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SUMMARY

'Plateau and Plain' deals with the results of a programme of prehistoric research in Arnhem Land, Northern Territory, in 1964 and 1965.

Chapter I describes the problem as it appeared when the research began. Earlier work had highlighted typological problems in the area but after the 1964 field season the aims of the programme were re-orientated in the light of the field situation. According to local Aboriginal informants and literary sources, two fairly distinct cultural groups had lived in the area. The plains people were woodworkers who seldom made or used stone tools, whereas the people of the hilly plateau made stone tools. As a result, attempts were made to see whether this cultural dichotomy was reflected in the archaeological record.

Having outlined the problem, the general environment of the research area is discussed briefly in terms of our current knowledge of the ethnography, geology, climate, fauna and flora.

Chapter II deals with the methods used in the field, and the procedures employed to analyse the material later. The most detailed part of the discussion concerns the code used to analyse the large collections of stone implements.

Having explained the aims and the methods of the research, the next five chapters deal with the description and analysis of material excavated at three sites on the plain, and two sites in the hilly plateau.

Chapter III concerns the excavations at Padypadiy, a small cave on the plain. Occupation lasted there for at least 3,000 years. Food remains include shells, bones and plant remains and a marked degree of differential weathering is noted. The implements include bone, shell, wood and stone tools and analysis shows that the bone, shell and wooden tools were probably made on the spot, whereas the stone tools (such as points and small scrapers) were clearly imported into the shelter.

The remains in Padypadiy are similar in many respects to items made and used by the Kakadu people who lived near Oenpelli in 1912, so that there is some justification for relating the archaeological remains and the people.

Chapter IV deals with the excavations at Malangangerr, another shelter on the plain. The stratigraphic sequence there consists of unstratified sand (dated to about 18-20,000 B.P.), overlain by a well stratified midden (dated from 6,000 to 300 B.P.). The dietary remains and artefacts recovered from the midden, are very similar to those found at Padypadiy. Only stone tools occur in the lower sands and these consist largely of chunky scrapers and edge ground axes.

Chapter V describes the material excavated at Nawamoyyn, another rock shelter on the plain. The stratigraphy and radiocarbon dates of this deposit are

almost identical with the series found at Malangangerr, thus overruling some of the earlier doubts about the antiquity of the deposits in general, and of edge ground axes in particular. The dietary remains and artefacts in the midden are very similar to those found at Padypadiy, so that the absence of stone working on the plains seems to be a fairly long lived tradition that possibly lasted for some 7,000 years.

Chapter VI contains a detailed analysis of the stone industry excavated at Tyimede I, a shelter in the plateau. It is argued that the earliest stages of the industry should be dated to about 4,000 B.P. The industry consists mainly of points and small scrapers, which are similar to the implements excavated at the plains sites, except for the fact that the Tyimede I tools were produced at the site.

Chapter VII deals with the material excavated at Tyimede II, a shelter only about 100 m. away from Tyimede I. Two stone industries occur here. The earlier one is characterised by chunky scrapers and edge ground axes and resembles the early series at Malangangerr and Nawamoyrn. It is dated to 6,000-7,000 B.P. The later industry is very similar in all respects to the assemblage from Tyimede I and the early stages are dated to about 4,500 B.P.

Chapter VIII contains a summary of the most important results of the research. An attempt is made to assess these findings in the light of previous work in other parts of the Northern Territory, and in the rest of the

country as a whole. In particular, there is an appraisal of Mulvaney's rationalisation of the changes in stone tool typology in Australia.

PLATEAU AND PLAIN

Prehistoric Investigations in Arnhem Land,
Northern Territory.

Carmel White

This work is a thesis submitted for the degree
of Doctor of Philosophy in The
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September, 1967

This thesis is the product of field research by the author. Specialist help has been sought in the analysis of some data and this is acknowledged. Apart from this, the thesis is my own original work.

Carmel White.

Carmel White
15 September, 1967.



This thesis is dedicated to Frank Gananggu
of Oenpelli, who told me the story in the
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PREFACE

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CHAPTER I

INTRODUCTION : THE PROBLEM IN PERSPECTIVE

Arnhem Land is the central peninsula of North Australia, lying between the Timor Sea on the west, and the Gulf of Carpentaria on the east. (Figure I-1).¹ It has long been the focus of anthropological research, because it was relatively accessible and contained large numbers of Aborigines leading a fairly traditional way of life. The complex and attractive art of the area was another source of interest, and the influence of non-indigenous visitors such as the Macassans who visited the north coast each year could also be observed.²

It was partly in the course of anthropological research that as much archaeological work had been done in Arnhem Land in 1964, as anywhere else in Australia. Warner excavated shell mounds at Milingimbi between 1926 and 1929.³ Davidson excavated rock shelters at Willeroo and Delamere in 1930,⁴ and McCarthy and Setzler

¹ R.M. and C.H. Berndt defined the area as follows:
The name Arnhem Land was formerly applied to all the northern part of the Territory, from the Roper River west to the Victoria River; but today it refers only to the reserve....
(Australian Encyclopedia, 1958 v.I, p.243).

In an archaeological dissertation, it is preferable to use the geographical term, rather than the more limited, political one.

² Berndt, R.M., and C.H. 1954.

³ Warner, W.L. 1958 pp.470-1.

⁴ Davidson, D.S. 1935 pp.145-84.

worked at Groote Eylandt, Yirrkalla, Milingimbi and Oenpelli in 1948 as part of the American-Australian Scientific Expedition to Arnhem Land.¹ Macintosh excavated the Tandandjal rockshelter in 1948² and W.E.H. Stanner excavated the Yarar shelter in 1957 and 1958.³ Finally in 1963, Mulvaney and Golson surveyed a large area near Katherine and Pine Creek and excavated sites at Kintore and Ingaladdi⁴ (Mulvaney), Katherine and Sleisbeck (Golson).⁵

Most of the excavations were made at rock shelters which yielded very little evidence of diet or economy. The industries were mainly of the point and scraper type, but at Ingaladdi, Kintore and Katherine there was evidence of an earlier pre-point industry containing mostly scrapers,⁶ some of which could be termed 'horsehoof cores'.⁷

Up to 1964 no detailed systematic analyses had been made of the collections, and naturally discussions focussed largely on the presence of stone tool types and their distribution, without attempting to investigate problems of typology or the relationship of artefacts to

¹ McCarthy, F.D. and Setzler, F.M. 1960 pp.215-95.

² Macintosh, N.W.G. 1951 pp.178-213.

³ Flood, J.M. 1967 M.A. Thesis, A.N.U. p.12.

⁴ Mulvaney, D.J., and Joyce, E.B. 1965 p.207; also pers. comm.

⁵ Golson, J. 1964 p.5; also pers. comm.

⁶ Mulvaney, D.J. and Joyce E.B. 1965 p.207.

⁷ See McCarthy, F.D. et al., 1946 p.19; McCarthy, F.D. 1967 pp.18-9.

the local environment and ethnography. As a result the following observations could be made:

- (i) An industry of points and scrapers made on large endstruck quartzite flakes was recognised at Tandandjal and in the uppermost levels at Katherine and Sleisbeck. This assemblage was apparently absent at the other excavated sites.
- (ii) Tula adze-flakes were present at Tandandjal and Ingaladdi¹ and one was noted amongst Davidson's collection from Delamere.² A few were present at Katherine and Sleisbeck³ but there were none in the collections from Oenpelli and further east.
- (iii) The excavations at Oenpelli revealed an interesting situation. McCarthy and Setzler⁴ investigated prehistoric remains on two hills, Umbalanja (Inyaluk) and Arguluk which are rocky outliers of the Buldiva escarpment (Figure I-2). Ten rock shelters were excavated at Inyaluk each of which yielded 6-9 in. of deposit and a wide variety of stone artefacts. Two blade-quarrying sites were also noted there. Two shelters were excavated at Arguluk which yielded 1-2 ft of deposit containing burials and artefacts. One shelter,

¹ Mulvaney, D.J. pers. comm.

² Macintosh, N.W.G. 1951 p.200.

³ Golson, J. pers. comm.

⁴ McCarthy, F.D. and Setzler, F.M. 1960 pp.215-95.

White Kangaroo Cave, also contained a heap of clam and snail shells, but these were not analysed in detail.

The excavations yielded a few bone implements and numerous stone tools. These, described according to the standard text on typology,¹ included points, blades, scrapers, elouera adze-flakes, edge-ground axes, flakes with use-polish and flake-fabricators. The authors deduced from this that two main cultural influences were present at Oenpelli, the Kimberleyan from the south and west, and the Eloueran from the east. They drew direct links between elements at Oenpelli and other parts of the country as follows:²

- (i) Leilira blades, uniface and biface points and horsehoof cores were linked with the Kimberleyan of Tandandjal³ and the Willeroo/Delamere area.⁴
- (ii) Leilira blades also linked the Mudukian-Murundian surface sites in central Australia and western Queensland.
- (iii) Uniface pirri points were linked with the Pirrian culture of the lower Murray valley, South Australia.⁵

¹ McCarthy, F.D. et al. 1946.

² McCarthy, F.D., and Setzler, F.M. 1960 pp.285-7.

³ Macintosh, N.W.G. 1951 pp.178-213.

⁴ Davidson, D.S. 1935 pp.145-84.

⁵ Hale, H.M. and Tindale, N.B. 1930 pp.145-218.

- (iv) Horsehoof cores were linked with the Pirrian-Mudukian-Murundian complex from surface sites in western New South Wales.
- (v) Elouera, flake fabricators and use-polished tools were linked with the Bondaian and Eloueran cultures of Lapstone Creek N.S.W.¹
- (vi) Bone points were linked with the Mudukian of Devon Downs² and coastal New South Wales.

As a result, the authors concluded that:

...at Oenpelli we obtained a mixed industry consisting of Bondaian, Eloueran, Kimberleyan, Pirrian, Mudukian and Murundian elements. ...all of the implement types found belong to the one industry or horizon, a complex from which all of the known cultures in the interior ...could have originated. The results of our excavations at Oenpelli might well be considered as indicating a meeting place of the above influences.³

This conclusion is of course based on the hypothesis that one small element of material culture denotes meaningful cultural links over a vast distance and an unknown time range. It is perhaps most intelligible if one recalls that the aim was to establish the 'origin, or at least the prehistory, of the Australian aborigines in Arnhem Land.'⁴ (the italics are mine).

¹ McCarthy, F.D. 1948 pp.1-34.

² Hale, H.M. and Tindale, N.B. 1930 pp.145-218.

³ McCarthy, F.D. and Setzler, F.M. 1960 p.286.

⁴ McCarthy, F.D. and Setzler, F.M. 1960 p.215.

Golson¹ later re-analysed the Oenpelli report and noted that there is a marked difference in the distribution of flaked stone implements from excavated sites on the two hills. This is tabulated briefly below:

Stone Tools at Oenpelli Sites (Per cent)		
Tools	Inyaluk	Arguluk
Points	26.4	2.2
Elouera	7.1	37.6
Use-polished flakes	4.4	18.1
Flake-fabricators	34.2	25.0
Scrapers	21.2	12.3
Other	6.7	4.8
Total numbers ²	269	228

Even allowing for errors made during excavation, these variations were so marked that Golson suggested that 'two distinct entities are presented as a single "culture".'³ He also suggested that his Sleisbeck site showed a sequence of elouera preceding points, which might support a new interpretation of the Oenpelli material.

¹ Paper delivered at the Australian Institute of Aboriginal Studies Conference on Typology and Nomenclature of Cultures, Sydney, 1963.

² These represent the total number of flaked stone implements from sites 1-10 on Inyaluk Hill, and sites 1-2 on Arguluk Hill. (McCarthy, F.D. and Setzler, F.M. 1960 p.274).

³ Golson, J. 1964 p.5.

A definite archaeological problem therefore existed at Oenpelli whose resolution was obviously important for local and perhaps Australian prehistory.

It was in this context that my first field season began (July-October 1964), during which the Oenpelli area (Figure I-2) was selected for detailed archaeological work. During this early period, the original aims of the project were continually reviewed in the light of the field situation, and as a result the project was totally re-oriented in the following way:

1. During the 1948 Arnhem Land Expedition, McCarthy and McArthur made a useful, and for Australia unique, study of the food gathering activities of Oenpelli Aborigines.¹ It lasted only a few weeks and presented a non-contextual portrait of hunter-gatherers, but it was nonetheless a valuable piece of work, because it provided one of the few 'limiting models'² for the archaeological interpretation of the behaviour of such groups.

In 1964, some Aboriginal inhabitants of Oenpelli Mission proved still to have an intimate knowledge of the traditional exploitation of the environment, and as a result, I tried to enlist their help in finding sites and interpreting the archaeological remains.

2. The deposits on the plains around Oenpelli proved to be so rich in ecological evidence that a special

¹ McCarthy, F.D. and McArthur, M. 1960 pp.145-94.

² Clark, G. and Piggott, S. 1965 p.133.

effort was made to exploit this aspect through archaeological techniques and ethnographic information.

3. A distinction was drawn constantly by local informants between the traditional material cultures of the people who lived on the plain around Oenpelli and those who lived in the hilly plateau to the south and east. Briefly they suggested that the plains people made and used bone, shell and wooden artefacts, but did not fashion stone tools. These they obtained by trade from stone working tribes who lived in the hills. These claims were supported by the ethnographic records of that region.¹ I therefore decided to investigate sites in both areas to see whether this dichotomy was reflected in the archaeological record.

In view of these stated aims, it is relevant at this stage to review briefly the ethnographic and ecological situation in the research area.

1. Ethnography

The first ethnographer to visit Oenpelli was W. Baldwin Spencer. Paddy Cahill, the famous buffalo hunter, had established a station there in 1906² and when Spencer arrived in 1912 a considerable number of Aborigines had already gravitated towards the settlement, so that the old tribal, linguistic and blood³ groups were already disturbed.

¹ Spencer, W.B. 1914 pp.247-8; 1928 p.844; Thomson, D.F. 1949 pp.65-9; Berndt, R.M. and C.H. 1964 p.116.

² Simpson, Colin 1951 p.4.

³ Kirk, R.L., 1965 pp.8-9.

Spencer described the main local inhabitants as follows:

The Kakadu is one of a group, or nation, of tribes inhabiting an unknown extent of country, including that drained by the Alligator Rivers, the Coburg Peninsula, and the coastal district...as far west as Finke Bay. Its eastern extension is not known. For this nation I propose the name Kakadu,¹ after that of the tribe which we know most.

He described the technology of the Kakadu in considerable detail, noting in particular that they did not fashion stone tools but 'seem to use shells for cutting'.² They made wooden tools which they then traded to other tribes.³

The distribution of tribes in Arnhem Land was studied by later workers who drew detailed maps based of necessity, largely on informant testimony rather than direct observation.⁴ In 1951 Elkin and the Berndts described the western region of Arnhem Land as an area that 'contains...remnants of tribes having a common cultural heritage, but speaking different languages'.⁵ They claimed that most of the original tribal groups at Oenpelli were now largely 'extinct', including the Manjeridji who lived around Oenpelli and were responsible for the rock paintings, the Wenji and

¹ Spencer, W.B. 1914 pp.121-2.

² Spencer, W.B. 1928 p.844.

³ Spencer, W.B. 1914 pp.247-8.

⁴ Tindale, N.B. 1940 pp.140-231, Berndt, R.M. and C.H. 1964 pp.26-46.

⁵ Elkin, A.P., Berndt, R.M. and C.H. 1951 p.253.

Erei who lived on the plain and river just west of Oenpelli and the Rereri and Wuningag living higher up the East Alligator River. The Gundjeimbi also lived on the East Alligator River but were related to the Gunwinggu people, who were 'in the main people of the rocky country',¹ and whose original territory extended from the creeks east of Oenpelli north to Tor Rock and Coopers Creek and east to the Liverpool River. These authors claimed however, that the Kakadu whom Spencer studied at Oenpelli were not in their home territory, but came from the area between the Jiwadja to the northwest of Oenpelli and the Rembarnga, southeast of Oenpelli.

I investigated this problem at Oenpelli in 1964 and 1965.² The informants agreed that the area was formerly occupied largely by Kakadu, Mengedji and Edey people who roamed over a wide area of the plain from Nimparpee Hill to Cannon Hill but were centred at Oenpelli. The Gunjepmi lived on the outskirts of this area and roamed along the edge of the escarpment from the waterfall to Tin Camp Creek and westwards to

¹ Elkin, A.P., Berndt, R.M. and C.H. 1951 p.253.

² These enquiries were made in conjunction with a linguist Mrs Joy Harris (Dept. of Anthropology and Sociology, Research School of Pacific Studies, A.N.U.) who worked at Oenpelli in 1965. I am most grateful for her co-operation in this matter.

I have used Mrs Harris' orthography henceforth for most tribal and place names. Thus 'Maneridji' of Elkin and Berndt is 'Mengedji', 'Erei' is 'Edey' and so on. The exceptions to this rule are the word 'Kakadu' where Spencer's spelling is used, and well known place names such as 'Nimparpee' and 'Mudginbarry', where the official map spellings are preferred.

Mudginbarry. Most of these people were 'taken over' by a large influx of Gunwinggu people who came in from the east when the mission was established in 1925 (Figure I-2).

The latest map of the 29 linguistic families of the Australian phylum¹ centres the Kakaduan on Oenpelli, with the large Gungwingguan family extending from the coast over most of the escarpment country.

These variations reflect the inherent difficulties of this study. Only Spencer worked at Oenpelli when the original inhabitants of the coastal plain predominated there, and his definition of the Kakadu is a broad one. It is not restricted to a specific tribal group and probably includes the Mengedji and Edey people of Elkin and the Berndts. It also covers two linguistic groups, the Kakaduan and the Iwaidjan, of O'Grady et al. Primarily, it refers to a group of Aborigines living on the coastal plain, whose material culture was distinct from that of other groups living in the hills and further east. This feature is highly relevant to archaeological studies, and therefore I shall use the term Kakadu, in Baldwin Spencer's sense, to describe the former wood-working inhabitants of the coastal plains and rocky outliers around Oenpelli.

¹ O'Grady, G.N., Voegelin, C.F. and F.M. 1966; O'Grady, G.N., Wurm, S.A. and Hale, K.L. 1966.

2. Geology¹

The relevant geological features of the area are the plateau and the plain. The plateau is the Upper Proterozoic Buldiva plateau and the plain can be subdivided into the alluvial plain, consisting largely of Tertiary alluvium derived from the plateau, and the coastal plain which is comprised of Quaternary estuarine sediments (Figure I-2).

The Buldiva plateau is comprised of near-horizontal strata of quartzite, sandstone and conglomerate of which Kombolgie sandstone is the chief component. There is no evidence of major post-depositional tectonic warping.

The escarpment of the plateau occurs as a series of steep cliffs up to 800 ft high, which form the north-west border of the main Arnhem Land plateau (Plate I-1). Erosional outliers such as Inyaluk (Plate I-2), Arguluk and Cannon Hill (Plate I-3) form a series of mesas and buttes flanked by basal wash slopes and overlaid by coarse arenaceous sands. Selective joint-guided vertical erosion results in the formation of tors, and weathering of debris derived from the breakdown of the Kombolgie sandstone has led to a capping of haematite and limonite on rocky outcrops.

The alluvial plains are composed largely of sandy silts derived from the plateau. Large rivers such as the East Alligator originate in the plateau and incise the plains as they flow north to the sea.

¹ I am most grateful to Dr R. Story (Division of Land Research, C.S.I.R.O.) and Mr M.A.J. Williams (Dept. of Geography, Research School of Pacific Studies, A.N.U.), for their advice in drafting this section.

The coastal plain is an ill-drained plain of estuarine mud and clay. Its position and features suggest that it represents the in-filled estuaries of north flowing rivers drowned in the last Pleistocene sea level rise. Relict dunes occur locally, which indicate the position of former emerged coastlines.

It is unclear whether the emergence of the plains should be attributed to gentle uplift and tilting or to a eustatic fall in sea level. Early authors¹ related the formation of the coastal plain to major universal eustatic fluctuations. The Arnhem Land plains are as yet undated and the only relevant dates come from the northwest coast of Queensland. Twidale² has cited radiocarbon dates for alluvium deposited before a period of uplift and for emerged strandlines. The alluvium is dated to at least 33,550 B.P. (GX-306) and the strandline to 3320 ± 125 B.P. (GX-305). The coastal plain therefore emerged sometime between 30,000 and 3,000 B.P.

Large rivers like the East Alligator widen out in the alluvial flats and meander in the lower reaches. Because of the 26 ft tide, the East Alligator is tidal up to 30 miles inland where estuarine conditions prevail (Plate I-4).

3. Climate

The climate is monsoonal with marked seasonality. Most of the rain falls between October and March, and

¹ Scrivenor, J.B. 1941-2 pp.120-6; Christian, C.S. and Steward, G.A. 1953 pp.34-5; Specht, R.L. 1958b p.343.

² Twidale, C.R. 1966 p.491-4.

Specht cites a 35 year record of rainfall from Oenpelli of 52.95 inches p.a.¹ Despite the marked variations in humidity, the temperature remains fairly constant, varying at Humpty Doo from 96.55 - 87.98°F mean maximum to 75.85 - 59.63°F mean minimum.²

The seasonal changes affect the ecology profoundly. In the Oenpelli area for instance, the wet season monsoonal winds are so strong that bees are confined to their hives and honey is not produced. The swamps overflow and water plants cannot be gathered. Animals hide on the dry islands among the long wet grass and the normally brackish East Alligator River flows with fresh water which kills the mangrove clams living on the muddy flats.³

These seasonal changes also affect human behaviour very markedly⁴ and it could be said that the abundance of water is a limiting factor in Arnhem Land in the same way as the scarcity of water restricts human activities in the arid areas.⁵ Traditional hunter-gatherers are isolated during the rainy season, food is scarce and movement is restricted, whereas when the Dry begins they are free to exploit a far wider geographical area.

¹ Specht, R.L. 1958b p.335.

² Story, R. pers comm.

³ Specht, R.L. 1958b p.334.

⁴ cf. Thomson, D.F. 1939 pp.209-21; 1949.

⁵ I am grateful to Mr N.C. Peterson, (Northern Territory Research Officer, Australian Institute of Aboriginal Studies, Canberra) for his helpful comments here.

4. Fauna¹

The indigenous terrestrial fauna is a typical tropical Australian savannah woodland fauna, which lacks the big representation of New Guinea elements found in Cape York. All animal phyla are represented and a good diversity of species occurs including bandicoots, possums, kangaroos, wallabies, flying foxes and rats. A wide variety of birds occurs, including large numbers of water fowl such as magpie geese, living near the permanent fresh water lagoons.

The aquatic fauna includes fresh water species (tortoises, fish, molluscs) and estuarine forms (crocodiles, fish, crabs and molluscs). The marine phyla are not as well represented because of the distance from the open sea.

A fairly wide range of introduced mammals is currently found, including dingo, horse, ass, pig, house mouse and water buffalo.²

5. Flora

Specht³ described the plant communities of Arnhem Land as climax communities where only some mangrove forests, swamps and marshes show seral relationships. The three main geological areas have complex and varied

¹ I am most grateful to Mr J.H. Calaby (Division of Wild Life Research, C.S.I.R.O.) for his advice in drafting this section.

² Johnson, D.H. 1964 pp.431-3.

³ Specht, R.L. 1958b pp.333-414.

flora. The plateau (Specht's quartzite and sandstone hills edaphic complex) is mainly under spinifex grassland with clumps of savannah woodland (Eucalyptus phoenicea, E. tetradonta, Callitris intratropica and Livistona humilis) on the gentler slopes, and patches of monsoonal forest with Pandanus spiralis in gorges and valleys. The alluvial plains are covered with tall trees (Eucalypts, Callitris intratropica), palms (Livistona humilis, Cycas media) and annual grasses and herbs. The coastal plains (Specht's estuarine (black soil) plain edaphic complex) is covered with rice (Oryza fatua) and sedge (Eleocharis dulcis) with grasses like Phragmites karka along stream beds and a wide variety of water plants in the lagoons, including waterlilies (Nymphaea gigantea) and lotus lilies (Nelumbo nucifera).

This then is the general background for the research at Oenpelli. The following chapters include an outline of the analytical procedures, and a detailed description of the excavations at five sites, three on the plain and two on the plateau (Figure I-2).

CHAPTER II

FIELD METHODS AND ANALYTICAL PROCEDURES

This chapter deals with the methods that I have used in the field and later to analyse the material. The procedures are as follows:

1. Surveying techniques.
2. Excavation techniques and sampling procedures.
3. Analysis of organic remains.
4. Analysis of implements.
5. Use of ethnographic material.

1. SURVEYING TECHNIQUES

Once the central problem was defined, we had to locate archaeological sites on the plains and in the hills. All reconnaissance was done with this aim in mind, rather than making a comprehensive survey of all promising sites in the area (see Appendix II-1).

We relied heavily on Aboriginal informants to guide us to 'old living places'. Most of the shelters in the escarpment were discovered under the guidance of Aboriginal men during two main exploratory trips. These sites include Tyimede I and II, Magalidiny and Tyadang.

More extensive reconnaissance was carried out on the plain, as a series of short day trips out from Oenpelli. We explored the area ourselves by driving to a promising looking outcrop and walking around

looking for shelters. Malangangerr and Nawamoyrn were discovered in this way, and Padypadiy was noticed whilst driving along the main road towards Mudginbarry cattle station.

All sites were tested to decide whether a detailed excavation should be made there or not. This was generally done by making one or more 'hand-holes' in the deposit. A 'hand-hole' is simply a test pit, about 10cm. square, which is scooped out by hand, using a small paintscraper to loosen the earth. These holes could be almost a metre deep. The material was passed through a 1/4 inch mesh plastic sieve, so that all organic and cultural remains were recovered. The hand-hole has an advantage over a test pit because a smaller area is disturbed, and yet one can get a fairly reliable picture of the general nature of the deposit before full scale excavations begin.

2a. EXCAVATION TECHNIQUES

Excavations were carried out in five rock shelters to discover the nature and sequence of events reflected there. This involved a study of the artefactual sequence in its ecological setting. The following basic techniques were used in all the excavations.

Firstly a base line was laid out and a datum point fixed by hammering a nail into the rock wall. The deposit was gridded in square metres and these were lettered in one direction and numbered in the other, e.g., Square O5, or A7.

All excavation was done by a professional archaeologist, myself or my husband J. Peter White.¹ The deposit was removed with trowels in 1964, but these were replaced by triangular-headed Harris Standard paint-scrappers; paint brushes, hearth brushes and ash-pans were also used.

The deposit was removed in a series of split levels that conformed as closely as possible to the trend of the observed stratigraphy. Every attempt was made to excavate back from two exposed faces, and each square metre was removed separately to the greatest depth possible. Several of the deposits contained large blocks of sandstone and the somewhat irregular shape of the excavated area at Malangangerr reflects my attempts to avoid these blocks.

The depth of the excavated level was recorded at each corner and in the middle of each square, using a line-level and a tape. The position of all implements recognised in situ was recorded horizontally in relation to the sides of the square and vertically in relation to the datum point. The implements were then labelled according to site,² square, spit and number, so that a

¹ Research scholar, Dept. of Anthropology, A.N.U.

² The following code was used for the five excavated sites:

P.B. - Padypadiy

M.G. - Malangangerr

C.H.I. - Nawamoyne (the letters stand for Cannon Hill area, Site I and were used because the Aboriginal name was not known until later)

J.M.1. - Tyimede I (pronounced Jeemari)

J.M.2. - Tyimede II.

tool labelled MG 3E/7-60, comes from Malangangerr, Square 3E, Spit 7, number 60.

The rest of the excavated deposit was passed through 1/4 inch mesh circular plastic sieves, to sort out all the desired remains. This work was done by Aboriginal men who expressed a marked preference for these small light sieves rather than a large metal one mounted on a cradle. I inspected the sieves after they had been sorted in most instances, but I have recorded when this was not done. The same sized sieves were used at all sites so that the results are strictly comparable in this particular respect.

2b. SAMPLING PROCEDURES

1) Soil Samples

Soil samples were taken on the advice of three geomorphologists¹ who visited the three coastal plain sites, (Padypadiy, Malangangerr and Nawamoyne), in 1965.

All of the excavated deposits consist largely of coarse sand and quartz pebbles, derived from abundant local sources in the Buldiva escarpment. These deposits also contain varying quantities of organic material such as shell, bone and charcoal, brought in largely by the

¹ Mr J.N. Jennings and Mr M.A.J. Williams, Geography Department, Research School of Pacific Studies, A.N.U., and Mr A.D.L. Hooper, Division of Land Research, C.S.I.R.O., Canberra. I am most grateful to them for their help in the field, and to Messrs Jennings and Williams for their kind assistance in drafting those sections relating to geomorphology.

Aboriginal inhabitants. Deposits with a heavy organic additive are clearly stratified, whereas sandy deposits with a low organic content generally show only slight gradational changes of colour and texture.

The variations in sandy deposits were noted in the field and are attributed to local weathering processes or variations in the parent rock. Samples of rocks were taken from the shelter walls and roof and also from local outcrops and stream beds. Unfortunately, none of the samples have been analysed in detail yet, largely because it would be premature to draw broad conclusions about the nature and conditions of weathering and accumulation in an area where so little detailed geomorphological research has been done.

2) Midden Samples

Dense accumulations of shells, bones and plant remains were found in the deposits and on the coastal plain. I consulted a large body of literature¹ dealing with the problems of midden analysis, and found R.F. Heizer's masterly summary² especially helpful.

¹ Nelson, W.C. 1909 pp.309-56; Gifford, E.W. 1916 pp. 1-29; Cook, S.F. 1946 pp.50-3; Cook, S.F. and Treganza, A.E. 1947 pp.135-41; 1950 pp.223-62; Treganza, A.E. and Cook, S.F. 1948 pp.287-98; Cook, S.F. 1950 pp.2-5; Cook, S.F. and Heizer, R.F. 1951 pp.281-312; Greengo, R.E. 1951 pp.1-29; Heizer, R.F. and Cook, S.F. 1956 pp.229-48; Meighan, C.W. et al., 1958 pp.1-23; 1959 pp.383-405; Ascher, R. 1959 pp.168-78; Matteson, M.R. 1960 pp.117-20; Greenwood, R. 1961 pp.416-20; Gould, R.A. 1964 pp.123-63; Lampert, R.J. 1966 pp.83-118; Ambrose, W.R. 1967, in press.

² Heizer, R.F. 1960 pp.93-157.

My chief aim was to get a general picture of the diet and economy of the inhabitants, rather than a detailed picture of the composition of the midden itself. As a result we took large numbers of samples and screened them through 1/4 inch mesh sieves in the field, in order to reduce the total bulk. The actual size of the samples varied; at Padypadiy we kept the retained fraction from the entire excavation for detailed analysis. At Malangangerr and Nawamoyu the middens were far more extensive, and as a result only column samples were removed in a series of levels 5 cm. deep, over an area of 30 x 30 cm.

The procedures proved to be effective in that analyses could be made of the changes in the proportions of different components (shell, bone, stone etc.) over time, and also of the variations in the proportion of different shell species.¹ The chief drawback is that I cannot now assess the ratio of organic matter to sand in the midden, and as a result I cannot make direct comparisons between the relative density of artefacts in middens and sands.

3) Charcoal Samples

One of the major problems that arose during the fieldwork concerned the unexpectedly old radiocarbon dates for charcoal from the lower sands at Malangangerr.² The charcoal occurs throughout the sands as discrete lumps or in finely divided form, and seems to represent

¹ I am most grateful to Mrs D. Gregory, Research Assistant, Department of Anthropology, A.N.U., for her help in sorting the column samples.

² Kigoshi, K. and Kobayashi, H. 1966 p.68.

the remains of hearths which have been partly destroyed by various weathering agents.

The deposits were carefully examined in the field by the geomorphologists, to see whether ancient charcoal could have been incorporated in large quantities from another source. This appeared to be very unlikely; there are no known sources of ancient charcoal in the area to provide a constant source of material, and furthermore the stone artefacts are apparently in situ in the sand.

A larger series of dates was clearly needed and since the laboratory required large charcoal samples,¹ the loose sand was screened through 1 mm. flymesh sieves, and the entire retained fraction was processed later. The new dates from both Malangangerr and Nawamoyyn confirmed the high antiquity of the associated industry, thus raising a problem which requires the attention of the prehistorian rather than the geomorphologist.

3. ORGANIC REMAINS

Faunal and floral remains occur in the deposits as bones, shells and vegetable matter.

1) Fauna

A wide range of animals occurs in the plain sites, including mammals, fish, reptiles, birds, crabs and shellfish. These can be broadly divided into food

¹ Polach, H.A. and Golson, J. 1966 pp.24-5.

remains and human burials. In contrast to this, there are very few faunal remains in the escarpment sites at Tyimede, where most organic material has been destroyed by weathering and decay.

In an ideal situation where all the faunal remains can be identified down to the specific level, we should be able to describe the environments exploited by man for food.¹ Analyses of the age of the animals might well reflect the seasonal occupation of a site,² and a detailed analysis of the incidence of different bones could reflect different butchering techniques.³ Eventually (all other things being equal) it might even be possible to deduce the size of the hunting group according to the amount of meat they ate.⁴

Very few of these deductions can be drawn for these collections, largely because the current taxonomy of Australian vertebrates is based on skull and skin forms only. Most of the archaeological remains are post-cranial bones and as a result only an expert with a large local reference collection, could identify all

¹ For a general account, see Reed, C.A. 1963 pp.204-16; also Coon, C.S. 1951.

² See Clark, J.D.G. 1954 pp.70-95; Higgs, E.S. and White, J.P. 1963 pp.282-9.

³ White, T.E. 1953a pp.160-4; 1953b pp.396-8; 1954 pp.254-64; 1955 pp.170-8; 1956 pp.401-4.

⁴ See also: Cook, S.F. 1946 pp.50-3; Cook, S.F. and Treganza, A.E. 1947 pp.135-41; 1950 p.245-6; Ascher, R. 1959 pp.168-78.

the bones and deduce the age of the animals, or the butchering techniques.¹

Most of my faunal analysis was therefore concerned with separating the main groups of animals such as mammals, humans and fish. Even this was difficult to do because many of the bones were fragmentary so that a large group of unidentifiable fragments was left. However, once the separation was done, the following analyses were made on each group.

1. Mammals

All skull fragments were isolated. These consist largely of jaws and many of them were identified down to specific level. Mr J.H. Calaby² identified most of the mammals, and Mr J.A. Mahoney³ identified all of the rodents.

¹ This has naturally limited the scope of faunal analyses in Australia, but even allowing for this, remarkably little effort has been made to interpret the identifiable remains. Most authors simply list the species that are present. (Hale, H.M. and Tindale, N.B. 1930 pp.145-218; Macintosh, N.W.G. 1951 p.197; Mulvaney, D.J. 1960 pp. 53-85; 1962 pp.1-15; Megaw, J.V.S. 1966 p.48).

In contrast to this, N.A. Wakefield (in Mulvaney, D.J. et al., 1964 pp.494-8) lists the number of individuals present in Shelter No.6 at Fromm's Landing, but he does not describe the methods used, nor does he provide sufficient data for re-analysis. Jones' work on Tasmanian middens, (Jones, R. 1966 pp.1-12) shows considerably more promise of providing information about the economy of the inhabitants, by studying such things as the range of food eaten, the ages of the slaughtered animals, and dietary changes over time.

² Division of Wild Life Research, C.S.I.R.O., Canberra. I am most grateful to Mr Calaby for his constant help and advice in all faunal analyses.

³ Department of Geology, University of Sydney, N.S.W. I am most grateful for his help.

The jaws were analysed in order to deduce the minimum number of individuals represented at each site. This was done by dividing the maxillae and mandibles into left and right side so that the largest group represents the minimum number of animals present. This is of course unsatisfactory in some respects, especially if it were used to deduce the amount of food eaten at the site, because the hunters might well have decapitated the animal before bringing it to the site. No attempt was made to assess the age of the animals, partly because the collections were generally small in number and also because there are no appropriate reference collections from the area.

2. Fish

The fish bone was separated with a fair degree of accuracy. This division was checked by Dr F.H. Talbot,¹ who estimated that at least 95 per cent of the bone was definitely piscine.

There are very few jaw bones in the collections and as a result very few fish could be identified even to family level. There are however numerous otoliths in one collection and these were used to assess the minimum number of fish represented in the deposit.²

¹ Then Curator of Fishes, Australian Museum, Sydney.

² Ryder, M.L. 1963 pp.294-312.

3. Reptiles

Reptilian remains include longbones, carapace and fragments of skin. All identifications were made by Mr H. Coggar,¹ largely according to jaw fragments, and an assessment of the minimum numbers of individuals was also made according to the number of left or right mandibles and maxillae present.

This count is patently unsatisfactory in reflecting the incidence of tortoise in the deposit, because large quantities of carapace and plastron often occur in a level with no jaws at all. These remains cannot at this stage be used to calculate the minimum number of individuals present, but they do reflect the presence and relative density of tortoises within the deposits.

4. Birds

Fragments of longbones, eggshell, feathers and quills were identified by Mr H.J. de S. Disney.² No skull fragments were recognised and no attempt has been made to calculate the minimum number of birds represented.

5. Crabs

Claws and carapace fragments of crabs were identified by Dr J.C. Yaldwyn³ and Mr Bruce Campbell.⁴

¹ Curator of Reptiles, Australian Museum, Sydney.

² Curator of Birds, Australian Museum, Sydney.

³ Curator of Crustacea, Australian Museum, Sydney.

⁴ Queensland Museum, Brisbane.

An assessment of the minimum number of individuals present was made by separating the claws into top and bottom and then dividing the larger group by two.

6. Human

The human bone was separated from the other fauna and divided into cranial and post-cranial remains. The cranial material was analysed by Mr A.G. Thorne,¹ who also studied certain limb bones in order to assess the age and sex of particular individuals. I myself analysed the remaining post-cranial material.

Human remains occur as discrete burials and also as charred fragments in and amongst midden debris. As a result analyses of the minimum number of individuals had to be made according to the number of cranial and post-cranial remains.

7. Shellfish

Large amounts of shell occur in the deposits of the coastal plain sites. Specific identifications were made by Dr D.F. McMichael² who identified shellfish from four distinct environments comprising mangrove-mudflat, fresh water, land and marine species.

These shells probably represent food debris, although very few show direct signs of having been cooked. Many shells are broken but the fragments can be easily identified because most shells have highly distinctive

¹ Anatomy Dept., University of Sydney.

² Curator of Molluscs, Australian Museum, Sydney.

shapes and markings. As a result a large percentage of shells in samples were identified and the relative quantities of different species were assessed according to weight.

The only species that were difficult to distinguish when broken were the mangrove-mudflat forms, Cassidula angulifera Petit and Cassidula rugata Menke. Their shapes are similar but they can be distinguished by distinctive surface markings: C. angulifera has a smooth surface, whereas C. rugata has a rough plicated surface. Unfortunately these surfaces decay easily so that both species are generally grouped together as Cassidula sp.

2) Flora

Floral remains occur mainly at Padypadiy in dry, well protected parts of the shelter. They include wooden tools and also large quantities of grass, straw and leaves which were in part used here as padding around human bones. This material was sorted in the laboratory and the distinctive components were separated and analysed.

The plant remains were analysed by Dr R. Story¹ and Professor R.L. Specht,² both of whom stressed the tentative nature of the identifications, which were often made on dessicated fragmentary remains. The wood samples were sectioned and identified by Dr R.W.R. Muncey.³

¹ Division of Land Research, C.S.I.R.O., Canberra.

² Department of Botany, University of Queensland, Brisbane.

³ Division of Forest Products, C.S.I.R.O., Melbourne. I am most grateful to these specialists for their help and advice.

4. IMPLEMENTS

Implements can broadly be defined as objects which have been deliberately modified in a set and regular pattern for and/or by use as tools. A wide variety of raw materials was used to make the implements in the collections, including bone, wood, shell and stone. The following basic principles and definitions are relevant to the discussions in later chapters.

1) Bone Implements

Introduction

A bone tool is a fragment of bone that has been deliberately modified for and/or by use as a tool.¹ The implements are often shaped by grinding or cutting and the scars are often overlaid by a localised high gloss, which may have been acquired through use. The gloss is often very similar to Type 8 utilisation found on stone implements.

Several types of bone implements can be distinguished in the collections. The types are defined briefly below, but more detailed descriptions are given for the bone tools in each site.

1. Bipoints

A bipoint is a fragment of bone that has been worked to a point at both ends. All of the specimens show a highly characteristic mid-shaft bulge which tapers

¹ I found Lampert's analysis of bone tools from a shelter on the New South Wales coast especially helpful. (Lampert, R.J. 1966 pp.83-118).

down towards the tips. The presence of this bulge is used to distinguish bipoints whose tips have broken off.

Similar implements, termed 'muduk'¹ have been found in other parts of the continent. They were used as spear tips, fish hooks and harpoon heads in Cape York² and possibly as toggles in other places.³ Our informants at Oenpelli said that bone bipoints were used as nose bones and could also serve as 'spear points'. Spencer does not mention bipoints in his books, but he does record single and multiple pronged bone tipped spears which were made by the Kakadu of Oenpelli in 1912.⁴

I examined some of these implements⁵ and X-rayed the prongs of three fish spears in order to study the shape of the bone tip (Plates II-1, II-2).⁶

These tips are clearly bone bipoints which have been pushed into the wooden prong and then packed round with resin. Plate II-2 shows thin cracks in the wood

¹ The term was first applied by Hale and Tindale to the material excavated at Devon Downs shelter. (Hale, H.M. and Tindale, N.B. 1930 pp.189). See also Mulvaney, D.J. 1961 pp.83-4; McCarthy, F.D. 1967 pp.82-4.

² Thomson, D.F. 1939 pp.209-10.

³ Smyth, R.B. 1878 v.I p.391.

⁴ Spencer, W.B. 1914 pp.357-9.

⁵ The specimens are housed in the National Museum of Victoria, Melbourne. I wish to thank Mr J. MacNally, Director of the Museum, for his permission to handle the material.

⁶ I wish to thank the staff of the Radiography Dept., Alfred Hospital, Melbourne who assisted in this operation.

below the tip of the bone points, suggesting that some force was exerted to force the point into the wood. Another interesting feature is that if the bone tip were to break off along the top of the resin, some broken tips would still retain the mid-shaft bulge, but others would not. As a result, only some of these broken bipoints could be classified as such according to my definition.¹

2. Unipoints

A unipoint is a fragment of bone that has been worked to a point at one end only. The other end may be ground blunt or cut off or broken. There is no mid-shaft bulge. In order to test whether unipoints could merely be broken bipoints, analyses are made of the length and shape of both types of implements.

3. Sections

These are fragments of the shafts of a small longbone, which are broken at both ends and show signs of grinding and/or polish. They may well be broken pieces of bipoints or unipoints and are included in the analysis to reflect more closely the potential number of bone tools at the site.

4. Spatulated points

These are slightly blunt points made at one end of a macropod fibula. This fibula has a flat somewhat semi-

¹ X-ray photographs of mounted artefacts have revealed interesting features in several other instances. For example see Setzler, F.M. and McCarthy, F.D. 1950 pp.1-5; Deacon, H.F. 1966 pp.87-90.

lunate cross-section which is why I have described them as 'spatulated'.

Many of these implements are broken, and whilst broken tips are easily distinguished, broken shafts are distinguished by the presence of grinding and/or polishing.

Similar implements are recorded from the Oenpelli area. Baldwin Spencer collected one of these points, called an awl, from a woman living on the East Alligator River¹ and refers to the use of a point made of a kangaroo fibula to bore the hole in the nasal septum.²

5. Utilised flakes

These are slivers and flakes of bone that show signs of having been used. Two main types of use-wear occur. These are similar to those found on stone flakes and are listed in the relevant section as unifacial use-wear (Type 2) and use-polish (Type 8).

6. Incised fragments

These are flat pieces of bone which have been cut with a sharp tool leaving intersecting lines. They are not implements in themselves but probably parts of larger tools.

7. Tubes

These are hollow shafts of longbone, which have been ground and sometimes polished at one or both ends.

¹ Spencer, W.B. 1914 p.248.

² Spencer, W.B. 1914 pp.330-1.

There is no record of similar implements in the area.

8. Utilised teeth

These are teeth which have been used as tools or ornaments. One variety is a kangaroo incisor with grinding and/or marked use-polish on both surfaces. Spencer¹ collected two kangaroo incisors set in gum from a woman living on the East Alligator River in 1912. Another variety of tooth implement is a macropod incisor with a hole drilled through the tool, presumably for use as an ornament.

2) Shell Implements

Most of the shell in the deposits is broken and many pieces have sharp edges that might have been used to cut and scrape. I have limited the number of recognised shell tools by using a strict definition: all shell implements show signs of deliberate shaping and/or use.

The shell tools in the collections have been ground or chipped into shape. Two types of utilisation occur - unifacial use-wear, where tiny flakes are detached off one surface, and use-polish, where a localised high gloss occurs.

3) Wooden Implements

Several types of wooden tools occur and most of them have highly explicit forms such as fire sticks,

¹ Spencer, W.B. 1914 p.248.

spear heads, linkshafts etc., so that they are generally described in terms of ethnographic parallels, cited by Baldwin Spencer.¹

4) Stone Implements

Introduction

Artefacts are pieces of stone which have been worked by man: they include implements and waste flakes. Implements are stones which have been secondarily modified by retouch and/or use. The collections of implements from the Arnhem Land sites have the following outstanding features:

1. Formal types are easily recognised. They include objects such as points and non-pointed scrapers which are visually distinguished with such ease that I have not thought it necessary to devise a code solely to differentiate them. On the other hand, since the actual terms 'point' and 'scraper' do carry functional connotations (although these have become blurred over time),² I have tried to define them by an analysis of the type of retouch and use-wear that is found on the different tool types.

2. The definition of different types of implements is not based on the standard text-book of Australian typology.³ McCarthy has described the different tool

¹ Spencer, W.B. 1914, 1928.

² But see also: Mellars, P. 1964 p.232; Clark, G. and Piggott, S. 1965 p.59; Mulvaney, D.J. and Joyce, E.B. 1965 p.185.

³ McCarthy, F.D. et al., 1946; McCarthy, F.D. 1967.

types, but he gives no detailed indication of the potential range of variation within a type, nor is there, for my purposes, a sufficient definition of the different types of retouch and use-wear found on the various implements. In spite of these shortcomings, I shall refer constantly to this text in order to make my typology intelligible within the current Australian context.

3. Many of the implements in these collections were broken in antiquity possibly during manufacture or use. Broken implements are analysed in relation to their complete counterparts and this analysis is based on two assumptions: firstly that intact implements are finished products and secondly that they are representative of the range found at the site.

Therefore, rather than concentrating solely on formal criteria such as shape and size - which are relevant only when studying unbroken tools - the code is designed to analyse how tools were made and used by describing the retouch and use-wear found on all implements, intact and broken.¹

Furthermore, the intact and broken implements are described separately, as for example complete points and broken butts of points. I have done this deliberately, rather than intergating the two groups, partly to test

¹ The analysis therefore differs from those of Roe and Binford (Roe, D.A. 1964 pp.245-67; Binford, L.R. 1963 pp.193-221) which are designed to analyse intact tools only. On the other hand, Fitting has designed a code which encompasses the broken fluted points in his collection. (Fitting, J.E. 1965 pp.484-91).

the reliability of my initial identification. The broken parts of an implement should correspond to its intact counterpart in terms of raw material, retouch and utilisation. If broken and intact implements were treated as one group, this could not be tested.

As a result, the analyses are longer than they would have been had the groups been amalgamated. This separation is advantageous in that another worker could select certain aspects of the analysis at once, without having to extract the data about broken points from a general section on points.

Conclusion

The code is designed to analyse several different types of tools; it is not solely geared to the definition of points, though I found such codes useful in formulating the one I used.¹

The analysis is divided into two main sections. The first deals with the general features of stone implements such as raw material, shape and size. The second deals with the retouch and use-wear found on the tools.

A. GENERAL FEATURES:

1. Raw Material

The following raw materials occur in the assemblages:-

1. Quartzite
2. Quartz

¹ Binford, L.R. 1963 pp.193-221; Roe, D.A. 1964 pp.245-67; Fitting, J.E. 1965 pp.484-91.

3. Chert
4. Limonite
5. Porphyritic dolomite, hornfels,
hornblende schist, schist

The first four rocks are easily recognised according to their textures and colours. The last group are igneous and metamorphic rocks many of which have large phenocrysts in a fine ground mass with a fairly tough texture. They are less hard than the other rocks (1-4) and were invariably used to make edge ground axes. These are listed as I/mm. which stands for this particular group of Igneous/metamorphic rocks.¹

2. Shape

The overall shape of worked pieces has been defined largely according to a series of ratios.² In every case the ratio is expressed as a percentage. For example, if an implement is 8.0 cm. long and 2.0 cm. broad, then the breadth/length ratio is expressed as $\frac{B}{L} \times \frac{100}{1}$, which in this case is 25.

The following basic orientations are used throughout:

(i) Surfaces

The dorsal and ventral surfaces on an implement are defined according to the position of the bulb of

¹ Some of these rocks were originally mis-identified as feldspar porphyry. (White, Carmel 1967) I am grateful to Dr G.A. Joplin, Geophysics Dept., Research School of Physical Sciences, A.N.U., for the new classification.

² I found D.A. Roe's (1964) analysis of British handaxes most helpful here, and many of the ratios that I devised, are based on his work. L.R. Binford (1963) used a series of models to describe the more complex outlines of his collection of tanged points.

percussion and the bulbar surface. In these cases, the ventral surface corresponds with the bulbar surface. In certain implements, such as bifacial points, the bulbar surface is not evident because it is obscured by secondary retouch. In these instances the dorsal and ventral surface are arbitrarily defined.

(ii) Position of striking platform

If the implement is made on a flake the striking platform may be evident. This may lie at the end of the length or breadth axis of the implement. Implements which were struck from the end of the length axis are termed 'endstruck', those struck at the end of the breadth axis are termed 'sidestruck'.

(iii) Nature of striking platform

In some cases flakes have been struck from the main striking platform off the dorsal surface of the artefact. This retouch may have occurred before or after the detachment of the main flake that forms the artefact. It may therefore relate more to core preparation than actual tool modification and is treated as a separate feature.

(iv) Length

This is the maximum length of an implement taken along an axis irrespective of the position of the striking platform.

(v) Breadth

This is the maximum breadth of an implement taken at right angles to the length axis.

(vi) Thickness

This is the maximum thickness of an implement taken in the plane at right angles to the breadth and length axes.

(vii) Margins

All implements in this assemblage have 4 margins unless otherwise stated. These lie on the outer rim of the implement and are defined in relation to the dorsal and ventral surfaces, the length and breadth axes and the striking platform.

Margins are grouped as sides and ends.

Sides lie along the length axis and are called 1 and 2 according to their position in relation to the striking platform and dorsal surface (Figure II-1).

Ends lie along the breadth axis at either end of the length axis. They are termed base and tip according to their relationship to the striking platform.

(viii) Cross-sections

This is the traverse section of the implement with the dorsal surface uppermost. Seven shapes occur as follows:

1. Isosceles triangle
2. Irregular triangle
3. Right angled triangle
4. Trapezium
5. Parallelogram
6. Lens
7. Rhombus
8. Dome

B. SECONDARY MODIFICATION:

Implements are modified by retouch and/or use-wear. This occurs in units termed edges and lengths which are defined as follows:

1. An edge occurs at the intersection of two planes where secondary retouch and/or utilisation is found.
2. An edge is continuous in one plane in one direction: where it curves imperceptibly in another direction, an arbitrary division has been made.
3. An edge may contain several types of retouch and/or utilisation, which are then termed lengths.

Thus an edge is the vehicle that may show the techniques used to make the implement as well as its use. The edge need not be the only functional part of the tool.

If an edge contains only one sort of retouch or use-wear it is termed single. If an edge contains several lengths of different forms of retouch and/or use-wear it is termed multiple.

The following features of an edge or length are noted:

1. Position

(i) Position of edge in relation to surface

The retouch or utilisation may be visible on either or both surfaces. If it is present on the dorsal surface it means that the pressures to detach the flakes have been exerted from the ventral surface and vice versa.

(ii) Position of edge in relation to margin

The edge may lie on the side or end of the implement as defined.

(iii) Position of length in relation to edge

If an edge has two lengths, they are called terminal because they extend to the limits of that edge. If the edge has more than two lengths, some may be termed central if they are bounded by two other lengths on the edge. Thus, all multiple edges have terminal lengths but only some have central lengths.

2. Size

The extent of an edge or length is measured in cm.

3. Shape(i) Viewed from dorsal or ventral surface

The shape of an edge or length conforms to the following models:

- a. Concave
- b. Convex
- c. Straight
- d. Concavo-convex

Within this general shape, the edge when viewed in this direction may be serrated or not.

(ii) Viewed end-on with dorsal surface on left¹

The shape of an edge or length conforms to the following models:

¹ These are equivalent to Binford's longitudinal sections. (Binford, L.R. 1963 pp.202-3).

- a. Concave
- b. Convex
- c. Straight
- d. 'S' shaped
- e. Wavy

4. Angle

The angle of a length or edge describes the shape of the intersecting dorsal and ventral surfaces that form the edge or length. This is measured with a goniometer to the nearest five degrees.

The following forms of secondary modification occur on edges and lengths:

I. RETOUCH:

Retouch is the deliberate modification of an edge or length by directed blows. Two main forms are found: unifacial retouch and bifacial retouch. Unifacial retouch is found where the blows are directed from one direction only to remove flakes off one face of the edge. Bifacial retouch occurs where the blows are directed from two directions to remove flakes off both faces of the edge.¹

¹ There is no evidence of pressure flaking in the collections. This may be partly because it is somewhat difficult to draw the line between tools that were flaked carefully with a soft hammer and pressure flaked tools.

Experiments with flint suggest that pressure flaking detaches slender parallel edged flakes, whereas percussion with a soft hammer removes broad and thin expanding flakes. (Jelinek, A.J. 1965 pp.277-9). These scars are clearly visible on a fine grained material such as flint, but most of the bifacially worked tools in the
(continued on p.44)

A. Unifacial retouch

1. Step flaking

This involves the removal of squat abbreviated flakes, snapped across the length axis opposite the bulb of percussion. Under normal circumstances knapping removes a complete flake; in step flaking the force of the blow directed into the mass of stone, is partly deflected at one stage and the flake snaps off leaving a step-like scar.

2. Scalar flaking

This involves the removal of complete scale-like flakes. The scalar retouch edge is often slightly convex where these small thin skimming flakes have been removed.

3. Inverse unifacial flaking

This describes a small length of unifacial scalar retouch within an edge which is on the inverse side to the rest of the flaking on that edge.

4. Notching/Serrations

This involves the removal of small squat flakes along an edge. It is done by single spaced blows which leave a notched edge.

(footnote 1 continued from previous page)

Oenpelli series are quartzite, and it is more difficult to distinguish negative flake scars.

I have observed Prof. Francois Bordes (Bordeaux, France) produce slender bifacial points by percussion flaking, and I feel that all the Oenpelli tools could have been made in this way, using a stone, bone or wooden hammer.

5. Single flake removal

This involves the removal of one flake by one blow on an edge.

6. Invasive retouch

This describes the removal of extremely flat flakes generally off a thin edge when the blow is directed at the intersection of the planes forming the edge.

B. Bifacial retouch

1. Alternate flaking

This is found when flakes are removed from alternate surfaces along the edge, first off one surface then off the other. Scalar flakes are generally detached. Alternate flaking is evident in a slightly zig-zag line running along the crest of the edge, which is visible when the edge is viewed end-on.

2. Non-alternate flaking

This occurs as follows. A series of flakes are first struck off one face of the edge. Then they are struck off the inverse surface using the negative flake scars as the striking platforms for the new blows. Unlike alternate bifacial retouch, this leaves a fairly straight edge when viewed end-on along the crest. There are two types of non-alternate flaking:

- a. In this group the flakes of the second series removed inversely to the main edge are step flakes.

- b. In this group the flakes of the second series removed inversely to the main edge are scalar flakes.

(II) UTILISATION OR USE-WEAR:

This describes the secondary modification of an edge by presumed use. In all cases the degree and intermittent appearance of this modification distinguishes it from retouch. Utilisation may occur alone, or in association with some form of retouch.

The following types of macroscopic use-wear have been distinguished:

1. Chattering use-wear

This describes tiny flakes that have been crushed from one surface of an edge, whose scars extend less than 1 mm. up the surface of the stone. Under a 10 x lens it looks as though tiny step flakes have been removed. Chattering slightly undercuts the main edge. It seems to result when the actual sharp-angled edge is subjected to blows either during manufacture or use.

2. Unifacial use-wear

This describes small flakes that have been detached, often at intermittent intervals, from one surface of the edge. If it occurs in association with retouch it is found on the same surface as the retouch.

3. Unifacial use-wear (inverse)

This is the same sort of utilisation as category 2 but it occurs in association with retouch on the inverse side of the retouched edge.

4. Bifacial use-wear

This is similar to category 2, except that the tiny flakes have been detached intermittently on both surfaces of the edge.

5. Snap-break use-wear

This describes the snapping off of a flake across the thin edge so that a square profile is left on the edge.

6. Bruising use-wear

This described battering and bruising along the actual line of intersection of the surface forming the edge. It could be termed 'bifacial' and can be most easily distinguished in quartz where bruising occurs as an opaque area in the normal translucency.

7. Smoothing use-wear

Like bruising this is found on the actual line of intersection of the surfaces forming the edge. It describes the blunt smooth areas found there.

8. Use-polish

This describes areas of high gloss and smoothness that generally occur on one or both surfaces of the edge. Striations can sometimes be seen, which indicate

which way the tool was used. Semenov¹ describes such use-wear suggesting that it results from working pliable material such as skin. McBryde² claims that use-polish is produced on stone tools by rubbing sheep skin or cutting grass.

Conclusion

The implements are analysed according to the principles that I have outlined. Where only small assemblages occur, as for example, at Malangangerr and Nawamoyrn, most tools are individually described. Where large assemblages are found, such as those from Tyimede I and II, the code is applied to make the detailed analyses.

In certain instances distribution patterns are presented for purely descriptive purposes, as for example in an analysis of the angles of edges, or the distribution of scrapers in a site. In these cases, the data has, of course, not been subjected to statistical tests.

On the other hand, certain analyses have been made to draw fairly crucial inferences concerning variations between groups, as for example in an analysis of the relative proportion of artefacts in different levels of a site. In these instances the trends were tested by calculating the standard deviations assuming a Poisson

¹ Semenov, S.A. 1964 pp.83-5.

² McBryde, I. 1966 Ph.D. Thesis, New England, p.318.

distribution.¹ I have noted the use of this test at all times, but have quoted the actual standard deviations in the most important instances only.

Finally it should be stressed at this point that this code is designed specifically to deal with the industries that I excavated. As such it represents only one way of analysing these collections: it is not the solution nor is it designed to solve the problems implicit in other Australian industries. The best I can offer is that some of the ideas I have used may be profitably applied when analysing other industries.

5. USE OF ETHNOGRAPHIC MATERIAL

Ethnographic evidence has been used extensively in the interpretation of the archaeological material. This evidence is of two types, the written reports of the travellers, scientists and ethnographers who have visited the area and the verbal reports of local Aboriginal informants recorded during my two seasons of fieldwork.

The Oenpelli region was visited by early explorers such as Leichhardt,² but their reports on the Aborigines are not extensive. By far the most detailed description of the people comes from Professor W. Baldwin Spencer,³ a zoologist who visited Paddy Cahill's station at Oenpelli in 1912. Most of the local inhabitants at that time were

¹ I am most grateful to Mrs E.M. Minson, Dept. of Genetics, John Curtin School of Medical Research, A.N.U., for her advice and assistance in this matter.

² Leichhardt, L. 1847 pp.500-37.

³ Spencer, W.B. 1914, 1928.

called 'Kakadu', though I have suggested that Spencer used this term fairly broadly to include several tribal groups living near Oenpelli.

Spencer described the life of the Kakadu in considerable detail. They lived on the settlement, but they camped in rock shelters in a nearby hill in the evening to catch the cool breezes and escape from the mosquitoes.¹ They made a wide variety of wooden tools including spears, clubs and digging sticks,² and they also made and used shell³ and bone⁴ implements.

The Kakadu used stone implements, but they were very rare and were not manufactured locally.⁵ Later authors noted that stone spear heads came into Oenpelli from the south and east as part of widespread exchange cycles.⁶

Spencer observed that the original inhabitants of Oenpelli were rapidly being outnumbered by a heavy influx of people from the hills to the south and east.⁷ These Gunwinggu speaking people predominate at Oenpelli today, forming over 2/3 of the 450 (approx.) people there. A few of the original Mengedji and Edey speaking people still remain, but the last Kakadu woman died in 1963.⁸

¹ Spencer, W.B. 1914 pp.31-2; 1928 pp.823-4.

² Spencer, W.B. 1914 pp.356-78.

³ Spencer, W.B. 1914 p.248; 1928 p.844.

⁴ Spencer, W.B. 1914 p.248, 331, 357-9, 404.

⁵ Spencer, W.B. 1914 p.389; 1928 p.844.

⁶ Thomson, D.F. 1949 pp.65-9; Berndt, R.M. 1951 pp.156-76; Berndt, R.M. and C.H. 1960 p.116.

⁷ Spencer, W.B. 1928 p.744.

⁸ Berndt, C.H. in litt. 1967.

Both Leichhardt¹ and Spencer² noted that iron and steel artefacts were present in the area and were rapidly replacing the traditional implements. The speed of 'culture contact' is described in a most graphic way by Ernestine Hill, who set the scene at an early British settlement on the north coast as follows:

A convict with a ball at head is felling a tree for a flagstaff. He comes loping in fright to tell that his axe is gone. He saw no one. The axe was there!³

The effects of acculturation are implied even more poignantly in the traditional bush ballad:

Oh the gins come down from Oenpelli mission,
They're all wrapped up in Jesus when they come,
But they soon forget about the Ten Commandments,
When you hit 'em with a snort of O.P. Rum.⁴

I relied heavily on aboriginal informants to locate archaeological sites and help interpret the excavated material. Most of the men employed were more than 40-50 years old, and many of them claimed to have lived as hunter-gatherers when they were young. They were all conversant with local wild plants and wild animals and knew the main features of the landscape.

As one would expect, I found Mengedji and Edey informants most helpful in locating sites on the plains,

¹ Leichhardt, L. 1847 p.512.

² Spencer, W.B. 1914 p.242.

³ Hill, E. 1951 p.44.

⁴ Willey, K. 1964, p.150.

and Gunwinggu informants most helpful in the escarpment country. Magdalene, an old Edey woman, was especially forthcoming about the names of shellfish, water plants and animals that were collected for food on the plains. My chief informant, Frank Gananggu is a Gunjepmi on his father's side, and Edey on his mother's. He is a close kinsman of Magdalene and proved to be a most reliable and consistent informant, though he constantly advised me to check his replies with her. 'My old lady', he would say, 'knows'.

I generally gave the informants a free rein in discussing the 'old times'. These interviews were recorded in the field and later transcribed. During one excavation, Gananggu helped to sort the excavated material and his identifications were tape recorded on the spot.

The informants were all aware of the cultural dichotomy between the tribes of the coastal plain and those of the escarpment country. Gananggu was the first to explain this to me, whilst we were excavating at Malakonanya. The deposit yielded a number of human bones but no stone artefacts and I asked where the people's knives were. Gananggu replies scornfully: 'You'd like to live with the stinkin' dead?'.¹ Later however he explained that the coastal plain people never made 'stone spears' and that we should excavate rock shelters in the hills if we wanted to find stone artefacts.

¹ Cf. Gould, R.A. 1966 p.43.

One difficulty in these interviews concerned the origin of the shells in the midden deposits. The informants first referred to them lightly as 'good tucker', but later when I asked where they came from, they insisted that they came into the shelters with Noah's Flood. This explanation persisted until 1965, when Priscilla visited the camp and casually remarked that as a child she had collected shells such as these in the mudbanks of the East Alligator River. This started a spate of reminiscences about how shells were collected, cooked and eaten. Gananggu recalled that they would remain edible for several days if kept in a firm-walled damp basket. Magdalene remembered how shells grew thickly near the crossing of the East Alligator River when she was a child, but that the shell-beds were now many miles downstream.

In short, Noah's Flood was forgotten until Gananggu remembered that a 'Mission boy' had suggested it some time before.

The main problem that arises in dealing with ethnographic evidence, is the extent to which it can be legitimately used to interpret archaeological remains. There is no doubt that ethnographic accounts can yield valuable general information about the everyday life of hunters and gatherers in the area.¹ It is clear too that information of this type can be of great interest

¹ Lee, R.B. 1966, Ph.D. Thesis, University of California, Berkeley.

in the study of recent prehistory.¹ It is more difficult to say, however, that one can interpret archaeological material several thousand years old by this method, other than in a very general way. For instance, is the modern Aboriginal classification of stone implements relevant to the study of old archaeological assemblages?²

In the Oenpelli situation in particular one also wonders how much influence the years of European contact and the abandonment of a hunting and gathering economy have had on my informants' cosmology.

There can be no definite answer to this problem, which remain unresolved at the recent 'Man the Hunter' Conference.³ In the Australian situation, however, and especially at this stage of Australian pre-history, I feel that this type of information cannot be ignored. Although one must be continually aware of the general problems of the range and applicability of this data, it seems to allow one to provide a fuller and more coherent prehistory than could otherwise be written.

¹ See for example: Clark, J.D. and Walton, J. 1962 pp.1-16; Longacre, W.A. 1964 pp.1454-5; Fagan, B.M. 1965; Fagan, B.M. and Van Noten, F.L. 1966 pp.246-61; Lampert, R.J. 1966 pp.83-118; Megaw, J.V.S. 1966 pp. 35-45; Mellaart, J. 1967 pp.49-51, p.68.

² Chang, K.C. 1967 pp.227-43; Cowgill, G.L. in Chang, K.C. 1967 pp.236-7.

³ Man the Hunter; Congress held under the Auspices of Current Anthropology, Chicago 1966.

CHAPTER III

EXCAVATIONS AT PLAIN SITES I : PADYPADIY

INTRODUCTION

Padypadiy is the Aboriginal name of a shallow cave ($12^{\circ}26'S.$ Lat., $132^{\circ}54'E.$ Long.) on the coastal plain about 12.5 miles southwest of Oenpelli and 4-5 miles west of the East Alligator River. It was discovered during a reconnaissance in the area in July 1965 (Figure I-2; Plate III-1).

The shelter stands 11-12m. above the ground in a hill of Kombolgie sandstone (Plate III-2). The hill, a steep walled residual of the main scarp, is composed largely of cross-bedded quartzitic sandstone with occasional bands of quartz conglomerate and is 16-18m. high in parts.

The shelter has three entrances: two lie along the main north face of the block at each end of the shelter and are reached by climbing up a series of natural platforms on the rock face. The third entrance on the northwest side of the shelter is accessible from the top of the hill down a talus slope of broken boulders.

The maximum dimensions of the recess are 20 x 11m., but it is divided inside by rock baulks and pillars. The roof is 1.3m. high at its highest point and it slopes down to 0.5m. in some places. The floor is covered with sand and dust in some parts, but is bare in others (Figure III-1, III-2; Plate III-3).

The shelter is protected from the sun for most of the day. In July, the sun shines into the western part until about 10 a.m., and continues to shine on to the talus slope until 4 p.m. The rest of the recessed area remains shady and well ventilated by breezes blowing in through the entrances. The position of the dripline shows that most of the shelter is protected from falling rain. During the Wet season, however, a small stream flows down the talus slope and along a clearly defined bed at the back of the shelter, over the rock floor at the east end and out over a nick point in the cliff. The stream bed is littered with water-worn artefacts, some of which were probably eroded out of the deposit.

The seasonal stream provides an immediate source of water during the Wet, but the nearest permanent water now is a billabong about 1/4 mile southwest of the hill (Plate III-1).

Several active weathering processes can be observed in the shelter today. The seasonal stream is eroding the wall of the recess, the roof and walls are stained with percolating iron solutions trickling through joints and cracks, and piles of freshly weathered sand are found on the floor.

Bearing these observations in mind, the formation of the shelter can be reconstructed as follows. Firstly, deeply penetrating weathering along a weak horizontal bedding plane on the north face of the block hollowed out part of the shelter, leaving only pillars to join what is now the roof and floor. Next, a vertical crack from the top of the hill at the north-west end of the shelter was enlarged by exposure and

percolating water. Further weathering along horizontal bedding planes detached large blocks of rock from the present roof of the shelter and the outer walls. This enlarged the recess and formed a talus slope of large boulders leading down to the shelter. As weathering proceeded, the two areas were joined by the stream flowing down the talus slope along the south wall of the shelter and out over the cliff at the east end.

The recess acted as a trap for debris carried in by the stream, for rocks and sand detached from the walls, pillars and roof, and possibly for windblown dust from the plain below. Deposition probably increased even further when the shelter was occupied, since men would tend to knock down weathering products from the roof and walls, and also to carry food and debris into the shelter.

There are several signs of human occupation in Padypadiy. The roof and walls are blackened with soot and covered with paintings. Stone tools, animal bones and shells lie in the stream bed, where they have been dropped or eroded out of the deposit. Finally, there are 39 small ground depressions in the rock shelf near the entrance and on boulders forming the talus slope.

METHOD OF EXCAVATION

When Padypadiy was first visited during reconnaissance in the area (10/7/65), three test holes (10cm. square and 20cm. deep) were dug into the deposit near the stream bed to see if it contained cultural material. Shells, bones and a fragment of a bone point

were recovered, and as a result a full scale excavation began on 13/7/65 and lasted for nine days. The party consisted of three Europeans, two of whom are archaeologists, and three Aborigines.

