NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION MONOGRAPH 11:
Atholl Anderson (ed.), ***Birds of a Feather: Osteological and Archaeological Papers from the South Pacific in Honour of R.J. Scarlett***

BIRDS OF A FEATHER

edited by

Atholl Anderson

New Zealand Archaeological Association
Monograph II

BAR International Series 62
1979

TAI RUA: A MOA-HUNTER SITE IN NORTH OTAGO

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The late 1950s were exciting years in New Zealand archaeology. Following pioneer work by Les Lockerbie in Otago, American field methods were introduced by Robert Bell and the sophisticated techniques of the English school were brought over by Jack Golson. The New Zealand Archaeological Association was formed and the New Zealand Historic Places Trust contracted its first site recording and archaeological salvage project; Roger Duff published a second edition of his Moa-hunter Period of Maori Culture, incorporating some minor revisions necessitated by new discoveries; museum expeditions still looked for signs of live moas in Fiordland, and radiocarbon dating—"the answer to every archaeologist's prayer"—had arrived.

All of this stimulated research that today, only twenty years later, seems naive; yet because the widely accepted version of New Zealand prehistory was so simple and straightforward at that time, it was very important to those who did not entirely agree with it to obtain evidence to support their alternative ideas. It was of vital importance to followers of the Otago school, for instance, to be able to prove that more than one species of South Island moa had survived into the human period; disciples of H. D. Skinner knew that the barb was an ancient feature of Polynesian culture and obtained and published evidence to prove it indisputably; and if remains of Cnemiornis or Aptornis could be found in primary association with such cultural material, then that was the sort of bonus that made the work so much more exciting. For a few years we almost experienced a revival of that flamboyant period of last century when Haast, Hector and Hutton were making momentous discoveries and repeatedly proving and disproving numerous hypotheses to each other's dissatisfaction.

It was in this climate that the investigation of the Tai Rua site commenced in 1956, as a purely salvage operation of occupational material in a ploughed paddock. Soon the discovery of an underlying, undisturbed deposit, plus the nature of the material being revealed, was responsible for a change in objective to a more research-oriented investigation. One of the principal factors influencing this change was the discovery of barbed fish-hooks in association with moa bones—there being some controversy at that time as to the place of the barb in the South Island cultural sequence.

Locality

The adopted name for the site, Tai Rua, is one which was recorded (by Stevenson 1947:81) as applying to an adjacent headland, now called Bridge Point, and it has been found convenient to use it in referring to the nearby archaeological site. A disadvantage of using this name is possible confusion with a North Island archaeological site called Tairua (first excavated in 1958-59).

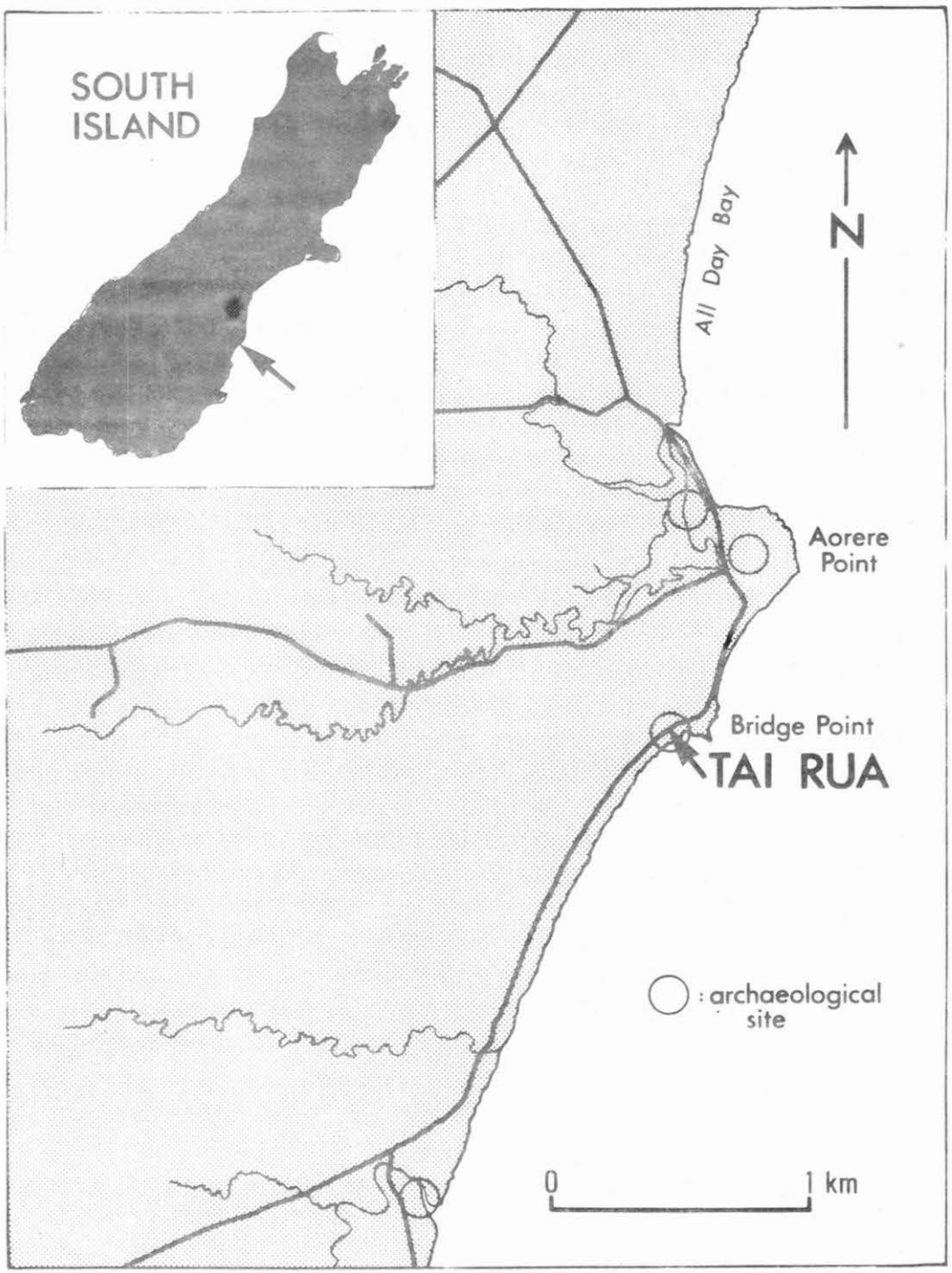

Fig. 13.1 Location map of the Tai Rua Moa-hunter site, South Island, New Zealand.

This, however, is outweighed by its common usage since the beginning of the investigations and in several publications (Trotter 1959, 1965a, 1965b, 1966, 1970; Otago Anthropological Society 1960; Gathercole 1961; Hjarnø 1967, etc.). Tai Rua is recorded as site number S136/1 with the New Zealand Archaeological Association.

The site is situated at the northern end of a narrow strip of coastal flat land immediately behind the present beach north of the Waianakarua River in North Otago (South Island, New Zealand), Fig. 13.1. This flat is about 150 metres wide and ita loamy top-soil thins out towards the beach giving way to sand dunes above high tide mark. High ground to the north provides some slight shelter from prevailing north-easterly winds but the site is exposed to the main rain bearing winds from the south. While bush or forest on the flat at the time of occupation could have given some shelter, the virtual absence of small forest-bird remains in the site suggests that bush, if present, was sparse. The predominant vegetation at present is pasture grass, and all suitable land in the area is used for mixed farming. In very wet weather a normally dry water course on the coastal flat carries surface water into a swamp which lies between the site and the hill that forms the northern boundary of the flat. This swamp is at present retained by the foundations of a road which parallels the coast (and runs across the site), but originally the water probably drained directly into the sea.

Methods and History of Excavations

With the help of a team of members of the North Otago Scientific and Historical Society (occasionally augmented by up to ten pupils from Waitaki Boys' High School), salvage work at the site was commenced by sieving the cultivated topsoil and recording the location of objects found according to a grid of ten foot (approximately three metre) squares.

When it became evident that there was a considerable amount of undisturbed occupational deposit beneath the cultivated level, a different method was adopted. A grid of five-foot squares was established, based on a brass peg set in concrete and with coordinate lines running parallel to and perpendicular to the surveyed road boundary. Excavation was done layer by layer with trowels (Fig. 13.2). (Because those assisting with the excavation varied widely in their experience and skill, many sieved the material after trowelling.) All artefacts and bones were retained, and samples were taken of shells, burnt stones, charcoal and soil. A record was kept of the square and layer in which each item was found, and the exact location and associated material of important items were noted. At this stage work was restricted to week-ends, not more than once a month, and it was deliberate policy to leave a major portion of the site untouched.

As the excavations progressed it became apparent that some prehistoric activities had been confined to certain parts of the site, and in order to sample the complete range of evidence, permission was obtained from the Waitaki County Council to extend the investigation to both sides of the road in 1958 and 1959.

In January 1960 I relinquished my direction of the excavations to Peter Gathercole, then of the University of Otago and the Otago Museum, who continued

Fig. 13.2 Excavations in progress, Area D, Tai Rua, looking south (1962).

