33
2	46	1536	200	93.5	8.2	33
3	8*	1200	200	87.5	29.2	33
4	462	1400	200	93.5	2.4	26
5	35	1550	200	62.9	17.4	70
6	11	1143	114	90.9	21.5	70
7	6*	1143	114	83.3	38.2	70
8	134	1550	200	15.7	6.5	70
9	79	1400	200	79.7	9.5	70
10	84	1220	200	96.4	4.6	70
11	4	1400	200	75.0	54.9	70
12	11*	1310	100	90.9	21.5	70
13	55	1071	98	98.2	4.4	43
14	180	1550	200	56.1	7.5	92
15	110	1400	200	70.9	8.9	92
16	36	1220	200	69.4	16.4	92
17	511	1300	200	93.9	2.2	92
18	171	1600	200	18.7	6.1	126
19	13	1719	32	46.2	30.9	126
20	114	1250	200	89.5	6.1	126
21	12	1400	200	58.3	32.1	122
22	31	1500	200	61.3	18.8	118
23	17	1320	200	58.8	26.3	118
24	3*	1100	200	66.7	70.0	118
25	21	1720	200	23.8	20.6	124
26	69	1550	200	31.9	11.7	124
27	20*	1720	200	5.3	12.7	121
28	9*	1720	200	11.1	26.1	115
29	60	1220	200	98.3	4.1	133
30	231	1550	200	40.7	6.6	52
31	347	1500	63	37.2	5.2	52
32	604	1350	100	38.2	4.0	52
33	648	1518	140	99.9	0.4	472
34	12	1500	200	16.7	25.3	127

Sample	No of Flakes	Date AD	95% Limits	% Mayor Is	95% Limits	km to Mayor Is
35	36	1800	100	8.3	10.4	900
36	7	1700	200	28.6	40.6	100
37	115	1395	68	88.7	6.2	699
38	66	1516	100	31.8	12.0	881
39	117	1508	106	99.2	2.1	1058
40	14*	1750	100	7.1	17.1	910
41	566	1361	140	41.3	4.1	444
42	56	1765	142	14.3	10.1	117
43	132	1765	142	21.2	7.4	117
44	3150	1154	112	94.9	0.8	341
45	83	1538	98	90.4	7.0	410
46	1975	1345	92	83.5	1.7	410
47	1467	1180	24	77.4	2.2	410
48	222	1538	98	86.0	4.8	255
49	4*	1375	142	75.0	54.9	255
50	6*	1375	142	83.3	38.2	255
51	3*	1480	140	33.3	70.0	255
52	3*	1539	152	33.3	70.0	255
53	6	1650	200	50.0	48.3	255
54	6*	1404	80	83.3	38.2	255
55	3*	1538	98	33.3	70.0	254
56	150	1180	2	86.7	5.8	252
57	16*	1250	200	93.8	15.0	251
58	4*	1750	100	75.0	54.9	261
59	7*	1147	108	85.7	33.1	261
60	3*	1273	8	66.7	70.0	261
61	117	1200	200	93.2	5.0	258
62	42	1249	60	95.2	7.6	258
63	15	1261	132	86.7	20.5	259
64	17	1250	200	94.1	14.1	258
65	122	1550	100	43.4	9.2	

* implies that 1 was added to the figures for both Mayor Island and 'other' to compensate for arbitrary zeros.

NB The distance to the Mayor Island source was calculated using program STD-03A on a Hewlett Packard HP65 calculator using latitudes and longitudes. The distances therefore are greater circle paths.

Appendix 21: Method Used to Determine the Minimum Number of Individuals of Birds from Identified Fragments

There are various ways of assessing the number of individuals from bone fragments (for example, Chaplin, 1971:70ff); all of these are fairly time consuming in the case of bird remains, owing to the large number of fragments which can be identified from any one individual bird. The approach suggested here has a number of advantages. On the one hand the method can be consistently applied between different species and this leads to a high degree of comparability. The second feature is that it allows a straightforward analysis of the parts of the body which were retained by prehistoric groups for preservation or immediate consumption. The figures for the different parts of the anatomy also provide an insight into butchering practices.

Figure 94 shows the common parts of each bone which may be identified. For each fragment an assessment is made whether the shaft portion covers more or less than the mid-shaft position. There are therefore 7 different sorts of fragment for each bone.

1) C The complete bone
2) P The proximal part with only a small part of the shaft
3) PS The proximal part and more than half of the shaft
4) S The shaft portion, including the mid-shaft area
5) DS The distal portion and more than half of the shaft
6) D The distal portion with only a small part of the shaft
7) F Small fragments other than those above

As the bones are identified they are entered on Table 1. Space is allowed for 9 major limb bones (including both sides), and a further 8 bones which commonly occur in archaeological sites. The latter 8 cannot be coded in any simple way, and common sense must dictate how these fragments are assessed. Of some importance is the sternum, and this has been divided into 4 fragment types. The rostrum is the small prominence at the anterior end of the sternum. This is often broken off in specimens and

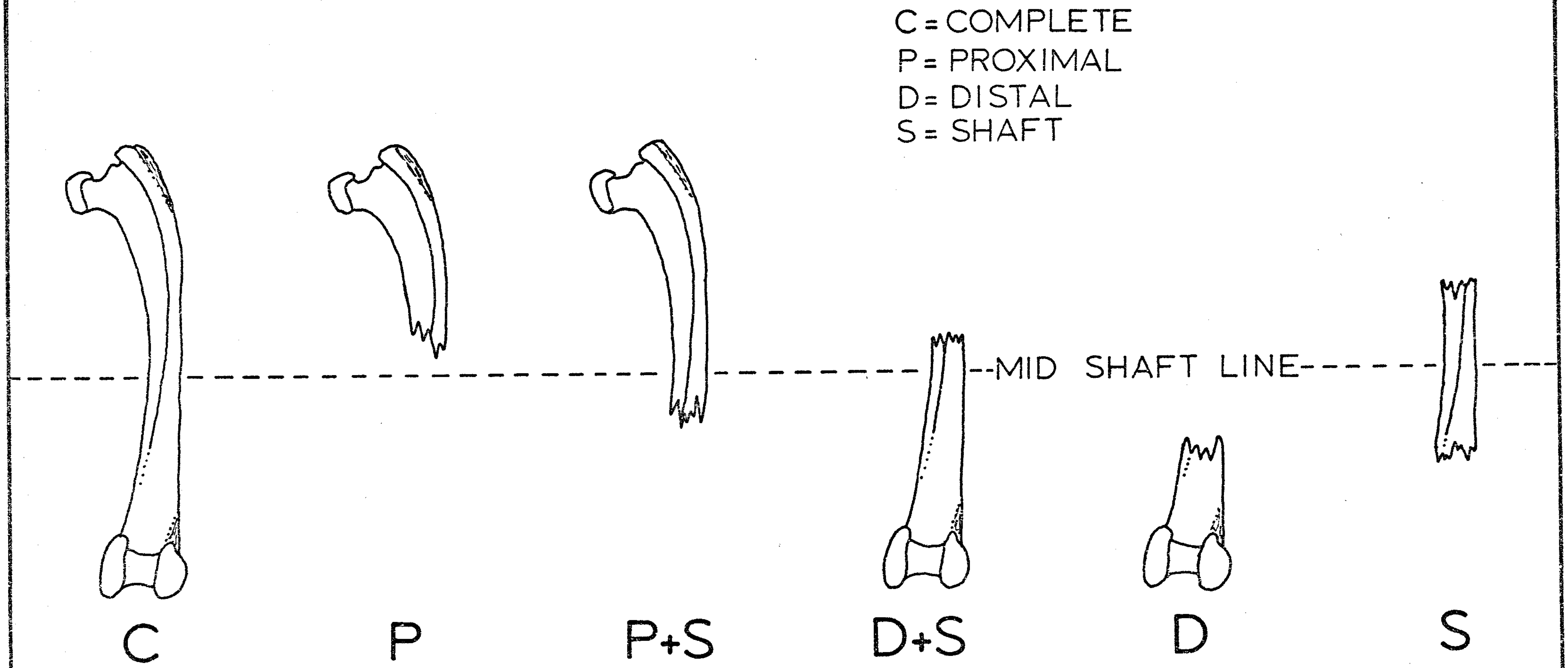


FIGURE 94 AVIAN LIMB BONE FRAGMENTS RECORDED

can be separately identified.

When a sample of bones is thus processed, Table 2 is filled in with the results. An example is given to explain this procedure. One 'minimum number' for the left femur is the addition of the figures in Table 1 under C plus P plus PS. Another is C plus D plus DS, and yet another is C plus PS plus DS plus S. Whichever is the greater of these sums is the 'Minimum number' for the bone of that side. If only fragments (F) occur, then the minimum number at this point is 1. These sums are calculated for the other side, and the final minimum number for the bone is simply the larger of the two numbers. This procedure is followed for each bone including the final 8 (no simple rules can be formulated for these fragments). Finally, whichever is the largest number in the right hand column is the Maximum minimum number.

Table 1 Site: .... Layer: .... Species: ....

Bone	C	P	PS	S	DS	D	F	
				Fragments				
L Carpometacarpus								
R Carpometacarpus								
L Ulna								
R Ulna								
L Radius								
R Radius								
L Humerus								
R Humerus								
L Scapula								
R Scapula								
L Coracoid								
R Coracoid								
L Femur								
R Femur								
L Tibiotarsus								
R Tibiotarsus								
L Tarsometatarsus								
R Tarsometatarsus								

C   C minus rostrum   rostrum   F

Sternum

Mandibles   Complete   Left side   Right side

Furcula   Complete   Left side   Right side

Pelvis and Sacrum   Complete   Fragments

Skull Fragments (describe)

L Quadrate

R Quadrate

Phalanges

Vertebrae

Table 2:

Bone	C+P+PS	C+D+DS	C+PS+DS+S	Minimum Per side	Minimum Per bone	Maximum Min.No
L Carpometacarpus						
R Carpometacarpus						
L Ulna						
R Ulna						
L Radius						
R Radius						
L Humerus						
R Humerus						
L Scapula						
R Scapula						
L Coracoid						
R Coracoid						
L Femur						
R Femur						
L Tibiotarsus						
R Tibiotarsus						
L Tarsometatarsus						
R Tarsometatarsus						
Sternum						
Mandible						
Furcula						
Pelvis & Sacrum						
Skull						
Quadrate						
Phalanges						
Vertebrae						

Appendix 22: Shellfish Minimum Numbers at the Washpool Midden Site

Species	Level 1	Level 2	Level 3	Total
Dentalium nanum	1407	-	-	1407
Haliotis iris	581	116	5	702
Melagraphia aethiops	532	63	1	596
Cellana radians	400	73	3	476
Lunella smaragda	323	146	1	470
Zediloma sp. (totals)	150	43	20	213
Zediloma ? sp.	75	39	20	134
Zediloma atrovirens	54	4	-	58
Zediloma digna	21	-	-	21
Haustrum haustorium	139	26	-	165
Cookia sulcata	116	13	1	130
Paphies subtriangulatum	80	22	-	102
Mytilis edulis	46	42	2	90
Haliotis australis	34	10	-	44
Perna canaliculus	22	7	-	29
Chiton ? sp.	19	10	-	29
Paphies australe	15	8	-	23
Benhamina obliquata	7	8	1	16
Cominella ? sp.	7	5	-	12
Protothaca crassicosta	7	2	-	9
Chamaesipho ? columna	3	6	-	9
Siphonaria zelandica	5	2	-	7
Cellana denticulata	5	-	-	5
Eudoxochiton ? nobilis	3	-	-	3
Maoricolpus roseus roseus	2	1	-	3
Aulocomya maoriana	1	1	-	2
Argobuccinum tumidum	2	-	-	2
Pecten novaezelandiae novaezelandiae	2	-	-	2
Ostrea sp. (totals)	2	1	-	3
Ostrea ? sp.	1	1	-	2
Ostrea cf charlottae	1	-	-	1

Species	Level 1	Level 2	Level 3	Total
Patelloidea corticata corallina	1	-	-	1
Penion adusta	-	1	-	1
Struthiolaria ? sp.	1	-	-	1
Totals	3912	606	34	4552

NB The figures for midden contained in the early structures have been added into those for Level 1

Appendix 23: Fish Minimum Numbers at the Washpool Midden Site

NB: The Level 1 figures include remains derived from the early structures.

Species	Level 1	Level 2	Level 3	Total
Pseudolabrus sp.	41(17.2%)	33(26.6%)	-	74(20.3%)
Cheilodactylus macropterus	49(20.5%)	22(17.7%)	-	71(19.5%)
Physiculus bachus	28(11.7%)	17(13.7%)	-	45(12.3%)
Arripis trutta	24(10.0%)	7(5.6%)	-	31(8.5%)
Anguilla sp.	22(9.2%)	5(4.0%)	-	27(7.4%)
Thyrsites atun	11(4.6%)	10(8.1%)	-	21(5.8%)
Chrysophrys auratus	6(2.5%)	4(3.2%)	1(50.0%)	11(3.0%)
Parapercis colias	9(3.8%)	2(1.6%)	-	11(3.0%)
Scomber japonicus	6(2.5%)	5(4.0%)	-	11(3.0%)
Latridopsis ciliaris	8(3.3%)	1(0.8%)	-	9(2.5%)
Chelidonichthys kumu	5(2.1%)	4(3.2%)	-	9(2.5%)
Squalus sp. cf acanthias	6(2.5%)	1(0.8%)	-	7(1.9%)
Galeorhinus cf australis	5(2.1%)	2(1.6%)	-	7(1.9%)
Callorhynchus millii	-	6(4.8%)	1(50.0%)	7(1.9%)
Polyprion oxygeneios	4(1.7%)	2(1.6%)	-	6(1.6%)
Coridodax pullus	4(1.7%)	1(0.8%)	-	5(1.4%)
Conger verreauxi	2(0.8%)	1(0.8%)	-	3(0.8%)
Seriolella brama	2(0.8%)	1(0.8%)	-	3(0.8%)
Caranx lutescens	2(0.8%)	-	-	2(0.5%)
Navodon convexirostris	1(0.4%)	-	-	1(0.3%)
Helicolenus papillosus	1(0.4%)	-	-	1(0.3%)
Genypterus blacodes	1(0.4%)	-	-	1(0.3%)
Aplodactylus meandratus	1(0.4%)	-	-	1(0.3%)
Trachurus novaezelandiae	1(0.4%)	-	-	1(0.3%)
Totals	239(100.0%)	124(100.0%)	2(100.0%)	365(100.0%)

Chi-square between Levels 1 and 2 equals 32.18, with 23 degrees of freedom which is not significant p equals 0.05.

Appendix 24: Crayfish Minimum Numbers at the Washpool Midden Site

Species	Level 1	Level 2	Level 3	Total
Jasus edwardsii	29	39	1	69

Appendix 25: Fish at the Washpool Midden Site - Breakdown according to different Catching Methods

NB: The figures presented below are based on the breakdown suggested in Appendix 27.

Catching Method	Level 1	Level 2	Level 3	Total
Hook and Line - demersal off-shore reefs and sandy bottom	126(47.0%)	56(34.4%)	1(33.3%)	183(42.2%)
Chrysophrys auratus Polyprion oxygeneios Helicolenus papillosus Latridopsis ciliaris Parapercis colias Genypterus blacodes Chelidonichthys kumu Physiculus bachus Conger verreauxi Squalus cf acanthias Galeorhinus cf australis Cheilodactylus macropterus Caranx lutescens				
Hook and Line - demersal inshore rocky ground	41(15.3%)	33(20.2%)	-	74(17.1%)
Pseudolabrus sp.				
Baited Traps and/or diving and spearing-demersal inshore rocky ground	30(11.2%)	39(23.9%)	1(33.3%)	70(16.1%)
Navodon convexirostris Jasus edwardsii				
Trolling Lure-pelagic	42(15.7%)	22(13.5%)	-	64(14.7%)
Scomber japonicus Trachurus novaezelandiae Arripis trutta Thyrsites atun				

Catching Method	Level 1	Level 2	Level 3	Total
Baited Traps and/or spearing				
Fresh Water	22(8.2%)	5(3.1%)	-	27(6.2%)
Anguilla sp.				
Set Nets	7(2.6%)	8(4.9%)	1(33.3%)	16(3.7%)
Sericlella brama				
Aplodactylus meandratus				
Coridodax pullus				
Callorhynchus millii				
Totals	268(100.0%)	163(100.0%)	3(100.0%)	434(100.0%)

Chi-square between Levels 1 and 2 equals 21.69 with 5 degrees of freedom which is highly significant p equals .005.

Appendix 26: Fishing Zones indicated by the Washpool Midden Site

NB: The figures suggested are based on the breakdown in Appendix 25 and 27

Zonation	Level 1	Level 2	Level 3	Total
Inshore Activities (such as hook and line, in shallow water, use of baited traps, diving and spearing, set nets, freshwater fishing) *Pseudolabrus sp.* *Navodon convexirostris* *Jasus edwardsii* *Anguilla sp.* *Seriolella brama* *Aplodactylus meandratus* *Coridodax pullus* *Callorhynchus millii*	100(37.3%)	85(52.1%)	2(66.7%)	187(43.1%)
Offshore Activities (such as hook and line, in deeper water, pelagic fishing and other canoe based activities) *Chrysophrys auratus* *Polyprion oxygeneios* *Helicolenus papillosus* *Latridopsis ciliaris* *Parapercis colias* *Genypterus blacodes* *Chelidonichthys kumu* *Physiculus bachus* *Conger verreauxi* *Squalus cf acanthias* *Galeorhinus cf australis* *Cheilodactylus macropterus* *Caranx lutescens* *Scomber japonicus* *Trachurus novaezelandiae* *Arripis trutta* *Thyrsites atun*	168(62.7%)	78(47.9%)	1(33.3%)	247(56.9%)
Totals	268(100.0%)	163(100.0%)	3(100.0%)	434(100.0%)

Chi-square between Levels 1 and 2 equals 9.10, degrees of freedom equals 1 which is highly significant p less than 0.005.

Appendix 27: Fish and Crayfish from the Washpool Midden Site - Their Seasonal Abundance and Habits in relation to Catching Methods.

Both the habits and seasonal fluctuations of New Zealand's common marine fish have been widely discussed. The main sources of information are articles by Hector (1872), Sherrin (1886), Graham (1953), Parrott (1957, 1958, 1960), and Doogue and Moreland (1966). The only information specific to Palliser Bay, however, are a few records by local fishermen (Crewe, n.d.), and the results of the Government Trawling Expedition of 1907 (Waite, 1909, 1911). In the following an attempt is made to summarize this information on each of the species present in the Washpool Midden Site, so that observations can be made about the different catching methods used by the occupants of that site. A particular problem surrounds the question of seasonal abundance of New Zealand fish, and what records exist indicate considerable complexity and variation from one part of New Zealand to another. Particularly useful records on this subject, however, are found in the New Zealand Marine Department Annual Report on Fisheries (Anon. a, 1929-1973) which sometimes give the monthly commercial catch for different species in different parts of the country. These records are not a simple reflection of actual abundance, but are related to a multitude of factors: what each fishing boat crew sets out to catch at different months, seasonal fluctuations in weather conditions and how often fishing boats put to sea, what species are valuable on the European market, what different catching methods are being employed, and so on. Nevertheless, these records constitute a huge sample, and for this reason are probably more valuable than the personal experiences of local fishermen (for example: Poata, 1919; Poynter, 1933; Crewe, n.d.), although there are notable exceptions to this when long term local studies have been made (for example Thompson, 1877; Graham, 1953). For each argument which can be advanced against using these records, a similar case can be put to the contrary. Changes in sea conditions, for example, which hamper modern fishermen also applied to prehistoric people. Of course most of the modern figures relate to trawling rather than hand line fishing or shallow water seine netting, and this must bias the catch rate of different species. Nevertheless, a similar overall seasonal pattern should be reflected in catches by both modern and prehistoric methods. The question of differing European preferences for different species is offset by the modern practice of taking large quantities of unpopular species such as barracouta for bait, pet food, fish paste, and 'fish and chips'.

As explained in Appendix 28, seasonal dating of faunal indicators was achieved by a particular method based on probable occurrence of different species throughout the year. In the case of fish, the figures used are presented below, and many of these are based on figures of commercial fish catches. The method for extracting these should be elaborated at this point with a concrete example. From the Fisheries Department Annual Report for 1971 the following figures were extracted relating to catches of *Physiculus bachus* at Akaroa (Anon.a, 1971).

Month	cwt Red Cod	cwt Total Catch
January	23	1299
February	48	618
March	273	1604
April	347	1313
May	66	677
June	291	1190
July	87	593
August	51	718

Month	cwt Red Cod	cwt Total Catch	
September	14	238	
October	8	475	
November	33	1333	
December	25	879	
Totals	1266	10937	Overall proportion 11.58%

The first step is to reduce the catch figures to a proportion of the monthly catch to account for general seasonal changes and also changes in monthly effort. This in turn can be simply reduced to a monthly probability distribution by dividing by the sum of the monthly catch rates

Month	% of Monthly Catch	Monthly Probability	
January	1.8	0.015	
February	7.8	0.064	
March	17.0	0.139	
April	26.4	0.217	
May	9.7	0.080	
June	24.5	0.201	
July	14.7	0.121	
August	7.1	0.058	
September	5.9	0.048	
October	1.7	0.014	
November	2.5	0.021	
December	2.8	0.023	
Totals	121.9	1.001	Mean monthly catch rate is 10.16%

An alternative method of arriving at seasonal probability distributions is to calculate the monthly proportions of the total catch for the particular species. The January entry above would be 23/1266, or 0.018 instead of 0.015. This method achieves similar results but does not compensate for variations in monthly effort. If figures were available for an extended number of years then these could be averaged to minimize this effect, and would be a superior indication of the seasonal cycle. Unfortunately, this information does not exist in most cases and the effort-compensated method illustrated above is therefore preferred.