An area of some 18sq. m. was marked out for excavation. This does not refer to the area of deposit actually removed, since many squares contained only a small pocket of earth on the exposed rock floor. There is in fact, an area of about 41sq. m. that could be excavated, of which about 15-16sq. m. have been removed (Figure III-1).

The deposit was excavated in a series of units 2-10cm. deep. These spit levels followed the slope of the surface and were directly related to any stratigraphic features such as local concentrations of ash, shell or bone.

It was apparent from the outset that the chief value of Padypadiy lay in the wealth of organic material that was preserved in this dry and well protected deposit. Every effort was made therefore to retain all the available evidence so that, instead of sieving and sorting the deposit at the side of the excavation, the following routine was established. One archaeologist excavated the deposit with a paint scraper and a brush. Two Aborigines under his guidance sieved the material in small 1/4 inch mesh plastic sieves and without sorting it, put it all into large plastic bags. The bags were then taken down to the camp where they were sorted and analysed at a table by an archaeologist, the other European and the most informative Aboriginal helper, Frank Gananggu.

From the outset, all the bone, shell, stone and wood artefacts and plant material that Gananggu identified as food or woven fibre, was retained. Other vegetable matter, like fragments of paperbark or grass, was noted and then thrown away together with charcoal and unworked stones. In some units all of the material was retained to show the exact composition of the deposit. As the sorting proceeded, the plants and artefacts identified by Gananggu were noted and checked. Only about 50 per cent of the material was processed in the field and the rest was brought back to the laboratory and sorted there.

This procedure eliminated in part the discomfort and resultant inefficiency of sorting the material in a sieve at the side of the trench. It increased the chances of retaining all the material we wanted, because there was no need for the sorters to keep pace with the excavator. Finally, there was plenty of time for our Aboriginal informants to handle and identify objects such as lotus lilly remains, which might otherwise have been thrown away.

STRATIGRAPHY

The deposit consists of 5 to 40 cm. of dark greyish brown sand (10 YR 3/2-4/3) resting on the decomposing floor of the cave. Loose blocks of sandstone which have apparently weathered off the walls and roof, are interspersed in the sand. The deposit varies in pH from 8.5 at the top to 4.5 at the bottom; the high alkalinity is directly related to the relatively large

numbers of shells that occur in the upper levels of the deposit (Figure III-3; Plate III-4).

In analysing material recovered from a shallow deposit such as this, it is tempting to treat the material as a single unit, or else to divide it fairly arbitrarily into an upper and lower horizon. However, a marked stratigraphic feature occurs in this deposit, and as a result the material has been divided horizontally into two major groups.

This feature is a dense discrete heap of shell bone and charcoal to the east corner of the excavation (Figure III-4). The area is especially well protected from the rain and from scuffage and treadage¹ because the roof is markedly lower here. Furthermore, some of the material in this area, which I shall term midden heap zone, occurs in well protected niches in the rock wall.

The rest of the deposit, termed non-midden zone, contains considerably fewer organic remains, though concentrations of charcoal, ash and paperbark do occur as discrete horizontal bands. It is more exposed than the midden heap zone; rain is blown in here, and the roof is higher which probably accounts for the high degree of scuffage and treadage.

The material is divided into three chronological levels within each zone. The first level (I), includes all material lying on and just below the present surface. The second level (II), contains all material

¹ Matthews, J.M. 1965 pp.295-8.

below this and the third level (III), material actually resting on the rock floor. Thus we can make a general distinction between the youngest material in the deposit (anything lying on the surface) and the oldest (anything lying on the original bare rock floor) (Figure III-3).

The only exception is the material from squares K6 and O6 which was very loose and was removed in one single unit extending from the surface to the rock floor. The material is most closely related to that from Level I in both zones and has therefore been treated accordingly.

The approximate volume of material in each zone is shown in the following table:

Level	Volume (cu. m.)	
	ZONE	
	Midden heap	Non-midden
I	0.2	0.3
II	0.5	0.8
III	0.3	0.9
Total	1.0	2.0

We are therefore dealing with material from 3.0 cu. m. of deposit, spread out over an area of 15-16 sq. m. The deposit probably accumulated in a series of small heaps banked up against the sides of a rock baulk at different times. As a result, all of these divisions should be treated broadly to allow for some degree of temporal overlap.

The deposit is dated in two ways. First, the upper levels contain European material such as glass, iron and cloth which could have been traded into the area about 100 years ago. Leichhardt¹ records that the natives living on the East Alligator River in 1845 had already obtained iron by trade. We can therefore safely assume that Padyadiy was occupied until fairly recently.

The earliest occupation of the shelter appears to be reflected in the lowest levels of the midden heap zone. This is suggested by the distribution of shell species, European material and possibly bone tools. As a result, a charcoal sample from Level III of the midden heap zone, was submitted for radiocarbon dating. This contained all the charcoal from an area of 1 sq. m. over a depth of about 5 cm. The sample was dated to 3120 $\pm$ 100 B.P. (ANU-17).

This date is older than I had expected for this loose, shallow deposit with European material in the upper levels. It may be argued that this sample dates a single small fire lit in the shelter before the main occupation took place, but this is unlikely since the sample dates a large heap of charcoal directly associated with midden debris. The most likely explanation is that the shelter was intermittently occupied for some 3000 years and that there is a marked break between Level I of the midden heap and the underlying levels as the following evidence will suggest.

¹ Leichhardt, L. 1847 p.512.

The following analyses deal first with all organic remains including shells, bones and plant remains, and then with the implements.

A. ORGANIC REMAINS

1) Shell Analysis

Shells from four different environments occur in the deposit. There are mangrove-mudflat species, fresh water forms, land snails and marine shells. Mangrove-mudflat species are found in intertidal mudflats such as those of the East Alligator River. Fresh water mussels occur in billabongs. The land snails may have been collected for food, but alternatively they could have crawled into the cave. Marine shell is represented by only one small worked piece which presumably points to some form of contact with the coast.

The following species occur:

1. Mangrove-mudflat species

- | | | |
|-------------|---|--|
| Potamididae | : | <u>Cerithidea obtusa</u> |
| | : | <u>Telescopium telescopium</u> L. |
| Ellobiidae | : | <u>Cassidula angulifera</u> Petit |
| | : | <u>Cassidula rugata</u> Menke |
| | : | <u>Ellobium aurisjudae</u> Linné |
| Neritidae | : | <u>Neritina (Dostia) crepidularia</u>
Lamarck |
| Geloinidae | : | <u>Geloina jukesi</u> (Deshayes) |

2. Fresh water species

- | | | |
|----------|---|-----------------------------------|
| Hyriidae | : | <u>Velesunio angasi</u> (Sowerby) |
|----------|---|-----------------------------------|

3. Land species

- | | | |
|------------|---|--|
| Camaenidae | : | <u>Xanthomelon sphaeroideum</u> Le Guillou |
| | : | <u>Arnemelassa creedi</u> (Cox) |

4. Marine species

- | | | |
|-----------|---|-----------------|
| Volutidae | : | <u>Melo</u> sp. |
|-----------|---|-----------------|

¹ M.R. Matteson (1959 pp.1094-6) notes that certain snails crawl on to shell heaps in order to eat wet chalk.

Many shells were broken in antiquity, and the incidence of breakage varies between different species. For instance most Cerithidea shells are broken at the tip, whilst many more Geloina shells are intact. This may also be related to attempt to remove the edible flesh and to the relative robustness of different species.

The density of shells from different environments is reflected in the weight of the group as follows:

Shell Species	Zone			
	Midden heap		Non-midden	
	Gm. per cu. m.	Per cent	Gm. per cu. m.	Per cent
Mangrove	4863	91.2	5.5	3.3
Fresh water	386	7.2	151.5	91.5
Land	83	1.6	8.5	5.2
Total	5332	100.0	165.5	100.0

Most of the shells occur in the midden heap, where mangrove-mudflat forms predominate. In contrast to this, fresh water mussels predominate in non-midden zone.

The following tables show the distribution of species in the two zones. Fresh water and land forms increase markedly in the upper level of the midden heap zone. The high proportion of mangrove-mudflat shells in the lowest level of the non-midden zone is statistically insignificant because the total sample is so small, and the shells probably represent the outer limit of the midden heap zone Level III.

a. Midden heap zone:

Level	Shell Species (Per cent)				Total gm.
	Mangrove	Fresh water	Land	Total	
I	61.7	31.1	7.2	100.0	924
II	96.7	2.9	0.4	100.0	3292
III	99.4	0.4	0.2	100.0	1116
Total	91.2	7.2	1.6	100.0	5332

b. Non-midden zone:

Level	Shell Species (Per cent)				Total gm.
	Mangrove	Fresh water	Land	Total	
I	0.5	94.4	5.1	100.0	215
II	1.9	93.3	4.8	100.0	105
III	72.7	18.2	9.1	100.0	11
Total	3.3	91.5	5.2	100.0	331

The final analysis shows the proportion of different mangrove-mudflat species in the three levels of the midden heap zone. There is a slight variation over time - Cerithidea becomes more numerous whereas Geloina decreases slightly, but basically the same relative proportions of species occur throughout the heap:

Level	Shell Species (Per cent) ¹							Total gm.
	1	2	3	4	5	6	Total	
I	16.7	0.9	1.4	77.6	1.8	1.6	100.0	570
II	18.7	0.2	1.5	78.6	0.7	0.3	100.0	3184
III	8.0	0.6	0.7	89.2	0.7	0.8	100.0	1109
Total	16.1	0.4	1.3	80.8	0.8	0.6	100.0	4863

¹ The numbers refer to the following species:

1. Cerithidea obtusa
2. Telescopium telescopium
3. Cassidula angulifera and rugata
4. Geloina jukesi
5. Neritina (Dostia) crepidularia
6. Ellobium aurisjudae

Conclusions

Two points emerge from the analysis. Firstly, fresh water mussels and land snails are rare in the lower levels of the midden heap, whereas they predominate in Levels I and II in the non-midden zone. Secondly, fresh water and land species increase fairly markedly in the uppermost level of the midden heap zone.

One could argue that the non-midden zone is so exposed that the mudflat species that were originally there have now been destroyed. This is very unlikely however, because these species are tougher than the fresh water or land varieties, and if all were subjected to the same pressures, the mangrove-mudflat shells would survive longest.

I feel that this variation suggests a broad chronological relationship between the two zones, which is shown in Figure III-5. Translated into human terms, the evidence suggests that when men first occupied Padypadiy, they ate mainly mangrove-mudflat shellfish and threw the debris into a pile in the east corner. The later occupants ate more fresh water mussels and scattered the remains over a wider area.

Earlier in this chapter, I discussed the problems that were raised by the dates of the midden heap. It seemed unlikely, on a priori grounds alone, that the heap accumulated continuously during an unbroken occupational phase. I therefore feel that the variation between the shells of the top level of this heap and those in the underlying levels represents a fairly significant hiatus in accumulation, which would help to justify the dates.

2) Bone analysis

Skeletal remains of marsupials, fish, reptiles, birds, crabs and humans occur in the deposit.

Most of the bone occurs in the midden heap zone and the best preserved remains are found in the niches or recesses in the rock wall in the top level of this zone. Most specific identifications are made from cranial fragments except for the bird and crab remains which are identified according to eggshell and carapace fragments respectively.

The minimum number of animals present is assessed according to an analysis of cranial fragments, but human post-cranial remains are also analysed for this purpose.

1. Mammals

The following mammals occur at Padypadiy:

Peramelidae	: <u>Isoodon macrourus</u> (Gould)	Bandicoot
Phalangeridae	: <u>Trichosurus vulpecula</u> (Kerr)	Possum
Dasyuridae	: <u>Satanellus hallucatus</u> (Gould)	Native 'cat'
	: <u>Sarcophilus harrisi</u> (Boitard)	Tasmanian devil
Macropodidae	: <u>Macropus antilopinus</u> (Gould)	Antilopine kangaroo
	: <u>Wallabia agilis</u> (Gould)	Sandy wallaby
	: <u>Petrogale penicillata</u> (Griffith, Smith and Pidgeon)	Rock wallaby
	: <u>Lagorchestes conspicillatus</u> (Gould)	Spectacled hare wallaby
Megadermatidae	: <u>Macroderma gigas</u> (Dobson)	Ghost bat
Pteropodidae	: <u>Pteropus scapulatus</u> Peters	Flying fox
Muridae	: <u>Hydromys chrysogaster</u> Geoffrey	Water rat
	: <u>Mesembriomys gouldii</u> (Gray)	Rabbit rat
	: <u>Zyzomys argurus</u> (Thomas)	Rock rat
	: <u>Rattus tunneyi</u> (Thomas)	Tunneys' rat
	: <u>Rattus conatus</u> Thomas	Cane rat
	: <u>Melomys</u> sp.	Fawn footed rat

These identifications are all based on cranial fragments, mainly mandibles and maxillae. All of these animals are found in the area today with the exception of S. harrisi.¹ This animal was identified from a single edentulous mandibular symphysis, lying in Level II of the midden heap zone (L5/4) approximately 20-25cm. below the surface. Its position is just above the charcoal in

¹ Calaby, J.H. and White, Carmel 1967 pp.473-5.

square K5 which was dated to 3120 ± 100 B.P. (ANU-17) so that this date provides a terminus post quem for the age of the specimen.

The animal was apparently smaller than the normal Tasmanian devil. It may have been a young specimen or a female but on the other hand the size may well be related to the appreciably smaller size of Arnhem Land mammals as opposed to their larger counterparts in southern Australia. This is the first time that S. harrisi has been found in the tropics and it significantly increases our knowledge of the distribution of the species in Recent times.

There are 67 individuals in this collection. This count is based on a within-level calculation of the maximum number of left and right mandibles or maxillae present.

The incidence of animals in each zone is shown in the following tables:

a. Midden heap zone - minimum number of animals:

Species	Level			Total
	I	II	III	
<u>Isoodon macrourus</u>	4	9	2	15
<u>Trichosurus vulpecula</u>	4	1	2	7
<u>Satanellus hallucatus</u>	-	3	-	3
<u>Sarcophilus harrisi</u>	-	1	-	1
<u>Macropus antilopinus</u>	-	1	-	1
<u>Wallabia agilis</u>	1	1	1	3
<u>Petrogale penicillata</u>	-	1	1	2
<u>Macroderma gigas</u>	-	2	-	2
<u>Pteropus scapulatus</u>	1	-	-	1
<u>Hydromys chrysogaster</u>	2	1	1	4
<u>Mesembriomys gouldii</u>	1	1	1	3
<u>Zyzomys argurus</u>	2	1	-	3
<u>Rattus tunneyi</u>	1	1	-	2
<u>Rattus conatus</u>	1	1	1	3
Total	17	24	9	50

b. Non-midden zone-minimum number of animals:

Species	Level			Total
	I	II	III	
<u>Isoodon macrourus</u>	6	3	-	9
<u>Trichosurus vulpecula</u>	-	1	-	1
<u>Wallabia agilis</u>	1	-	-	1
<u>Lagorchestes conspicillatus</u>	1	-	-	1
<u>Pteropus scapulatus</u>	1	-	-	1
<u>Hydromys chrysogaster</u>	-	1	-	1
<u>Rattus tunneyi</u>	-	1	-	1
<u>Rattus conatus</u>	1	-	-	1
<u>Melomys sp.</u>	1	-	-	1
Total	11	6	-	17

The bandicoot, Isoodon macrourus, is the most popular species in both zones. There are many more animals represented in the midden heap zone, and this can be partly attributed to cultural factors and partly to differential weathering in the two zones.

2. Fish

Although the fish bone is fragmentary most part of the skeleton are present, including skull, vertebral and fin fragments. No jaws are present, but the barramundi (Scleropages leichhardti) and catfish (Silurus sp.) were identified according to skull fragments.

In the absence of jaws, I calculated minimum number of fish present by counting the number of otoliths. These are small free aggregations of calcium carbonate which occur in each ear cavity. In order to express the minimum number of fish present, the number of intact otoliths was halved and the group of broken ones

quartered. Finally, the weight of fish bone in each zone was measured to show its relative density in various parts of the site.

The results are as follows:

a. Midden heap zone - fish remains:

Level	Bone (gm.)	Otoliths (Nos)		Min. nos fish
		Intact	Broken	
I	177.2	36	6	20
II	240.1	38	7	21
III	44.0	-	1	1
Total	461.3	74	14	42
Per cu.m.	461.3	74	14	42

b. Non-midden zone - fish remains:

Level	Bone (gm.)	Otoliths (Nos)		Min. nos fish
		Intact	Broken	
I	85.3	46	9	26
II	54.4	26	9	16
III	1.4	1	-	1
Total	141.1	73	18	43
Per cu.m.	70.5	36	9	22

The analysis shows that fish remains occur throughout the deposit and increase markedly over time. The density of fish bone per cu.m. is seven time higher in the midden

zone than the rest of the deposit. In direct contrast to this, the otolith analysis suggests that the same number of fish originally lay in each zone (Figure III-6).

It is well known that otoliths are the most resilient part of the fish skeleton and will survive after ribs, fins and vertebrae have been destroyed. Therefore, this disparity probably reflects differential weathering of bone in the two zones.

If the otoliths do not reflect the original number of fish that were originally deposited then there are three alternative explanations for this phenomenon. Firstly, otoliths were extracted elsewhere and carried into Padypadiy: there is no ethnographic evidence of this practice at all. Secondly, fish were cooked and eaten in the midden area and their otoliths were discharged into the rest of the deposit: this too is unlikely. Finally, the fish eaten in the non-midden area were smaller and more fragile than their 'midden' counterparts: again, analysis of the size of otoliths in the two areas show a high degree of similarity between the two groups.

Briefly then, it seems that the occupants of Padypadiy brought fish into the site, and since much of the bone is charred, we can assume that they cooked and ate them. The earliest occupants left fewer fish remains behind but this need not imply that they ate fewer fish. After the remains were deposited, they were subjected to various degrees of weathering and more fish bone was destroyed in the exposed non-midden zone.

3. Reptiles

Reptilian remains include skull fragments, limb bones, carapace and plastron fragments and one small piece of skin. The following forms were identified according to skull fragments:

Boidae	:	<u>Python</u> sp.	Python
Varanidae	:	<u>Varanus</u> sp.	Goanna
Agamidae	:	<u>Agamid</u> sp.	Agamid lizard
Chelydidae	:	<u>Chelonida expansa</u>	Long necked fresh water tortoise
	:	<u>Emydura</u> sp.	Short necked fresh water tortoise
? Gekkonidae or	-		Gekko or Skink
? Scincidae			

The minimum number of individuals in each zone was determined by jaw counts. According to the within-level count, there are 17 individuals present, which are distributed as follows:

a. Midden heap zone:

Species	Level			Total
	I	II	III	
<u>Python</u> sp.	1	2	-	3
<u>Varanus</u> sp.	1	1	-	2
<u>Agamid</u> sp.	-	2	-	2
<u>Chelonida</u> sp.	1	-	-	1
<u>Chelonida expansa</u>	1	-	-	1
<u>Emydura</u> sp.	1	-	-	1
? Gekko/skink	1	-	-	1
Total	6	5	-	11

b. Non-midden zone:

Species	Level			Total
	I	II	III	
<u>Varanus</u> sp.	-	2	-	2
<u>Agamid</u> sp.	2	1	-	3
? <u>Gekko</u> /skink	1	-	-	1
Total	3	3	-	6

The analysis suggests that the inhabitants of Padypadiy ate a wide variety of land and aquatic reptiles, all of which are readily available on the coastal plains today. It also shows that reptiles are absent in the lowest level of both zones, and that tortoises occur only in Level I of the midden heap zone. This is directly contradicted by the following analysis of the density of tortoise carapace and plastron in the deposit.

Level	<u>Gm. per cu. m.</u>	
	<u>ZONE</u>	
	Midden heap	Non-midden
I	220	410
II	306	132
III	39	3
Total	209	116

Clearly tortoise remains occur throughout the deposit. Many fragments are charred suggesting that the

animals were burned in their shells and there is relatively less shell in the lowest levels which may mean that fewer animals were in fact brought into Padyadiy at that time. However, most of the tortoise shell from the lowest levels is very brittle which suggests that some of the original bone may have weathered away.

The most important result of this analysis is that it stresses that jaw counts, in certain reptiles at least, provide a somewhat unreliable picture of the faunal content of the site. Unfortunately, there is as yet no reliable data on the average dry weight of the shell of these particular animals, but when this is available one should be able to calculate minimum number of animals present.¹

4. Birds

Identifiable bird remains include limb bones, quills, feathers and fragments of eggshell. Most of these occur amongst the vegetable padding in niches in the rock wall in Level I of the midden heap zone. All of the eggshell and some of the quills are attributed to Anseranas semipalmata, the magpie goose. This is the only species that could be identified from the remains, but it need not necessarily indicate that the bird was actually eaten in the shelter.

¹ I wish to thank Mr D.E. Drummond, Zoology Dept., University of Sydney and Mr A. Burlidge, Zoology Dept., University of Western Australia, for their helpful comments on this issue.

Fragments of eggshell occur in most of the deposit, and the relative density of eggshell is shown below:

Level	<u>Gm. per cu. m.</u>	
	<u>ZONE</u>	
	Midden heap	Non-midden
I	660	105
II	119	8
III	19	-
Total	197	19

Eggshell is very fragile and I feel that the marked variation in density both between and within the zones, is due largely to differential weathering rather than cultural factors.

5. Crabs

Claws and carapace fragments were submitted to Dr J.C. Yaldwyn¹ for identification and he conferred with Mr B. Campbell² who identified the remains as follows:

The excavated Crab fingers are almost certainly of Sesarma sp., but it is a species I have not as yet seen. It is possibly similar to S. tetragona Fabricius (known only from two specimens from the East Indies). The size (carapace width) of the crabs represented would be in the order of 25-35 mm. and with the usual blocky appearance of Sesarma sp.... This would put them in the edible range.³

¹ Curator of Crustacea, Australian Museum, Sydney.

² Queensland Museum, Brisbane.

³ In litt. 30.9.66.

These crabs are found in mangrove-mudflats, and the inhabitants of Padypadiy probably collected them along the muddy banks of the East Alligator River.

The minimum number of crabs present can be calculated by dividing the claws into top and bottom claws and then dividing the larger group by two. I had difficulty in distinguishing top and bottom claws, and as a result I have divided the total number of claws by four to give the absolute minimum number of individuals present as follows:

Level	<u>Minimum number of crabs</u>	
	<u>ZONE</u>	
	Midden heap	Non-midden
I	21	1
II	16	-
III	7	-
Total	44	1

Clearly most of the crabs occur in the upper and middle level of the midden heap zone; there is only one claw in the non-midden zone. This disparity may be the product of cultural and/or physical factors, but it is impossible to attribute it to either at this stage.

6. Humans

Human bones occur mainly in the midden heap zone. There are no formal placed burials and the bones occur throughout the deposit mingled with the food and occupational debris. The bones are burnt and broken,

and although most parts of the skeleton occur, only the smaller more compact bones such as metapodials and patellae, are intact.

The identifiable bones were divided into cranial and post-cranial material. Mr A.G. Thorne¹ analysed the cranial material and I sorted the post-cranial remains. Most of the material is analysed according to its level within the zone, except for the bones found in a niche in the rock wall in squares L6 and K6. This material, termed 'niche burial', would normally be treated as Level I of the midden heap zone, but it has been separated because it looks like a deliberate placement. The remains are listed in the table as follows:

a. Niche

The recess in the rock wall of squares L6 and K6 was apparently stuffed with dried grass, paperbark, food remains and numerous burnt and broken human bones. The plant wadding is only slightly charred in parts, so that the human bones must have been burnt before they were placed in the recess.

The analysis of teeth shows that the remains of at least five individuals are present. Three of these are adults, one is a juvenile and the last is a child. The juvenile is represented by an unerupted, permanent, lower right second molar, and the child by an unerupted, deciduous, upper left first molar. In both cases, the teeth must have been detached after death rather than by pre-mortem evulsion.

¹ Anatomy Dept., University of Sydney.

There are clearly too few post-cranial remains to account for five individuals. All the identifiable bones belong to mature individuals, and could in fact all belong to one adult. This has not been determined by my analysis and it is of course possible that some immature post-cranial material is present amongst the unidentifiable fragments.

Whatever the answer, this collection apparently reflects some form of secondary burial. Five individuals died and some or all of their bones were burnt and broken. Then the remains were stuffed into the niche and padded around with grass, bark and other debris.

b. Midden heap zone

Most of this bone is broken and heavily charred and looks very like the broken, burnt food debris.

Level I contains the scattered remains of one adult. Level II contains the remains of at least three adults and one child. Level III contains the bones of at least one adult and one child, since there are teeth belonging to one adult and one juvenile and two patellae of markedly different sizes.

According to a within-level count there are at least seven individuals present here - five adults and two juveniles or children. It is clear that we do not have all the post-cranial remains of seven individuals and furthermore, there are many more small compact bones (patellae, metapodials) than longbones (femora, tibiae). It is unlikely that the other longbones of seven individuals are contained amongst the unidentifiable

bone, so that it seems that only the smaller bones were in fact interred here.

Secondary burial is suggested even more strongly by the presence of several fragments of human skull and splinters of human bone which have been painted with red ochre. These all occur in Level II.

c. Non-midden zone

A few small bones occur on the surface of squares K4 and L3. These squares are contiguous to the midden heap zone and rather than representing another individual, the bones probably represent the outer limit of the main concentration.

Conclusion

The remains of at least 11 individuals occur in the deposit. Most of the bones come from the midden heap zone and they are found throughout this feature. It seems that some form of secondary burial is reflected in these remains. Secondary burial was widely practised in Arnhem Land¹ and the evidence from Padypadiy suggests that the ritual has some considerable antiquity.

7. Unidentifiable bone

All unidentifiable bone was weighed and the following table shows once again, that most of it occurs in the midden heap zone:

¹ Spencer, W.B. 1914 pp.228-56, Berndt, R.M. and C.H. 1964 pp.399-400.

ANALYSIS OF HUMAN BONE IN PADYPADIY
(Number of Bones)

BONE	NICHE (L6 & K6)	MIDDEN HEAP ZONE			NON-MIDDEN ZONE Level I
		I	Level II	III	
Teeth:					
Adult	4	-	4	2	
Juvenile	4	-	72	1	
Child	2	-	-	-	
Miscellaneous	2	4	15	12	
Skull fragments	7	2	100	41	
Scapula	1(R)	-	2(L)	-	
Humerus	-	-	1(L)	1(L)	
Radius	-	1	1(R)	-	
Ulna	1(R)	-	1(L)	-	
Carpal	6	-	15	1	
Metacarpal	8	-	5	4	
Phalange	30	4	58	25	
Pelvis	1(L)	-	2 a+j	1	
Femur	-	-	1	-	
Patella	1	-	2	2(2 indiv.)	
Tibia	-	-	2	-	
Fibula	-	-	-	-	
Tarsal	9	-	4	4	
Metatarsal	11	2	3	-	
Phalange	11	3	18	7	
Metapodial	-	7	-	7	2
Vertebra	55	-	72	23	
Sternum	1	-	-	-	
Rib	100	1	55	26	
<u>Minimum nos :</u>					
Adult	3[teeth]	1	3[phalanges]	1[teeth]	21
Juvenile/child	2[teeth]	-	1[pelvis]	1[teeth]	
Total	5	1	4	2	21
Unidentifiable bone (grams)	183	7	1247	1057	7

Key: x - present
 a - adult
 j - juvenile

Level	Gm. per cu. m.	
	ZONE	
	Midden heap	Non-midden
I	1992	813
II	3085	244
III	2301	17
Total	2631	227

As one would expect there is markedly more bone in the midden heap zone. There is considerably less bone in the lowest level of the non-midden area as opposed to the rest of the deposit, and this serves to emphasise the integrity of the midden zone.

3) Plant Analysis

Plant remains occur in the top level of both zones. Most of them are fragile and highly susceptible to decay and I attribute the absence of vegetable matter in the earlier levels to decay rather than to cultural factors.¹

Most of the remains come from the niches in squares L6 and K6, where they served as padding around the human remains. Another heap occurs on the surface of square K5, banked up against the rock wall there.

The specific identifications were made with great difficulty and should be treated with reservation. I

¹ Differential decay of floral material was especially marked in the analysis of material from the Amador 3 cave in California. (Cook, S.F. and Heizer, R.F. 1951 pp.283-6).

have not tried to express the amount of vegetable food present in the deposit, because it is impossible to tell exactly which remains represent food and how much of the plant was actually eaten. Instead, I have listed the nature of the remains, the potential food value of the plant and the name given to the actual specimen by our Aboriginal informants. (See Appendix III-1).

The remains of edible plants occur such as the fan palm, sedge, lotus lily and cycad. There are also pieces of inedible plants such as the phragmites reed, paperbark and acacia, which could have been used to make implements or as firewood.

Most of these plants grow near Padypadiy today, out on the plains, on river banks, in shallow billabongs and in rocky outcrops of the main escarpment.

It seems that the latest inhabitants of the shelter, at least, collected a wide variety of plants which they used for firewood, padding, mats and probably food. There is no direct evidence of seasonal occupation of the shelter and the following table shows that even if these plants were only eaten in the seasons cited by Specht,¹ the site was possibly used all year round.

Plant	SEASON			
	Wet		Dry	
	Oct-Dec	Jan-March	March-Aug	Sep-Oct
? <i>Livistona humilis</i>	X	X	X	X
<i>Cyperaceae</i>	-	-	-	X
<i>Nelumbo nucifera</i>	-	-	X	-
<i>Cycas media</i>	X	-	-	X

¹ Specht, R.L. 1958c pp.501-3.

4) Termite nest

Several pieces of charred termite nest occur in the lowest level of square K5 (K5/3), which is dated to 3120 ± 100 B.P. Basedow¹ records the use of termite bed as fuel in the Northern Territory and the material in K5/3 may well document that this is a fairly old practice.

ORGANIC REMAINS - Conclusion

The inhabitants of Padypadiy exploited several aspects of the plain environment in order to gather food. The mudflats of the tidal East Alligator River were combed for shellfish and crabs, and fish were probably caught in its waters too. Fresh water billabongs yielded shellfish, fish, tortoises and a variety of aquatic plants. Flocks of birds were probably caught near the waters. A wide variety of terrestrial mammals and reptiles were apparently hunted on the plains, and nuts and fruit were collected from trees growing in stony outcrops of the escarpment.

These activities imply that the inhabitants ranged over a wide area; they must have carried the mangrove-mudflat shells at least four or five miles across the plain from the East Alligator River. They probably hunted in the escarpment about two miles away, although this is not directly reflected in the faunal remains.

Many archaeologists working with midden remains have tried to use the types of data I have presented to assess the relative amounts of food eaten and the

¹ Basedow, H. 1925 p.108.

number of people concerned.¹ They often rely fairly heavily on the ethnographic record to establish the size of the group,² so that the argument becomes somewhat circular.

I have not attempted to make calculations of this kind for several reasons. Firstly, it is clear that organic remains are differentially preserved in Padypadiy and the original amount of bone or shell present has not been calculated. This would require a more extensive knowledge of local weathering processes and post-cranial faunal remains than we have today.

However, once this were done, we would have to deal with the more difficult problem: to what extent do these remains represent the actual amount of food eaten by the inhabitants of the site. This in turn would depend on how much debris was thrown over the cliff and how much food was eaten whilst the occupants were out hunting meat or gathering shellfish and plants. The ethnographic evidence, limited though it is, suggests that a large amount of food was cooked and eaten away from the current camp site.³ As a result, we cannot say whether the food remains at Padypadiy represent the full meals of a family or the snacks of an itinerant hunter. In short, there is such a wide potential range of variation that I feel I would be making a pseudo-

¹ Cook, S.F. 1946 pp.51-2; Cook, S.F. and Treganza, A.E. 1947 pp.135-41; 1950 pp.245-52; Treganza, A.E. and Cook, S.F. 1948 pp.287-97; Jones, R. 1966 p.7.

² Cook, S.F. and Treganza, A.E. 1950 pp.231-3, p.246; Cook, S.F. 1950 p.4; Ascher, R. 1959 pp.168-78.

³ McCarthy, F.D. and McArthur, M. 1960 pp.145-94.

scientific computation if I tried to assess the size of the group that lived at Padyadiy according to the amount of food eaten there. I cannot reconstruct the eaters of each meal; all I can say is that their diet included a wide variety of foods gleaned mainly from the coastal plains.

B. IMPLEMENTS

Implements made of bone, shell, plant matter (wood, fibre and resin), and stone occur in the deposit. European items such as glass, iron and cloth are also found.

1) Bone Implements

There are 13⁴ bone tools which may be described according to the following categories:

1. Bipoints (Figure III-7, a-d)

There are 22 bipoints in the collection. Only five (23 per cent) are intact but the other 17 all show the characteristic mid-shaft bulge from which the two tips taper off. Twenty-one (95 per cent) are made of mammal bones: 18 on an intact shaft and the other three on a splinter. The remaining bipoint is made from a fish bone.

Intact bipoints range from 1.7 to 3.7 cm. in length, and broken ones from 1.2 to 4.5 cm. All of these tools were ground and polished into their present shape, and the actual tip is formed by the intersection of three or more tiny ground surfaces.

2. Unipoints (Figure III-7, e-g)

There are 28 of these implements and all of them are broken at the end opposite the point. None of these show the mid-shaft bulge characteristic of bipoints. Twenty-two are made of mammal longbone, five of fish bone and one is made on a bird bone.

Unipoints with intact tips range in length from 1.0 to 3.2 cm. and the broken ones from 1.0 to 5.3 cm. They were all ground and polished into shape. The tip is formed by tiny intersecting planes in 16 instances and the other tools have bevelled tips (three) or round tips (one).

Bipoints and unipoints are technologically similar but unipoints are somewhat shorter (Figure III-8). This tends to support the idea that some small unipoints are broken tips of bipoints.

3. Sections (Figure III-7, h)

There are 30 sections. Twenty-nine are shafts of mammal bone and the other is a bird bone. Three are ground and they are all glossy. They may well be broken bipoints or unipoints.

4. Spatulated points (Figure III-7, i-1)

There are 38 of these implements, all made on the shaft of a macropod fibula. Only one is intact and it is 9.2 cm. long and made on the bone of an immature animal.

These tools were ground and polished into shape. Most fragments have an area of high gloss at the tip and along the convex surface of the bone. This gloss overlies the ground surface, suggesting that the tool was first ground into shape and then polished, possibly during use.

5. Utilised flakes (Figure III-7, n-o)

There are 11 flakes of mammal bone. Ten show a localised gloss and the other one has tiny chips removed along one thin edge. They seem to have been used without any deliberate grinding or shaping.

6. Incised fragments (Figure III-7, m)

There are two flat pieces of bone with cut or scratch marks on one surface. They are both small (1.8 x 0.5 cm. and 1.2 x 1.0 cm.) and the marks are truncated at the edges suggesting that they are parts of larger implements. One piece has a high gloss or use-polish on one edge suggesting that it was used to work pliable organic material.

7. Tubes (Figure III-7, p)

There are three of these, but only one has an intact circumference. They are all parts of the shaft of a bird bone and the intact specimen is the ulna of a flying bird.¹ All three are ground at one end at least, and the grinding is overlaid by a high gloss.

Conclusion

There is a wide variety of bone tools, which are distributed in the deposit as follows:

¹ I am indebted to Mr R.J. Scarlett, Canterbury Museum, Christchurch, for this information.

a. Midden heap zone:

Implements	Level						Total	
	I		II		III			
	Nos	%	Nos	%	Nos	%	Nos	%
1. Bipoints	3	15.8	4	8.9	-	-	7	9.1
2. Unipoints	4	21.1	6	13.3	-	-	10	13.0
3. Sections	1	5.2	12	26.7	5	38.4	18	23.4
4. Spat. points	6	31.6	17	37.8	8	61.6	31	40.2
5. Util. flakes	4	21.1	4	8.9	-	-	8	10.4
6. Incised	-	-	1	2.2	-	-	1	1.3
7. Tubes	1	5.2	1	2.2	-	-	2	2.6
Total	19	100.0	45	100.0	13	100.0	77	100.0

b. Non-midden zone:

Implements	Level						Total	
	I		II		III			
	Nos	%	Nos	%	Nos	%	Nos	%
1. Bipoints	6	20.7	8	33.4	1	25.0	15	26.4
2. Unipoints	12	41.4	5	20.8	1	25.0	18	31.6
3. Sections	5	17.3	5	20.8	2	50.0	12	21.0
4. Spat. points	4	13.8	3	12.5	-	-	7	12.3
5. Util. flakes	1	3.4	2	8.3	-	-	3	5.3
6. Incised	1	3.4	-	-	-	-	1	1.7
7. Tubes	-	-	1	4.2	-	-	1	1.7
Total	29	100.0	24	100.0	4	100.0	57	100.0

Bipoints, unipoints and spatulated points are the most distinctive and prolific forms found in this deposit. Two trends can be observed in their distribution, and since the numbers are small, both trends have been checked by a standard deviation test assuming a Poisson distribution. The following observations can now be made:

1. Bipoints and unipoints predominate in the non-midden zone, whereas spatulated points predominate in the midden zone. This is statistically valid (Figure III-9).
2. Bipoints and unipoints appear to increase over time in both zones, whilst spatulated points decrease in the midden heap zone. However, the standard deviations show that the numbers concerned are far too small to support this assumption.

a. Midden heap zone:

Implements	Level					
	I		II		III	
	%	S.D.	%	S.D.	%	S.D.
Bi- and unipoints	36.9	± 16	22.2	± 7.8	-	-
Spat. points	31.6	± 15	37.8	± 10.8	61.6	± 28
Total Nos	13		27		8	

b. Non-midden zone:

Implements	Level					
	I		II		III	
	%	S.D.	%	S.D.	%	S.D.
Bi- and unipoints	62.1	$\pm$ 39	54.2	$\pm$ 19	50.0	$\pm$ 43
Spat. points	13.8	$\pm$ 11	12.5	$\pm$ 8	-	-
Total Nos	22		16		2	

According to the shell analysis, the lower levels of the midden heap zone are the earliest strata in the deposit and on this basis, we can construct the following sequence:

During the earliest occupation of the site both forms of bone tools were probably used, but spatulated points predominated and were deposited in the lowest level of the midden heap zone. These spatulated points continued to be used until modern times, but they became increasingly less important whilst bipoints and unipoints increased in numbers.

If these bipoints and unipoints were the tips used in fish spears,¹ then it is perhaps interesting at this stage to note that there is a marked increase in the amount of fish remains in Levels II and I all over the site.

¹ Chapter II, p.31.

This is a very tentative correlation however: it is only found at Padypadiy where the effect of differential weathering on both bone tools and fish remains has not been accurately assessed.

2) Shell Implements

All fragments of shell were inspected for signs of use. This was difficult to determine objectively because most of the shells are broken and fragments have sharp edges which could have served as knives or scrapers. As a result only those fragments showing definite signs of utilisation, such as a localised gloss, were isolated as implements.

There are nine fragments of Geloina jukesii (the mangrove-mudflat clam), all of which have utilised edges along the natural margin of the shell. Small flakes have been detached on the dorsal surface of the shell and the scars are overlaid with a marked gloss. There is one fragment of Velesunio angasi (the fresh water mussel) which shows similar signs of utilisation. Finally, there is a single fragment (K5/2) of marine baler shell (Melo sp.) which is 3.0 cm. long and has been ground into a dull point along two sides.

All these implements come from Levels I and II of the midden heap zone but this does not necessarily imply that shell implements were not used when the rest of the deposit accumulated. The shells in these areas are chalky and friable and any evidence of use-wear has probably been weathered away.

It is clear from this evidence that the inhabitants of Padypadiy used shell to cut and scrape. The glossy use-polish suggests that shells were used on pliable organic remains,¹ such as skins, meat, bone or plants. This would provide some answer to the relatively small numbers of sharp stone tools in the deposit, for although good stone may have been fairly rare, there were plenty of shells in the river banks to be used for food and tools. Spencer² records the use of a fresh water mussel as a knife amongst the Kakadu of Oenpelli in 1912, thus documenting their use in modern times.

3) Implements of wood, fibre and resin

a. Wooden Implements

Eleven wooden implements were recovered from the deposit. They were associated with numerous wooden slivers and shavings that indicate that woodworking was practised on the spot. The tools are restricted to the top level of the midden heap zone and many occur in and amongst the vegetable padding in the recess in square K6. Several of these implements are charred, which raises the strong possibility that their restricted distribution may be because many were destroyed by fire.

I have classified these implements fairly loosely according to ethnographic records from the same area.³

¹ Semenov, S.A. 1964 pp.83-5.

² Spencer, W.B. 1914 p.248.

³ Spencer, W.B. 1914; 1928.

1. Points (Plate III-5, a-c)

There are three points. Two are slivers of wood with acute oval-sectioned tips at one end. They were apparently fashioned with a sharp tool and the tips are smooth and glossy, possibly as a result of use. One is made of Callitris ?intratropica and is 13 x 1.3 cm. The other, L5/1-12, is made of Eucalyptus ?tetrodonta, ?phoenicea, and is 8.7 x 0.8 cm. The third point, K6/1-7, is broken at the tip and was apparently whittled into shape. It is 2.5 x 1.0 cm. with an oval cross-section. There are no direct parallels for such tools in the ethnographic record, but they may have served as awls or spear points.¹

2. Firesticks (Plate III-5, d-f)

There are three firesticks. The positive stick, K6/1-4, is 14.9 x 0.7 cm. with a circular cross-section and the characteristic smoothing at one end. There are two negative sticks. The first, K6/1-2, is Meliaceae ?Owenia, and is 5.4 x 1.0 cm. The second, K6/1-6, is Euphorbiaceae ? Phyllanthus. It is 15.5 x 1.0 cm. and part of the characteristic hollow is visible at one end.²

3. Spearthrower knob (Plate III-5, g)

There is one knob (K6/1-5) consisting of a short wooden projection and a broken wooden stick, bound round with coiled bark fibre string and stuck into a lump of non-phenolic resin. Our informant (Ganangu)

¹ Spencer, W.B. 1914 pp.357-9.

² Spencer, W.B. 1914 pp.391-2.

termed it 'woomera head' and it is very similar to the knob of a Kakadu spearthrower, described by Baldwin Spencer.¹

4. Message stick (Plate III-5, h)

The specimen (L5/1-14) is made of Callitris ?intratropica. It is 15.7 x 1.9 cm. with a flat rectangular cross-section. It is pointed at one end and rounded at the other and was apparently cut into shape. A linear design is cut into the wood on both surfaces.

The implement is very similar to some of the message sticks that Mountford described from Oenpelli.² Unfortunately, similar designs often carry different meanings and as a result I cannot interpret the message on this particular stick. Our Aboriginal informants suggested that such sticks are useful for catching lice and fleas.

5. Hafted stick (Plate III-5, i)

There is a broken wooden stick (K6/1) of Polyalthia holtzeana with a knob of resin at one end. It is 3.9 cm. long with an oval cross-section and resembles part of a decorated firestick from the Oenpelli area.³

¹ Spencer, W.B. 1914 pp.376-8.

² Mountford, C.P. 1956 pp.466-75, also Figures 67B and 68E and F.

³ Spencer, W.B. 1914 p.397, Plate XXVII No.7.

6. Linkshaft (Plate III-6, a)

There is a hollow tube (K5/1-11) which may have served as a linkshaft on a spear. It is made of Phragmites karka and is 26.0 x 1.5 cm. One end is split in four places for a distance of about 10 cm. down the length of the tube. About 1.1 cm. from this end there is an intermittent ring of resin showing the impression of fibre binding. The other end is ragged and shows no signs of working.

This piece resembles the shaft of a fish spear where prongs were driven into the tube and then bound into place with fibres and resin.¹

7. Pipe (Plate III-6, b)

This specimen (K6/1-10) is a segment of a bamboo, Bambusa arnhemica. It is 47.0 cm. long and part of the circumference of a hole is visible at one end. The other end is cut off and the outer face of the bamboo is glossy for about 5.0 cm. from the end. It resembles the Arnhem Land bamboo smoking pipes illustrated by several authors.²

Conclusion

The wooden tools reflect the day by day activities of people who used them to make fire, to hunt and for recreational activities such as smoking. Many of them

¹ Spencer, W.B. 1914 pp.358-9.

² Elkin, A.P. and Berndt, C. and R. 1950 pp.102-4; Mountford, C.P. 1956 pp.389-90.

are similar to wooden tools used by Oenpelli people such as Spencer's Kakadu, and this enables us to identify the inhabitants of Padypadiy even more closely.

b. Fibres

Fragments of weaving and string occur in the uppermost level of the midden heap zone. This restriction is probably due to the same physical factors that apparently affect the distribution of plant remains.

1. Weaving (Plate III-7)

Three fairly large fragments of woven fibres occur in square L6, in and amongst the straw padding there. All of these consist of long strands bound together by knotted horizontal threads. Two fragments have tough thin strands closely woven together, but the third has loose, coarsely woven threads.¹

2. String

Pieces of rolled fibres occur in the top level of squares L5, L6 and K6, and one is tied into a knot. One piece was tentatively identified as either Hibiscus tiliaceus (cotton wood tree) or Brachychiton paradoxum. Early authors such as Tindale² and Warner³ noted that

¹ Spencer records a number of fine baskets made by Kakadu (1914 pp.378-89).

² Tindale, N.B. 1926 p.115.

³ Warner, W.L. 1937 p.493.

the inner part of Hibiscus tiliaceus was used to make rope in Arnhem Land.

c. Lumps of Resin

Nine lumps of vegetable resin occur in the top level of squares K5 and 6. The exact nature of the resin has not been identified but similar resins were used by the Kakadu as mastic.¹

4) European material

The following items occur in the deposit, all of which must have come into the area after European influence began to be felt there.

1. Glass

Fourteen fragments of green and white glass, and one blue glass bead were found in Levels I and II of the non-midden zone.

2. Iron

Ten fragments of metal occur in the Level I of both zones. These include seven fragments of iron, two parts of a metal spring and one nail 4 cm. long.

3. Cloth

Fragments of European cotton cloth occur on the surface of the midden heap zone and amongst the

¹ Spencer, W.B. 1914 pp.352-500, p.377.

vegetable padding in the recesses in the rock wall. Red and khaki cloth are found and five types of material can be distinguished according to the colour and weave.

Conclusion

European materials are found in both zones of this deposit. They are restricted to top level of the midden heap zone, but occur in Levels I and II in the non-midden zone. This suggests that there was more scuffage and treadage in the non-midden zone and that the relatively undisturbed upper level of the midden zone was deposited before and/or during the time that European goods came into the area.

The distribution is very similar to the pattern found in the distribution of shells, and supports the theory that Levels I and II of the non-midden zone accumulated after Levels II and III in the midden heap.

5) Stone Artefacts

The analysis of stone artefacts is based on the principles described in Chapter II, which are elaborated in the typological analyses in Chapters VI and VII.

I OVERALL FEATURES:

The following analysis deals with the density and distribution of worked stone in the deposit. It also describes the raw materials used in tool making and the ratios of implements to waste flakes.

1. Distribution and density of artefacts

There are 461 flaked stone artefacts in this collection: 73 (15.8 per cent) are implements and the rest are waste flakes.

The relative density of artefacts (implements and waste flakes) in the levels within each zone is shown in the following table:

Level	<u>ZONE</u>			
	Midden heap		Non-midden	
	Nos	Density per cu. m.	Nos	Density per cu. m.
I	61	305	67	223
II	129	258	94	116
III	30	100	80	88
Total	220	220	241	120

There are roughly the same number of artefacts in each zone, but they are more densely distributed in the

midden heap zone. The density of artefacts increases over time in both zones and they are most prolific in Level I of the non-midden zone.

2. Raw material

Four main types of stone occur here - quartzite, quartz, chert and hornblende schist. The first two are locally available in the Kombolgie sandstone, chert pebbles occur in stream beds, but the sources of schist are unknown.

The proportions of artefacts of different raw materials in each zone is shown below:

Zone	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	Schist	Total	
Midden	23.2	54.6	21.3	0.9	100.0	220
Non-midden	26.6	36.5	36.1	0.8	100.0	241
Total	25.4	45.1	28.6	0.9	100.0	461

Quartz is the predominant form of raw material. The proportions of different rocks in each zone are broadly similar, though there is slightly more quartz in the midden heap zone and more chert in the non-midden zone.

The high proportion of quartz in the midden heap zone reflects a group of 35 flakes in Level I of square L6. This may well have resulted from a single man knapping one block, and it emphasises the small number of flakes in the deposit as a whole, as opposed to the

far larger quantities in sites like Tyimede I and II. As a result, variations should be treated fairly broadly and this is especially relevant when interpreting trends in the distribution of waste flakes in various levels within the zones, as follows:

a. Midden heap zone:

Level	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	Schist	Total	
I	13.5	78.0	8.5	-	100.0	59
II	21.4	53.1	24.5	1.0	100.0	98
III	40.0	48.0	12.0	-	100.0	25
Total	21.4	60.5	17.6	0.5	100.0	182

b. Non-midden zone:

Level	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	Schist	Total	
I	33.3	45.0	21.7	-	100.0	60
II	26.8	39.1	32.9	1.2	100.0	82
III	17.2	37.4	45.4	-	100.0	64
Total	25.6	40.4	33.5	0.5	100.0	206

The standard deviation test, assuming a Poisson distribution, shows that the variations are not significant because the numbers concerned are so small. Archaeologically speaking, the variations are so liable

to reflect one man's activities that they are not necessarily reliable indicators of cultural change.

The ratio of implements to waste flakes is shown below:

Zone	Nos waste flakes per implement				
	Raw material				Total
	Quartzite	Quartz	Chert	Schist	
Midden	3	11	2	1	4.8
Non-midden	4.5	17	4	1	5.9
Total	4	13	3	1	5.3

The overall pattern of this analysis shows a very high ratio of implements to waste flakes. It contrasts markedly with the ratios of 1:20 and 1:32 in similar industries at Tyimede I and II. The high ratios at Padypadiy may reflect an unusually frugal or economic use of raw material, but no-one could fashion a schist axe and detach only one flake! Instead they probably indicate that stone tools were rarely, if ever, made on the spot.

This conclusion is strongly supported by the size of waste flakes in the deposit. Very few are smaller than $1/4 \times 1/4$ inch. (See Chapters VI and VII) suggesting that the secondary retouch on the implements was seldom if ever performed on the spot.

II. ANALYSIS OF ARTEFACTS:

(i) FLAKED STONE IMPLEMENTS

The implements are first described as a single group and their distribution is analysed later.

The following types of stone tool occur:

1. Points (Figure III-10, a-b)

There are five complete points. One is made of quartzite and four of chert. They range in length from 3.7 to 5.7 cm. and all have straight edges, (viewed dorso-ventrally and end-on), and curved butts. Four have lenticular cross-sections and one (N4/3-2), has a triangular cross-section. They are all bifacially retouched over a fairly extensive area. One, L5/3-15, shows marked signs of utilisation in the form of smoothing and use-polish on both sides.

2. Butts (Figure III-10, c-d)

There are five butts. Two are quartzite, two are quartz and one is chert. Their lengths range from 2.0 to 6.7 cm. and they all have lenticular cross-sections and straight edges. Four have curved butts, and the other, L4/3, is a quartz specimen made on a patently endstruck flake with a square butt.

All of these butts are bifacially retouched but none of them shows signs of utilisation.

3. Tip

There is one quartzite tip (M4/2). Its sides are straight when viewed end-on and convex when viewed dorso-ventrally. It is bifacially retouched with a lenticular cross-section and shows no signs of use-wear.

4. Shaft

There is one quartzite shaft (N5/3). It is unifacially retouched on both sides with scalar flaking and shows no signs of use-wear.

Conclusion

There are 12 complete and broken points. Only five of them are quartzite in contrast to the points from Tyimede I and II where quartzite points predominate. These implements may have been projectile tips but at least one of them shows clear signs of having served as a cutting or scraping tool.

5. Scrapers (Figure III-11, a-b)

There are 11 scrapers all of which are made of chert. Three are made on endstruck flakes, one on a sidestruck flake and the bulb of percussion is invisible on the others.

The scrapers are all somewhat rectangular in shape viewed dorso-ventrally and they range in length from 2.0 to 3.3 cm. They are all unifacially retouched along one or both sides with scalar and step flaking. Several of them show signs of utilisation, such as

chattering, unifacial use-wear and the detachment of small flakes on the inverse surface.

6. Broken scrapers

There are five broken scrapers: Four are made of chert and one of quartzite. Two are made on endstruck flakes which snapped off near the tip. They are all retouched along both sides on alternate edges. Unifacial use-wear and chattering are apparent along several edges.

Conclusion

These implements are very similar to the scrapers which are associated with bifacial points at Tyimede I and II as regards raw material, shape, size, retouch and use-wear.

7. Bifacial oval

There is one bifacially worked oval made of chert (N5/4).

8. Implements with bruised ends

There are six of these implements of which one is quartzite and the rest are quartz. They range from 2.8 to 3.4 cm. in length and are generally somewhat rectangular in shape when viewed dorso-ventrally. Their chief feature is a marked bruising at one or both ends, which is associated with bifacial retouch in four specimens and with unifacial step flaking in one implement.

9. Cores/Core scrapers

There are three quartz chunks ranging in length from 2.0 to 4.6 cm. One is part of a large crystal and they have all yielded fairly sizeable flakes. One specimen is bruised along one edge, suggesting that it might have served as a hammer too.

10. Utilised flakes (Figure III-11, c, e)

There are 12 utilised flakes, of which eight are quartzite, one is quartz and three are chert. They range in length from 2.6 to 3.6 cm. and most of them are somewhat oval in shape, when viewed dorso-ventrally. Six are endstruck flakes, four are sidestruck flakes and the bulb is invisible on the other two.

The type of use-wear varies considerably. Three flakes (two quartzite, one chert), have unifacial use-wear along one thin edge. Three (two quartzite, one quartz), have bifacial use-wear along an edge, and the other six flakes (four quartzite, two chert), have use-polish along the edge. This gloss overlies small flake scars in several cases, and is of varying intensity on different flakes. On four flakes the use-polish is bright on one surface and dull on the other.

Semenov describes flint tools with a high gloss on both surfaces of the edge. He suggests that they were used to work pliable skin with a two way movement (right to left and then left to right).¹ The gloss on the Padypadiy flakes may have been acquired scraping

¹ Semenov, S.A. 1964 pp.83-5.

skin¹ or even soft wood but the different intensity of polish on the surfaces suggests that the scraping was sometimes done with a one way movement.

One flake, L6/1, (Figure III-11 , c) is unusual in that there are traces of mastic on both surfaces opposite the utilised edge. This has been noted on utilised flakes from Oenpelli before,² and such tools may have been hafted in the same way as the specimen found on Arguluk Hill in 1948.³ I have not termed these tools 'elouera' however, because they have no secondary retouch and do not conform to the definition of such tools.⁴

11. Broken utilised flakes

There are seven broken flakes which have obviously been used. Three are quartzite, one is quartz and three are chert. One has unifacial use-wear along the edge, three show bifacial utilisation and one has small flakes snapped off at right angles to the edge. The remaining two flakes have use-polish along one edge, which is glossy and bright on one surface of the edge and dull on the other.

12. Miscellaneous

There are two pieces. The first O3/2 (Figure III-11, d) is a quartzite flake 2.8 x 2.0 cm. It is oval in

¹ McBryde, I. 1966 Ph.D. Thesis, New England, p.318.

² McCarthy, F.D., and Setzler, F.M. 1960 p.270, p.280.

³ Setzler, F.M., and McCarthy, F.D. 1950, pp.1-5.

⁴ See discussion on 'elouera', Chapter V, pp.

shape and one edge is bifacially retouched by the removal of alternate flakes. This edge is also heavily bruised and smoothed as though it was used to cut or scrape fairly hard material.

The other implement (03/3) is a quartzite flake with steep step flaking along one edge and smoothing use-wear along another.

13. Axes (Figure III-12, b-c)

There are two hornblende schist edge-ground axes. The first, N5/4-4, is 7.3 x 6.6 x 2.7 cm. It is 'U'-shaped in plan and slightly domed in cross-section. It was apparently bifacially flaked and then extensively ground on both surfaces to form a cutting edge at one end. The second, L4/4-4, is 8.8 x 6.7 x 2.4 cm. It is oval in plan and lenticular in cross-section. It was bifacially flaked around the perimeter and then ground on both surfaces towards the cutting edge.

14. Retouched fragments

a. Unifacially retouched fragments

There are eight fragments : two are quartzite, two are quartz and four are chert. They all show signs of step flaking and scalar retouch and are broken in at least one place.

b. Bifacially retouched fragments

There are four fragments : one quartzite, one quartz and two chert. They all show signs of bifacial flaking and are broken in at least one place.

Distribution

The number and density of stone tools in this deposit is very low compared to that found in stone working sites like Tyimede I and II. As a result the distribution of implements is tabulated according to the number of pieces present, rather than the percentage of implements in each level.

Implements		MIDDEN ZONE				NON-MIDDEN ZONE				Total Nos	Total %
		Level				Level					
		I	II	III	Total	I	II	III	Total		
1.	Points	-	2	-	2	-	-	3	3	5	6.9
2.	Butts	-	4	1	5	-	-	-	-	5	6.9
3.	Tip	-	1	-	1	-	-	-	-	1	1.4
4.	Shaft	-	-	-	-	-	1	-	1	1	1.4
5.	Scrapers	-	7	-	7	1	2	1	4	11	15.0
6.	Br. scrapers	-	2	2	4	-	1	-	1	5	6.9
7.	Oval	-	-	-	-	-	-	1	1	1	1.4
8.	Bruised ends	-	2	-	2	2	-	2	4	6	8.2
9.	Cores/ scrapers	-	1	1	2	-	-	1	1	3	4.1
10.	Util. fl.	1	5	-	6	2	2	2	6	12	16.4
11.	Br. util.fl.	1	1	1	3	1	2	1	4	7	9.6
12.	Misc.	-	-	-	-	-	1	1	2	2	2.7
13.	Axes	-	-	1	1	-	-	1	1	2	2.7
14a.	Unif. retouch	-	3	-	3	1	2	2	5	8	10.9
b.	Bif. retouch	-	2	-	2	-	1	1	2	4	5.5
Total		2	30	6	38	7	12	16	35	73	100.0

Points (including butts, tip and shaft), scrapers and utilised flakes are the main types of stone implements in the deposit. At least one point apparently served as a knife or scraper and the gloss on several utilised flakes suggests that some pliable material was worked at Padypadiy.

Points tend to occur in the lower levels of both zones, mainly in Levels II and III of the midden heap zone and Level III of the non-midden zone. Unfortunately the numbers concerned are very small, and although the distribution may echo the sequence suggested by the analysis of shells and European material, it could equally well be attributed to chance.

The collection closely resembles the point-scraper industry found at Malangangerr, Nawamoyn and Tyimede, except that the tools were apparently made in the Tyimede shelters, whereas most, if not all, of the Padypadiy implements were clearly manufactured elsewhere. Spencer¹ notes that the Kakadu of Oenpelli never made stone tools and the evidence from Padypadiy supports this observation and suggests that at this site at least, it was a fairly long standing tradition.

(ii) OTHER STONE ARTEFACTS

1. Abraded fragments

These are two small chert pieces (03/1, 04/1) which are about 2.5 cm. long and were ground along the side. Both come from Level I of the non-midden zone.

¹ Spencer, W.B. 1928 p.844.

2. Ochre

There are 425 lumps of ochre in the deposit. The pieces are coloured red, white, yellow, orange and purple. The distribution of ochre is shown according to the number of lumps present as well as the weight of material in grams:

a. Number of ochre pieces:

Level	ZONE			
	Midden heap		Non-midden	
	Nos	Density per cu.m.	Nos	Density per cu.m.
I	67	385	30	100
II	94	188	86	107
III	71	233	77	86
Total	232	232	193	97

b. Weight of ochre:

Level	ZONE			
	Midden heap		Non-midden	
	Gm.	Density per cu.m.	Gm.	Density per cu.m.
I	344	1720	150	500
II	575	1150	464	580
III	277	923	849	943
Total	1196	1196	1463	732

There is almost twice as much ochre in the midden heap zone as opposed to the non-midden. The number of pieces remains fairly constant in the different levels, but the weight of ochre increases towards the top of the

midden heap zone, whereas it decreases towards the top of the other zone.

3. Hammers/Pounders (Figure III-12, a)

There are two hammers. The first, K6/1, is a quartzite pebble weighing 262 grams, which has been used at both ends. It comes from the top level of the midden heap zone. The second (N5/4) is a quartz pebble weighing 270 grams, which has also been used at both ends. One surface is covered with a reddish gloss and was probably used to grind ochre. It comes from the bottom level of the non-midden zone.

IMPLEMENTS - Conclusion

The inhabitants of Padypadiy used tools made from a wide range of raw materials including bone, shell, wood and stone. It seems that stone tools were seldom if ever manufactured in the shelter. As a result there are very few sharp primary flakes in the deposit and sharp pieces of clam shell apparently took their place.

The most marked variation in the distribution of artefacts over time is the preponderance of shell and wooden implements in the upper levels. This I have ascribed to physical rather than cultural factors. There is also some change in the frequency of different types of bone tools over time and a slight hint that stone points were used mostly during the earlier occupation. Unfortunately, the numbers concerned are too small to indicate any definite pattern.

C. ROCK PAINTINGS

Paintings occur in three main areas. The first is on the rock wall and overhang just east of the main entrance, the second on the ceiling above the main entrance and the third is on the ceiling above the end of the talus slope.

The designs are painted in white, red, yellow and black and many are faded and superimposed on one another. Thirty separate designs are recorded below with the identifications given by our Aboriginal informant, Frank Gananggu.

I. Wall and roof east of entrance (Plates III-8, 9)

1. Mimis¹

Four anthropomorphic figures were termed 'mimi' by our informant.

a. A faded red figure about 30 cm. long.

b. A small faded red stick figure 10 x 8 cm. which seems to be running. The feet are drawn as solid features with four toes each. Two fine red lines are drawn across the waist, which were said to be spears being thrown at the fleeing figure (Plate III-8).

c. A faded red 'wishbone' design (20 x 22 cm) said to be the legs of a running mimi.

d. A large red and yellow figure, 130 x 80 cm. (Plate III-9). This is drawn in the X-ray style, showing red bones in yellow flesh. The limbs are disconnected,

¹ Mountford, C.P. 1956 p.112.

there is no torso, and there are barbs on the knees and thighs. Nearby is a rod with a barb through one end and a long curved line.

Our informant interpreted this as a magical drawing of a man who had committed a sexual offence. His limbs are drawn in this disjointed way to show that they will fall apart, and his penis is shown as a disconnected rod with a barb through one end. The wavy line may be an indication of how long it will be before the magic works, or it may show the path of 'Namiroto' the lightning god, to the heart.

2. Fish

There is a tail of a red and yellow fish (22 x 26 cm.) which was not identified.

II. Roof above main entrance (Plate III-10)

1. Mimis

There is one solid red figure lying on its back with its legs in the air. There is a barb in one elbow. It is termed 'morool', a wandering mimi, and is overlaid by the large red crocodile described below.

2. Reptiles

There are two distinct drawings:

a. A large faded red crocodile 3.3 m. long extends over the entire length of this panel. It is drawn in heavy outline with thick cross strokes. It overlies all the designs in the area it occupies (II-3b, 3d).

b. A red goanna (70 x 25 cm) is drawn in thick outline with a solid head.

3. Fish

There are five fish - a barramundi, three mullets and a barracuda.

a. An X-ray drawing of a barramundi 108 x 55 cm. in red and cream.

b. Two mullets (72 x 26 cm. and 72 x 21 cm.) drawn in thick white outline filled in with thick white lines. Both of these are overlaid by the large red crocodile (II-2a).

c. An X-ray mullet (68 x 25 cm.) in red and white with a disjointed head.

d. An X-ray barracuda (72 x 25 cm.) in red and white with a disjointed head. It lies under the red crocodile (II-2a).

4. Bag

A faint design of cross-hatched lines was identified tentatively as 'muraian' dilly bag.¹

III. Roof above talus entrance

1. Mimis

There is a faded red female mimi (66 x 12 cm).

¹ Spencer, B. 1914 p.20; p.150.

2. Reptiles

There is a goanna (90 x 30 cm.) outlined in a heavy white line with white bands at the head, neck and tail. It is overlaid by an X-ray painting of a goose (III-4b).

3. Fish

There are ten drawings of fish.

a. A dark red fresh water barracuda (45 x 14 cm.) drawn solid with a heavy outline.

b. A rifle fish (27 x 12 cm.) drawn in red.

c. An X-ray barramundi (111 x 48 cm.) drawn in yellow and red. This overlies the nailfish (III-3d).

d. A nailfish (60 x 20 cm.) drawn as an x-ray design in red and yellow.

e. Two more nailfish overlies each other. The top one (34 x 12 cm.) has a red outline with black lines down the length of the design. The lower fish (20 x 12 cm.) is drawn as an X-ray design in red and cream.

f. A catfish (43 x 13 cm.) drawn in solid black with a heavier outline.

g. An X-ray design of a mullet (50 x 24 cm.) drawn in red and white. The head is disjointed.

h. Two bonefish are superimposed on one another. The first is a red and white X-ray drawing (50 x 11 cm.) and overlies a smaller design of a fish (28 x 8 cm.) drawn in white outline.

4. Birds

There are three drawings of birds;

a. A yellow goose (54 x 21 cm.) is drawn as a solid figure over a faded X-ray drawing of a fish.

b. An X-ray drawing of a goose (75 x 25 cm.). It is drawn with a red outline and red and white cross hatching inside. It overlies the white goanna (III-2).

c. A faded red drawing of a jungle fowl (60 x 17 cm.). It is drawn as a red outline filled in with long vertical lines.

5. Plants

There is a faded red and yellow straggling line, identified as a wild potato with a long vine which is best eaten dry.

ROCK PAINTINGS - Conclusion

These paintings cannot be directly related to the archaeological material, although pigments such as ochre and charcoal occur throughout the deposit. Many of the intricate designs must have taken some time to complete, and it is reasonable to assume that the artists sat in the shelter and probably left some debris behind.

The designs can be interpreted in several ways. They portray things that were significant in the everyday life of the Aboriginal artist, such as animals, plants, spears and bags. Our informant called many of the animals that were painted 'good tucker', and all of them

occur in the immediate area today and were eaten by Aboriginal hunters. The X-ray designs show a close familiarity with the animals whilst the dislocated heads of many of the fish may show what they looked like before they were cooked.

Fish (seven varieties), reptiles (two varieties) and birds (two varieties) are found in the paintings but there are no pictures of marsupials, which formed a large part of traditional diet. This may be due to chance, but on the other hand the designs at Padypadiy may reflect a coastal plain economy more than a hilly escarpment one.

On the non-material side of life, the practise of magic is implied by the disjointed figure. This practice has been observed in the Oenpelli area before,¹ so that it is very likely that the story given by our informants is correct. The actual design is unusual in this area as the limbs are drawn in the X-ray style, which is rare in human figures.

The belief in spirit beings is also shown in the red mimi figures which were said to be drawn by spirit figures: again this is in accord with previous evidence.

Stylistically speaking, the Padypadiy paintings do not conform entirely to Mountford's classification. Mountford² divided the art of the Oenpelli area into two groups: the polychromatic, static, X-ray series of animals, and a monochromatic, single line group of

¹ Elkin, A.P., and Berndt, R.M. and C.H. 1950 pp.80-1. Mountford, C.P. 1956 p.183, p.264.

² Mountford, C.P. 1956 pp.256-64.

dynamic mimi figures. Both of these are represented at Padypadiy but some designs there fall into neither category. They include pictures of animals with heavy outlines that are either completely filled in or else filled in with longitudinal lines.

Mountford describes pictures like this, but never acknowledges that they are as much of a stylistic group as the other two he describes. Furthermore, he claims that the X-ray art is younger than the mimi art and was in fact the most recent style practised in the area. At Padypadiy no X-ray and mimi drawings overlap so no comment can be made, and the solid or heavy outline drawings seem to be contemporary with the X-ray drawings.

GENERAL CONCLUSION

Aborigines visited Padyadiy for at least 3000 years. They camped there sporadically over the years until and after European influences were felt in the area. There is some evidence of an occupational break in more recent times. They left behind evidence of what they ate, how they treated their dead and what types of tools they used.

Analysis has revealed a marked variation in the preservation of this evidence in different parts of the site and this is especially evident in the distribution of fish remains. As a result, it is difficult to assess to what extent variations reflect differential weathering, and to what extent they reflect changes in human behaviour.

The main variations that have been observed are:

1. Shells: The earliest occupants deposited mainly mangrove-mudflat species in a discrete heap. Later, relatively more fresh water species were deposited.
2. Fish: There are marked fewer fish remains in the lowest levels of both zones. This may not be due entirely to differential weathering: it may imply that less fish were actually deposited or eaten in the shelter at that time.
3. Implements: There are very few implements in this deposit and as a result many suggested trends are statistically unreliable. The only real change occurs in the distribution of bone tools and this is based on

the sequence suggested by the shell analysis. It seems that spatulated points predominated during the earlier stages and bipoints and unipoints during the later occupation.

The analysis has revealed many aspects of the economy and material culture of the inhabitants, and this is similar in many respects to that of the Kakadu people of this area.¹ If one makes allowance for a certain degree of weathering then it seems that despite change in the types of shells eaten and the tools used, the economy reflected at Padypadiy remained essentially similar during the entire period of occupation. The inhabitants ate the same type of food, buried their dead in a similar way and never made stone tools at the site, though probably made bone and shell and wooden tools, and used stone implements.