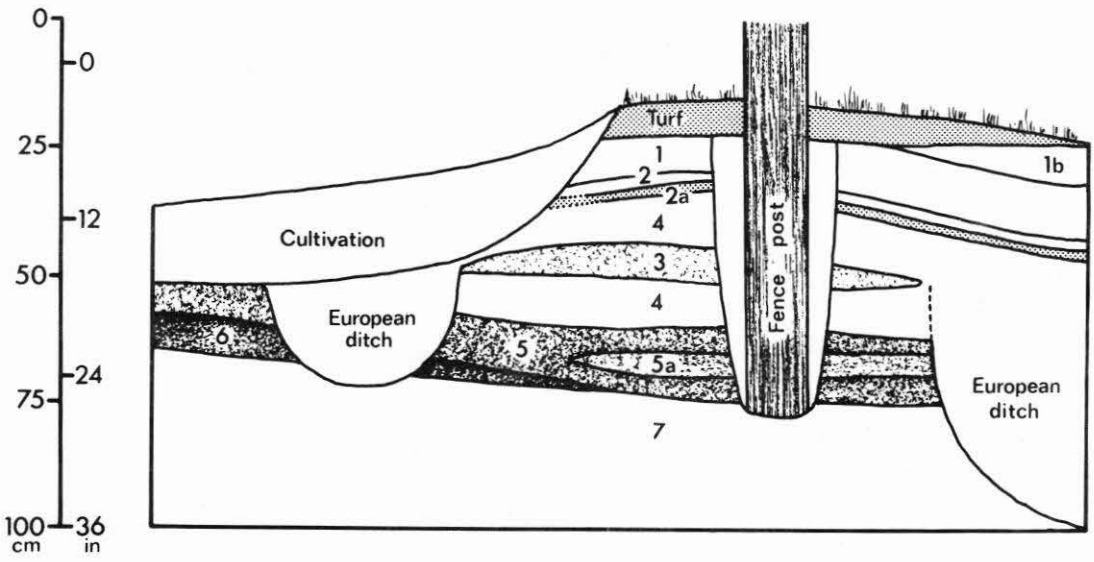

Fig. 13.3 Stratigraphy at fence line—see text for explanation. The main occupational deposit comprises layers 5, 5a and 6.

the work in close consultation with me as an extension of my investigations. This was done largely to provide training for students and others, and excavations were made on four occasions during the next two years (January and April 1960, April 1961 and January 1962).

In February 1968 Gathercole briefly reopened an area on the seaward side of the road where he had previously found a puzzling wooden structure, while the North Otago Scientific and Historical Society collected some pollen samples for me.

Finally, in 1973, I inserted a dosimeter probe in the site to record environmental radiation for a thermoluminescent dating experiment.

Stratigraphy

Although the stratigraphy varied considerably over the site, there was basically one main occupational deposit which was divided into two, three or even four layers in some places. On either side of the road some re-deposited occupational material, apparently derived from the main deposit as a result of European disturbance, occurred at a higher level. Near the surface were several layers that were either of European origin or connected with European settlement, and ditches, post-holes, rabbit burrows and cultivation disturbances intruded into the occupational layers in some places.

Strata revealed by excavation near the road boundary fence-line in 1958 were as follows (see Figure 13.3):

Surface:	turf	Present day
Layer 1:	sterile sandy humus	
Layer 1b:	scattered road gravel	
Layer 2:	clean wind-deposited sand	Historic
Layer 2a:	old turf line	
Layer 3:	re-deposited occupational material	
Layer 4:	sterile stained sand	
Layer 5:	midden etc. in sandy matrix	Prehistoric
Layer 5a:	lens of burnt midden	
Surface at time of occupation		
Layer 6:	black stained sand	
Layer 7:	sterile beach sand	Pre-human

It would appear that since the time of occupation, wind-deposited sand gradually built up over the occupational material, probably supporting some light growth which would account for its organic stain (layer 4). On either side of the fence, and running parallel to it, were found two European-made ditches, dug through the occupational layers into the sterile beach sand. Their purpose is unknown; drainage would not be necessary in such dry sandy soil. Their proximity to, and alignment with, the road strongly suggests some connection with it. Spoil from the ditches formed layer 3, a fairly homogeneous deposit of stained sand containing occupational material. The spoil had apparently been placed in a long mound between the ditches (which were five to six feet apart). Some of it had soon moved back (probably by wind) into the easternmost ditch, which was larger and more roughly dug than the other. Stained

sand, without any occupational material, also filled the smaller (westernmost) ditch, and later some of the layer 3 material shifted back over it, leaving only a very low mound of spoil between the ditches. These soil movements and infilling of the ditches are probably the effects of strong winds, first from the west and then from the east, shortly after the ditches were dug. There is no evidence that they were dug at the same time, but it is likely that they were approximately contemporaneous; that they are of European origin is deduced from their alignment and from pieces of iron wire in one of them. Their purpose could doubtless have been determined by further excavation, but only by removing the road boundary fence, which was not warranted. Local residents suggested that the ditches may have been remains of European defensive earthworks made at the time of the first World War. Turf (layer 2a) then grew on the levelled-out spoil, and was later covered with a thin deposit of clean sand (2), probably wind-blown from the beach. Above this were deposited layers of sandy humus (layer 1) and road rubble (1b), on which grew the present-day turf.

Over most of the site the stratigraphy was much less complex than this. Further into the paddock, north-west of the fence-line, was a strip where the occupational deposit had been completely disturbed by cultivation. In places there was only one occupational layer, or where it was divided, the layers did not necessarily correspond to any of the individual layers 5, 5a and 6. The composition of the occupational deposit, too, varied considerably over the site, although in general it could be described as scattered burnt stones, artifacts, shells, bones, and charcoal, in a dark stained sandy matrix.

Useful horizon markers were the clean wind-blown sand of layer 2, and small orange coloured quartz beach pebbles in the matrix of layer 5. The pebbles were assumed by me to be a natural beach deposit, although the Gathercole party considered them to be moa gizzard stones. They appeared to have lain on or very near the ground surface at the time of occupation, and were often associated with beach shells and definite beach stones.

Occasional seal bones, apparently of natural origin, were found in the sterile beach sand underlying the occupation deposit. On the inland margin of the site this sand had an increased mud content, or pinched out altogether so that the occupational material lay upon an old developed soil.

Layout of Site

It can be seen from Figure 13.4 that the excavated squares were mostly concentrated in three main groups, divided by the present roadway and by a strip of ground in which the occupational deposit was sufficiently near the surface to be destroyed by cultivation. Initially, when the excavations were of a purely salvage nature, the area concentrated on was that part of the central group on the inland (north-west) side of the road fence, Area C, as it was here that the most occupational material had been exposed by cultivation. A series of isolated five-foot squares was later dug to gauge the extent and basic characteristics of the site; further intermediate and often adjoining squares were then excavated in those areas shown to warrant fuller investigation.

For convenience the site can be divided into five areas (labelled A to E on Figure 13.4) and general characteristics of the occupational deposits in these