Pseudolabrus sp. (Spotty, Banded Parrotfish etc.). This polymorphic genus of labrids is very common throughout New Zealand in rocky, weedy, shallow water and readily takes a baited hook. These fish are practically impossible to speciate from cranial bones with the exception of a general division based on size into P. cf celidotus (Spotty) and P. cf pittensis (Banded Parrotfish). However, this is not a serious problem since they have very similar habitats. Even speciation of living specimens can be very difficult, although recent underwater studies have facilitated subdivision of this group (Doak, 1972:75ff). The genus now includes only 6 species (ibid.), but for consistency the older terminology is used here (q.v. Doogue and Moreland, 1966). These fish are not taken as food by Europeans on account of the large number of small bones, however, Graham (1953:272) regarded them as very edible. They were obviously highly prized by prehistoric New Zealand fishermen, and they are the most numerous remains at both the Washpool and at Black Rocks (Anderson, 1973a). These fish feed only in the daytime and are more or less asleep at night (Graham, 1953:272; Doak, 1972:75). They are easily caught in shallow water all year round. The probability distribution is therefore assessed as 0.083 for each month.

Cheilodactylus macropterus (Tarakihi). This fish is exclusively demersal in feeding habits and can be caught on a variety of bottom conditions with a baited hook. It moves in shoals and has been known to take a deep trolling lure. Information on seasonal abundance of this species is very confusing. Sherrin, for example, claimed they were caught throughout the year (1886:98), while Graham (1953:250) noted that they are in best condition in August. Poata (1919:13) claimed that these fish dominated catches in August, September and October, while local information in Palliser Bay suggests a winter abundance (see Anderson, 1973a:115). Because of its commercial importance, this species has now been studied in some detail (q.v. Tong and Elder, 1968; Tong and Vooren, 1972; Vooren and Tong, 1973), and it would now appear that significant coastal migrations take place to different parts of New Zealand throughout the annual cycle; even so, no simple pattern of movement has been fully described. Of the 36 fishing stations recorded in 1971 (Anon.a, 1971) this species is significant (greater than 20% by weight) at only Gisborne, Wellington, Paremata, Lyttleton, Greymouth and Westport, and this suggests a central New Zealand distribution. The catches for 1971 show a winter abundance in several places, and late summer in others (see Figure 95). The figures for Wellington are judged to be a good indication of the seasonal pattern in Palliser Bay and show two peaks - one in late summer, and another in June.

.129 .134 .141 .080 .056 .107 .031 .043 .035 .039 .123 .082

Physiculus bachus (Red Cod). These fish are caught on baited hook and line in medium depth water on clean sandy bottoms. Little is known of their seasonal habits, as they are not a popular fish today. The most significant catches are made at Akaroa and Timaru, where figures show a general abundance in early winter (see Figure 96), and this trend ties in well with Graham's observation (1953:167) that good catches can be made in June and July. The catch figures for Akaroa 1971 are judged to be a fair indication of the Palliser Bay situation also.

.015 .064 .140 .217 .080 .201 .121 .058 .048 .014 .021 .023

FIGURE 95 TARAKIHI

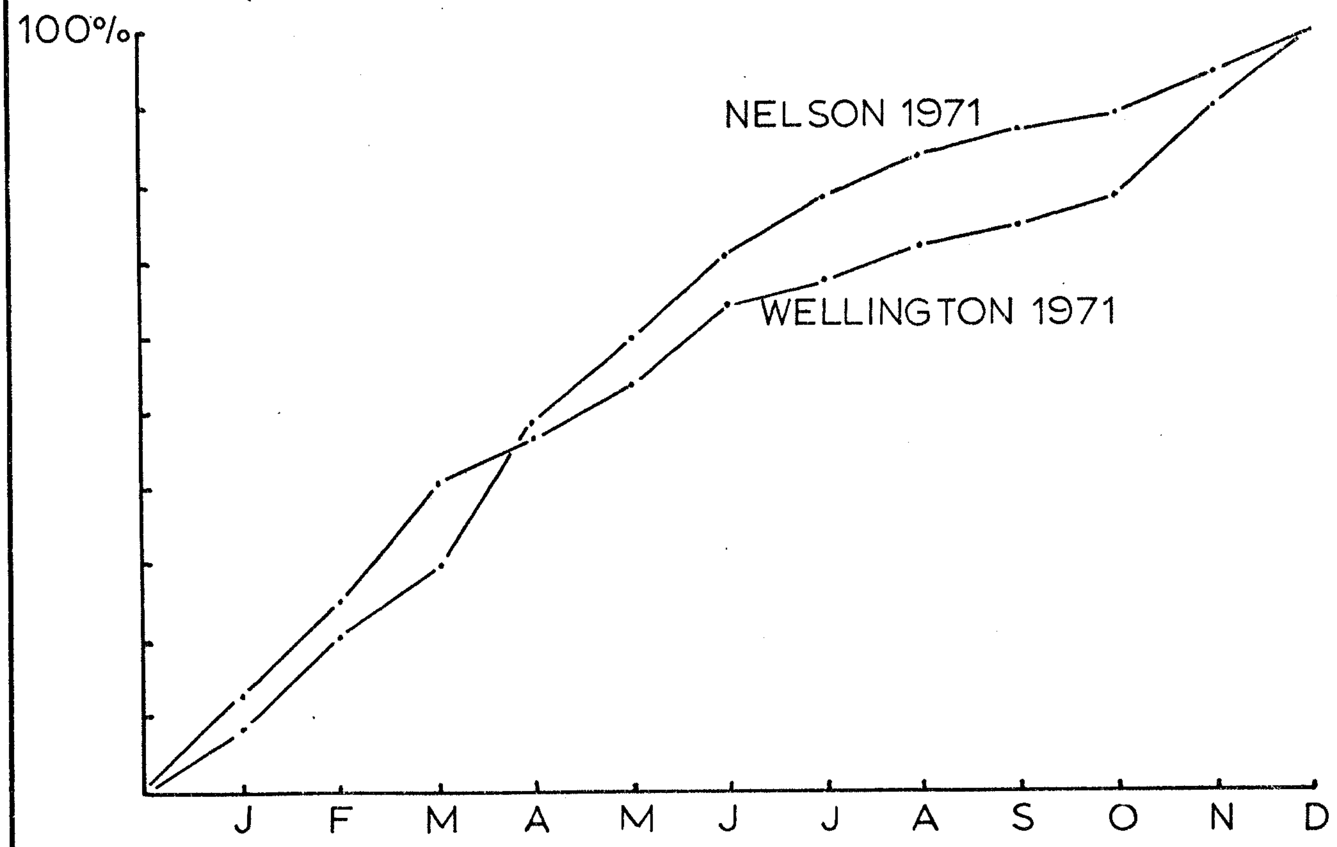
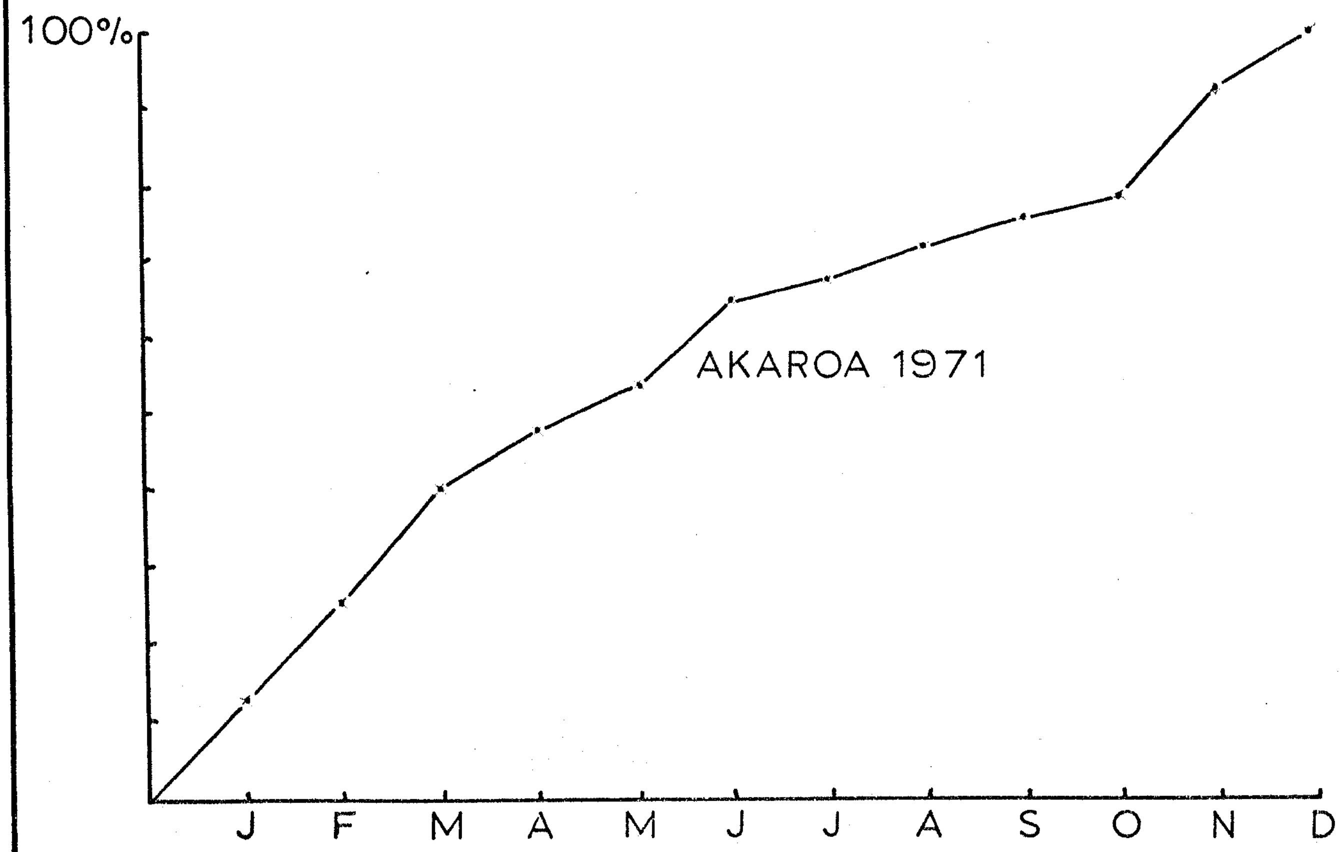


FIGURE 96 RED COD



Arripis trutta (Kahawai). This fish can be caught in medium depth water on a baited hook, but is more commonly taken with a trolled lure as it is a voracious hunter. It can be caught most of the year but there is a definite late summer to autumn abundance in most areas (Graham, 1953:239). Doogue and Moreland (1966:236) note that it is in best condition for smoking in autumn. Poata (1919:6) noted its dominance in catches in February and March. The probability assigned to this fish is an average of the only figures available viz: Gisborne and New Plymouth for 1971.

.305 .224 .206 .019 .018 .005 .002 .0008 .002 .051 .111 .058

Anguilla sp. (Freshwater eel). The seasonal pattern of eel movements has been studied in some detail for the Wairarapa area by Mair (1972:198ff), and while these movements are complicated by sex, different age grades, and also the two species involved, it appears that eels are particularly easy to catch from February to May when seaward migrations occur. However, they can also be caught in rivers throughout the year. An assessment of this cycle is given below.

.04 .17 .17 .17 .17 .04 .04 .04 .04 .04 .04 .04

These fish can be taken by gaff or spear, but are most commonly caught in baited traps or specially constructed weirs or channels.

Thyrsites atun (Barracouta). This fish is a voracious feeder and is commonly taken on a trolled lure. It was formerly especially common in the South Island (Doogue and Moreland, 1966:279), and three quarters of the total commercial catch in 1950 was taken off Otago (Parrot, 1957:151). Studies made on seasonal abundance are restricted to Otago (Sherrin, 1886:11; Graham, 1953:310) where they appear to be common from about October to June, with two peaks in spring and autumn. In the North Island, however, the situation appears to be quite different (see Mehl, 1971; Figure 97), and they are clearly most abundant in winter and spring. The commercial figures for Wellington 1949 were used for the probability distribution below:

.059 .018 .045 .039 .054 .118 .137 .114 .124 .102 .088 .101

Chrysophrys auratus (Snapper). These fish are commonly caught on a baited hook in medium depth water over sandy bottoms. They are strictly demersal, and much more abundant north of Cook Strait (Doogue and Moreland, 1966: 239). The decreasing number of fish southward is correlated with a persistent rise in mean size (Waugh, 1973:269, 274), and only a few large solitary specimens are seen as far south as Otago (Graham, 1953:243). Until recently, seasonal information was full of apparent contradictions; for example, Sherrin (1886:85) noted that the fish shoal in early summer when they are easily caught, while Poata (1919:9, 10) commented that they dominated catches in March, April and May. The movement of snapper has now been studied in some detail (q.v. Paul, 1974) and shown to be fairly complex. There is a strong tendency for continual migration to warmer waters although the larger solitary fish often over-winter inshore. After spawning the fish disperse to their inshore summer to autumn feeding grounds since coastal waters are warmest inshore from late spring to early autumn. However, the warmest waters in winter are offshore. The solitary fish, on the other hand, move offshore during summer. This general pattern is well reflected in commercial catch figures, and those for Napier are used for Palliser Bay, since it is the closest area with published information.

.106 .070 .100 .110 .112 .078 .039 .051 .041 .069 .110 .114

At the same time it should be noted that if a site contained a few very large specimens this is a fairly good indication of winter catching,

FIGURE 97 BARRACOUTA

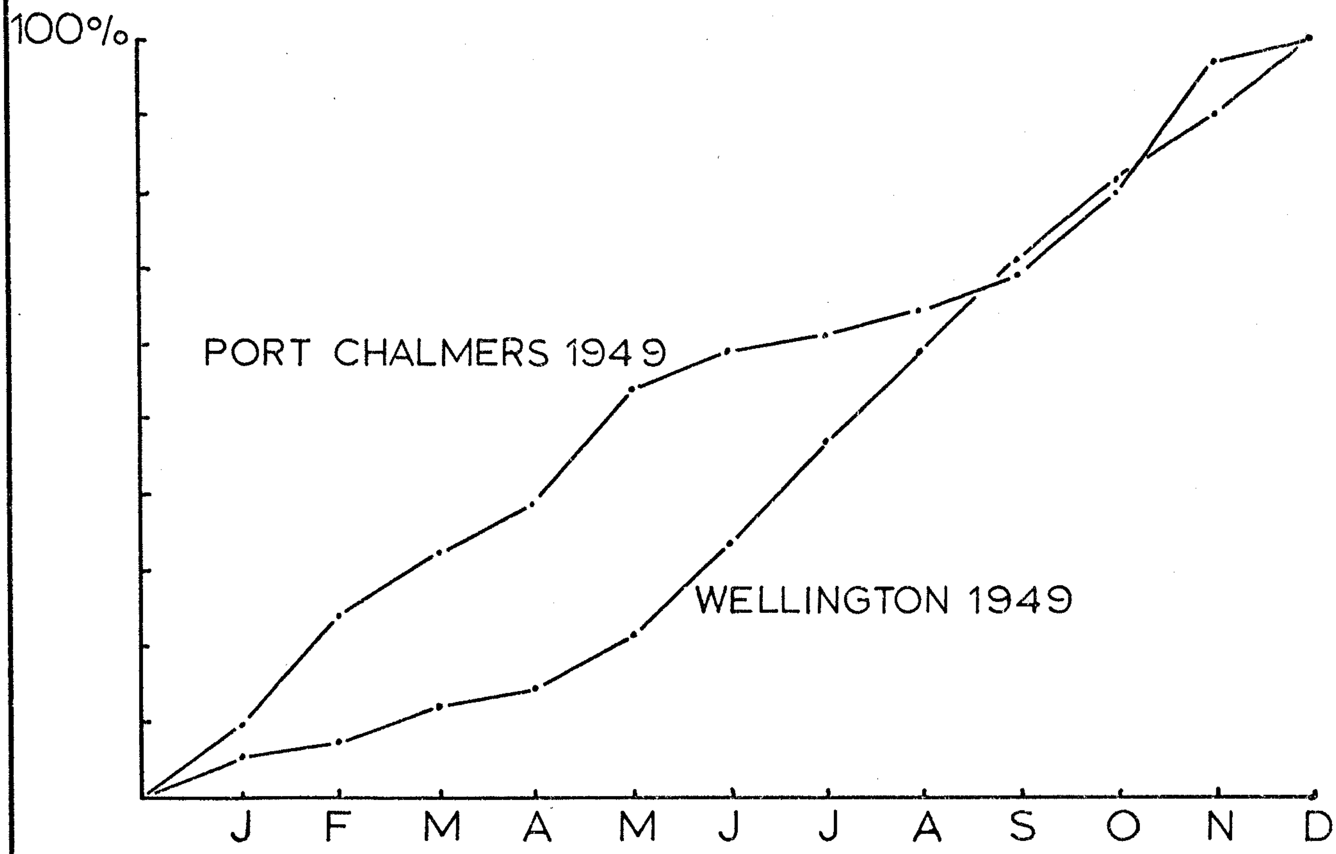
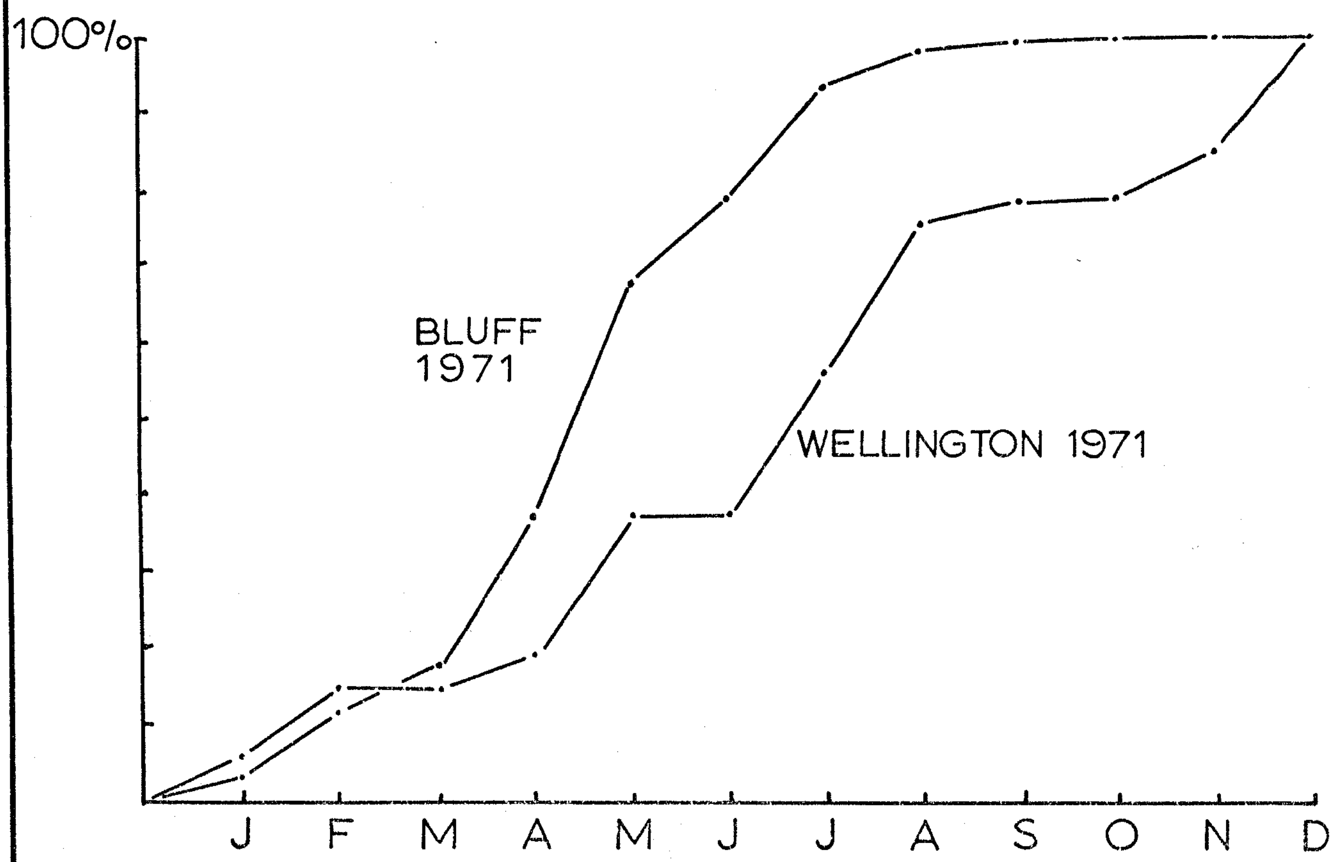


FIGURE 98 BLUE COD



while many smaller specimens is more likely to indicate summer.