I feel that we are justified in making this allowance, and this is why it appears that the Kakadu people - or people with similar behaviour patterns - occupied Padypadiy for some 3000 years. This assumption will be shown to be more significant in Chapter VIII, when an attempt is made to interpret the evidence in ethnographic terms.

¹ Spencer, W.B. 1914; 1928.

CHAPTER IV

EXCAVATIONS AT PLAIN SITES II : MALANGANGERR

INTRODUCTION

Malangangerr is the Aboriginal (Edey) name of a rock shelter on the East Alligator River ($12^{\circ}27'$ S.Lat., $132^{\circ}57'$ E.Long). We first visited it in August 1964 during a survey with Frank Gangangu, who said it was formerly a camping place of the Edey people who lived and hunted in that area (Figure I-2).

The shelter is a south facing recess in a block of massive, sub-horizontally bedded quartzite and quartz sandstone. The block, 9-10 m. high, covers an area of about 3,000 sq. m. and is a residual of the main Kombolgie sandstone escarpment (Plate IV-1). The recess, which at its maximum is 31 m. long and 10 m. deep, occurs where the bedding planes are finer, being only 15-20 cm. wide as opposed to the more massive 1.5-2.0 m. thick beds in the rest of the block. The floor of the shelter slopes downwards towards the plain, suggesting the accumulation of material inside. A massive block of sandstone has been detached from the roof and lies in the recess where it has weathered even further (Figures IV-1, IV-2; Plate IV-2).

The shelter is fully exposed on the south side and partly exposed on the east and west ends. A narrow fringe of fairly tall trees growing along the outer edge of the recess helps to shade it from the sun and

rain, though very little sunlight enters the shelter during the winter months. The overhanging rock protects most of the recess from the rain, and the dripline is visible on the margins where rounded pebbles line shallow rills. The nearest source of permanent water is a billabong 1/4 mile east of the shelter and the East Alligator River which is about 1/2 mile away. There are several signs of human occupation in the shelter today, such as rock paintings on the wall and smooth hollows in the loose lying blocks on the floor. A few abraded stone artefacts occur on the surface along the dripline.

Evidence of weathering in the shelter suggests how it was probably formed. Stains on the rock wall indicate the downward percolation of iron-stained solutions which infiltrated the bedding planes, decaying and detaching large blocks. This process is also seen in the flat roof and the detached blocks lying beneath. Other weathering is evidenced by exfoliated fragments of rock and heaps of weathered sand lying on the shelter floor. Wind etching probably also helped to enlarge the shelter. All of these processes are active today and can be seen at other parts of this block, especially on the north side where the rock has been undercut to form a low recess (Plate IV-13).

METHOD OF EXCAVATION

Malangangerr was the first site excavated in the research programme, and it was dug in 1964 and 1965. In the interval, the aims of the research changed so that the method of excavation varied accordingly (see Chapter

I). In 1964, our main aim was to establish a cultural sequence based on large collections of artefacts, whereas in 1965, sites such as Malangangerr were carefully excavated to study the ecological evidence. Finally, the carbon dates obtained for samples collected in 1964 were unexpectedly old and in order to check these dates, every effort was made to collect many large carbon samples in 1965.

Malangangerr was excavated for one month in 1964, from 24 September until 23 October. This was done by one archaeologist (C.W.) and two or three Aboriginal helpers, so that only one literate person was available to do all the excavation and recording. The deposit was excavated with a trowel and brush in units of one sq. m. A series of levels were removed, conforming as closely as possible to the observed stratigraphy and the positions of all recognised artefacts were recorded. The material was sieved by the Aboriginal helpers using a large 1/4 inch mesh metal sieve mounted on a cradle. There were very few implements in the deposit, and it was clear that a large volume of material would have to be removed to obtain a representative sample.

With only a limited field season available, detailed sorting of this deposit would have been a very lengthy job. As a result, all the stone was retained to be divided later into artefacts and waste. Behind the dripline where the midden was loosely compacted, all identifiable fragments of bone (jaws, carapace and epiphyses) and bone tools were retained. In front of the dripline, where the midden was harder and partly concreted, it was difficult to distinguish

the bone, and only large fragments were retained. I did not check the sorting of bone as carefully as I did in 1965, and the resultant analysis of the animal bones provides only a very general picture of the fauna in the site. Finally, two column samples were taken from the midden.

In 1965 the excavations were done by two archaeologists (C.W. and J.P.W.) and two Aboriginal helpers. One archaeologist excavated the deposit with a paintscraper and a brush, and the other sorted the material in the sieves. Small 1/4 inch mesh plastic sieves were used instead of the large metal one. All the bone and artefacts were retained and two more column samples were taken from the midden. Special care was taken to remove large samples of carbon from the basal sand, using a fine 1 mm. mesh wire screen which retained many small lumps of charcoal.

The extent of the excavation is shown in Figure IV-1. It covered an area of 29 sq. m. and represents about 1/4 of the available area within the shelter.

STRATIGRAPHY¹

The deposit at Malangangerr consists basically of unstratified coarse sand overlain by a stratified deposit of shell, bone, ash etc., which is termed 'midden'. A transitional zone has been defined as an expression of the changeover from sand to midden. Besides this vertical variation there is a marked difference between

¹ I am indebted to Mr J.N. Jennings and Mr M.A.J. Williams Geography Dept., Research School of Pacific Studies, A.N.U., for their kind help in drafting this section.

the deposit outside and inside the dripline. The outermost deposit has a maximum of 120 cm. of sand overlain by about 60 cm. of midden. The deposit is disturbed by roots and the midden has been weathered by exposure to rain. The inner deposit has a maximum of 80 cm. of sand lying between many large broken rocks, which is overlain by a maximum of 100 cm. of well stratified, well preserved midden (Figures IV-3 to 5; Plates IV-3 to 8).

The main features of the sands, transitional zone and midden are described below.

1.) Sands

The sands are characterised by an immature soil profile in which there is no clay shift, no illuvial B horizon and no evidence of pedogenetic development other than a slight darkening at the surface. This darkening could be attributed to the nature of the parent rock, incipient profile development or to the accumulation of humus. The sands are firmer at the base than the top and the colour varies from greyish brown (10 YR 5/2) at the base, to very dark brown (10 YR 2/2) at the top where the transitional zone occurs. The pH taken in August 1965 at the site was 6 - 6.5 throughout the profile.

Considering the general environment it is likely that the sands were derived from the abundant source of Kombolgie sandstone. Variations in colour and texture could well be attributed to variations in the parent rock, but since the original horizon has probably weathered away, there is no way to pinpoint the exact

origin of the sands. They were probably transported to the site by wind, water and human agencies. Wind action is evident in features like the dome of sand seen on the west wall of squares 4E-G (Figure IV-5), and eddies of wind probably carried sand into the recess. Lack of sorting suggests that the sands were not laid down by streams; they were probably washed in by flash-floods. Water action is evident in the sub-vertical alignment of the basal mottling which suggests dripping water.

The only organic material in the sands is charcoal, which occurs throughout as discrete lumps and in finely divided form. No hearths or marked concentrations of charcoal occur and the general poverty of organic remains can be largely attributed to weathering by water (vertical illuviation, seasonal fluctuations in water table and pH etc.), wind and human activity.

The sands are divided into two levels for analysis. They are termed Levels IIIa and b and are of approximately equal depth. Unfortunately, this distinction can only be made in 12 out of 29 squares, all of which lie outside the dripline and contain a large body of sand with few rocks (sqs OC, 8-2B, OB, 5-2A). The light brown sand lay in narrow crevices between large rocks in the rest of the excavation, and all this deposit is treated as one unit termed Level III.

The sands are dated as follows:

Date	Level	Square/Spit	Depth B.S. in cm.	Years B.P.
ANU-19	IIIa	0C/12	104-114	18,000 $\pm$ 400
GaK-629	IIIb	5B/6	138	22,700 $\pm$ 700
GaK-628	IIIb	2A/8	150-154	19,600 $\pm$ 550
ANU-77a ¹	IIIb	0C/15	134-144	24,800 $\pm$ 1600
ANU-77b	IIIb	0C/15	134-144	22,900 $\pm$ 1000

ANU-19 lay approximately 60 cm. below the base of the midden in that square, and the positions of GaK-629 and 628 are shown in Figure IV-4. The three samples from Level IIIb were taken from squares about 3-4 m. apart with varying surface elevations. As a result the depth of the sample does not necessarily reflect its relative age. All the dates are internally consistent and the dates for Level IIIb are in fairly close agreement when they are calculated to two standard deviations.²

¹ The two samples of ANU-77 represent the NaOH soluble fraction (a) and the insoluble fraction (b) respectively. The laboratory report states that:

Since there is no significant difference (between the two dates), you may conclude that no intrusive carbon (young or old) is present in your site. The 77b is the better of the two dates and your interpretation should be based upon 22,900 $\pm$ 1000.

² Polach, H.A., and Golson, J. 1966 pp.15-23.

2) Transitional Zone

This zone is defined to express the changeover from sand to midden. It represents the earliest accumulation of the midden on the upper surface of the sands and is the very dark brown (10 YR 2/2) sands which contain chalky shells, bone and charcoal. Finds made here may have come from the sands or the midden and are therefore treated separately as Level II.

3) Midden

This is a deposit of gritty sandy silty loam with a heavy shell and bone additive. The colour of the midden varies according to the contents of different lenses but is generally dark grey (10 YR 4/1) to dark greyish brown (10 YR 4/2). Largely because of the heavy shell additive it is highly alkaline, with a pH of 9 at the top and 8.5 at the bottom.

The midden probably accumulated faster than the underlying sand since shell and bone comprise a good deal of its actual bulk. This rapid build-up probably helped to preserve finer elements by protecting them from direct weathering.

In the more sheltered part of the site the clearly stratified midden deposit is deeper than 1 m. in places. Concentrations of bone, crab remains, shells, ash, charcoal and paper bark appear as interdigitating lenses, which seldom cover more than a square metre and apparently represent small heaps of food debris, hearths and sleeping mats. Two disturbances were noted: the first is a small oblique

burrow shown on the north wall of sq. 7D, (Figure IV-3; Plate IV-4) the other is a large pit visible on the east and north walls of sq. 4G.

No fine stratigraphic features are found in the more exposed parts of the midden (sqs. A2-5, B0-8, C0-1). The deposit is 80 cm. at its deepest and contains shells and bone in a dark grey (10 YR 4/1) matrix. This deposit has apparently been weathered by the vertical illuviation of slightly acid solutions trickling down the rock overhang and through dead leaves on the surface. As a result, localised aggregations are found; the shells are chalky and both shells and bones are covered with crystalline encrustations.

The midden is divided into an upper and lower level for analysis (Ia and Ib). This division was suggested by the analyses of material in the column samples and was made fairly arbitrarily by dividing the midden in each square into an upper and lower level of approximately equal volume. This has been done in all but four squares, where the midden was removed as a single unit, (sqs 1C, 3B, 1B), or where a large pit disturbed the deposit (sq. 4G). This material is listed as Level I.

Four column samples were taken to define and analyse the contents of the midden. They are numbered one to four and their positions are as follows:

Sample	Position	Depth in cm.
1	N. wall sqs 9E, 8E.	100
2	E. wall sq. 8E.	90
3	W. wall sq. 4G	70
4	E. wall sq. 2D	45

The first three samples come from protected parts of the site and the fourth comes from the more exposed area near the dripline. Each sample covers 30 cm. square and extends in depth from the surface of the midden to the bottom of the transitional zone. Samples 2, 3 and 4 were removed in units 5 cm. deep (labelled 1-10) but sample 1 was removed in units of unequal depth, which correspond more closely to the observed stratigraphy there. For several reasons (see Chapter II) the samples were screened through a 1/4 inch mesh sieve in the field and only the retained fraction has been analysed.

The samples were divided into their different components of shell, bone, crab remains, charcoal, plant remains (fragments of bark, roots) stone artefacts and waste stone (exfoliated fragments, rubble, pebbles). Each group was weighed to express its density and the proportion of different components was then compared.

These results are shown in Tables IV-1 and IV-2. Table IV-1 shows the relative proportion of components in each unit of each sample, and Table IV-2 shows the proportion of different components in each level and

the relative density¹ of these components over time.

Both analyses show the following features:

(i) The density of components in the midden rises steadily over time in all four samples. The actual density varies between samples and this stresses the complex makeup of a midden such as this.

(ii) Shell and waste stone are the main components in all four samples. In samples 2 and 3 the proportion of shell increases over time whereas bone decreases. Charcoal and plant remains are more prolific in the upper level of all samples.²

I feel that these variations can be attributed largely to the differential weathering of various components over time. The low density of material in Level II supports the idea that this is a true transitional zone, where shells and bones were trodden into the surface of the sand..

¹ All column samples were taken over the same area of 30 x 30 cm. The relative density of the group is therefore simply

$$\frac{\text{total weight}}{\text{depth of level}}$$

² I consulted Professor W. Ewens, Dept., of Statistics, La Trobe University, Melbourne, about the reliability of these observations, and of all the later observations made in this chapter and in Chapter V, concerning changes within column samples. He assured me that it is unnecessary to subject the data to statistical tests, since 'commonsense answers here seem to be enough'. (in litt., 1966).

The midden is dated as follows:

Date	Level	Square/Spit	Depth B.S. in cm.	Years B.P.
GaK-626	Ia	6C/1	8-10	370 $\pm$ 80
GaK-627	Ib	6D/4	85-90	5980 $\pm$ 140

The two dates show that the midden accumulated over at least 6,000 years. The position of GaK-627 is shown in Figure IV-3. The sample dates charcoal from the base of the midden lying on a large slab of rock. There is a small ground hollow in the rock so that the date also provides a terminus ante quem for the making of the hollow. (Plate IV-6).

Conclusion

The deposit at Malangangerr consists of sand overlain by a stratified midden. The material accumulated over some 20,000 years. There is a marked disparity between the age of the base of the midden (GaK-627: 5980 $\pm$ 140 B.P.) and the upper level of the sands (ANU-19: 18,000 $\pm$ 400 B.P.). This may imply that Malangangerr was not occupied for some time, or on the other hand it may merely reflect the weathering of the upper level of the sand. It is very likely that most of the organic material was weathered out of the sand during this 'time gap' leaving the deposit that we find today.

The deposit is divided into five levels for analysis. The volume of deposit in each level was

calculated fairly roughly according to the drawn sections and is tabulated below:

Level	Volume (cu. m.)
Ia - Upper midden	8.5
Ib - Lower midden	7.0
I - General midden	1.8
TOTAL MIDDEN	17.3
II TRANSITIONAL ZONE	3.7
IIIa - Upper sand	4.1
IIIb - Lower sand	3.8
III - General sand	2.9
TOTAL SAND	10.8
TOTAL VOLUME	31.8

TABLE IV-1

Analysis of Components in 4 Column Samples

The tables show the proportion of each component in each unit and the level in which that unit occurs.

IV-1: Sample 1Components (Per cent)

Level	Unit	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)
Ia	1	73.8	1.0	0.1	9.5	1.2	0.5	13.9	826.9
	2	69.1	2.7	1.0	15.1	x	-	12.1	896.2
	3	41.1	1.6	3.0	2.8	x	-	51.5	487.1
	4	91.6	x	2.4	1.5	x	0.8	3.7	1487.8
	5	79.1	1.6	6.0	0.8	x	-	12.4	460.8
	6	77.5	1.8	3.7	1.8	x	-	15.2	211.7
Ib	7	93.1	0.9	0.4	0.2	x	-	5.4	1042.9
	8	84.0	1.6	0.8	0.3	x	x	13.3	439.0
	9	71.5	1.6	x	x	x	1.5	25.4	516.0
II	10	85.2	2.2	x	x	x	x	12.6	691.7
	11	12.1	34.0	-	0.6	-	-	53.3	168.3

x = present but in insignificant amounts.

IV-1: Sample 2

Components (Per cent)

Level	Unit	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)
Ia	1	44.4	1.2	1.0	7.4	6.8	-	39.2	311.4
	2	68.5	3.0	1.4	8.1	1.9	-	17.1	470.1
	3	49.5	2.5	4.3	6.8	x	-	37.0	104.5
	4	80.5	2.2	3.4	2.9	x	-	11.0	102.8
	5	85.3	0.6	1.2	2.2	x	-	10.7	698.0
	6	66.4	x	1.2	0.8	-	-	31.6	402.1
	7	87.6	x	1.6	0.5	x	2.4	7.9	203.8
	8	65.4	x	1.7	0.8	x	-	32.1	152.1
	9	71.3	1.3	1.0	1.2	x	-	25.2	202.9
	10	45.7	0.6	0.2	0.6	0.1	-	52.8	82.9
Ib	11	72.0	2.0	0.5	0.4	x	-	25.1	152.8
	12	68.6	3.5	0.2	0.5	x	-	27.2	185.7
	13	50.3	10.2	-	0.2	0.2	-	39.1	122.8
	14	14.4	-	-	-	0.5	-	85.1	20.1
	15	0.1	31.5	-	0.4	0.1	-	67.9	74.7
II	16	0.2	17.6	-	0.4	-	-	81.8	79.0
	17	-	8.5	-	0.2	0.2	-	91.1	40.0
	18	0.9	23.0	-	-	0.6	-	75.5	32.2

IV-1: Sample 3

Components (Per cent)

Level	Unit	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)
Ia	1	50.0	0.6	0.1	4.0	1.3	0.6	43.4	1364.1
	2	80.4	1.1	x	8.5	x	x	10.0	720.3
	3	85.3	2.0	0.2	5.9	x	-	6.6	837.5
	4	70.5	0.4	1.3	5.4	x	-	22.4	575.5
	5	87.4	1.1	1.9	7.6	-	-	2.0	565.3
	6	85.3	1.1	1.0	5.2	-	-	7.4	620.7
	7	83.5	0.9	2.0	4.4	-	-	9.1	611.6
Ib	8	73.3	1.0	4.3	3.6	x	-	17.8	527.8
	9	83.6	2.3	4.0	2.0	0.1	-	8.0	379.5
	10	73.7	5.6	2.2	2.5	0.2	-	15.8	152.1
	11	62.3	4.5	0.9	1.2	x	-	31.1	191.9
	12	31.6	9.0	0.3	1.5	x	-	57.5	158.3
	13	5.2	11.6	-	0.7	0.2	10.8	71.5	154.6
	14	2.6	19.5	-	0.3	1.0	-	76.6	59.7

IV-1: Sample 4

Components (Per cent)

Level	Unit	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)
Ia	1	65.5	3.8	x	1.8	1.8	-	28.1	387.4
	2	75.5	4.8	0.8	0.2	0.2	-	18.4	290.7
	3	84.0	2.8	4.2	x	x	0.2	8.5	442.0
	4	94.7	1.2	2.0	0.1	0.1	-	1.9	600.1
	5	94.1	1.1	1.2	-	-	-	3.8	374.3
Ib	6	94.9	0.8	0.5	-	-	-	3.8	355.9
	7	91.1	2.0	0.1	-	-	-	6.7	292.8
	8	72.9	7.5	-	-	-	-	19.5	176.8
II	9	16.5	9.0	-	-	-	-	73.9	37.5

TABLE IV-2

Analysis of Components in 4 Column Samples

The tables show the proportion of each component in the three main levels covered by the column samples.

IV-2: Level Ia - Upper Midden

Sample	Components (Per cent)								Density per cu. unit
	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)	
1	76.0	1.2	2.1	5.9	0.2	0.4	14.1	4158.6	92.4
2	71.4	1.2	1.5	3.9	1.3	0.2	20.5	2292.6	65.5
3	74.1	1.1	0.8	5.6	0.3	x	18.1	5235.0	149.1
4	84.5	2.4	1.7	0.4	0.3	-	10.7	2094.5	83.8

IV-2: Level Ib - Lower Midden

Sample	Components (Per cent)								Density per cu. unit
	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)	
1	84.5	1.5	0.6	0.3	x	0.3	12.8	2901.5	64.5
2	58.8	4.9	0.4	0.6	0.1	-	35.2	994.0	24.8
3	63.5	4.0	2.7	2.3	0.1	1.1	26.3	1562.2	52.1
4	88.8	2.6	0.3	-	0.1	-	8.2	825.5	55.0

IV-2: Level II - Transitional Zone

Sample	Components (Per cent)								Density per cu. unit
	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)	
1	12.1	34.0	-	0.6	-	-	53.3	168.3	28.0
2	0.3	16.5	-	0.2	0.1	-	82.9	151.2	10.1
3	2.6	19.5	-	0.3	1.0	-	76.6	59.7	11.9
4	16.5	9.0	-	-	-	-	73.9	37.5	7.5

A. ORGANIC REMAINS

1) Shell Analysis

Shells from four environments occur in this deposit - mangrove-mudflat species, fresh water shells, land snails and marine shells. The possible sources of these animals are listed in Chapter III. The following species occur:

1. Mangrove-mudflat species

- Potamididae : Cerithidea obtusa
 : Telescopium telescopium L.
 Ellobiidae : Cassidula angulifera Petit
 : Cassidula rugata Menke
 : Ellobium aurisjudae Linné
 Neritidae : Neritina (Dostia) crepidularia Lamarck
 : Nerita lineata
 Geloinidae : Geloina jukesi (Deshayes)

2. Fresh water species

- Hyriidae : Velesunio angasi (Sowerby)

3. Land species

- Camaenidae : Xanthomelon sphaeroideum Le Guillou
 : Arnemelassa creedi (Cox)

4. Marine species

- Trochidae : Trochus niloticus

Most of the shell species listed above occur in the column samples, except for Nerita lineata and Trochus niloticus which were noted in other parts of the excavation and constitute a very small percentage of the shells in the midden.

During the excavation small concentrations of certain species of shell were noted. I did not excavate the midden carefully enough to distinguish these heaps, but it is clear that this could be done, and discrete 'meals' might be isolated. Instead the relative density of different species is assessed according to the contents of the column samples.

The results are shown in Table IV-3 and IV-4. Table IV-3 shows the relative proportion of different species in each unit and Table IV-4 shows the proportion of different species in each level as well as the relative density of shell there. The following results occur:

- (i) The density of shell increases over time in all samples to reach a peak in Level Ia. The actual density varies in the different samples probably because heaps of refuse built up in different places at different times.
- (ii) Mangrove-mudflat shells predominate in all the samples. The most prolific species are Cerithidea obtusa, Telescopium telescopium and Geloina jukesii.

(iii) There is some change in the relative proportion of different species over time. Cerithidea obtusa, Neritina (Dostia) crepulularia and Velesunio angasi are more prolific in the upper part of the midden, whereas Telescopium telescopium, Cassidula and Geloina jukesi are more popular in the lower levels. These trends are more marked in some samples than in others and may be partly due to differential weathering of different shells over time. This might account for the absence of the fragile Velesunio in the lower levels and the predominance of the stout Geloina there. However the variations occur within six species and probably also reflect dietary preferences and the relative availability of different shellfish.¹

In short therefore, the analysis shows that the inhabitants of Malangangerr ate shellfish and deposited the remains here for some 6,000 years at least. Most of the shells were probably collected in the mudflats of the East Alligator River and a change is seen in the relative proportion of different species over time. Finally, the content of the upper level (Level Ia), at Malangangerr is somewhat similar to that found at Padypadiy in that Telescopium is fairly rare. This would agree with the sequence suggested by the carbon dates for both sites.

¹ An informant (Magdalene) remembered that the rich shell beds had moved in her lifetime (see Chapter II). Dr D.F. McMichael assures me that the proportions of species in a colony of shells varies considerably even over a short period.

TABLE IV-3

Analysis of Shell Species in 4 Column Samples

The tables show the proportion of each species in each unit, and the level in which the units occur. The numbers refer to the following species:

1. Cerithidea obtusa
2. Telescopium telescopium
3. Cassidula angulifera and Cassidula rugata
4. Geloina jukesi
5. Neritina (Dostia) crepidularia
6. Ellobium aurisjudae
7. Velesunio angasi
8. Xanthomelon sphaeroideum and Arnemelassa creedi
9. Unidentifiable

x - present but in insignificant amounts

IV-3: Sample 1

Level	Unit	Species (Per cent)									Weight (gm.)
		1	2	3	4	5	6	7	8	9	
Ia	1	58.0	-	0.5	26.7	12.6	1.5	0.1	0.5	0.1	609.0
	2	69.5	x	0.2	15.6	10.2	4.2	-	0.2	0.1	618.4
	3	86.8	0.5	0.5	7.9	0.9	2.9	-	0.5	x	202.4
	4	95.9	-	0.8	1.2	0.2	1.7	-	x	0.2	1364.7
	5	71.7	0.7	1.2	21.6	0.2	3.7	-	0.1	1.4	363.9
Ib	6	25.2	28.4	4.8	24.7	0.4	9.5	-	0.2	6.8	164.3
	7	7.6	68.7	3.0	11.1	0.1	9.4	-	0.1	-	969.0
	8	7.4	39.3	4.5	40.1	0.4	5.7	-	1.1	1.5	368.0
	9	1.6	21.2	3.5	69.7	x	1.4	-	1.1	1.5	367.0
II	10	x	46.1	13.1	38.2	-	2.2	-	0.4	x	588.8
	11	-	42.7	12.4	40.5	-	4.4	-	-	-	21.1

IV-3: Sample 2

Level	Unit	Species (Per cent)									Weight (gm.)
		1	2	3	4	5	6	7	8	9	
Ia	1	51.2	-	0.7	21.0	18.2	5.6	3.3	-	-	138.1
	2	39.7	0.5	0.3	50.7	5.3	3.2	0.1	0.2	-	321.5
	3	47.7	0.4	0.4	34.0	2.5	15.0	-	-	-	51.9
	4	33.0	0.6	4.4	49.4	-	12.6	-	-	-	82.6
	5	55.9	5.4	4.5	28.1	0.2	5.9	-	x	-	596.4
	6	55.8	4.1	11.4	21.4	x	7.3	-	-	-	266.0
	7	42.6	8.7	16.8	25.4	0.3	6.2	-	-	-	178.2
	8	19.0	5.3	13.4	50.6	-	11.7	-	-	-	99.2
	9	8.7	5.3	3.9	74.5	0.3	7.3	-	-	-	144.5
	10	4.8	8.2	1.5	82.7	0.5	2.3	-	-	-	37.9
Ib	11	0.6	13.6	5.2	78.2	0.8	1.6	-	-	-	110.2
	12	0.2	5.2	8.4	82.6	0.2	3.4	-	x	-	127.3
	13	-	0.8	0.8	98.4	-	-	-	-	-	61.6
	14	-	-	-	100.0	-	-	-	-	-	2.9
	15	-	-	-	100.0	-	-	-	-	-	0.1
II	16	-	-	-	100.0	-	-	-	-	-	0.2
	17	-	-	-	-	-	-	-	-	-	-
	18	-	-	-	100.0	-	-	-	-	-	0.3

IV-3: Sample 3

Level	Unit	Species (Per cent)									Weight (gm.)
		1	2	3	4	5	6	7	8	9	
Ia	1	19.4	-	0.2	69.0	-	4.2	7.2	x	-	681.9
	2	20.5	-	0.1	64.6	2.6	6.1	4.7	0.2	1.2	577.3
	3	13.8	1.4	x	77.9	0.3	5.5	1.0	0.1	-	713.0
	4	36.3	0.1	1.8	44.9	5.2	11.7	-	x	-	364.1
	5	35.0	0.3	3.4	53.9	0.2	6.3	-	-	0.9	494.1
	6	25.6	4.5	8.1	51.6	0.2	10.0	-	-	-	528.8
	7	33.0	13.0	8.1	21.9	0.4	23.6	-	-	-	511.9
	8	23.6	22.0	12.2	26.2	0.1	15.9	-	x	-	386.8
Ib	9	16.1	2.0	5.2	65.2	0.1	11.4	-	x	-	317.6
	10	17.0	4.2	8.0	62.0	0.4	8.4	-	-	-	112.9
	11	32.0	5.4	5.9	51.0	0.3	5.4	-	-	-	119.7
	12	30.9	7.2	4.6	48.7	1.2	7.4	-	-	-	49.9
	13	-	1.3	-	97.4	-	1.3	-	-	-	8.0
	14	12.5	-	-	81.3	-	6.2	-	-	-	1.6

IV-3: Sample 4

Level	Unit	Species (Per cent)									Weight (gm.)
		1	2	3	4	5	6	7	8	9	
Ia	1	14.0	x	1.2	73.4	3.2	7.9	0.2	0.1	-	253.6
	2	35.5	0.2	0.4	52.0	7.6	4.3	x	-	-	219.3
	3	49.4	0.2	1.7	34.6	4.9	9.2	-	-	-	370.7
	4	26.1	0.5	1.3	65.8	0.8	5.5	-	-	-	568.5
	5	14.1	2.3	3.4	71.7	0.9	7.6	-	-	-	351.1
	6	14.0	1.2	4.4	74.2	0.2	6.0	-	-	-	338.0
Ib	7	11.0	1.2	3.2	79.1	0.2	5.3	-	-	-	267.2
	8	9.6	4.6	3.0	78.2	0.2	4.4	-	-	-	128.8
II	9	-	-	1.5	98.5	-	-	-	-	-	6.2

TABLE IV-4

Analysis of Shell Species in 4 Column Samples

The tables show the proportions of different shell species in the three main levels covered by the column samples. The numbers refer to the same species as in Table IV-3.

IV-4: Level Ia - Upper Midden

Sample	Species (Per cent)									Weight (gm.)	Density per cu. unit
	1	2	3	4	5	6	7	8	9		
1	80.0	0.1	0.7	11.6	4.6	2.5	x	0.2	0.3	3158.4	70.2
2	49.4	3.7	5.6	31.9	2.8	6.3	0.3	x	-	1634.7	46.7
3	24.7	2.6	2.8	57.2	1.1	9.1	2.1	0.1	0.3	3871.4	110.6
4	28.0	0.7	1.6	59.6	2.9	6.9	0.2	0.1	-	1763.2	70.5

IV-4: Level Ib - Lower Midden

Sample	Species (Per cent)									Weight (gm.)	Density per cu. unit
	1	2	3	4	5	6	7	8	9		
1	5.9	49.3	5.8	31.6	0.1	5.9	-	0.5	0.9	2457.1	54.6
2	5.8	6.5	6.2	76.3	0.1	5.1	-	x	-	583.7	14.6
3	21.7	10.7	8.2	47.5	0.2	11.7	-	x	-	994.9	33.2
4	12.2	1.8	3.7	76.6	0.2	5.5	-	-	-	734.0	49.0

IV-4: Level II - Transitional zone

Sample	Species (Per cent)									Weight (gm.)	Density per cu. unit
	1	2	3	4	5	6	7	8	9		
1	-	42.7	12.4	40.5	-	4.4	-	-	-	21.1	3.5
2	-	-	-	100.0	-	-	-	-	-	0.5	0.03
3	12.5	-	-	81.3	-	6.2	-	-	-	1.6	0.3
4	-	-	1.5	98.5	-	-	-	-	-	6.2	1.2

2) Bone Analysis

Bone occurs in the midden and in the transitional zone below. The quantities vary between different parts of the deposit (see analysis of midden components) but this is to be expected in a complex midden of this sort.

The bone has been analysed to show the range of animals present rather than the number of individuals. The minimum number of mammals and humans present is calculated largely according to jaw counts.¹

1. Mammals

The following mammals were identified mainly according to mandibles:

Peramelidae	:	<u>Isoodon macrourus</u> (Gould)	Bandicoot
Phalangeridae	:	<u>Trichosurus vulpecula</u> (Kerr)	Possum
	:	<u>Petaurus breviceps</u>	Gliding possum
	:	<u>Petropseudes dahlii</u> (Collett)	
			Ringtail possum
Dasyuridae	:	<u>Antechinus bellus</u> (Thomas)	
			Fawn marsupial mouse.
Macropodidae	:	<u>Macropus antilopinus</u> (Gould)	
			Antilopine kangaroo
	:	<u>Wallabia agilis</u> (Gould)	Sandy wallaby
	:	<u>Petrogale penicillata</u> sub sp.	
			Rock wallaby
Pteropodidae	:	<u>Pteropus scapulatus</u> (Peters)	
			Flying fox
Muridae	:	<u>Mesembriomys gouldii</u> (Gray)	
			Rabbit rat

¹ Chapter II, p.26.

The range is similar to that found at Padyadiy except that S. harrisi is absent at Malangangerr and there is only one species of murid but several species of possums here. All these animals are locally available and were probably caught on the plain or in the rocky foothills of the escarpment.

The maximum number of mammals in each level of the deposit is as follows:

Species	Level				Total Nos
	Ia	Ib	I	II	
<u>Isoodon macrourus</u>	5	5	3	2	15
<u>Trichosurus vulpecula</u>	5	2	3	-	10
<u>Petaurus breviceps</u>	1	-	-	1	2
<u>Petropseudes dahlii</u>	2	-	-	-	2
<u>Antechinus bellus</u>	1	-	-	-	1
<u>Macropus antilopinus</u>	1	1	1	1	4
<u>Wallabia agilis</u>	3	2	1	2	8
<u>Petrogale penicillata</u>	3	2	2	1	8
<u>Pteropus scapulatus</u>	1	-	-	-	1
<u>Mesembriomys gouldii</u>	2	1	-	1	4
Total	24	13	10	8	55

The bandicoot is the most common animal, and the other species are also relatively well represented. Unfortunately the number of animals is very small so that no real changes can be observed.

2. Fish

Fish remains, including vertebrae, ribs and otoliths, occur throughout Levels I and II, but no specific identifications could be made.

3. Reptiles

Reptile remains include skull fragments, limb bones, carapace and plastron. The following species, all of which occur locally today, were identified according to jaw fragments;

Boidae	:	<u>Python</u> sp.	Python
Varanidae	:	<u>Varanus</u> sp.	Goanna
Agamidae	:	<u>Agamid</u> sp.	Agamid lizard
	:	<u>Chlamydosaurus kingi</u>	Dragon lizard

Freshwater tortoises were also clearly eaten at the site because numerous pieces of carapace and plastron occur throughout. No specific identifications could be made however, since no jaws were found.

The minimum number of animals present in each level was calculated according to jaw counts as follows;

Species	Level				Total
	Ia	Ib	I	II	
<u>Python</u> sp.	1	1	-	1	3
<u>Varanus</u> sp.	2	2	3	-	7
<u>Agamid</u> sp.	2	2	3	-	7
<u>Chlamydosaurus kingi</u>	1	-	-	-	1
Total	6	5	6	1	18

The figures must be treated very broadly, bearing in mind the fact that although freshwater tortoises were clearly present at the site, no jaws were recovered so that they do not feature in the counts at all.

4. Birds

Fragments of bird longbones occur throughout the deposit but could not be identified any further. Pieces of eggshell were also noted in the deposit, and these belong to two birds - Anseranas semipalmata (the magpie goose) and Dromaius novae-hollandia (emu).

5. Crabs

Crab claws occur throughout Levels I and II and marked concentrations were noted, some of which are reflected in the components of the column samples. The claws belong mainly to the small mudflat crab Sesarma sp. and a few large claws of the large mangrove crab Scylla serrata also occur.

6. Humans

Human bones occur throughout the midden and a few also came from the transitional zone. Most of the bone is broken and charred and was found interspersed with food debris. Occasional bones were found in articulation and several discrete heaps or concentrations of bones were noted.

The results of the analysis are shown in Table IV-5, where the bones are analysed in four main groups as follows:

a. Level Ia

These bones occur in the upper midden all over the excavated area. At least three individuals are represented here: two adults are represented by two lower left canines and one juvenile is represented by a fragmentary mandible from 7D/4 (see Appendix IV-1).

b. Level Ib(i) 8E/5:

This was a small heap of disarticulated bones lying in the lower midden (Plate IV-9). No pit or hollow was noted. They represent one child aged about 1-4 years.

(ii) 7D/6:

These bones were also found as a small disarticulated heap in the lower midden. Again, no pit was present and they represent another child aged about 1-4 years.

(iii) General:

These bones occur in the lower midden over a wide area. The remains include two articulated legs of one adult which were found in 4B/2. At least two adults are represented here since there are two right tibiae in the collection.

c. Level I

These bones were all found in the large pit in square 4G. None of the bones was in articulation and they had apparently been thrown or packed into the pit.

A decayed piece of paper bark lay under the skull and a few large rocks lay nearby.

The bones represent the remains of at least three adult individuals since there are 25 metacarpals and the talus bones of three adults. There is, however, only one skull which Mr A.G. Thorne identified as an adult female (Appendix IV-1).

d. Level II

Only a few fragments of human bone occur in this level. They were probably trodden in from the midden above, but they might represent another individual.

Conclusion

The remains of at least ten individuals occur according to a within-level count.

The conditions and circumstances of these remains strongly suggest that both primary and secondary burial were practised at Malangangerr. The remains in Level Ia suggest secondary deposition of certain parts of the skeleton, whereas the bones of the children in 8E/5 and 7D/6 and the articulated legs in 4B/2 reflect some form of primary burial. The contents of the pit in square 4G may reflect an initial primary burial which was disturbed when other remains were thrown in, or else all three individuals may have been interred together as a secondary burial.

Secondary burial was also found at Padyadiy and Nawamoyyn so that this evidence lends support to the antiquity of the practice in the area.

TABLE IV-5
ANALYSIS OF HUMAN BONE IN MALANGANGERR
(Number of Bones)

Bone	Level					II
	Ia	Ib			I	
		8E/5	7D/6	General	4G-Pit	
Teeth:						
Adult	13					
Juvenile	-					
Child	-					
Miscellaneous	1					
Mandible	1j		1	1	1	
Skull (complete)	-				1	
Skull fragments	24	8	1	4	-	
Scapula	-			-	1(L), 1(R)	
Humerus	-	1(R)	1(L)	-	1(L), 1(R)	
Radius	1(L)	-	1(R)	2	-	
Ulna	1	1(R)	1(R)	1	-	
Carpal	2			-	6	
Metacarpal	5			-	25	
Phalange	12			5	42	
Pelvis	-	1(L), 1(R)	1(L)	3	1(L)	
Femur	2	1(L)	1(R)	3	2(R), 1(?)	
Patella	-			-	2(L), 2(R)	
Tibia	1(R)	1(L), 1(R)		1(L), 2(R)	1(R)	
Fibula	1	1(R)		2	-	
Tarsal	2			10	15	
Metatarsal	4			9	8	
Phalange	6			2	6	
Metapodial	5			1	-	1
Vertebra	8	x	x	-	42	
Sternum	1			-	2	
Rib	15	x	x	6	284	3
Clavicle	-			-	1(L), 1(R)	
<u>Minimum nos :</u>						
Adult	2 [teeth]	-	-	2[tibiae]	3[metacarpals, tali]	?1
Juvenile/child	1 [mandible]	1	1	-	-	-
Total	3	1	1	2	3	?1

Key: x - present
j - juvenile

ORGANIC REMAINS - Conclusion

The inhabitants of Malangangerr ate shellfish and hunted a variety of wild animals for some 6,000 years at least. Although I cannot calculate the exact number of animals the analysis shows that a wide range of aquatic and land fauna were exploited.

The dietary remains are basically very similar to those found at Padypadiy with a few exceptions. One notable feature is that there is a change in the relative proportions of shells at Malangangerr over time and moreover proportions found in the upper midden at Malangangerr (Level Ia) are somewhat similar to those found at Padypadiy. This agrees with the sequence suggested by the carbon dates at both sites.

B. IMPLEMENTS

There are bone, shell and stone implements in the deposit.

1) Bone Implements

There are 58 bone implements in the midden which are grouped as follows:

1. Bipoints (Figure IV-6, a-b)

There are five bipoints and although only one is intact, they all show the characteristic mid-shaft bulge. They are all made of mammal bone, two on an intact shaft and three on splinters of shaft. They range in length from 2.6 to 3.4 cm. and were apparently ground and polished into shape.

2. Unipoints (Figure IV-6, c-f)

There are nine unipoints, all of which are broken at the end opposite the tip. One (4G/3) has scars at one end, where it was cut and snapped off. Four are made on the shaft of a mammal longbone, four on the shaft of a bird's limb bone and one on a fish bone. They range in length from 1.6 to 5.7 cm. and were cut, ground and polished into shape. The tip is formed by the intersection of tiny ground surfaces in four cases, by a single long bevel in four bird-bone points and by a round blunt end in the ninth.

Most of these implements are at least as long as the bipoints and only the shortest could be part of a broken bipoint.

3. Sections

There are eight of these: seven are the shaft of a mammal longbone and the other is a fish bone. All of them have a high gloss and four have been ground.

4. Spatulated points (Figure IV-6, g-k)

There are 28 of these points and all are broken. The tip is intact in eight points and the articular end of the fibula is intact in six cases. Two points are covered with a heavy encrustation so that the full extent of their worked surfaces cannot be seen.

All these tools were ground and polished into shape. In three specimens the tip snapped off and the scar is overlain with a high gloss suggesting that the tool continued to be used after it was broken. Three fragments of the shaft have marked signs of use-wear along the edge.

5. Utilised flakes

There are three flakes of mammal bone with a localised high gloss along the sides and end, suggesting that they have been used.

6. Tubes

There is one broken shaft of a bird longbone, which was ground flat at one end.

7. Utilised teeth (Figure IV-6, l-m)

These are two first incisors of a wallaby (Wallabia agilis) with signs of use. The first, 4F/7 (Level Ib), has

a markedly high gloss on one lingual surface. The other, 8E/2 (Level Ia), has a broken tip and side and was ground on that side and on the lingual surface; all the ground surfaces are covered with a high gloss.

8. Miscellaneous (Figure IV-6, n-o)

This group contains two implements from Level Ia. The first (7C/3) is a fragment of macropod fibula which is covered with red ochre. The second (6D/2) is a piece of bird limb bone with one articular end intact. The other end is broken and has been ground inwards in the same way as the bone tubes.

Conclusion

The distribution of bone tools is tabulated below:

Distribution of Bone Tools at Malangangerr

Implements	Level								Total	
	Ia		Ib		I		II			
	Nos	%	Nos	%	Nos	%	Nos	%	Nos	%
1. Bipoints	3	9.4	1	6.7	1	10.0	-	-	5	8.6
2. Unipoints	5	15.6	1	6.7	3	30.0	-	-	9	15.5
3. Sections	6	18.8	1	6.7	1	10.0	-	-	8	13.8
4. Spat. points	13	40.7	10	66.5	5	50.0	-	-	28	48.4
5. Util. flakes	2	6.2	-	-	-	-	1	100.0	3	5.2
6. Tubes	-	-	1	6.7	-	-	-	-	1	1.7
7. Util. teeth	1	3.1	1	6.7	-	-	-	-	2	3.4
8. Miscell.	2	6.3	-	-	-	-	-	-	2	3.4
Total	32	100.0	15	100.0	10	100.0	1	100.0	58	100.0

There is fairly wide range of bone implements which is very similar to the collection found at Padypadiy¹ and Nawamoyne Level I.²

Spatulated points predominate in all levels. There are slightly more bipoints and unipoints in the upper part of the midden and relatively more spatulated points below, but the numbers are so small that the variations may well be due to chance. However, this trend is noted at the other two coastal plain sites and it therefore possibly reflects some form of cultural change over time.

2) Shell Implements (Plates IV-10, IV-11)

Shell tools occur throughout the midden. A few were recovered from the sieves during the excavation, but most were recovered from the column samples after careful inspection with a 10 x magnifier.

There are 141 pieces of Geloina jukesii with signs of use-wear, in the four column samples. This represents about 35 implements per sample and suggests that shell was extensively used in this site for some 6,000 years at least. The fragments were all used along the natural margin of the shell. Tiny flakes were detached off the dorsal surface along the edge and in many instances the scars are overlain with use-polish.

There is one other implement, a Geloina shell with heavy ochre stains in the hollow, which seems to have served as a tiny dish or palette.

¹ Chapter III.

² Chapter V.

3) Stone Artefacts¹

I OVERALL FEATURES:

The following analysis deals with the density and distribution of worked stone in the deposit, the raw materials used in tool making and the ratios of implements to waste flakes.

1. Distribution and density of artefacts

There are 1361 flaked stone artefacts in the deposit of which 82 (6.2 per cent) are implements and the other 1279 (93.8 per cent) waste flakes.

The relative density of artefacts in different levels of the deposit is tabulated below:

Level	Artefacts	
	Nos	Density per cu. m.
Ia	164	19.3
Ib	76	10.8
I	21	11.6
TOTAL I	261	15.0
TOTAL II	120	32.5
IIIa	345	84.4
IIIb	223	58.7
III	412	141.4
TOTAL III	980	90.7
GRAND TOTAL	1361	

¹ The following analysis is based on the principles described in Chapter II and elaborated in Chapters VI and VII.

The density of worked stone decreases markedly over time, but the change is more apparent than real because the high organic additive in the midden has deflated the artefact density there. In other words, the variation need not imply that less stone was actually deposited during the later stages of occupation. However, the overall density of stone artefacts is low compared to that of another midden, (Padypadiy - 120 to 200 per cu.m.), or another sandy deposit, (Tyimede I - ca. 2000 per cu.m.).

2. Raw material

Four main types of rock occur: quartzite, quartz, chert and igneous-metamorphic rocks, of which porphyritic dolorite is the main form. The first two are locally available in outcrops of Kombolgie sandstone, chert occurs as pebbles in local stream beds but the local sources of igneous-metamorphic rocks are unknown.

The proportion of artefacts of different raw materials in each level is tabulated below:

Level	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	I/mm.	Total	
Ia	67.7	2.4	12.2	17.7	100.0	164
Ib	31.6	44.7	9.2	14.5	100.0	76
I	76.2	-	14.3	9.5	100.0	21
TOTAL I	57.8	14.6	11.5	16.1	100.0	261
TOTAL II	20.0	29.2	26.6	24.2	100.0	120
IIIIa	31.6	12.2	27.2	29.0	100.0	345
IIIIb	58.3	9.9	15.7	16.1	100.0	223
III	59.5	13.1	17.5	9.9	100.0	412
TOTAL III	49.5	12.1	20.4	18.0	100.0	980

Quartzite predominates in every level except Level Ib. The fluctuating proportions of different raw materials in various levels can probably be attributed to chance, because the numbers of artefacts are so small that they would be significantly affected by one man flaking a large lump of stone.

The ratios of implements to waste flakes in the different levels are as follows:

Level	Nos waste flakes per implement				
	Quartzite	Quartz	Chert	I/mm.	Total
Ia	3.8	-	0.7	-	3.7
Ib	11.0	33.0	6.0	-	13.0
I	3.0	-	2.0	-	3.2
TOTAL I	4.2	37.0	1.1	-	4.9
TOTAL II	23.0	34.0	31.0	-	39.0
IIIIa	108.0	20.0	17.8	99.0	37.3
IIIIb	20.6	10.0	10.7	11.0	14.9
III	40.0	-	16.7	19.5	33.3
TOTAL III	36.3	28.5	15.7	28.5	27.0

There is a rather high ratio of chert tools to waste flakes in Levels I and III. In Level Ia in fact, chert tools outnumber waste flakes. The high chert tool/waste ratio is also found at Padypadiy, Nawamoyn and Tyimede and seems to reflect a widespread economical use of chert as tools.

The ratio of implements to waste flakes rises constantly over time, so that there is a relatively high

ratio in Level I. The figures may be compared with the overall ratios of 1:22 and 1:32 for the industry in the workshop sites at Tyimede.¹ This may imply that tools were made at Malangangerr during the earlier occupation only and that they were fashioned elsewhere and brought into the site, when Level I accumulated.

The following analysis was made to help test this interpretation.

3. Size and shape of waste flakes

A sample of approximately 1/3 of the waste flakes in Levels I and III was taken and the sizes were analysed.² Level II was omitted because it contains so few artefacts. The following results are found:

Level	Waste flakes (Per cent)					Total Nos
	Inches square					
	> 3/4	3/4-1/2	1/2-1/4	1/4-1/8	Total	
I	22.4	26.3	43.4	7.9	100.0	76
III	10.9	19.1	65.6	4.4	100.0	340

Although there are more smaller waste flakes in Level III, there are very few waste flakes smaller than 1/4" in either level. This contrasts fairly markedly with the size of flakes in the workshop sites of Tyimede I and II

¹ See Chapters VI and VII.

² This was done by passing the flake through a series of geological sieves (see Chapter VI p.267-8).

where an average of 33-55 per cent of waste flakes are smaller than 1/4".

This may imply that extensive secondary retouch was seldom done at Malangangerr, though the presence of hammers and many waste flakes in Level III suggests that flaking was certainly carried out. Malangangerr was probably never the type of workshop site where extensively retouched tools were made, but in the earlier occupation large flakes were produced and many of them probably served as tools.

II. ANALYSIS OF ARTEFACTS:

Artefacts are described according to the three main levels from which they come. Their distribution within the levels is discussed at the end of each section.

1) Level I - Midden

(i) FLAKED STONE IMPLEMENTS

There are 44 implements, which are grouped as follows:

1. Points (Figure IV-7, a-c)

There are three points; one is made of quartzite and two of chert. They range in length from 4.2 to 6.3 cm. and are all bifacially retouched. The quartzite point (2D/2) has a curved base, a lenticular cross-section and straight sides. One chert point, (8C/1-60), is made on an endstruck flake and is square butted, with a triangular cross-section. One side is retouched with

steep unifacial step-flaking, the other side is bifacially retouched in one place. The other chert point, (5D/1-122), has a squarish butt, a parallelogram shaped cross-section and the side edges, viewed end-on, are 'S' shaped.

2. Butts (Figure IV-7, e)

There are nine butts: eight are quartzite and one is made of chert. They range in length from 2.6 to 4.7 cm. and all have curved butts, lenticular cross-sections and straight edges (viewed end-on and dorso ventrally). None of them shows any signs of having been made on a flake and they are all bifacially retouched on all three sides. There are no signs of utilisation.

3. Tips (Figure IV-7, d)

There are three quartzite tips varying in length from 1.3 to 3.4 cm. They all have straight edges when viewed end-on and convex sides viewed dorso-ventrally. Two are bifacially retouched with lenticular cross-sections, the other is unifacially retouched with scalar flaking and has a domed cross-section.

4. Shafts

There are two shafts: one is quartzite and one is chert. Both are bifacially retouched and have lenticular cross-sections.

Conclusion

There are 17 intact and broken points, most of which are made of quartzite. They look very like the points in the collections from Tyimede I and II.

5. Scrapers (Figure IV-8, a-b)

There are five scrapers, of which three are quartzite and two are chert. Three are made on endstruck flakes, but no bulb of percussion is seen on the others. They range in length from 3.0 to 3.7 cm. One is smooth and glossy all over and seems to have been weathered elsewhere and then brought into the shelter.

Four scrapers are rectangular in shape and are generally unifacially retouched along one or both sides with step and scalar flaking. Two have one discrete length of bifacial retouch along one side, one scraper has smoothing (Type 7) use-wear along one side, and others have discrete lengths of chattering and unifacial use-wear.

The fifth scraper, (9D/4-91), is made of quartzite and is somewhat circular in shape. It is retouched with regular scalar flaking along one edge, and another adjoining edge is bifacially retouched and bruised, presumably by use.

6. Broken scrapers (Figure IV-8, c)

There are two of these, one is quartzite and one is chert. Both are rectangular in shape and snapped off at the end. They are retouched with lengths of bifacial and

unifacial flaking and the chert piece (8B/2-217) has unifacial use-wear only along one side.

Conclusion

The scrapers are similar to those associated with points at Tyimede I and II, except that the majority of those scrapers are chert, whereas the Malangangerr series are quartzite and chert.

7. Cores/Core scrapers (Figure IV-8, e)

There are three large slab-like pieces of quartzite, which are bifacially worked around the perimeter. They range in length from 4.9 - 7.5 cm. and are roughly oval or circular in shape. The largest piece (8B/3-219) is bruised along one end and may have served as a hammer. The smallest piece, (7B/1-296), is very neatly worked and may really represent the butt of a very large but incomplete bifacial point.

8. Utilised flake

There is one chert flake, (8E/7-138), with unifacial use-wear along one end.

9. Broken utilised flake

There is one quartzite end-struck flake, (2D/1), with unifacial use-wear on both sides.

10. Miscellaneous (Figure IV-8, d)

There is one chert piece, (4F/1), whose dimensions are 3.0 x 1.4 x 1.0 cm. One large flake has been

detached along the side by a blow directed at the very end of the piece and as a result this end is chisel-shaped. If this piece were found in a European collection it would be termed a burin,¹ but in this context, where there is no evidence that this tool was used as a graver or indeed is anything other than a chance piece, it is classified as 'miscellaneous'.

11. Retouched fragments

a. Unifacially retouched fragment

There is one quartzite fragment (2D/2) which has scalar retouch along one edge.

b. Bifacially retouched fragments

There are 13 fragments: seven are quartzite, five are chert and one is quartz and many may be parts of bifacial points. Two quartzite pieces are bruised along the edge and may have served as small hammers. One chert piece (9E/1) is covered with a high gloss and was probably exposed and weathered before being brought into the shelter.

¹ Oakley, K.P., 1958 p.57.

Distribution

These implements are distributed in Level I as follows:

Implements	Level						Total	
	Ia		Ib		I			
	Nos	%	Nos	%	Nos	%	Nos	%
1. Points	3	8.6	-	-	-	-	3	6.8
2. Butts	9	25.8	-	-	-	-	9	20.4
3. Tips	2	5.7	-	-	1	20.0	3	6.8
4. Shafts	1	2.8	-	-	1	20.0	2	4.5
5. Scrapers	3	8.6	1	25.0	1	20.0	5	11.5
6. Br. scrapers	1	2.8	-	-	1	20.0	2	4.5
7. Cores/ Scrapers	2	5.7	1	25.0	-	-	3	6.8
8. Util. fl.	-	-	1	25.0	-	-	1	2.3
9. Br. util. fl.	1	2.8	-	-	-	-	1	2.3
10. Miscell.	1	2.8	-	-	-	-	1	2.3
11a Unif. retouch	1	2.8	-	-	-	-	1	2.3
b Bif. retouch	11	31.5	1	25.0	1	20.0	13	29.5
Total	35	99.9	4	100.0	5	100.0	44	100.0
Per cent	79.5		9.1		11.4		100.0	

Most of the implements occur in the upper level of the midden. Perhaps the most outstanding feature of their distribution is the fact that nearly all the points (complete and broken) occur in Level Ia. It seems therefore that points were not deposited at Malangangerr when the midden began to accumulate some 6,000 years ago, but that most stone tools, including points, were used at this site in the later stages of occupation.

(ii) OTHER STONE ARTEFACTS

1. Abraded fragments (Figure IV-9, a-b)

There are three fragments of schist. The first, 8C/3-81 : Level Ia, is 'U' shaped and is 5.9 x 4.5 x 0.9 cm. It was apparently ground into shape and then broken at one end. It is covered with red ochre and may have been used as a rasp, like the fragments from Tyimede I and II.¹ The other two pieces, 8B/7-299 and 1C/1, come from Levels Ib and I respectively and show no signs of use.

There is one abraded piece of sandstone 4E/7 (Level Ib) which is 6.4 x 3.5 x 1.8 cm. and has been ground along several planes into a rod-like shape. It may have been used as a rasp or file but carries no signs of any specific use.

2. Ochre

Lumps of ochre occur throughout the deposit. The colours include purple, red, orange, yellow and white

¹ See Chapters VI and VII.

and the lumps range in weight from 2 to 10 gm. The quantity of ochre in different levels is shown in the following table:

Level	Ochre	
	Nos	Density per cu.m.
Ia	113	13.3
Ib	68	9.7
I	20	11.1
Total	201	11.6

Ochre is fairly sparsely distributed here, especially compared to the density found at Padypadiy. The density increases over time, but this may well be a purely local phenomenon.

3. Hammers/Pounders (Figure IV-9, c)

There are two quartzite pebbles which weigh 80 gm. (Level Ia) and 495 gm. (Level I) respectively, and which are bruised in several localities. The larger one is flattened along several adjoining planes around the perimeter and resembles a 'kulki' percussion stone.¹ It may well have been used for pounding vegetable foods.²

Level I - Conclusion

This is a fairly small assemblage containing points and small rectangular scrapers and relatively few waste

¹ McCarthy, F.D. 1967 p.55.

² McCarthy, F.D., and Setzler, F.M. 1960 p.273.

flakes. No complete axes are present, but fragments of igneous/metamorphic rocks occur throughout the level, and many have ground surfaces.

As a whole, the assemblage is very similar to the collections from Padypadiy and Nawamoyrn Level I, where the same assemblage occurs at roughly the same time. The only variation is the presence of use-polished tools at Padypadiy and Nawamoyrn, which are absent at Malangangerr.

The collection of implements is similar to those deposited at Tyimede I and Tyimede II Level I at roughly the same time. The main difference lies in the fact that both Tyimede sites were apparently workshops where the points and scrapers were manufactured on the spot.

2) Level II - Transitional Zone

1. Flaked implements

There are only three stone implements in this level. The first, 3A/4-403, is a chert flake with unifacial use-wear along one end. The second, 2B/3 is a lump of quartz which may be described as a core or core/scrapper. It is bruised on several edges and possibly served as a hammer. Finally, 6C/4-447 is a unifacially retouched fragment of quartzite.

None of these implements is diagnostic of any particular industrial tradition and since this is a transition zone, they may well have been derived from Levels III or I.

2. Ochre

There are 115 pieces of ochre in this level. The same range of colours and sizes occur here as in the other two levels. There are 31.1 pieces of ochre per cu. m. in the level.

3. Hammers/Pounders (Figure IV-10)

There are four hammers made of quartzite and quartz pebbles. They range in weight from 110 to 450 gm., and the largest one is battered all around the edges, like a somewhat elongated 'kulki' percussion stone.¹

Level II - Conclusion

This is a very small collection containing few diagnostic implements. There are relatively more waste flakes than in Level I which is understandable since it represents a transitional zone above Level III where numerous waste flakes occur.

3) Level III - Sand

(i) FLAKED STONE IMPLEMENTS

There are 35 implements which are grouped as follows:

1. Scrapers (Figure IV-11, a-b)

There are four scrapers: one is quartzite, one is quartz and two are chert. Two are made on flakes and the others are made on small chunks. They range in length

¹ McCarthy, F.D. 1967 p.55.

from 2.5 to 4.7 cm. Two are somewhat oval when viewed dorso-ventrally, one is triangular and the other is rectangular.

The scrapers are retouched along at least one edge. The quartzite scraper (8C/9-195) is circular in shape with a squarish cross-section and is retouched with step flaking all around the perimeter from both surfaces. The other three scrapers are unifacially retouched mainly with step flaking along one edge.

2. Broken scrapers (Figure IV-11, c)

There are two broken scrapers. The first (5A/8-453) is part of a large quartzite flake. It is 4.6 x 3.2 x 1.4 cm. and is unifacially retouched in a convex arc with step and scalar flaking. The second piece (5B/6-413) is a small piece of chert (2.3 x 2.2 x 1.1 cm.) with neat scalar retouch all along one convex edge.

3. Cores/Core scrapers (Figures IV-12, IV-13, IV-14, a-b)

There are six large chunky quartzite implements. The first two (7C/10-270 and 7D/10-286) are endstruck flakes measuring 16.5 x 10.0 x 4.5 cm. and 10.6 x 7.6 x 4.2 cm. respectively. They are both retouched by the removal of large scalar flakes off the dorsal surface and both have short lengths of bifacial flaking along one side. The larger one (7C/10-270) has several short lengths of step flaking along one edge which probably reflects unsuccessful attempts to remove more flakes. These implements resemble the large 'sumatraliths' found

on Kangaroo Island,¹ but have not been classified as such for obvious reasons.²

Another tool (7C/10) is a large slab 8.9 x 7.5 x 2.1 cm. which is worked all around the perimeter with bifacial and unifacial scalar flaking. 5B/6-414 is an oval shaped lump, 7.0 x 3.9 x 3.2 cm., with deep alternate bifacial retouch on one edge. This edge is also bruised, which may suggest that it was used as a hammer.

4B/6-424 is an irregular lump 5.4 x 4.1 x 4.0 cm. Large flakes have been removed all over the surface and one edge is unifacially retouched with heavy step flaking. The last tool is 3B/6, which again is also an irregular lump 4.3 x 3.5 x 2.8 cm. from which several large flakes were removed. There is a short length of unifacial step flaking along one edge.

4. Utilised flakes (Figure IV-14, c)

There are seven of these implements: one is quartzite, one is quartz and five are chert. The bulb of percussion is clearly visible on six flakes. They range in length from 1.2 to 4.0 cm.

Five of the flakes have fine unifacial use-wear along one side edge. One flake has bifacial utilisation along the end and the remaining quartz flake (2A/5) is heavily bruised along one side and one end.

¹ Tindale, N.B. 1937 p.47; McCarthy, F.D. et al., 1946 pp.13-4.

² Matthews, J.M. 1966 pp.5-22.

5. Axes (Figures IV-15, IV-16)

There are five complete axes and one large flake that may represent an incomplete axe (see Appendix IV-2). All the axes are heavily weathered but this carried no direct implications about their age. The complete axes were bifacially flaked and then ground into shape. One axe (2A/7-428) has a marked groove on one surface and on both sides. Another (5A/8-452) might be described as 'waisted' since one side is indented.

6. Retouched fragments

a. Unifacially retouched fragment

There are ten of these: four are quartzite, two are quartz and four are chert. The most common forms of retouch are unifacial retouch, step and scalar flaking. One quartzite piece and both quartz pieces are bruised along the retouched edge.

Distribution

These implements are distributed in Level III as follows:

Implements	Level						Total	
	IIIa		IIIb		III			
	Nos	%	Nos	%	Nos	%	Nos	%
1. Scrapers	2	22.3	-	-	2	16.7	4	11.4
2. Br. scrapers	-	-	2	14.3	-	-	2	5.7
3. Cores/ Scrapers	-	-	3	21.4	3	25.0	6	17.1
4. Util. flakes	3	33.3	2	14.3	2	16.7	7	20.0
5. Axes	1	11.1	3	21.4	2	16.6	6	17.2
6a Unif. retouch	3	33.3	4	28.6	3	25.0	10	28.6
Total	9	100.0	14	100.0	12	100.0	35	100.0
Per cent	25.7		40.0		34.3		100.0	

The implements are fairly evenly distributed in the sands and there is no real concentration of a particular tool type in any level within Level III.

(ii) OTHER STONE ARTEFACTS

1. Abraded fragments

There is a rod shaped piece of schist from Level III (7D/9-284) which is noticeably smoother on one surface and probably formed part of a larger ground tool. There is also a large broken chunk of porphyritic dolomite from Level IIIa (OB/5) with one smooth, glossy surface.

2. Ochre

Lumps of ochre occur throughout the sands covering the same range of colours and sizes as was found in the ochre in Level I. The distribution and density of ochre is shown below:

Level	Ochre	
	Nos	Density per cu.m.
IIIa	150	36.6
IIIb	101	26.6
III	196	67.6
Total	447	41.4

Ochre is more densely distributed in the sands than in the transitional zone or the midden.

3. Hammers/Pounders

Quartzite and quartz pebbles occur throughout the sands. Many may have served as hammers or anvils but only 13 bear recognisable traces of use as hammers.

There are seven intact hammers and six broken ones. Ten of these are quartzite pebbles, two are quartz pebbles and one is a slab of veined quartz. They range in weight from 44 to 2030 gm., and the largest one is flattened at one end and was probably used as a pounder.

Level III - Conclusion

Although this assemblage is again a relatively small one, it has several outstanding features in relation to the collection from the overlying Level I. Firstly, there are relatively more waste flakes, suggesting that the flaked implements were made on the spot. Secondly, there are no points or small rectangular scrapers here at all; instead there are larger chunky scrapers and core tools. Axes are present and they are heavily weathered. One axe is grooved, which suggests strongly that it was hafted.

This assemblage is very similar to that found at Nawamoyñ Level III, which was deposited at the same time. The same chunky scrapers, core tools and grooved axes occur there, though none of the small triangular axes found at Nawamoyñ, is present at Malangangerr. The assemblage is also similar to that found in Tyimede II Level III, which was deposited much more recently.

C. ROCK PAINTINGS

There are two areas of painting, one in the shelter and the other in a recess on the north side of the block.

I. Shelter (Plate IV-12)

There is a faded red painting of a barramundi on the outer wall, about 3.5 m. above square 7A. There are 18 dark red stick figures on the inner wall above squares J15 and 16. The group covers an area of about 60 x 44 cm. The largest figure is 12 cm. long and the smallest 2.5 cm. Most of them are complete but some contain only heads or limbs. They are all dynamic figures drawn at different angles. Some are running and some are lying down with limbs waving about. The figures were described by the Aborigines as 'mimis' or spirit beings who have cast their shadows on the rocks. This particular group was said to depict a 'mimi' corroboree.

II. North recess (Plates IV-13 to IV-15)

Two anthropomorphic figures, six fish, one goanna and several faded designs are found here.

Both anthropomorphic designs are painted in a thick yellow outline. The first (82 x 60 cm.) is on the ceiling about 1 m. above the ground (Plate IV-14). It is a male figure and most of the body is outlined with thick strokes but the head, legs, feet and penis are solid. Barbs protrude from the head. It is said to be a magical painting of a man whom the artist wished to punish. The barbs show where he will be attacked by pain or disease and the spine and bones are drawn to

show that he will waste away. A similar drawing is found on the back wall of the recess. The figure (42 x 30 cm.) is drawn in yellow with a thick outline and appears to be kneeling (Plate IV-15). It may be a female if two protuberances under the arms represent breasts. There are barbs at the base of the trunk and again they are said to show where disease and pain will be felt.

There are six yellow fish on this wall. They range in size from 37 x 15 cm. to 17 x 9 cm. Four of them have solid outlines with a fainter infilling and two are outlines only. Two are drawn with the head towards the ground, two with the head towards the roof and two with the head to the side.

There is one rather faded red and white goanna (80 x 19 cm.), drawn in fine cross hatching to show the bones and alimentary canal. Two faded red fish tails are also visible.

All the yellow drawings overlies the faded red and white paintings here. The goanna in particular is overpainted by several thick yellow lines. This sequence of finely cross-hatched red and white paintings followed by monochromatic heavily outlined ones contrasts with the evidence found at Padypadiy.

GENERAL CONCLUSION

Malangangerr was occupied for over 20,000 years. The earliest inhabitants camped amongst large weathered boulders which were strewn on the floor. They apparently flaked stone tools at the site and used chunky scrapers, primary flakes and edge ground axes. They also lit fires and probably left food debris behind, but weathering has removed almost all organic material from the sand leaving only small discrete lumps of charcoal behind. There are however numerous hammerstones in the deposit and some of these may have been used to crush vegetable foods.

The radiocarbon dates and the stratigraphy of the deposit suggest that the shelter might have been abandoned for some time at the end of the earliest occupation. By then many of the boulders were covered and the sand was domed in some places

About 6,000 years ago the new occupants of Malangangerr camped on this sandy surface and lit their fires on some of the flat rocks that were still exposed. They carried shells and animals into the shelter and these remains were trodden into the sand to form the Transitional zone.

Eventually, a midden of shell, bone, ash, charcoal and implements accumulated, until about 300 years ago when the shelter apparently ceased to be used. This is suggested by the radiocarbon dates and is supported by a complete absence of European material in the deposit.

Analysis of the midden suggests that the diet and material culture of the inhabitants remained broadly

similar for some 6,000 years. They ate a broad variety of food which is available on the coastal plains today. This included a wide range of small terrestrial animals, and aquatic fauna such as fish and tortoises. They also collected shellfish from intertidal mudflats such as those of the nearby East Alligator River.

It seems that the relative proportions of different shell species differed over time, and this may reflect personal preferences, variations in the proportions found in the shell beds and above all, sampling errors. They probably ate vegetable and there are several large pounders or hammers that may have been used to pulverise tough roots.

The inhabitants buried their dead in the shelter. Most of the remains suggest some form of secondary burial, but the primary burial of two children is also found.

They used a wide variety of implements and left bone, shell and stone tools in the deposit. They probably made the bone and shell tools at the site, using the food debris strewn around. The stone tools however, were apparently not manufactured at the site.

The proportions of various bone and stone tools vary over time. Unfortunately the numbers concerned are so small that the absence of a specific form need not necessarily imply that it was unknown at the time. Nonetheless, two trends are found. First, there are slightly more bone bipoints and unipoints than spatulated points in the upper levels and since this same trend was observed at Padypadiy and Nawamoy, it

probably represents a genuine change over time. Secondly, stone points are restricted to the upper level here, whereas they occur throughout the deposits at Padypadiy and Nawamoyn.

The general sequence at Malangangerr is very similar in many respects to that found at Nawamoyn, in terms of stratigraphy, radiocarbon dates, ecology and technology. The upper level of the midden at Malangangerr is similar to that found at Padypadiy in terms of radiocarbon dates and the range of shell species present.

The sequence of stone industries at Malangangerr is similar to that found at Tyimede II in several respects. Both deposits contain chunky scrapers and axes in the lower levels, and lighter points, small scrapers and axes in the upper ones. In contrast to this there are virtually no organic remains at Tyimede II.

The main phase in the lower industry at Tyimede II is dated to 6650 ± 500 B.P. (ANU-18), which implies that it was made at roughly the same time that the midden began to accumulate at Malangangerr. Finally, the later point and scraper industry was apparently made on the spot at both Tyimede I and II in contrast to the situation at Malangangerr.

CHAPTER V

EXCAVATIONS AT PLAIN SITES III : NAWAMOYN

INTRODUCTION

Nawamoyrn is a rock shelter ($12^{\circ}23'$ S. Lat., $132^{\circ}56'$ E. Long.). The name is an Edey word used by the Aborigines living at Oenpelli today. It was discovered in June 1965 during a reconnaissance of the area (Figure I-2).