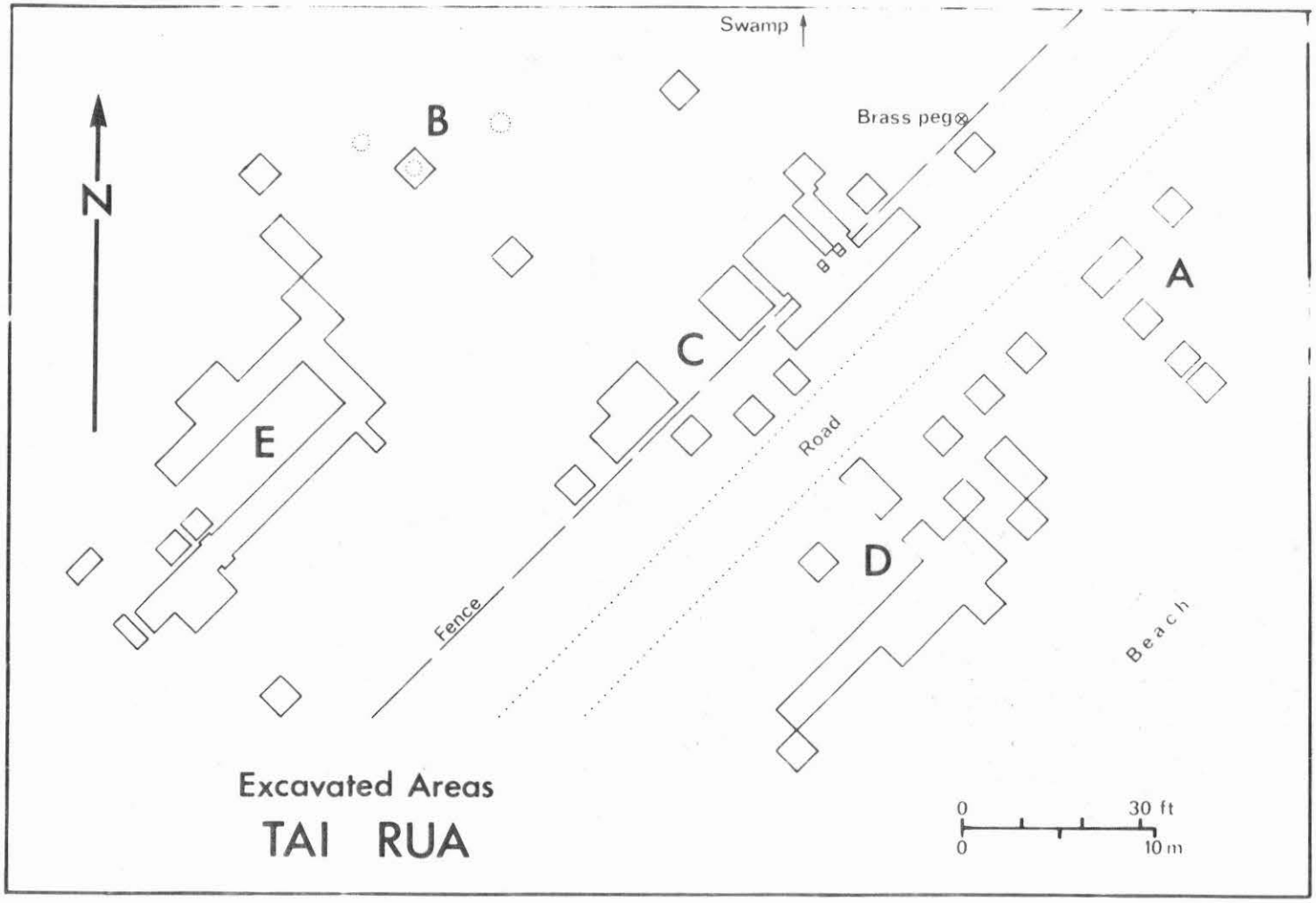

Fig. 13.4 Plan of Tai Rua, showing areas excavated by Michael Trotter and Peter Gathercole, 1958-1962.

areas can be summarised thus:

A. A buried soil blackened by charcoal and decayed organic material; faunal remains and artefacts sparse.

B. Very sparse occupational material except in three fireplace (cooking) hollows filled with charcoal and burnt stones. The ground surface at the time of occupation was higher here than in adjacent areas C and E, and as a consequence less overlying material had since been deposited over it.

C. Several layers of material from a single period of prehistoric occupation, partly disturbed in places by European activities. The description of the stratigraphy given previously specifically applies to this area. Shell midden was most prominent here.

D. Most notable for its post holes and small fireplace hollows projecting downwards from the occupational layers into the underlying clean sand. Features of this nature were very rare elsewhere in the site.

E. Concentrations of moa bones, with some tracheal rings, gizzard stones, and eggshell. The vertebrae of two complete necks and of some sections of necks were in articulation. Some shell midden.

This distribution of features and faunal remains immediately suggests that basically different activities were carried out in different parts of the site. For example, even though it was not possible to distinguish any discrete patterns in the fireplace and post hole distribution in Area D, it is highly probable that many, if not all, represented the remains of shelters or sleeping quarters. Area C was largely a midden or dumping area for food remains; the principal activity in B appears to have been cooking, while the butchering of moa carcasses was carried out in Area E. To the north-west, Area A was the outskirts of the living area.

This hypothetical pattern is not obviously supported by the distribution of artefacts. One might, for example, have expected to find a relatively high proportion of flakes and blades in the butchering area E, but in fact the most numerous artefacts there were fish-hooks. Similarly, manufacturing could have been carried out in the habitation area D, and certainly most of the drill points were found here, yet only four drilled tabs of moa bone were obtained from here as compared with 22 elsewhere. (This can, of course, be easily explained if the drill points were mainly for use on wood—which has not survived—yet they are generally associated with fish-hook manufacture in southern Moa-hunter sites.) Area D had as many adze portions as the other areas combined (no whole adzes were found at Tai Rua), but grindstones and files were mostly in Area E.

Notwithstanding the artefact distribution, however, I believe that the pattern outlined above is basically correct, and that the apparently anomalous association of certain classes of artefact with particular activities may be due to more than one activity being carried out in the one area or to some as yet unrecognized connection.

Nowhere in the site was found any indication of a large cooking pit such as is often present (in my experience, e.g. Trotter 1975a) in sites of this nature

for cooking moas and seals. Such a pit could, of course, be still present in the fairly large part of the site that remains unexcavated.

Artefacts

This report is not the place to describe in great detail all of the portable artefacts found at Tai Rua. Rather, I propose to limit the analysis and description to a minimum required to be able to say something about the culture of the inhabitants, and to enable broad comparisons to be made with assemblages from other sites. Any intensive or comprehensive studies should in any case, I feel, be made on the artefacts themselves, not merely on written descriptions or on drawings.

For some years now, portable artefact analysis has been widely relegated to a rather inferior position in New Zealand archaeology. There have been several reasons for this. Firstly, there has been, I think, a natural reaction against the amassing, by both public and private collectors, of particular classes of artefacts for their intrinsic rather than their informative value. In the course of obtaining these collections, vast amounts of archaeological data have been destroyed, albeit often in ignorance. Allied with this reaction has been the determination to make full use of other aspects of archaeological information, hence emphasis has been placed upon such things as midden analysis, post-holes and pits. As well, however, a fairly important reason for the relative absence of artefact studies seems to be that many of the sites that have been investigated in recent years have produced a dearth of portable artefacts.

At Tai Rua the character of the site as an archaeological unit was determined largely by the artefacts. Post-hole patterns have not been amenable to interpretation (possibly because we were looking for a regularity that was not there); there were no "pits" or prehistoric earthworks, nor any burials.

For the purposes of this discussion, a portable artefact can be defined as a piece of some natural material (usually stone, bone or shell) that has been shaped by man to produce an object of some particular use or that has been modified in the process of making such an object. Hence tools, implements and fishing gear are artefacts. So too are ornaments or pieces of waste material discarded during a manufacturing process. But bones broken in the course of preparing or obtaining food, or stones broken by heating or cooking fires, are not included here. This definition leaves at least two classes of objects in a limbo. Many pieces of broken moa leg bones are of a suitable size and shape for use as fish-hook "tabs" or "blanks" but they may have been produced accidentally when breaking open the bones to extract marrow. As well, pieces of red ochre may have been deliberately prepared by heating for use as pigment, or they may be just pieces of natural material in which the iron content has been naturally or artificially oxidised to produce a red colour. Neither of these classes are included in the artefact totals.

Careful analysis of the distribution of different classes of artefact throughout the site has not provided any significant information on the division of the encampment into separate activity areas—apart from that already mentioned above. There was, however, a general correlation between the density of artefact distribution and faunal remains, particularly bones.

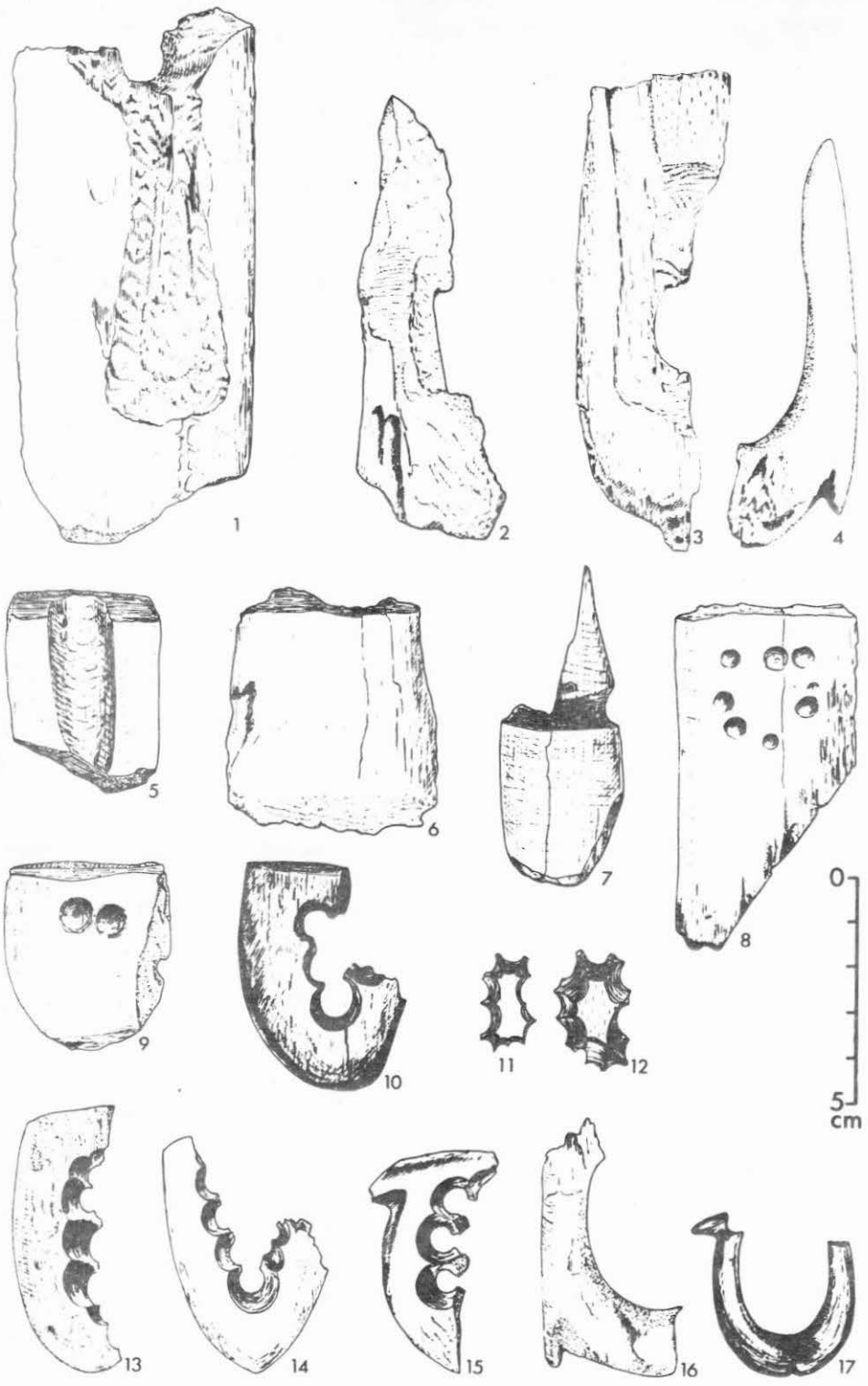

Fig. 13.5 Fish-hook tabs of moa bone: 1-3, chiselled; 4 and 17 parts of finished fish-hooks; 5, tab shaped by attrition cutting, breaking and grinding; 6, cut and chiselled; 7, cut to shape; 8, 9, partly drilled; 10, 13-15, shaped and drilled; 11, 12, drilled out centres; 16, part of a nearly finished fish-hook. Only 1, 4 and 5 are unbroken.