Parapercis colias (Blue Cod). These fish are exclusively bottom feeders and are taken with baited hook, generally in deeper water (Doogue and Moreland, 1966:264). Comments in the literature relating to seasonality vary widely. Poata (1919:13) commented that they dominated catches in August, September and October, while Sherrin (1886:15) noted that they can be taken at any time. Graham's comments (1953:288) are useful but probably more applicable to Otago. He wrote that in summer there is an inshore movement, followed by an offshore migration about May; and that they are far more easily caught between dawn and 9 am, although they freely bite in the late afternoon also. The fish spawns in early summer in Otago, but unlike other fish will readily take a hook at this time, and is generally in good eating condition all the year round. Graham also notes that for obscure reasons this fish is very nervous of thunderstorms, and behaves erratically at these times. Nearly 96% of the commercial catch in 1971 was taken by hand line (Anon.a, 1971), and Waugh (1973:257) claims that this factor makes the fish difficult to study. On the other hand, from the point of view of prehistoric fishing practices the various modern catch figures are probably particularly useful, since catching methods were probably very similar. Waugh (1973:275) argues that there is no good evidence of coastal migrations and that the wild fluctuations in catch from one place to another are probably caused by shoaling over limited feeding grounds. This confusing situation has been clarified by recent underwater research by Doak (1972:101). He notes that the inshore movements referred to by Graham did not occur in the North Island, where the fish has very marked year round territorial behaviour. They will apparently remember a particular diver who offers them food. This marked territoriality could be a useful factor in viewing the effects of human predation. It might be expected, for example, that frequent inshore line fishing in a particular locality would lead to a rapid decline of size and frequency of the fish in archaeological sites, because of the lack of regular replenishment provided by shoaling and migratory behaviour. Doak has also noted some variation in the spawning cycle in different parts of New Zealand.

The modern catch figures show a marked seasonality, although a somewhat different pattern emerges for the two islands (see Figure 98). The actual catches vary also from year to year, hence the probability distribution used below is an average of figures for the five years from 1967 to 1971 for Wellington.

.016 .039 .069 .100 .103 .0007 .248 .089 .080 .112 .047 .097

Scomber japonicus (Common Mackerel). This fish shoals in coastal waters and is usually caught with a lure. It is widespread in New Zealand, but more abundant north of Kaikoura (Doogue and Moreland, 1966:267). The fish accounts for 53% of the total catch off Blenheim and significant amounts are also caught at Nelson and Gisborne (Anon.a, 1971). According to Sherrin (1886:61ff) it was only occasionally seen in Wellington Harbour, but enormous numbers had previously been caught in late spring in Whangarei and the Bay of Islands, and in summer around Auckland. The fish apparently undertakes coastal migrations from deeper waters south in October and north in April and May (Doogue and Moreland, 1966:267). This movement is strongly reflected in the modern catch figures for Gisborne in 1971, which are the only published information (see Figure 99).

.159 .080 .183 .0001 .0001 .0001 .0003 .0003 .0001 .129 .106 .342

Latridopsis ciliaris (Blue Moki). These fish take a baited light hook in both shallow and medium depth water and over both rocky and sandy bottoms; they are sometimes caught in quantity in set nets since they school on the surface particularly in September to November during spawning (Parrott, 1957:120). They are found in both islands, but are more abundant in Cook Strait and further south. Large shoals are regularly seen at Cape Runaway in winter (Doogue and Moreland, 1966:252). Parrott (1957:120) wrote that substantial catches occur in Palliser Bay over sandy areas during autumn, and that they are most abundant in the Wellington market in winter and early spring. Sherrin (1886:67), however, claimed that they were most commonly seen in Wellington shops from spring to early summer, and that "the Maoris resident on Cook Strait set nets and catch moki in abundance during the winter" (ibid:68). According to Poata (1919:10) these fish dominated Maori catches in June and July. The 1971 commercial figures for Napier are judged to be a reasonable estimate for Palliser Bay (see Figure 100).

.023 .056 .065 .049 .037 .082 .177 .051 .257 .111 .051 .041

Chelidonichthys kumu (Red Gurnard). Sherrin (1886:36) noted that this fish was formerly very plentiful around Wellington and especially abundant in the harbour during the summer months (see also Parrott, 1957:165-8). It was caught with baited hook in medium depth water; however, Graham comments (1953:363ff) that it does not take a hook in Otago waters where it is most abundant in summer. The species is found over all kinds of bottom except rocks (Doogue and Moreland, 1966:291). Poata 1919: 13) claimed that red gurnard dominated catches in August, September and October. There are only a few published commercial figures, and those for Nelson in 1971 are judged to be a reasonable indication of the pattern.

.069 .068 .061 .043 .086 .065 .053 .062 .115 .095 .114 .170

FIGURE 99 COMMON MACKEREL

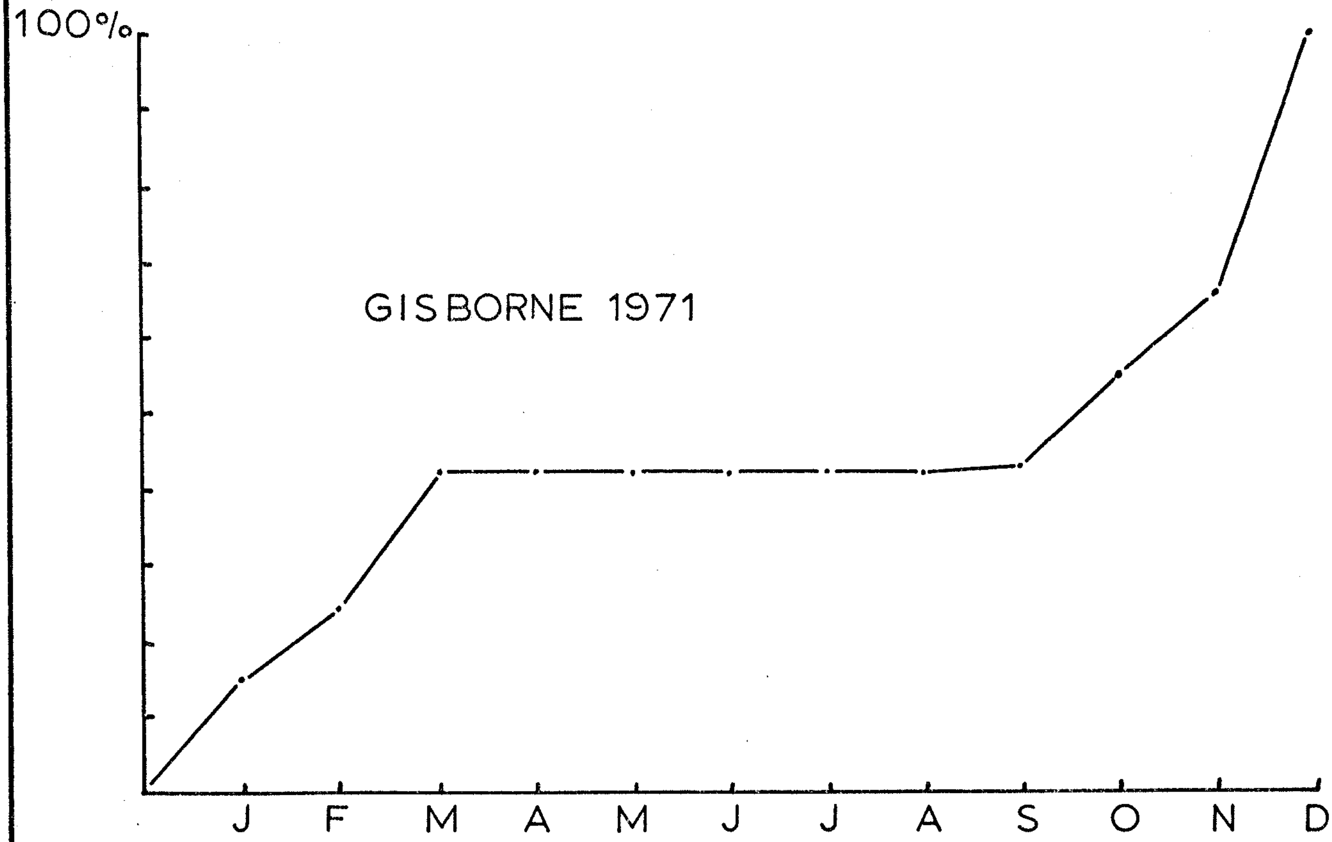
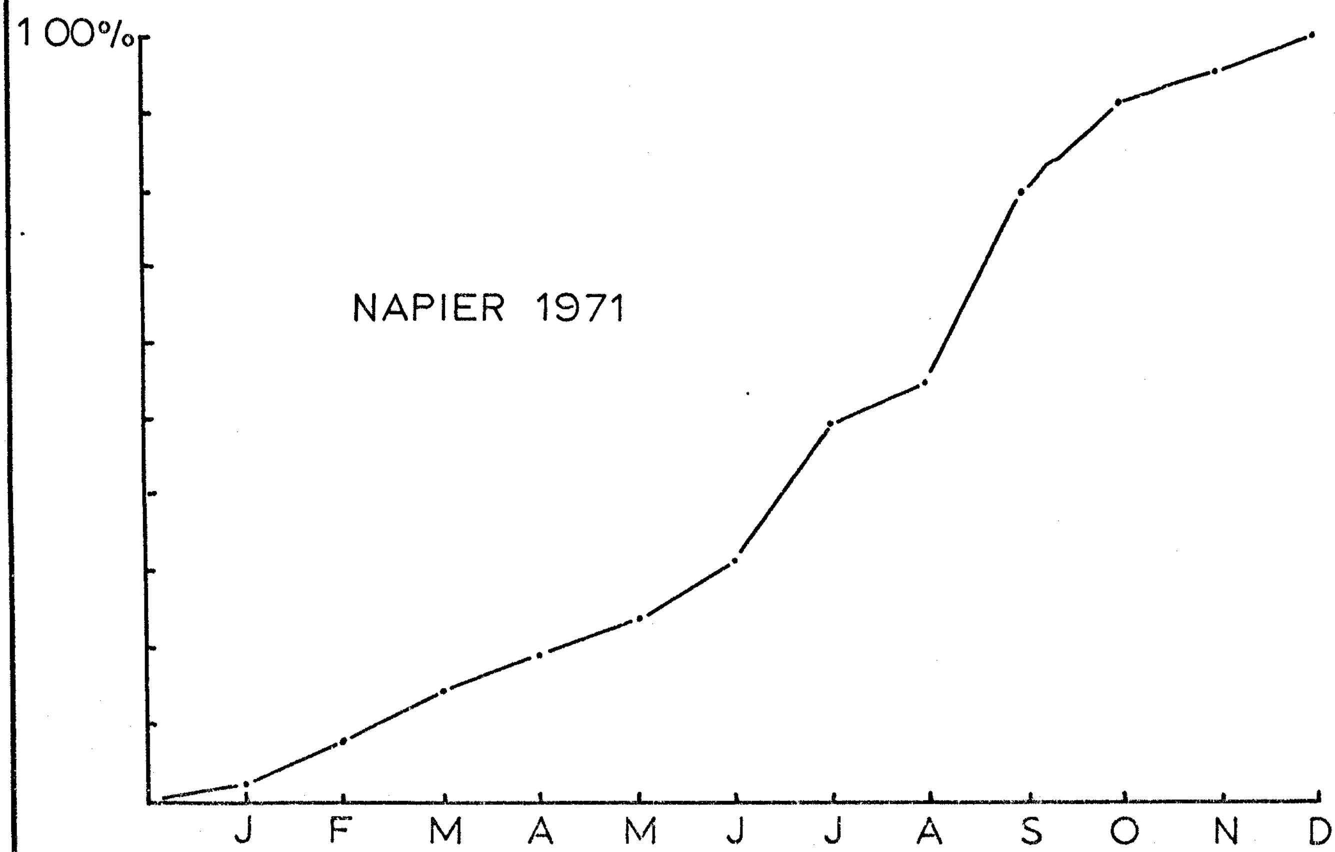


FIGURE 100 BLUE MOKI



Squalus cf acanthias (Southern Dogfish). Very little is known of the seasonal movements of these fish, but they appear to be more plentiful in the summer months. According to Graham (1953:71) they can be a nuisance to groper fishermen in mid-winter (presumably in deeper waters). They are commonly caught on a baited hook in medium depth water over sandy bottoms. Doogue and Moreland (1966:186-7) remarked that the close relative S. blainvillii is taken at precisely high water, and Graham (1953:71) commented that they can only be caught during daylight. The few commercial catch figures show the strong summer cycle, and those for Nelson 1971 are used here.

.227 .077 .053 .041 .064 .060 .039 .028 .038 .073 .157 .145

Callorhynchus millii (Elephant Fish). These fish are a very important commercial species and have been studied in some detail (Waugh, 1973:273; Coakley, n.d.,1973). Large numbers are caught in the Canterbury Bight, although the species does occur at times as far north as the Bay of Plenty (Powell, 1951). It only rarely takes a hook since it feeds on crustaceans and shellfish, and is obtained by beach seines (Doogue and Moreland, 1966:194). The fish appears to migrate into deeper water when cold weather sets in, and in these months very large specimens are sometimes hooked well offshore (Graham, 1953:84). At one time they were plentiful in Otago Harbour in summer from November to March. The figures for Akaroa in 1971 are used for the distribution below (see also Figure 101).

.143 .036 .010 .025 .020 .020 .034 .038 .063 .200 .205 .208

Galeorhinus australis (School Shark). This species is caught throughout New Zealand in medium depth water with baited hook. It often removes a hooked fish near the surface just before being landed. Little is known of seasonal abundance but since it can be caught throughout the year a

FIGURE 101 ELEPHANT FISH

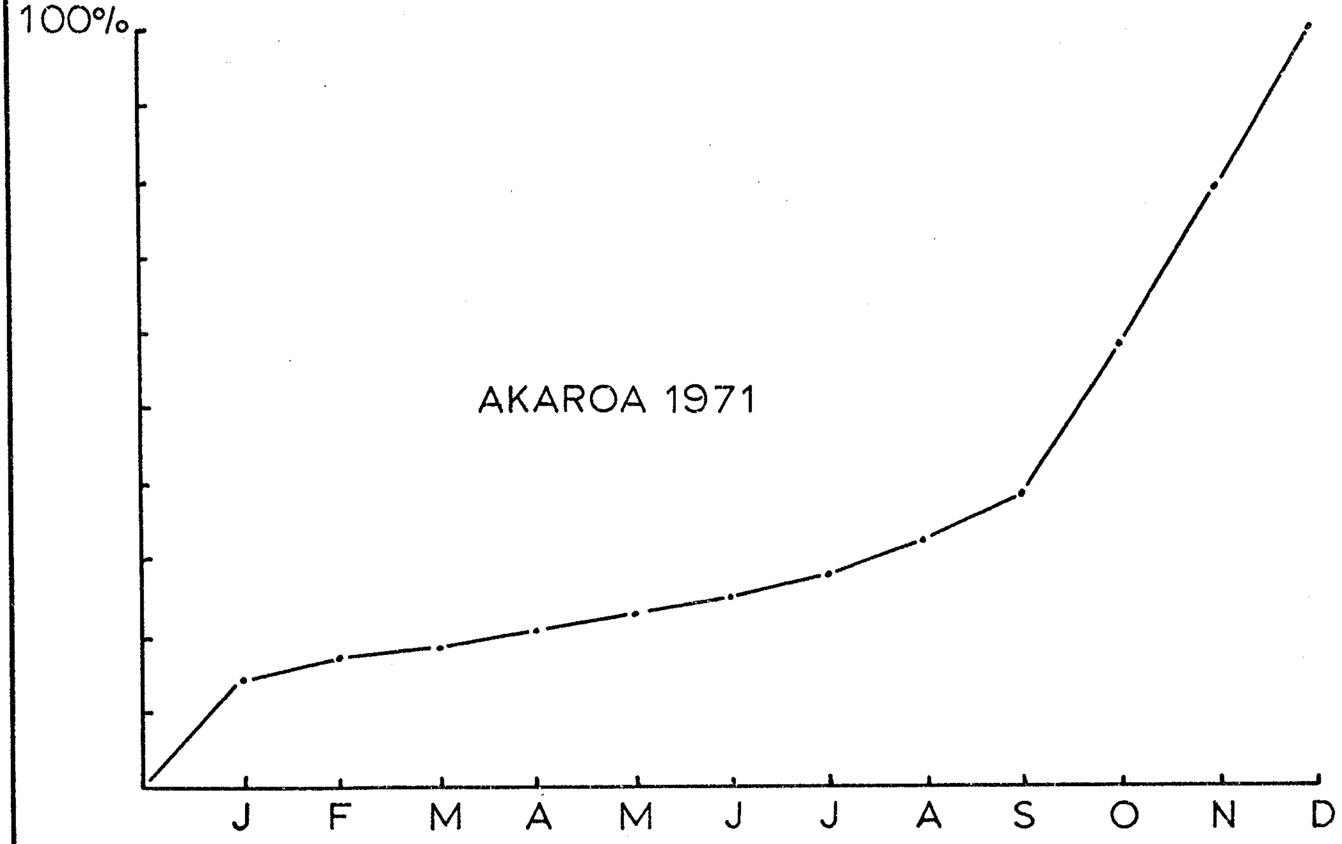
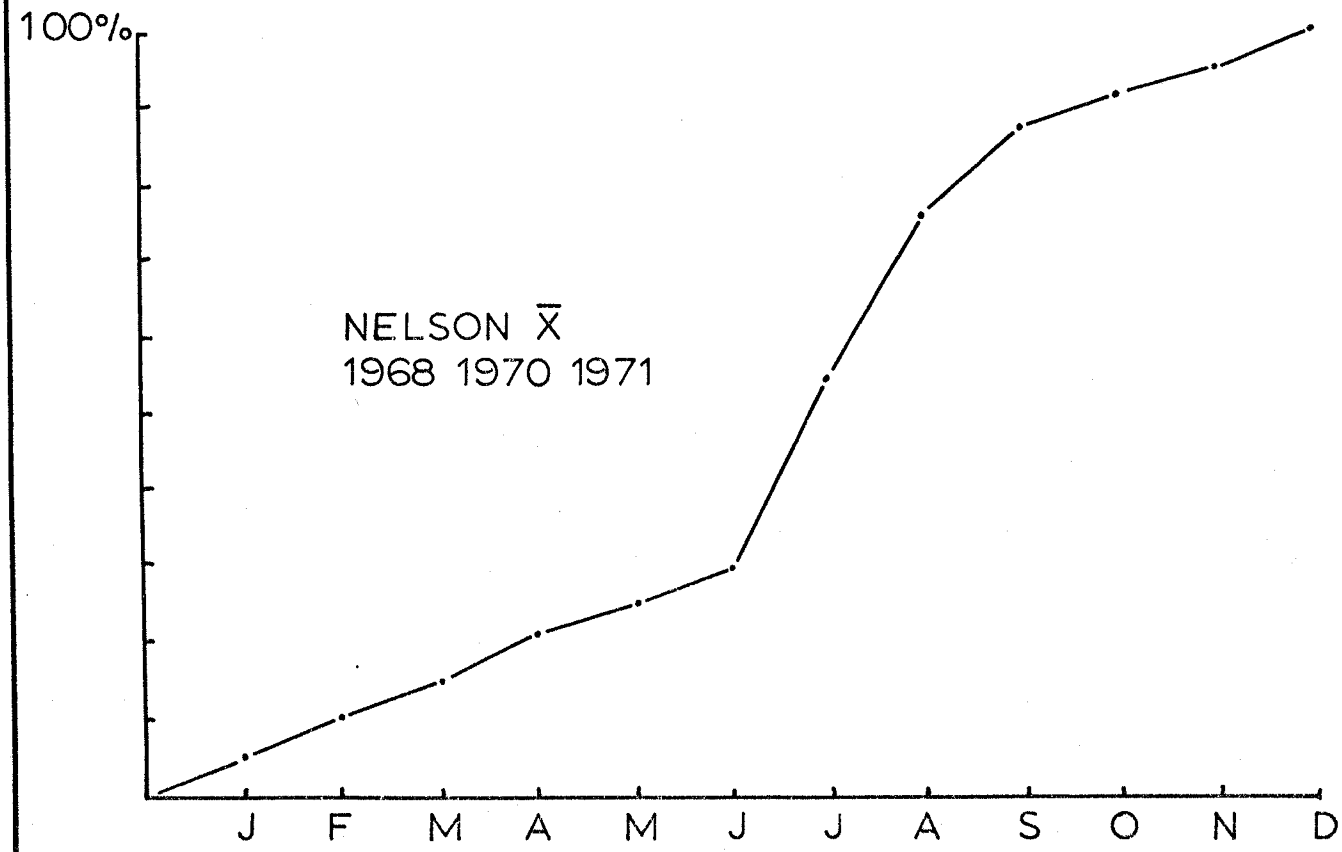


FIGURE 102 WAREHOU



uniform likelihood of 0.083 is assigned to each month for the species.

Polyprion oxygeneios (Groper). This fish is caught on a baited hook usually in deep water over rough ground, although it has been known to take a lure (q.v. Doogue and Moreland, 1966:224; Graham, 1953:228). As Waugh (1973:275) notes, 67% of these fish are today caught by long lines, and their habits are relatively unstudied. Poata (1919:9) claimed that they dominated catches in March and April, but from underwater studies by Doak (1972:27, 33-35) it would appear that seasonal abundance is related to spawning behaviour which varies with depth but not season and from north to south. He relied on Graham's observations that around Otago they are abundant in shallow waters in summer (October to May), but in June and July are only found in deep water. Doak's studies led him to believe that the pattern, at least north of East Cape, is different and that in winter (May to September) they are in moderate depths. It now seems that in the south the fish spawn in winter in deep water and migrate inshore in summer, but that in the north, spawning occurs in winter in shallow water, and that the fish migrates into deep water in summer. Just where this pattern changes over is not known, but commercial catch figures show strong summer abundance as far north as Timaru, and a strong winter abundance as far south as Wellington. The probability list below is an average of Wellington figures for 1949 and 1971.