The shelter faces northwest and lies at the base of a large sloping rock, which is one of a cluster of loose blocks lying at various angles that once formed part of a large sandstone tower (Plate V-1). The rock covers an area of about 250 sq. m. and is made up of current bedded, coarse quartz sandstone and quartz conglomerate with massive, but locally lenticular, strata. A series of profiles drawn from north to south across the site show an overhanging shelf of rock with an angle of $35-38^{\circ}$ which is locally buttressed at the basal neck by very coarse grained sandstone tending to fine current bedded quartz conglomerate. The roof of the shelter is extensively weathered, with signs of case hardening and of the percolation and flow of iron-stained solutions. The floor of the shelter slopes downwards towards the entrance, suggesting an accumulation of deposit within (Figures V-1 to V-3; Plates V-2, V-3).

The shelter is exposed on the east and west sides and is protected from rain and sun by the overhang and

by a few tall trees growing at the entrance. The dripline is evident on the margins of the shelter where rounded pebbles line shallow rills. Being a shallow recess, rain is blown into most of the sheltered area and seasonal water flows down the slope between the rocks, rounding and polishing the sides and leaving patches of sub-angular quartz gravels behind. The nearest permanent water is a billabong at Cannon Hill station about one mile away, and the East Alligator River is approximately two miles eastward across the plain.

Signs of the Aboriginal occupation of the site include six smooth depressions in a rock lying near the dripline, a few faded rock paintings on the east wall of the block and several stone artefacts lying near the dripline. The deposit in the shelter shows several signs of disturbance : there is an animal's sleeping hollow near the back wall on the east side, and a small rill where water has run down the roof of the shelter and over the floor on the west side.

METHOD OF EXCAVATION

Nawamoyne was excavated for a month, from 26 July until the 28 August 1965, by two archaeologists (C.W. and J.P.W.) and two or three Aboriginal helpers. An archaeologist removed the deposit in units of one square metre, using a paintscraper, a brush and a geological pick where necessary. A line level was fixed to the datum point and used to record depths. At first the material was removed in units 5-10 cm. deep conforming to the observed stratigraphy. After

about half of the excavation had been done and the nature of the deposit was better understood, larger units were removed in the less productive parts of the site.

The position of all stone implements recognised as such when in situ., was recorded in three dimensions. The rest of the material was sieved in 1/4 inch mesh plastic sieves and sorted by the Aborigines under the direction of the other archaeologist. All stone, bone and recognisable shell artefacts were retained, and all identifiable bone (jaws, skull fragments, epiphyses and carapace) were kept. Soil and rock samples were taken and two column samples of the midden material were removed for later analysis. Carbon samples were taken using a 1mm. mesh sieve in the areas where charcoal was scarce.

The extent of the excavation is shown in Figure V-2. Two separate trenches were dug at either end of the deposit to give a broad picture of its extension and content. They are called east and west trenches and there was no need to excavate the intervening area because the trenches showed the same stratigraphy and cultural content. The excavated area is 26 sq.m. which represents about 1/4 of the available area within the shelter.

STRATIGRAPHY¹

The profiles at Nawamoyn show a maximum of 130 cm. of deposit with the following sequence; at the base is a coarse gravel overlain by about 50-70 cm. of coarse loamy sand. This is succeeded in turn by 60-70 cm. of deposit with a heavy shell additive which is termed 'midden'. A transitional zone is defined to express the changeover from sand to midden (Figures V-4, V-5; Plates V-4 to V-6). Broadly speaking, this sequence of sand overlain by midden, is very similar to that found at Malangangerr. The main features are described as follows:

1) Sands

Coarse loamy sand is found at the bottom of the deposit all over the site. It ranges in colour from yellowish brown (10 YR 5/4) to brown (7/5 YR 5/4) and in pH from 6-6.5. Its texture changes markedly, becoming coarser at the base where a fine gravel occurs. In parts of the deposit, especially in the east trench, there is a coarse gravel at the bottom of the sand about 90-110 cm. below the surface.

The gravel contains quartz pebbles and rounded sub-angular sandstone blocks but apparently no float boulders. The quartz pebbles that occur in the rock forming the shelter are less concentrated than those in the basal gravel, and it seems that the gravel was

¹ I wish to thank Mr J.N. Jennings, Dept. of Geography, Research School of Pacific Studies, A.N.U., for his kind assistance in drafting this section.

derived both from the present block and other rocks in the vicinity. Stream action is evident at this level as several abraded stone artefacts were found here. The localised position of the gravels may be due in part to the production of less gravel by the local rocks, but it is very likely too that as the deposit accumulated in the shelter and it became a run-off rather than a run-on site, the direction of the local streams changed and less gravel was deposited.

The overlying sand is permeable and extends over the excavated area for a maximum depth of 70 cm. The upper surface of the sand is slightly domed in parts (Figure V-4, 3), indicating a peak of deposition. In other places, the upper surface of the sand is slightly runnelled and slopes downwards towards the back of the shelter (Figure V-4, 4). This is probably due to erosion by water streaming down the roof or off the surrounding plains, and it need not indicate that this surface was exposed for a significant length of time.

The sand contains stone artefacts. No hearths were found and charcoal occurs in the upper levels only, as discrete lumps or in finely divided form. A few fragments of glossy abraded bone occur in the upper levels of the sand but no shells are found here at all.

The sands were probably derived locally and deposited in the shelter by water, wind and human activity. Rain and a fluctuating water table probably permeated the deposit, removing fine elements like

ash, silt and clay and possibly any shell present there. The weathering was not sufficient, however, to abrade the flaked stone artefacts, which are still fresh and sharp. It is unlikely that it abraded the bone, which was probably weathered by wind and treadage.

The sands all over the site are divided into an upper and lower level (IIIa and b) for analysis. The division is a fairly general one, made by drawing an arbitrary line in the middle of the deposit, so that the groups contain approximately the same volume of material (see conclusion).

The sands are dated according to a sample of charcoal lumps lying about 25 cm. below the base of the midden, (Figure V-4, 1), as follows:

Date	Level	Square/Spit	Depth B.S. in cm.	Years B.P.
ANU 51	IIIb	E11/10	80	21450 $\pm$ 380

2) Transitional Zone

This is an expression of changeover from sand to midden. It extends over most of the excavated deposit for a depth of 5 to 10 cm. Vertical illuviation and treadage probably mixed the coarse loamy sand with the finer elements (ash, charcoal, shell) of the overlying midden. Finds made here cannot be positively attributed to either the midden or the sand and are therefore treated separately as Level II. The shells in this zone are very fragmented and chalky, and the pH is 6, as opposed to a higher value in the midden. The zone is

generally very dark greyish brown (10 YR 3/2) being composed of pale sands with a high charcoal content.

One small hearth was partially exposed on the west side of B//17. It consists of a ring of small stones with large lumps of charcoal inside and represents a fire lit on the surface of the sands.

3) Midden

The transitional zone is overlain by about 50 cm. of midden. This is made up of gritty sandy silty loam with a heavy additive of organic material including shell, bone, charcoal and ash. It is mainly very dark greyish brown (10 YR 3/2) in colour with a pH of 8-8.5. Shell is the most bulky component and the midden probably accumulated quickly so that finer elements were preserved. Patches of charcoal indicate the position of hearths and two large pits occur in squares B8 and C10 (Figures V-4, V-5). A shallow hollow was noted in the top of the midden (Level Ia) in C9/1, and a small horizontal burrow in the bottom, (Level Ib), in B11/6. No discrete hearths were isolated but a heap of four smooth pebbles was recorded in the lower part of the midden in I2/5 (Figure V-6). Minor stratigraphic features like small lenses of shell, crab remains or matting are rare because they have probably been weathered away.

Weathering is seen in several features. Firstly, below the surface 'bull-dust' there is a hard thin crust that was probably compacted by rain. Secondly, there are slightly cemented local aggregations of

shell, bone and sand in the more exposed parts of the midden (sqs A11, B11-8, C11-8, E2). This part of the midden has apparently been weathered by the vertical illuviation of slightly acid solutions trickling over the rock and through dead leaves on the ground. Local aggregations occur in the midden, and bones and shells are chalky and covered with crystalline encrustations.

The same process has apparently occurred in sqs D10-8 and G2 where loose aggregates occur in a very dark brown (10 YR 2/2) loamy sand. The aggregates vary in colour from dark yellowish brown (10 YR 3/4) to greyish brown (10 YR 5/2) to light grey (10 YR 7/2). Again, slightly acid water probably ran off the ceiling on to the deposit, so that local aggregates formed which are heavily stained with iron from the original solution.

In contrast to this, the midden at the back of the cave (sqs IO-2, J1-2) is loose and soft and the shells are fresh and unweathered. Lenses of charcoal and ash are faintly visible here, showing that in spite of its powdery texture this deposit is relatively undisturbed.

The midden is divided into an upper and lower level for analysis. These levels, Ia and Ib, are drawn fairly arbitrarily in order to divide the deposit into two groups of approximately equal depth and volume. Unfortunately, this was not very successful; part of the midden was removed fairly swiftly in two large spits, and instead of removing spits of equal depth, I made a mistake and consistently removed a larger top

spit. As a result Level Ia contains a larger volume of material than Ib.

Nonetheless, this division is made to draw a general distinction between the earlier and later parts of the midden. The midden could not be divided in this way in three squares - B10, C10 and B9. This is because the whole midden is disturbed by pits in C10 and B10, and the entire midden was removed in one unit in B9. The material from these squares is therefore termed Level I, since it comes from the midden in general.

Two column samples of the midden were taken, to analyse its contents. They extend over an area 30 x 30 cm. and were taken down to the bottom of Level II. Their positions are as follows:

Sample	Position	Depth in cm.
1	S. wall sq. D10	60
2	N. wall sq. B8	75

Both samples come from the east trench; sample 1 comes from the more protected area behind the dripline and sample 2 from the more exposed region. Both samples were removed in a series of units 5 cm. deep, and the retained fraction was sorted into its components in the same way as the samples from Malangangerr.¹

The results are shown in Tables V-1 and V-2. Table V-1 shows the relative proportion of different components in each unit and Table V-2, the proportion of components in each level. The following observations may be made:

¹ See Chapter IV.

- (i) The density of components is highest in Level Ia in sample 2 and in Level Ib in sample 2.
- (ii) Shell and waste stone are the main components in both samples, but are distributed differently in the two groups. In sample 1 the proportions of shell, waste stone, crab, charcoal and plant material increase over time, whereas bone decreases fairly markedly. In sample 2 however, the proportion of shell is higher in Level Ib, bone and crab remains increase proportionally over time whereas waste stone decreases.

These variations could well be attributed to the inherent complexities of midden structure, but they also suggest some degree of differential weathering in relation to the dripline. It seems that organic material is better preserved in sample 1 because it lies in the more protected area, whereas the components in sample 2 are more exposed and the organic content is therefore lower.

These results are very similar to those found at Malangangerr. There is a fairly complex midden at both sites, and the analysis of its components reflects variations in accumulation and subsequent weathering in different parts of the site.

The midden is dated by a charcoal sample from the bottom of Level Ib in the east trench, (Figure V-4, 3), which reflects the earliest accumulation of midden at that point as follows:

Date	Level	Square/Spit	Depth B.S. in cm.	Years B.P.
ANU-53	Ib	C8/2	42-48	7110 $\pm$ 130

Conclusion

The deposit at Nawamoyrn accumulated over some 20,000 years. There are two carbon dates which suggest that a substantial time elapsed after the sands were deposited and before the overlying midden built up. The stratigraphic sequence at Malangangerr is very similar and a larger series of dates there suggest a similar depositional break. I shall discuss this point later.

The deposit at Nawamoyrn is divided into five main levels. The volume of deposit in each level was calculated fairly roughly according to drawn sections and is tabulated below:

Level	Volume (cu. m.)
Ia - Upper midden	6.2
Ib - Lower midden	3.7
I - General midden	1.9
TOTAL MIDDEN	11.8
II TRANSITIONAL ZONE	1.2
IIIa - Upper sand	4.2
IIIb - Lower sand	5.0
TOTAL SAND	9.2
TOTAL VOLUME	22.2

TABLE V-1
Analysis of Components in 2 Column Samples

The tables show the proportion of each component in each unit, and the level in which that unit occurs.

V-1: Sample 1

Components (Per cent)

Level	Unit	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)
Ia	1	32.8	1.7	0.2	0.3	1.9	-	63.1	230.3
	2	63.0	2.5	0.2	0.5	-	-	33.8	322.5
	3	75.6	0.3	0.4	0.3	-	-	23.4	320.9
	4	71.5	1.2	0.6	1.5	-	-	25.2	373.6
	5	75.1	1.0	1.1	2.3	-	-	20.5	208.0
	6	66.4	1.7	0.9	13.4	-	-	17.6	151.0
	7	44.8	0.6	x	21.2	-	-	33.4	190.4
Ib	8	73.0	1.5	-	4.1	-	-	21.4	74.0
	9	85.7	8.8	-	2.4	-	-	3.1	112.7
	10	60.4	21.0	-	0.1	-	-	18.5	82.7
	11	21.0	41.5	0.4	0.4	-	-	36.7	23.4
II	12	18.9	78.4	-	2.7	-	-	-	3.7

x - present, but in insignificant amounts.

V-1: Sample 2

Components (Per cent)

Level	Unit	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone	Weight (gm.)
Ia	1	31.4	0.9	-	-	2.4	-	65.3	129.8
	2	35.6	4.6	0.4	-	3.4	-	56.0	76.9
	3	71.1	5.0	0.2	0.1	1.6	-	22.0	141.3
	4	55.9	2.4	-	x	0.1	-	41.6	449.2
	5	43.2	1.4	-	0.1	0.1	-	55.2	586.1
	6	20.4	0.4	x	x	x	4.2	75.6	837.3
	7	29.2	0.5	x	-	0.1	-	70.2	559.9
	8	40.1	0.1	-	x	x	-	59.8	954.3
Ib	9	63.6	x	x	x	x	0.2	36.9	1038.3
	10	63.7	x	x	x	x	-	36.3	1405.2
	11	59.0	0.2	x	x	x	-	40.7	878.8
	12	43.6	0.1	x	x	0.6	-	55.7	453.9
II	13	7.1	-	-	0.2	0.3	0.1	92.3	649.3
	14	1.5	-	-	0.1	1.0	-	97.4	324.7
	15	1.1	x	-	-	0.1	-	98.8	203.3

TABLE V-2

Analysis of Components in 2 Column Samples

The tables show the proportion of each component in the three main levels covered by the column samples.

V-2: Level Ia - Upper Midden

Sample	Components (Per cent)							Weight (gm.)	Density per cu. unit
	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone		
1	62.9	1.3	0.5	4.1	0.1	-	31.1	1796.7	50.7
2	37.4	1.2	0.1	-	0.3	0.9	60.1	3734.8	93.3

V-2: Level Ib - Lower Midden

Sample	Components (Per cent)							Weight (gm.)	Density per cu. unit
	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone		
1	70.2	13.1	x	2.0	-	-	14.7	292.8	14.6
2	52.2	0.1	x	x	0.1	x	47.6	4425.5	177.0

V-2: Level II - Transitional Zone

Sample	Components (Per cent)							Weight (gm.)	Density per cu. unit
	Shell	Bone	Crab	Charcoal	Plant	Stone Artef.	Waste Stone		
1	18.9	78.4	-	2.7	-	-	-	3.7	0.7
2	1.4	x	-	x	0.7	-	97.9	528.0	52.8

A. ORGANIC REMAINS

1) Shell Analysis

Shells from four environments occur in this deposit as follows:

1. Mangrove-mudflat species

Potamididae	:	<u>Certithidea obtusa</u>
	:	<u>Telescopium telescopium</u> L.
	:	<u>Terebralia semitrisulcata</u> (Röding)
Ellobiidae	:	<u>Cassidula angulifera</u> Petit
	:	<u>Cassidula rugata</u> Menke
	:	<u>Ellobium aurisjudae</u> Linné
Neritidae	:	<u>Neritina (Dostia) crepidularia</u> Lamarck
	:	<u>Nerita lineata</u>
Geloinidae	:	<u>Geloina jukesi</u> (Deshayes)
Muricidae	:	<u>Naquetia permaesta</u> (Hedley)

2. Fresh water species

Hyriidae	:	<u>Velesunio angasi</u> (Sowerby)
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3. Land species

Camaenidae	:	<u>Xanthomelon sphaeroideum</u> Le Guillou
	:	<u>Arnemelassa creedi</u> (Cox)

4. Marine species

Arcidae	:	<u>Tegillarea granosa</u> (Linne')
Galeodidae	:	<u>Syrinx aruanus</u> Linne'
Trochidae	:	<u>Trochus niloticus</u>
Volutidae	:	<u>Melo</u> sp.

The shells from the column samples were analysed in order to show the proportions of different species over time. The landsnails and all of the mangrove-mudflat shells (with the exception of Nerita lineata) occur in the column samples, but the freshwater and marine forms are absent and constitute a very small percentage of the midden shells.

The results of the column sample analyses are shown in Tables V-3 and V-4 and the main points that emerge are:

- (i) The density of shell increases over time in both samples, but the peak occurs in Level Ia of sample 1 and Level Ib in sample 2. The actual density varies in different samples too and can probably be attributed to the way heaps of refuse accumulated over time. These variations are also seen at Malangangerr.
- (ii) Mangrove-mudflat shells predominate in both samples, as they do at Malangangerr, and the proportions of different species vary over time. In sample 1, the proportion of all species increase over time, except for Geloina jukesi which decreases and is most prolific in Level II. In sample 2 the trends are less steady though Geloina decreases over time too. Some species predominate in Level Ia (Cerithidea, Neritina etc.) and others reach their peak in Level Ib (Telescopium, Ellobium).

Although there is some variation in the distribution of different species over time, the faint but steady

pattern of change that is observed at Malangangerr is not repeated here. The changes that occur probably reflect the complexities in midden accumulation over time, differential weathering of shells and slight changes in the shells available in the mudflats of the river. One should bear in mind that only two samples are analysed and more extensive sampling may reveal more general trends.

TABLE V-3

Analysis of Shell Species in 2 Column Samples

The tables show the proportion of different species in each unit, and the level in which the units occur. The numbers refer to the following species:

1. Cerithidea obtusa
2. Telescopium telescopium
3. Cassidula angulifera and Cassidula rugata
4. Geloina jukesi
5. Neritina (Dostia) crepidularia
6. Ellobium aurisjudae
7. Terebralia semitrisulcata
8. Naquetia permaesta
9. Xanthomelon sphaeroideum and Arnemelassa creedi

V-3: Sample 1

Level	Unit	Species (Per cent)									Weight (gm.)
		1	2	3	4	5	6	7	8	9	
Ia	1	11.1	5.7	1.4	71.0	6.6	4.2	-	-	-	75.5
	2	37.3	3.7	1.9	39.7	12.6	4.8	-	-	-	203.1
	3	43.7	5.6	2.2	21.2	21.6	5.7	-	-	-	242.2
	4	47.2	5.4	1.7	21.6	19.7	4.0	-	-	0.4	266.8
	5	46.0	14.4	4.2	16.6	12.7	6.1	-	-	0.1	156.2
	6	26.4	23.6	7.7	34.1	1.8	6.4	-	-	-	100.2
	7	2.1	16.2	11.5	63.3	0.8	6.1	-	-	-	85.3
Ib	8	3.9	7.2	6.8	77.8	0.9	1.7	-	-	1.7	54.1
	9	1.2	0.6	0.1	96.8	0.6	0.7	-	-	-	96.6
	10	0.2	0.2	0.6	98.4	-	0.6	-	-	-	49.9
II	11	-	-	-	100.0	-	-	-	-	-	4.9
	12	-	-	-	100.0	-	-	-	-	-	0.7

V-3: Sample 2

Level	Unit	Species (Per cent)									Weight (gm.)
		1	2	3	4	5	6	7	8	9	
Ia	1	12.7	6.6	0.2	70.2	7.6	2.5	-	-	0.2	40.7
	2	15.3	4.0	0.4	80.3	-	-	-	-	-	27.4
	3	12.4	6.7	1.9	77.3	0.1	1.6	-	-	-	100.5
	4	53.1	3.7	2.0	37.8	2.0	1.4	-	-	-	251.4
	5	31.8	9.1	1.8	46.2	3.2	3.1	2.2	-	2.6	253.8
	6	41.3	10.4	3.5	35.3	5.9	2.8	-	0.4	0.4	171.6
	7	45.5	18.7	2.2	25.9	5.3	1.9	-	-	0.5	163.0
	8	52.5	20.8	2.4	16.1	4.3	3.9	-	-	x	383.4
Ib	9	40.0	40.1	2.5	9.8	3.8	3.8	-	-	x	651.4
	10	22.2	51.3	2.6	17.2	1.9	4.8	-	-	-	894.8
	11	15.9	51.4	3.4	23.9	1.0	4.2	-	0.2	-	519.2
	12	4.8	29.4	4.9	58.1	0.9	1.9	-	-	-	197.4
II	13	5.8	16.4	6.5	64.4	0.9	6.0	-	-	-	46.3
	14	4.1	36.6	6.1	53.2	-	-	-	-	-	4.9
	15	13.2	17.4	-	69.4	-	-	-	-	-	2.3

TABLE V-4

Analysis of Shell Species in 2 Column Samples

The tables show the proportion of shell species in the three main levels covered by the column samples. The numbers refer to the same species listed in Table V-3.

V-4: Level Ia - Upper Midden

Sample	Species (Per cent)									Weight (gm.)	Density per cu. unit
	1	2	3	4	5	6	7	8	9		
1	37.0	8.8	3.4	31.6	13.9	5.2	-	-	0.1	1129.3	32.2
2	41.8	12.3	2.1	36.4	3.7	2.6	0.4	0.1	0.6	1391.8	34.8

V-4: Level Ib - Lower Midden

Sample	Species (Per cent)									Weight (gm.)	Density per cu. unit
	1	2	3	4	5	6	7	8	9		
1	1.7	2.3	2.0	92.6	0.5	0.9	-	-	-	205.5	10.3
2	23.9	45.7	3.1	21.1	2.1	4.1	-	x	x	2309.1	92.3

V-4: Level II - Transitional Zone

Sample	Species (Per cent)									Weight (gm.)	Density per cu. unit
	1	2	3	4	5	6	7	8	9		
1	-	-	-	100.0	-	-	-	-	-	0.7	0.1
2	6.9	30.5	4.2	58.4	-	-	-	-	-	7.2	0.7

2) Bone Analysis

Bone occurs throughout the midden and the transitional zone and in the upper part of the sand. All identifiable fragments were retained and the species are identified according to cranial remains as follows:

1. Mammals

The following animals occur:

Peramelidae	: <u>Isodon macrourus</u> (Gould)	Bandicoot
Phalangeridae	: <u>Trichosurus vulpecula</u> (Kerr)	Possum
	: <u>Petaurus breviceps</u>	Gliding possum
Dasyuridae	: <u>Satanellus hallucatus</u> (Gould)	Native 'cat'
Macropodidae	: <u>Macropus antilopinus</u> (Gould)	Antilopine kangaroo
	: <u>Wallabia agilis</u> (Gould)	Sandy wallaby
	: <u>Petrogale penicillata</u> sub sp.	Rock wallaby
Sub-order Microchiroptera sp.		Bat
Caninidae	: <u>Canis familiaris dingo</u>	Dingo
Muridae	: <u>Hydromys chrysogaster</u> Geoffrey	Water rat
	: <u>Rattus tunneyi</u> (Thomas)	Tunney's rat
	: ? <u>Rattus conatus</u> Thomas	Cane rat
	: <u>Melomys</u> sp.	Fawn footed rat

These animals are similar to those found at the other coastal plain sites, with two exceptions: this is the only site containing the remains of a dingo (one pre-molar) and S. harrisi is absent here.

The minimum number of mammals in each level is as follows:

Species	Level					Total Nos
	Ia	Ib	I	II	IIIa	
<u>Isoodon macrourus</u>	10	10	3	3	2	28
<u>Trichosurus vulpecula</u>	6	3	1	1	-	11
<u>Petaurus breviceps</u>	-	1	-	-	-	1
Phalangerid	1	-	-	-	-	1
<u>Satanellus hallucatus</u>	4	1	1	-	1	7
<u>Macropus antilopinus</u>	1	-	-	-	1	2
<u>Wallabia agilis</u>	2	1	1	1	-	5
<u>Petrogale penicillata</u>	1	1	-	-	-	2
Microchiroptera sp.	1	-	-	-	-	1
<u>Canis familiaris dingo</u>	1	-	-	-	-	1
<u>Hydromys chrysogaster</u>	-	2	-	-	-	2
<u>Rattus tunneyi</u>	1	2	-	-	-	3
<u>?Rattus conatus</u>	2	2	-	-	-	4
<u>Rattus sp.</u>	-	-	-	1	-	1
<u>Melomys sp.</u>	1	-	-	-	-	1
Total	31	23	6	6	4	70

The bandicoot is the most common animal, followed by the possum. This is the same pattern that is found at Padypadiy and Malangangerr. The dingo occurs at the top of the midden and must have been deposited in the latest occupational phase. Unfortunately, there are too few animals present to show any real faunal change over time

2. Fish

Fish remains occur in the midden and transitional zone below. Only one species, Silurus sp. (catfish), was identified according to its distinctive cranial fragments.

3. Reptiles

Reptile remains occur in and above Level IIIa and include skull fragments, limb bones, carapace and plastron. The following species were identified according to cranial remains:

Boidae	:	<u>Python</u> sp.	Python
Varanidae	:	<u>Varanus</u> sp.	Goanna
Agamidae	:	<u>Agamid</u> sp.	Agamid lizard
	:	<u>Chlamydosaurus kingi</u>	Dragon lizard

Fresh water tortoises also occur but no specific identifications could be made because only post-cranial remains were identified.

The minimum number of reptiles, (other than tortoises) in each level, is calculated according to skull fragments as follows:

Species	Level					Total
	Ia	Ib	I	II	IIIa	
<u>Python</u> sp.	1	1	-	-	-	2
<u>Varanus</u> sp.	1	4	1	1	-	7
<u>Agamid</u> sp.	5	3	-	3	1	12
<u>Chlamydosaurus kingi</u>	-	-	-	-	1	1
Total	7	8	1	4	2	22

4. Birds

Avian longbones occur throughout the deposit, from Level IIIa upwards. A few quills and fragments of eggshell occur in the upper level of the midden, which belong to the magpie goose, Anseranas semipalmata.

5. Crabs

Crab claws occur mainly in the upper level of the midden. Most of them belong to the small mangrove crab Sesarma sp., and a few large claws belong to the large mangrove crab, Scylla serrata.

6. Humans

Human bones occur throughout the midden and a few are tentatively identified from the underlying Levels II and IIIa. Most of the bone is charred and broken and lay scattered in and amongst the food debris. Two discrete burials occur, one in sq. F3 and the other in sqs D12 and E11.

The bones are analysed according to the level in which they occur (Table V-5) as follows:

a. Level Ia

(i) F3/1: (Plate V-7)

A flexed burial was encountered between five and 15 cm. below the surface. Some bones were disturbed by water running along a modern rill. No pit or hollow was noted and it seems that the body was simply placed on the surface of the midden.

The skeleton lay on its left side facing north. The hands were in front of the face and the knees were well drawn up below the chin. Most of the bones are present but many are broken. An analysis of the skull (see Appendix V-1) shows that the body is an adult with signs of dental pathology. The sex was not determined.

Three human teeth and a few skull fragments (labelled skull ?second) were found near the skeleton, but they belong to another individual. They may constitute some form of grave goods, or else they may simply be part of the general midden refuse.

(ii) El1/2 and 3:

A concentrated heap of bones was noted in the north part of this square, some 5-24 cm. below the surface. The rest of the skeleton was not removed though several bones were visible in the north wall of the square. One tooth (Appendix V-1) found here, belongs to an adult.

(iii) General:

Scattered human bones occur in the west trench. The remains of at least three individuals (two adults, one juvenile) are present. A few scattered teeth and one edentulous mandible also occur, all of which are attributed to adults (Appendix V-1).

b. Level Ib

These remains occur in the west trench, scattered over a wide area. The remains of at least two adults and possible one juvenile are represented here.

There are two skulls in this group of bones. The first (I1/3) comes from the bottom of the midden and was found in a fragmented condition resting on the top of the transitional zone (Plate V-8). It belongs to an adult male and shows signs of dental pathology (Appendix V-1).

The second skull (F2/4 and 5) lay in the heavy midden about 20-30 cm. below the surface. The foramen magnum lay uppermost and the mandible lay below. It belongs to an adult but the sex has not been determined (Appendix V-1.).

Three teeth were found in this group, all of which belong to adults (Appendix V-1).

c. Level I

An extended burial occurs in sqs D12 and E11. It is attributed to Level I because although some of the leg bones occur in Level Ib (E11/4 and 5) most of the skeleton occurs in the midden in D12/1 which was removed in one large unit (Figure V-7).

The skeleton lay on its back on a slight slope. The skull was uncovered about 15 cm. below the surface in sq. D12, and the feet about 30 cm. below the surface in sq. E11. Several large stones lay on the chest, pelvis and legs and no pit or hollow was observed.

The body was apparently placed on the surface of the midden and large rocks were placed on it. One (80 lbs) was placed on the ribs and two (50 lbs and 27 lbs) on the pelvis. Smaller rocks were laid on the legs just above the knees.

Most of the skeleton is present, except for both humeri and one patella. The other bones are fragmented and many were probably crushed by the weight of the rocks above. Most of the remains were in articulation except for the mandible, the proximal end of the left ulna and several metapodials.

The skull, left femur, scapula and clavicle are analysed in detail (see Appendix V-1). The skeleton is identified as an adult male and certain pathological anomalies were noted on the left scapula and clavicle.

This body was clearly buried according to a prescribed plan or ritual. The rocks may have been placed on the body to protect it from predators, but they may reflect some belief in the supernatural. The humeri and patella may have been removed by predators, but it seems unlikely that they would have been so selective; it is more likely that the bones were removed by men, possibly to serve some other ritual purpose.¹

d. Level II

Five fragments of bone occur here, but I cannot say with certainty that they are human and I do not therefore assume that they represent an individual.

e. Level IIIa

Four fragments occur here, but again I am doubtful of their identity and treat them in the same way as the bones in Level II.

¹ I identified the post-cranial material myself and it is of course possible that I failed to recognise fragmented parts of the humeri.

TABLE V-5
ANALYSIS OF HUMAN BONE IN NAWAMOYN
(Number of Bones)

Bone	Level						
	Ia			Ib	I D12/1, E11/4 & 5	II	III
	F3/1	E11/ 2 & 3	General				
Teeth:							
Adult	3	1	4	3			
Juvenile	-						
Child	-						
Mandible	-		1				
Skull (complete)	1			2	1		
Skull fragments	20		20	x			
Scapula	1		1	2(L) 1(?)	1(L) 1(?)		
Humerus	1(L) 1(R)		1	1(L) 1(R)	-		
Radius	1(L) 1(R)		1(L)	1	1(L) 1(R)		
Ulna	1(L) 1(R)		1	2(L) 1(R)	1(L) 1(R)		
Carpal	x	3		2	7		
Metacarpal	6			9	6		
Phalange	13	14	9	11	7	72	
Pelvis	1	1	1	1	1	-	
Femur	1(R) 1(?)L	2	2(R) 1j	1(L) 2(R)	1(L) 1(R)	21	
Patella	1(L) 1(R)			-	1(R)		
Tibia	1(L) 1(R)			1 1j	1(L) 1(R)		
Fibula	1(R)			-	-		
Tarsal	4	1	10	9 [2(R) calcanea]	4(L) 4(R)		
Metatarsal	x	2		3	5(L) 5(R)		
Phalange	x	3	3	5	10		
Metapodial	37		-	7	x	-	
Vertebra	x	x	3	22	x	2	
Sternum	1		-	2	1		
Rib	x	x	3	78	43		74
Clavicle	1		1	1	1(L)		
Minimum nos :							
Adult	2	1	2(femora)	2	1		
Juvenile	-	-	1	21(tibia)	-		
Total	2	1	3	73	1		

Key: x - present
j - juvenile

Conclusion

The remains of at least nine individuals occur at Nawamoyn. Two of these individuals were buried in a specific position in the deposit, though neither was placed in a pit. The other remains occur scattered throughout the midden and probably reflect some form of secondary burial, such as that found at the other two coastal plain sites.

These scattered fragments occur throughout the midden which suggests that secondary burial was practised for at least 7,000 years whilst the midden accumulated.

ORGANIC REMAINS - Conclusion

The organic remains at Nawamoyn reflect the Aboriginal exploitation of a coastal plain environment for some 7,000 years. The remains are very similar to those found in the nearby shelters, Padypadiy and Malangangerr, and include shells, bones of aquatic and terrestrial animals. Unlike Malangangerr, there is no consistent change in the proportion of different shell species over time and it is very likely that this is due to limited sampling rather than any other cause.

B. IMPLEMENTS

The deposit contains implements of bone, shell and stone.

1) Bone Implements

There are 63 bone implements which are grouped as follows:

1. Bipoints (Figure V-8, a-d)

There are nine bipoints of which three are intact. All show the characteristic mid-shaft bulge and all are made of mammal bone. One is made on the intact shaft of a bone, and the rest are made on flakes or splinters of longbone. They range in size from 1.6 to 3.1 cm. and were all ground and polished into shape.

2. Unipoints (Figure V-8, e-h)

There are 17 unipoints, 16 of which are broken at the end opposite the tip. Thirteen are mammal bone (three are made on an intact shaft), one is made on a birds longbone, two on a quill and one on a fish bone.

They range in length from 1.0 to 8.7 cm. and most are 1.5-2 cm. long. They were all ground and polished into shape. The tip is formed by the intersection of tiny ground planes in ten points and by a single long bevel on the bird bone and the quill points.

It is possible that the shorter points were originally the tips of bipoints but it is impossible to distinguish the particular examples now.

3. Sections

There are ten sections of mammal bone. Eight are pieces of the intact shaft of a longbone and two are splinters of bone. They range in length from 1.3 to 2.2 cm. Five are ground and all of them have a high gloss.

4. Spatulated points (Figure V-8, i-l)

There are 11 of these points and all are broken. There are five intact tips and all were formed by grinding and polishing. One specimen was snapped off at the end and the scar is overlain with a high gloss. Another fragment of shaft (H2/4) is covered with red ochre.

5. Utilised flakes (Figure V-8, m-o)

There are 13 flakes of mammal bone which show signs of use. One (D11/6) is a flat squarish piece with unifacial use-wear along one side, and the others are long splinters with areas of localised gloss.

6. Utilised teeth (Figure V-8, p-q)

There are two of these artefacts. The first (C8/1) is a wallaby incisor (Wallabia agilis) with an unusually high gloss on the lingual surface. The second (D11/3) is the upper incisor of a kangaroo (Macropus antilopinus) with a hole drilled through the root: it may well be an ornament.

7. Miscellaneous (Figure V-8, r)

There is a fragment of bird bone (H2/4) with the articular end intact. The other end is scarred and was apparently cut and then snapped off. The break has subsequently been ground over.

Conclusion

There is a wide range of bone tools at Nawamoyne and they are distributed in the deposit as follows:

Distribution of Bone Tools at Nawamoyu

Implements	Level								Total	
	Ia		Ib		I		II			
	Nos	%	Nos	%	Nos	%	Nos	%	Nos	%
1. Bipoints	7	16.7	2	11.8	-	-	-	-	9	14.3
2. Unipoints	13	30.9	4	23.5	-	-	-	-	17	27.0
3. Sections	8	19.1	2	11.8	-	-	-	-	10	15.8
4. Spat. points	6	14.3	4	23.5	1	33.3	-	-	11	17.5
5. Util. flakes	6	14.3	4	23.5	2	66.7	1	100.0	13	20.6
6. Util. teeth	2	4.7	-	-	-	-	-	-	2	3.2
7. Miscell.	-	-	1	5.9	-	-	-	-	1	1.6
Total	42	100.0	17	100.0	3	100.0	1	100.0	63	100.0

Most of these types are also found at Padypadiy and Malangangerr Level I, which helps to stress the cultural similarity in the three sites. At Nawamoyndas at Malangangerr, most of the tools occur in the upper level of the midden, but this is possibly related to differential preservation of bone in various parts of the midden.

The proportion of bipoints and unipoints increases over time, whereas the relative number of spatulated points decreases. One may well argue that this trend is not very significant since very few tools are present. However, this same trend is noted at Padypadiy and Malangangerr, so that in spite of the small numbers concerned, it may well reflect some form of genuine cultural change over time.

2) Shell Implements (Plates V-9, V-10)

Shell tools occur throughout the midden. Several large ones were recognised during the excavation but small pieces of utilised shell were recovered from the column samples after careful microscopic inspection.

There are 24 fragments of Geloina jukesi with use-wear along the natural margin of the shell. Most of the pieces have tiny flakes detached from the dorsal surface, and in several cases the scars are overlain with use-polish. These fragments occur throughout column sample 1, and only one is found in sample 2.

There are five other artefacts. The first is a large valve of Geloina jukesi (10/3), with a dentated margin where large flakes were detached. The next is

another Geloina valve (J1/3), with a round hole (diam. 1.2 cm.) in the main body of the shell, and a smooth margin. It may have been a pendant.

There are two ark shells Tegillarea granosa, (F2/3, I2/6), with holes drilled in the base. One is covered with red ochre.

Finally there is a large triangular fragment of baler shell (Melo sp.) with use-polish along one edge.

Conclusion

The inhabitants of Nawamoyyn used local mangrove-mudflat shells and marine shells as ornaments and artefacts. The marine shells may have been traded into the area or collected during trips to the coast. They occur throughout the midden suggesting that coastal contact existed for some 7,000 years at least.

3) Stone Artefacts

I. OVERALL FEATURES:

The following analysis deals with the density and distribution of worked stone at Nawamoy, the raw materials used in tool making and the ratios of implements to waste flakes.

1. Distribution and density of artefacts

There are 2361 flaked stone artefacts in the deposit of which 109 (4.6 per cent) are implements, and 2252 (95.4 per cent) waste flakes.

The relative density of artefacts in different levels of the deposit is as follows:

Level	Artefacts	
	Nos	Density per cu. m.
Ia	67	10.8
Ib	100	27.0
I	18	0.9
TOTAL I	185	15.6
TOTAL II	83	69.1
IIIa	1356	322.6
IIIb	737	147.4
TOTAL III	2093	227.5
GRAND TOTAL	2361	

¹ The following analysis is based on the principles described in Chapter II and elaborated in Chapters VI and VII.

The density of stone artefacts decreases over time in the same way as it does at Malangangerr. Again, the low density in the midden must be attributed partly to the large bulk of organic matter there. Nonetheless, the densities remain low when compared to other middens, (Padypadiy), and other sandy deposits, (Tyimede I).

2. Raw material

The same four types of rock occur here as are found at Malangangerr, namely quartzite, quartz, chert and igneous/metamorphic rocks of which porphyritic dolorite is the main form.

The proportion of artefacts of different raw materials in each level, is tabulated as follows:

Level	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	I/mm.	Total	
Ia	37.3	25.4	17.9	19.4	100.0	67
Ib	33.0	34.0	24.0	9.0	100.0	100
I	61.1	27.8	11.1	-	100.0	18
TOTAL I	37.3	30.2	20.6	11.9	100.0	185
TOTAL II	53.0	32.6	8.4	6.0	100.0	83
IIIa	39.7	34.8	15.3	10.2	100.0	1356
IIIb	37.4	43.6	9.9	9.1	100.0	737
TOTAL III	38.9	38.0	13.4	9.7	100.0	2093

Quartzite and quartz are the most important raw materials and occur in roughly equal proportions throughout the deposit.

The ratio of implements to waste flakes in the various levels is as follows:

Level	Nos of waste flakes per implement				
	Raw material				Total
	Quartzite	Quartz	Chert	I/mm.	
Ia	4.0	4.7	2.0	0.9	2.6
Ib	10.0	16.0	2.4	0.8	4.9
I	10.0	4.0	1.0	-	5.0
TOTAL I	6.7	8.3	2.3	0.8	3.7
TOTAL II	10.0	26.0	6.0	4.5	9.4
IIIIa	19.7	93.6	19.7	44.7	29.8
IIIIb	33.4	160.0	23.1	12.4	39.9
TOTAL III	23.0	112.5	20.6	23.2	32.6

The ratio of tools to waste flakes increases markedly over time, and the ratios of chert and I/mm. implements to waste products are consistently higher than the quartzite and quartz ratios.

This same trend also occurs at Malangangerr, where an analysis of the size of waste flakes was made to help interpret its meaning.

3. Size and shape of waste flakes

Samples of about 30 per cent of the waste flakes in each level were analysed¹ and the distribution of different sized flakes in each level is shown below:

¹ See Chapter VI p.267.

Level	Waste flakes (Per cent)					Total Nos
	Inches square					
	> 3/4	3/4-1/2	1/2-1/4	1/4-1/8	Total	
I	20.0	37.1	20.0	22.9	100.0	35
II	6.1	45.4	42.4	6.1	100.0	33
III	7.4	24.3	54.8	13.5	100.0	593

These results are very similar to those found at Malangangerr in that there are relatively more smaller flakes in Level III, but comparatively few flakes smaller than 1/4 inch in any level. Again it seems that the type of secondary retouch practised at Tyimede I and II, was not done at Nawamoy, and that although the earliest inhabitants flaked more stone at the site, they produced somewhat larger flakes.

Most of the waste flakes are squarish in shape. There are several thermal flakes in Level III and several flakes in the lowest level are abraded and patinated. It is somewhat difficult to distinguish use-wear as opposed to physical weathering on these flakes, and I have tried to exclude all dubious specimens. As a result the class of utilised flakes in this level probably represents the minimum number present.

II. ANALYSIS OF ARTEFACTS:

Artefacts are analysed according to the three main levels in the deposit. Their distribution within each level is discussed at the end of each section.

1) Level I - Midden

(i) FLAKED STONE IMPLEMENTS

There are 39 implements as follows:

1. Points (Figure V-9, a-c)

There are three points; one is made of quartzite and two of chert. They range in length from 4.0 to 7.3 cm. The quartzite point (G2/1) has a curved butt, a lenticular cross-section and straight sides. It is extensively bifacially retouched and shows no signs of utilisation.

Both chert points (A11/1 and H1/3A) are made on endstruck flakes with flakes struck off the dorsal surface from the striking platform. A11/1 has a squarish butt, a triangular cross-section and is unifacially retouched with heavy step and scalar flaking. There is a little bifacial working at the tip, and a little inverse use-wear (Type 3) along one side. The other point, H1/3A, has a square butt and a cross-section shaped like a right angled triangle. One side is steeply retouched with unifacial step flaking that closely resembles the backing on an Audi or Chatelperron point.¹ There is a faint trace of use-polish along this

¹ de Sonnevile-Bordes, D. 1960 pp.151-67; Bordes, F. 1961 Planche 35.

edge too. The other side has light unifacial scalar retouch along both surfaces.

The use-wear on both chert points suggests that they were probably used for cutting or scraping. The shape of H1/3A suggests that it may have been held like a penknife.

2. Shaft

There is one chert shaft with a triangular cross-section and bifacial retouch.

3. Scrapers (Figure V-9, d-e)

There are two quartzite implements. The first, I2/1-1, is an endstruck flake somewhat oval in plan with a cross-section shaped like a right angled triangle. It is retouched along one side where blows were struck from both surfaces, to produce steep backing. The other side is unretouched with marked use-polish on both surfaces. The gloss is dull on the ventral surface and extends about 1.9 cm. in from the edge. It is bright on the dorsal surface and extends about 1.0 cm. in from the edge.

The second implement I0/-2, shows no direct signs of being made on a flake. It is 4.9 x 2.6 x 1.7 cm. and is similar to the previous implement in every way, except that the utilised edge shows both use-polish and snapping, since several flakes came off the edge after the gloss was acquired.

Similar implements from the Oenpelli area have been termed 'elouera'¹ and it is necessary therefore to review the definition of this tool type.

'Elouera' is the Aboriginal word for Illawarra, a locality on the east coast of Australia. Towle² suggested that it be used to describe the 'chipped-back' knives³ which occurred there in some numbers. He hoped that it would be 'a non-committal title, which will not suggest usage, but will serve to distinguish this type from other flakework types'.⁴

There was some controversy about the function of these tools,⁵ and the term 'elouera' was used fairly widely to describe both the implements and the industry.⁶ Campbell and Noone⁷ noted that a wide range of forms could be grouped together as chipped-back knives, and McCarthy⁸ concluded that elouera seemed to have been used for a wide range of activities. He suggested later⁹ that the elouera must have been an adze flake, citing Hunter's¹⁰ report that New South Wales Aborigines hafted stone

¹ McCarthy, F.D. and Setzler, F.M. 1960 pp.250-87.

² Towle, C.C. 1930 pp.3-16.

³ See Hall, L.D. 1928 pp.254-79.

⁴ Towle, C.C. 1930 p.8.

⁵ Turner, R. 1931 pp.30-5.

⁶ McCarthy, F.D. and Davidson, F.A. 1943 pp.210-30.

⁷ Campbell, T.D. and Noone, H.V.V. 1943 p.293

⁸ McCarthy, F.D. 1943 pp.139-45.

⁹ McCarthy, F.D. 1948 p.31.

¹⁰ Hunter, J. 1793 p.519.

tools for use as an adze. Unfortunately, Hunter does not describe the hafted stone, so that it is impossible to know whether it resembled an elouera or not.

In 1946, the elouera was defined as '...a segment, triangular in transverse section, which bears scraper trimming on one or both edges of the thick margin, and either scraper trimming or evidence of cutting use on the thin margin'.¹ In 1960 elouera were reported from Oenpelli, and one was discovered hafted in resin at the end of a wooden handle.² The authors noted that it was mounted in line with the handle as an axe, thereby resolving some of the earlier controversy about which side of the implement represented the functional edge. Finally in 1967, the definition of elouera was widened to include the Oenpelli examples where the chords 'display use-polish and no trimming on the majority of examples'.³

I examined 91 implements, classified as elouera in the Oenpelli collection.⁴ Few of them conform to the formal definition of an elouera, since they show a wide variety of shapes and sizes and contain varying amounts of secondary retouch. On the other hand, most of them are made of red quartzite and have a distinctive form of

¹ McCarthy, F.D. et. al., 1946 p.28.

² Setzler, F.M., and McCarthy, F.D. 1950 pp.1-5.

³ McCarthy, F.D. 1967 p.26.

⁴ Housed at the Australian Museum, Sydney, and examined there by courtesy of the Curator of Anthropology, Mr D.M. Moore.

use-polish along one edge, the gloss being dull on one surface and bright on the other.

These tools therefore constitute a functional group rather than a formal one, and since the original definitions of an elouera were based on form, it is perhaps wiser at this stage to avoid any cultural implications by classifying the Oenpelli specimens as 'scrapers' or 'utilised flakes' as the case may be, with the proviso that some resemble elouera in the morphological sense only.¹

4. Cores/Core scrapers

There are three globular pieces of quartz which are bifacially flaked around the perimeter. They range in length from 4.8 - 7.5 cm. and are all roughly oval or circular when viewed dorso-ventrally. One piece (E11/4) is bruised along the edges and probably served as a hammer.

5. Utilised flakes (Figure V-9, f-g)

There are three utilised flakes. The first, E2/1-1, is a triangular fragment of coarse quartzite with use-polish along one edge. This polish is almost identical to that found on the scrapers, being bright on one surface and dull on the other. It seems clear that despite the formal differences, all these tools performed similar functions.

¹ Steward, J.H. 1954 p.54. 'The morphological type...is based solely on form - on physical or external properties. When the use or cultural significance of an object...is unknown, a descriptive label is necessary'.

The second flake, I2/5-15, is a thin endstruck quartzite flake with smoothing along one side. The third, J2/2-1, is a crescent shaped piece of chert with unifacial use-wear and smoothing along the chord.

6. Utilised lump

There is one quartz lump 6.0 x 3.3 x 2.7 cm., with unifacial use-wear and bruising along one edge.

7. Miscellaneous

There is a chert endstruck flake with bifacial flaking along both sides. A large fragment has snapped off on one side, but it is still roughly oval in plan. Use-wear occurs along one edge where the light bifacial flaking is overlain by a slight gloss.

8. Axes (Figures V-10, V-11)

There are 13 axes in this level. They show a wide variety of forms and are individually described in Appendix V-2.

Most of the axes are made of porphyritic dolomite and one is quartzite. Eleven are finished implements and the other two probably represent an early stage of manufacture.

All of the finished axes were bifacially retouched and then ground to form a cutting edge. This cutting edge occurs at the end of ten axes and on the side in one case, (I1/1-1). None of the axes is grooved, but one, (I1/3-2), could be termed 'waisted'.

9. Retouched fragments

a. Unifacially retouched fragments

There are nine fragments: two are quartzite, two are quartz and five are chert. They all show signs of step and scalar flaking and two show signs of use-wear. The first is a small fragment of quartzite with smoothing use-wear on one side, the second is a piece of chert with use-polish on one edge and across one surface.

b. Bifacially retouched fragments

There are three fragments: one is quartzite and two are chert. One fragment (I1/3-3) may be the butt of a large quartzite point, but it has broken off short of the point of maximum breadth, so that it is impossible to identify it any further.

Distribution

Implements are distributed in Level I as follows:

Implements	Level						Total	
	Ia		Ib		I			
	Nos	%	Nos	%	Nos	%	Nos	%
1. Points	2	10.5	1	5.9	-	-	3	7.7
2. Shaft	-	-	1	5.9	-	-	1	2.6
3. Scrapers	2	10.5	-	-	-	-	2	5.1
4. Cores/ Scrapers	1	5.3	2	11.8	-	-	3	7.7
5. Util. flakes	1	5.3	2	11.8	-	-	3	7.7
6. Util. lump	1	5.3	-	-	-	-	1	2.6
7. Miscell.	1	5.3	-	-	-	-	1	2.6
8. Axes	7	36.7	6	35.2	-	-	13	33.3
9a Unif. retouch	3	15.8	3	17.6	3	100.0	9	23.0
b Bif. retouch	1	5.3	2	11.8	-	-	3	7.7
Total	19	100.0	17	100.0	3	100.0	39	100.0
Per cent	48.7		43.6		7.7		100.0	

There are very few tools in the midden and this should be remembered when drawing inferences about their distribution. The main feature of this table is that, unlike Malangangerr, points occur throughout Level I. The scrapers are restricted to the top of the midden and the utilised flake with use-polish is also in Level Ia.

(ii) OTHER STONE ARTEFACTS1. Abraded fragments

There is one piece (IO/3) of sandstone which has been ground on both surfaces. It is 7.2 x 4.5 x 2.7 cm. and its function is unknown.

2. Ochre

Lumps of ochre occur throughout this level. The colours include red, white, yellow, orange and purple, and the pieces range in weight from about 2 to 50 gm. The distribution of ochre lumps in different levels is shown as follows:

Level	Ochre	
	Nos	Density per cu. m.
Ia	153	24.7
Ib	60	16.2
I	21	11.1
Total	234	19.8

Ochre is therefore sparsely distributed in the deposit, especially in comparison with Padypadiy. The density of ochre increases over time.

3. Hammers/Pounders (Figure V-12)

There are 19 pebbles that show signs of being used as hammers. Thirteen are quartzite and six are quartz and the 16 intact ones vary in weight from 64 to 1,200 gm. Most hammers were used in one specific place only,

but two were used over a wide area and may have functioned as pounders. Another four are elongated pebbles which were used on both ends over a fairly wide area.

There are eight hammers in Level Ia and 11 in Ib.

4. Rocks with ground hollows (Plate V-6)

There are two rocks with smooth depressions ground into the surface. The first is a large slab 62 x 60 x 20 cm., which comes from squares G1-2 in Level Ia. It has two small hollows (10 cm. diam.) on one surface. The second rock, is 34 x 20 x 10 cm., has one hollow, and comes from Level Ib.

Level I - Conclusion

This is a small collection of artefacts, characterised mainly by relatively few waste flakes and a fairly wide variety of implements including points, scrapers and edge ground axes. As such it is very similar to the collection from Padypadiy, except that there are no small rectangular chert scrapers at Nawamoy. It is also very similar to the industry in Level I at Malangangerr, except that there are no use-polished implements there.

2) Level II - Transitional Zone

(i) FLAKED STONE IMPLEMENTS

There are eight implements in this level.

1. Scrapers (Figure V-13, a)

There are two scrapers. The first, I1/4-6, is quartzite and is probably made on a flake though no bulb of percussion is visible now. It is 7.6 x 2.6 x 2.6 cm. and is somewhat pointed in plan with a high domed cross-section.

It is unifacially retouched with steep step flaking along both sides meeting in a dull point at one end.¹ Chattering use-wear occurs as discrete lengths while smoothing use-wear and a dull gloss are found on the sides and at the tip itself. The tip is dull and worn and it seems that the implement was used as a scraper, plane or as an awl.

The other scraper, H2/7-1, is a lump of chert, 5.8 x 3.2 x 1.5 cm. It is somewhat oval in plan with a domed cross-section and there are several discrete lengths of unifacial step flaking along the sides.

2. Cores/Core scraper (Figure V-13, b)

There is a large fragment of quartzite (J1/4), 5.1 x 4.3 x 3.2 cm. First large primary flakes were detached and then several regular blade-like flakes were removed from the base. No use-wear is found.

¹ The implement resembles a carinated scraper such as those illustrated by Bordes, (Bordes, F. 1961, Planches 33-4).

3. Utilised flake

There is one endstruck chert flake (G1/3) with unifacial use-wear on two sides.

4. Miscellaneous (Figure V-13, c)

There is a broken quartz pebble (I0/4-1) which is bifacially retouched along one edge. The edge is heavily bruised and so is the pebble cortex at the opposite end of the implement. It appears to be a hammer, but unlike other hammers in the collection, it is retouched.

5. Axes (Figure V-14, a-b)

There are two axes listed in Appendix V-2. One is porphyritic dolorite, the other hornblende schist. Both were bifacially flaked and ground to form a cutting edge along the side. One axe (H2/7-2) has a small protuberance on either side just behind the blade, which may have facilitated hafting or may occur purely by chance.

6. Bifacially retouched fragment

There is one small piece of quartzite which is bifacially worked on one side and broken on the other.

(ii) OTHER STONE ARTEFACTS

1. Ochre

There are 24 pieces of ochre which show a similar colour and size range to those in Level I. The density of ochre here is 20 pieces per cu. m. which is roughly similar to that found in Level I.

2. Hammers/Pounder

There is one quartz pebble (367 gm.), which was used as a hammer at both ends.

Level II - Conclusion

There are, again, very few implements in this level. The collection consists mainly of a few chunky scrapers, core tools and axes. The scrapers are very similar to those found in Level III and are quite unlike the small rectangular scrapers that are generally associated with the more recent, point-scraper industry.

3) Level III - Sand

(i) FLAKED STONE IMPLEMENTS

There are 62 implements in this level which are described as follows:

1. Scrapers (Figure V-15)

There are nine quartzite scrapers: five are made on endstruck flakes, one on a sidestruck flake and no bulb is visible on the other three. Two scrapers are thick flakes struck off pebbles and they retain a fairly large area of pebble cortex. The implements vary from 2.2 to 6.4 cm. in length and most are about 4 cm. long. Viewed dorso-ventrally, they are oval or rectangular in shape and somewhat chunky in general appearance.

Eight scrapers are unifacially retouched on two (6) or one (2) sides, with step and scalar flaking. The ninth, (C10/4), is unifacially retouched on the dorsal

surface all around the perimeter with step and scalar flaking. At one end flakes were subsequently struck off the ventral surface so that the edge is hollow or gouge like, when viewed end-on. This may be the most important edge on this implement, or else the flakes may have been struck off the ventral surface in order to reduce that area and facilitate hafting.

2. Cores/Core scrapers (Figure V-16, a-b)

There are three quartzite cores or core scrapers. Two globular pieces have large primary flakes struck off various platforms. The third (I2/8-18) could best be described, in the Australian sense only,¹ as a 'horsehoof core'.² It is a large chunk 6.3 x 5.0 x 4.0 cm., and flakes were struck off the circumference of a plain platform. The first flakes removed were blade-like slivers some 4-5 cm. long. Next large step flakes were removed and finally small step flakes and chattering were produced along the edge.

3. Utilised flakes (Figure V-16, c)

There are 15 utilised flakes of which eight are quartzite, one is quartz and six are chert. The bulb of percussion is visible on all flakes and they range in length from 2.5 to 7.6 cm. Seven flakes show unifacial use-wear along at least one side, five show bifacial use-wear and two flakes have smoothing use-wear down one side.

¹ McCarthy, F.D. 1967 pp.18-9.

² Cf. Clark, J.D. 1959 p.127.

4. Broken utilised flake

There is one quartzite piece with a slight gloss along one edge.

5. Utilised lumps

There are four chunky irregular lumps: one is quartz and three are chert. They range in length from 3.0 to 7.3 cm. and all have discrete lengths of unifacial use-wear, except for the quartz lump which has bruising on two edges.

6. Miscellaneous

There is one large endstruck quartzite flake (I0/5-12), 7.4 x 5.4 x 3.2 cm. It is bifacially retouched with scalar flaking along one end and the edge is slightly bruised too. There is a small quartz pebble (E11/10-2), 3.7 x 2.5 x 2.1 cm. from which several flakes have been removed.

7. Axes (Figure V-14, c; V-17)

There are nine axes listed in Appendix V-2. They are all heavily weathered. One (C11/9) may be a natural pebble and another (H1/7) may be an unfinished axe. One axe is 'waisted' (J1/6-5) and another is grooved on one surface and one side (J1/7-8).

Three axes are small and thin with a triangular outline. These all occur in Level IIIb and are extremely unusual in the Australian context.

8. Retouched fragments

a. Unifacially retouched fragments

There are 12 fragments. Six are quartzite, three are quartz and three are chert. All have short lengths of step and scalar flaking.

b. Bifacially retouched fragments

There are seven fragments, five quartzite, one quartz and one chert. They all show lengths of alternate bifacial flaking.

Distribution

Implements	Level				Total	
	IIIIa		IIIIb			
	Nos	%	Nos	%	Nos	%
1. Scrapers	6	13.3	3	17.6	9	14.5
2. Cores/ Scrapers	2	4.5	1	5.9	3	4.8
3. Util. fl.	14	31.1	1	5.9	15	24.2
4. Br. util. fl.	1	2.2	-	-	1	1.6
5. Util. lumps	2	4.5	2	11.7	4	6.4
6. Miscell.	1	2.2	1	5.9	2	3.2
7. Axes	3	6.7	6	35.4	9	14.5
8a Unif. retouch	10	22.2	2	11.7	12	19.4
b Bif. retouch	6	13.3	1	5.9	7	11.4
Total	45	100.0	17	100.0	62	100.0
Per cent	72.5		27.5		100.0	

Most implements occur in the upper level, but the same types of tools occur in both levels. There are relatively more axes in Level IIIb but it is probably more significant that three of these have unusual triangular shapes; this is perhaps the only real difference between the implements in these two horizons.

(ii) OTHER STONE ARTEFACTS

1. Ochre

Ochre occurs throughout this level and the same wide range of colours is found as is noted in Level I. The fragments are larger though, and there are several large pieces of haematite, each weighing several hundred gm. The distribution and density are as follows:

Level	Ochre	
	Nos	Density per cu. m.
IIIa	145	34.5
IIIb	102	20.4
Total	247	26.8

Ochre is slightly more densely distributed here than in the overlying levels.

2. Hammers/Pounders (Figure V-16, d)

There are 22 pebbles showing signs of use as hammers. Eleven are quartzite and 11 are quartz. Twelve are intact and weigh between 67 and 600 gm. One, B11/9-8, is a

round pebble hammered all around the perimeter so that it looks exactly like a 'kulki' percussion stone.

There are 12 hammers in Level IIIa and ten in IIIb.

3. Rock with ground hollow

There is a rock in Level IIIa (30 x 25 x 10cm), with a small depression, (diam. 11cm.) ground into the surface.

Level III - Conclusion

This assemblage is relatively small, but it has several outstanding features. Firstly, the relative numbers of waste flakes suggest that the assemblage was manufactured on the spot and secondly the main tool types are chunky scrapers, core tools, utilised flakes and edge ground axes. One axe is grooved and another is waisted as if to facilitate hafting. There are no small points or scrapers such as those commonly found in later industries in this area.

The assemblage is very similar to that from Malangangerr Level III which is roughly contemporary according to a large series of carbon dates. It is also similar to the series from Tyimede II Level III which is considerably younger.

C. ROCK PAINTINGS

There are no rock paintings in the main shelter at Nawamoyu but a few faded ones can be seen along the east face of the main block.

There are two tortoises and two stick figures. The first tortoise (42 x 20 cm.) is faded and appears to have been painted originally in dark red. Faint white lines indicate the outline and the position of the gut so that this can be termed as X-ray painting (Plate V-11). The second tortoise (47 x 15 cm.) is also faded, and has been drawn with a heavy red outline filled in with a faded red.

Both stick figures are red but are too faded to distinguish any formal details. One is 34 x 3 cm. in size, the other is about 17 cm. long. Both were called 'mimi' by the Aboriginal informants.

GENERAL CONCLUSION

Perhaps the most significant feature about the evidence from Nawamoyrn is that it practically duplicates the sequence at Malangangerr, thereby overruling any doubts about the age of the deposits in general and the antiquity of edge ground axes in particular.

A reconstruction of the prehistory of the site, may be attempted as follows:

Men first occupied Nawamoyrn over 20,000 years ago. They camped on the pebbly floor and flaked stone tools. The occupation was probably seasonal then because the shelter was a run-on site and water flowed over the pebbles, removing all organic remains and abrading the stone implements lying there.

Gradually the deposit built up. The occupants continued to make stone tools and they also used edge ground axes, several of which show signs of having been shaped for hafting. No dietary remains occur though there are several heavy stone pounders which may have been used to pulverise tough vegetable food.

The radiocarbon dates suggest that a considerable time elapsed after the lower sands accumulated, and before the midden built up above. A similar gap occurs at Malangangerr, and it may reflect a period of non-occupation or alternatively, the effect of local weathering processes.

About 7,000 years ago the new inhabitants camped on the slightly domed surface of the sand. They dropped shells, bones and charcoal on the floor and a

transitional zone is defined where these have been scuffed and trodden into the sand. Gradually a midden of organic remains accumulated, which is roughly contemporary with the midden at Malangangerr and reflects a similar economy.

The inhabitants ate a wide variety of terrestrial and aquatic animals and collected shellfish from intertidal mudflats. There is some variation in the proportion of different shell species found over time, but the change is far less consistent than that found at Malangangerr. No vegetable remains occur, but pounders are found which may have been used to prepare such food.

The occupants buried their dead in the midden and practised both primary and secondary burial. They used bone, shell and stone tools, and although there are rather few tools in the deposit, several important observations can be made.

Firstly, the artefactual assemblage as a whole closely resembles that found at Padypadiy and Malangangerr. The bone and shell tools were probably made on the spot, whereas the stone tools were clearly manufactured elsewhere. Secondly, the analysis of bone tools shows that there are proportionally more spatulated points in the lower levels, whilst bipoints and unipoints increase in the upper levels. This trend also occurs at the other two plains sites, thus supporting the reality of this change.

Finally the range of stone tools is again similar to that found at Padypadiy and Malangangerr. There are no major variations over time, and unlike Malangangerr,

points occur throughout the midden. There are also several implements with a distinctive form of use-polish which is similar to the polish found on utilised flakes in Padypadiy.

CHAPTER VI

EXCAVATIONS AT PLATEAU SITES I : TYIMEDE I

INTRODUCTION

Tyimede (pronounced Jeemari) is the Gunwinggu name of a small area containing a re-entrant in a valley of the escarpment about 14 miles on a bearing of 110° from Oenpelli Mission ($12^{\circ}24'$ S. Lat., $133^{\circ}15'$ E. Long). The area was investigated in 1964 at my suggestion by Mr R.J. Lampert,¹ and two Aboriginal guides. They reported two shelters and these were excavated in 1964 and 1965. They are called Tyimede I and II (Figures I-2, VI-1).

The re-entrant at Tyimede is formed in a large cliff of Kombolgie sandstone. The cliff is comprised of massive sub-horizontal beds of quartzite and quartz conglomerate, which are in parts cross-bedded. Below the cliff is a scree slope of rocks that have weathered off it and now lie scattered on the slope and valley plain.

The nearest permanent water is a few hundred yards north of the re-entrant where a perennial spring seeps through the mossy undergrowth. Approximately half a mile south of the re-entrant is a cavern from which a subterranean spring flows all year round (Plate VI-1). A seasonal rain wash flows over a nick at the top of the cliff on the north side of the re-entrant, along the base of the cliff and over the scree slope below.

¹ Research Officer, Department of Anthropology, A.N.U.

Tyimede I is a shallow southwest facing recess at the base of the cliff on the north side of the re-entrant. The cliff is approximately 10 m. high at this point and there is a vertical joint immediately above the shelter where the cross-bedding dips down.

The shelter is fully exposed on the southwest side and partly exposed on the east and west sides. The seasonal rain wash that flows over the cliff, runs down the side of the slope, over the rocks at the east side of the shelter, across the entrance and then out along the base of the cliff at the west end. The dripline is apparent on the margin of the recess where small pebbles and coarse sand line shallow rills (Figures VI-2, VI-3; Plate VI-2).

Several large trees growing at the entrance help to shade the shelter during the day and the overhanging cliff affords protection from the rain. As a result the effective sheltered area is about 11 m. wide and 5 m. deep. The floor slopes slightly downwards towards the entrance suggesting a slightly greater accumulation of deposit within.

Several signs of human occupation were noted when the shelter was first seen in 1964. The roof and walls are black with soot and there are paintings on the walls. A stone tool and several fragmentary mussel shells lay on the surface and at the back of the shelter was a decayed sheet of paperbark and a fragment of a human tibia.

Modern weathering is evident in the shelter and at various undercuts along the base of the cliff.

Slightly acid iron-stained solutions have percolated through the joints and bedding planes and helped to weather the cliff, and the recess was probably formed by water and wind erosion.

METHOD OF EXCAVATION

In August 1964 Mr R.J. Lampert dug a 30 cm. square test hole in Tyimede I to see whether it contained archaeological material. As a result it was excavated in October 1964 for ten days by myself assisted by Mr H.W. Morris¹ and two Aboriginal helpers. Further excavations were made in September 1965 for two weeks, by C.W., and J.P. White and two Aboriginal helpers.

The deposit consists largely of unstratified sand interspersed with blocks and angular rubble. It was excavated in spits ranging from 5-15 cm. in depth which were removed in accordance with the slope of the surface. The positions of all implements recognised as such in the field, were recorded in three dimensions. Paintscrapers and brushes were used to remove the deposit and the material was sieved through 1/4 inch plastic sieves.

The excavation covers an area of approximately 12 sq. m. The area excavated in squares 3-4 F increased as the rock wall sloped away and the total excavation covers approximately 1/3 of the available area within the shelter.

¹ Patrol Officer, Department of District Administration, T.P.N.G.

STRATIGRAPHY

The deposit at Tyimede I consists of sand interspersed with weathered blocks of sandstone that rest in part on larger blocks of ferruginised sandstone with a crust of haematite and limonite. Some of the rocks were weathered off the roof and walls of the shelter, others apparently form part of the scree slope at the foot of the cliff. Material was excavated between the large blocks to a maximum depth of 1 m. (Figures VI-4, VI-5; Plates VI-3, VI-4).

The pH of the sand is 5.5 throughout but the colour varies in different places. The sand is yellowish brown (10 YR 5/4) to brown (7.5 YR 5/6) at the bottom of the deposit, grading to greyish brown (10 YR 4/2-5/2) and very dark grey (10 YR 3/1) above. Charcoal occurs throughout, as discrete lumps in the lower levels and concentrated heaps in the upper part of the sand. The variations in colour are largely due to the relative amount of charcoal present and the percolation of iron-stained solutions through the deposit.

Food remains such as shells and bones are restricted to the upper 25 cm. of the deposit, but stone artefacts occur throughout, and are concentrated in a zone about 25 to 45 cm. below the surface.

It seems reasonable to suggest that if the stone workers lit fires in the shelter, they also ate food there. These food remains were probably destroyed by processes such as the seasonal changes in pH and fluctuations of the water table within the deposit.

This weathering would reduce the volume of material in the deposit, and leave only the implements and charcoal we find today. As a result, the marked concentration of worked stone need not necessarily reflect intensity of occupation.

Typological analysis shows that the same types of stone artefacts occur throughout the deposit. The industry is characterised by points and small scrapers which are very similar to those found at Padypadiy and in the upper levels at Malangangerr and Nawamoyn on the plain.

In the absence of any major cultural change or marked stratigraphic variations in the deposit, the distribution of stone artefacts provides the basis upon which the material is grouped for analysis. The deposit is divided into three main levels. Level I contains material from the dark grey sands above the main concentration of artefacts. Levels II and III contain material from the main concentration of stone artefacts. The approximate volume and depth of deposit in each level is tabulated as follows:

Level	Volume (cu. m.)	Approx. depth B.S. in cm.
I	3.4	0 - 26
II	2.1	26 - 38
III	2.7	38 - 60+
Total	8.2	

Most of the deposit is disturbed by roots but there is considerably less intrusion at the back of the recess. As a result all charcoal samples submitted for radiocarbon dating come from the back of the shelter.

The deposit is dated according to four charcoal samples as follows:

Date	Level	Square/Spit	Depth B.S. in cm.	Years B.P.
GaK-630	I	2E/1	0-5	Modern < 230
GaK-631	II	2E/5	30	1900 $\pm$ 90
GaK-632	III	2E/9	55-60	10790 $\pm$ 200
ANU- 52	III	3E/9	50-55	3820 $\pm$ 100

The samples were taken over a limited area; three came from the same square and lay almost directly below one another. The fourth, (ANU-52), came from an adjoining square and the charcoal lay in the same basal rubble about 1 m. away from GaK-632 (Figures VI-4, VI-5).