For convenience the Tai Rua artefacts may be grouped in seven classes according to the material they are made from and their apparent use—see Table 13.1. In order of numerical importance these groups are:

1. flake tools, cores and waste flakes of siliceous stone
2. unfinished and completed fish-hooks and other artefacts made from bones and teeth
3. cutting, chopping and hammering tools, plus sinkers of greywacke and similar material
4. ornaments (necklace units) of shell
5. flaked pieces of argillite, andesite and greenstone produced in the manufacture or reshaping of adzes
6. files and grindstones of abrasive material—sandstone and schist
7. pieces of clay that have been moulded to shape and baked.

I propose to discuss firstly groups 2 and 4 which are artefacts of biological materials—bones, shells and teeth—and then the remainder approximately in the order given above.

Bone and Tooth Artefacts

There were 263 artefacts made of bone or ivory and four from dog teeth. Most of the bone was moa bone which appears to have been obtained from the same species as were represented in the midden remains. Of this total number, 250 were either definitely or probably parts of fish-hooks or "tabs" of bone that were in the process of being made into fish-hooks.

Most of the latter were merely flat tabs of bone that had been reduced to approximate size by sawing or chiselling from either side and then breaking across the weakened line; some had also been ground (e.g. Figure 13.5:5-7). Further shaping had been carried out by chiselling or drilling on almost a third of them (Figure 13.5:1-3, 8-10, 13-15). Numbers of tabs were as follows (with one figured example for each group in parenthesis):

Unshaped tabs (Figure 13.5:6)	106	67.0%
Partly chiselled to shape (Figure 13.5:1)	26	16.5%
Drilled tabs (Figure 13.5:9)	23	14.5%
Drilled centres (Figure 13.5:12)	3	1.9%

Presumably the sawing was done with sharp edged flakes of siliceous rocks, and the drilling to remove the centre (of one-piece hooks) was done with the aid of the flaked, pointed artefacts of chalcedony and orthoquartzite that are generally considered to be drill points (e.g. Figure 13.9). The chiselling of moa bone in the manufacture of fish-hooks was probably done with these tools as well; no other chisels were found on the site, and some of the marks on the bone indicate a blade width of about four millimetres which corresponds with the average "drill point" width. A microscope search for wear marks (cf. Semenov 1964) was inconclusive, due, at least partly, to the degree of polish on the worn surfaces. Eighty-two abrasive tools of sandstone and schist from the site were suitable for use in the final shaping of fish-hooks from the drilled or chiselled tabs (e.g. Figure 13.9).

Table 13.1 Portable Artefacts

	Number	% No.	Weight (in g)
Siliceous rock			
Chalcedony flakes	397	24.45	6160
Orthoquartzite flakes	259	15.95	4484
Silicified tuffaceous material	22	1.35	318
Porcellanite flakes	53	3.26	968
Jasperoid flakes	21	1.29	291
Vitreous porcellanite	5	.30	11
Obsidian flakes	14	.88	35
Drill points	43	2.65	510
		50.13	
Greywacke etc.			
"Teshoa"	104	6.40	12660
"Choppers"	28	1.72	7432
"Hammers"	25	1.54	7144
Sinkers	11	.68	4448
		10.34	
Adze materials			
Argillite etc.	98	6.03	2087
Greenstone	3	.18	12
		6.21	
Abrasive stone			
Sandstone	49	3.02	2456
Schist	33	2.03	1721
		5.05	
Bone and tooth			
Fish-hooks	112	6.90	390
Tabs	196	12.07	2868
Others	8	.49	63
		19.46	
Shell			
Fossil	63	3.88	66
Recent	72	4.43	18
		8.31	
Clay			
Moulded to shape	8	.49	103
Total	1624		

As might be expected from a Moa-hunter site, the majority of fish-hooks were of the one-piece type, but they were of several varieties. Most were small and U-shaped with inturned points and were without barbs, the classic Moa-hunter type that was classified by Skinner (1942) as 1A and by Hjarnø (1967) as D (e.g. Figure 13.5:17, 13.6:1). However, at least one of these was more circular (Figure 13.6:10), two fragments were much thicker than usual (e.g. Figure 13.6:7), and one was heavily ornamented with notches (Figure 13.6:22). This latter was the only ornamented specimen from Tai Rua, and while it was recorded as coming from layer 2 during Gathercole's excavation in January 1960, there is good reason to believe that it must have been derived from layer 3 (the redeposited material). Nevertheless, it cannot definitely be associated with the rest of the assemblage from the site.

Three slightly larger one-piece hooks had external basal barbs (Figure 13.5:4, 16; Figure 13.6:23). Fourteen fragments appeared to be from a still larger variety of one-piece hooks that may have been up to 15 centimetres long (Figure 13.6:13, 14, 16-21). Two barbed point fragments may have been of this variety although I earlier considered them to be from two-piece hooks (Trotter 1965a:350-51, Fig. 9-10).

Next most common were points for trolling hooks, the kind that are generally called barracouta hooks, which comprise Skinner's type 5 and Hjarnø's type A.1. In use these would have been fixed to heavy straight wooden shanks (Figure 13.7:12-15). One of the points was made from dog jaw bone, up to five were whale ivory and the rest were made of moa bone. Ten unbroken points were between 5.5 and 6.5 centimetres long.

Three varieties of points for two-piece fish-hooks were present—long straight unbarbed points, small curved unbarbed points, and large points having an external barb. These varieties are illustrated in Figure 13.7:1-4, 5-8 and 9-11 respectively and comprise Hjarnø's types C.1 and C.3. Four of the small curved points were made from dog canine teeth. A single shank of a two-piece hook may be the re-used broken shank of a one-piece hook (Figure 13.6:15).

Fish-hook numbers were as follows:

One-piece,	small (4.0-5.5 cm)	46	40.35%
	intermediate (6-10 cm)	3	2.63%
	large (10-15 cm)	14	12.28%
Two-piece,	straight points	7	6.14%
	curved points	6	5.26%
	barbed points	3	2.63%
	indeterminate points	2	1.75%
	shank	1	0.88%
Trolling hook points		32	28.07%

The great majority of fish-hooks and tabs had probably been discarded because of breakage; less than 13% of them were unbroken. One would expect bone fish-hooks to be highly prone to breakage while in use but in fact there were almost as many point portions as there were shank portions of one-piece hooks, which indicates that they were probably broken on the site (possibly