.073 .053 .044 .063 .075 .096 .144 .091 .114 .092 .077 .078

Coridodax pullus (Greenbone). These fish live in shallow water in rocky weedy ground and browse on seaweeds (Doogue and Moreland, 1966:256). They are generally caught in set nets but will sometimes take a very small hook. According to Sherrin (1886:14) they can be easily caught with a hoop net dragged through kelp, and Parrott (1957:130) remarked that Maoris caught them all the year round in basket traps set close to the shore. It would appear that the fish sleep at night (Graham, 1953:261) and are therefore only able to be caught during daylight. Apparently the fish have a very high concentration of iodine (from their diet) and are occasionally washed ashore in numbers after sudden changes in water temperature. They therefore only venture into shallow harbour waters in warm weather (Graham, 1953:261). At one time these fish were common on the market in Auckland and Wellington from January to October. This may reflect their general condition which improves from February onwards (Doak, 1972:96). Seasonal abundance is judged to be virtually non-existent and a uniform probability of 0.083 is assigned to each month.

Conger verreauxi (Conger Eel). These solitary fish are caught with a baited hook in rough ground of medium depth, and are more abundant from Cook Strait south (Doogue and Moreland, 1966:198). They are strictly nocturnal in feeding habits (q.v.Sherrin, 1886:18; Graham, 1953:135; Doak, 1972:18); however, they are occasionally taken on handlines during daylight hours. Nothing is known of seasonal abundance, and the probability is set as 0.083 per month.

Seriolella brama (Warehou). These fish occur mostly in the South Island and southern parts of the North Island, although they reach as far as the Bay of Plenty in winter (Doogue and Moreland, 1966:222; see also Tong and Elder, 1968:66). They shoal in large numbers both inshore and offshore and are taken in set and seine nets. Graham (1953:218) recounted stories of enormous catches of these fish in the South Island in former times, and noted that they had a very regular seasonal pattern, being most abundant in summer in these waters. The pattern is quite different further north, however, and Poata (1919:10) comments on their abundance in catches in June and July in the Opotiki area. This observation is strongly borne out by the few commercial catch figures, and the probabilities used here are an average of figures for Nelson in 1968, 1970 and 1971 (see Figure 102).

.047 .055 .044 .063 .042 .041 .251 .222 .107 .038 .043 .048

Caranx lutescens (Trevally). These fish occur in huge summer shoals around Auckland and elsewhere. The smaller fish congregate in deeper waters, while the large fish are found in deep water bays around rocky headlands where they live in moderate sized communities (Graham, 1953: 236). They are much more abundant from Banks Peninsula northward, and are caught with very light baited hooks and sometimes with a lure. The fish is a very shy eater during daylight, but will bite freely at night (Doogue and Moreland, 1966:230). Judging from modern commercial catch figures there appear to be several seasonal patterns in different parts of the country. Napier shows a strong summer abundance, while in Tauranga there is an equally strong spring and winter bias to catches (see also Tong and Elder, 1967:52; and Doak, 1972:37). In yet other areas, such as Nelson, two peaks are detected, in both autumn and spring. The high winter concentration in the Bay of Plenty is possibly related to the inshore warm waters of the East Auckland Current. It is difficult to assess the situation in Palliser Bay. Crewe (n.d.) noted catches in the area in January, February and March, while the 1907 Government Trawling Expedition (Waite, 1909) caught the species there in August. From the few published figures on modern catches the summer abundance appears to be the strongest overall pattern, and those for Napier 1968 are used here (see also Figure 103).

.220 .104 .080 .059 .100 .061 .030 .032 .061 .047 .044 .163

FIGURE 103 TREVALLY

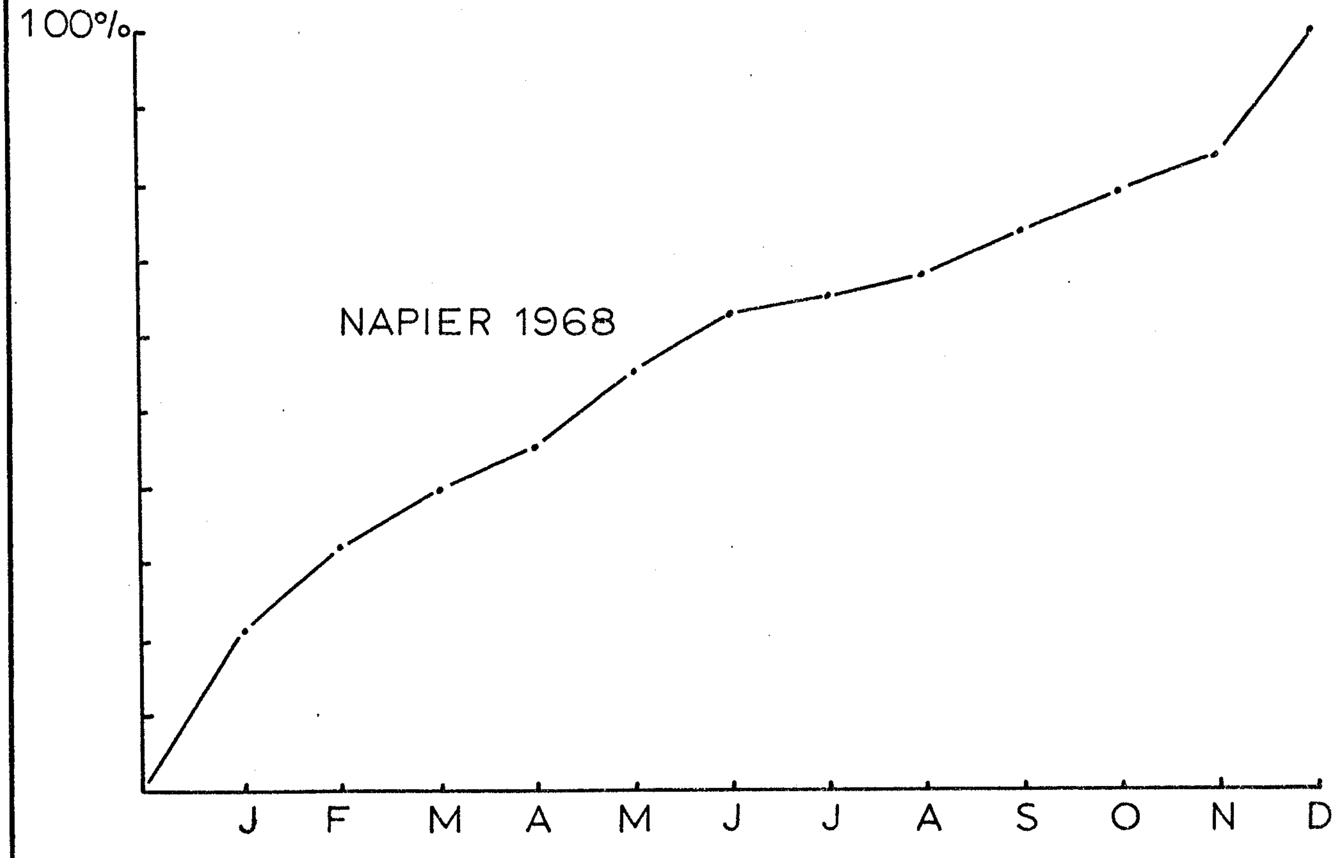
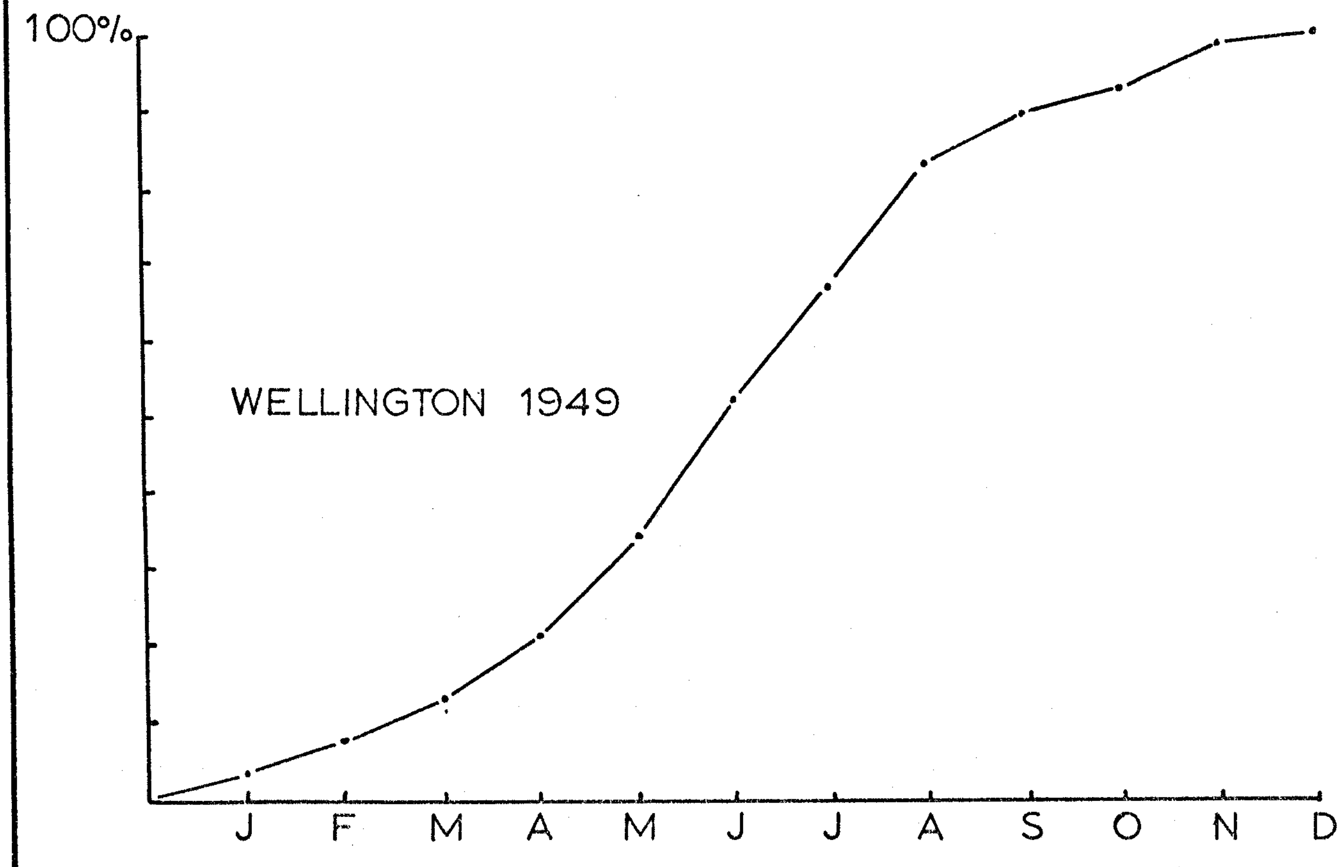


FIGURE 104 LING



Navodon convexirostris (Rough Leatherjacket). These fish are widespread in New Zealand especially in shallow broken ground and can only be caught on a very small hook (Doogue and Moreland, 1966:293; Sherrin, 1886:58). The species has catholic food habits and is one of the few small fish which will bite a diver (Doak, 1972:107); it hides in crevices at night. Witter (1969) has argued that fish traps are much more likely to have been used to catch these fish than other methods because of their very small mouths, although a few may have been speared. There is apparently no marked seasonal abundance of these fish (Graham, 1953:372), and a uniform likelihood of 0.083 is assigned to each month.

Helicolenus papillosus (Sea Perch). This species is found throughout New Zealand in medium depth water over rough ground. It is more abundant about Cook Strait and to the south, and is occasionally caught in extremely deep water (q.v. Parrott, 1957:161). Doogue and Moreland note (1966:287) that some parts of its intestines may be poisenous and it should therefore be filleted. Large baited hooks can be used, and this fish will often take gear set for cod which have a similar habitat. According to Doak (1972:24) the fish is mainly nocturnal, but will feed during daylight. Information on seasonality is rare, but Graham notes (1953:344) that they were more common on the Christchurch market during the early months of the year. A slight bias is therefore given to these months in making up a probability distribution.

.108	.108	.108	.075	.075	.075	.075	.075	.075	.075	.075	.075

Genypterus blacodes (Ling). A baited hook is used for catching this fish which is found over rocky locations in medium to very deep water (Doogue and Moreland, 1966:285). Brodie (1973:79-80) argued that they are most abundant in the central and southern areas of the South Island (cf Waugh, 1973:257), increasingly so with depth, and that there is a strong rise in numbers in autumn with fewest in spring. Graham, however, claimed that there is no seasonal pattern, but rather a diurnal one, for many more can be caught at night than during daylight hours (Graham, 1953: 337). Sherrin remarked that "This is one of the fish that is cast up on the beaches outside Wellington Harbour, after heavy gales, in extraordinary profusion", and that they are in best condition at the beginning of winter (Sherrin, 1886:59). The latter point is reinforced by observations of Parrott (1957:158), who also noted that very large ling are numerous off Kaikoura. Judging from cranial bones from a number of archaeological sites, large specimens of these fish must have been once more numerous generally than today. Only a few commercial catch figures are published and these confirm the autumn and winter abundance noted above. Graham's observations on this point must relate to particular conditions around Otago. In 1949 47% of the total catch at Kaikoura was of ling. The probability distribution follows the figures for Wellington 1949 (see Figure 104).

.034 .047 .048 .084 .134 .172 .151 .160 .066 .037 .054 .015

Aplodactylus meandratus (Marblefish). This fish is found in shallow water in weedy areas throughout New Zealand and is not known to take a baited hook, since it browses solely on seaweeds (Doogue and Moreland, 1966:246); it can be taken in nets or by spearing. Doak (1972:65) noted that marblefish graze during early morning and late evening, and may possibly be more easily caught then. These fish are seldom eaten by Europeans but were formerly highly prized by Maoris, especially at Opotiki where they were caught by frightening them into a bag-shaped net (Graham, 1953:248). Poata (1919:13) noted that they dominated the catch in August, September and October. A slight seasonal bias to these months is given below.

.075 .075 .075 .075 .075 .075 .075 .108 .108 .108 .075 .075

Trachurus novaezelandiae (Horse Mackerel). Very little is known of the habits of this species. It is generally caught with a lure when it shoals on the surface, but it has also been caught in deep water (Graham, 1953: 237). It is apparently more abundant in the northern half of its range, which extends as far south as Otago (Doogue and Moreland, 1966:231), and is probably more common in the summer months. A slight bias is therefore given to December, January and February.

.108 .108 .075 .075 .075 .075 .075 .075 .075 .075 .075 .108

Jasus edwardsii (Crayfish). The species is abundant on rocky ground throughout New Zealand down to about 60m (Doogue and Moreland, 1966:298), but is also found on clean ground down to 200m in places. They are easily taken by traps or diving. Crayfish move to shallow water and protection to moult, which for mature males is November and December (and in some parts of the country July and August), and for females March to early May; thereafter they are generally in deeper water (Coombs, 1974). Lowest catches are at the time of mating which is April and May. The distribution below is an average of the commercial figures for the 5 years 1967 to 1971 for the whole of New Zealand.

.126 .125 .062 .016 .011 .042 .086 .092 .086 .104 .133 .120

Appendix 28: A Probability Model for Determining the Season of Occupation from Faunal Data

It is well known that the presence of certain animal remains on archaeological sites can provide strong indications of season of occupation. In New Zealand, for example, the shining cuckoo (*Chalcites lucidus*) regularly arrives from Fiji in early October and stays throughout the summer; setting aside problems arising from preservation practices, the presence of bones of these birds should be good evidence of occupation sometime during that period. There are, however, various problems concerning spatial and seasonal distribution inherent in the use of modern information for this purpose. For one thing the question of different palaeo-distribution cannot be ignored, especially with accumulating evidence for significant climatic shifts during the prehistoric period. An even more significant problem is that the modern information is seldom as specific as the case cited above. More often seasonal abundance is a general phenomenon arising from a host of inter-related variables including the climatic pattern in that particular year. A species may be present throughout the year but may be easier to catch in some months because of its dietary habits, which in turn may depend on changing ripening times of its food supply. In addition , the seasonal abundance can be very different from one part of the country to another. With caution, these problems can be resolved in particular archaeological instances, although it is obviously a rather complex task. However, archaeologists lack any strict procedure for evaluating the different classes of evidence. This deficiency is the crux of the archaeological problem, and it is quite possible that two archaeologists could arrive at a quite different conclusion when faced with exactly the same information, one choosing to emphasise a different line of evidence from the other. It is clearly desirable to formulate a standard procedure.

There are several alternatives, but the method chosen should take account of the different quantities of each species in the site, and also the varying probability that any particular animal can be caught at each month of the year. The most common assessment of species composition is the minimum number, and this will be used in the following discussion. The second essential body of data is the list of probabilities for each species. Obviously this list will vary from place to place, and it should also take into account as many local factors as the archaeologist considers important. The emphasis should be on 'catchability' rather than mere presence, and also on factors such as variations in desirability, since some animals undergo marked changes in condition throughout the year. Thus if very local sea conditions virtually prohibit deep water line fishing in certain months, then this factor should be taken into account, even though a particular fish may be very abundant over the same period. After evaluating the relevant local information on any one species, a list can be drawn up expressing the likelihood of that species being caught by the prehistoric group.

For example, a particular midden layer at the Karitane Pa site (S155/1) has produced the following fish minimum numbers (H.Leach, 1969:54).

A	Thyrsites atun	106
B	Physiculus bachus	34
C	Polyprion oxygeneios	6
D	Genypterus blacodes	6
E	Pseudolabrus cf pittensis	1
	Total	153

The seasonal probabilities for this site might be assessed as follows:

Thyrsites atun: In Otago this fish is very abundant from October to June (Sherrin, 1886:11; Graham, 1953:310), and the commercial records of catches at Port Chalmers confirm this (Anon, a., 1949). From these latter figures a probability table can be simply drawn up for January through to December as follows:

0.098 0.137 0.086 0.064 0.151 0.054 0.015 0.036 0.046 0.112 0.171 0.031.

Further details on the precise method of reducing these catch figures to a probability distribution can be found in Appendix 27.

Physiculus bachus Graham (1953:167) claims that they are found all year round in Otago, but are somewhat more plentiful in summer. They do not bite freely in July and August when their roes are ripe, and they spawn in deep water in September. This information can be summarised by allowing a higher probability to the summer months of November to March, and a very low probability to July, August and September, as follows:

0.170 0.170 0.170 0.0338 0.0338 0.0338 0.005 0.005 0.005 0.0338 0.170 0.170.

Polyprion oxygeneios This fish is only slightly seasonal in this area, being a little more common in late summer in Otago waters. The Port Chalmers commercial catch figures for 1949 (Anon, a.) are a good reflection of this tendency.

0.108 0.114 0.122 0.096 0.136 0.094 0.023 0.023 0.098 0.043 0.056 0.083.

Genypterus blacodes Graham (1953:337) clearly states that in Otago they can be caught throughout the year and there is no seasonal abundance in this area. A uniform probability of 0.083 could therefore be assigned for each month.

Pseudolabrus cf pittensis These are solitary fish and can easily be caught inshore throughout the year. A probability of 0.083 is assigned to each month.

These individual probability lists can now be scaled according to the relative quantities of each species by multiplying the minimum numbers by each list. The figures are added for each species to give an overall monthly probability distribution which adds up to the total minimum number as follows:

Month	A	B	C	D	E	Total
January	10.39	5.78	0.65	0.50	0.08	17.40
February	14.52	5.78	0.68	0.50	0.08	21.56
March	9.12	5.78	0.73	0.50	0.08	16.21
April	6.78	1.15	0.58	0.50	0.08	9.09
May	16.01	1.15	0.82	0.50	0.08	18.56
June	5.72	1.15	0.56	0.50	0.08	8.01
July	1.59	0.17	0.14	0.50	0.08	2.48
August	3.82	0.17	0.14	0.50	0.08	4.71
September	4.88	0.17	0.59	0.50	0.08	6.22
October	11.87	1.15	0.26	0.50	0.08	13.86
November	18.13	5.78	0.34	0.50	0.08	24.83
December	3.29	5.78	0.50	0.50	0.08	10.15
Totals	106.12	34.01	5.99	6.00	0.96	153.08
N	106	34	6	6	1	153

The resulting overall monthly figures can now be scaled to yield the percentage probability of occupation for each month.

11.4 14.1 10.6 5.9 12.1 5.2 1.6 3.1 4.1 9.1 16.2 6.6 (Total 100.00)

In the case of the Karitane Pa site then, there are good indications of occupation in November, January, February, March and May, and far less direct evidence for occupation at other months. This conclusion parallels that arrived at by H.Leach (1969:56).

The method described above was applied in this thesis in Chapter 4, using the probability distributions outlined in Appendix 27.

Appendix 29: Bird Remains at the Washpool Midden Site: Minimum Numbers Species arranged in decreasing abundance.

NB: Remains for the early structures are included in Level 1. Figures in brackets are %s.