There is a large discrepancy between GaK-632 and ANU-52, which raises the problem of the actual age of the earliest occupation of the site by the makers of points and scrapers. One might well argue that the ANU-52 sample was contaminated with younger charcoal, were it not for the dates of the deposit at Tyimede II. This shelter is only 100 m. away from Tyimede I and contains a similar point and scraper industry in its upper levels. The earliest phase of this industry at

Tyimede II, is dated to 4770 ± 150 B.P. (ANU-50). It suggests that ANU-52 represents the true age of the early phase of the point-scraper industry at Tyimede I.

How then can we explain the high antiquity of GaK-632? There are no known sources of ancient charcoal in the environment which could have contaminated the sample. Once again a possible solution lies in the nature of the deposit at Tyimede II where an earlier industry underlies the point-scraper series and is dated to 6650 ± 500 B.P. (ANU-18).

It seems therefore that men were in the area before this date and that they possibly occupied Tyimede I then, although the occupation is not reflected strongly, if at all, in the artefactual record. When the makers of points and scrapers occupied Tyimede I about 4000 years ago, their activities disturbed the charcoal left by the earlier occupants so that the old charcoal is now apparently associated with points and scrapers. This is the most reasonable hypothesis, given the evidence, and it is difficult to envisage how more radiocarbon dates from the bottom level of Tyimede I could, at this stage, advance the argument (see Figure VIII-1).

An attempt was made to assess the integrity of the levels by testing to what extent the deposit has been disturbed. This can be done by joining together fragments of implements which were broken in antiquity. The position of the pairs in the deposit may indicate contemporary living floors but it also shows the

minimum amount of disturbance that has occurred in the deposit by scuffage, treadage and other agents.¹

Twenty fragments were joined together to make ten implements. The separate halves of six pairs were spread over an area less than 30 cm. square, and the halves of the other four pairs over an area of up to 165 cm. Allowing for the general slope of the deposit the minimum depth between most pairs was 5-6 cm., but in one case it was 12 cm.

This documented disturbance of the archaeological material supports on the one hand the explanation offered for the anomalous radiocarbon date in the bottom level; on the other hand it suggests that the three main levels in terms of which the site is to be analysed, should be treated as broad units which may well overlap.

A. ORGANIC REMAINS

1. Shell

Two species occur in the upper 25 cm. of the deposit. They are Velesunio angasi (a fresh water mussel) and Xanthomelon sphaeroideum (a land snail). Mussels are currently available in local billabongs: the land snails may represent food debris or they may have crawled into the shelter themselves.

2. Bone

Ten fragments were found in the upper 10 cm. of the deposit. Three pieces were identified as the jaw

¹ See Matthews, J.M. 1965 pp.295-8.

of a bandicoot (Isoodon macrourus), a claw of a mangrove crab (Sesarma sp.) and a human tibia. The crab claw denotes some form of contact with the plain environment. The human bone was found resting on a piece of paperbark at the back of the shelter and it probably reflects some form of secondary burial.

3. Plant remains

Thirteen lumps of resin and a few strands of rolled fibre were found on the surface of the deposit.

B. IMPLEMENTS

1) European Material

The following items occur in the top 5 cm. of the deposit: three glass beads, one glass flake, one rusty nail, one padded tack and a tooth from a plastic comb. Clearly the shelter was used after European goods came into the area, but most of the deposit had already accumulated by then.

2) Stone Artefacts

The stone artefacts, implements and waste flakes, are analysed in two stages. First the collection is treated as a whole and the overall features are discussed. Then the implements are analysed according to the code described in Chapter II.

I. OVERALL FEATURES:

This analysis deals first with the distribution and density of worked stone in the deposit, then with an analysis of the raw materials used in toolmaking and finally with the size and shape of the waste flakes.

1. Distribution and density of artefacts

There are 17,534 pieces of flaked stone in the excavated deposit. 855 (4.8 per cent) are implements and the rest are waste flakes.

The horizontal distribution of waste flakes in the deposit is shown in Figure VI-6, which records the relative number of waste flakes per cu. m. in each

square. It is difficult to assess the exact volume because material was excavated in between sandstone blocks in spits of unequal depth. This is therefore a fairly broad picture of the artefactual density in the site, and should be treated as such.

The analysis shows that the more sheltered area at the back of the shelter is richer in waste flakes than the exposed area in the front: the stoneworkers probably preferred to work in a more protected area away from the rain, wind and sun.

The density of implements and waste flakes in the three levels is shown in the following table. Three implements are omitted because they were broken in antiquity and the halves now lie in different levels:

Level	Nos	Density per cu. m.
I	1441	424
II	7866	3746
III	8224	3046
Total	17531	2138

Artefacts are concentrated in the lower levels of the deposit and their distribution through depth is unimodal. The same types of implements, (points and small scrapers), occur throughout the deposit, suggesting that only one major cultural phase is represented here.

2. Raw material

Five main types of stone are found in Tyimede I, as follows:

1. Quartzite.
2. Quartz.
3. Chert (including jasper, chalcedony, shale etc.).
4. Igneous/metamorphic rocks (including porphyritic dolorite, hornfels and schist).
5. Highly ferruginised limonite.

Quartzite and quartz are available in the local outcrops of Kombolgie sandstone and chert occurs as pebbles in local streams. The limonite occurs locally on rocks at the bottom of the deposit but the local sources of igneous/metamorphic rocks are unknown.

The relative proportion of waste flakes of different raw materials in the three main levels is shown below:

Level	Raw material (Per cent)						Nos
	Qz.	Q.	Chert	I/mm.	Lim.	Total	
I	47.2	28.4	19.8	4.4	0.2	100.0	1,324
II	54.0	23.8	20.8	1.3	0.1	100.0	7,464
III	63.6	16.2	16.7	1.9	1.6	100.0	7,891
Total	58.0	20.5	18.9	1.8	0.8	100.0	16,679

This suggests a gradual decrease in the use of quartzite over time, which is counterbalanced by a gradual increase in the use of quartz and I/mm. rocks.¹

¹ Standard deviations calculated assuming a Poisson distribution, show that these are real differences.

The relatively high proportion of limonite flakes in Level III may be related to the presence of limonite in the rocks at the bottom of the deposit, which were exposed when Tyimede I was first occupied.

These variations probably reflect the gradually changing habits and preferences of the stone workers over time.

The distribution of different raw materials among implements and waste flakes is as follows:

	Raw material (Per cent)						Total Nos
	Qz.	Q.	Chert	I/mm.	Lim.	Total	
Implements	35.5	16.3	47.5	0.6	0.1	100.0	855
Waste flakes	58.0	20.5	18.9	1.8	0.8	100.0	16,679
Total artefacts	56.9	20.4	20.2	1.7	0.8	100.0	17,534

Quartzite is the main rock used at the site. The table also shows that more implements are made of chert and that the ratio of implements to waste flakes varies according to the form of raw material. This is tabulated as follows:

	Raw material					Total
	Qz.	Q.	Chert	I/mm.	Lim	
Nos waste flakes per implement	32	25	8	60	20	20

Many implements are broken so that these figures represent the minimum ratios of tools to waste. It seems that implements were manufactured at the site because a similar ratio is found at other workshop sites.¹

There is a markedly high ratio of chert implements to waste flakes. This may imply that chert tools were not fashioned on the site, but the analysis of the size of chert flakes (see next section) suggests that some chert tools at least were retouched in the shelter. The ratio may imply that the workers used many more chert flakes as tools and this is borne out to some extent by the comparatively low proportion of large unutilised waste flakes made of chert (see following section). All in all, it seems that the inhabitants of Tyimede I preferred to use chert implements and this is reflected in their markedly economic use of the raw material.

3. Size and shape of waste flakes

(i) Size:

All of the waste flakes in square 3E were analysed as a sample of the flakes in the deposit. The sizes were assessed by passing them through geological sieves of $3/4$, $1/2$ and $1/4$ inch mesh. The flakes were divided according to raw material and the percentage of different sized flakes in each group is expressed as follows:

¹ See Inskip, R.R. 1959 p.94.

Raw material	Waste flakes (Per cent)				Total Nos
	Sizes in inches				
	> 3/4	3/4-1/2	1/2-1/4	1/4-1/8	
Quartzite	1.6	5.0	36.4	57.0	1,656
Quartz	7.0	10.4	36.0	46.6	470
Chert	0.1	3.8	35.2	60.9	705
I/mm.	27.9	23.3	41.8	7.0	43
Limonite	-	5.9	76.5	17.6	17
Total waste flakes	2.5	5.9	36.3	55.3	2,891

Most waste flakes are less than 1/2 inch (1.3 cm.) in at least one dimension. This is considerably smaller than the average dimensions of complete implements in this collection, and suggests that many of the flakes are by-products of tool making.

Quartzite, quartz and chert flakes are roughly the same sizes and there are many large I/mm. flakes.

An analysis was also made of the relative sizes of waste flakes in the three levels in the sample as follows:

Level	Waste flakes (Per cent)				Total Nos
	Size in inches				
	> 3/4	3/4-1/2	1/2-1/4	1/4-1/8	
I	3.6	12.7	39.1	44.6	110
II	3.6	7.1	34.0	55.3	940
III	1.8	1.9	37.4	55.9	1,841

The size of waste flakes remains fairly constant throughout, but there is a slight tendency for the flakes in Level I to be larger than those below.¹

(ii) Shape:

A visual inspection of the waste flakes shows immediately that most of them are squarish in shape. It is clear that the stone workers did not produce blades in any noticeable amounts. This contrasts with the situation found at sites such as Ingaladdi, where large triangular primary flakes occur.²

¹ Standard deviations calculated assuming a Poisson distribution, show that these are real differences.

² Mulvaney, D.J. pers. comm.

II. ANALYSIS OF ARTEFACTS:

Introduction

In the following analysis, the assemblage is treated as a single unit and the implements are described according to the class to which they belong. The distribution of implements is discussed at the end of each specific section and the contents of the entire deposit are analysed at the end of the chapter.

(i) FLAKED STONE IMPLEMENTS

Points - Definitions

A point is an implement that approximates in shape to an isosceles triangle. The maximum length generally extends from the tip to the base of the triangle. Each point has a butt, a tip and a shaft which are defined as follows (see Figure VI-7):

1. Butt - is the part of the point below the actual tip.
2. Tip - is the part of the point where the two longer sides of the triangle intersect.
3. Shaft - is the body of the point extending from, but not including the tip or the base.

There are 52 complete intact points in Tyimede I and 239 broken points, comprising butts, tips and shafts of points.

1. Points (Figures VI-18, VI-19, VI-22, a)

A. GENERAL FEATURES:

There are 52 complete points. Five of these were broken in antiquity and have subsequently been rejoined.

1. Raw material

Most points are made of quartzite as follows:

Points	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	36	13	3	52
Per cent	69.2	25.0	5.8	100.0

2. Shape - General

(i) Position of striking platform:

36.5 per cent of the points are made on endstruck flakes, and 3.8 per cent on sidestruck flakes. The other 59.7 per cent show no obvious signs of being made on a flake.

(ii) Nature of striking platform:

Twenty points (38 per cent) have retouch on the dorsal surface struck from the main striking platform. Of these, 16 are endstruck flakes.

(iii) Shape/Size:

The overall shape and size of points is shown by correlating the length with the Breadth/Length ratio (see Figure VI-8).

Most points are fairly slim with a B/L ratio 50-70. Points range in length from 2.5-7.6 cm. and most of them are 3.0-5.0 cm. long. There is a slight tendency for squatter points, (B/L >60), to be slightly shorter than the more slender ones. Finally, Figure VI-8 shows clearly that the points broken in antiquity are longer and more slender or attenuated than most of the other points. This could imply that the makers had not fully mastered the technique of making long slender points, or that such points broke more frequently during use.

(iv) Shape of cross-section:

Most of the mid-shaft sections of points are lenticular or domed as follows:

Cross-section	Nos	Per cent
Isosceles triangle	1	1.9
Irregular triangle	9	17.3
Lens	26	50.0
Dome	16	30.8
Total	52	100.0

3. Shape of Butt

Points can be divided according to the shape of the butt, which in this instance refers to the relationship of the sides to the base. Four main shapes can be found by viewing the point with the dorsal surface uppermost. These are:

1. Curved butt: The sides curve imperceptibly round the base so that the limits of base edge have to be arbitrarily defined.
2. Square butt: The sides intersect at right angles with the base.
3. Pointed butt: The sides slope inwards along the base to form a dull point at the one end of the length axis.
4. Asymmetrical butt: One side curves imperceptibly round the base and the other intersects with the base usually at an obtuse angle.

Shapes that approximate to the extremes of the range are of course easy to define, but many do not, and are grouped in a fairly arbitrary fashion. The analysis should therefore be treated as a fairly broad classification.

The following shapes occur in the points from Tyimede I:

Butt shape	Nos	Per cent
Curved	29	55.9
Square	18	34.6
Pointed	2	3.7
Asymmetrical	3	5.8
Total	52	100.0

In addition to this visual analysis, the shape of butts is defined metrically according to the Ll/B ratio.

B is the maximum breadth of the point and L1 is the distance from the base to the point of maximum breadth (see Figure VI-9). The L1/B ratio therefore describes the shape of the point below the axis of maximum breadth.

Visual butt shape and the L1/B ratio are correlated as follows:

L1/B ratio	Butt shape (Per cent)				
	Curved	Square	Pointed	Asymm.	Total
15-24	17.2	-	-	33.3	11.5
25-34	13.8	22.2	-	33.3	17.3
35-44	13.8	22.2	-	33.3	17.3
45-54	31.0	16.7	100.0	-	27.0
55-64	10.4	16.7	-	-	11.5
65-74	13.8	16.7	-	-	13.5
75-84	-	5.5	-	-	1.9
Total Nos	29	18	2	3	52

Curved butts are slightly more triangular than square ones but since the numbers concerned are so small this must remain only a suggestion. The following correlations can also be made.

(1) Butt shape/Raw material:

Raw material	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
Quartzite	89.7	33.3	100.0	66.7
Quartz	6.9	55.5	-	33.3
Chert	3.4	11.2	-	-
Total Nos	29	18	2	3

This tends to isolate the square butted points, suggesting fairly strongly that more of them are made of quartz, whilst most of the others are made of quartzite.

(ii) Butt shape/Position of striking platform:

Of the 19 points made on endstruck flakes, 13 have square butts and of these 13, eight are made of quartz.

(iii) Butt shape/Length and B/L ratio:

There is no clear link between the shape of the butt and the shape and size of the artefact (Figure VI-10).

(iv) Butt shape/Thickness (T/B ratio):

T/B ratio	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
20-29	13.9	-	-	-
30-39	27.6	22.2	-	66.7
40-49	48.1	50.0	100.0	33.3
50-59	10.4	27.8	-	-
Total Nos	29	18	2	3

Square butted points are slightly thicker than curved ones: this is probably correlated with the fact that 13 of the square butted points are endstruck with a clear basal bulb of percussion, whereas this is rare in the other points where a bulb has probably been removed by retouch.

(v) Butt shape/Shape of cross-section:

Cross-section	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
Isos. triangle	-	5.5	-	-
Irreg. triangle	3.5	39.0	-	33.3
Lens	65.5	22.2	50.0	66.7
Dome	31.0	33.3	50.0	-
Total Nos	29	18	2	3

Most of the curved butted points are lenticular sectioned whereas square butted points have a variety of different sections.

Conclusion

Points can be divided according to the shape of the butt and when this is done we find some correlation in the incidence of butt shape, position of striking platform, type of raw material, shape of cross-section and general size.

For example, many square butted points are made of quartz on endstruck flakes and are somewhat thicker than the other varieties.

4. Shape of Tip

The shape of the tip is studied by analysing the relationship of the sides $2/5$ of the distance from the tip along the length axis. The sides are symmetrical in every case, and tip shape is defined by correlating the following two ratios:

1. B1/B5

B1 and B5 are the breadth of the point taken 1/5 and 2/5 along the length axis from the tip. This ratio expresses the relationship of the sides that converge to form the tip. If the sides are straight the ratio will be 50. If they are convex it will be greater than 50, if concave, less than 50.

2. B5/L2

L2 is the distance along the length axis from the tip of the point to B5. The ratio B5/L2 expresses the general shape of this part of the point. A squat tip has a B5/L2 ratio greater than 100 whereas the ratio of a more slender tip is less than 100.

These ratios are correlated in Figure VI-11, which shows that all tips have convex sides and that they range in shape from squat to slender with no direct correlation between the two ratios.

5. Relationship of Butt and Tip Shape

According to Figure VI-12, there is no direct correlation between the different butt and tip shapes.

Conclusion

Points display a wide range of forms but it is difficult to distinguish absolutely distinct types, partly because the group is so small. The most distinct forms that do emerge from the analysis are curved and square butted points and as a result points are grouped according to butt shape in the following analyses.

B. SECONDARY MODIFICATION:

The following features are relevant in studying the retouch on points.

1. Number of Edges per Tool

Points	Nos edges			Total
	3 side base	2 side	1 side	
Nos	32	19	1	52
Per cent	61.6	36.5	1.9	100

Points are extensively worked; most are retouched on both sides and many are retouched on the base as well. The position of retouch is related to the shape of the butt as follows:

Butt shape	Nos edges (Points)			Total nos edges
	3 Side Side Base	2 Side Side	1 Side	
Curved	25	4	-	83
Square	3	14	1	38
Pointed	2	-	-	6
Asymm.	2	1	-	8
Total points	32	19	1	135

This stresses the difference between curved and square butted points, since curved ones are more frequently retouched on the base than square ones.

2. Shape of Edge

(i) Viewed dorso-ventrally:

The edges of points are generally curved or straight and there are no serrated edges.

(ii) Viewed end-on:

The edges of points are shaped as follows:

Shapes	Nos	Per cent
Convex	6	4.5
Straight	121	89.6
'S' shaped	7	5.2
Wavy	1	0.7
Total	135	100.0

Most points have straight edges. The convex, 'S' shaped and wavy edges occur on points whose remaining edges are straight. The high incidence of straightness may be related to the use of points as missile tips which had to be regular to fly true.

3. Angle of Edge

Most of the retouched edges are acute angled. This is of course intimately related to the type of retouch found on the edge, and is assessed in terms of retouch type in the following section.

4. Nature of Secondary Modification on Edge

I. RETOUCH:

Two main types of retouch are found on the points.

1. Bifacial retouch

This occurs on 36 points, alone, or on an edge together with unifacial retouch and/or utilisation. Both the alternate and non-alternate forms are found and scalar flakes were invariably removed in both cases. The two forms often occur on the same edge which suggests that points were made using both processes to trim the surfaces.

2. Unifacial retouch

This occurs on 29 points, sometimes on an edge together with bifacial retouch and/or utilisation on an edge. Scalar retouch is the dominant form and there are only a few lengths of step flaking and notching.

II. UTILISATION:

This is found either alone or in direct association with retouch. It is rare, possibly because it is difficult to recognise on quartzite and quartz.

1. Discrete lengths

These occur on 12 tools. The main type is unifacial utilisation, but occasional lengths of bifacial utilisation also occur.

2. Associated with retouch

The only form of use-wear found in association with retouch is a slight smoothing (Type 7) found on bifacially retouched edges.

5. Incidence of Secondary Modification on Edge

The incidence of retouch and use-wear on points is shown in the following tables.

The secondary modification found on the three edges comprising the point, is described using the following code:

B	-	bifacial retouch
U	-	unifacial retouch
Ut	-	utilisation.

These symbols may be combined as for example, in BUUt which implies that bifacial and unifacial retouch and utilisation are all found as discrete lengths on the same edge.

(1) Points with three worked edges:

Position of edge			Butt shape (Nos)				Total
Side	Side	Base	Curved	Sq.	Pt.	Asymm.	
B	B	B	14	-	1	2	17
B	B	BU	1	-	-	-	1
B	B	U	2	1	-	-	3
B	BU	B	2	-	-	-	2
B	B	BUt	1	-	-	-	1
B	B	U	-	1	-	-	1
BU	B	B	1	-	-	-	1
BUUt	BUUt	U	1	-	-	-	1
BU	U	U	1	-	-	-	1
U	U	U	1	1	-	-	2
U	U	Ut	-	-	1	-	1
U	UUt	U	1	-	-	-	1
Total nos points			25	3	2	2	32
Total nos edges			75	9	6	6	96

(ii) Points with two worked edges:

Position of edge		Butt shape (Nos)				Total
Side	Side	Curved	Sq.	Pt.	Asymm.	
B	B	2	2	-	-	4
B	BU	-	1	-	-	1
B	BUt	-	-	-	1	1
BU	BU	1	-	-	-	1
B	U	-	1	-	-	1
U	U	1	4	-	-	5
U	UUt	-	5	-	-	5
U	Ut	-	1	-	-	1
Total nos points		4	14	-	1	19
Total nos edges		8	28	-	2	38

(iii) Points with one worked edge:

Position of edge	Butt shape (Nos)				Total
Side	Curved	Sq.	Pt.	Asymm.	
UUt	-	1	-	-	1
Total nos points	-	1	-	-	1
Total nos edges	-	1	-	-	1

The following properties of points can now be listed:

1. Bifacial and unifacial retouch and utilisation occur in a variety of combinations on different parts of the points. This can be quantified by analysing the lengths that comprise the edges according to the form of secondary modification they contain.

This is shown in the following table. It illustrates clearly that bifacial retouch is the predominant form of secondary modification in these points.

Lengths	Retouch		Utilisation	Total
	Bifacial	Unifacial		
Nos	123	62	17	202
Per cent	60.9	30.7	8.4	100.0

In addition, the angles of different lengths are analysed as follows:

Angles in degree	Lengths (Per cent)		Utilisation
	Bifacial retouch	Unifacial retouch	
21-30	-	-	5.9
31-40	5.4	9.7	17.6
41-50	27.7	19.3	52.8
51-60	37.5	29.1	11.7
61-70	25.2	27.4	-
71-80	4.8	9.6	5.9
81-90	-	4.8	5.9
Total Nos	123	62	17

Most retouched and utilised lengths are acute angled. Furthermore, utilised lengths are more acute angled, or thinner, than retouched ones. If one of the aims of retouch were to create thin acute angled edges, then this observation may mean that the utilised edges remained unretouched because they were thin enough in their original state.

2. The only criterion that I use to define a bifacial point as opposed to a unifacial one, is the absence or presence of bifacial retouch. The dotted line on the tables separates the two forms showing that there are 36 bifacial points and 16 unifacial points in this collection.

Some authors¹ describe a point as unifacial even if it contains bifacial work, but my definition does not allow for this. In fact my definition is even easier to apply to this collection since all the unifacial retouch on these points occur on the dorsal surface only. There are no unifacially worked points with alternately worked edges to confuse the issue.

In the unifacial points, both butt and tip are unifacially worked. Of the 36 bifacial points 33 are bifacially retouched over a large area and the other three are bifacially worked on the butt only; two for about 1/5 of the length from the base, and one for 4/5 of the length from the base.

This suggests that when broken points are analysed, it will be more reliable to reconstruct the type of retouch on the complete piece from the butt fragments, than from the tips.

Using this division of bifacial and unifacial points, the following correlations can be made:

(i) Type points/Butt shape:

Points	Butt shape (Per cent)				Total Nos
	Curved	Square	Pointed	Asymm.	
Bifacial	72.2	16.7	2.8	8.3	36
Unifacial	18.7	75.0	6.3	-	16
Total Nos	28	18	2	3	52

¹ See Campbell, T.D. 1960 p.518.

(ii) Type point/Raw material:

Points	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Bifacial	80.5	16.7	2.8	36
Unifacial	43.7	43.7	12.5	16
Total Nos	36	13	3	52

(iii) Type point/Position of striking platform:

Points	Position striking platform (Per cent)			Total Nos
	Endstruck	Sidestruck	Invisible	
Bifacial	13.9	-	86.1	36
Unifacial	87.5	12.5	-	16
Total Nos	19	2	31	52

(iv) Type point/Shape of cross-section:

Points	Cross-section (Per cent)				Total Nos
	Isos. triangle	Irreg. triangle	Lens	Dome	
Bifacial	2.8	5.5	69.5	22.2	36
Unifacial	-	43.7	6.3	50.0	16
Total Nos	1	9	26	16	52

These correlations support the integrity of the division into bifacial and unifacial points to some extent. Bifacial points have four distinctive general features: many are curved-butted, made of quartzite,

lenticular-sectioned and have no visible striking platforms. Unifacial points have two general distinctions: many are square butted and are made on endstruck or sidestruck flakes.

The degree of correlation is shown in the following tables:

(i) Bifacial points:

Points	Nos characteristics					Total
	4	3	2	1	0	
Nos	17	11	5	1	2	36
Per cent	47.2	30.6	13.9	2.8	5.5	100.0

(ii) Unifacial points:

Points	Nos characteristics			Total
	2	1	0	
Nos	11	5	-	16
Per cent	68.8	31.2	-	100.0

The group is small and it would be unreasonable to expect a 100 per cent correlation, but there is a reasonably high degree of correlation which supports the integrity of the types. It is of course possible that some unifacial points represent an early stage in bifacial point manufacture: for instance the bases of unifacial points could be bifacially trimmed into curved ones at a later stage. I have assumed however that all the

implements are complete, and therefore interpret the collection as containing two distinct types of points.

Distribution

The distribution of points in the deposit is tabulated below. The 1/2 points refer to those joined specimens, parts of which lay in different levels.

1. Density

Level	Nos	Per cent
I	1	1.9
II	16 1/2 1/2	32.6
III	33 1/2 1/2	65.5
Total	52	100.0

Most points occur in Levels II and III.

2. Retouch/Depth

Level	Points in each level				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
I	1	100.0	-	-	1
II	9 1/2	56.0	7 1/2	44.0	16 1/2 1/2
III	25 1/2	75.0	8 1/2	25.0	33 1/2 1/2

Bifacial points predominate at all levels, and there are slightly more unifacial points in Level II.

3. Butt shape/Depth

The range of shapes in Levels II and III are very similar as follows:

Level	Points in each level (Per cent)				Total Nos
	Curved	Square	Pointed	Asymm.	
I	-	-	-	100.0	1
II	58.9	38.2	2.9	-	16 1/2 1/2
III	55.9	33.8	4.4	5.9	33 1/2 1/2

There is no variation in the proportions of points made of different raw materials, or in points of different sizes and shapes in the three levels. Points are concentrated in Levels II and III and the Level II contains relatively more unifacial points.

2. Butts (Figures VI-20, VI-21, a-d)

There are 110 butts of points in the assemblage. All the pieces are broken above the point of the maximum breadth and in all cases the sides clearly slope inwards towards the tip.

A. GENERAL FEATURES:

1. Raw Material

Most butts are made of quartzite as follows:

Butts	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	64	33	13	110
Per cent	58.2	30.0	11.8	100.0

2. Shape - General

(i) Position of striking platform:

Thirty-seven per cent of the butts are obviously made on endstruck flakes, and the rest show no evidence of flake orientation. The endstruck flakes are made of all varieties of raw material: 50 per cent are quartz, 45 per cent are quartzite and five per cent are chert.

(ii) Nature of striking platform:

Thirty butts (27 per cent) are retouched on the dorsal surface from the original striking platform. Of these, 28 are patently endstruck flakes.

(iii) Shape/Size:

Length in cm.	Per cent
1.00-1.49	0.9
1.50-1.99	3.6
2.00-2.49	10.0
2.50-2.99	20.0
3.00-3.49	24.6
3.50-3.99	16.4
4.00-4.49	16.4
4.50-4.99	3.6
5.00-5.49	2.7
5.50-5.99	-
6.00-6.49	1.8
Total Nos	110

Points range in length from 1.4 to 6.4 cm. as above:

As the butts are all broken parts of points it is not very meaningful to describe their actual size, and instead, the general shape is analysed to define the point of breakage.

The points from which these butts come, were broken across the length axis, at a right angle to it or slightly obliquely. As a result the maximum breadth of the butt at the break can be assessed by measuring the distance at right angles to the length axis from the lowest point of the oblique break. This measurement is called B8 and can be taken on 109 butts, the exception being a single butt which is broken very obliquely down one side.

The ratio of B8 to the maximum breadth, B, expresses the relationship of the sides as they taper towards the tip: it is an index of the degree of convergence they have reached, and therefore it can be used to express the distance of the break from the original tip. In order to judge the distance, the $B8/B$ ratio of the butts is compared with the breadth ratios of the intact points in this collection. These are $B1/B$, $B5/B$ and $B7/B$ and $B2/B$ which express the relationship of the sides at $1/5$, $2/5$, $3/5$ and $4/5$ of the total length of the point from the tip (see Figure VI-13).

The results are tabulated as follows:

Ratio range	Butts (Per cent)	Intact points (Per cent)			
	B8/B	B1/B	B5/B	B7/B	B2/B
10-19	11.9	-	-	-	-
20-29	13.8	2.0	-	-	-
30-39	16.5	26.8	-	-	-
40-49	14.7	40.4	-	-	-
50-59	2.7	23.1	15.4	-	-
60-69	15.6	7.7	30.8	-	-
70-79	14.7	-	38.4	11.6	3.8
80-89	5.5	-	15.4	25.0	17.3
90-99	4.6	-	-	57.6	63.5
100-109	-	-	-	5.8	15.4
Total Nos	109	52	52	52	52

The B8/B range is wider than the others, suggesting that the butts were broken at various distances along the length axis.

At least 11.9 per cent of the butts broke off less than $1/5$ from the original tip (B8/B 10-19). The distribution of the B8/B ratios is markedly bimodal. This may be fortuitous: there is no correlation between these groupings and features such as raw material or butt shape. On the other hand it may suggest that points tended to break at two main positions, one about $1/5$ from the tip, and the other $2/5$ - $3/5$ from the tip. It may be relevant to note that the five complete points formed by joining the two halves together, are all broken 2 - $3/5$ from the tip, and most of them appear to

have broken during manufacture. I raise the tentative suggestion, that the grouping found above may indicate that points broken 2-3/5 from the tip, broke largely during manufacture, whereas those broken closer to the tip, snapped off during use.

(iv) Shape of cross-section:

The shape of the cross-section is measured at the break in those butts broken about 2-3/5 from the tip, and in the assumed centre of the original point in others. Like intact points, most butts have lenticular or domed cross-sections.

Cross-section	Nos	Per cent
Isosceles triangle	1	0.9
Irregular triangle	1	0.9
Lens	75	68.2
Dome	33	30.0
Total	110	100.0

3. Shape of Butt

A visual analysis shows that most butts are curved. The same result occurs in the analysis of points.

Butt shape	Nos	Per cent
Curved	66	60.0
Square	33	30.0
Pointed	6	5.5
Asymm.	5	4.5
Total	110	100.0

Visual butt shape and the L1/B ratio are correlated in the following table:

L1/B ratio	Butt shape (Per cent)				Total
	Curved	Square	Pointed	Asymm.	
15-24	7.6	3.1	-	-	5.4
25-34	16.7	18.2	33.3	20.0	18.2
35-44	25.7	27.2	16.7	20.0	25.5
45-54	21.2	21.2	-	-	19.1
55-64	18.2	18.2	-	20.0	17.3
65-74	7.6	9.1	-	20.0	8.2
75-84	1.5	-	50.0	20.0	4.5
85-94	1.5	3.0	-	-	1.8
Total Nos	66	33	6	5	110

Unlike the intact points this analysis does not suggest that curved butts are more triangular than square ones. Instead the two groups are highly similar in this particular respect.

The following correlations can also be made:

(i) Butt shape/Raw material:

Raw material	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
Quartzite	63.6	45.4	33.3	100.0
Quartz	21.2	51.5	33.3	-
Chert	15.2	3.1	33.3	-
Total Nos	66	33	6	5

Like the intact points, most curved and asymmetrical butts are quartzite, whereas more square butts are quartz.

(ii) Butt shape/ Position of striking platform:

Position of striking platform	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
Endstruck	13.7	70.0	100.0	40.0
Invisible	86.3	30.0	-	60.0
Total Nos	66	33	6	6

The division of butts according to their shape is supported here since most square butts are made on endstruck flakes. It is also worth noting that 35 per cent of the square butts made on endstruck flakes, are quartz.

(iii) Butt shape/Thickness (T/B ratio):

T/B ratio	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
20-29	21.2	-	-	-
30-39	45.6	48.5	83.0	60.0
40-49	24.2	24.2	-	40.0
50-59	4.5	27.3	17.0	-
60-69	4.5	-	-	-
Total Nos	66	33	6	5

Square butts are slightly thicker than curved ones. This trend is also present in the analysis of intact points, and it supports the suggestion that there is a link between features such as square butt, endstruck flake and quartz, which combine to produce a slightly thicker tool.

(iv) Butt shape/Shape of cross-section:

Cross-section	Butt shape (Per cent)			
	Curved	Square	Pointed	Asymm.
Isos. triangle	1.5	-	-	-
Irreg. triangle	-	3.1	-	-
Lens	86.4	39.3	33.3	80.0
Dome	12.1	57.6	66.7	20.0
Total Nos	66	33	6	5

Again curved and square butts are differentiated since most curved ones are lenticular sectioned, whereas more square ones are domed.

Conclusion

The division of butts according to their basal shape seems to be meaningful and there are two main types, the curved and the square butt.

B. SECONDARY MODIFICATION:

Butts are grouped according to the main visual shapes for much of this analysis, because the previous analysis indicates that it is a meaningful subdivision.

1. Number of Edges per Tool

Butts	Nos edges				Total
	side 3 side base	2 side side	2 side base	1 side	
Nos	62	44	1	3	110
Per cent	56.4	40.0	0.9	2.7	100.0

Most butts are retouched on two sides and many are retouched on the base as well. This degree of retouch is shown in relation to the shape of the butt as follows:

Butt shape	Nos edges (Butts)				Total nos edges
	side 3 side base	2 side side	2 side base	1 side	
Curved	54	10	1	1	185
Square	6	25	-	2	70
Pointed	-	6	-	-	12
Asymm.	2	3	-	-	12
Total	62	44	1	3	279

This stresses the difference between curved and square butts, since curved butts are more frequently retouched at the base.

These conclusions are the same as those found in the analysis of complete points.

2. Shape of Edge

(i) Viewed dorso-ventrally:

Edges are curved or straight and no butts have serrated edges.

(ii) Viewed end-on:

The edges of butts are shaped as follows:

Shapes	Nos	Per cent
Concave	3	1.1
Convex	3	1.1
Straight	264	94.6
'S' shaped	4	1.4
Wavy	5	1.8
Total	279	100.0

Most of the edges are straight and the other shaped edges are generally found on artefacts whose remaining edges are straight. This regularity is similar to that found on complete points and again may relate to the use of these points as missile heads.

3. Angle of Edge:

Most of the edges are acute angled. This is shown in greater detail in the discussion of retouch that follows.

4. Nature of Secondary Modification on Edge

I. RETOUCH:

Two main types of retouch occur on butts.

1. Bifacial retouch

This is found on 81 butts, alone or an edge together with other forms of secondary modification. The alternate and non-alternate forms of retouch occur, often together on the same edge. Scalar flakes were invariably removed.

2. Unifacial retouch

This occurs on 57 butts, alone or on an edge together with another form of retouch or utilisation. The dominant form is scalar retouch although a few lengths of step flaking and notching are also found.

II. UTILISATION:

This occurs alone as a discrete length or in direct association with retouch.

1. Discrete lengths

These are found on 35 butts and they occupy a whole edge on 16 specimens. They occur on sides and bases.

The main form is unifacial utilisation, but the bifacial variety also occurs.

2. Associated with retouch

Utilisation is seldom noted in association with retouch on the quartzite and quartz butts largely because of the difficulties in recognising macroscopic utilisation and these rocks. The chert butts show signs of unifacial and bifacial utilisation in direct association with retouch. Chattering occurs very occasionally, and is always associated with the discrete lengths of step flaking.

5. Incidence of Secondary Modification on Edge

The incidence of retouch and use-wear on the edges of butts is shown in the following tables. The key is the same as that used to analyse intact points.¹

¹ See p.281.

(i) Butts with three worked edges:

Position of edge			Butts shape (Nos)				Total
Side	Side	Base	Curved	Sq.	Pt.	Asymm.	
B	B	B	36	2	-	1	39
B	B	BU	2	1	-	-	3
B	B	U	5	1	-	-	6
B	B	UUt	1	-	-	-	1
B	B	Ut	2	-	-	-	2
B	BU	B	2	-	-	-	2
BU	BU	B	1	-	-	1	2
BU	BU	BU	1	-	-	-	1
B	UUt	B	-	1	-	-	1
B	U	U	1	-	-	-	1
B	Ut	Ut	1	-	-	-	1
U	U	B	1	-	-	-	1
U	U	U	-	1	-	-	1
Ut	U	U	1	-	-	-	1
Total nos butts			54	6	-	2	62
Total nos edges			162	18	-	6	186

(ii) Butts with two worked edges:

Position of edge		Butt shape (Nos)				Total
Side	Side	Curved	Sq.	Pt.	Asymm.	
B	B	1	4	-	1	6
B	BUt	-	1	-	-	1
B	U	1	1	-	-	2
B	UUt	-	-	1	-	1
B	Ut	2	-	1	-	3
BU	U	1	2	-	-	3
BU	UUt	-	2	-	-	2
BU	Ut	1	-	-	-	1
BUt	BUt	-	1	-	-	1
U	U	2	4	-	-	6
U	UUt	-	5	2	1	8
U	Ut	2	2	1	1	6
UUt	UUt	-	2	-	-	2
Ut	UUt	-	1	1	-	2
Total nos butts		10	25	6	3	44
Total nos edges		20	50	12	6	88

(iii) Butts with two worked edges

Position of edge		Butt shape (Nos)				Total
Side	Base	Curved	Sq.	Pt.	Asymm.	
U	B	1	-	-	-	1
Total nos butts		1	-	-	-	1
Total nos edges		2	-	-	-	2

(iv) Butts with one worked edge:

Position of edge	Butt shape (Nos)				Total
Side	Curved	Sq.	Pt.	Asymm.	
U	1	-	-	-	1
UUt	-	2	-	-	2
Total nos butts	1	2	-	-	3
Total nos edges	1	2	-	-	3

The following observations can be drawn from the tables:

1. Retouch and utilisation are found on the butts, in different places and in varying amounts. As in the intact points, bifacial retouch predominates as follows:

Lengths	Retouch		Utilisation	Total
	Bifacial	Unifacial		
Nos	229	96	45	370
Per cent	61.9	25.9	12.2	100.0

In addition the angles of different lengths vary as follows:

Angles in degree	Lengths (Per cent)		
	Bifacial retouch	Unifacial retouch	Utilisation
21-30	-	-	8.9
31-40	9.6	10.4	37.8
41-50	44.8	32.4	24.4
51-60	31.7	29.2	22.3
61-70	12.2	21.9	4.4
71-80	1.7	4.1	2.2
81-90	-	1.0	-
91-100	-	1.0	-
Total Nos	229	96	45

The retouched lengths generally have acute angles. The analysis also indicates that the utilised edges are thinner than the retouched ones: the same picture emerges in the analysis of intact points.

2. Bifacial and unifacial butts are defined in the same way as points. All unifacial butts are retouched on the dorsal surface only: there are no alternate sided butts. There are 81 bifacial butts and 29 unifacial ones and the following correlations can now be made,

(i) Type butt/Butt shape:

Butts	Butt shape (Per cent)				Total Nos
	Curved	Square	Pointed	Asymm.	
Bifacial	74.0	19.8	2.5	3.7	81
Unifacial	20.7	58.6	13.8	6.9	29
Total Nos	66	33	6	5	110

(ii) Type butt/Raw material:

Butts	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Bifacial	63.0	22.2	14.8	81
Unifacial	44.9	51.7	3.4	29
Total Nos	64	33	13	110

(iii) Type butt/Position of striking platform:

Butts	Position striking platform (Per cent)		Total Nos
	Endstruck	Invisible	
Bifacial	17.3	82.7	81
Unifacial	93.1	6.9	29
Total Nos	41	69	110

(iv) Type butt/Shape of cross-section:

Butts	Cross-section (Per cent)				Total Nos
	Isos. triangle	Irreg. triangle	Lens	Dome	
Bifacial	1.2	1.2	85.2	12.4	81
Unifacial	-	-	20.7	79.3	29
Total Nos	1	1	75	33	110

As in the analysis of points, the correlations support the division of butts into bifacial and unifacial ones. Bifacial butts have four general features: many are curved, made of quartzite and lenticular sectioned with no visible striking platform. On the other hand unifacial butts have three main general features: many are square, domed sectioned and made on endstruck flakes.

The degree of correlation is shown below:

(i) Bifacial butts:

Butts	Nos characteristics					Total
	4	3	2	1	0	
Nos	35	28	9	5	4	81
Per cent	43.2	34.6	11.1	6.2	4.9	100.0

(ii) Unifacial butts:

Butts	Nos characteristics				Total
	3	2	1	0	
Nos	15	9	4	1	29
Per cent	51.8	31.0	13.8	3.4	100.0

The tables show a reasonably high degree of correlation and support the conclusions drawn about intact points.

Distribution:

Butts occur in the deposit as follows:

1. Density

Level	Nos	Per cent
I	4	3.6
II	46	41.8
III	60	54.6
Total	110	100.0

Butts predominate in Levels II and III, and there are slightly more in Level III.

2. Retouch/Depth

Level	Butts in each level				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
I	3	75.0	1	25.0	4
II	27	58.8	19	41.2	46
III	51	85.0	9	15.0	60

Bifacial butts predominate throughout, but there are slightly more unifacial butts in Level II. This same tendency is noted in the distribution of intact points.

3. Butt shape/Depth

Level	Butts in each level (Per cent)				Total Nos
	Curved	Square	Pointed	Asymm.	
I	-	100.0	-	-	4
II	47.7	41.5	6.5	4.3	46
III	73.4	16.6	5.0	5.0	60

Although curved butts predominate throughout, there are proportionally more square ones in Level II. This is of course linked with the distribution of unifacial butts which are often square.

In all therefore, butts are distributed in the same way as points in the deposit and there is a stronger tendency in their distribution for Level II to contain more unifacial butts.

3. Tips (Figure VI-22, b-e)

There are 75 tips of points in this assemblage. Each apparently once formed part of an intact point which broke in antiquity. The position of the break varies as we shall see, and of course no observations can be made about the butt of the original point.

A. GENERAL FEATURES:

1. Raw Material

Most of the tips are made of quartzite as is shown in the following table. There are fewer quartz tips than quartz butts and points, but this may be because they are more difficult to recognize.

Tips	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	54	12	9	75
Per cent	72.0	16.0	12.0	100.0

2. Shape-General

(i) Shape/Size:

Most of the tips broke off obliquely across the length axis of the original point. The length and breadth of tips are defined as follows: the length, L_3 , is the perpendicular distance from the point where the two sides converge to B_3 . B_3 is the breadth of the tip taken from the highest point on the oblique break. The maximum length of tips (L_3) varies as follows:

Length in cm.	Per cent
0.50-0.99	5.3
1.00-1.49	28.0
1.50-1.99	29.4
2.00-2.49	17.3
2.50-2.99	13.4
3.00-3.49	4.0
3.50-3.99	-
4.00-4.99	1.3
4.50-4.99	1.3
Total Nos	75

There is a fairly uniform distribution in lengths of tips. Like butts, this measurement is not very meaningful because these are broken pieces, not complete implements. As a result the general shape of tips is analysed to try and determine the position of the break in relation to the original tool.

This is relatively easy to do when analysing the butt fragments because the maximum breadth of the original tool is intact and can serve as a reference point. As a result, ratios between breadth measurements at different stages along the length axis are used to determine the point of breakage. The point of maximum breadth of the original complete tool is found on only five tips, where the sides begin to slope inwards towards the base. The other 70 tips therefore broke off at or beyond this point. Visual comparison of tips and points suggest that most tips broke off at a position between

1/5 to 4/5 of the distance from the tip of the original tool. In order to determine the position of the break more precisely, the Length/Breadth ratios of tips are compared with specific ratios on intact points.

If points were straight sided triangles, then the Length/Breadth ratios taken from the tip to points along the length axis would remain constant. However, most of the intact points in this collection have convex sides so that the ratios vary accordingly. The Length/Breadth ratio of tips is termed $L3/B3$ (see p.309). Comparable ratios on intact points are located 1/5, 2/5 and 3/5 of the distance down the length axis from the tip and are termed $L4/B1$, $L2/B5$ and $L5/B7$ respectively (see Figure VI-14).

The following results are found:

Ratio range	Tips (Per cent)	Intact points (Per cent)		
	$L3/B3$	$L4/B1$	$L2/B5$	$L5/B7$
40-59	1.4	7.7	19.3	1.9
60-79	10.0	44.2	28.8	15.4
80-99	31.5	30.8	28.8	32.7
100-119	17.1	11.6	15.4	30.8
120-139	14.3	5.7	7.7	7.7
140-159	15.7	-	-	5.7
160-179	4.3	-	-	1.9
180-199	1.4	-	-	3.8
200-219	4.3	-	-	-
Total Nos	70	52	52	52

This result is not as successful as the attempt to show where butts broke off, largely because points are fairly symmetrical so that the L/B ratios overlap to a large extent. There is however, a high degree of correlation between the length and the shape of broken tips: 90 per cent of tips shorter than 2.0 cm. have a L3/B3 ratio of less than 120. Clearly, the shorter the tip the nearer the end of the original point is broke off. As a result the rough position of the break can be assessed by comparing the length (L3) of tips with that of complete points 1/5, 2/5 and 3/5 of the distance along the length axis. This is shown below:

Length in cm.	Tips (Per cent)	Intact points (Per cent)		
	L3	1/5	2/5	3/5
0.50-0.99	5.3	78.9	-	-
1.00-1.49	28.0	19.2	40.3	-
1.50-1.99	29.4	1.9	38.5	15.4
2.00-2.49	17.3	-	13.5	40.3
2.50-2.99	13.4	-	5.8	23.2
3.00-3.49	4.0	-	1.9	9.6
3.50-3.99	-	-	-	5.8
4.00-4.49	1.3	-	-	3.8
4.50-4.99	1.3	-	-	1.9
Total Nos	75	52	52	52

Tips broke off at a variety of distances along the length axis. The most interesting feature is that very few tips broke off less than $1/5$ of the distance from the end of the original point. This contrasts with the result of the analysis of butts which shows that this type of breakage occurred quite frequently. I can only assume that tiny tip fragments were lost in sieving or else remain unrecognised amongst the waste flakes. This would also explain why there are more broken butts than tips in the assemblage.

(11) Shape of cross-section:

The shape of the section is measured at the break in all cases. Since some pieces broke off nearer the tip than the centre of the point, this result is less directly comparable with those of the butts and intact points.

Cross-section	Nos	Per cent
Isosceles triangle	10	13.3
Irregular triangle	8	10.7
Lens	37	49.4
Dome	20	26.6
Total	75	100.0

The relatively high proportion of triangular sectioned objects can possibly be attributed partly to the position of the break.

3. Shape of Tip

The shape of the tips is assessed by comparing the following two ratios:

1. $L3/B3$

This expresses the overall pointedness of the tip.

2. $B4/B3$

$B4$ is the maximum breadth of the implement taken at right angles to the length axis $1/3$ of the distance down the length axis from the tip. Since all tips are almost symmetrical about the length axis, this ratio expresses the relationship of the two sides, for example, a straight sided tip will have a $B4/B3$ ratio of 33.

The results are expressed in Figure VI-15. The main inferences that can be drawn are as follows:

1. There is a wide variation in the shape of tips and the $L3/B3$ ratio ranges from 50 - 210.
2. Only one tip has slightly concave sides, ($B4/B3$ 29) and most have convex sides ($B4/B3$ 40-60).
3. There is a very slight suggestion that squatter tips ($L3/B3 < 130$) have straighter sides ($B4/B3$ 30-40).

4. Overall Pointedness/Thickness

Since there is such a wide range in the $L3/B3$ ratio, an attempt is made to see if this can be correlated with the relative thickness of the tip expressed in the ratio of maximum thickness, $T3$, to maximum breadth, $B3$.

The results are shown in Figure VI-16. There is a tendency for squatter tips to be slightly thinner than the more slender ones and this probably reflects the fact that since intact points are thinnest at the tip, squat tips probably broke off closer to the end of the original point.

B. SECONDARY MODIFICATION:

Tips are retouched and/or utilised on the sides only, as follows:

1. Number of Edges per Tool

Tips	Nos edges		Total
	1	2	
Nos	73	2	75
Per cent	97.5	2.5	100.0

Most tips are retouched on both sides.

2. Shape of Edge

(i) Viewed dorso/ventrally:

Edges are convex and there are no serrated edges.

(ii) Viewed end-on:

Edges are shaped as follows:

Shapes	Edges	
	Nos	Per cent
Convex	3	2.0
Straight	143	96.6
'S' shaped	1	0.7
Wavy	1	0.7
Total	148	100.0

Most tips have straight edges. The other shapes generally occur on a tip together with another straight edge, but one tip has one convex and one wavy edge. Again the straightness may be related to the use of points as spear tips.

3. Angle of Edge

Most edges are acute angled as is shown later, when correlating retouch and angles.

4. Nature of Secondary Modification on Edge

I. RETOUCH:

Two main types of retouch occur:

1. Bifacial retouch:

This occurs on 53 tips, alone or on an edge in association with unifacial retouch and/or utilisation. Both forms - alternate and non-alternate - occur but they are rarely associated on a single edge. Scalar flakes were invariably removed.

2. Unifacial retouch:

This is found on 35 tips alone, or on edge, in association with another form of retouch or utilisation. Scalar retouch is by far the dominant form, and notching and step flaking occur very occasionally.

II. UTILISATION:

Discrete lengths of use-wear occur in nine tips. Unifacial use-wear is the dominant form but bifacial utilisation and snapping (Type 5), are also found.

Utilisation is associated with retouch on 12 tips, most of which are made of chert. The low incidence is probably again related to my inability to recognize utilisation on quartzite.

5. Incidence of Secondary Modification on Edge

The incidence of retouch and use-wear on the edges of tips is shown in the following table. The code is the same one that is used to analyse complete points.

(i) Tips with two worked edges:

Position of edge		Tips
Side	Side	
B	B	40
B	BU	4
B	U	7
BU	U	2
U	U	11
UUt	UUt	9
Total nos tips		73
Total nos edges		146

(ii) Tips with one worked edge:

Position of edge	Tips
Side	
U	2
Total nos tips	2
Total nos edges	2

The following observations may be drawn from the tables:

1. Bifacial and unifacial retouch and use-wear occur as discrete lengths on edges in the following proportions:

Lengths	Retouch		Utilisation	Total
	Bifacial	Unifacial		
Nos	105	61	14	180
Per cent	58.4	33.8	7.8	100.0

Bifacial retouch predominates here but to a slightly lesser extent than it does on butts. This may be related to the small number of points with bifacially worked butts and unifacially worked tips (see p.285).

The angles of different lengths vary as follows:

Angles in degrees	Lengths (Per cent)		Utilisation
	Bifacial retouch	Unifacial retouch	
31-40	14.3	14.7	50.0
41-50	45.7	37.7	35.7
51-60	31.4	39.4	14.3
61-70	8.6	8.2	-
Total Nos	105	61	14

All lengths are acute angled. It suggests, (tentatively because the numbers are so small), that utilised edges are thinner and this may be more significant since it is also found in utilised lengths on butts and points.

2. Bifacial and unifacial tips are defined in the same way as points and butts. The unifacial tips are all retouched on the dorsal surface only; there are no alternate sided tips. In all, there are 53 bifacial tips and 22 unifacial ones. The following correlations can now be made:

(i) Type tip/Raw material:

Tip	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Bifacial	77.4	9.4	13.2	53
Unifacial	59.1	31.8	9.1	22
Total Nos	54	12	9	75

(ii) Type tip/Shape of cross-section:

Tip	Cross-section (Per cent)				Total Nos
	Isos. triangle	Irreg. triangle	Lens	Dome	
Bifacial	5.7	9.4	66.0	18.9	53
Unifacial	31.8	13.6	9.1	45.5	22
Total Nos	10	8	37	20	75

Bifacial and unifacial points are distinguished more clearly in the analyses of points and butts. The tables show that the shape of the tip is largely determined by the type of secondary retouch: bifacial tips generally have lenticular cross-sections whereas the cross-sections of unifacial tips are generally domed or triangular.

Distribution1. Density

Tips are distributed in the deposit as follows:

Level	Nos	Per cent
I	4	5.3
II	35	46.6
III	36	48.1
Total	75	100.0

Like points and butts, most tips occur in Levels II and III.

2. Retouch/Depth

Level	Tips in each level				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
I	4	100.0	-	-	4
II	21	60.0	14	40.0	35
III	28	78.0	8	22.0	36

As in points and butts, bifacial tips predominate throughout the deposit, and there are proportionally more unifacial tips in Level II.

4. Shafts (Figure VI-21, e)

There are 41 broken shafts of points. In most cases only the last few mm. of tip are missing so that the pointed shape of the fragment is unmistakable. The following features are relevant to the analysis:

1. Raw Material

Shafts	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	21	15	5	41
Per cent	51.2	36.6	12.2	100.0

Like points, most of these fragments are quartzite.

2. Type shaft/Raw material

Shafts can be grouped according to the type of retouch they contain, as bifacial or unifacial shafts. The same definition is used here as is used to describe points, butts and tips. The following correlation can be made between the type of shaft and the raw material from which it is made:

Shafts	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Bifacial	61.5	23.1	15.4	26
Unifacial	33.3	60.0	6.7	15
Total Nos	21	15	5	41

Most shafts, (like most points), are bifacially worked. Moreover, most bifacially worked shafts are made of quartzite whereas most unifacially worked shafts are made of quartz. The same correlation is also found in the preceding analyses of points, butts and tips and it therefore supports this grouping.

Distribution

The position of shafts in the deposit, is as follows:

1. Density

Level	Nos	Per cent
I	5	12.0
II	18	44.0
III	18	44.0
Total	41	100.0

Most shafts, like points, occur in the main concentration of implements in Levels II and III.

2. Retouch/Depth

Level	Shafts in each level				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
I	3	60.0	2	40.0	5
II	9	50.0	9	50.0	18
III	14	88.0	4	22.0	18

Bifacial shafts, like points, butts and tips, predominate at all levels, but Level II has proportionally more unifacial shafts than the others.

5. Unfinished points (Figure VI-26, a-b)

These are unifacially retouched flakes which appear to be unfinished points.

There are four specimens. Two are made of quartzite, one of quartz and one of chert. The quartzite and quartz specimens are endstruck flakes whose distal end is fashioned into a pointed tip. The rest of the flake retains its original outline. The chert specimen, 3B/5, has no bulb of percussion but the ventral surface is distinguishable. It is unifacially worked to a point at one end, and for a short distance along one side. The rest of the flake retains its original irregular outline.

If these specimens are indeed unfinished points then it is clear that at least some points were fashioned from irregular shaped flakes, and that the tip was fashioned before the butt. This theory is supported to some extent by the absence of regular triangular shaped flakes amongst the waste flakes in the collection.

Distribution

All unfinished points occur in Level II but since the numbers are so small, no further conclusions can be drawn.

Points - Conclusions

Points were made throughout the occupation of Tyimede I. Many were broken during manufacture or use, or even as a result of scuffage, treadage and other weathering processes.

The following analyses deal with the distribution of different types of points throughout the deposit. I have combined intact and broken implements (complete points, butts, tips and shafts), but have omitted two intact points whose halves originally lay in different levels. There are too few points in Level I to indicate reliable trends and as a result, only the variations between the other two levels are noted.

1. Raw Material

Most points are made of quartzite, but there are relatively more quartz points in Level II.

Level	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
I	64.2	28.6	7.2	14
II	56.5	36.6	6.9	115
III	68.0	17.7	14.3	147
Total Nos	174	72	30	276

2. Type of Retouch

There are bifacial and unifacial points which are distributed in the deposit as follows:

Level	Implements (Per cent)				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
I	11	78.6	3	21.4	14
II	66	57.4	49	42.6	115
III	118	80.3	29	19.7	147
Total	195	100.0	81	100.0	276

There are relatively more unifacial points in Level II. We have already noted that many unifacial points are made of quartz and it seems highly likely that this fluctuation is directly related to the increased proportion of quartz in Level II. This is shown in the final correlation.

3. Raw Material/Type of Retouch

The proportion of unifacial implements in the various levels is tabulated below, to show for example that 22.2 per cent of the quartzite points in the Level I are unifacially worked:

Level	Unifacial implements (Per cent)		
	Quartzite	Quartz	Chert
I	22.2	25.0	-
II	30.8	64.3	25.0
III	16.0	34.6	19.0

There is an increase in the proportion of unifacial points from all raw materials in Level II, a trend which is most pronounced in the case of quartz.

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Some of the points in the collection resemble 'pirri' points and 'Kimberley biface points', but unfortunately the definition of these types is so broad that I am unable to analyse the collection accordingly.

The 'pirri' was first described by Horne and Aiston in 1924¹ as a pear shaped tool, trimmed to a fine point and used as a graver or a drill. It was made by pressure flaking and mounted. Hale and Tindale² suggested that such points in South Australia should be called

¹ Horne, G. and Aiston, G. 1924 p.90.

² Hale, H.M., and Tindale, N.B. 1930 p.205.

'pirri' in a formal sense only, because they were probably used as spear tips. They added that the pirris were probably made by percussion flaking. Later, Campbell and Noone¹ classified the pirri as a microlith (a tool smaller than 3 cm. in any dimension) although they illustrated several examples almost twice as long! They suggested that such points were made by pressure flaking and were unifacially and bifacially trimmed. They also defined three varieties of the South Australian pirri.

McCarthy² listed a number of types of point found in Australia, including those made on backed blades (Bondi points) and flakes (pirris). He defined the pirri as a symmetrical uniface point, although rare examples are semi-bifaces with trimming across the bulb of percussion.³ He also described symmetrical biface points and Kimberley serrated biface points.

The terminological confusion was heightened by Campbell's analysis of pirris.⁴ Again he defined it as a 'uniface trimmed, symmetrical point' adding somewhat dogmatically:

'The slight inner face trimming gives no justification for considering the pirri a biface trimmed implement - term [sic] which has a definite and accepted connotation; as for example, the Kimberley point'.⁵

¹ Campbell, T.D. and Noone, H.V.V. 1943 pp.281-307.

² McCarthy, F.D. et al., 1946 pp.34-40.

³ McCarthy, F.D. et al., 1946 pp.37-8.

⁴ Campbell, T.D. 1960 pp.509-24.

⁵ Campbell, T.D. 1960, p.518.

He presented a metrical analysis of other pirri points - the Fulham and the Eyrean-types, but since the types were distinguished before analysis, one cannot really accept the validity of the distinction.

To sum up therefore, the definitions of Australian stone points are somewhat blurred, despite Mulvaney's claim that 'the pirri (is) one of the most distinctive items of prehistoric culture'.¹ The term 'pirri' covers a wide range of unifacial and bifacial points of various sizes and shapes. It has not yet been shown whether the sub-types (Fulham, Eyrean) represent the extremes of a range, or distinct cultural entities. As a result it is extremely difficult to draw the line between the pirris and Kimberley bifaces in the Tyimede collection, and they are all therefore called bifacial or unifacial points to avoid implying any specific cultural links.

¹ Mulvaney, D.J. 1961 p.75.

6. Scrapers (Figures VI-23, VI-24, VI-25, a)

A scraper is a secondarily worked piece whose shape generally approximates to a rectangle. Unlike points, scrapers may be retouched at the tip edge.

This is a broad definition: it acquires more detail as the analysis proceeds.

There are 96 complete scrapers in this collection. Two were broken in antiquity and were fitted together later. The following are the main features of this series:

A. GENERAL FEATURES:

1. Raw Material

Scrapers	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	6	1	89	96
Per cent	6.3	1.0	92.7	100.0

Chert is the overwhelmingly predominant form of raw material used to make scrapers.

2. Shape - General

(i) Position of striking platform:

Scrapers	Endstruck	Sidestruck	Invisible	Total
Nos	53	5	38	96
Per cent	55.2	5.2	39.6	100.0

Many scrapers are made on flakes. The base and tip are clearly defined on the endstruck scrapers, but are arbitrarily defined on others. This analysis distinguishes most of these scrapers from tula adzes on one count, since tulas are invariably made on wide angled sidestruck flakes.¹

(ii) Nature of striking platform:

Fifteen of the 58 endstruck and sidestruck scrapers have retouch on the dorsal surface struck from the main striking platform. Five of the scrapers with no readily perceptible bulb are also retouched in this way on the dorsal surface of one end. All this suggests preparatory flaking on the parent core.

(iii) Shape/Size:

Scrapers vary in length from 2.0 to 6.6 cm. though most of them are 2.5 to 4.0 cm. long. This is shown below:

Length in cm.	Per cent
2.00 - 2.49	8.3
2.50 - 2.99	30.2
3.00 - 3.49	31.4
3.50 - 3.99	15.6
4.00 - 4.49	8.3
4.50 - 4.99	4.2
5.00 - 5.49	1.0
5.50 - 5.99	-
6.00 - 6.49	-
6.50 - 6.99	1.0
Total Nos	96

¹ See McCarthy, F.D. et al., 1946 p.29; McCarthy, F.D. 1967 pp.27-8.

The shape of scrapers viewed dorso-ventrally is shown by the B/L ratio as follows:

B/L ratio	Per cent
20-29	1.0
30-39	8.3
40-49	20.9
50-59	27.2
60-69	17.7
70-79	15.6
80-89	8.3
90-99	1.0
Total Nos	96

There is thus a considerable range in the general shape of scrapers. 30.2 per cent fall into Bordes' category of blades,¹ having a B/L ratio less than 50. There are no square scrapers, but many tend towards a fairly squat rectangular shape.

Scrapers are all basically rectangular but the spatial relationship of the two long sides varies, and as a result there are waisted, oval and convergent scrapers. The convergent scrapers have two sides that converge either at the base or at the tip. Where they converge at the base (as defined according to the bulb of percussion), they are termed 'flared'. The sides of convergent scrapers never meet at a point as the object is always four sided. Thus these scrapers are distinguished from burren adzes because according to the textbook definition the ends of burren adze flakes

¹ Bordes, F. 1961 p.18.

are 'pointed or possess a very narrow working edge which may be straight or rounded'.¹

Some scrapers have biconcave and biconvex sides and some have 'noses' on the side too. These forms are comparatively rare and the shapes are incidental to the general outline. There are no clear crescent shaped scrapers though some oval scrapers are slightly crescent shaped.

Variations in shape are defined metrically as follows:

The scrapers are divided into two groups. The first group includes those made on endstruck flakes where the base and tips are defined according to the position of the bulb. The second group includes the rest of the scrapers where base and tip are arbitrarily defined. The maximum breadth of the scrapers taken at the base, middle and tip, are termed B1, B2 and B3 respectively. The ratios B2/B1 and B3/B1 can be compared to show the overall plan of the tool (see Figure VI-17).

In the endstruck scrapers, the following range of shapes occurs:

Shapes	Nos	Per cent
Waisted	3	5.7
Flared	6	11.3
Convergent	11	20.8
Oval	33	62.2
Total	53	100.0

¹ McCarthy, F.D., et al., 1946 p.30; see also McCarthy, F.D. 1967 p.28.

In the other group of scrapers the same range of shapes occurs but the flared and pointed group are merged because of the arbitrary distinction between base and tip.

Shapes	Nos	Per cent
Waisted	1	2.3
Flared	12	27.9
Convergent		
Oval	30	69.8
Total	43	100.0

It is clear that most scrapers are somewhat oval in shape though waisted, flared and convergent forms are also found.

An attempt is made to correlate B/L ratio and the shape categories for the endstruck scrapers. No specific correlation occurs since the B/L ratio vary through waisted, flared, convergent and oval shaped scrapers.

(iv) Thickness (T/B ratio):

The thickness of scrapers is shown by their T/B ratio, the ratio of maximum thickness, T, to maximum breadth, B. Clearly most scrapers are fairly slim with a T/B ratio 30 to 59.

T/B ratio	Per cent
10-19	1.0
20-29	6.2
30-39	26.1
40-49	33.3
50-59	29.2
60-69	4.2
Total Nos	96

(v) Cross-section:

The shape of the cross-section of all scrapers is taken in the middle at B2. The following shapes occur:

Cross-section	Nos	Per cent
Isosceles triangle	9	9.4
Irregular triangle	22	22.9
Trapezium	31	32.2
Parallelogram	9	9.4
Lens	2	2.1
Dome	23	24.0
Total	96	100.0

A variety of shapes occurs in these implements, contrasting markedly with the more standardised cross-sections of points. Almost all these scrapers, and all the sidestruck scrapers, have flat ventral surfaces. In contrast to this, inspection of worked tula adzes reveals that the cross-section in the middle of the length axis is rhomboid¹ because most of them are made on wide angled sidestruck flakes. This is another significant distinction between the Tyimede scrapers and tula adzes.

Conclusion

Most scrapers are rectangular and slightly oval and do not conform in shape to the standard definition of tula adzes or burren adze-flakes.

¹ See McCarthy, F.D. et al., 1946 p.26, Figure 108.

If the scrapers were used to cut, chop and scrape, then it is possible that the specific features of each edge are more important than the overall shape. In contrast to this, if points were largely used as missile tips then their pointedness is more significant than the configuration of each edge.

I can find no way to prove this because we have no ethnographic evidence of the range of point and scraper usage. This assumption I have made must be termed 'intuitive'. It is on this 'intuitive' aspect of typological analysis that I base the following analysis of secondary modification of scrapers, by analysing them as a series of side and end edges.

B. SECONDARY MODIFICATION:

1. Number of Edges per Tool

Most scrapers have two or three retouched and/or utilised edges as the table below shows:

Scrapers	Nos edges				Total
	4	3	2	1	
Nos	11	34	36	15	96
Per cent	11.5	35.4	37.5	15.6	100.0

2. Shape of Edge

(i) Viewed dorso-ventrally:

Edges have a variety of shapes and are generally straight, convex or concave; there are no serrated edges.

(ii) Viewed end-on:

Most edges are straight when viewed end-on, as is shown in the following table:

Shapes	Nos	Per cent
Concave	4	1.7
Convex	39	16.7
Straight	184	79.0
'S' shaped	6	2.6
Total	233	100.0

3. Angle of Edge

This is analysed later in relation to the specific forms of retouch found on the edges.

4. Position of Edge

Edges are found on the sides and ends of scrapers. Their position and distribution are shown in the following tables where the scrapers are divided into two groups. The first contains those scrapers made on endstruck flakes where tip and base are objectively defined and the second group includes the other scrapers whose tip and base are arbitrarily defined. The distribution of implements in each group is expressed as a percentage of that particular group.

The code used to describe the position of the edge is as follows:

S - side
 T - tip
 B - base
 E - end (This is used in describing scrapers where tip and base are arbitrarily defined).

Therefore a scraper coded as SSST has three side edges and one tip edge, and one coded as EES has two end edges and one side edge.

(i) Position of edges on endstruck scrapers:(53)

Position	SSS	SS	S	-	Total Per cent
TB	-	7.5	-	-	7.5
T	1.9	33.9	15.1	5.7	56.6
B	-	5.7	3.8	-	8.5
-	-	17.0	9.4	-	26.4
Total Per cent	1.9	64.1	28.3	5.7	100.0

(ii) Position of edges on other scrapers:(43)

Position	SSS	SS	S	-	Total Per cent
EE	-	13.9	7.0	-	20.9
E	-	23.3	34.8	-	58.1
-	-	4.7	16.3	-	21.0
Total Per cent	-	41.9	58.1	-	100.0

There is clearly a great similarity in the position of worked edges on all scrapers. Nearly all scrapers (92 per cent) are worked on one or two sides, and many (76 per cent) are worked at one or both ends. We find that endstruck scrapers are more frequently retouched on the tip than the base, probably because retouch on the base would tend to remove the evidence that the flake is endstruck.

The incidence of side and end edges in the whole collection is tabulated as follows:

Edges	Nos
Side	147
End	86
Total	233

5. Nature of Secondary Modification on Edge

Edges can be classified as single or multiple according to the working they contain (see Chapter II). The following distribution is found in these scrapers:

Edges	Position of Edge			
	Side		End	
	Nos	Per cent	Nos	Per cent
Single	65	44.2	71	82.5
Multiple	82	55.8	15	17.5
Total	147	100.0	86	100.0

There are more multiple side edges than end ones. This is probably to be expected since side edges, by definition, are longer than end edges and there is more physical room for variation.

The following tables show the incidence and nature of multiple and single edges. The single edges appear on the marked diagonals.

The following key is used in these tables:

- A - step flaking retouch
- B - scalar flaking retouch
- C - other unifacial retouch
- D - bifacial retouch
- E - utilisation

These forms are combined in various ways. For instance AB shows that step and scalar retouch are both present on the same edge.

SIDES: (147)

	A	B	C	D	E	AB	DE	CE	CD
A	21								
B	32	17							
C	2	1	4						
D	2	3	1	1					
E	8	3	1	1	22				
AB	-	-	5	5	8	-			
DE	2	2	-	-	-	1	-		
CE	2	-	-	-	-	-	-	-	
CD	1	1	-	-	-	1	-	-	-
Total	70	27	11	7	30	2	-	-	-

ENDS: (86)

	A	B	C	D	E	AB	DE	CE	CD
A	15								
B	3	17							
C	2	2	6						
D	-	-	-	5					
E	6	1	1	-	28				
AB	-	-	-	-	-	-			
DE	-	-	-	-	-	-	-		
CE	-	-	-	-	-	-	-	-	
CD	-	-	-	-	-	-	-	-	-
Total	26	20	7	5	28	-	-	-	-

The tables show that bifacial and unifacial retouch and use-wear occur on the edges. The relative amounts that occur on all edges are shown in an analysis of lengths below:

Lengths	Retouch		Utilisation	Total
	Bifacial	Unifacial		
Nos	26	271	86	383
Per cent	6.7	70.7	22.6	100.0

I. RETOUCH:

1. Unifacial Retouch

This is the main form of retouch: it occurs on all scrapers and is a technical factor that helps to distinguish scrapers from points, which are generally bifacially worked.