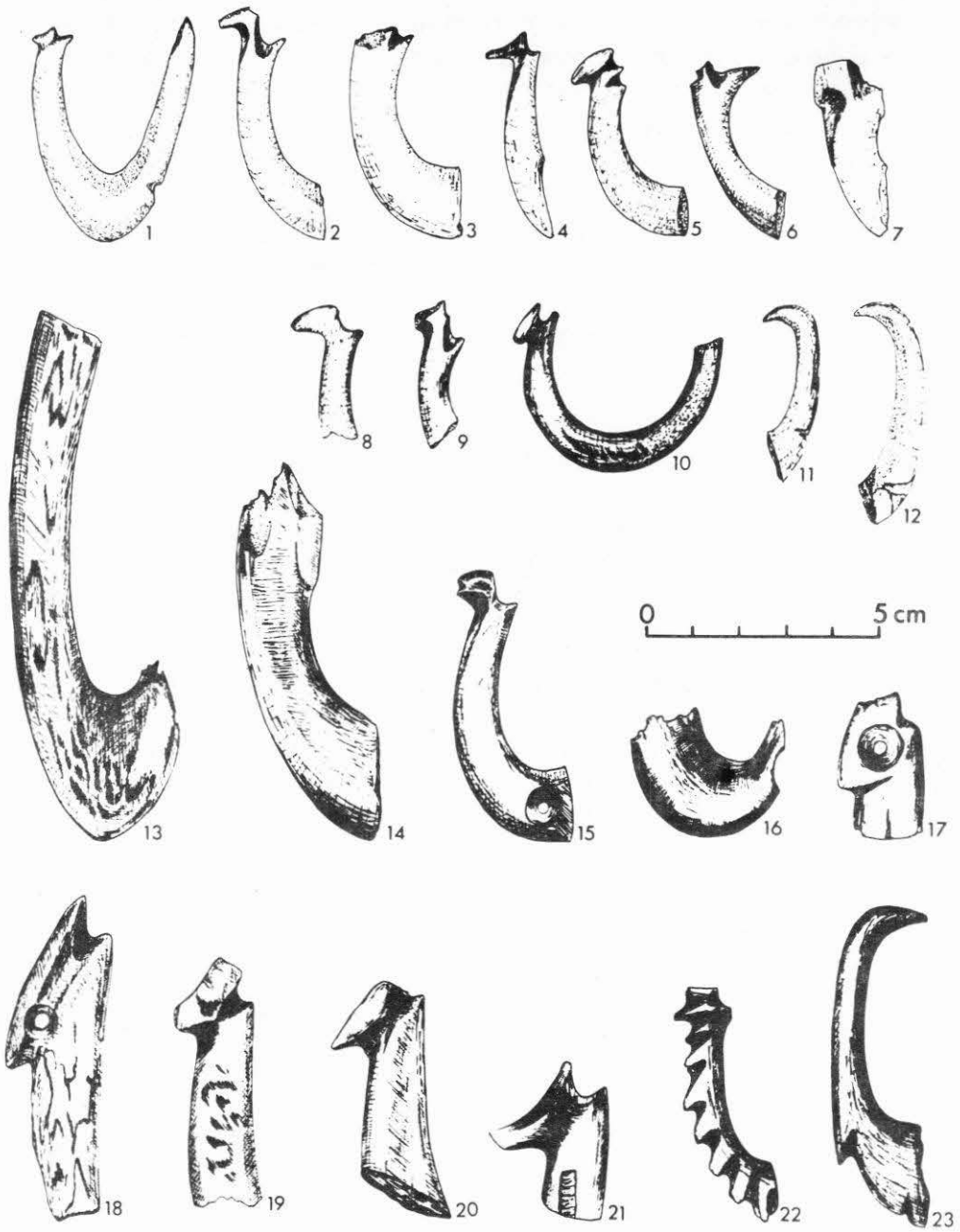

Fig. 13.6 Fish-hooks of moa bone: 1-12, shanks and points of small one-piece hooks; 13, 14, 16-21, parts of large one-piece hooks; 15, shank of two-piece hook; 22, ornamented shank of one-piece hook; 23, point leg of medium sized one-piece hook.

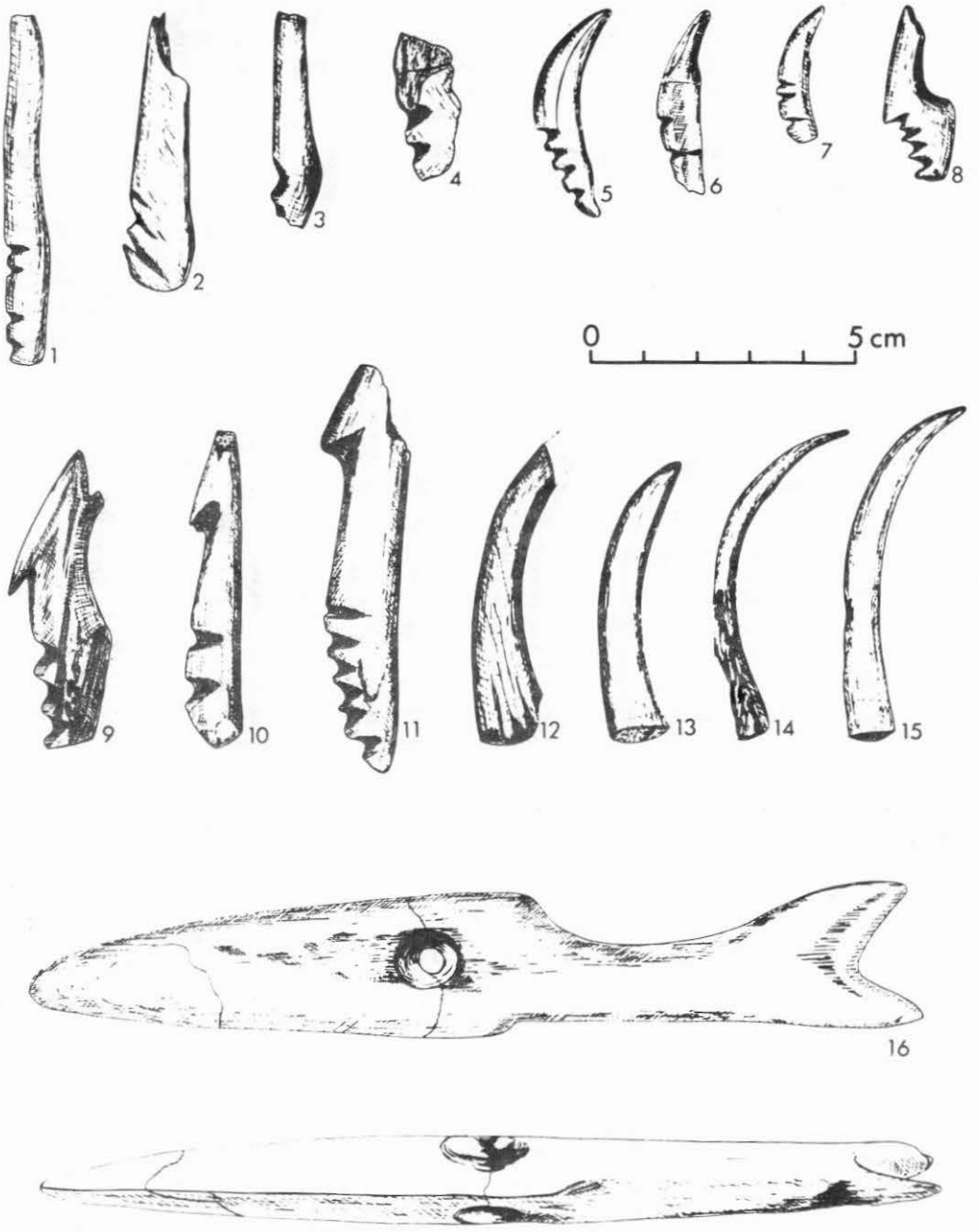

Fig. 13.7 1-4, basal ends of long straight unbarbed points for two-piece fish-hooks; 5-8, small curved points for two-piece hooks; 9-11, externally barbed points for two-piece hooks; 12-15, points for trolling hooks; 16, side and top views of harpoon point. Numbers 5-7 are dog-teeth, 16 is whale bone, the rest are moa bone.

while extracting the hooks from caught fish). Amongst the trolling hooks, seven had the tip of the point missing and three were basal portions, but twelve had the base missing (the remainder were unbroken). Again this suggests a high percentage of breakage on the site. Only three, one complete and two with the base missing, were heavily scored with fish tooth marks, indicating use.

Thirty-six per cent of the fish-hooks and a lesser proportion of the tabs were heat-stained dark grey or black, whereas only half that amount of non-artefactual moa bone, for example, had been burnt. The proportion of burnt dog bone was similar to that of the moa but hardly any of the seal, fish or small bird bones showed any sign of having been burnt. There is thus a strong, but not irrefutable, suggestion that many bone artefacts were deliberately put into fires.

A seventeen centimetre long harpoon point was found in three pieces (each burnt) in a five-foot square in Area E (Figure 13.7). This particular square contained a surprising number of artefacts, including nine hook tabs, a broken hook, drill points, and flakes of chalcedony, orthoquartzite and greywacke, as well as the harpoon point. Moa bones were also very numerous here—both body and leg bones of Euryapteryx and Pachyornis—with some shells, fish-bones and fragments of charcoal. The harpoon point is made of whale bone and was presumably designed for catching moas or seals.

Other artefacts made of bone consisted of five pieces of moa bone, eleven to twelve centimetres long, that had each been roughly fashioned to a circular sectioned point at one end, one broken piece of bird bone that may have been a needle, one "awl" of bird bone, and eight other worked fragments that were not sufficiently complete to suggest a likely function. Besides these, a small cut section of bird limb bone and a tattooing chisel were recovered from the site but have since been lost. The chisel was approximately 12 millimetres wide and 25 millimetres long to its broken proximal end; part of a single hole could be seen at one side of the break. One dog canine tooth was drilled near the proximal end, presumably for use as a pendant.

Shell Artefacts

A collection of 63 shells of the small dark top-shell, Zediloma sp., each pierced in the outer whorl, 35 cut section of fossil Dentalium sp., and a pierced flat valve of an oyster shell, Ostrea sinvata, were found together in Area D (see Figure 13.8). There can be little doubt that these had been prepared for a necklace or similar type of personal ornament. Strung together they would measure about 108 centimetres, more or less depending on how they were arranged. Besides these, five pierced Zediloma sp. shells, 28 sections of fossil Dentalium sp. and three sections of the extant Dentalium nanum were found separately, most but not all in the same general area.

The fossil Dentalium (probably Dentalium solidum) could have been obtained from limestone outcrops two or three kilometres north of Tai Rua. Zediloma sp. and Dentalium nanum could have been found on the rocks and beach respectively, adjacent to the site.