Species	Level 1	Level 2	Level 3	Total
Prosthemadera novaeseelandiae	77(33.9)	9(20.5)	1(50.0)	87
Cyanoramphus novaezelandiae } (35.6)	48(21.1)	5(11.4) } (31.8)		53
Cyanoramphus auriceps	20(8.8)	3(6.8)		23
Cyanoramphus ? sp.	13(5.7)	6(13.6)		19
Hemiphaga novaeseelandiae	7(3.1)	5(11.4)		12
Passeriformes ? sp.	7(3.1)			7
Bird ? sp.	1(0.4)	4(9.1)	1(50.0)	6
Petroica australis longipes	4(1.8)			4
Nestor meridionalis septentrionalis	3(1.3)	1(2.3)		4
Turnagra capensis tanagra	3(1.3)			3
Gallirallus australis greyi	2(0.9)	1(2.3)		3
Capellirallus/Rallus ? sp.	3(1.3)			3
Coturnix novaezealandiae novaezealandiae	3(1.3)			3
Eudyptes pachyrhynchus pachyrhynchus	3(1.3)			3
Moa ? sp.	1(0.4)	2(4.5)		3
Philesturnus carunculatus rufusater	2(0.9)			2
Callaeas cinerea wilsoni	2(0.9)			2
Euryapteryx geranoides	2(0.9)			2
Euryapteryx gravis	2(0.9)			2
? Pachyornis mappini/Euryapteryx geranoides		2(4.5)		2
Anas ? sp.	2(0.9)			2
Anas superciliosa superciliosa	2(0.9)			2
Small petrel ? sp.	1(0.4)	1(2.3)		2
Eudyptula minor	2(0.9)			2
Puffinus ? gavia/huttoni	1(0.4)	1(2.3)		2
Rhipidura fuliginosa placabilis	1(0.4)			1
Anthornis melanura melanura	1(0.4)			1
Ninox novaeseelandiae novaeseelandiae	1(0.4)			1

Species	Level 1	Level 2	Level 3	Total
Heteralocha acutirostris	1(0.4)			1
Pachyornis mappini	1(0.4)			1
Rallus philippensis assimilis	1(0.4)			1
Circus approximans gouldi	1(0.4)			1
Cygnus sumnerensis		1(2.3)		1
Halcyon sancta vagans	1(0.4)			1
Anas rhynchotis variegata	1(0.4)			1
Diomedea exulans/epomophora		1(2.3)		1
Diomedea cauta	1(0.4)			1
Larus dominicanus	1(0.4)			1
Phalacrocorax ? sp.	1(0.4)			1
Halobaena caerulea	1(0.4)			1
Petrel ? sp.		1(2.3)		1
Puffinus gavia	1(0.4)			1
Puffinus ? sp.	1(0.4)			1
Eudyptes pachyrhynchus sclateri		1(2.3)		1
Eudyptes ? sp.	1(0.4)			1
Totals	227(100.0)	44	2	273

Chi-square Level 1 to Level 2 = 79.1 with 44 degrees of freedom, which is a highly significant difference (p less than .005).

Appendix 30: Bird Remains at the Washpool Midden Site - Species arranged into taxonomic orders.

NB: Derived from the figures in Appendix 29.

Order	Level 1	Level 2	Level 3	Total
Dinornithiformes	6	4	-	10
Pachyornis mappini				
Euryapteryx geranoides				
Euryapteryx gravis				
? Pachyornis mappini/Euryapteryx geranoides				
Moa ? sp.				
Procellariformes	6	4	-	10
Diomedea ? exulans/epomophora				
Diomedea cauta				
Halobaena caerulea				
Small petrel ? sp.				
Petrel ? sp.				
Puffinus gavia				
Puffinus ? gavia/huttoni				
Puffinus ? sp.				
Sphenisciformes	6	1	-	7
Eudyptes pachyrhynchus pachyrhynchus				
Eudyptes pachyrhynchus sclateri				
Eudyptula minor				
Eudyptes ? sp.				
Pelecaniformes	1	-	-	1
Phalacrocorax ? sp.				
Anseriformes	5	1	-	6
Cygnus sumnerensis				
Anas rhynchotis variegata				
Anas ? sp.				
Anas superciliosa superciliosa				

Order	Level 1	Level 2	Level 3	Total
Falconiformes	1	-	-	1
Circus approximans gouldi				
Galliformes	3	-	-	3
Coturnix novaezealandiae				
Gruiformes	6	1	-	7
Gallirallus australis greyi				
Capellirallus/Rallus ? sp.				
Rallus philippensis assimilis				
Charadriiformes	1	-	-	1
Larus dominicanus				
Columbiformes	7	5	-	12
Hemiphaga novaeseelandiae				
Psittaciformes	84	15	-	99
Nestor meridionalis septentrionalis				
Cyanoramphus novaezelandiae				
Cyanoramphus auriceps				
Cyanoramphus ? sp.				
Strigiformes	1	-	-	1
Ninox novaeseelandiae novaeseelandiae				
Coraciiformes	1	-	-	1
Halcyon sancta vagans				
Passeriformes	98	9	1	108
Prosthemadera novaeseelandiae				
Passeriformes ? sp.				
Petroica australis longipes				
Turnagra capensis tanagra				
Philesturnus carunculatus rufusater				
Callaeas cinerea wilsoni				
Rhipidura fuliginosa placabilis				
Anthornis melanura melanura				
Heteralocha acutirostris				
Bird ? genus	1	4	1	6

Proportions of different orders (excluding Moa and Bird ? genus - percentages in brackets)

	Level 1	Level 2	Total
Procellariiformes (petrels etc)	6 (2.7)	4 (11.1)	10
Sphenisciformes (penguins)	6 (2.7)	1 (2.8)	7
Pelicaniformes (shags)	1 (0.5)	- (0)	1
Anseriformes (ducks etc.)	5 (2.3)	1 (2.8)	6
Falconiformes (hawk etc.)	1 (0.5)	-	1
Galliformes (quail etc.)	3 (1.4)	-	3
Gruiformes (weka etc.)	6 (2.7)	1 (2.8)	7
Charadriiformes (gulls etc.)	1 (0.5)	-	1
Columbiformes (pigeon etc.)	7 (3.2)	5 (13.9)	12
Psittaciformes (parakeets etc.)	84 (38.2)	15 (41.7)	99
Strigiformes (morepork etc.)	1 (0.5)	-	1
Coraciiformes (kingfisher etc.)	1 (0.5)	-	1
Passeriformes (tui etc.)	98 (44.5)	9 (25.0)	107
Totals	220 (100.0)	36 (100.0)	256

Appendix 31: Bird Remains from the Washpool Midden Site - arranged into habitat types

Habitat	Level 1	Level 2
Forest Dwellers	190 (86.4%)	29 (80.6%)
Columbiformes		
Psittaciformes		
Strigiformes		
Passeriformes		
Fringe Dwellers	16 (7.3%)	2 (5.6%)
Anseriformes		
Falconiformes		
Galliformes		
Gruiformes		
Coraciiformes		
Coastal Dwellers	14 (6.4%)	5 (13.9%)
Procellariiformes		
Sphenisciformes		
Pelecaniformes		
Charadriformes		
Totals	220 (100)	36 (100)

Habitat	Level 1	Level 2
Forest and Fringe Dwellers	206 (93.6%)	31 (86.1%)
Coastal Dwellers	14 (6.4%)	5 (13.9%)
Totals	220 (100)	36 (100)

NB: None of the observed differences in proportions above are significant at the 5% level (tested as in Appendix 35).

Appendix 32: Bird Remains at the Washpool Midden Site - arranged into two size groups

Size Group	Level 1	Level 2
Larger Birds	41 (18.6%)	13 (36.1%)
Procellariiformes		
Sphenisciformes		
Pelecaniformes		
Anseriformes		
Falconiformes		
Galliformes		
Gruiformes (minus *R.philippensis*)		
Charadriiformes		
Columbiformes		
Nestor meridionalis		
Callaeas cinerea wilsoni		
Heteralocha acutirostris		
Smaller Birds	179 (81.4%)	23 (63.9%)
Rallus philippensis assimilis		
Cyanoramphus sp.		
Strigiformes		
Coraciiformes		
Passeriformes (minus C.*cinerea* and *H.acutirostris*)		
Totals	220	36

Appendix 33: Cyanoramphus sp. from the Washpool Midden site: combined figures for Lens IIB and Crust of Layer 5 - minimum numbers for different parts of the anatomy

Anatomy		Minimum Number	% of Maximum Minimum Number
Carpometacarpus	L	3	4.4
	R	7	10.3
Ulna	L	4	5.9
	R	6	8.8
Radius	L	1	1.5
	R	0	0
Humerus	L	18	26.5
	R	23	33.8
Scapula	L	7	10.3
	R	5	7.4
Coracoid	L	25	36.8
	R	17	25.0
Femur	L	9	13.2
	R	10	14.7
Tibiotarsus	L	17	25.0
	R	12	17.6
Tarsometatarsus	L	25	36.8
	R	30	44.1
Quadrate	L	0	0
	R	0	0
Mandible	L	7	10.3
	R	7	10.3
Cranium and Maxilla		21	30.9
Furcula		1	1.5
Sternum		68	100.0
Vertebrae		7	10.3
Pelvis and sacrum		4	5.9
Phalanges		3	4.4
Ribs		1	1.5

Chi-square from Left to Right = 6.83, with 9 degrees of freedom.

Therefore no significant bilateral asymmetry in identifications.

Appendix 34: Prosthemadera novaeseelandiae at the Washpool Midden site: combined figures for Lens B and Crust of Layer 5 - minimum numbers for different parts of the anatomy

Anatomy		Minimum Number	% of Maximum Minimum Number
Carpometacarpus	L	5	8.8
	R	6	10.5
Ulna	L	7	12.3
	R	8	14.0
Radius	L	8	14.0
	R	8	14.0
Humerus	L	27	47.4
	R	36	63.2
Scapula	L	15	26.3
	R	15	26.3
Coracoid	L	27	47.4
	R	30	52.6
Femur	L	3	5.3
	R	2	3.5
Tibiotarsus	L	49	86.0
	R	44	77.2
Tarsometatarsus	L	10	17.5
	R	18	31.6
Quadrate	L	2	3.5
	R	3	5.3
Mandible	L	20	35.1
	R	23	40.4
Cranium and Maxilla		3	5.3
Furcula		6	10.5
Sternum		57	100.0
Vertebrae		2	3.5
Pelvis and sacrum		4	7.0
Phalanges		3	5.3
Ribs		1	1.8

Chi-square from Left to Right = 3.68, with 10 degrees of freedom.

Therefore no significant bilateral asymmetry in identifications.

Appendix 35: Method for Calculating the Standard Error of a Percentage Difference

In a number of places in this thesis it was found necessary to test the significance of observed differences between two percentage statistics. For example, in Appendix 31 it is seen that in Level 1 at the Washpool Midden Site 6.4% of the bird remains are coastal sea birds, while in Level 2 the figure has risen to 13.9%; is this a significant increase or not? There is no simple solution, although Rosenbaum's nomographic chart (Rosenbaum, 1959:49) was used extensively in this thesis to assess this sort of problem. Unfortunately there are some inherent errors in Rosenbaum's method of approximation, and where these were suspected to be significant an exact probability was calculated. This departure in procedure should be fully explained.

The common question referred to above is called the 'V problem' by Rosenbaum (ibid:45-6), and his V scales in the nomographic chart are proportional to the logarithm of the standard error(s) of the difference between observed percentages. The method of approximation used was:

$$s = t.(P.(200-P)/(N-1))^{0.5}$$

where $P = p + q$

and $N = m + n$

and where in the first sample the percentage = p, and the sample size = m, and in the second sample the percentage = q and the sample size = n. In the equation above t = the value of Student's t for an arbitrary constant value N = 175 degrees of freedom and whichever probability level is chosen (in Rosenbaum's case 0.05 and 0.01).

In defending the approximation, which is the first mathematical term in the more time consuming exact probability formula, Rosenbaum constructed a table comparing the results obtained by the two methods, and found that the ratio of one to the other varied from 0.79 to 1.05. At first glance this variation may not seem very great; however, when converted into actual percentage differences it is clear that in certain borderline cases the difference in methods can be quite important. In addition, it should be noted that the value of t used for constructing the nomographic chart is arbitrarily based on N = 175. For samples which are less, this choice will lead to an overestimation of significance levels.

The table below indicates the difference in percentage units of the standard error as calculated by the two methods. Where the figure is positive the approximation has lead to an artificially high significance level; where it is negative the exact method is more powerful in rejecting the null hypothesis, and the approximation is regarded as too conservative.

Table of Differences (exact-approximate) of Standard Errors of Percentage Differences

		N	50	60	80	80	60	50
		m	30	40	60	20	20	20
		n	20	20	20	60	40	30
		t(.01)	2.678	2.660	2.638	2.638	2.660	2.678
p	q	t(.05)	2.008	2.000	1.989	1.989	2.000	2.008
50	50	.01	0.79	2.10	4.59	4.59	2.10	0.79
		.05	0.59	1.58	3.46	3.46	1.58	0.59
50	30	.01	1.06	2.47	5.02	3.61	1.47	0.42
		.05	0.79	1.86	3.78	2.72	1.11	0.31
50	10	.01	1.93	3.66	6.38	0.22	-0.67	-0.81
		.05	1.49	2.76	4.81	0.16	-0.50	-0.61
50	5	.01	2.26	4.11	6.89	-1.22	-1.54	-1.30
		.05	1.69	3.10	5.20	0.02	-1.16	-0.98
30	10	.01	1.74	3.37	5.94	0.73	-0.33	-0.60
		.05	1.31	2.53	4.48	0.55	-0.25	-0.45
30	70	.01	0.66	1.77	3.90	3.90	1.77	0.66
		.05	0.49	1.33	2.94	2.94	1.33	0.49
20	70	.01	0.19	0.94	2.57	4.35	2.19	0.98
		.05	0.15	0.71	1.94	3.28	1.65	0.74
20	80	.01	0.51	1.36	3.01	3.01	1.36	0.51
		.05	0.38	1.02	2.27	2.27	1.02	0.38

As can be seen, within the ranges of m and n, and p and q which are considered (the same as chosen by Rosenbaum), the approximation has the general tendency to err on the non-conservative side by nearly 7% in some instances, and can lead to accepting significance as proven when it is not. A case in point is the example first mentioned here.

m = 220 p = 6.4%
n = 36 q =13.9%
Observed difference = 7.5%
Standard error (by approximation) (p = .05) = 7.41%
Standard error (by exact method) (p = .05) = 9.27%

Thus at the 5% level we would accept that the observed difference was significant in one case, and reject it in another.

For the majority of cases, the nomographic chart constructed by Rosenbaum has much to recommend it as a rapid test (although it is difficult to see why it was not constructed on the exact basis), but in situations where results appear to be borderline, the lengthy algorithm for finding exact probability should be calculated out. A magnetic program for an HP-65 Hewlett Packard calculator was written for this purpose and used in doubtful cases in this thesis. The algorithm used was as follows:

$$s = t.(P.(200-P)/(N-1)+(m-n).(m.p.(100-p)-n.q.(100-q))/(m.n.(N-1)))^{0.5}$$

Appendix 36: Mammal Remains at the Washpool Midden Site

Species	Level 1	Level 2	Level 3	Totals
Lagenorhynchus cruciger or *Delphinus delphis*	1			1
Globicephala melaena		2		2
Order Mysticeti ? genus	1			1
Arctocephalus forsteri	3	3		6
Neophoca hookeri	1			1
Hydrurga leptonyx	2			2
Rattus exulans	94	18	1	113
Canis familiaris	14	7	1	22

Appendix 37: Faunal Remains from the Washpool Camp Site M1/I

NB: The figures given below are minimum numbers.

Marine Shellfish

Zediloma sp.	20
Cellana radians	3
Haliotis iris	3
Mytilus edulis	2
Lunella smaragda	2
Cookia sulcata	1
Melagraphia aethiops	1
Benhamina obliquata	1

Birds

Moa ? sp.	1
Small bird ? sp.	1

Mammal

Canis familiaris	1
? *Globicephala melaena*	1
Rattus exulans	1

Fish

Cheilodactylus macropterus	1
Physiculus bachus	1
Thyrsites atun	1

Appendix 38: Terrace Dimensions in Palliser Bay (measurements in metres)

Washpool Garden Terraces

	Length	Breadth	Area	Length-Breadth ratio
	2.8	1.4	3.9	2.0
	2.8	2.8	7.8	1.0
	4.0	3.3	13.2	1.2
	5.2	3.4	17.7	1.5
	5.5	4.1	22.6	1.3
	5.7	3.6	20.5	1.6
	5.7	4.1	23.4	1.4
	8.0	2.5	20.0	3.2
	8.2	3.5	28.7	2.3
	8.4	5.5	46.2	1.5
	10.0	3.6	36.0	2.8
	10.7	4.7	50.3	2.3
	11.7	3.6	42.1	3.3
	11.9	4.7	55.9	2.5
	12.6	3.3	41.6	3.8
	17.1	4.3	73.5	4.0
	23.4	5.8	135.7	4.0
Means	9.04	3.77	37.59	2.33

NB: Terraces 15 and 17 are divided by a slight bank; also terrace 13 has a slight bank across it (see Figure 69).

'Hamenga' Garden Terraces

	35.0	10.0	350.0	3.5
	40.0	18.0	720.0	2.2
	50.0	15.0	750.0	3.3
	65.0	22.0	1430.0	3.0
	80.0	15.0	1200.0	5.3
Means	54.00	16.00	890.00	3.46

Washpool Cross Site Garden Terraces

	33.4	8.1	270.5	4.1
	34.4	7.8	268.3	4.3
Means	33.90	7.95	269.40	4.20

Pararaki North Garden Terrace

	40.0	18.0	720.0	2.2

Washpool Cross Site House Terrace

	9.0	5.0	45.0	1.8

Moikau Valley House Terrace

	10.2	6.0	61.2	1.7

Washpool Stone Wall Fort ? House Terraces

	5.0	4.0	20.5	1.3
	7.0	6.5	45.5	1.1
	7.5	4.6	34.5	1.6
	8.0	4.5	36.0	1.8
	9.5	5.3	50.4	1.8
	11.0	5.0	55.0	2.2
	14.0	5.0	70.0	2.8
	15.0	5.0	75.0	3.0
Means	9.63	4.99	48.36	1.95

Appendix 39: Faunal and Floral Remains from the Cleft Burial

NB: Figures are minimum numbers

* denotes adventive species

Mammals etc		
	* Oryctolagus cuniculus	3 juv
	* Trichosurus vulpecula	4 (3 juv)
	Gekkonidae sp.	1
	Rattus exulans	1
Birds		
	Hemiphaga n. novaeseelandiae	2
	Anas ? sp.	1
	Puffinus cf gavia/huttoni	1
Marine Shells		
	Haliotis iris	2
	Paphies subtriangulatum	2
	Paphies australe	1
	Dentalium nanum	160
Landsnails		
	Charopa (Charopa) coma	161
	Phenacharopa novoseelandica	17
	Charopa (Ptychodon) buccinella	3
	Allodiscus sp.	3
	Charopa (Ptychodon) colensoi	1
	Delos coresia	1
	Laoma (Phrixgnathus) marina	1
	Therasia zelandiae	1
Insects		
	Cryptorhynchinae sp.	2
	Phrynixinae sp.	2

Seeds

	Cordyline australis	406
	Myoporum laetum	109
	Alectryon excelsus	44
	Leptospermum ericoides	20
	Hymenanthera cf crassifolia	7
*	Galium aparine	2

Appendix 40: Midden Remains from the Washpool Stone Wall Fort

A: Adkin's sample 1955

Marine Shells		
	Haliotis iris	most
	Cookia sulcata	few
	Melagraphia aethiops	few
	Mytilis cf caniculatus (sic)	occasional
Fish		
	Lepidopus caudatus	present
	Other species unidentified	present
Crustacean		
	? a large kind of crayfish	12 limy objects
Mammal		
	Rattus exulans	1
Birds		
	Nestor septentrionalis	several
	Phalacrocorax sp.	1 or 2

B: Present Sample, excavated 1970 (figures are minimum numbers)

Marine Shells		
	Haliotis iris	8
	Cellana radians	1
	Haustrum haustorium	1
Fish		
	Thyrsites atun	4
	Conger verreauxi	1
	Parapercis colias	1
	Polyprion oxygeneios	1
	Galeorhinus ? australis	1
Crustacean		
	Jasus edwardsii	3

Mammal		
	Rattus exulans	1
Birds		
	Nestor meridionalis septentrionalis	1
	Callaeas cinerea wilsoni	1
	Heteralocha acutirostris	1
	Prosthemadera novaeseelandiae	1
Landsnails		
	Charopa (Charopa) coma	2

Appendix 41: Shellfish from the Washpool Midden Site: Shift away from the Filter feeders.

NB: The significance of the trend was assessed using Rosenbaum's exact probability method (see Appendix 35): The change from Level I to Level II is highly significant, but significance cannot be proven at the 5% level for the change between Level II and Level III. The numbers in brackets are %.

	Level I	Level II	Level III
FILTER FEEDERS	1585 (40.5)	89 (14.7)	2 (5.9)
Mytilus edulis			
Perna canaliculus			
Ostrea spp.			
Aulocomya maoriana			
Chamaesipho sp.			
Protothaca crassicosta			
Paphies subtriangulatum			
Paphies australe			
Dentalium nanum			
Pecten n. novaezelandiae			
BROWSING ANIMALS	2327 (59.5)	517 (85.3)	32 (94.1)
Haliotis spp.			
Melagraphia aethiops			
Cellana spp.			
Lunella smaragda			
Zediloma sp.			
Haustrum haustorium			
Cookia sulcata			
Chiton sp.			
Benhamina obliquata			
Cominella sp.			
Siphonaria zelandica			
Eudoxochiton nobilis			
Maoricolpus roseus r.			
Argobuccinum tumidum			
Patelloidea corticata corallina			
Penion adusta			
Struthiolaria sp.			
TOTALS	3912 (100)	606 (100)	34 (100)

Appendix 42: Shellfish from the Washpool Midden Site: Changes in the dominant species away from the close inshore habitat.

NB1: Only species where minimum numbers are greater than 50 are included.

NB2: The significance of the fall in *M.aethiops* and the rise in *L.smaragda* was assessed with Rosenbaum's exact probability method (see Appendix 35): both changes are highly significant. The figures in brackets below are percentages.