(i) Incidence:

The incidence of different forms of unifacial retouch is shown in the analysis of lengths as follows:

Retouch type	Lengths	
	Nos	Per cent
Step flaking	125	46.1
Scalar flaking	124	45.7
Notching	14	5.2
Single flake removal	7	2.6
Invasive retouch	1	0.4
Total	271	100.0

The predominant forms are step flaking and scalar retouch.

(ii) Position of edge dorso-ventrally:

Most unifacial retouch is visible on the dorsal surface of the scrapers. Thirty per cent of the scrapers are unifacially retouched on both the dorsal and ventral surfaces but most of these edges occur at the ends of the scrapers.

(iii) Position of lengths within an edge:

Lengths of retouch which do not occupy a whole edge have a spatial relationship to other forms of working on that edge. Only lengths of step and scalar retouch have been analysed here because they comprise 91.8 per cent

of all retouched lengths and are the only forms whose frequency and distribution suggest any patterning.

Only 20 per cent of the edges (47) contain more than two lengths of retouch and these therefore have central lengths.¹ There are 47 central lengths and they are retouched as follows:

Retouch	Central lengths (Per cent)
Step	68.0
Scalar	32.0
Total Nos	47

Most central lengths are step flaked. If scalar retouch and step flaking represent two stages in the process of unifacial retouch, then this analysis may show that the most intensive use and retouch was directed towards the middle of the edges of the Tyimede scrapers.

(iv) Shape of lengths of retouch:

Only step and scalar flaked lengths are analysed for the same reasons given above. The following shapes occur:

Retouch	Shape of lengths (Per cent)				
	Concave	Convex	Straight	Other	Total
Step	38.4	16.8	44.8	-	100.0
Scalar	16.1	44.4	37.9	1.6	100.0

¹ See Chapter II, p.42.

Most step flaked lengths are concave, whereas scalar lengths are generally convex. If the two forms are part of a continuous process, then this analysis shows that in the early stage convex lengths were produced, and as flaking intensified concave edges appeared. It is worth noting here that very few central lengths are convex: most (80 per cent) are straight or concave.

(v) Angles of lengths of retouch:

Step and scalar flaked lengths are analysed separately again and the other unifacially retouched lengths are treated as a group. The following angles occur on lengths:

Angles in degrees	Type retouch (Per cent)		
	Step	Scalar	Other
31-40	-	4.0	-
41-50	3.2	13.7	9.1
51-60	10.4	27.5	22.7
61-70	26.4	30.6	45.5
71-80	29.6	14.5	18.2
81-90	20.0	8.9	-
91-100	8.0	0.8	4.5
101-110	2.4	-	-
Total	100.0	100.0	100.0
Total Nos	125	124	22

Most unifacially retouched lengths are acute angled. The angles of step flaked lengths tend to be slightly wider than those of scalar retouched lengths. Again this may reflect the processional relationship of step

and scalar flaking, by suggesting that more intensive unifacial flaking (step) transformed on acute angled edge into a slightly more obtuse one.

Conclusion

Step and scalar flaking are the chief forms of unifacial retouch and are possibly two stages in the retouch process.

2. Bifacial Retouch

This occurs on 26 edges on 24 scrapers but only occupies a whole edge in six of them. Five of these edges are end edges and are therefore short.

Alternate and non-alternate forms of retouch occur and the predominant type is the non-alternate form where step flakes were detached on the inverse surface. It may represent the rejuvenation or sharpening of a blunt unifacially retouched edge.

The angles of bifacially worked lengths are shown as follows:

Angles in degrees	Lengths (Per cent)
41-50	11.5
51-60	42.4
61-70	30.8
71-80	3.8
81-90	11.5
Total Nos	26

These are generally acute, but too few lengths are present to make a more meaningful general statement.

II. UTILISATION:

1. Discrete lengths

Utilisation occurs as a discrete length on 86 edges. The relative frequency of different forms of use-wear is shown in the following table:

Type of use-wear	Lengths	
	Nos	Per cent
Chattering	2	2.3
Unifacial (i)	44	51.1
Unifacial (ii)	4	4.7
Bifacial	22	25.6
Snapping	7	8.1
Bruising	3	3.5
Smoothing	4	4.7
Total Nos	86	100.0

Unifacial and bifacial forms of use-wear are most commonly found. It seems that edges and part of edges were often used without being retouched.

The angles of the lengths in the two main groups are as follows:

Angles in degrees	Type utilisation (Per cent)	
	Unifacial	Bifacial
11-20	2.1	-
21-30	8.3	4.5
31-40	18.7	31.8
41-50	14.6	31.8
51-60	14.6	22.8
61-70	25.0	9.1
71-80	8.3	-
81-90	4.2	-
91-100	2.1	-
101-110	2.1	-
Total Nos	48	22

There is a wide range of angles on utilised lengths but most lengths are acute angled.

2. Utilisation associated with retouch

Bifacially worked lengths seldom, if ever, show signs of use-wear. This is however frequently visible on unifacially worked lengths.

Lengths of step and scalar retouch are directly associated with utilisation in the following way:

Type of retouch	Type utilisation per retouched length (Per cent)					Total nos lengths
	1. Chattering	2. Unifacial	3. Inverse	Other	None	
Step	35.2	24.0	12.8	4.0	24.0	125
Scalar	2.4	42.0	12.9	9.7	33.0	124

The following associations occur:

1. Slightly more step flaked lengths have use-wear associated with retouch.
2. Step flaking is associated more frequently with chattering than with any other form of use-wear, whereas scalar flaking is generally associated with unifacial utilisation.
3. Both forms of retouch are associated with the inverse form of use-wear.

This suggests that when edges were used, pressure was generally applied to the inverse surface so that unifacial use-wear and chattering resulted. Occasionally it was applied directly against the cutting edge or against the scars forming the retouched edge, so that 'inverse' use-wear resulted.

Conclusion

The scrapers found at Tyimede I do not conform to the standard definitions of burren or tula adze-flakes. They are rectangular scrapers which are generally unifacially retouched. A few of them are bifacially flaked and since they occur in close association with bifacial points, this probably reflects the fact that both forms of flaking were known and used by the makers.

The retouch and utilisation found on the scrapers have been analysed and a tentative sequence of manufacture and use may be constructed as follows:

Flakes or flat fragments of stone were chosen, with a marked preference for chert. The edges were

then retouched generally leaving lengths of step and scalar flaking. The scalar flaked lengths were sharper or more acute-angled than the step flaked ones.

Then the retouched edges were subjected to pressure, presumably whilst the scraper was being used. As a result, tiny flakes were dislodged from scalar flaked lengths as 'unifacial' use-wear and tiny flakes were crushed from step flaked edges, as 'chattering'.

The edges continued to be used, and presumably became blunted by the constant dislodging of tiny flakes. Some edges were then retouched further in order to resharpen them and this possibly created the more concave step flaked lengths within scalar flaked edges. The relatively high incidence of central lengths of step flaking may well indicate the area of the edge which was subjected to greatest pressure during use.

There is no ethnographic record of the use of scrapers such as these in Arnhem Land. However it is reasonable to suggest that they were used to cut, scrape and chop organic material such as fibre, meat, skin or wood. The nature and incidence of utilisation on these tools, suggests that they were used to fashion a fairly resilient medium such as wood, rather than soft pliable skin or meat. Indeed the absence of use-polish on these tools suggests that they were not extensively used to fashion meat, skin or fibre.¹

These suggestions are hypothetical but they serve as one possible explanation of the nature of these scrapers.

¹ See Semenov, S.A. 1964 pp.83-5.

Distribution

The distribution of scrapers in the three levels of the deposit is shown below. 1/2 refers to the scrapers broken in antiquity and whose halves lay in different levels.

1. Density

Level	Nos	Per cent
I	18 1/2	19.2
II	45 1/2	47.4
III	32	33.4
Total	96	100.0

Most scrapers occur in Level II.

2. Retouch/Depth

Level	Scrapers in each level (Per cent)		Total Nos
	Bifacial and Unifacial	Unifacial	
I	40.5	59.5	18 1/2
II	25.2	74.8	45 1/2
III	15.6	84.4	32

More scrapers in Level I are bifacially worked than in the other levels. In fact there is a gradual increase in the proportion of bifacially retouched scrapers over time.

There is no variation in the relative proportions of endstruck scrapers or scrapers of different sizes, shapes or raw materials through the deposit.

7. Broken scrapers (Figure VI-25, b-f)

These fragments all show the predominant type of raw material, retouch and utilisation found in the scrapers in the collection. There are 106 broken scrapers, 91.5 per cent of which are made of chert. 59 per cent are made on endstruck flakes whose distal end has broken, and the rest are fragments of the ends or shafts of implements.

In the analysis of scrapers, the types of retouch and use-wear are analysed according to their inter-relationships within the edge. These broken implements cannot be analysed in the same way since edges are truncated. However, the following observations can be made:

The predominant type of retouch is unifacial and the main varieties are step and scalar flaking. Bifacial retouch is rare, and the most common form is the non-alternate variety where step flakes were removed on the inverse side of the main retouched surface. Utilisation occurs as discrete lengths and also in association with retouch. Chattering and unifacial use-wear are the predominant forms.

If these broken implements are in fact broken scrapers, it is difficult to judge whether they were broken during manufacture, use or simply by weathering. Most are snapped across the middle, which is the weakest point in a narrow rectangular object, and it could therefore have happened during retouch or use.

Distribution

Broken scrapers are distributed through the deposit as follows:

Level	Nos	Per cent
I	21	19.8
II	62	58.5
III	23	21.7
Total	106	100.0

Most of these implements occur in Level II: this supports the identification of the broken implements as scrapers, not points which are most common in Level III.

8. Bifacial ovals (Figure VI-27, d-e)

There are seven bifacially retouched fragments which, when viewed dorso-ventrally, have an oval shape. Two are quartzite and five are chert: they range in length from 2.4-3.6 cm. and are retouched alternately and non-alternately by the removal of scalar flakes. Three ovals have use-wear along one side.

These are the only complete implements with extensive bifacial retouch that cannot be classified as points. They may of course be incomplete points whose tips have yet to be fashioned. On the other hand, some scrapers are bifacially worked and these ovals could represent a form of scraper with intensive bifacial retouch.

Distribution

There are four ovals in Level II and three in Level III.

9. Implements with bruised ends (Figure VI-27, a-c)

These implements are generally made on a chunk rather than a flake and their dominant characteristic is the form of utilisation found on the ends: all of them are bruised on one or both ends.

There are 18 artefacts in this group. The main features can be listed as follows:

A. GENERAL FEATURES:

1. Raw Material

Three implements are made of quartzite, six of quartz and nine of chert.

2. Shape - General

(i) Position of striking platform:

One implement is made on a sidestruck flake, and the others are made on irregular flakes and chunks of stone.

(ii) Shape/Size:

Most tools (11) are 1.5-2.5 cm. long, and the largest is 4.6 cm. in length. They range in shape from rectangular (B/L ratio 60) to squarish (B/L ratio 90).

B. SECONDARY MODIFICATION:

The following features are relevant in studying the retouch on these implements.

1. Number of Edges per Tool

In the following table S and E stand for 'side' and 'end' and refer to the position of the edge on the implement.

Implements	Nos edges					Total
	4SSEE	3SEE	2SE	2EE	1E	
Nos	1	2	2	5	8	18
Per cent	5.6	11.1	11.1	27.7	44.5	100.0

All specimens are worked at one or both ends and comparatively few are worked on the sides. There are six worked sides and 26 worked ends. This helps to distinguish these tools from scrapers which are generally worked along the sides.

2. Shape of Edge viewed End-on

Most edges are straight as is seen below:

Edges	Shapes (Nos)			Total
	Concave	Straight	Wavy	
Side	-	5	1	6
End	5	18	3	26
Total	5	23	4	32

3. Nature of Secondary Modification on Edge

Only eight edges are retouched, mostly with non-alternate bifacial flaking.

The most significant feature of these implements is the bruising on the edge and as a result this is analysed in some detail as follows:

Edges	Retouch and/or use-wear (Nos)			Total
	Retouched only	Bruised and retouched	Bruised only	
Side	5	—	1	6
End	3	16	7	26
Total	8	16	8	32

Although the tools were retouched on the sides, it appears that the sides were seldom used, though the ends were subjected to some form of violent use which left signs of bruising.

Conclusion

The most outstanding features of these tools is clearly the bruising found on the ends. Many are bifacially retouched, generally to a small extent. The ends are usually straight when viewed end-on, but some are concave or wavy.

These features occur in a somewhat ill defined type of Australian tool called a 'fabricator'. It is defined as follows:

Fabricators and trimming stones are flakes or blades with one, and usually both, facets of the working edge battered, and splintered from use. The working edge is frequently gouge-like. The majority are trimmed bifaces with working edges on one lateral margin or one end, one margin and one end, two opposite lateral margins, two lateral margins and one end, or two lateral margins and both ends; the punch-type has a working edge at both ends and is comparatively thick.¹

The implements from Tyimede I have many of these features, but I am reluctant to call them 'fabricators' for the following reasons.

Fabricators are reported frequently from sites in New England² and coastal New South Wales.³ They are not described in detail, but generally occur in assemblages where bifacial working is rare if not altogether absent. This, I imagine, serves to emphasise the integrity of bifacially worked fabricators.

On the other hand, large numbers of fabricators are reported from Oenpelli in association with bifacial points.⁴ I examined these collections housed in the Australian Museum, Sydney, and analysed 108 implements classified as 'fabricators' there. Only 23 conform to

¹ McCarthy, F.D. et al., 1946 p.34; see also McCarthy, F.D. 1967 p.36.

² McBryde, I. Ph.D. Thesis, New England, 1966.

³ Megaw, J.V.S. 1966 pp.30-2.

⁴ McCarthy, F.D. and Setzler, F.M. 1960 pp.215-95.

my definition of implements with bruised ends, and the others are mainly broken retouched pieces.¹

It seems, therefore, that McCarthy and Setzler may have over-emphasised the significance of 'fabriactors' at Oenpelli. Tools with bruised ends are found at Tyimede I, but since they occur together with bifacially retouched pieces, their retouch is less distinctive and they may merely represent an early stage in bifacial point production.

There in order to avoid implying any cultural relationship between these tools and 'fabricators', I have termed them 'implements with bruised ends'.

Distribution

Implements with bruised ends are distributed in the different levels of the deposit as follows:

Level	Nos	Per cent
I	6	33.3
II	9	50.0
III	3	16.7
Level	18	100.0

¹ The others can be classed as follows: two broken points, two scrapers, 14 utilised flakes, six utilised lumps, 37 fragments with unifacial retouch, three fragments with bifacial retouch and 21 waste flakes.

10. Endstruck quartzite flakes (Figure VI-29)

These flakes are larger than the others in the collection and are all retouched to some extent. There are seven of them with the following features:

1. Size/Shape

They range in length from 5.7 to 8.0 cm. and are therefore considerably longer than the average point (3-4 cm.) or scraper (2.5-4 cm.). There is a wide variety of shapes in the group, some are squarish, others are narrow and rectangular, and one is triangular.

2. Retouch

Most are worked along the side and one is retouched along the end. They are generally unifacially retouched with step and scalar flaking which is found mostly on the dorsal surface, except for the long triangular flake (2E/1-263) which is unifacially retouched on the ventral surface of one side. Another implement (4F/5-30) is heavily retouched along one side only and looks like a large backed blade.

3. Utilisation

This occurs alone on three implements. The first is a squarish flake (2E/4-270) with smoothing (Type 7) on one edge. The edge is concave when viewed dorso-ventrally and it may have been used for scraping or planing. The second is the large 'backed blade' (4F/5-30) which has a short length of unifacial use-wear on the unretouched side.

The third is the triangular flake (2E/1-263) which has marked smoothing on two extremes of one side. The use-wear is truncated in the middle of the edge. It seems that this flake was used as a knife or saw, and as a result the side became worn and the smooth abrasion of use-wear appeared. Extensive use later led to the break along this edge. Therefore, although this implement is shaped like a point, and may indeed have been a point, I have classified it in the present group because unlike the points of the collection, it seems to have been used latterly at least, as a knife or saw.

All these tools may have been used for similar purposes as such well defined types as points and scrapers. They are isolated largely because of their size and because some appear to have been used as knives. Some of them (the triangular one in particular) may be classified as leilira-blades,¹ in the broad sense, being large endstruck flakes.

Distribution

There are four tools in Level I, one in Level II and two in Level III.

¹ McCarthy, F.D. et al., 1946 pp.30-1; McCarthy, F.D. 1967 p.32.

11. Broken endstruck quartzite flakes

These tools are separated from the group of unifacially worked fragments, because of their size. There are four pieces and all of them are longer than 5 cm. and broken across the length axis.

All of these flakes are retouched along the sides with unifacial scalar flaking.

Distribution

Three occur in Level I and one in Level III.

12. Cores/Core scrapers (Figure VI-32, c)

These are 11 chunks from which large flakes have been struck. Many are bruised along the retouched edges and this may be attributed to attempts to detach flakes and/or use as a hammer.

Nine are made of quartz, one of quartzite and one of chert. They are all chunky in appearance and range in weight from 20 to 220 gm. The quartz specimens are generally formless and chunky, but the quartzite and chert ones could be termed disc-cores, since flakes have been detached on both sides of the perimeter. The chert core (3C/12 - 172) comes from the basal rubble about 65 cm. below the surface in square 3C. It is the only implement in the collection that shows possible signs of having been worked at two different times, because patinated and hence early flake scars are truncated by unpatinated, later ones. As such, it is

the only tool in the collection which hints at a pre-point-scraper industrial tradition in the shelter.¹

In one sense these are not the only cores that occur. Every piece of retouched stone acted as a core at some stage in its manufacture, because flakes were produced that could in turn be used as implements. Therefore the small number of 'cores' classified as such, is perhaps misleading.

Distribution

There are five tools in Level II and six in Level III.

13. Utilised flakes (Figures VI-28, VI-30, a)

There are 23 flakes with use-wear along the margins.

A. GENERAL FEATURES:

1. Raw Material

Nine flakes are quartzite, two are quartz and 12 (52.3 per cent) are chert.

2. Shape - General

(i) Position of striking platform:

Twenty (87 per cent) are endstruck flakes, two (8.7 per cent) are sidestruck flakes, while the bulb is invisible on the remaining specimen.

¹ See p.260.

(ii) Shape/Size:

Utilised flakes range in length from 1.7 cm. to 14.0 cm. and are mostly 2.0-4.0 cm. long. The longest flakes are all made of quartzite and resemble 'Endstruck quartzite flakes' except for their lack of retouch.

Utilised flakes range in shape from rectangular to squarish (B/L ratio 30-95); the largest quartzite specimens are all rectangular with a B/L ratio of 50 or less. They may therefore be termed utilised 'blades' according to Bordes' definition.¹

B. SECONDARY MODIFICATION:1. Number of Utilised Edges per Tool

In the following table, 'S' for side and 'E' for end, refer to the position of the edge on the implement.

Implements	Nos edges					Total
	3SSE	2SS	2SE	IS	1E	
Nos	3	9	2	8	1	23
Per cent	13.1	39.1	8.7	34.8	4.3	100.0

Some flakes are more extensively used than others.

2. Nature of Utilisation on Edge

Edges can be classified as single or multiple according to the form of use-wear they contain.

¹ Bordes, F. 1961 p.18.

(i) Single edges:

These are divided into side and end and contain the following types of use-wear.

Edges	Use-Wear (Per cent)			Total Nos
	Unifacial	Bifacial	Smoothing	
Side	76.7	23.3	-	30
End	60.0	20.0	20.0	5

Unifacial use-wear predominates on single edges.

(ii) Multiple edges:

There are five multiple edges, four of which occur on sides and one on an end. Sides predominate here probably because they are longer than ends and there is more physical room for variation. Bifacial or unifacial use-wear are generally found on these edges, either together or associated with snapping (Type 5) and inverse unifacial breakage (Type 3).

Conclusion

The predominance of chert as raw material for utilised flakes may be because it is fine grained and the primary flakes have sharper margins than quartzite ones. They are therefore highly suitable for cutting and scraping. The different types of use-wear suggest that these implements were used in different positions, possible for different tasks. Finally it should be noted that utilised flakes and scrapers have the same

type of use-wear which suggests that both types were used for similar purposes.

Distribution

Utilised flakes are distributed in the deposit as follows:

Level	Nos	Per cent
I	5	21.7
II	10	43.5
III	8	34.8
Total	23	100.0

14. Broken utilised flakes (Figure VI-30, b-c)

There are 35 broken flakes with use-wear. Most of them seem to be broken utilised flakes, but some may be fragments of scrapers with the retouched part broken off.

Twenty-five (71.5 per cent) are made of chert, eight (22.8 per cent) of quartzite and two (5.7 per cent) of quartz. Five quartzite pieces are considerably longer than the other fragments, the largest being 7.3 cm. long. This distinction also occurs in the analysis of intact utilised flakes.

Most of these implements have unifacial use-wear along one edge and there are two quartzite flakes with use-polish along one edge. The first, (2D/1-178), is an endstruck flake measuring 7.5 x 5.3 cm. Tiny flakes

were detached on the ventral surface of one edge and the scars are covered with a faint gloss.

The other flake, (3E/4-17), has no bulb of percussion or striking platform. One side is steep and a few flakes may have been struck off the edge from the dorsal surface but it is difficult to decide whether this was done before or after the detachment of the main flake from the core. The other side has use-polish on both surfaces which extends in from the edge for a distance of some 6 cm. The polish is dull on one surface and bright on the other.

Similar implements occur at Padypadiy¹ and Nawamoyin Level I,² and were probably used on pliable organic materials such as wood, skin or bone.

Distribution

Level	Nos	Per cent
I	5	14.3
II	13	37.2
III	17	48.5
Total	35	100.0

Most flakes occur in Level II and the use-polished specimen (3E/4-17) comes from Level II.

¹ Chapter III

² Chapter V

15. Utilised lumps

There are two lumps both of which occur in Level III. One is chert, with chattering along one edge. The other is limonite, with unifacial use-wear along one edge.

16. Miscellaneous (Figure VI-26, c-d)

There are seven chert tools which are grouped as follows:

1. Points or Scrapers

There are six implements in this group. Three, (Level III), are pointed but have the retouch and use-wear that is generally found on scrapers in the collection. The remaining three, (distributed one to each level), are oval in plan with bifacial retouch along one side. They may be unfinished points, ovals or scrapers.

2. ?Scraper

This implement, (2E/8 - 287: Level III), is roughly oval in shape, and measures 3.6 x 2.9 x 1.3 cm. No striking platform can be seen. Two sides are unifacially retouched and one has heavy step flaking in the middle of the edge. Its most outstanding feature is the rhomboid cross-section which extends almost throughout the length of the piece. Apart from the absence of a striking platform, this implement conforms fairly closely with the definition of a used tula adze flake.¹

¹ See McCarthy, F.D. et al., 1946 p.29.

On the other hand however, apart from the cross-section it is very similar to the other scrapers in the Tyimede I collection.

17. Axes (Figure VI-31)

There are five axes made of porphyritic dolorite, which are described individually in Appendix VI-1. They are all bifacially retouched and four are ground. They occur throughout the deposit: one in Level I, two in Level II and two in Level III.

18. Retouched fragments

There are 252 fragments with unifacial or bifacial retouch. They cannot be attributed to any particular type of implement but are isolated to show the incidence of tool breakage in the deposit.

a. Unifacially retouched fragments:

There are 169 pieces. Fifty-eight (34.2 per cent) are quartzite, 42 (24.9 per cent) are quartz and 69 (40.9 per cent) are chert. Twenty-nine pieces have intact striking platforms.

b. Bifacially retouched fragments:

There are 83 pieces. Twenty-two (26.5 per cent) are quartzite, eight (9.6 per cent) are quartz and 53 (63.9 per cent) are chert. Most of the bifacially retouched tools in the collection are quartzite points and if the bifacial fragments are broken parts of

points, this may imply that chert points broke more frequently than quartzite ones.

Distribution

Level	Fragments			
	Unifacial		Bifacial	
	Nos	Per cent	Nos	Per cent
I	28	16.6	11	13.2
II	87	51.5	44	53.0
III	54	31.9	28	33.8
Total	169	100.0	83	100.0

(ii) OTHER STONE ARTEFACTS

1. Abraded fragments (Figure VI-32, a)

There are three pieces of schist and one sandstone specimen. The first schist piece (2E/4 : Level I) is 4.8 x 4.7 x 2.6 cm. One end is broken and the other is abraded as if the object was rubbed by rocking it to and fro. It is covered with reddish ochre. The next piece (3F/3 : Level I) is rod shaped and measures 7.2 x 1.5 x 1.0 cm. It has a triangular cross-section and is also covered with ochre. The third schist piece (2E/9-331 : Level III) is a flat object, 7.4 x 4.5 x 1.0 cm.

The sandstone specimen (4C/11-143 : Level III), is rectangular in plan and measures 5.4 x 4.0 x 2.0 cm. Aboriginal informants called it a 'whetstone'.

The use of these artefacts is not known, but the presence of ochre on two schist pieces suggests that they might have been used as rasps for pulverising pigments.

2. Ochre

There are 377 lumps of ochre varying in length from 0.7 to 13.0 cm. and in weight from 1.0 to 175.0 gm. Most of them are ground on more than one surface and several are conical. A wide range of raw material occurs, including haematite and clay. The colours include dark purple, red, yellow and white.

Distribution

The distribution of ochre throughout the deposit is shown in the following table:

Level	Number of lumps (Per cent)	Weight in gm. (Per cent)	Mean weight of lumps (gm.)
I	23.9	10.7	4.8
II	27.0	17.3	6.9
III	49.1	72.0	15.8
Total	377	4065.7	

Ochre occurs throughout the deposit but mainly in Level III. The lumps in the bottom level are on the whole, larger and heavier than those above.

3. Hammers/Pounders (Figure VI-32, b)

These are all pebbles which have been used as hammers or rubbers and have been pecked or smoothed by use. Pebbles are found in the conglomerate of the Kombolgie sandstone and in stream beds in the vicinity. Ten hammers are intact. Twelve are made of quartzite and six of quartz. They range in weight from 33 to 1537 gm. and most are 300-400 gm.

One irregular pebble has been used as a hammer on the narrowest end. Another (3F/4-5) has been used all round the perimeter and resembles a 'kulki' percussion stone.¹

¹ McCarthy, F.D. 1967 p.63.

Distribution

There are two hammers in Level I, six in Level II and ten in Level III.

C. ROCK PAINTINGS

The back wall of the shelter is covered with paintings (Plate VI-5). Many of the designs were identified by Aboriginal informants as follows:

1. Fish

Four fairly distinct fish were recognised:

a. This design is drawn in white and is partly filled in. The fish is 41 x 13 cm. and was identified as a type of fresh-water bream, called 'dunbukmayn' (Plate VI-6).

b. A heavy white outline of a fish 28 x 10 cm., was termed fresh-water mudfish or 'magaliy'. It is overlain by a red painting of a hand and arm.

c. A rather chunky fish 61 x 24 cm., is drawn in solid white with a thin red outline. Some features such as the eye, fins and bones are drawn in a heavier white line over the thinner white infill. This was termed 'yawadkuna' which is a type of barramundi with a long tail. The informants said this fish was most frequently found in fresh water rivers but was not considered good food because it was 'slimy'.

d. The last fish is drawn as a solid white figure with a heavier outline. It is 60 x 10 cm. and was identified as a fresh water fish called long-tom or 'kudukapal'.

One interesting feature of all these fish is that they are fresh water species. In contrast to this, most of the fish drawn at Padypadiy and Malangangerr on the plain, are brack and salt water forms.

2. Handprints

Four handprints occur as follows:

a. There is a white stencil of a left hand, 38 x 16 cm.

b. Another white stencil of a small left hand is found near the first. The design is only 18 x 15 cm. and the fingers are outlined in red.

c. A third white stencil of a left hand and forearm is found. It is about 47 cm. long and is outlined in red with red lines in the palms. This design overlies the white mudfish, 'magaliy'.

d. The final hand print is a white stencil of a left hand, measuring 25 x 18 cm.

These prints were all apparently made by placing the hand on the rock and spraying the area with white paint. We were told that this was done by an artist blowing the pigment out of his mouth.

3. Mimis

Four of these were distinguished as follows:

a. The first is a solid white figure with a bird-like head drawn head down. It is 58 x 11 cm. and was called 'Namarndiy', a female devil-mimi.

b. There is a stick like figure again drawn in white, which was 52 cm. long. It was said to have clearly drawn wings and tail feathers and was called 'marlinidydi', a type of ancestor spirit-man.

c. The final two mimis are small dynamic stick figures drawn in white. One is 25 cm. long, the other about 13 cm.

All these figures have bird-like heads which Gananggu said was the 'old' way of drawing mimi spirits. All the designs were said to be portrayals of mimis as opposed to other paintings of stick figures, which are generally made in red ochre and were said to be the work of mimis themselves or the image of their passing shadows.

ROCK PAINTINGS - Conclusion

Most of these paintings are monochromatic and white is the dominant colour. The motifs seem to reflect the type of food eaten by the artists and may reflect some aspect of their supernatural beliefs. The age of the paints is not known: no exfoliated slabs were recognised in the deposit, nor were any concentrations of white pigment found.

GENERAL CONCLUSION

Tyimede I was occupied for some 4,000 years at least. During this time the inhabitants lit fires in the shelter and presumably cooked and ate food there. They produced and used stone tools such as points and small scrapers, which are typologically similar to those found at sites on the plain. The chief difference is that at Tyimede I stone tools were apparently fashioned on the spot whereas the tools at Padyadiy, Malangangerr and Nawamoyrn were not.

The inhabitants of Tyimede II used a wide variety of raw materials but favoured certain rocks when making certain implements. In particular, they tended to make points from quartzite and quartz, scrapers from chert, and axes from porphyritic-dolorite.

The proportions of different flaked stone implements in the deposit are shown in the following table where the numbers correspond to the types described in the text. Three implements (two points and one scraper) are omitted from the analysis of implements in each level, because they were broken in antiquity and the halves came from different levels.

Implement Types	Level						Total	
	I		II		III			
	Nos	%	Nos	%	Nos	%	Nos	%
1. Points	1	0.9	16	4.0	33	9.9	52	6.1
2. Butts	4	3.4	46	11.5	60	18.0	110	12.9
3. Tips	4	3.4	35	8.7	36	10.8	75	8.8
4. Shafts	5	4.3	18	4.5	18	5.4	41	4.8
5. Unfin. pts	-	-	4	1.0	-	-	4	0.5
6. Scrapers	18	15.4	45	11.2	32	9.6	96	11.2
7. Br. scrapers	21	17.9	62	15.5	23	6.9	106	12.4
8. Ovals	-	-	4	1.0	3	0.9	7	0.8
9. Bruised	6	5.1	9	2.2	3	0.9	18	2.1
10 Endstruck	4	3.4	1	0.2	2	0.6	7	0.8
11 Br. endst.	3	2.6	-	-	1	0.3	4	0.5
12 Cores/ Scrapers	-	-	5	1.2	6	1.8	11	1.3
13 Util. flakes	5	4.3	10	2.5	8	2.4	23	2.7
14 Br. util. fl.	5	4.3	13	3.2	17	5.1	35	4.1
15 Util. lumps	-	-	-	-	2	0.6	2	0.2
16 Miscell.	1	0.9	1	0.2	5	1.5	7	0.8
17 Axes	1	0.9	2	0.5	2	0.6	5	0.6
18a Unif. retouch	28	23.8	87	21.6	54	16.3	169	19.7
b Bif. retouch	11	9.4	44	11.0	28	8.4	83	9.7
Total	117	100.0	402	100.0	333	100.0	855	100.0

This analysis shows that the three levels are basically similar in that the most distinctive tool types, points and scrapers, occur throughout, and there is a high proportion of broken implements in all levels. (69.7 per cent in Level I, 76 per cent in Level II and 71.2 per cent in Level III).

There is a considerable difference in the actual number of implements in each level and in order to deduce significant variations in the proportions of certain classes of tools over time, the intact and broken implements of each specific type are combined and the standard deviations are calculated.

This is shown in the following table. The numbers in brackets refer to the implement classes listed in the text and the standard deviations are calculated assuming a Poisson distribution.

Implements	Level					
	I		II		III	
	%	S.D.	%	S.D.	%	S.D.
1. Points (1-5)	12.0	±3.4	29.7	±3.1	44.1	±4.4
2. Scrapers (6-7)	33.0	±6.2	26.7	±2.9	16.5	±2.4
3. Ovals (8)	-	-	1.0	±0.5	0.9	±0.5
4. Bruised (9)	5.1	±2.1	2.2	±0.7	0.9	±0.5
5. Endstruck (10-11)	6.0	±2.3	0.2	±0.2	0.9	±0.5
6. Cores/Scrapers (12)	-	-	1.2	±0.5	1.8	±0.7
7. Util. (13-15)	8.6	±2.8	5.7	±1.2	8.1	±1.6
8. Miscell. (16)	0.9	±0.9	0.2	±0.2	1.5	±0.7
9. Axes (17)	0.9	±0.9	0.5	±0.4	0.6	±0.4
10. Unif. frags (18a)	23.8	±5.0	21.6	±2.6	16.3	±2.4
11. Bif. frags (18b)	9.4	±3.0	11.0	±1.8	8.4	±1.7
Total Nos	117		402		333	

The following conclusions may now be drawn.

The most marked variation between the levels is the steady decrease in the proportion of points over time, which is accompanied by a slight increase in the proportion of scrapers. Most points are bifacially worked as opposed to the unifacial work on scrapers, so that this variation could be seen in one respect as a decrease in bifacial working and a corresponding increase in unifacial working over time. This is supported to some extent by our earlier observation that there are more unifacial points in Level II than in Level III. On the other hand, it is contradicted by the observation that more scrapers in Level I are bifacially worked and by the fairly even distribution of unifacial and bifacial fragments in the deposit.

One slight variation can be seen in the distribution of large endstruck quartzite flakes. The proportion of these tools increases over time, but unfortunately only a few specimens are present. The validity of these variations will be tested later in the analysis of the point-scraper industry at Tyimede II. Until then, it seems that there is basically one industry at Tyimede I which undergoes certain fairly minor changes over time.

During the excavations at Tyimede, I asked the Aboriginal informants to classify the excavated implements. They did this on four different occasions in 1964 and again in 1965. The main informants were Gunwinggu men from the Gumadeer area east of Oenpelli, and Gananggu also proved useful as an interpreter.

The men occasionally distinguished formal types such as axes and hammerstones, but the most striking feature of their classification was that it was based largely on the type of raw material from which the implement was made, not on the form or shape of the piece.

The main groups of raw materials they distinguished were quartzite, quartz, chert and porphyritic dolorite. Quartzite had several names which varied according to its colour: 'Lauk'¹ was used for white and yellow quartzite, 'yorndit' for dark red or purplish quartzite. Lauk was also used as a general term to describe a 'stone spear', whenever it was made of a whitish coloured stone. 'Pitudk' described translucent white quartz irrespective of the form in which it occurred: a hammer made of a quartz pebble and a flake were all called pitudk. 'Marlpa' and 'tulundyi' were used to describe cherts; the former general referred to reddish opaque chert and the latter to translucent jaspers and greenish chert. Porphyritic dolorite flakes were generally termed 'tomahawk piece'.

After some time I gave the men one perfect point and one perfect scraper, both made of chert, and asked what they were. Again they tended to ignore the formal differences and called them both 'marlpa' - remarking aside that one was a 'stone spear' and the other 'must be broken stone spear'.

This classification is particularly interesting in view of my typological analysis of the implements. This

¹ See McCarthy, F.D., and Setzler, F.M. 1960 p.283.

shows a marked coincidence of formal types and raw material so that one could broadly equate quartzite and quartz with points, chert with scrapers and porphyritic dolomite with axes. It is reasonable to assume that the markers acknowledged these associations too. Therefore when a modern Aborigine classifies an assemblage in terms of raw material this may well be his implicit expression of formal types.

I have not the anthropological or linguistic training to explore this hypothesis at this stage, but it may be one way of determining the relationship of the archaeological and the craftsman's classification.

CHAPTER VII

EXCAVATIONS AT PLATEAU SITES II : TYIMEDE II

INTRODUCTION

Tyimede II is a west facing cave at the foot of the cliff on the southeast side of the re-entrant, about 105 m. due south of Tyimede I (Figures I-2, VI-1; Plate VII-1).

The entrance of the cave occurs at the base of the cliff which is about 10 m. high at this point. The cave extends into the cliff for about 30 m. in an easterly direction and then turns north for an unknown distance. Two main chambers can be defined, separated by a dip in the roof approximately 7 m. from the baseline at the entrance. The floor of the cave is sandy and flat, except for a slight build-up of sand against the walls and a small meandering depression in the centre of the floor. This is filled with coarse white sand and can be traced from the rear of the cavern to the north side of the entrance; it is probably a small seasonal watercourse. There are several heaps of sandstone blocks that have weathered off the walls and roof of the cavern (Figures VII-1, VII-2).

Most of the occupational debris is found in the first chamber at the entrance of the cave. This area is sheltered by the overhanging cliff and shaded by a few tall trees growing near the entrance on the slope outside. A dripline is seen where small pebbles line shallow rills.

The walls of the entrance are coloured by percolating iron-stained solutions and there are abundant signs of case hardening and lattice weathering. A few angular blocks of sandstone are scattered on the floor: they were probably weathered off the cliff and now form part of the scree slope below.

There are several surface signs of human occupation. The walls and roof of both chambers are black with soot and there are rock paintings on the walls of both caverns. A few stone artefacts and fresh water mussel shells lay on the floor near the entrance, and two bone implements were found in recesses in the rock wall.

METHOD OF EXCAVATION

In October 1964 I dug a test hole in square 2C to a depth of 50 cm. but the yield of artefacts was so small that no further excavations were made then. In 1965 the same test hole was extended to a depth of 100 cm. and it was apparent then that there might be two successive industries in the deposit. As a result the cave was excavated for 2¹/₂ weeks in October by myself, J. Peter White and two Aboriginal helpers.

The sandy deposit was removed in a series of spits which were generally 10 cm. deep and followed the slope of the surface. A paintscraper and brush were used to remove the material and it was sieved through 1/4 inch plastic sieves. We did not record the exact position of implements in this deposit in order to save time.

The excavation covered approximately 21.5 sq. m. This represents less than ten per cent of the area of the

cave as shown in Figure VII-1, but it probably represents a greater proportion of the area that was actually occupied.

STRATIGRAPHY

The deposit at Tyimede II consists largely of sand with varying amounts of sandstone blocks and quartz pebbles. It was excavated until sterile sand was reached at maximum depth of 135 cm. below the surface in squares 1C-D, and a minimum depth of 65 cm. in squares 6F and 6C (Figure VII-3; Plates VII-2, VII-3).

The stratigraphy in the front and rear of the excavation (east and west of Line 2/3) varies to some extent and the two areas are described separately as follows:

The excavated area east of 2/3 contains sand grading from very dark grey (10 YR 3/1) at the top to yellowish brown (10 YR 5/4) at the base. These colour changes are largely due to the relative amount of charcoal in the deposit and the colour of the parent rock. The basal sand is coarser and more compact than the sand above and it contains small ferruginous aggregations which are yellowish brown (10 YR 5/6) and reddish yellow (7.5 YR 6/6) in colour. These were probably precipitated by percolating iron-stained solutions. The pH of the sand is 5.5 throughout.

There are comparatively few rocks in this part of the deposit though occasional blocks of sandstone are found, which have apparently weathered off the adjacent walls. There is a marked concentration of tiny rounded

quartz pebbles (approximately 0.5 cm. in diameter) lying about 50 cm. below the surface. These may indicate more intensive sorting of the sand by gently running water. Finally there are numerous larger quartz pebbles in the basal coarse sand which were probably derived from the conglomerate of the parent rock and may suggest more intensive water action in the cave at that stage.

The deposit west of Line 2/3 varies in colour and texture in the same way as the rest but there is considerably more root disturbance here and a markedly higher incidence of sandstone blocks, angular rubble and quartz pebbles throughout. The rocks are concentrated in the lower levels and were probably weathered off the walls and roof of the cave entrance and the cliff above: as such they constitute part of the scree lying at the base of the cliff all round the re-entrant.

Two disturbances were noted in this part of the deposit. The first is a large steep 'pit' that is restricted to square 2F and is seen on the sections of the north and west walls (see Figure VII-4). The disturbance apparently extends from approximately 5 cm. below the surface, to the bottom of the excavation 110 cm. below.

It is cut into greyish brown sand (10 YR 5/2) with numerous blocks of sandstone and filled with very dark greyish brown sand (10 YR 3/2-4/2) with a markedly high charcoal content. There are very few rocks in the pit and although most of them are distributed at random,

several seem to lie against the side as though they had slipped in down the slope.

The 'pit' contains a relatively large number of stone artefacts and fragments of iron occur throughout. Iron is restricted to the top 10 cm. of the excavated deposit and since the pit extends from just below the surface, it seems that most of the infill is modern and contemporary with the latest occupation of the shelter. The full extent of this disturbance is unknown, for it was only exposed in one square and as a result it is difficult to assess its origin. It may be a natural feature and on the other hand it may have been dug by the occupants of the shelter.

If we assume that it is a natural feature, then the contours of the cave floor and the slope beyond the entrance are far too gradual to suggest that the pit was hollowed out by stream action. It lies within the sheltered area behind the dripline and there is no evidence of a plungepool. It may however be the head of a gully that extended along the slope outside the cave entrance, and at the present stage, this is probably the most plausible explanation if it is a natural feature.

Whatever its origin, it is clear that debris would tend to gravitate into a hollow of this sort and this might explain the strikingly high incidence of stone artefacts there. The only problem is that the infill of the pit is modern and there are very few stone artefacts in the uppermost levels of this deposit over the excavated area. Therefore, unless most of the stone artefacts made during the latest occupation of

the site were deposited in this pit, I am at somewhat of a loss to suggest an explanation.

The problem is somewhat academic however, because it was difficult to delineate the limits of the pit during excavation, and as a result the infill was not removed as a discrete entity. Consequently all the material in square 2F is treated as a separate unit.

The other disturbance is found in the adjacent square 2E and is visible on the west wall (see Figure VII-4). It is a shallow depression filled with dark greyish brown sand, which extends for some 20 cm. from about 10 cm. below the surface. Again its origin is unknown, but unlike the pit in square 2F it contains the same material as is found in adjacent levels outside. As a result the material from square 2E is treated in the same way as the bulk of the excavated material.

Organic remains such as shells and bone are restricted largely to the top 10 cm. of the deposit throughout the excavated area. The same weathering processes that apparently operated at Tyimede I seem to have destroyed much of the organic remains at Tyimede II.

Stone artefacts are found throughout the deposit, but unlike Tyimede I where a single concentration occurs, the stone artefacts at Tyimede II show a markedly bimodal distribution pattern over time.

The distribution of waste flakes in different parts of the deposit is shown in Figure VII-5. The number of flakes is shown on the vertical axis and the depth of the spit below datum on the horizontal axis. Most spits

are 10 cm. deep but where they are not, I have made allowance and adjusted the number of flakes per spit, in order to make units which are directly comparable in volume. The only problem is that there are more rocks in the front squares (1C-D etc.) than in the back ones. The volume of these stones was not calculated in the field and as a result of the diagram should be treated as a fairly broad expression of artefact density.

The analysis shows:

1. The cultural deposit is deeper in the excavated area in the front of the shelter. It is 135 cm. deep in square 1D but only 65 cm. deep in square 6F.

2. Where the cultural deposit is deeper, there is a bimodal distribution of waste flakes in the deposit. There are generally many more flakes in the upper or first peak and the bimodalism is most noticeable in squares 3E and F.

This suggests that there are two occupational phases represented in this site. In the earlier phase people deposited debris mainly in the front of the shelter whereas the later occupation was more widespread and more artefacts were deposited at that stage.

There are no marked stratigraphic divisions in the deposit to suggest how to group the material for analysis. As a result the material is divided according to the grouping shown by the distribution of stone artefacts. Level I contains material from the upper concentration of stone artefacts and coincides broadly with the upper dark grey sand. Level II is a transitional zone between the two concentrations of artefacts and

coincides broadly with the zone of tiny pebbles. Level III contains material from the lower concentration of stone artefacts and corresponds broadly with the lower yellowish brown sand.

The approximate volume and the depth of each level is as follows:

Level	Volume (cu. m.)	Approx. depth B.S. in. cm.
I	1.5	0-50
II	3.4	50-65
III	6.4	65-135
Total	18.4	

The analysis of implements shows that Level I contains points and scrapers similar to those found at Tyimede I, and in order to compare the material from both sites more closely, Level I is subdivided into an upper and lower level (Ia and Ib), as follows:¹

Level	Volume (cu. m.)
Ia	4.0
Ib	4.3
Total	8.3

¹ The material from square 3H is excluded from this analysis because unlike all the other squares, most of the artefacts in 3H lie in Level Ia. This may represent the debris of the latest occupants of the cave but alternatively these artefacts may belong to Level Ib, if no deposit accumulated in 3H during the later occupation of the cave.

The deposit is dated according to two charcoal samples as follows:

Date	Level	Square/Spit	Depth B.S. in cm.	Years B.P.
ANU-50	Ib	3E/4	29-34	4770 $\pm$ 150
ANU-18	III	3B/7	60-70	6650 $\pm$ 500

The position of the samples is shown in Figures VII-3 and VII-5. ANU-50 dates the earliest level of the later point-scraper industry and ANU-18 dates the main part of the early industry. The relationship of these dates and those at Tyimede I, has already been discussed in Chapter VI.

The three main levels seem to be discrete units and there is no direct evidence of intermixing by scuffage or treadage. Level II is treated as a transitional zone which probably contains material from both occupational phases.

A. ORGANIC REMAINS

1. Shell

Shell is concentrated in the top 10 cm. of the deposit, though a few fragments were found 45 cm. below the surface in square 3C. There are two species present: Velesunio angasi, a fresh water mussel, and Xanthomelon sphaeroideum, a land snail. The same species occur at Tyimede I and they probably carry the same implications.

2. Bone

There are 99 fragments of bone: 89 come from the top 15 cm. of the deposit and these include two bandicoot mandibles, (Isoodon macrourus), several macropod teeth, one fish vertebra and three crab claws of Sesarma sp. Ten fragments were recovered between 40 and 85 cm. below the surface and these include one agamid mandible, two fish vertebrae and one Sesarma sp. claw.

Many of these animals also occur at Tyimede I and reflect the varied diet of the inhabitants.

3. Plant remains

Five lumps of resin were recovered in the top 10 cm. of the deposit. Two wooden sticks with cut marks were found on the surface.

B. IMPLEMENTS

1) European Material

The following items occur: 34 glass beads, eight glass flakes, 106 gm. of iron flakes, one iron rod and several pieces of plastic including the hand of a doll.

Most of these artefacts come from the top 10 cm. of the deposit, though one piece of glass was found 45 cm. below the surface. The evidence shows that although Tyimede II was occupied after European material came into the area, most of the deposit had already accumulated by then. One Aboriginal informant (Gananggu) recalled how he played in the cave as a child, when he was small enough to walk upright down the length of both chambers.

2) Stone Artefacts

The stone artefacts of Tyimede II are treated in two stages: first the general features are described and then the implements are analysed. The contents of two squares are omitted from the analysis: these are square 2C which served as the trial trench, and square 2F which contained the major disturbance (see Appendix VII-1). The material from square 3H, Level I, is included in the analysis of artefacts in that level, but it is omitted from the discussion of the distribution of artefacts within Level I.

The following analysis is shorter than that of the Tyimede I series because it is made largely in the light of results obtained there.

I. OVERALL FEATURES:

1. Distribution and density of artefacts

There are 22,300 flaked stone artefacts in the deposit. 662 (three per cent) are implements and the rest are waste flakes.

The distribution of waste flakes has already been discussed in the previous section. Analysis suggests that two occupational phases are represented in the deposit: in the earlier phase most debris was deposited in the front of the cave whereas the later occupation was more widespread.

The density of implements and waste flakes in the three levels is shown in the following table, which stresses the high density of artefacts in Level I.

Level	Nos	Density per cu. m.
I	18,808	2,187
II	795	234
III	2,697	421
Total	22,300	1,212

The density of waste flakes within Level I is shown below, and this stresses the predominance of material in the lower part of the level. (The disparity in numbers occurs because the material from square 3H has been omitted from this analysis).

Level	Nos	Density per cu. m.
Ia	6,428	1,607
Ib	11,591	2,677
Total	18,019	2,168

2. Raw material

Quartzite, quartz, chert and Igneous/metamorphic rocks are found, as they are at Tyimede I. There are no limonite artefacts at Tyimede II possibly because it was not immediately available here as it was at Tyimede I.

The relative proportions of raw material present as artefacts in each level are as follows:

Level	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	I/mm.	Total	
I	62.3	16.4	18.8	2.5	100.0	18,808
II	41.5	25.2	21.9	11.4	100.0	795
III	29.8	38.9	14.9	16.4	100.0	2,697
Total	57.6	19.4	18.5	4.5	100.0	22,300

Standard deviations calculated assuming a Poisson distribution are small enough to show that real differences exist between the proportions in various levels and direct comparisons can therefore be drawn from this table. The proportion of quartzite used increases over time, whilst the proportions of quartz

and Igneous/metamorphic rocks decrease. As one would expect from the similarity of the industries in both sites, the proportions of different rocks in Level I corresponds most closely with those found at Tyimede I.

The proportions of different raw material in Level I are as follows:

Level	Raw material (Per cent)					Nos
	Quartzite	Quartz	Chert	I/mm.	Total	
Ia	62.3	21.4	17.5	3.1	100.0	6,428
Ib	65.4	14.2	18.1	2.3	100.0	11,591

The standard deviations proved again to be very small thus allowing direct comparisons to be drawn from this table. There is a slight decrease in the density of quartzite over time and a corresponding increase in quartz and Igneous/metamorphic rocks. This is precisely the same trend that is observed at Tyimede I, and it reinforces the conclusion that the industries in Tyimede II, Level I, and Tyimede I, are very similar.

The ratio of implements to waste flakes, varies in the different levels of the deposit as follows:

Level	Nos waste flakes per implement				
	Raw material				Total
	Quartzite	Quartz	Chert	I/mm.	
I	46	76	12	119	32
II	46	66	15	29	32
III	46	115	12	87	41

These represent the minimum ratios because many implements are broken. It appears that stone was knapped in the site at all stages of occupation, and that the ratio of implements to waste flakes remained fairly constant throughout. In all three levels there is a markedly high ratio of chert implements to waste flakes and a low ratio of quartz and I/mm. tools to waste which suggests a relatively frugal use of chert. There is a broad resemblance between the ratios in Level I and those found at Tyimede I: the main difference between the two sites is that there are proportionally more waste flakes per tool at Tyimede II and there are considerably more quartz implements at Tyimede I.

3. Size and shape of waste flakes

(i) Size:

All waste flakes in square 3F were analysed as a sample of the waste material in both industries at the site.¹

¹ See Chapter VI p.267.

The relative sizes of flakes of different raw materials are shown below:

Raw material	Waste flakes (Per cent)				Total Nos
	Size in inches				
	> 3/4	3/4-1/2	1/2-1/4	1/4-1/8	
Quartzite	2.7	9.8	46.6	40.9	662
Quartz	4.9	23.2	46.3	25.6	593
Chert	-	8.8	48.6	42.6	228
I/mm.	12.9	29.7	49.5	7.9	101
Total waste flakes	3.8	16.0	46.8	33.4	1584

Most waste flakes are less than 1/2 inch in at least one dimension and quartz and I/mm. flakes tend to be somewhat larger than the others. Chert flakes are smaller than the other types: this is probably related to the high ratio of chert implements to waste flakes since the larger chert flakes were probably made into tools.

The size of waste flakes in each level is tabulated below. The standard deviations are especially relevant here because of the small numbers present in Level II.

Level	Waste flakes									Total Nos
	Size in inches									
	> 3/4		3/4-1/2		1/2-1/4		1/4-1/8			
	%	S.D.	%	S.D.	%	S.D.	%	S.D.		
I	0.7	± 0.3	8.3	± 1.0	44.9	± 2.7	46.1	± 2.8	871	
II	9.8	± 5.1	36.6	± 11.0	31.7	± 10.0	21.9	± 8.1	41	
III	7.6	± 1.1	24.6	± 2.1	50.0	± 3.3	17.8	± 1.8	672	

There are relatively more large flakes in Level III as opposed to Level I. The size of flakes in Level I is very similar to those in Tyimede I.

(ii) Shape:

Visual inspection of the waste flakes shows that most flakes are squarish in shape. Triangular blanks and large regular flakes were obviously not produced in significant numbers at any stage in the occupation of the site.

II. ANALYSIS OF ARTEFACTS:

Introduction

The analysis of stone artefacts differs from that applied to the material from Tyimede I in two ways:

1. Only one major industrial phase is present at Tyimede I, and as a result the implements there are treated as a single group and their distribution in the deposit is discussed at the end of the analysis. In contrast to this, it seems that two industrial phases are represented at Tyimede II. As a result the implements from each level are analysed separately and the contents of all three groups are discussed later.
2. The retouch and utilisation on the tools in the Tyimede I collection are analysed in considerable detail. This involves a lengthy and time consuming procedure and as a result the Tyimede II implements are treated in less detail, and only the most relevant features that emerge from the Tyimede I analysis, are regarded here.

1) Level I

(i) FLAKED STONE IMPLEMENTS

There are 574 implements which are analysed as follows:

1. Points (Figure VII-9)

A. GENERAL FEATURES:

There are 21 complete points in the collection. Two were broken in antiquity and have been rejoined.

1. Raw Material

Most points are made of quartzite and unlike Tyimede I, there are no quartz points here.

Points	Raw material		Total Nos
	Quartzite	Chert	
Nos	18	3	21
Per cent	86.0	14.0	100.0

2. Shape-General

(i) Position of striking platform:

Seven points are made on endstruck flakes but the others show no signs of this.

(ii) Nature of striking platform:

Five of the seven points mentioned above have retouch on the dorsal surface, which was made before or after the detachment of the main flake.

(iii) Shape/Size:

The length of points is correlated with their Breadth/Length ratio in Figure VII-6. The points are clearly similar to those at Tyimede I in terms of their B/L ratio and general length. The main difference is that there are two points longer than 8.5 cm. in this collection whereas the largest point at Tyimede I is only 7.6 cm. long. The two points broken in antiquity, do not differ from the others in the way they do at Tyimede I.

(iv) Shape of cross-section:

The same four types of cross-section found at Tyimede I occur on these points, and in roughly the same proportions:

Cross-section	Nos	Per cent
Isosceles triangle	2	9.5
Irregular triangle	2	9.5
Lens	13	61.9
Dome	4	19.1
Total	21	100.0

3. Shape of Butt

Three of the four butt shapes recognised in complete points at Tyimede I, occur here as follows:

Butt shape	Nos	Per cent
Curved	14	66.6
Square	4	19.1
Pointed	-	-
Asymm.	3	14.3
Total	21	100.0

Butt shape can be further expressed by correlating these visual shapes with the L1/B ratio as follows:

L1/B ratio	Butt shape (Per cent)			
	Curved	Square	Asymm.	Total
15-24	14.3	25.0	-	14.3
25-34	7.2	-	33.3	9.5
35-44	14.3	25.0	-	14.3
45-54	21.4	-	33.3	19.1
55-64	28.5	-	-	19.1
65-74	-	-	33.3	4.7
75-84	14.3	25.0	-	14.3
< 100	-	25.0	-	4.7
Total Nos	14	4	3	100.0

Although the L1/B ratio for the whole collection is similar to that found at Tyimede I, I cannot find any significant trends in the relationship of butt shape and L1/B ratio. The following correlations can now be made:

(i) Butt shape/Raw material:

Raw material	Butt shape (Per cent)		
	Curved	Square	Asymm.
Quartzite	86.0	75.0	100.0
Chert	14.0	25.0	-
Total Nos	14	4	3

The lack of correlation here contrasts with Tyimede I and is probably related to the total absence of quartz points at Tyimede II.

(ii) Butt shape/Position of striking platform:

Of the seven points made on endstruck flakes, three have curved butts, two square butts and two asymmetrical butts. There is therefore no correlation here at all.

There is a similar lack of correlation between butt shape and the Breadth/Length ratio, Thickness/Breadth ratio and shape of cross-section.

4. Shape of Tip

All tips have convex sides and visual inspection shows no clear link between the degree of convexity and any other features.

Conclusion

There is a variety of forms amongst these points and there is a considerably smaller degree of correlation between various features. This I attribute partly to the size of the group, but largely to the lack of quartz points here as opposed to Tyimede I, where quartz points show a number of distinctive features.

B. SECONDARY MODIFICATION:

Points are retouched along the edges and most edges are curved or straight when viewed dorso-ventrally: none are serrated. When viewed end-on, all edges are straight except for an 'S' shaped side on one point.

Points are unifacially and bifacially retouched generally with the removal of scalar flakes. According to the strict definition applied to the Tyimede I collection, there are 17 bifacial points and four unifacial ones in this series. None of them shows signs of utilisation, but this may be because it is difficult to recognise on quartzite implements. The following correlations help to distinguish bifacial and unifacial points:

(i) Type point/Butt shape:

Points	Butt shape (Per cent)			Total Nos
	Curved	Square	Asymm.	
Bifacial	82.3	11.8	5.9	17
Unifacial	50.0	-	50.0	4
Total Nos	14	4	3	21

(ii) Type point /Raw material:

Points	Raw material (Per cent)		Total Nos
	Quartzite	Chert	
Bifacial	82.3	17.7	17
Unifacial	100.0	-	4
Total Nos	18	3	21

(iii) Type point/Position of striking platform:

Points	Position striking platform (Per cent)		Total Nos
	Endstruck	Invisible	
Bifacial	17.7	82.3	17
Unifacial	100.0	-	4
Total Nos	7	14	21

(iv) Type point/Shape of cross-section:

Points	Cross-section (Per cent)				Total Nos
	Isos. triangle	Irreg. triangle	Lens	Dome	
Bifacial	5.9	-	76.4	17.7	17
Unifacial	25.0	50.0	-	25.0	4
Total Nos	2	2	13	4	21

Bifacial points have four main features: many are curved butted, made of quartzite, lenticular sectioned and show no signs of being made on endstruck flakes. Unifacial points are made of quartzite on endstruck flakes and have a variety of cross-sections, all of which indicate the flat ventral surface.

Therefore, whereas the bifacial points are very similar to those from Tyimede I, the unifacial points are different since the examples at Tyimede I are generally square butted and made of quartz.

Distribution1. Density

Level	Nos	Per cent
Ia	12	57.0
Ib	9	43.0
Total	21	100.0

2. Retouch/Depth

Level	Points in each level (Per cent)				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
Ia	10	83.0	2	17.0	12
Ib	7	78.0	2	22.0	9

These analyses show that bifacial and unifacial points are evenly distributed in the deposit, and there is no variation in the distribution of points with different shaped butts.

2. Butts (Figure VII-10, b-d)

There are 71 butts and their most relevant features are discussed below.

A. GENERAL FEATURES:1. Raw Material

Most butts are made of quartzite and there are considerably fewer quartz butts here compared to Tyimede I.

Butts	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	57	6	8	71
Per cent	80.3	8.4	11.3	100.0

2. Shape-General(i) Position of striking platform:

Seven butts (ten per cent) are made on patently endstruck flakes; four of them are quartzite and three are quartz. This is considerably fewer than occurs at Tyimede I.

(ii) Nature of striking platform:

Five of the seven butts described above have retouch struck off the dorsal surface from the main striking platform.

(iii) Shape/Size:

The relative sizes of butts are expressed according to the position of the break. This is shown in the B8/B ratio which is then compared with other breadth ratios on complete points. Unfortunately the collection of

points in this site is very small and I have therefore used the ratios for points from the larger Tyimede I series. The results are tabulated as follows:

Ratio range	Tyimede II	Tyimede I			
	Butts (Per cent)	Intact points (Per cent)			
	B8/B	B1/B	B5/B	B7/B	B2/B
10-19	16.9	-	-	-	-
20-29	11.3	2.0	-	-	-
30-39	9.9	26.8	-	-	-
40-49	14.1	40.4	-	-	-
50-59	19.7	23.1	15.4	-	-
60-69	16.9	7.7	30.8	-	-
70-79	5.6	-	38.4	11.6	3.8
80-89	2.8	-	15.4	25.0	17.3
90-99	2.8	-	-	57.6	63.5
100-109	-	-	-	5.8	15.4
Total Nos	71	52	52	52	52

There is no sharp drop in the frequency of butts with a B8/B ratio of 50-59 as opposed to the situation found at Tyimede I. Evidently butts broke off at various places and this is probably related to techniques of manufacture and/or use.

(iv) Shape of cross-section:

This is taken in the assumed centre of the original point as follows:

Cross-section	Nos	Per cent
Lens	53	74.6
Dome	18	25.4
Total	71	100.0

There is less variety here compared to the Tyimede I series.

3. Shape of Butt

Most butts are curved as is shown in the following table:

Butt shape	Nos	Per cent
Curved	55	77.5
Square	5	7.0
Asymm.	11	15.5
Total	71	100.0

Visual butt shape is correlated with the $L1/B$ ratio in the following table. It shows no real correlation between visual shape and $L1/B$ though curved butts here are perhaps slightly more triangular based ($L1/B < 44$) than their counterparts at Tyimede I.

L1/B ratio	Butt shape (Per cent)			
	Curved	Square	Asymm.	Total
15-24	7.3	20.0	-	7.0
25-34	27.3	20.0	18.2	25.4
35-44	20.0	20.0	18.2	19.7
45-54	12.7	-	36.3	15.5
55-64	12.7	20.0	-	11.3
65-74	12.7	20.0	9.1	12.7
75-84	1.8	-	18.2	4.2
85-94	5.5	-	-	4.2
Total Nos	55	5	11	71

(i) Butt shape/Raw material:

No real correlation occurs here except that three of the six quartz butts are square. The other forms are evenly distributed throughout the different raw materials.

(ii) Butt shape/Position of striking platform:

Of the seven endstruck butts, four are asymmetrical and three are square; there are no curved endstruck butts.

(iii) Butt shape/Thickness (T/B ratio):

T/B ratio	Butt shape (Per cent)		
	Curved	Square	Asymm.
20-29	29.1	-	-
30-39	54.6	60.0	72.8
40-49	12.7	40.0	27.2
50-59	3.6	-	-
Total Nos	55	5	11

Curved butts are slightly thinner than the others. This trend is also observed at Tyimede I where it is even more definite, possibly because there are proportionally more square and asymmetrical butts.

(iv) Butt shape/Shape of cross-section:

Cross-section	Butt shape (Per cent)		
	Curved	Square	Asymm.
Lens	81.8	60.0	45.5
Dome	18.2	40.0	54.5
Total Nos	55	5	11

This distinguishes curved from asymmetrical butts but contrasts with Tyimede I where more square butts tend to be domed in cross-section. The variation is again probably due to the relatively small number of square butts at Tyimede II.

Conclusion

There are fewer variations found in these butts compared to the collection at Tyimede I. I attribute this again largely to the small number of quartz butts which help to form a significantly different group at Tyimede I.

B. SECONDARY MODIFICATION:

Butts are retouched along the edges, which when viewed dorso-ventrally, vary in shape according to the butt shapes described above. There are no serrated edges, and most edges are straight when viewed end-on.

Butts are bifacially and unifacially retouched with the removal of scalar flakes and very few signs of use-wear are seen. They can be divided according to the strict definition used at Tyimede I, into 65 bifacial and six unifacial butts. The following correlations can now be made.

(i) Type butt/Butt shape:

Butt	Butt shape (Per cent)			Total Nos
	Curved	Square	Asymm.	
Bifacial	81.5	6.2	12.3	65
Unifacial	33.4	16.6	50.0	6
Total Nos	55	5	11	71

(ii) Type butt/Raw material:

Butt	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Bifacial	84.7	3.1	12.3	65
Unifacial	33.3	66.7	-	6
Total Nos	57	6	8	71

(iii) Type butt/Position of striking platform:

Butt	Position striking platform (Per cent)		Total Nos
	Endstruck	Invisible	
Bifacial	4.6	95.4	65
Unifacial	66.7	33.3	6
Total Nos	7	64	71

(iv) Type butt/Shape of cross-section:

Butt	Cross-section (Per cent)		Total Nos
	Lens	Dome	
Bifacial	81.5	18.5	65
Unifacial	-	100.0	6
Total Nos	53	18	71

Bifacial and unifacial butts can be distinguished by a number of other characteristics too. Bifacial butts have four general features: they often are curved, made of quartzite, lenticular sectioned with no visible striking platform. Unifacial butts have three main features: they are often made on endstruck quartz flakes with domed cross-sections.

The degree of correlation is as follows:

(i) Bifacial butts:

Butts	Nos characteristics				Total
	4	3	2	1	
Nos	37	19	7	2	65
Per cent	56.9	29.2	10.8	3.1	100.0

(ii) Unifacial butts:

Butts	Nos characteristics			Total
	3	2	1	
Nos	1	3	2	6
Per cent	16.7	50.0	33.3	100.0

Conclusion

The bifacial butts at Tyimede I are characterised by the same features to a similar extent. The unifacial butts there however tend to be square and are more frequently made of quartz. Unfortunately there are too few unifacial butts at Tyimede II to draw any further inferences.

Distribution1. Density

Level	Nos	Per cent
Ia	32	45.0
Ib	39	55.0
Total	71	100.0

2. Retouch/Depth

Level	Butts in each level				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
Ia	28	87.5	4	12.5	32
Ib	37	94.9	2	5.1	39

3. Butt shape/Depth

Level	Butts in each level (Per cent)			Total
	Curved	Square	Asymm.	
Ia	68.8	6.2	25.0	32
Ib	84.6	7.7	7.7	39

4. Raw material/Depth

Level	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Ia	68.8	12.5	18.7	32
Ib	89.8	5.1	5.1	39

There are slightly more butts in Level Ia and, despite the small numbers, there are proportionally more unifacial ones in Level Ib: these same trends occur at Tyimede I and strengthen the link between the two sites. On the other hand, there is a higher proportion of asymmetrical butts and butts made of quartz and chert in Level Ia, but these tendencies are not found at Tyimede I.

3. Tips (Figure VII-10, e-h)

There are 55 tips of points in this assemblage which show the following features:

A. GENERAL FEATURES:1. Raw Material

Most tips are made of quartzite as follows:

Tips	Raw material (Per cent)			Total
	Quartzite	Quartz	Chert	
Nos	49	3	3	55
Per cent	89.2	5.4	5.4	100.0

2. Shape-General

(i) Shape/Size:

In order to assess where the tips broke off the original point, the length (L3) is compared with the length of complete points, 1/5, 2/3 and 3/5 of the distance along the length axis. I have used the Tyimede I series again here because there are too few points at Tyimede II to act as a reliable standard.

Length in cm.	Tyimede II	Tyimede I		
	Tips (Per cent)	Intact points (Per cent)		
	L3	1/5	2/5	3/5
0.5 -0.99	5.4	78.9	-	-
1.00-1.49	27.3	19.2	40.3	-
1.50-1.99	23.7	1.9	38.5	15.4
2.00-2.49	12.7	-	13.5	40.3
2.50-2.99	16.4	-	5.8	23.2
3.00-3.49	9.1	-	1.9	9.6
3.50-3.99	5.4	-	-	5.8
4.00-4.49	-	-	-	3.8
4.50-4.99	-	-	-	1.9
Total Nos	55	52	52	52

The tips broke off at a variety of distances along the length axis: the range is very similar to that found in tips at Tyimede I and probably carries the same implications.

(ii) Shape of cross-section:

This is observed at the break as follows:

Cross-section	Nos	Per cent
Isosceles triangle	4	7.3
Irregular triangle	2	3.6
Lens	36	65.5
Dome	13	23.6
Total	55	100.0

3. Shape of Tip

The relationship of the ratios $L3/B3$ and $B4/B3$ are shown in Figure VII-7, from which the following inferences may be drawn:

1. The shapes of tips as shown by the $L3/B3$ ratio, range widely from 79-216. It differs slightly from the Tyimede I series where 7.3 per cent of tips are squatter with a $L3/B3$ ratio less than 80.
2. Most tips have convex sides, and only one has concave sides. ($B4/B3$ 23). As a group however, these tips have slightly more convex sides ($B4/B3$ 50-60) than the Tyimede I series.
3. Unlike the Tyimede I series, there is no suggestion that squatter tips ($L3/B3 < 130$) have straighter sides ($B4/B3$ 30-40).

These are probably local variations which help to stress the differences between collections at adjacent sites.

4. Overall pointedness/Thickness

The ratio $L3/B3$ is correlated with $B3/T3$ in Figure VII-8. The slight correlation found in Tyimede I does not appear here.

B. SECONDARY MODIFICATION:

Most tips viewed dorso-ventrally, have convex sides (see above), and one of these (7C/4-6) is serrated. This is the only fragment of a serrated edged point at Tyimede I and II (Figure VII-10, f). All edges are straight when viewed end-on.