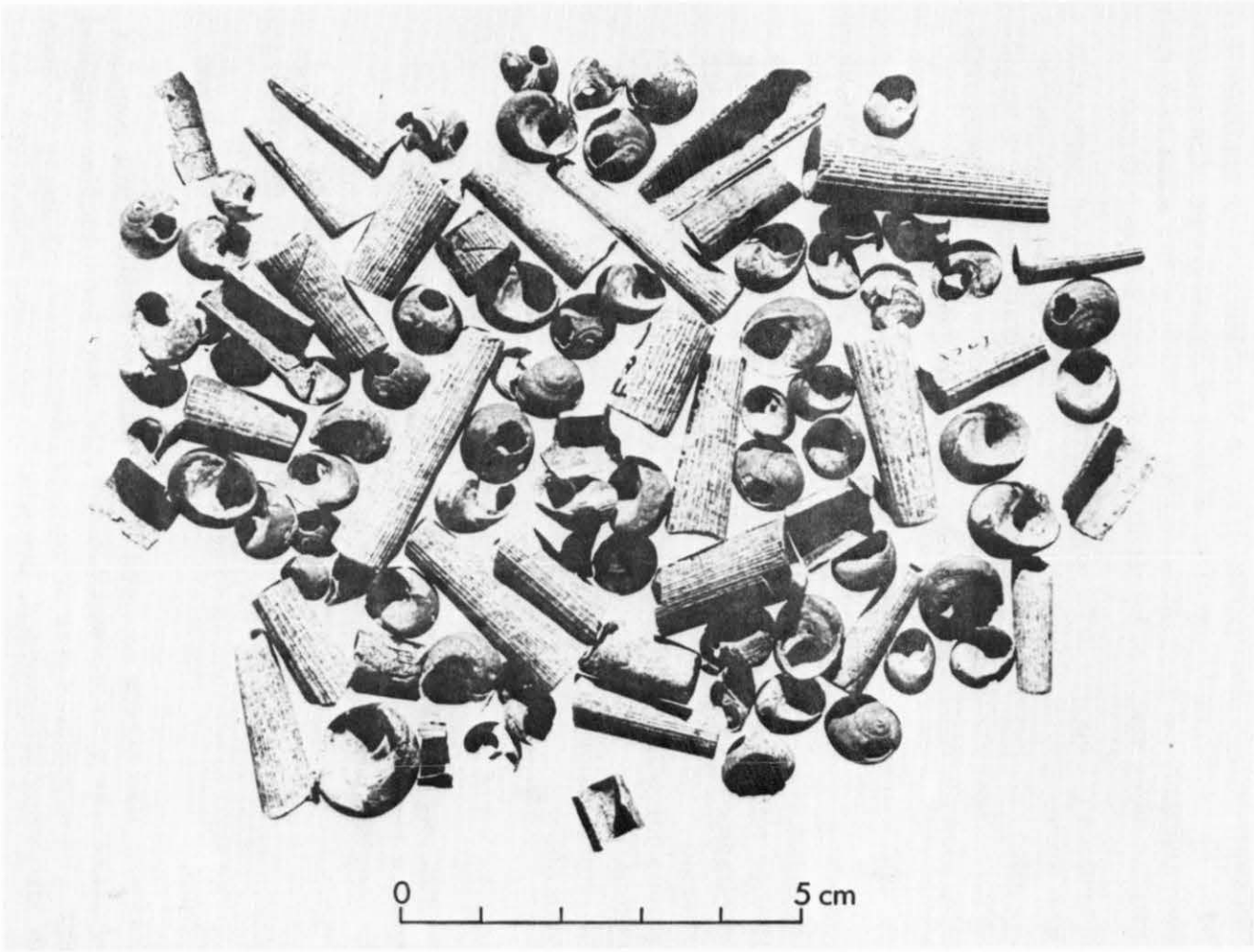

Fig. 13.8 Part of an assemblage of necklace units, found together, of sections of fossil Dentalium and pierced Zediloma shells.

Stone Artefacts

Almost half the total number of artefacts from Tai Rua were flakes, cores and waste pieces of various siliceous materials. No study has been made of them and while some have retouch flaking and some have been chipped by use, it is fairly apparent that there are very few carefully made tools among them. This could be due to lack of skill, unsuitability of available material, or possibly the absence of any need here for the skilfully produced flake tools that occur on some early sites, particularly in Murihiku (i.e. in southern New Zealand). An exception is the class of drill or chisel points mentioned above and which are included here because they are made of the same materials and produced the same way, i.e. by flaking, as the rest in this category.

There does not appear to be any universal agreement amongst petrologists —let alone archaeologists—as to the use of particular names for varieties of siliceous material, but here again the categories given below are largely for convenience. Numbers and weights of flakes, cores and chips according to materials, plus the drill/chisel points, are as follows:

	Number	% Number	Weight (g)
Chalcedony	397	48.77	6160
Orthoquartzite	259	31.82	4484
Silicified tuffaceous material	22	2.70	318
Porcellanite	53	6.51	968
Jasperoid	21	2.58	291
Vitreous porcellanite	5	.61	11
Obsidian	14	1.72	35
Drill/chisel points of orthoquartzite and chalcedony	43	5.28	510

Possible sources of the principal materials are given below.

The greywacke spawls that Haast named teshoa (see Trotter 1971:142-3, Fig. 8h) were reasonably common, but did not occur with such frequency as on the coastal Canterbury sites at Rakaia and Wakanui. Each teshoa has been knocked from a natural water-worn cobble of greywacke by a single blow. The teshoa was used for cutting and chopping soft materials, probably meat or wood, and is quite distinct in use, and hence in wear marks, from the similarly formed greywacke spawl that was used in later times as an attrition saw for cutting stone.

The twenty-five hammers found at Tai Rua are mostly water rounded stones of greywacke or other suitable material and have a median weight of 240 grams. Intermediate between hammers and teshoa, as far as the shape of the working edge is concerned, are what I have called "choppers", although it is perhaps doubtful if the users thought of them as a special class of tool. Fishing sinkers also grade into hammers in that here (as at other sites) a number of stones have been both used as hammers and prepared as sinkers. Figure 13.10 shows three of the Tai Rua sinkers.

Because of their durability, their size and their ease of recognition by the layman, stone adzes (i.e. adze heads) form the largest class of artefacts in

most museum collections. More often than not, however, they comprise such a small proportion of archaeological assemblages that they cannot legitimately be related to the general typological studies that have been made of them. Such is the case at Tai Rua. No complete adzes with "diagnostic" features were recovered. There were broken portions of five unfinished adzes, and 93 flakes from the manufacture, reshaping or breakage of adzes. My interpretation of these pieces is that the people of Tai Rua had both adze "blanks" and completed adzes and carried out a very small amount of shaping and reshaping, perhaps more in the nature of maintenance than of manufacture, by flaking and grinding. The materials from which these adzes were made were diverse, and included various grades of indurated mudstones, tuffs and fine-grained arenites, andesite and greenstone. Some pieces showed an adze shape having a quadrangular section, and one piece was a hammer-dressed, rounded quadrangular poll. Two pieces were simply primary flakes with the distal end ground to a cutting edge.

In a previous reference to pieces of moulded and baked clay from Tai Rua, I suggested that they may have come from bird carcasses that had been covered in damp clay before cooking (Trotter 1965b:166). A similar method of cooking rats by Canterbury Maoris in early European times has been recorded (Hay 1915:14-15), but rat remains were very few at Tai Rua. However, one of the pieces in the present assemblage is in the shape of a flattened ball of "clay" (actually a silty mud) that has been baked (Figure 13.10:1) and most of the rest could easily be fragments of similar balls. Part of a similar ball was recently recovered from a Moa-hunter site in Kaikoura, and shapeless fragments of baked clay from other sites are not uncommon. Marks on the nearly complete ball and on other pieces appear to be impressions of grass-like leaves made while the clay was still damp.

Probable determinations of the main Tai Rua stone materials, which have been made by hand specimen comparisons only, together with closest source locations, are as follows:

Chalcedony: Moeraki-Katiki coast area, 20 kilometres south.
Orthoquartzite: Central Otago, 50 or more kilometres south west.
Porcellanite (baked mudstone): Moeraki-Katiki coast.
Obsidian: Seven flakes with green translucency and six with grey doubtless come from North Island offshore and mainland sources, while one black flake is possibly a Canterbury material.
Greywacke: local beach stones.
Argillite (various fine-grained indurated mudstones): at least some from the Nelson-Marlborough area.
Andesite: probably Otago.
Greenstone (nephrite): probably west coast of the South Island, about 225 kilometres north of Tai Rua.
Sandstone (fine-grained with abrasive quality): some appears to be from Shag Point on the coast 25 kilometres south.
Abrasive schist: inland Otago.
Fossil Dentalium: from limestone deposits, the nearest of which would be two or three kilometres north.