Species	Level I	Level II	Change in %
Haliotis spp.	615 (25.9)	126 (24.2)	down 1.7
Melagraphia aethiops	532 (22.4)	63 (12.1)	down 10.3
Zediloma sp.	150 (6.3)	43 (8.3)	up 2.0
Cellana radians	400 (16.9)	73 (14.0)	down 2.9
Lunella smaragda	323 (13.6)	146 (28.1)	up 14.5
Haustrum haustorium	139 (5.9)	26 (5.0)	down 0.9
Cookia sulcata	116 (4.9)	13 (2.5)	down 2.4
Paphies spp.	95 (4.0)	30 (5.8)	up 1.8
Totals	2370 (100)	520 (100)	

Appendix 43: Miscellaneous Faunal Remains from the Washpool Midden Site

Species	Level I	Level II
Evechinus chloroticus	20	3
Gekkonidae sp.	2	1
Odontria spp. (includes *O.nr.striata*, *O.smithi*, and perhaps *Costelytra* sp.)	12	7
Crabronine sp.	1	
Pericoptus sp.	1	
Colletid bee		3

Appendix 44: Landsnails from the Washpool Midden Site

Species	Level I	Level II	Level III
Charopa (Charopa) bianca (Hutton)	8		
C. C. coma (Gray)	110		
C. C. pilsbryi (Suter)	2		
C. (Mocella) prestoni (Sykes)		1	
C. (Ptychodon) buccinella (Reeve)	367		1
C. P. varicosa (Pfeiffer)	12		
C. (Subfectola) caputspinalae (Reeve)	178		
Lamellidae novoseelandica	7		
Paralaoma laleumbilicata (Suter)	37		
P. pumila (Hutton)	2592	7	3
Phenacharopa novoseelandica (Pfeiffer)	418	5	2
Potamopyrgus antipodum antipodum (Gray)	3		
Pseudallodiscus ponderi	34		
Therasia zelandiae (Gray)	319	1	1
Totals	4087	14	7

Appendix 45: Seasonality at the Washpool Midden Site

NB: Using fish minimum numbers given in Appendix 23, their seasonal abundance probabilities in Appendix 27, and the method outlined in Appendix 28, the following probability distributions have been calculated for the Washpool Midden site.

Month	Level 1 Raw	Level 1 %	Level 2 Raw	Level 2 %
January	28.41	10.59	11.94	9.63
February	29.09	10.85	11.27	9.09
March	30.43	11.35	13.30	10.73
April	22.73	8.48	11.13	8.98
May	18.12	6.76	8.59	6.93
June	21.61	8.06	11.32	9.13
July	20.15	7.51	9.22	7.44
August	16.24	6.06	7.70	6.21
September	17.21	6.42	7.91	6.38
October	17.79	6.63	8.88	7.16
November	23.81	8.88	11.15	8.99
December	22.60	8.43	11.57	9.33
Totals	268.19	100.00	123.98	100.00
N	268		124	

Appendix 46: Landsnails in Main Botanical Zones in Modern Palliser Bay Environment

NB: All entries are percentages.

Species			Coastal	Inland	Podocarp	Black Beech
Charopa (Charopa) anguicula (Reeve)				1.1	0.8	
C.	C.	bianca (Hutton)				0.6
C.	C.	coma (Gray)	75	18.3	3.1	7.3
C.	C.	pilsbryi (Suter)		1.1	0.4	0.6
C.	(Geminoropa) cookiana (Dell)			1.1	10.3	11.0
C.	G.	microrhina (Suter)		11.4	5.6	
C.	G.	eta (Pfeiffer)	0.4			
C.	(Ptychodon) brouni (Suter)			8.0	1.7	
C.	P.	buccinella (Reeve)		24.0	10.0	43.3
C.	P.	colensoi (Suter)		6.9	2.3	
C.	P.	infecta (Reeve)		1.1		1.3
C.	P.	microundulata (Suter)		2.3	2.7	20.8
C.	P.	pseudoleioda (Suter)			7.3	
C.	P.	reeftonensis (Suter)	19.0			
C.	P.	serpentinula (Suter)		3.4		2.5
C.	P.	varicosa (Pfeiffer)			0.4	
C.	(Subfectola) caputspinalae (Reeve)		4.2	2.3	1.5	
Cytora lignaria (Pfeiffer)					0.6	
Flammulina chiron (Gray)					0.2	
F.	perdita (Hutton)				0.4	0.6
Laoma sp.			0.4	1.1		
L.	(Phrixgnathus) mariae (Gray)				0.2	
L.	P.	marina (Hutton)			2.1	
L.	P.	microreticulatus (Suter)		1.1	2.7	2.5
L.	P.	phrynia (Hutton)		4.6	5.2	2.5
L.	P.	regularis (Pfeiffer)			0.4	
L.	P.	serratocostatus(Webster)			0.6	
Obanella spectabilis (Powell)					0.6	2.5

Species	Coastal	Inland	Podocarp	Black Beech
Omphalorissa purchasi (Pfeiffer)			25.9	
Otoconcha sp.		3.4		
O. *dimidiata* (Pfeiffer)		3.4		
Paralaoma allochroida (Suter)			5.6	
P. *lateumbilicata* (Suter)			0.6	2.5
P. *pumila* (Hutton)	1.0		5.0	
P. *raricostata* (Suter)			0.2	
P. *sericata* (Suter)				1.3
Phenacharopa novoseelandica (Pfeiffer)		4.6	1.5	0.6
Potamopyrgus zelandiae (Gray)	0.4			
Suteria ide (Gray)			0.4	
Therasia traversi (E.A.Smith)			0.2	
T. *zelandiae* (Gray)		1.1	1.0	
Totals	100.4	100.3	99.5	99.9
Sample Numbers	310	88	478	163

BIBLIOGRAPHY[1]

ADKIN, G.L. 1948 Horowhenua: its Maori Place-names and their Topographical and Historical Background
Polynesian Society Memoir 26

ADKIN, G.L. 1955 Archaeological Evidence of Former Native Occupation of Eastern Palliser Bay
JPS 64: 450-80

ADKIN, G.L. 1959 The Great Harbour of Tara
Whitcombe and Tombs Ltd.

ALLAN, H.H. 1961 Flora of New Zealand, Volume 1
Government Printer, Wellington

ALLO, J. 1970 Analysis of Midden from Two Sites on Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus. 7:83-91

ALLO, J. 1971 The Dentition of the Maori Dog of New Zealand
Rec.Auck.Inst.and Mus. 8:29-45

AMBROSE, W. 1962 Further Investigations at Kauri Point, Katikati
NZAA Newsletter 5(1):56-67.

AMBROSE, W. 1966 A Limiter of New Zealand Archaeology
NZAA Newsletter 9(2):71-73

ANDERSON, A.J. 1973a Archaeology and Behaviour: Prehistoric Subsistence Behaviour at Black Rocks Peninsula, Palliser Bay
Unpublished MA Thesis: Anthropology, University of Otago

ANDERSON, A.J. 1973b The Conchiolin dating method
New Zealand Journal of Science 16:553-558

ANDERSON, A.J. 1973c A Critical Evaluation of the Methodology of Midden Sampling
NZAA Newsletter 16(3):119-127

ANDERSON, A.J. and N.J.PRICKETT 1972 Radiocarbon Dates for the Wairarapa - IV
NZAA Newsletter 15(4):164

ANDERSON, A.J. and D.G.SUTTON 1973 Archaeology of Mapoutahi Pa, Otago
NZAA Newsletter 16(3):107-118

ANDERSON, J.C. 1940 The so-called 'spool' artifact
JPS 49: 595-599

---

[1] **Abbreviations and Addendum are given at end of Bibliography**

ANDERSON, W.	1967	A Journal of a Voyage Made in His Majestys Sloop Resolution pp 723-986 In: The Journals of Captain James Cook Vol. 3(2) J.C.Beaglehole Ed. Cambridge University Press
ANON, a.	1929-1973	Report on Fisheries New Zealand Marine Deaprtment
ANON, b.	1965	Historic Papawai Pa Te Ao Hou 50:36-7
ARMITAGE, G.C., R.D.REEVES and P.BELLWOOD	1972	Source identification of archaeological obsidians in New Zealand New Zealand Journal of Science 15(3): 408-420
BAKER, A.N.	1972	New Zealand Whales and Dolphins Tuatara 20(1):1-49.
BAKER, A.N.	1974	Pers.comm. Curator of Echinoderms, National Museum of New Zealand
BANKS, J.	1963	The Endeavour Journal of Joseph Banks J.C.Beaglehole Ed. Angus and Robertson
BARROW, T.	1959	An Archaic Type of Maori Hei-Tiki From the Wairarapa East Coast NZAA Newsletter 2(4): 6-7
BARROW, T.	1969	Maori Wood Sculpture of New Zealand A.H. and A.W.Reed
BARROW, T.	1972	Art and Life in Polynesia A.H. and A.W.Reed
BATES, T.E.	1969	The Whatarangi Formation (Lower Cretaceous), Aorangi Range, Wairarapa, New Zealand Transactions of the Royal Society of New Zealand: Geology 6(11):139-142
BELLWOOD, P.S.	1969	Excavations at Skippers' Ridge, Opito Bay, Coromandel Peninsula, North Island of New Zealand Archaeology and Physical Anthropology in Oceania 4(3):198-221
BELLWOOD, P.S.	1971	Archaeological Research at Lake Mangakaware, Waikato NZAA Newsletter 14(3):113-126

BELLWOOD, P.S. 1972 Excations at Otakanini Pa, South Kaipara Harbour
Journal of the Royal Society of New Zealand 2(3):259-291

BEST, E. 1901 Te Whanga-nui-a-Tara. Wellington in Pre-Pakeha Days
JPS 10: 107-165

BEST, E. 1905 Maori Eschatology: The whare potae (house of mourning) and its lore; ....
TNZI 38:148-239

BEST, E. 1916 Maori Storehouses and Kindred Structures
Dominion Museum Bulletin 5

BEST, E. 1924 The Maori
Polynesian Society Memoir 5. 2 Vols.

BEST, E. 1925 Maori Agriculture
Dominion Museum Bulletin 9.

BEST, E. 1942 Forest Lore of the Maori
Dominion Museum Bulletin 14.

BEST, E. 1952 The Maori as he was
N.Z.Government Printer

BEST, S.B. 1975 Adzes, Rocks and Men
Research essay, University of Auckland

BEU, A.G. 1967 Deep-water Pliocene Mollusca from Palliser Bay, New Zealand
Transactions of the Royal Society of New Zealand: Geology 5(3):89-122

BOWIE, D. 1972 Pers.comm.
Artefact Collector, Masterton.

BRAY, J.R. 1971 Vegetational Distribution, Tree Growth and Crop Success in Relation to Recent Climatic Change
pp 177-233
In: Advances in Ecological Research Vol. 7
J.B.Cragg Ed.
Academic Press

BREW, J.O.(Ed.) 1968 One Hundred Years of Anthropology
Harvard University Press

BRODIE, J.W. 1973 The Ocean Environment
pp 61-92
In: Williams, 1973 q.v.

BROTHWELL, D. and E.HIGGS (Eds.)	1969	*Science in Archaeology* Thames and Hudson
BRYDEN, M.M.	1972	Body Size and Composition of Elephant Seals; absolute measurements and estimates from bone dimensions *Journal of Zoology* 167:265-276
BUCK, P.	1962	*The Coming of the Maori* Whitcombe and Tombs Ltd.
BUIST, A.G.	1961	Taranaki Archaic Artefacts *NZAA Newsletter* 4(4):17-18
BUTZER, K.W.	1971	*Environment and Archaeology* Methven
BYRNE, D.R.	1973	*Prehistoric Coprolites* Unpublished MA Thesis, Anthropology, University of Auckland
CAIRNS, K.R.	1959a	A Hangi Site at Glenburn *NZAA Newsletter* 2(4):26
CAIRNS, K.R.	1959b	Work in the Wairarapa *NZAA Newsletter* 2(4):19-20
CAIRNS, K.R.	1960	Fieldwork, Wairarapa *NZAA Newsletter* 3(4):24
CAIRNS, K.R.	1961	Wairarapa District *NZAA Newsletter* 4(4):22-24
CAIRNS, K.R.	1971	Rediscovering the Wairarapa *Wairarapa Times Age* Feb 19, p.14
CHAPLIN, R.E.	1971	*The Study of Animal Bones from Archaeological Sites* Seminar Press
CHILDE, V.G.	1935	Changing Methods and Aims in Prehistory *Proceedings of the Prehistoric Society* 1(1):1-15
CLARK, J.G.D.	1954	*Excavations at Star Carr* Cambridge University Press
CLARKE, D.L.	1968	*Analytical Archaeology* Methven
CLARKE, D.L. (Ed.)	1972	*Models in Archaeology* Methven
CLIMO, F.M.		Pers.comm. Curator of Molluscs, National Museum of New Zealand

COAKLEY, A.	1973	A Study in the Conservation of Elephant Fish (*Callorynchus millii*, Bory) in New Zealand *Fisheries Technical Report* 126
COAKLEY, A.	n.d.	The Biological and Commercial Aspects of the Elephant Fish 1: The Commercial Fishery *Fisheries Technical Report* 76
COCKAYNE, L.	1921	*The Vegetation of New Zealand* Germany
COLENSO, W.	1879	On the Moa *TNZI* 12:63-108
COOK, J.	1968	*The Journals of James Cook:* Vol 1, The Voyage of the Endeavour 1768-1771, J.C.Beaglehole Ed. Cambridge University Press
COOK, J.	1969	*The Journals of James Cook:* Vol 2, The Voyage of the Resolution and Adventure 1772-1775 Cambridge University Press
COOMBS, R.	1974	Crayfish *New Zealand Nature Heritage* 2(26:725-732; 27:740-745)
COUTTS, P.J.F. and M.JURISICH	1973	Canine Passengers in Maori Canoes *World Archaeology* 5(1):71-85
CRESSWELL, P., G.HAMEL and B.F.LEACH	n.d.	Landsnails and Vegetation in Palliser Bay *In*: Leach and Leach n.d. q.v.
CREWE, N.	n.d.	Diary of Fish Catches in Palliser Bay in 1957. Manuscript
CROSBY, E.	1963	Preliminary Report on Whiritoa *NZAA Newsletter* 6(1):46-49
CUMBERLAND, K.B.	1949	Aotearoa Maori: New Zealand about 1780 *Geographical Review* 39:401-424
DANIEL, G.	1968	One Hundred Years of Old World Prehistory pp 57-93 *In*: Brew 1968 q.v.
DANIELSSON, B.	1967	Kia Ora Keneti pp 1-36 *In*: Highland et al 1967 q.v.

DAVIDSON, J.M. 1969 Excavation of a Coastal Midden Deposit, SU-LO-1
pp 224-252
In: Green and Davidson 1949 q.v.

DAVIDSON, J.M. 1970a Excavation of an "Undefended" Site, N38/37, on Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus. 7:31-60

DAVIDSON, J.M. 1970b Survey of Archaeological Sites on Motutapu Island
Rec.Auck.Inst.and Mus. 7:1-12

DAVIDSON, J.M. 1970c Notes on Artifacts from Site N38/24
Rec.Auck.Inst.and Mus. 7:24-30

DAVIDSON, J.M. 1971a Archaeology on Nukuoro Atoll
Auckland Institute and Museum Bulletin No.9

DAVIDSON, J.M. 1971b Early Man in New Zealand
New Zealands Heritage 1(2):29-32

DAVIDSON, J.M. 1972 Archaeological Investigations on Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus. 9:1-14

DAVIDSON, J.M. 1974a Radiocarbon Dates from the Sunde Site (N38/24), Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus. 11:9-10.

DAVIDSON, J.M. 1974b Further Identifications of Sources of Obsidian Flakes from N38/37 on Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus. 11:11-12

DAVIDSON, J.M. 1974 Pers.comm.
Archaeologist, Auckland Institute and Museum.

DAVIDSON, J.M. n.d. The Excavation of Skipper's Ridge (N40/7), Opito, Coromandel Peninsula, in 1959 and 1960. Manuscript

DAVIS, S. 1957 Evidence of Maori Occupation in the Castlepoint Area
JPS 66:199-203

DAVIS, S. 1959 A Summary of Field Archaeology from the Dominion Museum Group
NZAA Newsletter 2(4): 15-19

DAVIS, S. 1962 Makara Beach (Wellington) Excavation
NZAA Newsletter 5(3): 145-150

DAWSON, E.W. and J.C. YALDWYN 1952 Excavation of Maori Burials at Long Beach, Otago. Part II
JPS 61:283-91

DELL, R.K. 1956a Some New Zealand Subfossil Land Mollusca
Records Dominion Museum 2 (3):135-44

DELL, R.K. 1956b The Archibenthal Mollusca of New Zealand
Dominion Museum Bulletin 18

DELL, R.K. 1963 Archibenthal Mollusca from Northern New Zealand
Transactions of the Royal Society of New Zealand: Zoology 3(20):205-216

DOAK, W. 1972 *Fishes of the New Zealand Region*
Hodder & Stoughton

DOLE, G.E. and R.L.CARNEIRO (Eds.) 1960 *Essays in the Science of Culture*
New York

DOOGUE, R.B. and J.M.MORELAND 1966 *New Zealand Sea Anglers' Guide*
A.H. and A.W.Reed

DRUCE, A.P. 1971 The Flora of the Aorangi Range, Southern Wairarapa
Wellington Botanical Society Bulletin 37: 4-29

DUFF, R.S. 1942 Moa-hunters of the Wairau
Records of the Canterbury Museum 5:1-43

DUFF, R.S. 1946 Native Quarries of Baked Argillite
Records of the Canterbury Museum 5 (2):115-124

DUFF, R.S. 1956 *The Moa-Hunter Period of Maori Culture*
N.Z.Government Printer

DUFF, R.S. 1961 Excavation of House-Pits at Pari-Whakatau Pa, Claverly, Marlborough
Records of the Canterbury Museum 7: 269-302

DUGDALE, J.S. 1973 Pers.comm.
Entomology Division, D.S.I.R.Nelson

D'URVILLE, D. 1950 *New Zealand 1826-1827*
Translated by Olive Wright, Wingfield Press

EMORY, K.P. and Y.H.SINOTO 1964 Eastern Polynesian Burials at Maupiti
JPS 73(2):143-160

EVANS, J.G.	1972	Land Snails in Archaeology Seminar Press
EVANS-PRITCHARD, E.E.	1940	The Nuer Oxford
EVANS-PRITCHARD, E.E.	1961	Anthropology and History, A Lecture delivered in the University of Manchester Manchester
EYLES, J.R.	1975	Rakautara - a cave site on the Kaikoura Coast (S49/3) NZAA Newsletter 18(3):132-139
FAGAN, B.M.	1972	In the Beginning: An Introduction to Archaeology Little, Brown & Co.
FALL, M.W., A.B.MEDINA and W.B.JACKSON	1971	Feeding Patterns of Rattus rattus and Rattus exulans on Eniwetok Atoll, Marshall Islands Journal of Mammalogy 52(1):69-76
FIRTH, R.	1957	We, the Tikopia Allen & Unwin
FIRTH, R.	1959	Economics of the New Zealand Maori N.Z.Government Printer
FLEMING, C.A.	1957	The Genus Pecten in New Zealand New Zealand Geological Survey, Paleontological Bulletin 26.
FLEMING, C.A.	1966	Marwick's Illustrations of New Zealand Shells, with a checklist of New Zealand Cenozoic Mollusca New Zealand DSIR Bulletin 173
FOX, A.	1974	Prehistoric Maori Storage Pits: Problems in Interpretation JPS 83(2):141-154
FREEMAN, J.D. and W.R.GEDDES (Eds.)	1959	Anthropology in the South Seas Thomas Avery, New Plymouth
GASKIN, D.E.	1968	The New Zealand Cetacea Fisheries Research Bulletin 1 (NS)
GASKIN, D.E.	1972	Whales Dolphins and Seals: with special reference to the New Zealand Region Heinemann Educational Books
GATHERCOLE, P., B.F.LEACH and H.M.LEACH (Eds.)	1974	Comparatively Speaking: Studies in Pacific Material Culture 1921-1972 Otago University Press

GIBB, J.A. and J.E.C.FLUX	1973	Mammals pp 334-371 In: Williams, 1973 q.v.
GILL, L.T.	1929	The Rat that does not gnaw Nature Magazine 14:278-280
GOLSON, J.	1959	Culture Change in Prehistoric New Zealand pp 29-74 In: Freeman and Geddes 1959 q.v.
GOLSON, J.	1960	Archaeology, Tradition, and Myth in New Zealand Prehistory JPS 69(4):380-402
GOLSON, J.	1961	Investigations at Kauri Point, Katikati, Western Bay of Plenty NZAA Newsletter 4(2):13-41
GOLSON, J.	1965	Some Considerations of the role of Theory in New Zealand Archaeology NZAA Newsletter 8(2):79-92
GOLSON, J.	1969	Excavations at SU-VA-1 pp 108-113 In: Green and Davidson 1969 q.v.
GOODYEAR, F.H.	1971	Archaeological Site Science Heinemann
GORBEY, K.	1967	Climatic Change in New Zealand Archaeology NZAA Newsletter 9(2):74-76
GRAHAM, D.H.	1953	A Treasury of New Zealand Fishes A.H. and A.W.Reed
GRANT-TAYLOR, T.L.	1974	Letter to the Editor NZAA Newsletter 17(3):146-148
GREEN, R.C.	1963a	A Review of the Prehistoric Sequence of the Auckland Province Publication of the Auckland Archaeological Society No.1
GREEN, R.C.	1963b	Summaries of Sites at Opito, Sarah's Gully, and Great Mercury Island NZAA Newsletter 6(1):57-69
GREEN, R.C.	1963c	An undefended Settlement at Kauri Point, Tauranga District Whakatane and District Historical Society Historical Review 11(3):143-156