Tips are bifacially and unifacially retouched and none of them shows signs of utilisation. According to the definition used for the Tyimede I series, there are 49 bifacial and six unifacial tips in this collection.

The following correlations can be made:

(i) Type tip/Raw material

Tip	Raw material (Per cent)			Total Nos
	Quartzite	Quartz	Chert	
Bifacial	89.8	6.1	4.1	49
Unifacial	83.3	-	16.7	6
Total Nos	49	3	3	55

(ii) Type tip/Shape of cross-section:

Tip	Cross-section (Per cent)				Total Nos
	Isos. triangle	Irreg. triangle	Lens	Dome	
Bifacial	4.1	2.0	73.5	20.4	49
Unifacial	33.3	16.7	-	50.0	6
Total Nos	4	2	36	13	55

The chief difference between these tips is that most bifacial tips are lenticular sectioned whereas unifacial ones tend to have triangular and domed cross-sections. The same result is found in the Tyimede I analysis.

Distribution1. Density

One bifacial tip is omitted from this analysis because it comes from square 3H.¹

Level	Nos	Per cent
Ia	29	53.7
Ib	25	46.3
Total	54	100.0

¹ See p. 390.

2. Retouch/Depth

Level	Tips in each level				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
Ia	26	89.6	3	10.4	29
Ib	22	88.0	3	12.0	25

There are slightly more tips in Level Ia but there is no increase in the proportion of unifacial tips there. These features contrast with the tendencies noted in the distribution of butts.

4. Shafts

There are 40 broken shafts of points with the following features:

1. Raw Material

Shafts	Raw material (Per cent)			Total
	Quartzite	Quartz	Chert	
Nos	33	3	4	40
Per cent	82.5	7.5	10.0	100.0

2. Type shaft/Raw material

Thirty-nine shafts are bifacially worked and one chert shaft is unifacially retouched. There is therefore no correlation between quartz shafts and unifacial retouch, such as that found at Tyimede I.

Distribution

Level	Nos	Per cent
Ia	15	37.5
Ib	25	62.5
Total	40	100.0

There are more shafts in Level Ib and the unifacial one comes from Level Ia.

5. Unfinished points (Figure VII-10, a)

These are two quartzite pieces. The first, (6G/4-1), is a unifacially worked flake with one end fashioned into a tip. It is very similar to the specimens from Tyimede I. The second piece, (6C/3-5), is bifacially worked at one end into a curved butt. The other end is thicker and heavily step flaked on one surface. It seems as though this end had not yet been reduced enough to fashion the tip.

In analysing the unfinished points at Tyimede I, I suggest that the tips of points may have been fashioned before the butt. The specimen described above suggests that for Tyimede II at least, this was not always the case.

Distribution

One specimen occurs in each level of this deposit.

Points - Conclusion

Points occur throughout Level I at Tyimede II and many are broken. All points, intact and broken, are divided according to the type of retouch they contain, into bifacial and unifacial implements. This includes complete points, butts, tips and shafts and they are distributed in the Level I as follows:

Level	Implements (Per cent)				Total Nos
	Bifacial		Unifacial		
	Nos	Per cent	Nos	Per cent	
Ia	78	88.5	10	11.5	88
Ib	91	92.9	7	7.1	98
Total	169	100.0	17	100.0	186

Bifacial points predominate strongly throughout Level I and unifacial ones never attain the proportions found in Level II at Tyimede I. This can be partly attributed to the paucity of quartz tools at Tyimede II, but the trend to unifacialism is considerably stronger even in the quartzite points of Tyimede I.

This variation may imply some form of seriation between the two sites, namely that the industry at Tyimede II is older than the material in Levels I and II at Tyimede I.

I feel that it would be unwise to interpret the variations in this way now. We do not yet know the potential variation between point and scraper industries in this area. Until such data are available, it is

perhaps wiser to view these differences as local rather than temporal variations.

6. Scrapers (Figures VII-11; VII-12, b; VII-16, a)

There are 60 scrapers in the assemblage, which show the following features:

A. GENERAL FEATURES:

1. Raw Material

Most scrapers are made of chert as they are in Tyimede I.

Scrapers	Raw material			Total
	Quartzite	Quartz	Chert	
Nos	3	1	56	60
Per cent	5.0	1.7	93.3	100.0

2. Shape-General

(i) Position of striking platform:

Scrapers	Endstruck	Sidestruck	Invisible	Total
Nos	12	8	40	60
Per cent	20.0	13.3	66.7	100.0

There are fewer scrapers made on flakes showing a striking platform here, than at Tyimede I. As a result butt and tip can be distinguished for only 20.0 per cent of the scrapers.

(ii) Nature of striking platform:

Only three scrapers, one made on an endstruck flake and the other two on sidestruck flakes, have retouch on the dorsal surface struck from the main platform.

(iii) Shape/Size:

Scrapers vary in length from 2.0 to 4.99 cm. and there are proportionally more small scrapers (2.0 - 2.49 cm.) here than at Tyimede I.

Length in cm.	Per cent
2.00 - 2.49	23.4
2.50 - 2.99	35.0
3.00 - 3.49	18.3
3.50 - 3.99	16.7
4.00 - 4.49	3.3
4.50 - 4.99	3.3
Total Nos	60

The shapes of scrapers are shown in the B/L ratios below. There is a fairly wide range and their distribution is very similar to that of the Tyimede I series. 35.7 per cent could be termed blades, according to Bordes'¹ definition, since their B/L ratio is less than 50.

¹ Bordes, F. 1961 p.18.

B/L ratio	Per cent
20-29	1.7
30-39	11.6
40-49	23.4
50-59	33.3
60-69	15.0
70-79	10.0
80-89	3.3
90-99	1.7
Total Nos	60

None of these scrapers conforms in shape to the definition of a burren adze¹ and none of them is strictly speaking crescentic in shape. They are grouped according to the shapes defined in the Tyimede I series. In that analysis flared and convergent forms can only be distinguished on scrapers made on endstruck flakes where butt and tip are obvious. Consequently, since endstruck scrapers form only 20.0 per cent of this collection, flared and convergent forms are amalgamated as follows:

Shapes	Per cent
Waisted	3.3
Flared)	26.7
Convergent)	
Oval	70.0
Total Nos	60

¹ McCarthy, F.D. et al., 1946 p.30; see also Chapter VI pp.331-2.

Most scrapers are generally oval in shape and the other forms occur in the same proportions here as are found at Tyimede I.

(iv) Thickness (T/B ratio):

The thickness of scrapers, shown by the T/B ratio below, again stresses the similarity between these scrapers and those at Tyimede I.

T/B ratio	Per cent
20-29	16.7
30-39	21.6
40-49	23.4
50-59	25.0
60-69	8.3
70-79	3.3
80-89	1.7
Total Nos	60

5. Cross-section

The shapes of scrapers taken at B2, are as follows:

Cross-section	Nos	Per cent
Isos. triangle	10	16.7
Irreg. triangle	4	6.7
Rt. angled triangle	1	1.7
Trapezium	8	13.3
Parallelogram	8	13.3
Lens	7	11.7
Dome	22	36.6
Total	60	100.0

The same wide variety of shapes occurs here as in the Tyimede I series, but there are proportionally slightly more domed and lenticular sectioned scrapers at Tyimede II. All sidestruck scrapers have trapezoidal sections, in contrast to the rhomboid cross-sections of most tula adzes.

One implement (3G/2-1 : Level Ia) has a section shaped like a right angled triangle, and in this particular respect it resembles an elouera.¹ It is oval in plan with steep bifacial retouch along one edge (Figure VII-16, a).

Conclusion

Most scrapers are made of chert and are somewhat oval in shape. None of them conforms to the definition of a tula or burren adze, but one conforms in one respect to the definition of an elouera.

As a group, these implements are most similar to the scrapers at Tyimede I.

B. SECONDARY MODIFICATION:

All scrapers are unifacially retouched and most of this retouch is visible on the dorsal surface of the implement. Seven are unifacially worked on both dorsal and ventral surfaces.

The main forms of unifacial working are scalar and step flaking. These forms often occur together on a

¹

See Chapter V pp.233-6.

multiple edge and they vary in terms of shape and angle in the same way as they do in the Tyimede I series.

Only ten scrapers (16.7 per cent) are bifacially worked as opposed to 25 per cent in the Tyimede I series. Like the Tyimede I scrapers, the chief form of bifacial retouch is non-alternate flaking where step flakes are detached on the inverse surface.

Discrete lengths of utilisation are found and unifacial use-wear predominates on fairly acute angled edges. Use-wear also occurs in association with retouch and a visual inspection suggests that step flaked edges show signs of chattering whereas scalar retouched edges generally show unifacial use-wear.

Conclusion

These scrapers are retouched and were apparently used in a similar way to those found at Tyimede I.

Distribution

1. Density

Scrapers are distributed evenly in the deposit as follows:

Level	Nos	Per cent
Ia	30	50.0
Ib	30	50.0
Total	60	100.0

2. Position of striking platform/Depth

Scrapers made on patently endstruck or sidestruck flakes form 20.0 per cent (6) of all scrapers in Level Ia, and 46.7 per cent (14) of all scrapers in Level Ib. Although the numbers concerned are small, this variation over time is not found in the Tyimede I series at all.

3. Retouch/Depth

Unlike Tyimede I, scrapers with bifacial retouch are distributed evenly throughout the deposit.

7. Broken scrapers (Figures VII-12, a, c-d; VII-16, b)

There are 48 broken scrapers of which four (8.3 per cent) are made of quartzite and 44 (91.7 per cent) of chert. Seven (14.6 per cent) of them are made on endstruck flakes whose distal end has broken off, and the rest are fragments of the ends and shafts of implements. The relatively low proportion of patently endstruck flakes corresponds with the proportions found amongst intact scrapers in this deposit, as opposed to the relatively high proportions found at Tyimede I.

The fragments are generally unifacially retouched with step and scalar flaking. Bifacial retouch is rare and the non-alternate form, where step flakes are removed off the inverse surface, predominates. Utilisation occurs as discrete lengths or in association with retouch. One quartzite scraper (1D/4 : Level Ib) is particularly noteworthy. It is bifacially retouched on one side so that it has a cross-section shaped like a right angled triangle, in which respect

it resembles the scraper 3G/2-1 . The other side is covered with use-polish which extends over both surfaces for a distance of some 0.5 cm. in from the edge. The gloss is high on the dorsal surface and dull on the ventral one (Figure VII-16, b).¹

Distribution

Level	Nos	Per cent
Ia	24	50.0
Ib	24	50.0
Total	48	100.0

8. Bifacial ovals (Figure VII-12, f-g)

There are four bifacial ovals: one is made of quartzite, one of quartz and two of chert. They range in length from from 2.5-3.7 cm. and are retouched alternately and non-alternately by the removal of scalar flakes.

Distribution

All ovals occur in Level Ib, but the numbers are too small to draw any conclusions.

9. Implements with bruised ends

There are 20 of these implements and they show the following features:

¹ See Chapter V pp.233-6.

1. Raw Material

Two are made of quartzite, two of quartz and 16 of chert. This contrasts with the Tyimede I series, where most implements with bruised ends are made of quartz.

2. Shape-General

(i) Position of striking platform:

Two implements are made on endstruck flakes and the rest are made on irregular flakes and lumps.

(ii) Shape/Size:

Implements range in length from 1.7 to 3.7 cm. and in shape from rectangular (B/L 45) to squarish (B/L 95).

B. SECONDARY MODIFICATION:

1. Number of Retouched and/or Utilised Edges per Tool

In the following table S and E stand for side and end and refer to the position of the edge on the implement.

Implements	Nos edges				Total
	2SE	2EE	1S	1E	
Nos	1	1	3	15	20
Per cent	5.0	5.0	15.0	75.0	100.0

All implements are worked at one or both ends, which helps to distinguish them from scrapers, which are generally worked on the sides.

2. Shape of Edge viewed End-on

Edges	Shapes (Nos)			Total
	Concave	Straight	Wavy	
Side	1	3	-	4
End	6	10	2	18
Total	7	13	2	22

3. Retouch and Utilisation on Edges

Edges are unifacially and bifacially retouched but their most salient feature is that they are bruised. The following table shows that bruising is often, but not always, associated with retouch.

Edges	Retouch and/or use-wear (Nos)			Total
	Retouched only	Bruised and retouched	Bruised only	
Side	1	2	1	4
End	-	11	7	18
Total	1	13	8	22

Conclusion

These implements closely resemble the series from Tyimede I and carry the same implications.

Distribution

Most implements occur in Level Ib.

Level	Nos	Per cent
Ia	7	35.0
Ib	13	65.0
Total	20	100.0

10. Broken implements with bruised ends

There are two of these: one is made of quartzite and one of quartz and both come from Level Ib.

11. Endstruck quartzite flake (Figure VII-13)

There is only one of these, (6C/2-1). It is 15.7 x 6.7 x 2.4 cm. and rectangular in shape. The base is retouched on the dorsal surface with flakes struck off the striking platform before or after the flake was detached.

The flake is unifacially retouched on both sides and along the tip. Both sides are retouched with scalar flaking on the dorsal surface for 1/5 of the distance along the length axis from the base, and on the ventral surface for the remaining 4/5. The tip is retouched on the dorsal surface with scalar flaking and is bruised almost as though the flake were used as a hammer.

The specimen comes from Level Ia.

12. Broken endstruck quartzite flakes (Figure VII-14)

There are three implements and they are all longer than 5 cm. They are retouched on the sides with unifacial scalar flaking. Two come from Level Ia and one from Ib.

13. Cores/Core scrapers (Figure VII-15)

These are two large quartzite implements which belong to this class as defined in the analysis of the Tyimede I series. The first (7C/4-10 : Level Ia) is a large chunky flake, 8.6 x 8.1 x 3.1 cm. It has a flat, plain striking platform with flakes struck off the dorsal surface. Both sides are unifacially retouched, one on the dorsal surface and the other on the ventral surface of the implement. One side is bruised and may have served as a hammer.

The second piece (6C/4-16 : Level Ib) is also a large and irregular flake, 8.5 x 4.8 x 3.0 cm. in dimension. It is unifacially retouched on one side and bifacially worked on the other.

14. Utilised flakes (Figure VII-16, c-d)

There are 40 utilised flakes with the following features:

A. GENERAL FEATURES:

1. Raw Material

Four (10 per cent) of these implements are quartzite, two (5 per cent) are quartz and the other 34 are chert.

A similar predominance of chert occurs among the utilised flakes at Tyimede I.

2. Shape-General

(i) Position of striking platform:

Twenty-two (55 per cent) are endstruck flakes, one (2.5 per cent) is a sidestruck flake and the striking platform is invisible on the remaining 17 (42.5 per cent).

(ii) Shape/Size:

Utilised flakes range in length from 1.6 to 10.4 cm. and most are 3.0 - 4.0 cm. long. The longest specimens are made of quartzite, which is also the case at Tyimede I.

The flakes range in shape from rectangular (B/L 20) to squarish (B/L 95).

B. SECONDARY MODIFICATION:

Use-wear occurs on a varying number of edges on different implements. Unifacial and bifacial varieties are found, but unifacial use-wear is the predominant form. Use-polish occurs on two flakes. The first is a chert flake with a slight gloss on the cutting edge of one side. The second is an endstruck quartzite flake, (6G/3-12 : Level Ia), 3.7 x 2.6 x 0.6 cm., with use-polish on both surfaces of one side. The gloss on the dorsal surface is high and extends about 0.5 cm. in from the edge. The gloss on the ventral surface is dull extending about 0.3 cm. in from the edge. Similar use-polish

occurs on a broken scraper in this collection, (1D/4), and on a broken utilised flake at Tyimede I, (3E/4-17). It is also found on scrapers and utilised flakes in the point and scraper assemblages at Padypadiy and Nawamoyu on the plain. It seems very likely therefore that these formally distinct tools performed similar functions (see Figure VII-16).

Distribution

Level	Nos	Per cent
Ia	18	45.0
Ib	22	55.0
Total	40	100.0

There are slightly more utilised flakes in Level Ib.

15. Broken utilised flakes

There are 27 of these: four (14.8 per cent) are quartzite and the remaining 23 are chert.

Most of these flakes show unifacial or bifacial forms of use-wear and one quartzite piece has been smoothed along the edge.

Distribution

Level	Nos	Per cent
Ia	11	40.7
Ib	16	59.3
Total	27	100.0

There are more of these implements in Level Ib.

16. Miscellaneous (Figure VII-12, e)

There are two pieces: The first, (2D/4-2 : Level Ib), is a bifacially retouched piece of quartzite which, viewed dorso-ventrally, is shaped like an equilateral triangle. It is not sharply pointed on any corner and has a form midway between a bifacial point and a bifacial oval.

The second piece is a large fragment of quartz, (3G/6 : Level Ib), 7.2 x 5.0 x 2.3. One side is thick and unretouched and the other is acute angled and bifacially retouched. The piece has a section shaped approximately like an irregular triangle. The retouched edge is bruised as though it were used as a chopping or cutting tool.

17. Axes (Figures VII-17, a; VII-18)

There are four axes of porphyritic dolorite which are individually described in Appendix VII-2. Two are so badly weathered that it is difficult to see the position of retouch and grinding. Three axes are bifacially retouched and all of them are ground. One comes from Level Ia and the rest from Level Ib. These are the only porphyritic dolorite implements in this level, so that the waste flakes of this material which occur throughout Level I, are probably to be interpreted as the by-products of axe manufacture and/or use.

18. Retouched fragments

There are 172 fragments with unifacial or bifacial retouch.

a. Unifacially retouched fragments:

There are 113 pieces. Forty-five (39.8 per cent) are quartzite, 13 (11.5 per cent) are quartz and 55 (48.4 per cent) are chert. Seventeen pieces have intact striking platforms and most pieces show signs of scalar retouch.

b. Bifacially retouched fragments:

There are 59 pieces. Twenty-one (35.6 per cent) are quartzite, seven (11.8 per cent) are quartz and 31 (52.6 per cent) are chert. The high proportion of chert pieces contrasts with the fact that most bifacially worked implements in the collection are quartzite points. The same contrast also occurs at Tyimede I and remains a problem, if the fragments are indeed parts of bifacial points.

Distribution

Level	Fragments			
	Unifacial		Bifacial	
	Nos	Per cent	Nos	Per cent
Ia	59	52.2	24	40.6
Ib	54	47.8	35	59.4
Total	113	100.0	59	100.0

(ii) OTHER STONE ARTEFACTS1. Abraded fragments

Five abraded pieces occur in Level Ib. Four are schist and vary in length from 18.0 to 8.0 cm. The remaining piece is a slab of sandstone, 7.7 cm. long, with smoothing along one edge.

2. Ochre

There are 584 lumps of ochre in the deposit which weigh a total of 5306.3 gm. This includes haematite and clay and the colours include purple, red, yellow and white.

Distribution¹

Level	Number of lumps (Per cent)	Weight in gm. (Per cent)	Mean weight of lumps (gm.)
Ia	34.6	27.6	6.8
Ib	65.4	72.4	8.6
Total	570	4510.6	

There is more ochre in Level Ib and the mean weight of lumps is larger there too.

¹ The material in square 3H is omitted from this analysis.

3. Hammers/Pounders

There are 11 hammers made of quartz, quartzite pebbles and blocks of quartzite. They are all intact and range in weight from 43 to 1400 gm. though most weigh 300-500 gm.

Some are battered at several corners and others on one projecting end only. There are no hammers that resemble the 'kulki' found at Tyimede I, though several have been used all round the perimeter.

Distribution

There are five hammers in Level Ia and six in Level Ib.

4. Rock with ground hollow

There is a slab of quartzite, approx. 60 x 40 x 10 cm. in Level Ia, with a small depression (diam. 10 cm.) on one surface.

Level I - Conclusion

Many of the implements in this level were probably fashioned on the spot. The makers used a wide variety of raw materials and apparently favoured certain rocks when making certain tools. For instance, points were generally made of quartzite, scrapers of chert and axes of porphyritic dolorite. These features are very similar to those found at Tyimede I and probably carry the same implications. Similar quantities of different rocks were knapped at both sites and the chief difference

between the two series lies in the markedly higher proportion of quartz implements in the Tyimede I collection.

The proportion of flaked implements in Level I is shown in the following table, where the numbers correspond to the types described in the text. One tip from square 3H is omitted from the analysis of implements in Level Ia and Ib.

Implements	Level				Total	
	Ia		Ia			
	Nos	%	Nos	%	Nos	%
1. Points	12	4.5	9	2.9	21	3.7
2. Butts	32	12.0	39	12.8	71	12.3
3. Tips	29	10.9	25	8.2	55	9.6
4. Shafts	15	5.6	25	8.2	40	7.0
5. Unfin. pts	1	0.4	1	0.3	2	0.3
6. Scrapers	30	11.3	30	9.8	60	10.5
7. Br. scrapers	24	9.0	24	7.8	48	8.4
8. Ovals	-	-	4	1.3	4	0.7
9. Bruised	7	2.6	13	4.3	20	3.5
10. Br. bruised	-	-	2	0.7	2	0.3
11. Endstruck	1	0.4	-	-	1	0.2
12. Br. endst.	2	0.7	1	0.3	3	0.5
13. Cores/ Scrapers	1	0.4	1	0.3	2	0.3
14. Util. flakes	18	6.7	22	7.2	40	7.0
15. Br. util. fl.	11	4.1	16	5.2	27	4.7
16. Miscell.	-	-	2	0.7	2	0.3
17. Axes	1	0.4	3	1.0	4	0.7
18a Unif. retouch	59	22.0	54	17.6	113	19.7
b Bif. retouch	24	9.0	35	11.4	59	10.3
Total	267	100.0	306	100.0	574	100.0

The two levels are very similar and both contain points and scrapers. 72.8 per cent of the implements are broken which is very similar to the proportion found at Tyimede I.

In order to compare the content of the two groups more closely, the intact and broken implements are combined and the standard deviations are given. This is shown in the following table where the numbers in brackets refer to the implement classes listed in the text, and the standard deviations are calculated assuming a Poisson distribution.

Implements	Level			
	Ia		Ib	
	%	S.D.	%	S.D.
1. Points (1-5)	33.4	± 4.1	32.4	± 3.8
2. Scrapers (6-7)	20.3	± 3.0	17.6	± 2.6
3. Ovals (8)	-	-	1.3	± 0.7
4. Bruised (9-10)	2.6	± 1.0	5.0	± 1.3
5. Endstruck (11-12)	1.1	± 0.6	0.3	± 0.3
6. Cores/Scrapers (13)	0.4	± 0.4	0.3	± 0.3
7. Util. (14-15)	10.8	± 2.1	12.4	± 2.1
8. Miscell. (16)	-	-	0.7	± 0.5
9. Axes (17)	0.4	± 0.4	1.0	± 0.6
10. Unif. frags (18a)	22.0	± 3.2	17.6	± 2.6
11. Bif. frags (18b)	9.0	± 1.9	11.4	± 2.0
Total Nos	267		306	

The contents of the two levels are very similar in nearly every respect, and closely resemble the industry in Levels II and III at Tyimede I. I have already observed the variations that do occur - such as the relatively low number of quartz tools and the high proportion of bifacial points at Tyimede II - but I prefer to treat these as local variations until we know more about the prehistoric industries of the area.

Level II

(i) FLAKED STONE IMPLEMENTS

There are 24 implements in this level as follows:

1. Butts (Figure VII-20, a)

There is one chert butt (2D/6-1). It is curved and bifacially retouched.

2. Tips

There are two tips made of quartzite. One is bifacially worked, the other is unifacially retouched on the ventral surface.

3. Scrapers (Figure VII-20, b)

One chert scraper, (2D/5, 6-5), 3.4 x 1.2 x 0.7 cm., occurs here. It is shaped like the small rectangular scrapers found in the top level and is unifacially retouched with step and scalar flaking on both surfaces along one side.

The other scraper (2D/5, 6-4) is made of quartzite. It is 7.1 x 3.9 x 2.3 cm. and is considerably larger than

the scrapers found in Level I of this deposit, though a few large scrapers do occur in the point-scraper industry at Tyimede I. It is an endstruck flake, unifacially worked on one side with step and scalar flaking.

4. Utilised flakes

There are three chert flakes with use-wear on the edges; one is heavily patinated.

5. Unifacially retouched fragments

There are nine fragments: three are quartzite, two are quartz and four are chert.

6. Bifacially retouched fragments

There are three chert pieces.

7. Cores/Core scrapers

Two implements occur here. The first, (3F/5-8), is a chunk of quartzite from which one or two flakes have been struck off. Several other flake scars are convex suggesting that thermal flakes have been detached. The edge is bruised possibly as a result of use.

The second implement, (3G/7-1), is a slab of quartz from which large flakes have been struck bifacially around the perimeter.

8. Axes (Figure VII-19)

There are three axes made of porphyritic dolorite (see Appendix VII-2). All are bifacially retouched and ground to form a cutting edge. They are the only porphyritic dolorite tools in this level, and are associated with numerous waste flakes of the same material, that were probably produced during axe manufacture and/or use.

(ii) OTHER STONE ARTEFACTS

1. Ochre

There are 196 lumps of ochre which cover the same range of colours and types as is found on Level I. The lumps weigh a total of 2049.5 gm. so that the mean weight of a lump is 10.4 gm. They are therefore heavier than the lumps in Level I.

2. Hammers/Pounders

There are four hammers: two are quartzite and two are quartz pebbles. Only one quartz pebble is intact and it shows signs of use on several surfaces.

Level II - Conclusion

This level is treated as a transitional zone and contains elements peculiar to both Levels I and III. For example, the butt, tips and small scraper are typical of the industry in Level I, whereas the larger scraper, the heavily patinated utilised flake and the core/core scraper with thermal fractures, are more characteristic of the material in Level III.

Level III(i) FLAKED STONE IMPLEMENTS

There are 64 implements which are described as follows:

1. Scrapers (Figure VII-21)

There are six scrapers which are analysed as follows:

A. GENERAL FEATURES:1. Raw Material

Two scrapers are made of quartzite, one of quartz and three of chert.

2. Shape-General(i) Position of striking platform:

The scrapers are apparently not made on flakes, but on chunks of stone from which primary flakes were removed, either at random or else deliberately around the periphery of the lump off both surfaces. In some respects therefore these scrapers resemble cores, and they probably served as cores in the early stage of manufacture. They are therefore different from the scrapers in Level I most of which are made on flakes.

(ii) Shape/Size:

Most scrapers are 3.0 - 4.0 cm. long, but they range in length from 2.4 to 5.5 cm. They are all roughly circular when viewed dorso-ventrally. They are

therefore considerably smaller than the core/core scrapers. Their B/L ratio ranges from 58 to 85, but most have a B/L ratio of 75-85. They are fairly thick and chunky and their T/B ratio ranges from 50-100. These features also help to distinguish these scrapers from those in Level I, whose B/L ratio is generally 40-70, and whose T/B ratio is generally 30-59.

(iii) Cross-section:

This varies considerably. One highbacked scraper (T/B 100) has a triangular cross-section, two have parallelogram shaped sections, two are lenticular and one is domed in cross-section.

B. SECONDARY MODIFICATION:

All scrapers are unifacially retouched on at least one edge, the most common form being step flaking though scalar retouch is occasionally found. Two scrapers are retouched on different edges from alternate surfaces.

Utilisation occurs in association with step flaking on one tool, where a length of chattering is found. Unifacial use-wear occurs alone on the edge of one artefact (3C/7-1).

There are several large waste flakes which show signs of heavy step flaking and chattering. These may well have been detached from chunky scrapers in order to rejuvenate the edge.

2. Cores/Core scrapers (Figure VII-22)

There are two implements. The first (3E/6-1) is a large quartzite slab 10.8 x 7.6 x 3.8 cm. It is roughly oval in plan and has a cross-section shaped like a right angled triangle. It is bifacially flaked on one side and end and the edges show a marked zig-zag line when viewed end-on.

The second implement, 3D/7, is made of chert. It measures 6.3 x 4.2 x 1.7 cm. and is roughly oval in plan. Flakes have been removed all round the perimeter off both surfaces. One edge is heavily bruised suggesting that the implement may have been used as a chopper or hammer.

3. Utilised flakes (Figures VII-20, c; VII-23, b-d)

There are 16 utilised flakes as follows:

A. GENERAL FEATURES:

1. Raw Material

Three are quartzite, one is quartz and the remaining 12 are chert. Three of the chert flakes are patinated.

2. Shape-General

(i) Position of striking platform:

Eight are endstruck flakes and the others show no clear striking platform.

(ii) Shape/Size:

The flakes range from 2.2 to 7.4 cm. in length and most are 3.0 to 4.0 cm. long. They range in shape from rectangular (B/L 27) to squarish (B/L 95). The range is therefore similar to that found in the utilised flakes elsewhere in the deposit.

B. SECONDARY MODIFICATION:

This occurs on a varying number of edges on different implements. Unifacial use-wear is the most common form but bifacial utilisation is more common on these flakes than on utilised flakes from other levels of the deposit.

None of the flakes shows any signs of use-polish.

4. Broken utilised flakes

There are 12 of these implements. Four are quartzite, one is quartz and the other seven are chert. One quartzite flake has an unusual ridged surface and is apparently a thermal flake.

The most common form of use-wear found on these tools is the unifacial variety, and bifacial utilisation also occurs.

5. Utilised lumps (Figure VII-23, a)

There are three of these: two are quartzite and one is made of chert. They range in length from 6.5 to 4.5 cm. and are roughly circular in plan. The two quartzite specimens show large convex flake scars where thermal flakes have apparently been detached.

One quartzite lump has unifacial use-wear on one edge; another is bruised on one edge. The chert specimen has unifacial use-wear along one edge.

6. Miscellaneous

There are five lumps of quartz from which only one or two flakes have been struck. I hesitate therefore to call them cores, though they probably served this purpose.

There is one piece of chert (1D/9), which measures 3.3 x 3.9 x 0.9 cm. This has two lengths of step flaking on each surface which suggests that attempts were made to thin the piece down.

7. Axes (Figures VII-25, VII-26)

There are five axes (see Appendix VII-2). They are all made of porphyritic dolorite and were bifacially retouched and then ground. Once again these are the only porphyritic dolorite tools in Level III so that the associated waste flakes of the same material probably represent by-products of axe manufacture and/or use.

8. ?Hatchets (Figure VII-24)

I use this term to describe the following implements: The first, (3D/9-1), is a large red quartzite flake. The dimensions of the piece are 7.9 x 5.5 x 1.7 cm. and it is a sidestruck flake, with a plain platform and bulb of percussion lying at the end of the breadth axis.

The implement is almost rectangular when viewed dorso-ventrally and has a cross-section shaped roughly

like a right angled triangle. The retouched edge lies opposite the striking platform: small flat flakes were detached from both surfaces but it is difficult to judge whether this occurred during retouch or use. The edge is straight when viewed end-on, and is fairly acute angled.

The second implement, (2E/8-8), is a slab of quartzite, parts of which were recovered separately during the excavation and later pieced together. It remains incomplete however, but resembles the previous implement in general size and shape. One side has been used: small flakes were detached from both surfaces and smoothing use-wear can be seen.

These implements may be some form of knife or scraper. The forms have not hitherto been recorded in Australian collections, but since there are so few in this deposit it is difficult to judge whether they are a discrete type or merely a variety of utilised flake.

9. Retouched fragments

a. Unifacially retouched fragments:

Ten unifacially retouched fragments occur here. Two are quartzite, one is quartz and seven are chert. Two chert flakes are heavily patinated. Most of these fragments have lengths of step flaking as opposed to the high incidence of scalar retouch on fragments in Level I. It is impossible to reconstruct the shape of the original intact tool from these fragments.

b. Unifacially retouched fragments:

Two of these occur: one is quartzite and the other is chert.

(ii) OTHER STONE ARTEFACTS

1. Abraded fragments (Figure VII-17, b)

There are two abraded fragments. The first, (3F/7-2), is a narrow piece of schist, 6.3 x 2.8 x 1.7 cm. One surface is covered with yellow ochre. Similar specimens occur at Tyimede I and they may have been rasps used for pulverising ochre.

There is one unusual fragment of sandstone, (2B/9), which has been ground to form a shallow 'dish'. It is 5.7 x 4.0 x 1.5 cm. and is broken down the length axis. It is ground along one side to form a circular outline and is also ground on both surfaces, one of which is concave, the other convex.

2. Ochre

There are 630 lumps of ochre covering the same range of types and colours found in the other two levels. The total weight of the ochre is 7227.2 gm. so that the mean weight of an ochre lump is 11.4 gm. This is heavier than the mean weight of lumps in the succeeding levels.

3. Hammers/Pounders

There are six hammers: two are quartz pebbles and the other four are quartzite. Four are intact and weigh between 137.0 and 1400 gm. All show signs of localised bruising and pitting. The largest one is flattened at one end as though it were used to pound and rub.

4. Rocks with ground hollows

Two large rectangular slabs were recovered. They are about 30.0 cm. long and each has a small ground depression, (diam. 10 cm.), on one surface.

5. Miscellaneous

There are three lumps of schist, ranging in weight from about 100-800 gm. They are all rod shaped and unworked. They may be the centre of a natural fold but are foreign to the shelter.

Level III - Conclusion

The makers of this industry used a wide variety of raw materials and apparently fashioned their implements on the spot. The proportions of different tool types are shown in the following table and the numbers correspond to those used in the text:

Implements	Nos	Per cent
1. Scrapers	6	9.4
2. Cores/Scrapers	2	3.1
3. Utilised flakes	16	25.0
4. Br. util. fl.	12	18.8
5. Utilised lumps	3	4.7
6. Miscellaneous	6	9.4
7. Axes	5	7.8
8. ?Hatchets	2	3.1
9a. Unifacial retouch	10	15.6
b. Bifacial retouch	2	3.1
Total	64	100.0

This is a relatively small collection and it is composed largely of chunky scrapers, cores/scrapers, utilised flakes and edge ground axes. The most distinctive feature of this series, compared with the industry in Level I, is seen in the complete absence of the points and small scrapers that predominate in the uppermost level. The industry is technologically somewhat different from the point-scraper series too, in that there are proportionally more waste flakes of quartz and I/mm. rocks and considerably fewer quartzite waste flakes. Furthermore the waste flakes in Level III are somewhat larger than those in the upper levels. This is probably related to the absence of extensively retouched tools, such as bifacial points, in Level III.

On the other hand there are certain elements in both Levels I and III that suggest some degree of cultural continuity. These include utilised flakes, axes, abraded fragments, ochre and hammers. It is perhaps worth noting that, unlike the collection in Level I, there are no use-polished flakes in Level III.

The material in Level III is broadly similar to the assemblages from Levels III at the two sites on the plain, Malangangerr and Nawamoyne. A similar typological sequence occurs at all three sites where an assemblage of chunky scrapers and axes is overlain by a point-scraper industry. Unfortunately the early industry at all three sites is represented by relatively small collections of stone tools and virtually no organic remains other than charcoal. As a result, one can only point to the broad similarities in stone tool typology until larger collections become available.

C. ROCK PAINTINGS

Paintings occur on both sides of the entrance and on the south wall of the second chamber of Tyimede II (see Figure VII-1). The main designs were identified by our Aboriginal informants as follows:

I. South wall of entrance

Paintings extend for about 3.6 m. across the rock wall here. Reading approximately from north to south, the following designs occur:

1. Fish

Two superimposed fish are drawn with a red outline and white infill. One is drawn horizontally, the other vertically and the horizontal fish was identified according to the shape of the tail, as a fresh water species, termed rifle fish. A third fish, shown only by a tail drawn in thicker red outline, was identified as a catfish.

2. Mimis

Two mimis were identified. The first, termed 'devil mimi', is a white stick figure drawn in outline only. One arm is longer than the other and was said to be ready to grab somebody. The second mimi, termed 'lightning mimi' or 'namargon', is about 34.0 cm. long. It is a white figure with wildly outstretched limbs and spokes radiating out from the head. Nearby is a round red patch identified as its dilly-bag (Plate VII-4).

3. Night owl

A vertical bird-like figure, 35 x 11 cm., outlined in red and filled in with white and red, was identified as 'goldol', the night owl. Our informants said they seldom saw the bird but that it was 'good tucker' (Plate VII-5).

4. Women

Two rather indistinct red patches, one 35 cm. long, the other 30 cm. long, were identified as female figures.

5. Basket

A pattern of red lines about 17 cm. long was identified as a 'muraian' basket called 'won gorol'.¹ The informants said that such baskets were made of spinifex grass with tails of blue parrot feathers and that they were used to carry sacred stones.

II. North wall of entrance

These paintings occur within the shelter, mostly along a fairly fresh rock face directly above squares 3-5F. Excavations revealed several large rocks in squares 4-5F which had apparently weathered off the wall above. These rocks lie approximately 30-50 cm. below the surface in Level II. The position of these rocks provides a terminus post quem for the paintings, since the surface on which they occur was apparently only

¹ See Spencer, W.B. 1914 p.20, p.150.

exposed after the earliest occupational phase had ended. It is therefore reasonable to suggest that unless modern Aborigines made them, they were painted by the makers of points and rectangular scrapers (Plate VII-6).

The drawings include many lines and patches which could not be identified. Only two designs were distinguished:

1. Lizard

There is a solid white drawing of an upright figure 17 cm. long and a faded white patch nearby. The solid figure was identified as a large lizard without a frill.

2. Human

An upright drawing of the head and arms of a human figure approximately 15 x 18 cm. is present. It is drawn with fine red lines and filled in with heavy white lines. It was called 'maruwa', a gorilla-like man who lives near Cooper Creek. He is not a true spirit like a mimi, but a form of wild man: old men have seen him and Gananggu assumed that he was drawn by someone who saw him.

III. South wall of second chamber

Most of the designs here consist of heavy white lines, though there is one patch where the pigment was apparently sprayed on the wall. It is very dark in the cavern today and the painters probably lit a fire there in order to see more clearly. Only one series of lines

was identified. These were termed spearthrowers: two are normal specimens, the third is a 'lazy-man's woomera', which differed from a normal one because the knob, instead of being bound in place, was a natural projection.

ROCK PAINTINGS - Conclusion

Most of these designs are monochromatic and very few have fine outlines. Many are white, like the paintings at Tyimede. There is evidence to suggest that some designs were painted after the earlier phase of occupation at the site.

GENERAL CONCLUSION

Perhaps the most important feature of the evidence at Tyimede II, is that the deposit contains a similar typological sequence to the series found at the two plain sites, Malangangerr and Nawamoyrn. All three sites contain an early industry of chunky scrapers, utilised flakes and axes, which is succeeded by a later tradition characterised by points, small scrapers and axes. The chief difference is that the later industry was manufactured on the spot in both Tyimede sites whereas the stone tools in the plain sites were clearly manufactured elsewhere.

The evidence from Tyimede II shows that the early tradition was not restricted to the plains and that there was a certain cultural similarity between the two ecological areas at that early stage. Radiocarbon dates suggest that the early tradition on the plain is older than the similar industry in the hills and this will be discussed more fully in the final chapter.

A reconstruction of the prehistory of Tyimede II may be attempted as follows:

Tyimede II was periodically occupied for more than 7,000 years. The early inhabitants camped among the blocks and pebbles on the floor, possibly beside a small seasonal stream. They lit fires there and although they probably ate a wide variety of food, subsequent weathering has destroyed almost all traces of organic remains.

The occupants were undoubtedly itinerant hunters, ranging over a fairly wide area. The presence of one

crab claw suggests that they may have foraged down to the coastal plain, and ancient charcoal in Tyimede I suggests that they probably camped there too.

These people fashioned stone tools presumably using stone hammers. They produced chunky scrapers and edge ground axes and used sharp primary flakes. Ochre was collected and apparently pulverised with schist rasps. They ground small circular depressions in slabs of rock but left no discernable trace of their purposes.

As time went by different types of stone tools, such as small points and rectangular scrapers, made their appearance and the old types of chunky scrapers apparently disappeared. We have no evidence of whether this change represents new ideas acquired by the descendants of the original inhabitants or the arrival of a new and distinct group. Certain practices continued however: the inhabitants still manufactured the stone artefacts on the spot, and they still produced edge ground axes, used sharp primary flakes, collected ochre and ground enigmatic hollows in blocks of sandstone. They ate a wide variety of food, including small marsupials, fish, crabs and fresh water mussels. Again, the presence of crab claws suggests widespread foraging in search of food.

In the earliest stage of this later phase of occupation a few large blocks finally fell off the north wall of the shelter, leaving a clean fresh surface upon which people painted designs.

There is strong evidence to suggest that these people also camped at Tyimede I. Typological analysis shows that the deposits in both sites contain similar points and small scrapers. The main differences are that they are relatively more bifacial than unifacial points at Tyimede II, and there are more quartz tools at Tyimede I: these are termed 'local variations' for the present.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

This chapter contains three main sections. Firstly, there is a summary of the prehistoric sequence in the Oenpelli area. Secondly, this is set in the context of the prehistory of the country as a whole. Finally, an attempt is made to suggest some further productive avenues of research.

A. SUMMARY OF RESULTS

A survey of sites in the research area and extensive excavations at five sites, provide a consistent picture of the prehistory of the area. Broadly speaking, two successive industrial traditions occur. The earlier one is found in the plateau and on the plain and is dated from about 20,000 to 6-7,000 years B.P. The later tradition occurs as two marked regional variants which lasted from about 6-7,000 B.P. until the ethnographic present (Figure VIII-1).¹

The earlier industry is found at Malangangerr, Nawamoyrn and Tyimede II. It occurs in coarse, unstratified sand in all three shelters and is dated by a consistent series of radiocarbon dates to 18-20,000 B.P., at both

¹ This is a purely diagrammatic representation of the relationships of the sites and the position of charcoal samples. Reference should be made to earlier chapters to ascertain the precise position of samples within the deposits.

Malangangerr and Nawamoyrn. At Tyimede II, however, the industry is dated to 6-7,000 B.P.

Taking into account the positions of the samples in the deposits, the dates may imply that the earliest occupants of the area lived on the plain and that they only moved into the hilly country much later. On the other hand the evidence may suggest that the industry continued to be made in the hills until a considerably later date. The disparity may also reflect more extensive weathering of the upper part of the sands at Malangangerr and Nawamoyrn. Whatever the answer, one should remember that these inferences are all based on limited data drawn from only three sites, and it is therefore somewhat premature to draw such broad conclusions at this stage.

The industry is characterised by stone artefacts only: no organic remains survive to provide a picture of the economy, physical type or supplementary artefacts of these people.

The analysis of the stone artefacts suggests that at least some implements were manufactured on the spot. The implement assemblages are so small that it is statistically inadvisable to draw detailed comparisons between different sites and instead a general picture of the industry is shown in Figure VIII-2.

All three assemblages are characterised by chunky scrapers, cores/core scrapers, utilised flakes and edge ground axes. Several axes have grooves or indentations suggesting that they were mounted in a handle. Other stone artefacts include ochre, abraded

pieces of rock, rocks with smooth round hollows ground into the surfaces and hammers or pounders.

The later industry overlies the early series at Malangangerr, Nawamoyn and Tyimede II and also occurs at Padypadiy on the plain and Tyimede I in the hills. The stratigraphy and radiocarbon dates of the plains sites, (Malangangerr and Nawamoyn), suggest that a considerable time elapsed before the later deposit began to accumulate. This time-gap may reflect some kind of ecological change on the plain or even a major movement of people, but alternatively it could equally well merely reflect the weathering of the upper level of the sand at Malangangerr and Nawamoyn. It would be unwise at this stage to draw any conclusions on the basis of such limited evidence.

The radiocarbon dates for the earliest level of the later industry at Malangangerr, Nawamoyn and Tyimede II are in broad agreement, ranging from about 5-7,000 B.P. The most striking feature of the industry is that two regional variants can be distinguished, one on the plain, the other on the plateau. This distinction is supported by the ethnographic record which allows us to discuss the evidence with added confidence despite the small number of sites concerned.

The plain variant is found at Padypadiy, Malangangerr and Nawamoyn, in dense midden deposits. The radiocarbon dates suggest that the industry lasted from about 6-7,000 B.P. until 200 B.P., and the presence of iron, glass and cloth in the upper levels at Padypadiy indicates that it probably lasted until the ethnographic present.

The inhabitants of these shelters exploited a wide range of flora and fauna found on the coastal plain. They ate shellfish, small mammals, fish, tortoises and birds and probably also vegetable foods such as lotus lily rhizomes and edible fruits although these plant remains are preserved only at Padypadiy.

The analysis of dietary remains suggests that the economy remained broadly similar throughout the entire period. Some change is observed in the proportion of shell species found at all three sites, and this may reflect changes in the composition of the shell populations, dietary preferences or even limited sampling. There are unfortunately too few mammals present to infer any changes in diet over time, but one specimen of the Tasmanian devil, now extinct in mainland Australia, is present at Padypadiy.

I do not use the midden analyses to infer the amount of food represented or the size of the group responsible for the accumulation. This is largely because the local ethnographic sources suggest very strongly that food was eaten and the remains were deposited over a wide area between the source and the current camp site. Further studies of similar deposits may well reveal more encouraging grounds for making such estimates, but until then the matter will have to remain open.

Human remains occur in all three sites, though the discrete burials are not specifically dated. Both primary and secondary burial were practised and if secondary burial is to be inferred from scattered remains

in the lower levels of the middens at Malangangerr and Nawamoyrn, then it seems that this practice lasted for some 6-7,000 years in the Oenpelli area.

A wide range of artefacts is found, including bone, shell, wood and stone tools. Most of the bone, shell and wooden tools were probably produced at the sites, but the stone implements, such as bifacial points, small scrapers, utilised flakes and edge ground axes, were apparently manufactured elsewhere.

The analyses show certain consistent changes in the proportions of bone artefacts over time. Spatulated points predominate in the earlier levels, whilst bipoints and unipoints are more common later. This pattern occurs at all three sites, so that in spite of the small numbers concerned at any one site, it probably represents a genuine cultural change.

Shell artefacts are found throughout the middens and consist largely of sharp fragments of clam shells with signs of use-wear. There are also a few artefacts made from marine shells, which point to some link with the coast either through trade or wandering. Wooden tools are restricted to the upper levels of Padypadiy, but this probably reflects differential decay rather than cultural innovation. The stone implements are very sparsely distributed and no reliable changes over time can be discerned.

The pattern of life that is reflected in the plain industry is very similar to the description of the Kakadu people who lived near Oenpelli in 1912.¹ Its

¹ Spencer, W.B. 1914, 1928.

closest archaeological parallels can be found in the latest manifestation of this tradition, in the well preserved upper levels at Padyadiy. In this respect therefore, we have succeeded in relating the archaeological evidence and the ethnographic record.

The plateau variant of the later industry is found at Tyimede I and II, where a rich stone industry occurs in coarse, unstratified sand. The earliest date for the industry comes from the base of the deposit at Tyimede I, (GaK-632), but it is highly inconsistent with another date, (GaK-631), from the same horizon and with a date for the lower levels of the same industry at Tyimede II (ANU-50). As a result I argue that the earliest manifestation of the later industry at Tyimede should be dated to about 5,000 B.P. and the latest to modern times.

The assemblages are composed of points, small rectangular scrapers, utilised flakes and edge-ground axes and can be classified as a point-scraper industry. These same tool types occur in the plain sites too and the chief difference between the two regions is that the artefacts were manufactured in the plateau sites, whereas they were apparently imported into the plain sites (see Figure VIII-3).

The collections from Tyimede I and II are very similar: the only real difference lies in the relatively high proportion of quartz implements at Tyimede I, which in the absence of supplementary data, I term 'local variation'.

The composition of the Tyimede I industry changes over time. The relative proportion of points decreases steadily whilst the incidence of scrapers and large endstruck flakes rises slightly. At Tyimede II, the proportion of different stone tools remains fairly consistent over time and the industry is very similar to that found in the lower levels at Tyimede I. This possibly implies that Tyimede II was occupied less intensively in recent times.

Conclusion

The research presents a cultural sequence for the Oenpelli area that extends from about 20,000 B.P. until modern times. Between about 20,000 and 6,000 B.P. a similar (Early) industry occurs all over the area, but after this two distinct regional variants of the point-scraper (Later) industry occur. They are distinguished mainly by the fact that stone tools were manufactured in the plateau sites but were apparently imported into the plain sites. This dichotomy has some ethnographic reality so that we can, to some extent, relate the living people and the prehistoric remains.

B. THE AUSTRALIAN CONTEXT

1. Early Industry

The early tradition at Oenpelli lasts from about 20,000 to 6-7,000 B.P. and is characterised by stone implements such as large chunky scrapers and edge ground axes.

This evidence accords fairly well with our current knowledge of the early colonisation of Australia. Other radiocarbon dates suggest an initial settlement some 20,000 to 30,000 years ago during the maximum of the Wurm glaciation in Europe. At this time land bridges and shorter sea distances allowed easier movement between Indonesia, New Guinea and Australia.¹

The early industry at Oenpelli is typologically similar to industries found in dated stratigraphic contexts in a few widely dispersed sites. These are Ingalladdi shelter in the Northern Territory,² Kenniff Cave and the Tombs shelter in south-central Queensland,³ and Seelands,⁴ Curracurrang,⁵ Noola⁶ and the Capertee valley shelters in New South Wales.⁷

¹ Mulvaney, D.J. 1961 pp.60-2; Mulvaney, D.J. 1964a p.266; White, Carmel 1967 p.151.

² Mulvaney, D.J. and Joyce, E.B. 1965 p.207.

³ Mulvaney, D.J. and Joyce, E.B. 1965 pp.147-212.

⁴ McBryde, I. 1966 Ph.D. Thesis, New England, Part C. pp.285-92.

⁵ Megaw, J.V.S. 1965 pp.202-7.

⁶ Tindale, N.B. 1961 pp.193-6.

⁷ McCarthy, F.D. 1964 pp.197-246.

The evidence from these sites may be summarised as follows:

Site	Age in years B.P.	Stone Implements
Kenniff	13200 $\pm$ 300 to 4650 $\pm$ 100	Core scrapers, scrapers, utilised flakes.
Tombs	9410 $\pm$ 100	Scrapers, utilised flakes.
Ingaladdi	6255 $\pm$ 135 ¹	Flake and core industry.
Seelands	6444 $\pm$ 94	Unifacial pebble tools, primary flakes.
Curracurrang	7450 $\pm$ 180	Pebble tools, primary flakes.
Noola	11600 $\pm$ 400 ² 12550 $\pm$ 185 ³	Pebble choppers, large flakes, scrapers.
Capertee	3625 $\pm$ 70 ⁴	Cores, coroids; tools with
(Shelters 1 and 3)	7360 $\pm$ 125 ⁵	saw edges, fabricators.

A similar but undated industry is reported stratified below a technologically more complex series, at Laura shelter in Cape York,⁶ Katherine shelter and Kintore Cave in the Northern Territory,⁷ Burrill Lake shelter

¹ Mulvaney, D.J. in Dury, G.H. 1966 p.162 (GX-104).

² Tindale, N.B. 1964 p.24 (GaK-334).

³ Birmingham, A. 1966 p.514. (V-35).

⁴ Birmingham, A. 1966 p.513. (V-34).

⁵ Birmingham, A. 1966 p.513. (V-18).

⁶ Wright, R.V.S. 1963 p.4; also pers. comm.

⁷ Mulvaney, D.J. 1965 p.207.

in New South Wales¹ and at a shelter near Warburton Mission in the far north of South Australia.² Finally there is evidence of early human activity at Koonalda Cave, on the Nullabor Plain in western South Australia, where the early stage of an amorphous flake industry is dated to 18,200 $\pm$ 550 B.P. (GaK-511),³ and at Lake Menindee in western New South Wales, where a stone implement is presumed to be older than charcoal dated to 18,800 $\pm$ 800 B.P. (GaK-335).⁴

Only McCarthy, McBryde and Mulvaney discuss the early industry in any detail. At Seelands it is essentially negatively distinguished. McBryde⁵ notes that pebble tools are present in the lower levels without specialised types of implements which appear in the later levels, accompanied by an unchanged assemblage of pebble artefacts. However, the number of implements in the site as a whole is so small that the absence of specialised types is not statistically significant.

At Kenniff Cave the early industry is again distinguished on negative grounds. Mulvaney notes that in the lower level 'varieties of scraper constitute 100 per cent of all classifiable artifacts' as opposed to the upper levels where 'scrapers...are rare or absent (and) give way to delicately retouched microlithic artifacts'.⁶ He analyses scrapers from the entire

¹ Lampert, R.J. pers. comm.

² Gould, R.A. pers. comm.

³ Gallus, A. 1966 pp.23-4.

⁴ Tindale, N.B. 1964 p.24.

⁵ McBryde, I. 1966 Ph.D. Thesis, New England, pp.391-2.

⁶ Mulvaney, D.J. and Joyce, E.B. 1965 p.172.

deposit in order to show changes over time, but again the numbers found in different levels are so small that the variations are statistically insignificant.¹

Although the early industry at Oenpelli is similar to those I have tabulated, edge ground axes are associated with chunky scrapers at Oenpelli alone, a point to which I shall return later. It must be stressed however that the similarities suggested are based only on broad descriptive analyses of stone implements from widely separated areas. We have no evidence as yet of the ecological framework in which the industry was produced, or of the bone, shell or wooden implements that may have existed. With this lack, the apparent cultural uniformity may be very misleading.

2. Later Industry

The later industry at Oenpelli lasts from 6-7,000 B.P. until the ethnographic present. The technology is more complex than that of its predecessor and a wide variety of bone, shell and stone tools occurs. The stone industry is characterised by bifacial and unifacial points, small rectangular scrapers, utilised flakes and edge ground axes, and can be termed a 'point-scraper' industry.

The excavations that produced these results ought to be directly comparable to those of McCarthy and Setzler in the same area.² Unfortunately however, they are not.

¹ Mulvaney, D.J. and Joyce, E.B. 1965 pp.177-81. There are five groups which contain 32, 64, 118, 14 and 21 implements respectively.

² McCarthy, F.D. and Setzler, F.M. 1960 pp.215-95.

For a start, not recognising any stratigraphy in their sites, McCarthy and Setzler removed the entire deposit as if it were a single homogeneous unit. As a result, no seriation can be made of their excavated material.

They do not analyse any dietary remains, though they note that a 'concentrated area of snail shells (and) numerous bird, marsupial and fish bones' was present in the White Kangaroo Cave on Arguluk hill.¹ As a result I cannot relate their material to the ecological evidence from the other plains sites.

The only material that can be directly compared with my collections is the stone assemblage itself and unfortunately McCarthy and Setzler did not retain the waste flakes from the deposits. No waste flakes are listed in the report, though there are several, classified as implements, in the Museum collections. As a result it is impossible to deduce whether the implements from Inyaluk and Arguluk were manufactured on the site or not: consequently, I cannot say whether the industries there resemble the plateau or plain variant in this particular respect. Whilst it may seem that more numerous collections of stone tools were excavated at Inyaluk and Arguluk, compared to the rather meagre assemblages from Padyadiy, Malangangerr and Nawamoyyn, I cannot directly relate the density of stone implements from the McCarthy-Setzler sites, to that of my own for two reasons. Firstly, the artefactual

¹ McCarthy, F.D. and Setzler, F.M. 1960 p.270.

density in a midden (Padypadiy) and a sandy deposit (Umbalanja hill, Site 1) cannot be directly compared. Secondly, McCarthy and Setzler do not record the area excavated or the volume of material removed from any shelter. If we assume that they excavated the entire deposit in every shelter, then their yield may not be as rich as it seems.

I can only therefore directly compare the types of implements found in the deposits. McCarthy and Setzler recovered a range of stone implements similar to my later industry. These include points, small scrapers, use-polished flakes, edge-ground axes, hammers and ochres. They also recovered a few bone points and a tooth 'chisel' which are similar to some of the bone tools that I found.

Amongst their material, McCarthy and Setzler recognise a number of implements with bruised ends as opposed to a few in my collections. These they call 'fabricators'. I argue elsewhere, that the term 'fabricator' is generally used fairly loosely to describe any bruised flake, and I also note that a number of 'fabricators' from the 1948 collection are really broken flakes or other miscellaneous forms.

Perhaps the most striking difference between the collections I excavated and those of the 1948 expedition lies in the large number of use-polished 'elouera' and flakes that were recovered by McCarthy and Setzler. These represent 11.5 per cent and 55.7 per cent of the total stone tools from Inyaluk and Arguluk hills respectively. In contrast to this,

implements resembling 'elouera' and/or showing signs of marked use-polish, never exceed 8.2 per cent of the total tools in any of my collections, and form less than one per cent of the prolific industries at Tyimede I and II.¹

I criticise earlier the use of the term 'elouera' as applied to the Oenpelli specimens: because many of those in the Museum collection are utilised flakes with little, if any, secondary retouch. However, whether we choose to call these implements 'elouera' or not, their most striking characteristic is that nearly all show a highly distinctive form of use-polish which probably resulted from working organic material such as skin or wood. The high incidence of these tools in the 1948 collections may therefore reflect some sort of specialised activity that was concentrated on the two investigated hills, and especially Arguluk hill.

It is also worth noting that most of the use-polished implements from Inyaluk, Arguluk and the sites excavated in 1964-5 are made of a particular type of red quartzite, called 'yorndit' by local Aborigines. Numerous blocks of 'yorndit' lie scattered on the slopes of Inyaluk and Arguluk today and it is possible that the tools were locally produced. This would imply a certain modification in the plateau/plain dichotomy,

¹ There are six use-polished flakes forming 8.2 per cent of the industry at Padypadiy and none at Malangangerr. There are two scrapers shaped like elouera and one use-polished flake, forming 7.7 per cent of the industry in Level I at Nawamoyne. There is one use-polished flake, (0.1 per cent), at Tyimede I and two scrapers shaped like elouera and one use-polished flake, forming 0.5 per cent of the industry in Level I at Tyimede II.

but without the waste flake to tool ratios of the excavated sites this question must remain open.

The next nearest investigated site is Tandandjal cave, which was excavated in 1948.¹

Macintosh's excavations covered an area of 7.0 x 0.5 m. and the maximum depth reached was 44 cm. He recovered 102 flaked stone implements from the surface of the deposit and 135 below. These are analysed in two groups, which were separated by an intervening sterile stratum. Group I (227 implements) has a tool to waste ratio of about 1:3² but if we assume that Macintosh did not collect the waste flakes from the surface, then the ratio for material below the surface is about 1:6. Group II (ten implements) has a tool to waste flake ratio of 1:20.

The implements from Groups I and II are very similar. McCarthy³ notes that most implements are made on 'quartzite blades' and that a variety of forms occur. The upper group contains points (ranging from the 'pirri' to the trimmed leilira blade), scrapers, five tula adze-flakes and edge ground axes. The lower group includes seven broken or intact scrapers made on blades, one 'microlithic' scraper and two broken bifacial points.

¹ Macintosh, N.W.G. 1951 pp.178-213.

² Macintosh does not give the precise number of waste flakes in the deposit. He does say that about 900 'chips and rejected pieces' were recovered from the excavation (p.197) and that 200 chips were associated with the material in Group II (p.198).

³ McCarthy, F.D. in Macintosh, N.W.G. 1951 pp.205-13.

Macintosh deduces that Tandandjal was a workshop site throughout the occupation, but the tool to waste ratio for Group I certainly does not support this claim. He concludes that the industry is broadly similar to those found in other areas, such as Delamere and Oenpelli, where edge ground axes are 'a late intruder'¹ into the region.

The Tandandjal industry is similar to the later industry at Oenpelli, in that both contain points and scrapers. It differs from the Oenpelli series in three main ways. Firstly, many of the Tandandjal tools are made on long endstruck flakes, whereas the Oenpelli tools, in particular the points, are generally made on irregular flakes. Secondly, there are tula at Tandandjal but none at Oenpelli. Thirdly, there are no use-polished flakes at Tandandjal in contrast to the prolific series from Inyaluk and Arguluk and the smaller series from the other Oenpelli sites. Finally, axes are restricted to the upper level at Tandandjal whereas they occur throughout my sites in the Oenpelli area.

The Tandandjal material is broadly similar to the assemblages from Katherine shelter and Sleisbeck. These have not been analysed in any detail, but Golson² observes that most of the implements in the upper levels are made on large endstruck quartzite flakes, rather like those found in Tandandjal. Tula are present in very small numbers and axes are restricted to the upper levels. It

¹ Macintosh, N.W.G. 1951 p.200.

² Golson, J. pers. comm.

has not yet been ascertained whether elouera are present, but Golson has withdrawn his earlier suggestion¹ that elouera precede points at Sleisbeck.

It is difficult to assess the content, let alone the significance of Davidson's excavations at Willeroo and Delamere,² because the sites are not described separately and the finds are never listed. As a result I can only tentatively infer the typological sequence found there, as follows:

Quartzite spear heads and adze points ('suggestive of the 'pirri'')³ occur throughout the deposits, except towards the very bottom of some caves where a few scrapers, 'adze points' and at one site one bifacial 'pressure flaked' chert point⁴ with serrated edges, are found. Macintosh⁵ observes that a chert discoidal scraper from Delamere⁶ is really a tula. Edge ground axes are restricted to the surface levels.

The assemblage can therefore be termed a point-scraper industry. Davidson's statement that 'quartzite spear-heads constituted roughly 90 per cent of all the specimens extracted'⁷ would make one suggest that the industry is based on endstruck quartzite flakes and is

¹ Golson, J. 1964 p.5; also pers. comm.

² Davidson, D.S. 1935 pp.145-84.

³ Davidson, D.S. 1935 p.160.

⁴ Davidson, D.S. 1935 pp.160-62.

⁵ Macintosh, N.W.G. 1951 p.200.

⁶ Davidson, D.S. 1935 p.163.

⁷ Davidson, D.S. 1935 p.152.

therefore very similar to the series from Tandandjal, Katherine and Sleisbeck. However, McCarthy notes that the Tandandjal assemblage differs from those of the Willeroo and Delamere areas 'in its use of the quartzite pointed blades of Leilira type as scrapers and probably as hafted adze-flakes. Also, presumably, they were used as knives'.¹

As a result all I can say is that the point-scraper industry from Willeroo and Delamere is similar to the assemblages from Oenpelli in the broadest sense only. It resembles the series from Tandandjal, Katherine and Sleisbeck in that they all contain points, scrapers and tula, and axes are restricted to the upper levels of the deposits.

The next relevant assemblage comes from Ingaladdi shelter on Willeroo Station, near where Davidson did some of his work. Mulvaney's excavations yielded a prolific industry of stone points and tula dated to 1545 ± 75 B.P. (GX - 103).² Many points are made on regular endstruck quartzite flakes, but pending a detailed analysis, no further comparisons can be made with the Oenpelli material other than to note again that tula are absent at Oenpelli.

The last Northern Territory collection comes from the Yarar shelter, near Port Keats Mission. This was excavated by W.E.H. Stanner in 1957 and 1958 and later analysed by Mrs J.M. Flood.³ The collection consists

¹ McCarthy, F.D. in Macintosh, N.W.G. 1951 p.211.

² Mulvaney, D.J. in Dury, G.H. 1966 p.162; also Mulvaney, D.J. pers. comm.

³ Flood, J.M. 1966, M.A. Thesis, A.N.U.

mainly of stone tools, and Flood reaches the following conclusions:

Firstly, Yarar was occupied for about 1,500 years. The earliest occupation (Level 5) is dated to 1620 ± 100 B.P. (ANU-16) and a later stage in Level 3 to 450 ± 100 B.P. (ANU-15). There are pieces of glass in the upper levels that testify to very recent occupation.

Secondly, it seems that the raw material was quarried nearby and many triangular primary flakes occur in the deposit. Certain implements were apparently retouched at the site, since there are numerous tiny flakes and a tool to waste flake ratio of 1:15.

Thirdly, most of the implements (95 per cent) are points. There are a few scrapers and utilised flakes and axes are restricted to the upper levels (1 - 3). Most points are unifacially retouched and there are proportionally more unifacial to bifacial points in the later levels (1, 2).

Finally, Flood concludes that Yarar 'was a specialised "factory" site for manufacturing points'.

I have studied the line drawings and photographs of the implements, and it seems to me that Flood has misidentified a number of pieces. For a start, her category of points includes non-pointed pieces (Plate 17, top line, nos 2-4; Plate 10, nos 2645, 4009). Secondly, numerous broken implements are classified as intact 'square tipped' points (Plate 10, nos 7600, 6036, 881, 221, 3594). Other implements classified as 'round tipped' points (Plate 10, nos 2645) are not points in the generally accepted sense of the term at

all and in fact they closely resemble her 'bifacial blanks' (Plate 21). Finally, her category of scrapers is no better defined: for example the scraper, Plate 8, no. 4120, is virtually indistinguishable from a point, Plate 10, no. 1318.

I feel that these errors have a profound effect on the analysis. If the writer is unable to distinguish between intact and broken tools, then can we assume that she can consistently differentiate between unifacial and bifacial retouch? Given the wide range of forms present in the illustrations alone, one cannot help wondering why the analysis was not geared to distinguish these morphological variations. Finally, it is clear that we cannot really accept Flood's assumption that Yarar was a point producing site.

As a result of these shortcomings, I am reluctant to compare the Oenpelli material with the Yarar industry in any detail. The most one can say is that assemblages of points and scrapers occur at both sides, but whereas most of the Oenpelli scrapers are made of chert, nearly the whole Yarar assemblage is quartzite. Many Yarar tools are made on endstruck flakes whereas the Oenpelli implements are made on more irregular flakes. Finally, axes are not restricted to the upper levels at Oenpelli.

Conclusion

Point-scraper industries are found in all of the excavated shelters in the Northern Territory. The age of the assemblages varies in different places: so far the earliest point-scraper industry is found near

Oenpelli, at Nawamoyne at 7110 ± 130 B.P. and by inference at Malangangerr from 5980 ± 140 B.P.¹ Early levels are also dated at Tyimede II to 4770 ± 150 B.P., at Tyimede I to 3820 ± 100 B.P., and Padypadiy to 3120 ± 100 B.P. The only other dated assemblages are found at Ingaladdi at 1545 ± 75 B.P., and Yarar from 1620 ± 100 B.P.

The industries all contain points and scrapers. At Tandandjal, Katherine, Sleisbeck, Ingaladdi and Yarar most points are made on endstruck quartzite flakes, whereas the Oenpelli points are generally made on irregular flakes. At Tandandjal, Sleisbeck and Katherine, many scrapers are also made on endstruck quartzite flakes, but this situation is not found at Davidson's sites, nor is it found at Oenpelli. Tula occur at Tandandjal, Katherine, Sleisbeck, Delamere and Ingaladdi but are absent at Yarar and Oenpelli. Finally, edge ground axes occur throughout the deposit at Oenpelli alone.

It seems therefore that whilst the industries show broad typological similarities, certain regional differences can be observed. These will undoubtedly be analysed in greater detail when more extensive work is done.

One may draw a broad analogy between the point-scraper industry in the Northern Territory and industries

¹ There are very few stone tools in the lower part of the midden at Malangangerr. The economy and bone tools are similar to that of the upper midden so that the continuity must be treated as inferential.

from other parts of the country. Points and tula adze-flakes occur in a surface collection from northern Western Australia, though the age and precise nature of the industry are unknown.¹ Bifacial and unifacial points occur at Kenniff Cave and at the Tombs, (south central Queensland), as far back as 4130 ± 90 B.P. (GaK-523) and are associated with tula adzes and also backed blades.² Points are also found in stratified sites in the Lower Murray Valley. The earliest level containing points is dated to 4850 ± 100 B.P. at Fromm's Landing Shelter No.2,³ and to 4250 ± 180 B.P. (L - 217 G) at Devon Downs.⁴ The points are associated in various levels with tula adzes and backed blades.

I do not wish to imply any cultural link between the point-scraper industries in these widely separated areas, but we should note that from about 4,000 B.P., Australian stone assemblages are all characterised by a wide range of tool types. The implements are smaller, more refined and more diverse than the generalised chunky scrapers in the early tradition. Certain industries such as the Bondaian are dominated by backed blades, whilst others, like the Oenpelli series, are characterised by small points and scrapers.

¹ McCarthy, F.D. 1957 pp.163-4.

² Mulvaney, D.J. and Joyce, E.B. 1965 p.169.

³ Mulvaney, D.J. 1961 p.77.

⁴ Tindale, N.B. in Dury, G.H. 1966 p.159.

Mulvaney's interpretation of Australian prehistory¹ stems directly from the observation of this contrast. He suggests that the proliferation of smaller distinctive implements reflects the introduction of the hitherto unknown idea of hafting in Australia.

Mulvaney's construct of Australian prehistory is based largely on the analysis of stone implements from Kenniff Cave.² This shelter contained 11 feet of stratified material, which accumulated over a period of some 12,000 years, from about 13,000 to 16,000 B.P. Mulvaney analyses the stone implements according to the proposition that Australian prehistory is divided into two phases: a pre-hafting phase characterised by large scrapers which lasted until 4,000 B.P., and a hafting phase, characterised by delicately retouched microlithic artefacts such as points and backed blades, which he considers would be functional only when hafted in composite tools, and larger hafted tools such as edge ground axes and Juan knives.

Using these admittedly subjective criteria of hafting, Mulvaney suggests that the same change is observable in stratified assemblages in many other parts of the country.³ But we now have contrary evidence from the early industry at Oenpelli, where edge ground axes with grooving, dated to about 20,000 B.P., suggest that the 'idea of hafting' is as old as

¹ Mulvaney, D.J. and Joyce, E.B. 1965 pp.147-212; and Mulvaney, D.J. 1966 pp.84-93.

² Mulvaney, D.J., and Joyce, E.B. 1965 pp.147-212.

³ Mulvaney, D.J., and Joyce, E.B. 1965 p.207.

our current evidence for the existence of man in Australia.