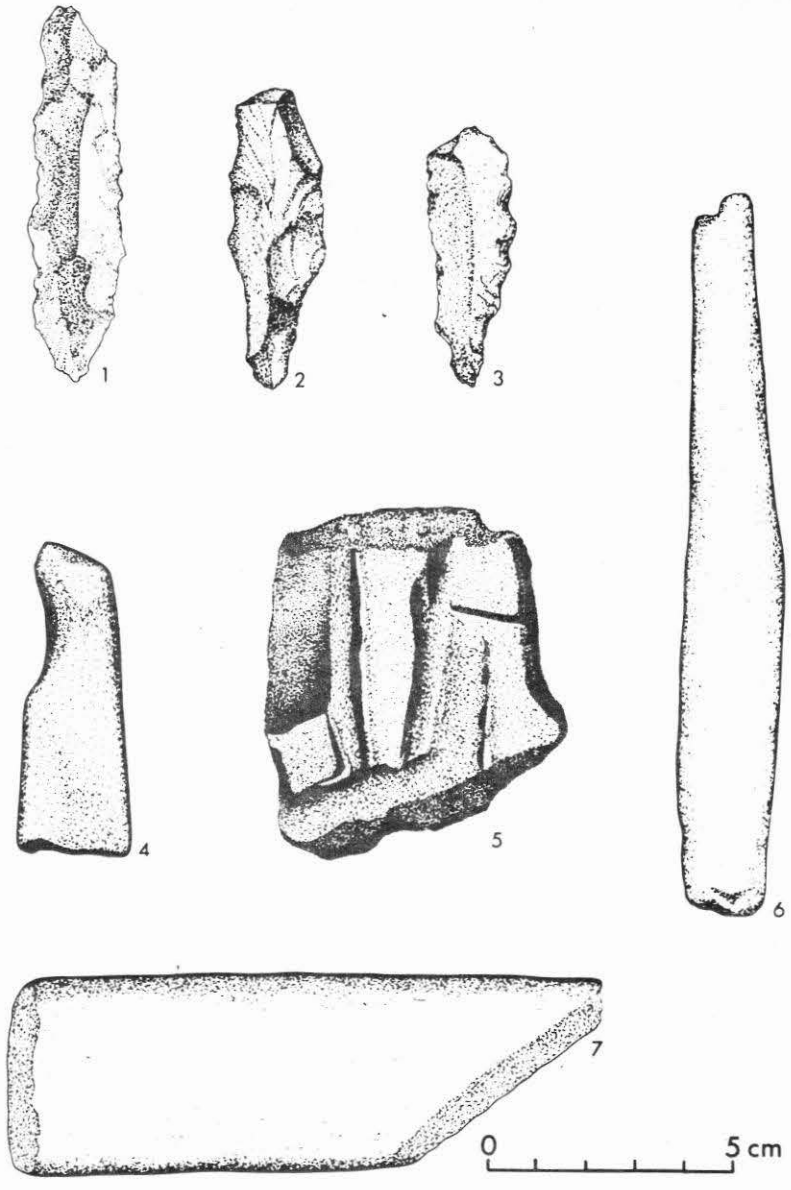

Fig. 13.9 1-3, drill points of orthoquartzite—these or similar artifacts were probably used also as chisels. 4-7, attrition tools. 6 is of schist, 4, 5, 7 are of fine grained sandstone.

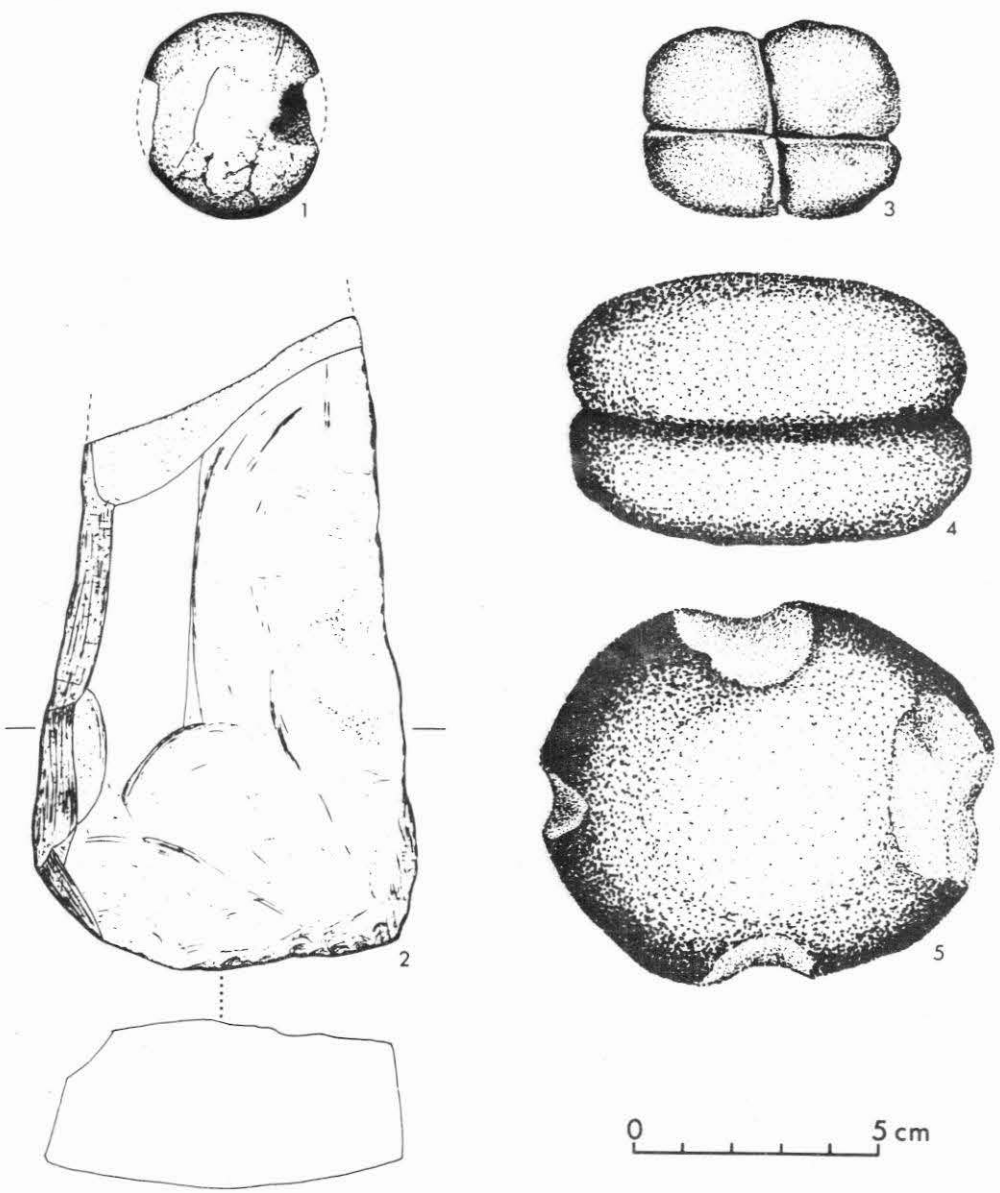

Fig. 13.10 1, flattened (and broken) clay ball; 2, part of an unfinished quadrangular sectioned adze of fine-grained litharenite; 3-5, fishing sinkers.

Faunal Remains

No detailed data on faunal remains are available due to the lack of identification facilities and available time. An extensive shell midden area occurred in Area C and there was at least one small shell midden in Area E. Scattered shell middens also occurred in Area D but were virtually absent in A and B. The species composition varied throughout the site but the average amounts over 350 square feet of Area C were as listed below (Table 13.2). Percentages are of individual whole or broken bones and shells.

Table 13.2

Catseye shells (Lunella smaragda)	56%
Fish bones	29%
Moa bone pieces (mostly Euryapteryx gravis)	each < 5%
Paua shells (Haliotis spp.)	
Dog bones (Canis familiaris)	
Limpet shells (Cellana spp.)	
Mussel valves (Perna canaliculus)	each < 1%
Oyster valves (Ostrea sp.)	
Turban shells (Cookia sulcata)	
Bird bones (listed separately)	
Cockle valves (Chione stutchburyi)	each < 0.2%
Mactra valves (Resania lanceolata)	
Seal bones	
Mussel valves (Mytilus edulis	
Tuatua valves (Paphies subtriangulata)	each < 0.1%
Shield shells (Scutus breviculus)	
Sea-urchin pieces (Evechinus chloroticus)	

Besides the molluscs listed here, fresh-water mussel shells, Hyridella menziesi, were found elsewhere on the site; all these species are considered to have been used for food. The above list does not indicate the relative importance of food species throughout the site as there was an area almost exclusively of moa bones in part of Area E. Some shells had been carefully placed on the midden heaps—for example seven paua were found together with the backs of some shells in the openings of others, and three Mactra valves were found together nearby. Large water-worn stones had been placed in the midden deposit in several places. As mentioned previously some Dentalium sp. shells were also present amongst the midden material and had probably been collected for ornamental use as had the Zediloma sp. shells found with them in Area D. Beach shells, distinguishable by wear, internal deposits and the borings of carnivorous species, occurred in the sand matrix of the site, mostly in layer 5 in association with scattered beach pebbles.

Moa bones were present in the occupational deposits throughout Tai Rua, but were concentrated in parts of Area E. In places the occupational layer here was composed almost solely of moa remains—both body and leg bones in approximately natural proportions, with some tracheal rings, gizzard stones and eggshell. There were also dog bones and faeces amongst them, but very few moa (or any other) bones had any possible dog tooth marks on them—a feature that has been noted on other sites. No attempt has been made to

estimate the number of individual moas represented, but there can be little doubt that they, and shellfish, provided the bulk of the food-stuffs at Tai Rua, followed closely by fish. The place of the latter is perhaps surprising in view of the numbers of completed and unfinished fish-hooks found. The ratio of moa to dog bones was roughly ten to one, and to seal bones about twenty to one.