GREEN, R.C.	1964	Sources, Ages and Exploitation of New Zealand Obsidian: an interim report NZAA Newsletter 7(3):134-143
GREEN, R.C.	1966	Linguistic Subgroupings within Polynesia: The implications for Prehistoric Settlement JPS 75(1):6-38
GREEN, R.C.	1970	A Review of the Prehistoric Sequence in the Auckland Province 2nd ed. Edited by B.F.Leach University Bookshop, Dunedin
GREEN, R.C.	1972	Moa-hunters, Agriculture and Changing Analogies in New Zealand Prehistory NZAA Newsletter (15 (1):16-39
GREEN, R.C.	1974	Adaptation and Change in Maori Culture Reprint of an article to the published In: Biogeography and Ecology in New Zealand G.Kuschel (Ed.), W.Junk.
GREEN, R.C.	1975	Pers.comm. Professor of Anthropology, University of Auckland
GREEN, R.C., R.R.BROOKS and R.D.REEVES	1967	Characterization of New Zealand Obsidians by Emission Spectroscopy New Zealand Journal of Science 10 (3): 675-682
GREEN, R.C. and J.M.DAVIDSON (Eds.)	1969	Archaeology in Western Samoa I Auckland Institute and Museum Bulletin 6
GREEN, R.C. and J.M.DAVIDSON (Eds.)	1974	Archaeology in Western Samoa II Auckland Institute and Museum Bulletin 7
GREEN, R.C. and K.GREEN	1963	Classic and Early European Maori Sites on the Hauraki Plains NZAA Newsletter 6(1):27-34
GREEN, R.C. and N.KELLY (Eds.)	1970, 1971	Studies in Oceanic Culture History Vol 1 Pacific Anthropological Records 11 Vol 2 Pacific Anthropological Records 12
GREEN, R.C., K.GREEN, R.A.RAPPAPORT, A.RAPPAPORT, and J.M.DAVIDSON	1967	Archaeology on the Island of Mo'orea, French Polynesia Anthropological Papers of the American Museum Natural History 51(2)

GREEN, R.C. and W.SHAWCROSS	1962	The Culture Sequence of the Auckland Province NZAA Newsletter 5(4):210-220
GROUBE, L.M.	1967	Models in New Zealand: A Consideration of the New Zealand Evidence Archaeology and Physical Anthropology in Oceania 2(1):1-27
GROUBE, L.M.	1969	From Archaic to Classic Maori Auckland Student Geographer 6:1-11
GROUBE, L.M.	1970	The Origin and Development of Earthwork Fortifications in the Pacific, pp 133-164 In: Green and Kelly 1970, 1971 q.v.
HAAST, J. VON	1871	Moas and Moa-Hunters TNZI 4:66-107
HAMILTON, A.	1892	Notes on Maori Necklaces TNZI 25:491-493
HAMILTON, A.	1901	The Art Workmanship of the Maori Race in New Zealand N.Z.Institute, Dunedin
HAMILTON, A.	1908	Fishing and Sea-Foods of the Ancient Maori Dominion Museum Bulletin No.2
HANDY, E.S.C.	1940	The Hawaiian Planter Bishop Museum Bulletin 161
HARRISON, W.J.	1920	Moa bones from Martinborough New Zealand Journal of Science and Technology 3:156
HARROWFIELD, D.L.	1969	A Study of the Types and Distribution of Archaeological Sites on Banks Peninsula, Canterbury NZAA Newsletter 12(2):94-102
HEAPHY, C.	1846	Account of an Exploring Expedition to the South-west of Nelson pp 188-249 In: Taylor, N.M. 1959 q.v.
HEAPHY, C.	1879	Notes on Port Nicholson and the Natives in 1839 TNZI 12:32-39
HECTOR, J.	1872	Notes on the edible fishes of New Zealand pp 95-133 In: Hutton, F.W. 1872 q.v.

HENDY, C.H. and A.T.WILSON 1968 Palaeoclimatic data from Speleothems. Nature 219:48-51

HIGGS, E.S. (Ed.) 1972 Papers in Economic Prehistory. Cambridge University Press

HIGGS, E.S. (Ed.) 1975 Palaeoeconomy. Cambridge University Press

HIGHAM, C.F.W. 1968 Prehistoric Research in Western Southland. NZAA Newsletter 11(4):155-164

HIGHLAND, G.A., R.W.FORCE, A.HOWARD, M.KELLY and Y.H.SINOTO (Eds.) 1967 Polynesian Culture History. Bishop Museum Press

HITCHINGS, M. and M. O'ROURKE n.d. Site Survey Fieldbook: Eastern Wairarapa. MS.

HJARNO, J. 1967 Maori Fish-hooks in Southern New Zealand. Records of the Otago Museum Anthropology No.3

HODSON, F.R., D.G.KENDALL and P. TAUTU (Eds.) 1971 Mathematics in the Archaeological and Historical Sciences. Edinburgh University Press

HOLE, F. and R.F.HEIZER 1973 An Introduction to Prehistoric Archaeology. Holt, Rinehart and Winston

HOSKING, T. 1962 Report on Excavation of Whakamoenga Cave, Lake Taupo. NZAA Newsletter 5(1):22-30

HOUGHTON, P. and P. de SOUZA 1975 Discriminant Function Sexing of Prehistoric New Zealand Skeletal Material from Lengths of Long Bones. JPS 84(2):225-229

HOUGHTON, P. 1975 Pers.comm. Anatomy Department, Otago Medical School

HOUGHTON, P. n.d. The People of Wairau Bar. Mimeographed Report 22p. Anatomy Department, Otago Medical School

HUTTON, F.W. 1872 Fishes of New Zealand. Catalogue with diagnoses of the species. Colonial Museum, Wellington

HUTTON, F.W. 1873 *Catalogue of the Tertiary Mollusca and Echinodermata of New Zealand, in the Collection of the Colonial Museum* N.Z.Government Printer

HUTTON, F.W. 1875 Notes on the Maori cooking places at the mouth of the Shag River *TNZI* 8:103-108

HUTTON, F.W. 1877 Note on the Maori Rat *TNZI* 9:348

ISHIZUKI, K. 1968 A Preliminary report on the Folasa-a-lalo excavations *NZAA Newsletter* 11(1):50-56

JACKSON, J.E. 1956 Quality Control Methods for Two Related Variables *Industrial Quality Control* 12(7):4-8

JOLLY, R. and R.C.GREEN 1963 Beach Middens on the Coromandel Coast *NZAA Newsletter* 5(1):41-43

JOLLY, R.G.W. and P.MURDOCK 1973 Further Excavations at Site N40/2, Opito Bay *NZAA Newsletter* 16(2):66-70

JONES, A. 1962 Sites on the North-East Coast of Banks Peninsula *NZAA Newsletter* 5(2):112-116

JONES, K. 1973 Excavations at Tairua (N44/2) 1958-64: A Synthesis *NZAA Newsletter* 16(4):143-150

KEYES, I.W. 1960 The Cultural Succession and Ethnographic Features of D'Urville Island *JPS* 69(3):239-265

KEYES, I.W. 1961 The Age of the Quarry Sites on D'Urville Island *NZAA Newsletter* 4(4):30-32

KEYES, I.W. 1969 Maori Utilisation of drifted limestone from the South Wellington Coastline *NZAA Newsletter* 12(2):103-107

KEYES, I.W. 1970 Wairarapa Chert Sources in New Zealand Prehistory *NZAA Newsletter* 13(3):128-34

KEYES, I.W. 1972 A further source of Chert in the Wairarapa *NZAA Newsletter* 15(2):57-58

KEYES, I.W. 1975 The D'Urville Island-Nelson Metasomatised Rocks and their significance in New Zealand Prehistory Whakatane and District Historical Society Historical Review 23(1):1-17

KEYES, I.W. 1975 Pers.comm. N.Z.Geological Survey

KERRICH, J.E. and D.L.CLARKE 1967 Notes on the Possible Misuse and errors of Cumulative Percentage Frequency Graphs for the Comparison of Prehistoric Artefact Assemblages Proceedings of the Prehistoric Society 33:57-69

KING, L.C. 1934 Tertiary Molluscan Faunas from the Southern Wairarapa TNZI 63:334-354

KINSKY, F.C. 1970 Annotated Checklist of the Birds of New Zealand A.H. and A.W.Reed

KNOX, G.A. (Ed.) 1969 The Natural History of Canterbury A.H. and A.W.Reed

LAW, R.G. 1969 Pits and Kumara Agriculture in the South Island JPS 78(2):223-251

LAW, R.G. 1970 A file manufacturing technique NZAA Newsletter 13(2):84-85

LAW, R.G. 1972 Archaeology at Harataonga Bay, Great Barrier Island Rec.Auck.Inst.and Mus. 9:81-123

LAW, R.G. 1973 Tokoroa Moa-Hunter Site, N75/1 NZAA Newsletter 16(4):150-164

LAW, R.G. 1974 C14 Date List - Eastern Polynesia 17 pp Mimeographed

LAW, R.G. 1975 C14 Dates from Harataonga Bay, Great Barrier Island NZAA Newsletter 18(1):48-52

LEACH, B.F. 1969 The Concept of Similarity in Prehistoric Studies: A test case using New Zealand Stone Flake Assemblages Studies in Prehistoric Anthropology Vol 1, Anthropology Department, University of Otago

LEACH, B.F. 1970 Foreword to Second Edition of Green, 1970 q.v.

LEACH, B.F.	1972	Multi-sampling and Absolute Dating Methods: a problem of statistical combination for archaeologists NZAA Newsletter 15(3):113-116
LEACH, B.F.	1973	Obsidian in the Chatham Islands NZAA Newsletter 16(3):104-106
LEACH, B.F.	n.d.	The Bones of Rattus exulans from the Washpool Midden Site N168-9/22 MS
LEACH, B.F. and A.J.ANDERSON	1974	The Transformation from an Estuarine to Lacustrine environment in the Lower Wairarapa Journal of the Royal Society of New Zealand 4(3):267-275
LEACH, B.F. and H.M.LEACH	1971a	Radiocarbon Dates for the Wairarapa - I NZAA Newsletter 14(4):199-200
LEACH, B.F. and H.M.LEACH	1971b	Radiocarbon Dates for the Wairarapa - II NZAA Newsletter 14(4):201
LEACH, B.F. and H.M.LEACH	1972a	Radiocarbon Dates for the Wairarapa - III NZAA Newsletter 15(2):70
LEACH, B.F. and H.M.LEACH	1972b	Radiocarbon Dates for the Wairarapa - III NZAA Newsletter 15(4):163
LEACH, B.F. and H.M.LEACH (Eds.)	n.d.	The Archaeology of the Wairarapa In Preparation
LEACH, B.F. and G.M.MASON	n.d.	Seaweed holdfasts as ecological indicators MS
B.F.LEACH and D.G.SUTTON	1972	Report on a Prehistoric Burial from Tiwai Point, Southland 24 pp Mimeographed, Anthropology Department, University of Otago
LEACH, H.M.	1969	Subsistence Patterns in Prehistoric New Zealand Studies in Prehistoric Anthropology Vol 2, Anthropology Department, University of Otago
LEACH, H.M.	1972	The Hearth as an Archaeological Feature in New Zealand NZAA Newsletter 15(2):59-75
LEACH, H.M.	1975	Pers.comm. Lecturer in Anthropology, University of Otago

LEACH, H.M. 1976 Horticulture in Prehistoric New Zealand: An Investigation of the Function of the Stone Walls of Palliser Bay
Unpublished Ph.D.Thesis, Anthropology, University of Otago

LEACH, H.M. n.d. Kawakawa Burial Salvage Excavation
MS

LEAHY, A. 1970 Excavations at Site N38/30, Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus. 7:61-82

LEAHY, A. 1972 Further Excavations at Site N38/30, Motutapu Island, New Zealand
Rec.Auck.Inst.and Mus.9:15-26

LEAHY, A. 1974 Excavations at Hot Water Beach (N44/69), Coromandel Peninsula
Rec.Auck.Inst.and Mus. 11:23-76

LEWTHWAITE, G.R. 1964 Man and Land in early Tahiti
Pacific Viewpoint 5(1):11-34

LOCKERBIE, L. 1959 From Moa-Hunter to Classic Maori in Southern New Zealand.
pp 75-110
In: Freeman and Geddes 1959 q.v.

McCULLOCH, B. and M.M.TROTTER 1975 The First Twenty Years. Radiocarbon Dates for South Island Moa-Hunter Sites, 1955-74
NZAA Newsletter 18(1):2-17

McFADGEN, B.G. 1972 Palaeoenvironmental Studies in the Manawatu Sand Plain with particular reference to Foxton
Unpublished MA Thesis, Anthropology, University of Otago

McFADGEN, B.G. 1975 Pers.comm.
Geology Department, Victoria University of Wellington

McFADGEN, B.I. 1975 Pers.comm.
Ethnologist, National Museum of New Zealand

MACKAY, A. 1871 The Traditionary History of the Natives of the South Island up to the Time of their Conquest by the Northern Tribes under Te Rauparaha
pp 37-53
In: McKay, A. 1873 q.v.

MACKAY, A.(Ed.) 1872 A Compendium of Official Documents Relative to Native Affairs
Volume 2
Luckie and Collins, Nelson

MACKAY, ALEXANDER (Ed.) 1873 A Compendium of Official Documents relative to Native Affairs in the South Island
Volume 1
N.Z.Government Printer

MACKAY, A. 1891 Claims of Natives to Wairarapa Lakes and adjacent Lands
Appendix to the Journal of the New Zealand House of Representatives
G4:pp1-71

MacKAY, J.A. 1966 Historic Poverty Bay and the East Coast, North Island, New Zealand
J.G.MacKay, Gisborne

McKINLAY, J. 1975 Pers.comm.
The Archaeologist, N.Z.Historic Places Trust

McLEOD, H.N. 1902 Caves in the Martinborough District & Moa bones found therein
TNZI 34:562-3

MAIR, G. 1870 Notes on the Chatham Islands and their inhabitants
TNZI 3:311-13

MAIR, G.M. 1972 The Protohistoric Period of Wairarapa Culture History
Unpublished MA (Hons)Thesis, Anthropology, University of Otago

MANLY, B.F.J. 1975 Pers.comm.
Senior Lecturer in Mathematics, University of Otago

MARKHAM, E. 1963 New Zealand or Recollections of it
Edited by E.H.McCormick
N.Z.Government Printer, Wellington

MARPLES, R.R. 1955 Rattus exulans in Western Samoa
Pacific Science 9:171-6

MASON, R. 1973 Pers.comm.
Botany Division, DSIR, Christchurch

MASON, G. 1975 Pers.comm.
Anthropology Technician, University of Otago

MEAD, S.M. 1969 *Traditional Maori Clothing*: A study of Technological and functional change A.H. and A.W.Reed

MEHL, J.A.P. 1971 Spawning and length-weight of barracouta (*Teleosti*: *Gempylidae*) from eastern Cook Strait *NZJMFR* 5(2):300-317

MILLAR, D.G.L. 1964 Preliminary Report on an Archaic Site at Tahunanui, Nelson *NZAA Newsletter* 7(3):120-123

MILLAR, D.G.L. 1967 Recent Archaeological Excavations in the Northern Part of the South Island *Journal of the Nelson Historical Society* 11 (2):5-12

MILLAR, D.G.L. 1971 Excavation of an Archaic Site at Tahunanui, S20/2, Nelson *NZAA Newsletter* 14(4):161-172

MILLAR, D.P. 1971 Whalers, Flax Traders and Maoris of the Cook Strait Area *Dominion Museum Records in Ethnology* 2(6):57-74

MITCALFE, B. 1968a Flat Point - Glenburn Site Survey: Queen's Birthday weekend 1968 June 1-3 Mimeographed Notes, Wellington Teachers College

MITCALFE, B. 1968b White Rock - Te Awaiti Site Survey: 11-13 July, 1968 Mimeographed Notes, Wellington Teachers College

MITCALFE, B. 1968c White Rock Site Survey: August 26-29, 1968 Mimeographed Notes, Wellington Teachers College

MITCALFE, B. 1968d Castlepoint - Mataikona: Preliminary Field Report Sept 13-15, 1968 Mimeographed Notes, Wellington Teachers College

MITCALFE, B. 1968e Wairarapa Coastal Survey: Vegetation Mimeographed, Wellington Teachers College

MITCALFE, B. 1968f The Wairarapa Coastline: One Hundred Miles and a Thousand Years Away *Te Kaunihera Maori*, Spring 1968:25-33

MITCALFE, B.	1969	The Significance of Karaka in an Assessment of Pre-European Land Utilisation in New Zealand NZAA Newsletter 12(4):184-188
MITCALFE, B.	n.d.	Towards a Regional Definition of Maori New Zealand: Coastal Wairarapa 33p. Mimeographed Paper, Wellington Teachers College
MITCHELL, J.H.	1944	Takitimu A.H. and A.W.Reed
MOORE, L.B. and E.EDGAR	1970	Flora of New Zealand, Volume II Government Printer, Wellington
MOORE, P.	1974	Pers.comm. Geologist, New Zealand Geological Survey
MOLLOY, B.P.J.		Pers.comm. Botany Division, DSIR, Christchurch
MONKHOUSE, W.B.	1968	Journal of William Brougham Monkhouse pp 564-587 In: Vol 1, The Voyage of the Endeavour 1768-1771, J.C.Beaglehole (Ed.) Cambridge University Press
MORELAND, J.M.		Pers.comm. Curator of Fishes, National Museum of New Zealand
MORONEY, M.J.	1956	Facts from Figures Penguin
MORTON, J. and M.MILLER	1968	The New Zealand Sea Shore Collins
MORWOOD, M.J.	1974	A Functional Analysis of Obsidian Flakes from Three Archaeological Sites on Great Barrier Island and One at Tokoroa Rec.Auck.Inst.and Mus.11:77-99
MURDOCK, R.T.	1963	Oterewa Pa, Kopuarahi NZAA Newsletter 6(1):69-72
MURDOCK, C.J. and R.G.W.JOLLY	1967	An Excavation at Opito Bay NZAA Newsletter 10(4):157-166
NEWMAN, S.	1972	Two Early Hawaiian Field Systems on Hawaii Island JPS 81(1):87-89

NICHOLLS, M.P. 1964 Excavations on Ponui Island
Rec.Auck.Inst.and Mus. F(1):23-38

OLIVER, W.R.B. 1949 The Moas of New Zealand and Australia
Dominion Museum Bulletin No 15

OPPENHEIM, R.S. 1973 Maori Death Customs
A.H. and A.W.Reed

ORCHISTON, D.W. 1972 Maori Neck and Ear Ornaments of the 1770's: a Study of Protohistoric Ethno-Archaeology
Journal of the Royal Society of New Zealand 2(1):91-107

PALMER, J.B. 1956 Notes on Maori Sites in Eastern Wellington Harbour
JPS 65:342-355

PALMER, J.B. 1959 Maori Sites in Queen Charlotte Sound
NZAA Newsletter 2(4):12-15

PALMER, J.B. 1961 Some Aspects of N.Z.Field Archaeology
JPS 70:466-470

PARK, G.N. 1970 A Maori Oven site in the Tararua Range, New Zealand
NZAA Newsletter 13(4):191-197

PARK, G.S. 1969 Tiwai Point - A Preliminary Report
NZAA Newsletter 12(3):143-146

PARK, G.S. 1971 Chemical Analysis in Archaeology
NZAA Newsletter 14(4):173-178

PARK, G.S. 1975 Pers.comm.
Anthropologist, Otago Museum

PARKER, R.H. 1962 Aspect and Phase on Skipper's Ridge (Opito) and Kumara - Kaiamo (Urenui)
NZAA Newsletter 5(4):222-232

PARKER, T.J. and W.A.HASWELL 1960, 1962 A Text-Book of Zoology: 2 Vols.
MacMillan and Co.

PARROT, A.W. 1957 Sea Angler's Fishes of New Zealand
Hodder and Stoughton

PARROTT, A.W. 1958 Big Game Fishes and Sharks of New Zealand
Hodder and Stoughton

PARROTT, A.W. 1960 The Queer and the Rare Fishes of New Zealand
Hodder and Stoughton

PAUL, L.J.	1974	Marine Fish: The Snapper New Zealand's Nature Heritage 2(24): 671-676
PETERS, K.M.	1971	Excavations at Lake Mangakaware Site 1, N65/28 NZAA Newsletter 14(3):127-140
PHILLIPPS, W.J.	1948	An Introduction to the Study of Tattooing Chisels of the Maori with Notes on Tattoo Dominion Museum Records in Ethnology 1(3):113-120
PIETRUSEWSKY, M.	1969	The Physical Anthropology of early Tongan populations Unpublished Ph.D Thesis, University of Toronto Microfilm, Otago University Library
POATA, T.R.	1919	The Maori as a fisherman and his methods W.B.Scott & Sons, Opotiki Also Reprinted Te Aroha News 1929
POPPER, K.R.	1972	Conjectures and Refutations: the Growth of Scientific Knowledge Routledge and Kegan Paul
POWELL, A.W.B.	1951	Native Animals of New Zealand Unity Press Ltd., Auckland
POWELL, A.W.B.	1961	Shells of New Zealand Whitcombe and Tombs Ltd.
POYNTER, J.B. (trans.)	1933	Maori fishing calendar pp 130-2 of Echoes of the Pa - "Proceedings of Tairawhiti Maori Assoc. for 1931-1932" Gisborne
PRICKETT, K.E.	1975	The Prehistoric Exploitation and Knowledge of Geological Resources in Southern Wairarapa Unpublished MA Thesis Anthropology, University of Otago
PRICKETT, K.E.	1975	Pers.comm. c/- Taranaki Museum, Private Bag, New Plymouth
PRICKETT, K.E.	n.d.	Tables of Lithic Materials from Prehistoric Sites in Palliser Bay Mimeographed, Anthropology Department, Otago University

PRICKETT, N.J.	1974	Houses and House Life in Prehistoric New Zealand Unpublished MA Thesis Anthropology, University of Otago
PRICKETT, N.J., K.PRICKETT and A.J.ANDERSON	n.d.	Pararaki Salvage Report Mimeographed, Anthropology Department, University of Otago
PRICKETT, N.J. and K.E.WALLS	1973	<u>D'Urville Island Archaeological Survey</u> 1973 Department of Lands and Survey, Nelson
RENFREW, C. (Ed.)	1973	<u>The Explanation of Culture Change:</u> Models in Prehistory Duckworth
REYMENT, R.A.	1971	<u>Introduction to Quantitative Paleoecology</u> Elsevier, Amsterdam
RITCHIE, N.	n.d.	A Contribution towards the characterisation of N.Z.Greenstone Sources MA Anthropology thesis, University of Otago. In preparation
ROBERTON, J.B.W.	1956	Genealogies as a basis for Maori Chronology <u>JPS</u> 65:45-54
ROBINSON, D.W.	1961	A Second Archaic Site Near Hawera <u>NZAA Newsletter</u> 4(4):15-16
ROBSON, C.H.	1876	Further Notes on Moa Remains <u>TNZI</u> 9:279-280
ROSENBAUM, S.	1959	A Significance chart for Percentages <u>Applied Statistics</u> 8(1):45-52
ROTHSCHILD, LORD	1961	<u>A Classification of Living Animals</u> Longmans
ROWE, N.	1969	An Archaeological Assemblage from Houhora, Northland Unpublished MA Thesis, Anthropology, University of Auckland
ROWLAND, M.J.	n.d.	Cellana denticulata in middens on the Coromandel Coast: - Possibilities for a temporal horizon MS Anthropology Department, University of Auckland
RUTLAND, J.	1894	Traces of Ancient Human Occupation in the Pelorus District, Middle Island, New Zealand <u>JPS</u> 3(4):220-232

RUTLAND, J. 1897 On Ancient Pit Dwellings of the Pelorus District, South Island, N.Z. JPS 6(2):77-84

SAUNDERS, T.V. 1965 The eels of Lake Wairarapa Te Ao Hou, 51:36-38

SCARLETT, R.J. 1958 A Dentalium Shell Necklace 'Workshop' JPS 67(1):75

SCARLETT, R.J. 1960a Conference Report 1960 NZAA Newsletter 3(3):3-11

SCARLETT, R.J. 1960b Excavations at Pari Whakatau, Claverly NZAA Newsletter 4(1):2-7

SCARLETT, R.J. 1973 Pers.comm. Osteologist, Canterbury Museum

SCOTT, S.D. 1970 Excavations at the 'Sunde Site', N38/24, Motutapu Island, New Zealand Rec.Auck.Inst.and Mus.7:13-30

SHAND, A. 1897 The Moriori People of the Chatham Islands JPS 6:161-168

SHAPIRO, H.L. 1940 Physical Anthropology of the Maori-Moriori JPS 49:1-15

SHAWCROSS, W. 1964a An Archaeological Assemblage of Maori Combs JPS 73(4):382-398

SHAWCROSS, W. 1964b Stone Flake Industries in New Zealand JPS 73(1):7-25

SHAWCROSS, W. 1964c Archaeological Investigations at Ongari Point, Katikati, Bay of Plenty. A report on the first season of excavations. NZAA Newsletter 7(2):79-98

SHAWCROSS, W. 1966 Ongari Point - Second Season NZAA Newsletter 9(2):53-71

SHAWCROSS, W. 1967 An Investigation of Prehistoric Diet and Economy on a Coastal Site at Galatea Bay, New Zealand Proceedings of the Prehistoric Society 33:107-131

SHAWCROSS, F.W. and J.E.TERRELL	1966	Paterangi and Oruarangi Swamp Pas JPS 75(4):404-429
SHERRIN, R.A.A.	1886	Handbook of the fishes of New Zealand Wilson and Horton
SHORTLAND, E.	1844	General condition of the Natives of the Middle Island pp 123-126 In: Mackay, A. 1872 q.v.
SHORTLAND, E.	1851	The Southern Districts of New Zealand Longman
SIMMONS, D.R.	1967	Little Papanui and Otago Prehistory Records of the Otago Museum, Anthropology 4.
SIMMONS, D.R.	1968	The Lake Hauroko Burial and the Evolution of Maori Clothing Records of the Otago Museum, Anthropology 5
SIMMONS, D.R.	1970	Regional Traditions and Material Culture in New Zealand: An Attempt at a Culture History Unpublished Notes of Lectures given to University Extension Classes 1970, Auckland Institute and Museum
SIMMONS, D.R.	1971	Regional Traditions and Culture History NZAA Newsletter 14(3):92-97
SIMMONS, D.R.	1973	Suggested Periods in South Island Prehistory Rec.Auck.Inst.and Mus.10:1-58
SINGLETON, R.J.	1972	New Zealand Fur Seals at Three Kings Islands NZJMFR 6(4):649-650
SINOTO, Y.H. and M.J.KELLUM	1965	Preliminary Report on Excavations in the Marquesas Islands, French Polynesia Mimeographed, Bishop Museum
SINOTO, Y.H.	1966	A Tentative Prehistoric Cultural Sequence in the Northern Marquesas Islands JPS 75(3): 287-303
SINOTO, Y.H.	1970	An Archaeologically based assessment of the Marquesas as a dispersal centre in East Polynesia pp 105-132 In: Green and Kelly, 1970 q.v.

SISSON, S. and J.D.GROSSMAN | 1953 | The Anatomy of the Domestic Animals
W.B.Saunders Co.

SKINNER, H.D. | 1914 | An Ancient Maori Stone Quarry
TNZI 46:324-9

SKINNER, H.D. | 1923 | The Morioris of the Chatham Islands
Bishop Museum Memoir 9(1)

SKINNER, H.D. | 1924 | Results of Excavations at the Shag River Sandhills
JPS 33:11-24

SKINNER, H.D. | 1942 | A Classification of the Fish-Hooks of Murihiku with Notes on Allied Forms from Other Parts of Polynesia
JPS 51:208-21, 256-86

SKINNER, H.D. | 1959 | Murdering Beach Collecting and Excavating: The first Phase 1850-1950
JPS 68:219-238

SKINNER, H.D. | 1974a | Maori Adzes from the Murihiku Region, New Zealand
pp 101-114
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D. | 1974b | Maori Amulets
pp 45-98
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D. | 1974c | Culture Areas in New Zealand
pp 18-26
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D. | 1974d | The Origin and Relationship of Maori Material Culture and Decorative Art
pp 27-44
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D. | 1974e | South Island Canoe Paddles
pp 132-137
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D. | 1974f | Ulu in the Pacific
pp 115-122
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D. | 1974g | Fishing Harpoon Heads in Prehistoric New Zealand
pp 138-146
In: Gathercole et.al. 1974 q.v.

SKINNER, H.D.and W.B.BAUCKE | 1928 | The Morioris
Bishop Museum Memoir 9(5)

SKINNER, H.D. and W.J.PHILLIPPS	1953	Necklaces, pendants, and amulets from the Chatham Islands and New Zealand <u>JPS</u> 62:169-95
SMART, C.D.	1962	Report on Paremata Burials <u>NZAA Newsletter</u> 5(3):141-144
SMART, C.D.	1966	The Ditch-and-Bank Fence <u>NZAA Newsletter</u> 9(1):19-28
SMART, C.D. and R.C.GREEN	1962	A Stratified Dune Site at Tairua, Coromandel <u>Dominion Museum Records in Ethnology</u> 1(7)
SMITH, J.	1974	Tapu Removal in Maori Religion <u>JPS Memoir</u> 40
SMITH, S.P.	1899	Wars of the Northern Against the Southern Tribes of New Zealand in the Nineteenth Century <u>JPS</u> 8:141-164, 201-230
SMITH, S.P.	1904	The Occupation of Wai-rarapa by Ngati-kahu-ngunu <u>JPS</u> 13:153-165
SMITH, S.P.(trans.)	1906	Incidents in the History of Horehore Pa, Te Takapau, Hawkes Bay District, Written by Tanguru Tuhua <u>JPS</u> 15:69-93
SMITH, S.P.	1910a	<u>Hawaiki: The Original Home of the Maori</u> 3rd Ed. Whitcombe and Tombs Ltd.
SMITH, S.P.	1910b	History and Traditions of the Maoris of the West Coast: North Island of New Zealand: Prior to 1840 <u>Memoirs of the Polynesian Society</u> Vol 1
SMITH, S.P. (trans.)	1913-15	Lore of the Whare Whananga or teachings of the Maori College on Religion, cosmogony and history. 2 vols. <u>Polynesian Society Memoirs</u> 3 & 4. New Plymouth
SNEDECOR, G.W. and W.G.COCHRAN	1967	<u>Statistical Methods</u> Iowa State University Press
SORENSON, J.H.	1969	N.Z.Seals with Special Reference to the Fur Seal <u>Fisheries Technical Report</u> 39
SPAULDING, A.L.	1960	The Dimensions of Archaeology pp 437-456 <u>In</u>: Dole & Carneiro, 1960 q.v.

SPOEHR, A. 1968 Problems of Oceanic Archaeology pp 173-176 In: Yawata and Sinoto, 1968 q.v.

STEAD, E.F. 1937 The Maori Rat *Transactions of the Royal Society of New Zealand* 66:178-81

STERMER, G.D. deF.VON 1975 Pers.comm. Senior Lecturer Psychology Department, University of Auckland

STEWARD, J.H. 1942 The Direct Historical Approach to Archaeology *American Antiquity* 7(4):337-343

STIDOLPH, R.H.D. 1971 *The Birds Around Us* Hedleys Bookshop, Masterton

STIRLING, I. 1968 Diurnal movements of the New Zealand fur seal at Kaikoura *NZJMFR* 2(2):375-7

STONEHOUSE, B. 1969 Sea Mammals pp 519-523 In: Knox, 1969 q.v.

SUGGS, R.C. 1961 The Archaeology of Nuku-Hiva, Marquesas Islands, French Polynesia *Anthropological Papers of the American Museum of Natural History* 49(1)

SULLIVAN, A. 1972 Excavation of a Pit at Site N38/25, Station Bay, Motutapu Island *Rec.Auck.Inst.and Mus.* 9:27-60

SUTER, H. 1909 Scientific Results of the New Zealand Government Trawling Expedition, 1907 - Mollusca, Part 1 - Amphineura, Gastrapoda and Scaphapoda *Records of the Canterbury Museum* 1(2):117-130

SUTER, H. 1913 *Manual of the New Zealand Mollusca* 2 Vols, N.Z.Government Printer

SUTER, H. 1914 Revision of the Tertiary Mollusca of New Zealand, based on Type Material. Part 1 *New Zealand Geological Survey Paleontological Bulletin* 2

SUTHERLAND, A. 1947 *The Sutherlands of Ngaipu* A.H. and A.W.Reed

SUTTON, D.G. 1971 Cooking Methods in Prehistoric New Zealand
Unpublished BA (Hons) thesis, Anthropology, University of Otago

SUTTON, D.G. 1974 Resurrection of the Prehistoric Dead: the Personal Histories of Sixteen Ancient Inhabitants of Eastern Palliser Bay
Unpublished MA (Hons) thesis, Anthropology, University of Otago

TATE, G.H.H. 1935 Rodents of the genera _Rattus_ and _Mus_ from the Pacific Islands
Bulletin of the American Museum of Natural History 68:145-178

TAYLOR, N.M. (Ed.) 1959 _Early Travellers in New Zealand_
Oxford

TAYLOR, R. 1870 _Te Ika a Maui_
William McIntosh, London

TAYLOR, W.W. 1948 A Study of Archaeology
American Anthropologist 50(3 part 2): 1-256
Memoir No 69
Also published 1967 Arcturus Books

TEAL, F.J. 1975 Pleasant River Excavations 1959-62
Unpublished Research Report, Anthropology Department, University of Otago

TERRELL, J. 1965 Limitations on archaeology in New Zealand
NZAA Newsletter 8(4):125-130

TEVIOTDALE, D. 1924 Excavations near the mouth of the Shag River
JPS 33:3-10

THOMPSON, P. 1877 The Dunedin Fish Supply
TNZI 10:324-330

THOMSON, G.M. 1922 _The Naturalisation of Animals and Plants in New Zealand_
Cambridge University Press

THOMSON, J.A. 1918 Maori Rock Quarries on D'Urville Island
New Zealand Journal of Science and Technology 1:321-2

TILLYARD, R.J. 1926 _The Insects of Australia and New Zealand_
Angus and Robertson Ltd

TITE, M.S. 1973 *Methods of Physical Examination in Archaeology* Seminar Press

TONG, L.J. and R.D.ELDER 1968 Distribution and Abundance of Demersal Fish from Trawl Stations in the Bay of Plenty, New Zealand, 1961-63 *NZJMFR* 2:49-66

TONG, L.J. and C.M.VOOREN 1972 The Biology of the New Zealand Tarakihi, *Cheilodactylus macropterus* (Bloch and Schneider) *Fisheries Research Bulletin* 6

TRAVERS, W.T.L. 1872 *The Stirring Times of Te Rauparaha* Whitcombe and Tombs, Facsimile Edition Wilson and Horton Ltd.

TRAVERS, W.T.L. 1876 Notes of the Traditions, and Manners and Customs of the Mori-ori *TNZI* 9:15-27

TREGEAR, E. 1889 The Moriori *TNZI* 22:75-79

TRIGGER, B.G. 1967 Settlement Archaeology - Its Goals and Promise *American Antiquity* 32(2);149-60

TROTTER, M.M. 1956 Maori Shank Barbed Fish-hooks *JPS* 65:245-252

TROTTER, M.M. 1968 On the Reliability for Radiocarbon Dating New Zealand Archaeological Sites *NZAA* Newsletter 11(2):86-88

TROTTER, M.M. 1970 Excavations at Shag Point, North Otago *Records of the Canterbury Museum* 8(5):469-485

TROTTER, M.M. 1972a A Moa-hunter Site near the Mouth of the Rakaia River, South Island *Records of the Canterbury Museum* 9(2):129-150

TROTTER, M.M. 1972b Investigations of the Weka Pass Shelter S61/4 *NZAA Newsletter* 15(2):42-50

TROTTER, M.M. 1974 *Marlborough Sounds Archaeological Survey 1974* Canterbury Museum

TROWER, D. 1963 Opito Beach: Two Sites *NZAA Newsletter* 5(1):43-46

TU-NUI-O-RANGI 1904. Kakahi-Makatea Pa, Lower Wairarapa
JPS 13:126-129

URLICH, D.U. 1970 The Introduction and Diffusion of Firearms in New Zealand 1800-1840
JPS 79:339-410

VAYDA, A.P. 1960 Maori Warfare
A.H. and A.W.Reed

VOOREN, C.M. and L.J.TONG 1973 A Survey of the Tarakihi, Cheilodactylus macropterus (Bloch and Schneider), in the East Cape Area, New Zealand, 26-30 March 1971
Fisheries Research Bulletin 9

WAITE, E.R. 1909 Introduction to: Scientific Results of the New Zealand Government Trawling Expedition 1907
Records of the Canterbury Museum 1(2):45-62

WAITE, E.R. 1911 Scientific Results of the New Zealand Government Trawling Expedition, 1907: Pisces Parts I and II
Records of the Canterbury Museum 1(2):131-156, 1(3):157-272

WALLACE, R. 1975 The Study of Landsnails in New Zealand Archaeological Sites
Unpublished Research Report, Anthropology Department, University of Otago

WALLACE, W.J. and E.T. WALLACE 1969 Pinao Bay Site (H-24)
Pacific Anthropological Records No 2

WALLS, J.Y. 1974 Argillite Quarries of the Nelson Mineral Belt
NZAA Newsletter 17(1):37-43

WALLS, K. 1971 Cherts and New Zealand Archaeology
Unpublished Research Report, Anthropology Department, University of Otago

WARD, G.K. 1972 Obsidian and New Zealand Archaeology: A Paradigm for Sourcing Artefact Assemblages using X-ray Fluorescence Spectrography
Unpublished MA Thesis, Anthropology, University of Otago

WARD, G.K. 1973 Obsidian Source Localities in the North Island of New Zealand
NZAA Newsletter 16(3):85-103

WARD, G.K. 1974a A Paradigm for Sourcing New Zealand Archaeological Obsidians
Journal of the Royal Society of New Zealand 4(1):47-62

WARD, G.K. 1974b Source of Obsidians from the Motutapu Undefended Site N38/37
Rec.Auck.Inst.and Mus.11:13-14

WARDLE, J. 1967 Vegetation of the Aorangi Range Southern Wairarapa
New Zealand Journal of Botany 5:22-48

WARDLE, P. 1973 Variations of the Glaciers of Westland National Park and the Hooker Range, New Zealand
New Zealand Journal of Botany 11:349-88

WATSON, J.S. 1955 The present distribution of Rattus exulans (Peale) in New Zealand
New Zealand Journal of Science and Technology 37B(5):560-570

WAUGH, C.D. 1973 Fish and the Fisheries
pp 251-284
In: Williams 1973 q.v.

WEBB, B.F. 1973 Dolphin sightings, Tasman Bay to Cook Strait, New Zealand, September 1968-June 1969
NZJMFR 7(4):399-405

WELLMAN, H.W. 1962a Holocene of the North Island of New Zealand, a Coastal Reconnaissance
Transactions of the Royal Society of New Zealand, Geology 1:29-100

WELLMAN, W.H. 1962b Maori Occupation layers at D'Urville Island, New Zealand
New Zealand Journal of Geology and Geophysics 5(1):55-73

WHITE, J. 1887 The Ancient History of the Maori, his Mythology and Traditions
Volume 3: Horo-uta or Taki-tumu Migration
N.Z.Government Printer

WHITE, T. and F.W.HUTTON 1879 Note accompanying Specimens of the Black Rat (Mus rattus, L.)
TNZI 11:343-4

WHITLEY, G.P. 1968 A Check-list of the Fishes Recorded from the New Zealand Region
Australian Zoologist 15(1):1-102

WILKES, O.R. and R.J.SCARLETT	1967	Excavation of a Moa-Hunter Site at the Mouth of the Heaphy River <u>Records of the Canterbury Museum</u> 8(3):177-208
WILLEY, G.R.	1968	One Hundred Years of American Archaeology pp 29-53 <u>In</u>: Brew 1968 q.v.
WILLIAMS, G.R. (Ed.)	1973	<u>The Natural History of New Zealand</u> A.H. and A.W.Reed
WILLIAMS, H.W.	1971	<u>A Dictionary of Maori Language</u> N.Z.Government Printer
WILSON, A.T.	1973	Pers.comm. Professor of Chemistry, University of Waikato
WILSON, A.T. and C.H.HENDY	1971	Past wind Strength from Isotope Studies <u>Nature</u> 234:344-345
WILSON, J.G.	1939	<u>History of Hawke's Bay</u> A.H. and A.W.Reed
WILSON, P.R.	1975	Birds: Starling and Myna <u>New Zealand's Nature Heritage</u> 5(62): 1730-1734
WISSLER, C.	1923	<u>Man and Culture</u> Harrap
WITTER, D.	1969	Notes on the Significance of the Leather Jacket Fish in Middens <u>NZAA Newsletter</u> 12(1):51
YALDWYN, J.C.	1956	A Preliminary Account of the Sub-fossil Avifauna of the Martinborough Caves <u>Records Dominion Museum</u> 3(1):1-7
YALDWYN, J.C.	1958	Notes on the Environment and Age of the Sub-Fossil Deposits of the Martinborough Caves <u>Records Dominion Museum</u> 3(2):129-133
YALDWYN, J.C.	1960a	Notes on the environment and age of the Sub-fossil deposits of the Martinborough Caves <u>Records of the Dominion Museum</u> 3:129-136

YALDWYN, J.C. 1960b A Preliminary Account of the Subfossil Avifauna of the Martinborough Caves
Records of the Dominion Museum 3(1):1-8

YAWATA, I. and Y.H.SINOTO (Eds.) 1968 Prehistoric Culture in Oceania
Bishop Museum Press

YEN, D.E. 1961 The Adaptation of Kumara by the New Zealand Maori
JPS 70:338-48

Abbreviations

JPS	Journal of the Polynesian Society
NZAA Newsletter	New Zealand Archaeological Association Newsletter
NZJMFR	New Zealand Journal of Marine and Freshwater Research
Rec.Auck.Inst.and Mus.	Records of the Auckland Institute and Museum
TNZI	Transactions of the New Zealand Institute

ADDENDUM

GIFFORD, F.W. 1951 Archaeological Excavations in Fiji
Anthropological Records 13(3)
University of California Press

KIRCH, P.V. 1971 Halawa Dune Site (Hawaiian Islands): a Preliminary Report
JPS 80(2):228-236

KIRCH, P.V. 1973 Prehistoric Subsistence Patterns in the Northern Marquesas Islands, French Polynesia.
Archaeology and Physical Anthropology in Oceania 8(1):24-40

MULLOY, W. 1961 The Tupa of Hiramoko
pp 323-328
In: Archaeology of Easter Island.Vol.1
Heyerdahl,T. and E.N.Ferdon (Eds.)
Allan and Unwin

REINMAN, F.M. 1967 Fishing, An aspect of Oceanic Economy
Fieldiana: Anthropology 56(2)

SKJØLSVOLD, A. 1972 Excavation of a habitation Cave, Hanapete'o Valley, Hiva Oa, Marquesas Islands.
Pacific Anthropological Records 16

SPOEHR, A. 1957 . Marianas Prehistory: Archaeological Survey and Excavations on Saipan, Tinian and Rota
Fieldiana: Anthropology 48