Sections of moa vertebrae in position of articulation were not uncommon and two almost complete necks with skulls and tracheal rings in position were found in Area E. In this area too was a group of fragments of moa egg-shell which appeared to be from a single egg.

There was considerable variation in the specific gravity of moa bones from different parts of the site; bones from the damp Area E were always heavier and denser, even after drying, than those from the rest of the site where the matrix was generally dry and sandy. This was due, not to "mineralisation" of the heavy bones, but to their high organic content which was up to 23% for bone from Area E where conditions were better for preservation, compared with as little as 8% for bone from a dry sand matrix.

Vertebrate species represented by bones at Tai Rua are listed in Table 13.3. Where given, numbers refer to the numbers of bones identified by Ron Scarlett, who examined all the small bird bones. Half as many again were considered not identifiable. Bones of the moas Euryapteryx and Pachyornis were present at a ratio of about 11 to 4, but total numbers are not available.

The composition of the bird list is interesting in that apart from the moas there is only one bone of a forest-dwelling species (tui). This may reflect the abundance of moas rather than a scarcity of small forest birds—moas would presumably provide a greater return for the energy, time and trouble required in catching them than would small birds in the same habitat. It might further be hypothesised that the small, predominantly coastal, species present were included in the diet to provide taste variety. In short I suggest that the composition of Table 13.3 may represent the choice of the inhabitants of Tai Rua rather than the availability of species.

The habitat of the still extant species indicates that most of the small bird hunting was carried out in coastal or estuarine localities, possibly the Tai Rua headland and adjacent All Day Bay lagoon to the north. The number of bones identified, 99, represents approximately two thirds of the total number found; small birds thus provided only a small proportion of the food eaten.

Very few rat bones were found, nor was there much rat gnawing evident on any midden bones. Dog and seal bones were reasonably plentiful and these animals could have provided a fair proportion of the meat eaten. There were some broken pieces of whale bone in the occupational deposit but there is no suggestion that whale flesh was eaten.

Associated with some of the small fireplace depressions in Area D, and also in Area C, was a material that I have called "consolidated ash" (Trotter 1966). Analyses of this material from Tai Rua and other North Otago sites have shown it to be largely calcium carbonate, presumably derived from burnt mollusc shells. The purity of the "ash" and the degree of burning that must have been required to produce it suggest that it was done deliberately.

Table 13.3 Bird Species

		Bone numbers
Extinct		
Moa	Pachyornis elephantopus	n.a.
Moa	Euryapteryx gravis	n.a.
Duck	Euryanas finschi	1
Hawk	Accipeter (Circus) eylesi	1
Coot	Nesophalaris chathamensis	1
Crow	Phalaeocorax moriorum	2
Living		
Blue penguin	Eudyptula minor	22
Crested penguin	Eudyptes pachyrhynchus	11
Mollymawk	Diomedea cauta	27*
Fluttering shearwater	Puffinus gavia	1
Stewart Is. shag	Leucocarbo carunculatus	8
Spotted shag	Stictocarbo punctatus	13
Paradise duck	Tadorna variegata	2
Grey duck	Anas superciliosa	5
N.Z. scaup	Aythya novaeseelandiae	2
N.Z. quail	Coturnix novaezealandiae	1
Banded rail	Hypotaemidia (Rallus) philippensis	1
Tui	Prosthemadera novaeseelandiae	1
		99

*Seven of these were artefacts

Mammals	
Seal	?Arctocephalus forsteri
Dog	Canis familaris
Rat	Rattus exulans
Fish	
Barracouta	Thyrsites atun
Parrot-fish	Pseudolabrus sp.
(Others not identified)	

Dating

Initially (in the late 1950s) the occupation at Tai Rua was dated at about 500 years before present. This estimation was made on the basis of comparison of artefacts types with dated sites at Wairau Bar and in South Otago, and on the species of extinct birds represented there. This estimate coincided with radiocarbon dates that were obtained some time later.

Carbon isotope analyses were made of nine samples of bone collagen, bone carbonate, shell and charcoal by the Institute of Nuclear Sciences, partly to obtain radiocarbon dates for the occupation, and partly to compare the results

from different materials (see Trotter 1968b, Rafter et al. 1972). The results are briefly listed below; ages in radiocarbon years before present have been calculated according to the "old" half life with reference to the appropriate New Zealand standards for bone and shell (see Rafter et al. 1972 for details of these standards) and to the 0.95 NBS oxalic acid standard for charcoal. They have been corrected for "industrial effect" but not for conversion to calendar dates.

NZ 558	Moa bone carbonate	Recent
NZ 559	Moa bone collagen	503 ± 32 BP
NZ 578	Moa bone collagen	503 ± 32 BP
NZ 749	Marine shell (Haliotis)	485 ± 32 BP
NZ 750	Charcoal	831 ± 33 BP
NZ 751	Moa bone carbonate	Recent
NZ 752	Moa bone collagen	543 ± 32 BP
NZ 765	Moa bone carbonate	Recent
NZ 766	Moa bone collagen	393 ± 37 BP

All samples came from the main occupational layer (i.e. number 5) although from different parts of the site. NZ 559 was obtained from a dry sandy matrix and the bone had a low specific gravity, whereas NZ 578 was heavy bone from a dense "greasy" matrix; both gave the same radiocarbon result.

Carbonate samples NZ 558, 751 and 765 show the usual atmospheric contamination due to nuclear bomb tests, while NZ 766 was analysed to determine the result of long storage and handling.

At the time the samples were processed, 1965-66, the difference between the charcoal and the animal remains proved to be greater than expected. Subsequent dating from many South Island sites however, has shown that this is a normal situation, and that charcoal dates can be expected to be several centuries older than those from bone collagen or shell (Trotter 1968b; Rafter et al. 1972; McCulloch & Trotter 1975). Because of this charcoal error, the shell and bone collagen dates must be preferred for reliability.

From these results the date of the prehistoric occupation of Tai Rua can be placed at about 500 radiocarbon years before present. Although northern hemisphere research indicates that this age is not equivalent to 500 calendar years, the absence of specific data for New Zealand makes any conversion unwise.

Moa bone from Tai Rua was also used in experimental relative dating methods. Samples contained 0.19%, 0.20%, 0.20% and 0.24% of fluorine which is much as expected, but the fluorine content of archaeological bones has been found to be too variable under average New Zealand conditions to be useful even for relative dating (Trotter & Malthus 1967). Other chemical analyses made through the courtesy of Professor F. B. Cousins of the Otago Dental School included measurements of total organic content, nitrogen, phosphorus and calcium for bones from Tai Rua and a number of other sites. Experimental work on thermoluminescent dating was also carried out at Tai Rua (and elsewhere) with at least promising results (Driver 1973).

Conclusions

I do not feel that many positive conclusions about the people of Tai Rua can be drawn from the material recovered and analysed so far. Information was obtained on only a very few of the occupants' probable activities or on other aspects of their lives. More information, particularly regarding their diet and their shelter, lies there in the ground and could be obtained by present-day techniques, but hopefully, as mentioned earlier, the techniques of future decades will yield still more. For this reason I have resisted the strong temptation faced while writing this report, to go back and extend the excavations to tidy up a number of loose ends, to look at the distribution of post-holes, the hearths, middens and other structures, and to obtain data on food use and, if possible, the size of the community and the length of their occupation.

From the information presently available we can see that a small group of people lived for a time at Tai Rua some 500 radiocarbon years before present. Various activities such as butchering, cooking, refuse dumping and lighting fires for warmth tended to be carried out in specific parts of the site. Protein food was largely the flesh of moas, shellfish and fish (in that order), with dogs, seals and small birds providing a smaller proportion of their diet. Various tools, particularly cutting implements, were made from rock materials from a variety of locations, principally within 50 kilometres of Tai Rua, but with small amounts from as far away as the West Coast, northern Marlborough and the northern half of the North Island. Most of the stone tools (flakes of siliceous rock or greywacke) seem to have been intended for cutting soft material e.g. flesh; some were designed for drilling or chiselling bone, and a few were adzes for shaping wood or possibly digging in the ground. Other artefacts fashioned from rock included hammers and sinkers. Fish-hooks comprised the most prominent class of artefacts that were made of bone. There is some evidence that the emphasis was on manufacturing rather than using fish-hooks at Tai Rua, and a variety of different designs were made.

Although the artefact assemblage from Tai Rua differs greatly from that of Wairau Bar, which is commonly thought of as a "type site" for the Moa-hunter period of Polynesian culture in New Zealand, this may well have been due to factors other than solely an evolutionary change during the period of 150-200 radiocarbon years between their occupations (see Trotter 1975b). Tai Rua may have been a less permanent settlement, for example, with an economy reflected more by fish-hook production than by the types of activities that were carried out at Wairau.

While there is a greater variety of fish-hooks than is usual from most Moa-hunter sites, the general types of these and other artefacts are not inconsistent with artefact types from other early Polynesian sites throughout the country.

Acknowledgements

I am grateful to John Brown and to the Waitaki County Council for permission to excavate at Tai Rua, and to members of the North Otago Scientific and Historical Society for the work they did there. My thanks go also to Peter Gathercole for help with data from his investigations of 1960-62, to Roger Duff for advice and encouragement, to Athol Rafter for radiocarbon dates, to

Beverley McCulloch for drawing the bone artefacts, and to Ron Scarlett for bird bone identifications.

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