We may reasonably ask therefore what is meant by hafting? Mulvaney acknowledges the fact that it is a difficult problem which requires a subjective view of the matter. He is clearly in a dilemma when he says that step flaking distinguishes a hafted scraper,¹ because as Jones² has pointed out, many 'non-hafted' Tasmanian scrapers are heavily step flaked.

One may explore these difficulties even further. Firstly, should a distinction be drawn between single and multiple hafted tools? On a practical level, one could probably recognise a spear-head or backed blade as a hafted tool but it would be almost impossible to recognise as such a small waste flake like those hafted in a death spear.³ Secondly, non-stone tools such as bone spear tips might also reflect hafting and the absence of such organic remains in all early Australian industries need not mean that they were not present. Finally, however, we can attack the validity of the whole concept as a distinct idea. Is a gob of gum, a fibre wrapping or a leaf wrapping to be regarded as a haft? It acts as a cushion protecting the user's hand and certainly Mulvaney⁴ classifies the fibre-bound Juan knife as a hafted tool. But then surely the callous on a man's hand which cushions the stone tool, is also a haft? In the final analysis, is a hand a haft too?

¹ Mulvaney, D.J., and Joyce, E.B. 1965 p.189.

² Jones, R. 1966 p.5.

³ Smyth, R.B. 1878 p.304.

⁴ Mulvaney, D.J., and Joyce, E.B. 1965 p.190.

This leads us a long way from the Oxford English dictionary's definition of hafting,¹ but it does emphasise the suggestion that hafting may be reflected in a wide range of evidence and that it need not be viewed as a particularly distinct concept. We cannot therefore assume that the absence of certain small stone tools, or for that matter, of any bone or wooden tools implies that the makers were ignorant of hafting techniques. Above all, it is highly likely that men hafted tools in a wide variety of ways, and it is equally unlikely that the use of an ad hoc haft such as a leaf wrapping, would be reflected consistently, if at all, in the stone tool morphology.

At all events, one form of hafting was present 20,000 years ago in the Oenpelli region, although grooved edge ground axes of this age are to date unique in Australia.² One possible correlate of the Oenpelli evidence may be found in the linguistic situation in Arnhem Land. Recent linguistic studies³ show that there are a large number of distinct families concentrated in the area, and whilst I do not wish to imply any direct link between language and material culture, this kind of pattern may help us to visualise how a specific trait like axe making, could remain within a fairly small area for some time.

¹ Haft - that which is taken hold of. A handle. (Oxford English Dictionary).

² Recent work in the Highlands of Australian New Guinea shows that polished axes were in use there at least 10,000 years ago (White, J.P. pers. comm.).

³ See O'Grady, G.N., Voegelin, C.F. and F.M. 1966; O'Grady, G.N., Wurm, S.A. and Hale, K.L. 1966.

Now whilst we may reject Mulvaney's thesis that the variations in stone tools over time reflect the introduction of hafting, we are still left with the fact that the earliest tradition at Oenpelli as much as elsewhere, is somewhat different from the later one.

We may interpret this variation in very general terms as a series of new ideas, but if a broad explanation is required, then I suggest that it may in part reflect the introduction of a new technique of producing regular blade-like flakes which could be easily worked into points, 'elouera', backed blades and the like.¹

The evidence for this technological change does not come from the sites in the Oenpelli area, where the analysis has shown that most tools in the point-scraper industry were made on irregular flakes, but Mulvaney himself has observed that at Kenniff Cave 'the manufacture of small, hafted artifacts was a sudden development associated with the appearance of the first definite blade cores'.² However, 'core-scrappers'³ and 'high-backed scrapers'⁴ from the early 'non-hafted' series, look very like blade

¹ This is of course analagous with the sequence of European prehistoric traditions where a succession of core-flake tools (Acheulean) to flake tools (Mousterian) to blade tools (Aurignacean, Gravettian) has been recognised for many years (see McBurney, C.B.M. 1960 pp.15-61).

² Mulvaney, D.J., and Joyce, E.B. 1965 p.192.

³ Mulvaney, D.J., and Joyce, E.B. 1965 p.183, Figure 17, b-c.

⁴ Mulvaney, D.J., and Joyce, F.B. 1965, p.184, Figure 18, a.

cores and certainly produced small blades. It may well be worth analysing the shape of all the waste flakes in terms of their length to breadth/length ratio, in order to see when regular blades were produced and transformed into implements. The later industry in certain Northern Territory sites (Tandandjal, Katherine, Sleisbeck, Ingaladdi) is characterised by implements made on regular endstruck flakes, and further analyses may reveal whether this represents a technological change or not.

Until then, the hypothesis of technological innovation is one possible explanation of the widespread and consistent change in Australian stone industries.

C. PROSPECTS AND ASSESSMENTS

Mulvaney's succinct summary of changes in Australian prehistoric research from 1929 to 1964 provides a good beginning for this discussion.¹ He describes the early research when 'cultures' were delineated on the basis of stone tool morphology, with little regard for such factors as the size of the country, the diversity of the environment and the origin of the early inhabitants. In 1956 he excavated at Fromm's Landing and

the lesson which I drew from that dig was that long distance correlations were premature and that archaeologists should concentrate on a regional approach and obtain dated stratigraphic sequences while expecting considerable variation between sites.²

He lists certain problems that are central to prehistoric studies today: the origin and identity of the first Aboriginal occupants, the ways in which they adapted themselves to a new environment and the spread of industrial techniques. He stresses the need for more precise studies of stone tool typology and finally urges that attempts be made to co-ordinate research with other disciplines such as geomorphology, anthropology and linguistics.

The work at Oenpelli has emphasised some of these problems. Firstly, we have produced evidence of the

¹ Mulvaney, D.J. 1964b pp.39-44.

² Mulvaney, D.J. 1964b p.42.

stone implements of men living in the area some 20,000 years ago, but unfortunately we have no idea of the actual identity of the inhabitants because no human remains or for that matter organic remains other than charcoal, have survived.

Secondly, the analysis of the middens has highlighted some of the current difficulties in identifying Australian faunal remains, and also the scope for specialised studies. The detailed analysis of material from Padyadiy has yielded interesting data on Aboriginal diet and differential preservation in a dry cave. The column sample analyses from Malangangerr and Nawamoyne have provided useful information about the general composition of the middens and the range of shellfish eaten over time. Unfortunately the variations have had to be given a wide range of interpretations and I cannot help feeling that an inordinate amount of sorting was done to achieve a fairly limited result.

Thirdly, the typological analyses of bone and stone tools have emphasised the need for more precision in this field. I have analysed the implements in non-committal terms, by differentiating such groups as 'points', 'scrapers' and 'endstruck quartzite flake tools' rather than 'pirris', 'elouera/tula' and 'leilira', in order to avoid making any direct cultural implications. I have analysed the shape and retouch on various classes of implements in order to show the range of variation within the group, the methods of manufacture and a suggested sequence of use. This is one way of analysing the collections: there are undoubtedly many others.

Finally the Oenpelli work, drawing on literary sources and informant testimony, has sharpened our awareness of the potential and urgency of ethnographically oriented studies in Australia. This is one of the last places in the world where a traditional hunter-gatherer economy might be found. The tropical areas are of specific interest, since no-one could regard the inhabitants as living in a refuge area.¹

This is a more specific concern than Mulvaney's general plea for interdisciplinary co-operation with anthropologists and linguists. It is termed ethno-archaeology,² and although the approach is not new, it has become increasingly fashionable as the opportunities shrink.³

A programme of this scope of course requires groups living entirely within the traditional economy, and it is almost certain, that apart from a handful of people in the Western desert, none such groups exist in Australia today. However, the work at Oenpelli has shown that some useful information can be obtained even from informants who have lived near a European settlement for some 50 years, under the daily impact of acculturation.

Other work in a 'non-contextual' situation has yielded interesting results too. For example, N.C. Petersen has collected data about the food gathering activities of a group living in the Arafura Swamp, south of Elcho Island. The people obtain a supply of European

¹ Clark, G. and Piggott, S. 1965 pp.114-5.

² Chang, K.C. 1967 p.230.

³ See Chang, K.C. 1967 pp.227-43.

food every three weeks, and they own guns. However, once the supply of flour, sugar and bullets runs out they revert to more traditional hunting methods. The men hunt with metal tipped spears and the women collect roots and water plants. Petersen's observations help to amplify our 'limiting model' of the life of hunter-gatherers.¹

These kinds of data would certainly amplify the interpretation of archaeological evidence from the same area, and they would probably be relevant to analyses of data from other parts of the continent. They are there to be gathered in the more remote areas of Australia where aspects of traditional Aboriginal life still survive. It should be stimulating and certainly essential for the archaeologist to carry out this type of ethnographic research, hand-in-hand with systematic excavations and analyses.

¹ Petersen, N.C. pers. comm.; see also Tindale, N.B. 1965 pp.131-64.

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APPENDIX II-1SURVEY OF SITES IN THE RESEARCH AREA

I surveyed the research area specifically to find sites that would repay detailed excavation. Many rock outcrops were inspected and most of the following sites contain promising deposits or an exceptional series of rock paintings (Figure I-2).

A. PLAIN1. Marlakunanya ($12^{\circ} 23'$ S. Lat., $133^{\circ} 4'$ E. Long.)

There are two rock shelters at the base of a high cliff on the edge of the escarpment. Both shelters face north and are well protected from the rain. Signs of human occupation were noted, including stone artefacts on the talus slope outside the recesses, a few human bones on the surface of one shelter and numerous rock paintings in both recesses.

A test trench 50cm. square, was dug in the upper shelter to a depth of 60cm., but only a few stone chips were recovered in the sand. A larger trench, covering six sq.m. was excavated in the lower shelter, and the deposit yielded food debris (mangrove - mud-flat shells, animal bones), human burials and implements of wood, bone and stone. There are very few waste flakes in the collection and it seems clear that the stone tools were made elsewhere. Informants said Marlakunanya was used by Gunjepmi people who did

not make their own stone tools. The entire assemblage is essentially similar to that found at other plains sites like Padypadiy, Malangangerr Level I and Nawamoyrn Level I and probably represents the debris of a similar group of Aborigines.

The rock paintings include X-ray designs, mimi figures and solid designs.

2. Arguluk Hill ($12^{\circ} 21'$ S. Lat., $133^{\circ} 4'$ E. Long.)

A few small shelters occur on the lower slopes of the hill, at the foot of large boulders. Small test holes were made in the sandy floors of three shelters but only a few lumps of charcoal were recovered to suggest that people had once camped there.

3. Area around Malangangerr ($12^{\circ} 27'$ S. Lat., $132^{\circ} 57'$ E. Long.)

Several rock shelters were examined and numerous rock paintings were noted, including paintings of ships and guns. Most shelters have sandy floors with occasional stone tools and shells lying on the surface. Only one promising deposit was found, in a south facing shelter about $\frac{1}{4}$ mile east of Malangangerr.

The recess is at ground level and was formed by pillar weathering. A marked heap of deposit occurs inside and some 20 stone tools were collected from shallow rills along the dripline. Three hand-holes were dug in the sandy deposit, but only a few quartz flakes and bones were recovered. No shells were found. This site may repay excavation.

4. Warlkada ($12^{\circ} 22'$ S. Lat., $132^{\circ} 57'$ E. Long.)

This is a north northeast facing shelter about $\frac{1}{4}$ mile south of Cannon Hill station, and about $\frac{1}{4}$ mile from Nawamoyne. The effective sheltered area is about 10 x 5m. and evidence of human occupation includes numerous fragments of glass on the floor, rock paintings, ground hollows in loose lying rocks and several 'bush tables' erected in previous years by local Aborigines (Plate 1).

We excavated four sq.m. of deposit to a maximum depth of one metre and recovered food debris (mangrove-mudflat and fresh water shells, animal bones), human remains and bone and stone tools. Again there are very few waste flakes in the collection and the stone tools were clearly not made on the spot. Unfortunately the deposit was honeycombed with animal burrows and post-holes, and it was impossible to assess whether certain objects such as glass flakes found throughout the deposit were in situ. As a result, the excavations were abandoned in favour of the less disturbed deposit at Nawamoyne.

5. General

Numerous other shelters were visited on the road between Oenpelli and Mudginbarry, but no other promising deposits were located.

B. FOOTHILLS OF PLATEAU

1. Tyedlkmede ($12^{\circ} 17'$ S. Lat., $133^{\circ} 12'$ E. Long.), is a small north facing shelter at the base of a large boulder. Surface finds include a few fragments of

edge ground axes and two bifacial points. There are two black rock paintings, one of an aeroplane and one of a lugger. A test hole revealed only a few cm. of sand on the rocky floor and no artefacts.

2. Panggartpanggart ($12^{\circ} 17'$ S. Lat., $133^{\circ} 12'$ E. Long.), is a small north facing shelter near Tyedlkmede, with a scatter of stone flakes on the surface. A test hole revealed no archaeological deposit.

3. Kadapulinya ($12^{\circ} 16'$ S. Lat., $133^{\circ} 13'$ E. Long.), is a northeast facing shelter about $\frac{1}{4}$ mile from Panggartpanggart, formed by selective weathering of massive horizontally bedded quartzite. The floor is rocky with a few shallow patches of sand containing a few stone flakes. The walls are covered with very fine polychromatic paintings including X-ray designs of animals such as crocodile, emu, wallaby, fish and python. Many animals are drawn in profile with two eyes joined by intersecting lines.

4. Nimbuwah Tor ($12^{\circ} 12'$ S. Lat., $133^{\circ} 21'$ E. Long.), is a shelters occur on the slopes of this tor below angular boulders and heavily weathered blocks. Three sites were examined; the first (i), is just west of the main tor and the other two, (ii) and (iii), are east of the tor on a small hill called 'Gilinalgun' by Gunwinggu speakers.

(i) a shelter formed by two boulders leaning against each other. The recess is open at both ends and the floor slopes gently. A seasonal stream flows

through the deposit and numerous stone tools were found in the shallow bed. Several stone axes lay on the floor of the shelter and numerous stone tools lay outside the recess. A few rough white designs occur on the soot blackened walls, and a bird and man were distinguished.

Three hand-holes were dug in the loamy deposit. They yielded no organic remains and only a few quartz flakes. It seems probable therefore that the stone tools in the stream bed are in situ and were not eroded out of the surrounding deposit. The site had never been visited by Europeans before and it could provide useful information about the surface configurations of an Aboriginal camp.

(ii) a small shelter at the base of a large boulder. Surface indications included a few human bones in rock crevices and several quartzite flakes and an edge ground axe on the floor. A test pit was dug in the dark grey sand on the floor but only a few flakes were recovered.

(iii) a large shelter at the base of a smooth weathered overhang. The sandy deposit yielded only a few stone flakes and a decayed macropod bone. The walls are covered with paintings including several human figures, one large female figure and X-ray designs of animals (Plate 2).

C. PLATEAU

1. Magalidiny ($12^{\circ} 17'$ S. Lat., $133^{\circ} 15'$ E. Long.)

There are two small east facing recesses at the base of a cliff. Surface indications included a

scatter of stone artefacts on the sandy floors that cover about 10 sq.m. A test pit was dug in one shelter (50 x 50 cm.) and it yielded some 60 cm. of deposit. The top 25 cm. were almost sterile, but a rich deposit of stone artefacts was encountered below. This contained implements such as bifacial points and small scrapers and numerous waste flakes. No organic remains were found.

The stone tools were apparently manufactured on the spot and the industry is similar to that found at Tyimede I, and Tyimede II Level I. The site would probably be worth a fairly extensive excavation.

2. Mangimlgirntgani ($12^{\circ} 18'$ S. Lat., $133^{\circ} 17'$ E. Long.), is a west facing shelter at the bottom of a steep cliff. A scatter of stone artefacts was noted on the slope below the recess. The sheltered area (12 x 3m.) has a sandy floor but a test hole revealed only some 10cm. of sterile sand lying above reddish laterite.

3. Tyadang ($12^{\circ} 22'$ S. Lat., $133^{\circ} 20'$ E. Long.), is a big east facing shelter at the base of a cliff. The recessed area is protected by large loose lying blocks. The back wall is smooth and covered with paintings that extend for almost 100m. along the cliff face. The floor of the main shelter is at ground level. A test hole revealed charcoal but no artefactual remains.

The paintings are well preserved and include large drawings of buffalo (Plate 3) and pictures of bush knives, guns and axes (Plate 4). There are also

traditional X-ray designs of kangaroos, fish and tortoises. Several dynamic white paintings of 'mimi' occur and there are three human figures made by pressing beeswax on the rock wall (Plate 5).

It would be worth recording this art in detail, especially since local Aborigines claim to have painted some of the designs.

4. Tyelum ($12^{\circ} 17'$ S. Lat., $133^{\circ} 21'$ E. Long.) in an east facing shelter at the base of a large overhanging rock. Surface indications included stone artefacts and chips of glass lying in shallow rills on the dripline and several human bones lying inside the recess. We also noted a human skull painted with red ochre, wedged into a hollow log. A few white designs occur on the walls.

The deposit inside the recess is composed largely of dark loamy sand and a peak of deposition was observed at the back. A test hole dug to a depth of one metre, yielded fragments of glass at the top, and stone artefacts (waste flakes and points) below.

This site would probably repay detailed excavation.

Conclusion

Many rock shelters in the research area contain paintings, but comparatively few have promising archaeological deposits. The extensive excavations confirmed the results of the survey, and showed clearly that the deposits in the plain sites contain a wealth

of organic remains but very few stone tools, whereas the plateau sites contain very few organic remains but abundant evidence of stone working.



Plate 1. Warlkada shelter before trial excavation, showing Aboriginal 'bush tables'. Scale in 20 cm.

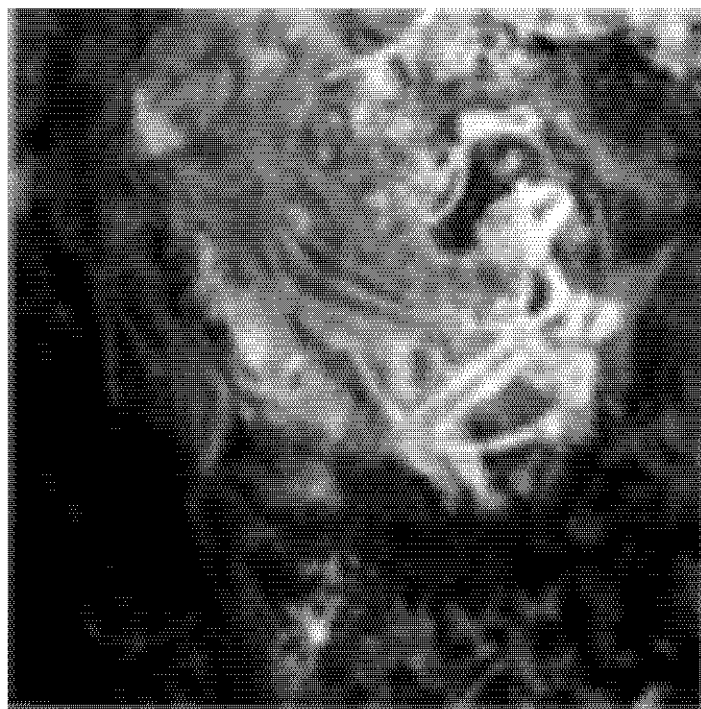


Plate 2. Nimbuwah Tor, shelter iii: anthropomorphic figure.



Plate 3. Tyadang: head of buffalo drawn in outline.
Scale in cm.



Plate 4. Tyadang: paintings of guns, fish and 'mimi'.
Scale in cm.

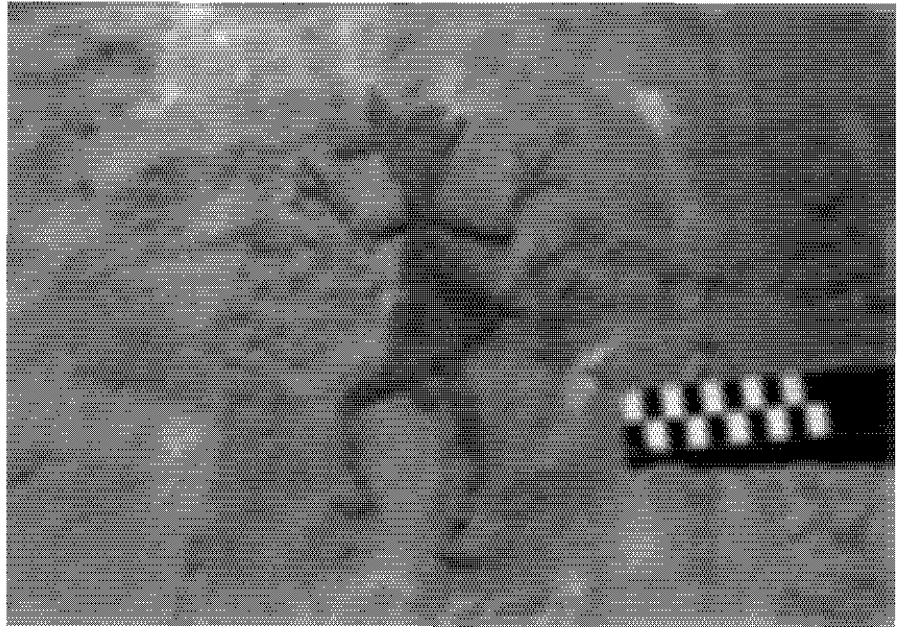


Plate 5. Tyadang: human figure in beeswax. Scale in cm.

APPENDIX III-1ANALYSIS OF PLANT REMAINS FROM PADYPADIY

The following identifications were made by Dr R. Story,¹ Professor R.L. Specht² and Mr R.W.R. Muncey,³

1. ?*Livistona humilis* (fan palm)

The leaf bases of this plant occur in the deposit and some specimens may belong to the more slender species *L. inermis*. These plants grow in the open forest and parts are edible. The shoots are eaten and the bark can be cooked and pulped into an edible glutinous mass.⁴ Both shoots and bark are edible all year round though shoots are more sought after in the Wet season.

Aboriginal name - 'Manguluduk' (Gunwinggu)

The informants claimed that the bark was soaked and a sweet liquid was later sucked out.

¹ Division of Land Research, C.S.I.R.O., Canberra.

² Dept. of Botany, University of Queensland.

³ Division of Forest Products, C.S.I.R.O., Melbourne.

⁴ Warner, W.L. 1937, p.44.

2. Cyperaceae (Sedge)

Bundles of fibrous material of this plant occur. The plants grow in swamps and freshwater marshes. Specht¹ records that the tubers are ready to be eaten at the end of the Dry season.

Aboriginal name - 'Mandim'

The informants said the fibres were used as a sponge to soak up sweet liquids which were later sucked out.

3. Nelumbo nucifera (Pink lotus lily)

The rhizomes, bases, fruits and seeds of this plant occur. There is some confusion however about the identity of the seeds, which are termed Nelumbo by Dr Story and Ferminalia fernandiana by Professor Specht.

Nelumbo nucifera grows in lagoons on the estuarine plain. According to Specht it is eaten mainly between March and August,² though Leichhardt³ recorded natives eating nelumbium in the East Alligator River area in December.

An unidentified tuberous fragment also occurs in the deposit. It was termed 'Manbulet' by local Aborigines and said to be a swamp plant with an edible tuber, which is eaten all year round.

¹

Specht R.L. 1958c. p.484.

²

Specht, R.L. 1958c. p.502.

³

Leichhardt, L. 1947 p.512.

4. Cycas media (cycad)

The seed coat and part of a young megasporophyll of this plant occur. It grows in open forest and is one of the staple vegetable foods in the traditional Aboriginal diet.¹ Thomson² records that it is eaten mainly during the Dry season.

5. Pandanus aquaticus (Pandanus)

A phalange of this plant is present. It grows in the open forest but I do not know whether it is eaten or not.

6. Owenia vernicosa (Emu apple)

Some charred fruits occur. The tree grows in the sandstone hills near Oenpelli.³ Again I do not know whether the fruits are edible.

7. Petalostigma

Stems are found, which were possibly intended for use as firewood.

8. Platysace arnhemica

Stems are found in the deposit. The plant grows in the sandstone hills near Oenpelli⁴ and again the twigs may have been brought in to serve as fuel.

¹ Specht, R.L. 1958c. p.482.

² Thomson, D.F. 1949 p.19.

³ Specht, R.L. 1958a, p.248.

⁴ Specht, R.L. 1958a, p.274.

9. Melaleuca (Paperbark)

The leaves and bark of this plant occur as padding in the niche in squares L6 and K6. The bark is also found in the deposit, (see section of S. wall square 03), apparently serving as a mat.

10. Acacia? cunninghamii (Acacia)11. Parinari nonda

Leaves occur as padding in the niches in squares K6 and L6.

12. Phragmites karka (Phragmites reed)

Sections of the reed occur as padding in the niches in squares K6 and L6. Phragmites reeds grow on the edge of the East Alligator River.¹

13. Verbenaceae ? vitex14. Myrtaceae Eucalyptus

Both species are represented by charred pieces of wood which apparently served as fuel.

¹

Specht, R.L. 1958a, p.200.

APPENDIX IV-1

ANALYSIS OF HUMAN BONES FROM MALANGANGERR

A.G. Thorne, Anatomy Department,
University of Sydney.

a. Level Ia

Mandible from 7D/4:

Fragment of a child's mandible; very little bone really and teeth held together mainly by encrustation. Visible are a left deciduous lower first molar which has erupted into occlusion, and an unerupted lower left second deciduous molar which has not been completely calcified. The age of the individual therefore is about two years or a little more.

b. Level I

Skull from pit in 4G:

The skull belongs to an adult female. Occipital bunning is evident and there is no evidence of pathology. The mandible is present but the maxilla is missing except for the central part of the R. maxilla. The dentition is normal but there is a post-mortem loss of the two lower centrals and a pre-mortem loss of all six lower molars.

APPENDIX IV-2ANALYSIS OF AXES FROM MALANGANGERR

The axes are described according to their level in the deposit. The raw material was identified by Mr C.A. Key¹ who studied the sections of several axes in order to describe the degree of weathering present. Several axes show a weathered zone below their ground surface which suggests post-manufacture exposure, but need not imply any particular antiquity since the weathering rates of these rocks in Arnhem Land are unknown.

The measurements of each axe refer to the maximum length, breadth and thickness in that order. Ends and sides are defined in relation to the length axis and the plan of the axe or edge refers to the shape viewed dorso-ventrally.

Level IIIa:

1. 4B/5-324 is an axe of porphyritic dolorite which is very heavily weathered and partly destroyed. It is 13.0 x 9.2 x 14.1 cm. and is oval in plan with a lenticular cross-section. It was bifacially retouched on two sides and one end and then ground on both surfaces to form a straight cutting edge at the other end (Figure IV - 15,a).

1

Research Fellow in Environmental Archaeology, Research School of Pacific Studies, A.N.U.

Level III:

1. 1C/3 is deeply weathered epitodised quartz dolorite, with a 10mm. thick zone of iron staining below the ground surface. It is 11.0 x 6.7 x 4.0cm. and part of one surface has weathered away. It is rectangular in plan with a lenticular cross-section. It may have been made on a pebble because it shows no signs of flaking. The cutting edge is formed at one end by two intersecting ground surfaces (Figure IV - 15,b).
2. 7C/10-266 is a large flake of porphyritic dolorite, 16.5 x 9.3 x 3.0 cm. It has light bifacial flaking along two sides and smoothing is visible on one side. It may well represent an early stage in axe production.

Level IIIb:

1. 5A/8-452 is a fine grained hornfels with a 5mm. thick zone of iron staining below the ground surface. It is 8.1 x 6.2 x 2.2cm. and is rectangular in plan with a slightly parallelogram shaped cross-section. It is bifacially flaked along both sides and ground on both surfaces to form a sharp cutting edge at one end. There is a marked hollow groove on one side, but no groove on the surfaces at all. It may therefore be termed a ?waisted axe (Figure IV - 15,c).
2. 2A/7-428 is fine grained hornfels. It is 8.2 x 8.0 x 3.3cm. It is slightly 'U' shaped in plan with an oval cross-section. It was bifacially worked along both sides and then extensively ground to form a cutting edge at the broader end.

An outstanding feature of this axe is a marked groove on one surface. The groove is about 1.5cm. wide and 0.3cm. deep and lies parallel to the cutting edge about $\frac{2}{3}$ of the distance down the length axis from that edge. It was apparently ground into the surface of the axe and is perfectly smooth and even (Figure IV - 16,a).

3. 2A/8-431 is fine grained hornfels. It is 10.9 x 8.7 x 2.0cm. It is slightly 'U' shaped in plan with a flat lenticular cross-section. Both sides and one end are bifacially flaked and both surfaces are ground to form a cutting edge along the broader end. There is a slight groove on one surface which runs diagonally across the axe, but this is probably a natural feature (Figure IV - 16,b).

APPENDIX V-1ANALYSIS OF HUMAN BONES FROM NAWAMOYN

A.G. Thorne, Department of Anatomy,
University of Sydney.

a. Level Ia

(1) F3/1:

Most of the skull is intact. The mandible shows heavy wear of all teeth with pre-mortem loss of the L. second molar and the L. lateral and central incisors. Evidence of pathology is present in some molars - complete exposure of the buccal roots of the R. second molar with apical abcessing and complete exposure of the distal surface of the distal root of the L. molar. There has also been some resorption of the alveolus generally.

The maxillary fragments also demonstrate pathology on both sides. On the right side there is severe pathological excavation in the region of the apex of the root of the first and second premolars. There is also evidence of pre-mortem loss of the first molar on this side, which preceded death considerably. On the left side there is abcessing, again in the region of the premolars, but this is less severe and more superficial. Again there is evidence of pre-mortem loss of the first molar and, if not loss, then at least buccal root exposure of the second molar.

Three teeth associated with this burial do not belong to the above individual. There is one mandibular

3rd molar, one maxillary premolar and the root of a premolar. They all belong to an adult and may belong to the same individual.

(ii) E11/3 - 1:

Mandibular R. permanent 3rd molar. This is very worn with dentine exposure.

(iii) General:

1. Teeth:

G2/2 - one mandibular R. permanent molar - very worn - adult.

G2/2 - one mandibular R. permanent canine - very worn - adult.

G2/3 - one maxillary R. permanent molar with a small amount of alveolar bone between the roots. This tooth shows very considerable wear with $\frac{3}{4}$ of the crown removed and deep wear on the distal surface down to the level of the base of the roots.

F2/2 - one maxillary R. permanent first molar - very worn - adult.

2. Mandible:

J1/2 - Adult mandible showing a long-standing loss of the majority of the cheek teeth. There is some evidence of alveolar pathology of the R. canine.

b. Level Ib

(i) Teeth:

G2/4 - one fragment of a maxillary permanent central incisor.

G2/5 - one mandibular L. permanent canine - very worn - adult.

I2/4A - one permanent 3rd molar - adult.

(ii) Skulls:

1. I1/3:

Most of this skull is intact. It belongs to an adult male and there is a small hole in the parietal which may indicate a developmental mistake. Post-mortem fragmentation has occurred; the maxilla is intact but the mandible is missing.

The following teeth are found:

8	-	6	5	-	3	2	-		-	2	3	4	5	6	-	-

There is a pre-mortem loss of the upper permanent L. central incisor, upper R. second molar and the upper L. second molar. All teeth are heavily worn and no crown is left on the incisors, canines and first premolars. Buccal fraction is found on the L. second premolar, and small buccal plates of enamel occur on either first molars. The R. third molar shows heavy wear on the lingual half of the crown with deep dentinal excavation. Apical pathology is evident on the buccal surface of the R. first molar.

2. F2/4 and 5:

Most of the skull is present; the mandible is complete except for the R. condyle angle and the posterior border. The maxilla is fragmentary and so is the R. temporal, but all the remains belong to the same skull.

The following teeth are present.

8	7	6	5	4	-	2	-		-	2	3	-	-	-	-	-
8	7	-	5	4	3	2	-		1	2	3	4	5	-	-	8

All the teeth are heavily worn. The maxilla is heavily encrusted with carbonate aggregations but still shows a clear pre-mortem loss of the upper central incisors. There is heavy wear on the upper R. second molar and the R. premolars. There is also evidence of a possible apical absence on the upper R. first molar.

c. Level I

(i) D12/1 and E11/4 and 5:

1. Skull:

Most parts of the skull are represented except for the face. The mastoid process is small. The mandible is present, and contains the following teeth:

8	7	6	5	4	3	-	-		1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---	--	---	---	---	---	---	---	---	---

All the teeth are worn and this is an adult skull.

2. Femur:

The proximal end of the L. femur suggests that this is an adult male, since the diameter of the femur head is above the range of male - female overlap for Australians.

3. Clavicle:

The medial half of the L. clavicle shows an anomalous osseous outgrowth on the deep surface, medially.

4. Scapula:

The L. scapula is perforated at the base of the spine inferiorly. In the absence of any apparent morphological anomaly, the perforation possibly represents post-mortem trauma, either accidental or deliberate.

APPENDIX V-2
ANALYSIS OF AXES FROM NAWAMOYN

The axes are described according to their level in the deposit. All axes are made of porphyritic dolorite unless otherwise stated and the petrological identifications were made by Mr C.A. Key.¹ The measurements of the axe refer to the maximum length, breadth and thickness, in that order. Ends and sides are defined in relation to the length axis and the plan or shape of the axe or edge refers to the shape viewed dorso-ventrally.

Level Ia

1. B9/1 is 9.0 x 8.9 x 3.6cm. It is roughly oval in plan with a lenticular cross-section. It is bifacially flaked at the base and ground all over to form a curved cutting edge at one end.
2. I1/1-1 is 8.3 x 7.8 x 3.5cm. It is 'U' shaped in plan and has a lenticular cross-section. It is bifacially flaked on both ends and one side and ground to form a straight cutting edge on the other side. This distinguishes it from most other axes whose cutting edge is at one end (Figure V-10,a).
3. I2/3-4 is hornblende schist. It is 9.0 x 7.2 x 2.2 cm. with a rectangular plan and a lenticular cross-section. It is bifacially flaked on both sides and ground on both surfaces to form two slightly convex cutting edges at either end (Figure V-10,b).

¹

See Appendix IV-2.

4. A11/2-1 is 10.1 x 8.0 x 4.6cm. and is oval in plan with a lenticular cross-section. It is bifacially flaked along one end and ground on both surfaces to form a slightly curved cutting edge at the other end (Figure V-10,c).

5. B11/1-1 is 8.9 x 6.8 x 3.7cm. It is oval in plan with domed cross-section. It is extensively ground on both surfaces, and a cutting edge was apparently produced by bifacial flaking on one side.

6. J1/2-1 is 7.0 x 6.5 x 2.8cm. It is circular in plan with a lenticular cross-section. Flake scars and grinding are visible on both surfaces but no cutting edge is seen. It may represent an early stage of axe manufacture and is therefore included in the axe group.

7. J2/1 is hornfels and is 7.5 x 5.1 x 1.3cm. It was bifacially flaked all around the perimeter and then ground smooth on both surfaces. The cutting edge is formed by bifacial flaking at one end.

Level Ib

1. I2/5-2 is 11.1 x 8.4 x 3.2cm. It is roughly oval in plan with a lenticular cross-section. Bifacial flaking is visible on both sides and one end and the axe is ground on both surfaces to form a sharp straight cutting edge along the other end (Figure V-10,d).

2. I1/3-2 is 9.4 x 8.2 x 3.4cm. It is oval in plan with a slight indentation on both sides. It has a lenticular cross-section and was bifacially flaked on both sides and one end and then ground to produce a curved cutting edge at the other end.

This axe is not grooved on either surface, but could be described as 'slightly waisted' because of the shape of the two sides (Figure V-11,a).

3. I1/3-5 is 7.9 x 6.8 x 3.4cm. It is oval in plan with a lenticular cross-section. It was bifacially flaked on both sides and one end and then ground on both surfaces to produce a slightly wavy cutting edge at the other end (Figure V-11,b).

4. J1/3-2 is quartzite. It is 11.7 x 11.3 x 4.3cm. It is roughly circular in plan with an oval cross-section and is bifacially flaked around most of the perimeter. It is ground on both surfaces to form a slightly curved cutting edge at one end. The flake scars are weathered and it seems that this axe may have been exposed to running water before being brought into the shelter (Figure V-11,c).

5. J2/2-1 is 13.7 x 9.3 x 2.5cm. It is oval in plan with a narrow lenticular cross-section. It was extensively retouched with bifacial flaking on both sides and the end and then ground on both surfaces to produce a straight cutting edge at the other end (Figure V-11,d).

6. I0/3-6 is 8.3 x 7.8 x 4.3cm. It is circular in plan with a thick oval cross-section. It was bifacially worked for a short length on one side and then ground on one surface. There is no cutting edge but it is included in this series because it probably represents an early stage in axe production.

Level II

1. H2/7-2 is 10.3 x 10.0 x 3.9cm. A thin section shows 3.5mm. of final weathering below the polished surface. The axe is somewhat circular in plan with two slight protuberances or 'ears' on both edges just below the ground blade. It has a lenticular cross-section and was bifacially flaked all around the perimeter and then ground on both surfaces to produce a curved cutting edge along one side (Figure V-14,a).
2. I0/4-10 is coarse grained hornblende schist. It is 9.7 x 9.0 x 2.7cm. with a roughly oval outline and a lenticular cross-section. It was bifacially flaked at both ends and along one side and then ground on both surfaces to form a slightly convex cutting edge along one side (Figure V-14,b).

Level IIIa

1. I1/5-7 is 8.1 x 7.2 x 3.8cm. It is oval in plan with a lenticular cross-section. It was bifacially flaked around most of the perimeter and then ground on both surfaces to produce a convex cutting edge at one end. The edge was later truncated by the removal of a large flake.
2. J1/6-5 is altered porphyritic dolomite with a 4mm. thick zone of final weathering under the ground surface. The axe is 10.4 x 8.1 x 4.2cm. and oval in plan with a lenticular cross-section. There is a slight indentation on each side¹ which gives the axe a waisted.

¹

It is very similar in this respect to I1/3-2.

appearance. It was bifacially flaked on both sides and one end and subsequently ground on both surfaces to produce a convex cutting edge at the other end (Figure V-14,c).

3. J2/B-1 is a very weathered piece of hornblende schist. It is 7.7 x 7.5 x 3.6cm. and is the base of a bifacially flaked axe whose blade has broken off.

Level IIIb

1. G1/6-3 is a fine grained hornfels with iron staining extending 1.0mm. below the surface. It is 8.8 x 6.3 x 1.5cm. It is triangular in plan with a thin lenticular cross-section. The axe is heavily weathered and there is evidence of bifacial flaking. No grinding is visible (Figure V-17,a).

2. G1/6-2 is fine grained hornfels. It is 8.6 x 5.9 x 1.4cm. and is triangular in plan and could almost be termed 'stemmed'. It has a lenticular cross-section. Although it is heavily weathered, it was apparently bifacially flaked and then the curved cutting edge was formed by a neatly ground bifacial bevel (Figure V-17, b).

3. Ell/9-1 is a fine grained hornfels axe, 7.2 x 5.2 x 1.7cm. It is again triangular in plan with a lenticular cross-section. It is heavily weathered and was bifacially flaked and then the curved cutting edge was formed by a neatly ground bifacial bevel (Figure V-17,c).

4. J1/7-8 is altered porphyritic dolorite, deeply weathered with a final iron stained rim extending up to 2.5mm. below the ground surface. It is 7.6 x 6.9 x 3.5cm.

and is obliquely broken across one side. It has a lenticular cross-section and was bifacially flaked around the perimeter and then ground on both surfaces to form a convex cutting edge at one end (Figure V-17,d).

A horizontal groove is visible on one surface. It occurs about 5cm. below the cutting edge and is about 1.1cm. wide and 0.1cm. deep. A slight indentation occurs on one side.

5. H1/7 is schist and is 6.7 x 4.5 x 1.2cm. It is broken along one side but was originally oval in plan with a flat lenticular cross-section. Rough bifacial working and subsequent grinding are visible. No cutting edge is seen; it might well have broken off, or this might be an unfinished axe.

6. C11/9 is coarse grained quartzite. It is 6.2 x 6.0 x 2.6cm. It is somewhat pear shaped in plan since one side shows a marked hollow. It has a domed cross-section. No flaking is seen and the cutting edge was apparently formed at one end by bifacial grinding.

This piece comes from the basal gravel and may be a natural lump of quartzite, but I have classified it as an implement because of the localised grinding (Figure V-17,e).

APPENDIX VI-1ANALYSIS OF AXES FROM TYIMEDE I

The axes are described according to their level in the deposit. They are all made of porphyritic dolorite. The measurements refer to the maximum length, breadth and thickness of the axe, in that order. The plan refers to the shape of the piece viewed dorso-ventrally.

Level I:

1. 4E/3-1 is 9.9 x 5.6 x 4.1 cm. It is oval in plan and flat-based with a high domed cross-section. It is bifacially flaked but unground (Figure VI - 31,a).

Level II:

1. 3E/4-15 is 8.9 x 5.9 x 2.5 cm. It is oval in plan and flat-based with a triangular cross-section. The cortex of the parent block is visible on the dorsal surface. It is bifacially worked on both ends and ground along the cutting edge of one side, and on part of the ventral surface (Figure VI - 31,b).

2. 4E/5-22 is 9.4 x 7.3 x 3.8 cm. It is roughly oval in plan with a lenticular cross-section, and is bifacially worked around the perimeter. Grinding is visible on both surfaces, but does not form a cutting edge (Figure VI - 31,c).

Level III:

1. 2E/9-326 is 5.9 x 5.0 x 1.8 cm. and is the smallest axe in the collection. It is made on a flake and is oval in plan with a lenticular cross-section. It is bifacially worked on both sides and one end is ground on both surfaces to form a cutting edge at the other end (Figure VI-31,d).
2. 4D/6-12 is a broken axe. It is 8.7 x 8.0 x 4.1 cm. It is oval in plan with a lenticular cross-section and shows signs of bifacial retouch and grinding.

APPENDIX VII-1ANALYSIS OF STONE ARTEFACTS FROM SQUARE 2F, TYIMEDE II

The material from this square comes mainly from the large 'pit'. It is analysed briefly as follows:

OVERALL FEATURES:

There are 2755 waste flakes and 141 implements here. Most waste flakes are quartzite and many implements are made of chert. This is partly reflected in the ratio of implements to waste flakes as follows:

	Raw material				Total
	Quartzite	Quartz	Chert	I/mm.	
Nos waste flakes per implement	29	93	7	98	19

This table reflects the economic use of chert as implements as opposed to quartz and igneous/metamorphic rocks. This result is very similar to that found in Level I of the site as a whole.

ANALYSIS OF IMPLEMENTS:

The incidence of implements is shown in the following table. The numbers correspond to those which are used to describe the implements in Level I:

Implements	Nos	Percent
1. Points	7	5.0
2. Butts	13	9.2
3. Tips	5	3.5
4. Shaft	1	0.7
5. Unfinished pts	-	-
6. Scrapers	17	12.1
7. Broken scrapers	8	5.7
8. Ovals	2	1.4
9. Bruised	4	2.8
10. Endstruck flakes	-	-
11. Broken endstruck flakes	-	-
12. Cores/Core scrapers	-	-
13. Util. flakes	19	13.5
14. Broken util. flakes	6	4.2
15. Util. lump	1	0.7
16. Miscell.	-	-
17. Axe	1	0.7
18a Unif. retouch	40	28.4
b Bif. retouch	17	12.1
Total	141	100.0

This assemblage also contains five hammers made on quartzite pebbles and 215 lumps of ochre. The mean weight of ochre lumps is 11.9 gm.

The collection is similar to the industry in Level I in several respects. Firstly, most of the points, (intact and broken), are made of quartzite whereas all of the scrapers are chert. Secondly, most

of the points (80 per cent) are bifacially retouched whereas all of the scrapers are unifacially worked.

One notable piece is a broken utilised flake, 2F/4. It is made of quartzite and measures 2.8 x 1.5 x 0.4 cm. It has use-polish on one side, which is dull on one surface and bright on the other. In this respect it resembles a broken scraper, (1D/4), and a utilised flake, (6G/3-12), from Level I. It seems that these formally different tools all performed similar functions.

There are several heavily patinated utilised flakes and one chunky scraper in this collection. These forms are generally restricted to Level III. Furthermore, the mean weight of ochre lumps is almost identical with that found in Level III. These features, as well as the iron found throughout, help to document the admixture of material in the pit.

APPENDIX VII-2ANALYSIS OF AXES FROM TYIMEDE II

The axes are described according to their level in the deposit. They are all made of porphyritic dolorite. The measurements given refer to the maximum length, breadth and thickness of the implement in that order. Ends and sides are defined in relation to the length axis, and the plan of the axe refers to the shape viewed dorso-ventrally.

Level Ia:

1. 6G/3-24 is 5.5 x 4.7 x 1.3 cm. It is slightly triangular in plan and lenticular in cross-section. It is bifacially worked all around the margin and is ground on both surfaces to form a cutting edge at one end (Figure VII - 17,a).

Level Ib:

1. 1C/4-20 is 10.6 x 7.4 x 3.8 cm. It is oval in plan with a thick lenticular cross-section. The surface is grossly pitted. Grinding is visible on both surfaces and the cutting edge may lie at either end (Figure VII - 18,a).

2. 1C/4-19 is 9.2 x 6.8 x 2.0 cm. It is oval in plan with a lenticular cross-section and is bifacially flaked. It is ground on both surfaces to form a cutting edge at one end (Figure VII - 18,b).

3. 1D/5-2 is 8.2 x 5.6 x 4.1 cm. It is oval in plan and the section is shaped like an isosceles triangle with a slightly convex base. It is bifacially worked all around the margin and ground on both surfaces to form a cutting edge at one end (Figure VII - 18,c).

Level II:

1. 2B/5-1 is 8.4 x 7.4 x 3.4 cm. It is oval in plan and lenticular in cross-section. It was bifacially flaked on one end and both sides, and then ground on both surfaces to form a cutting edge at the other end (Figure VII - 19,a).

2. 3F/5-4 is 7.4 x 6.6 x 3.8 cm. It is slightly triangular in plan and lenticular in cross-section. It was bifacially flaked on both sides and on the broad end, and then ground to form a dull edge at that end (Figure VII - 19,b).

3. 3C/4-1 is 6.9 x 6.4 x 2.7 cm. It is squarish in plan and lenticular in cross-section. It was bifacially flaked on one side and end and then ground on both surfaces to form a cutting edge on the side. This is a distinctive feature since the ground cutting edge lies at one end of most of the other axes (Figure VII - 19,c).

Level III:

1. 3G/8-1 is 12.5 x 7.7 x 3.1 cm. It is oval in plan with a lenticular cross-section. It is bifacially flaked on two sides at one end. Both surfaces are ground to form a cutting edge at the other end (Figure VII - 25,a).

2. 3G/8-3 is 9.7 x 9.3 x 4.0 cm. It is roughly circular in plan with a lenticular cross-section. It was bifacially retouched on two sides and one end then ground on both surfaces to form a cutting edge at the other end (Figure VII - 25,b).
3. 3G/8-2 is 11.0 x 8.1 x 3.9 cm. It is oval in plan with a lenticular cross-section. It is bifacially worked all round the perimeter and grinding is visible on a few projections on the dorsal surface. No ground cutting edge can be seen: this may well be an incomplete axe, where the flaking was completed but the grinding was not yet finished (Figure VII - 25,c).
4. 2E/6-2 is 9.9 x 9.2 x 4.1 cm. It is roughly circular in plan with an oval cross-section. It is bifacially retouched and ground to form a cutting edge at one end. The cutting edge is truncated by a large flake scar, and the flake was probably detached during use (Figure VII - 26,a).
5. 4F/5-1 is 9.1 x 7.2 x 3.5 cm. It is oval in plan with a domed cross-section. It is extensively weathered, but in spite of this, signs of bifacial working are visible around the perimeter and there is a suggestion of grinding on the dorsal surface (Figure VII - 26,b).

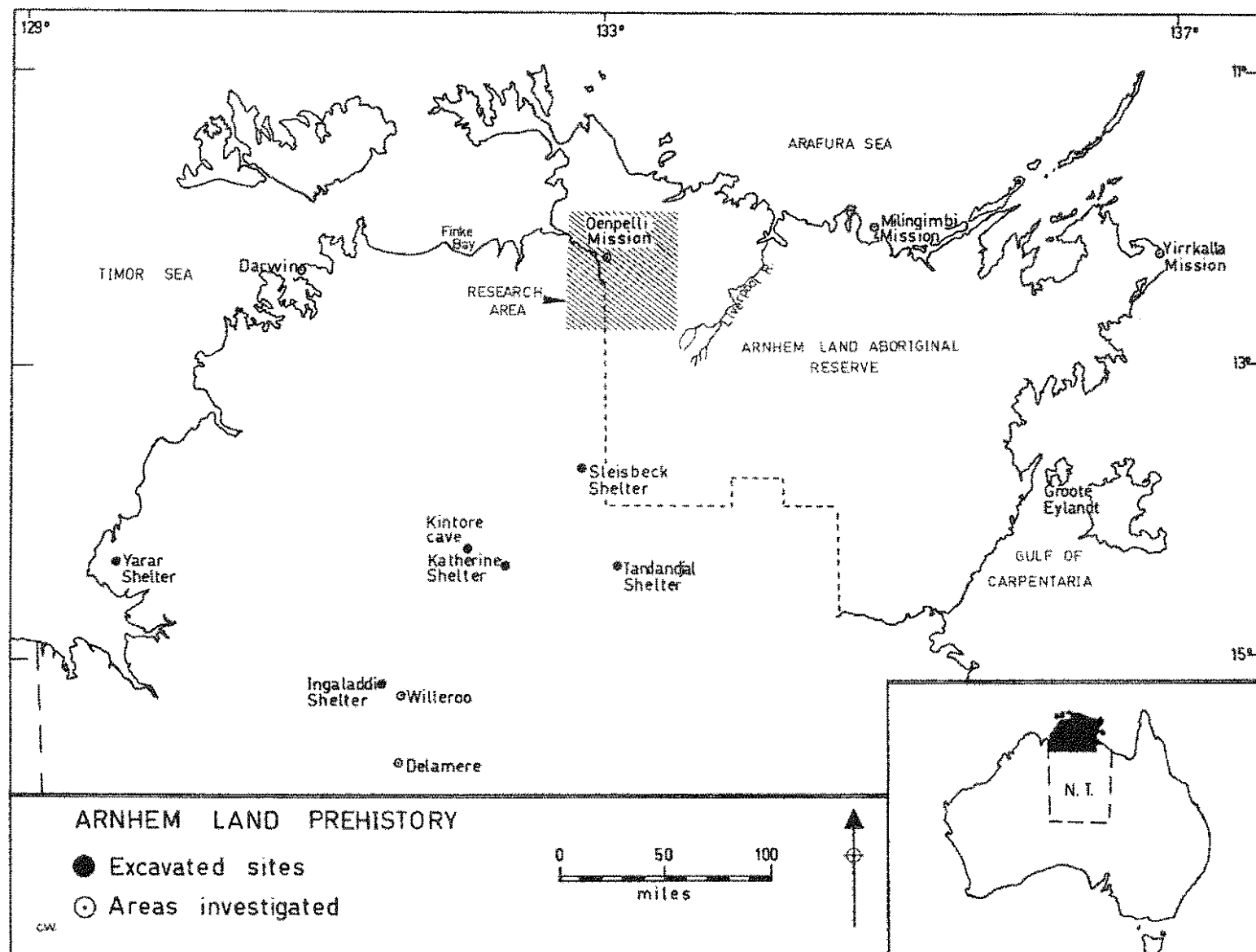
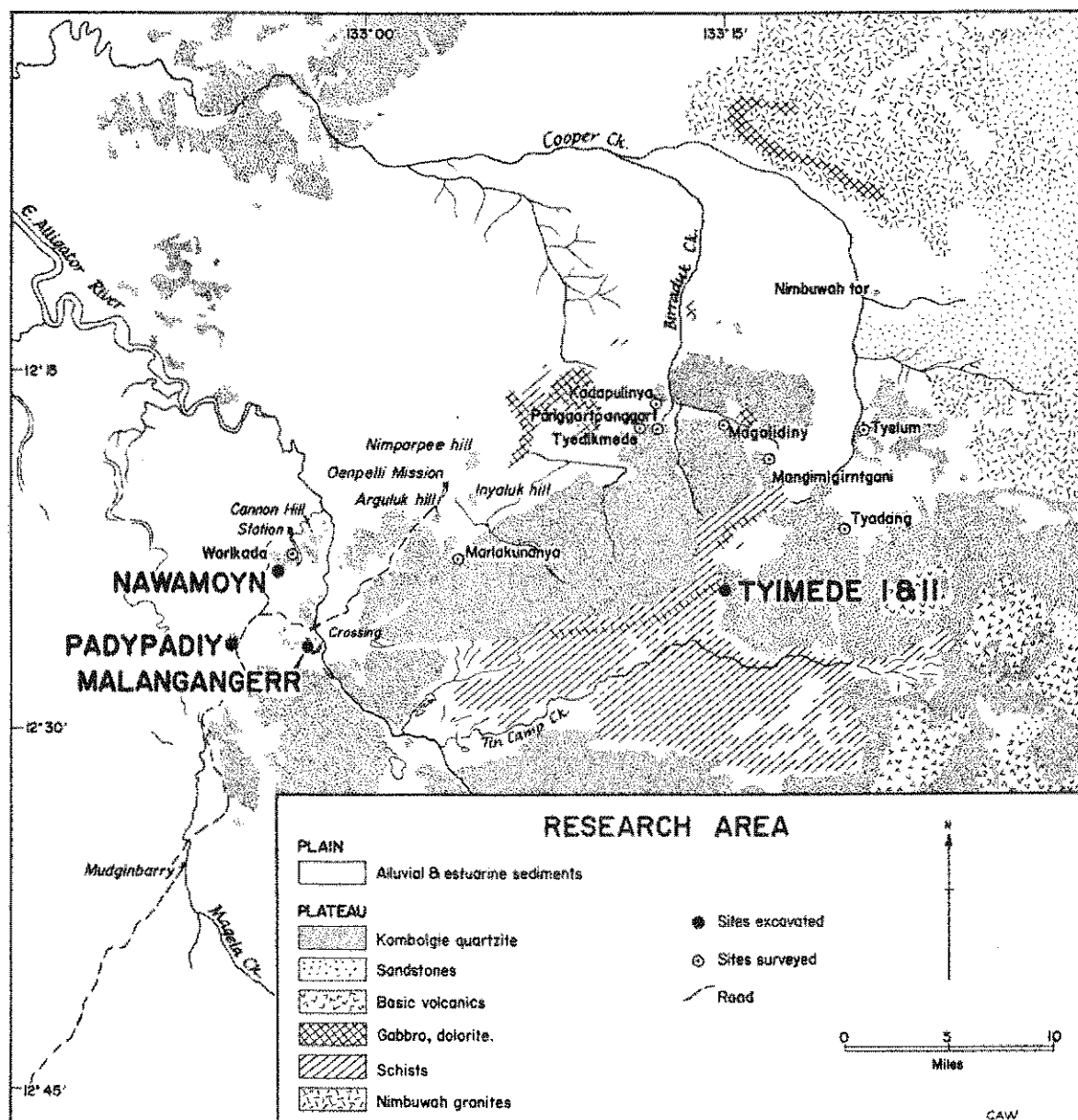


Figure I-1

Figure 1-2



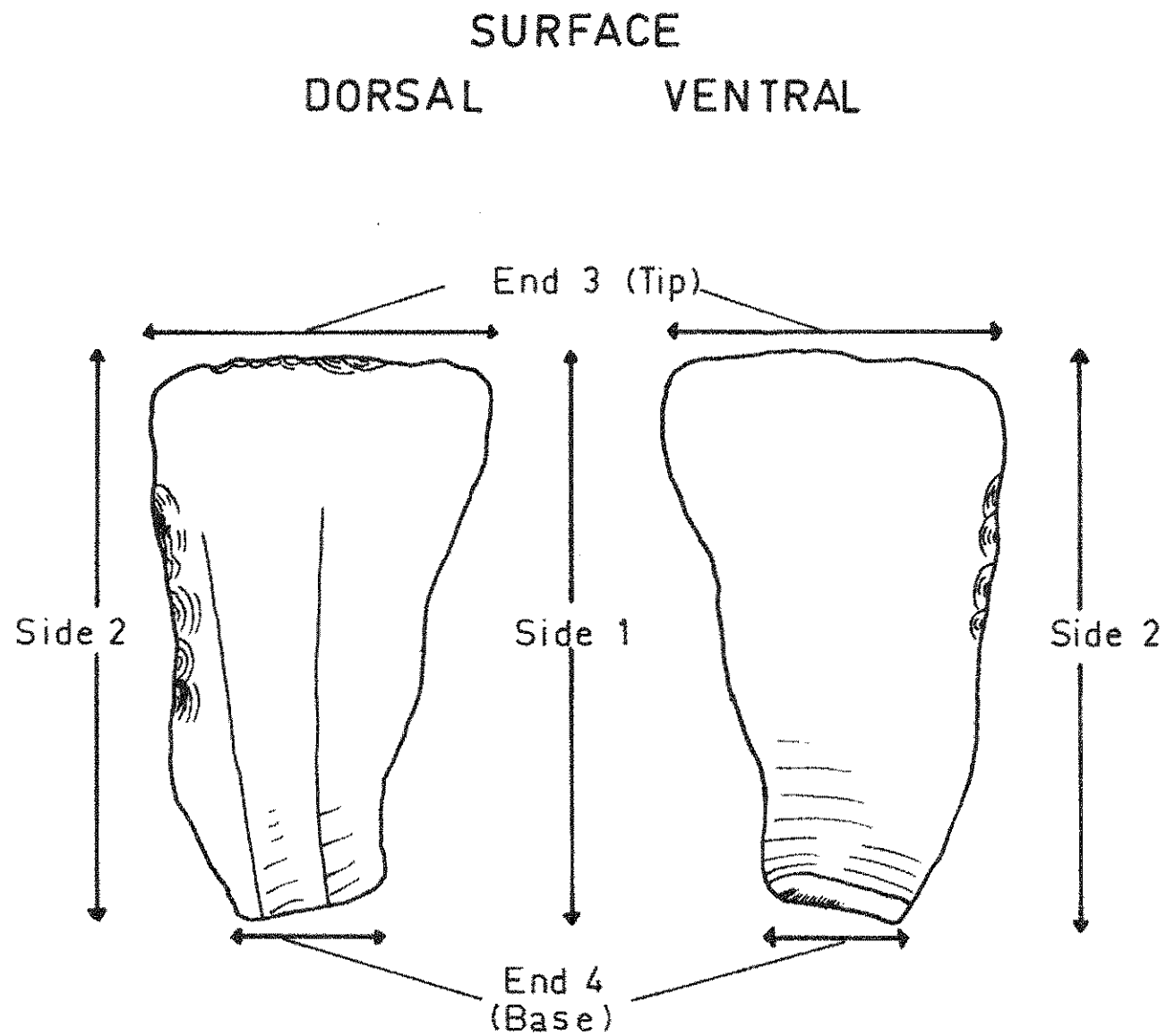


Figure II-1

Figure III - 1

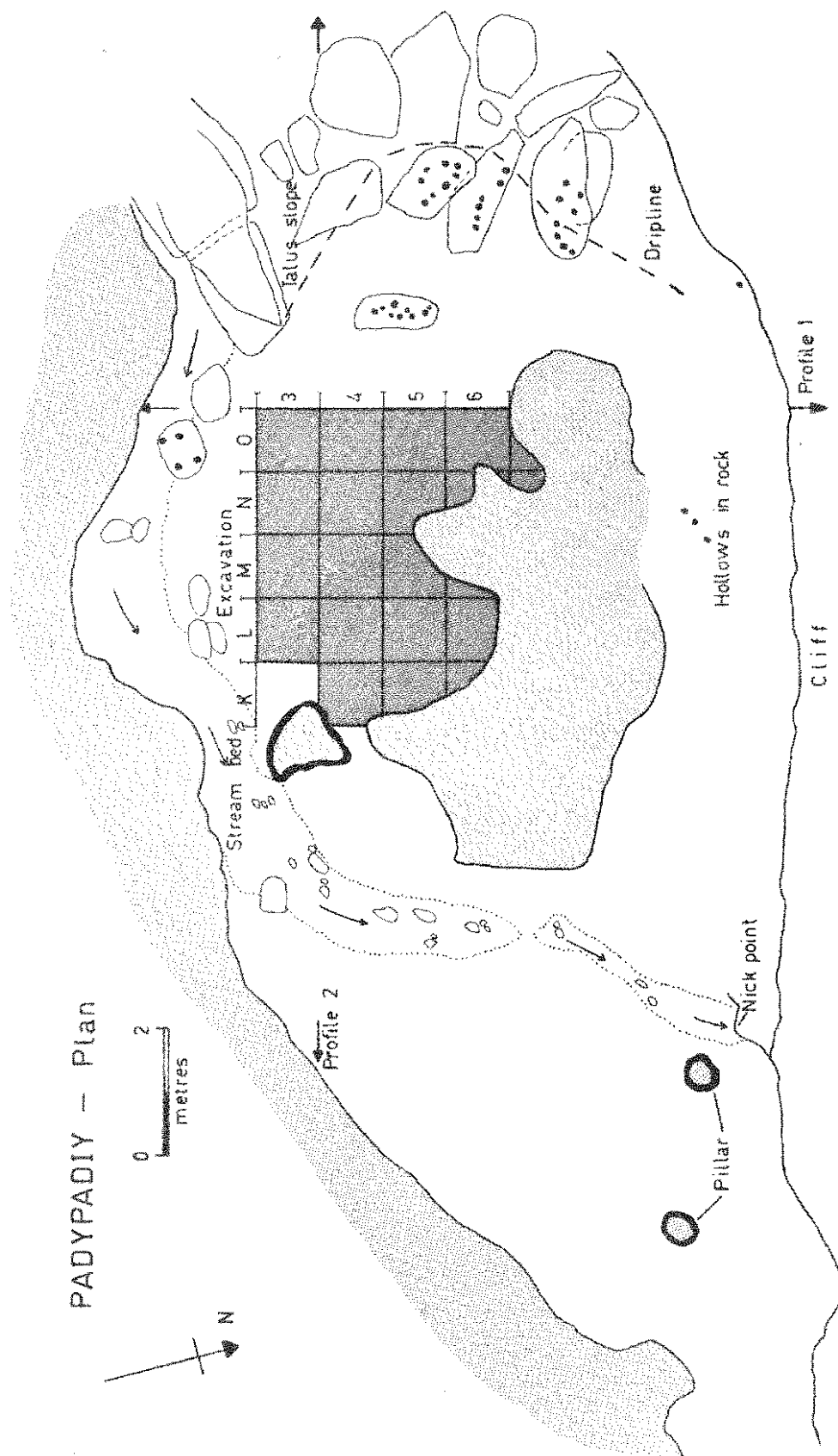


Figure III-2

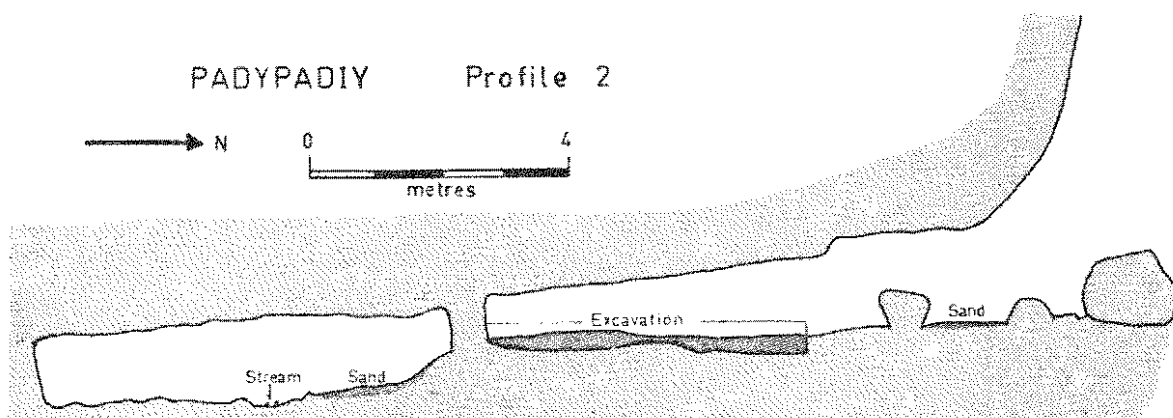
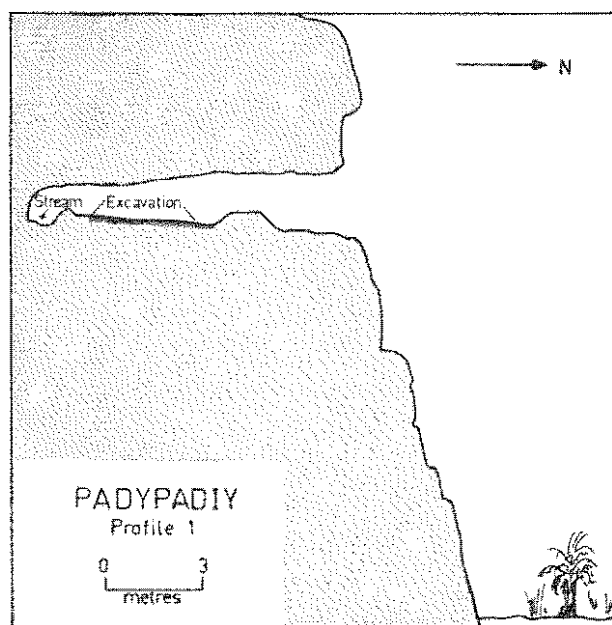
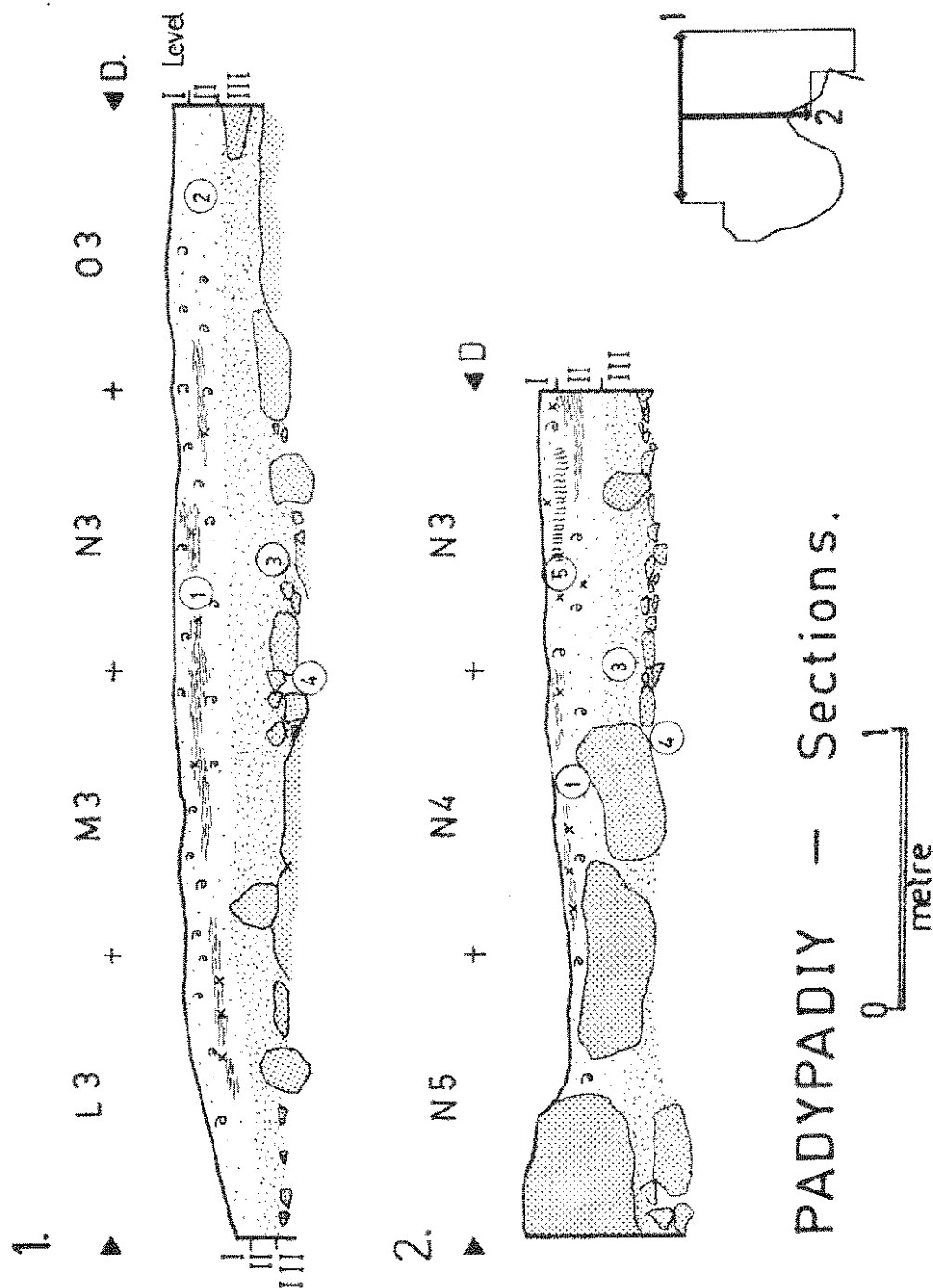


Figure III-3 : Padypadiy

Stratigraphy of 1. South wall of L3 - O3.
 2. East wall of N5 - N3.

1. Lenses of ash and charcoal.
2. Grey sand with shell and bone. (10 YR 3/2-4/2).
3. Sand.
4. Sandy rubble and bedrock.
5. Lens of paperbark.

Figure III-3



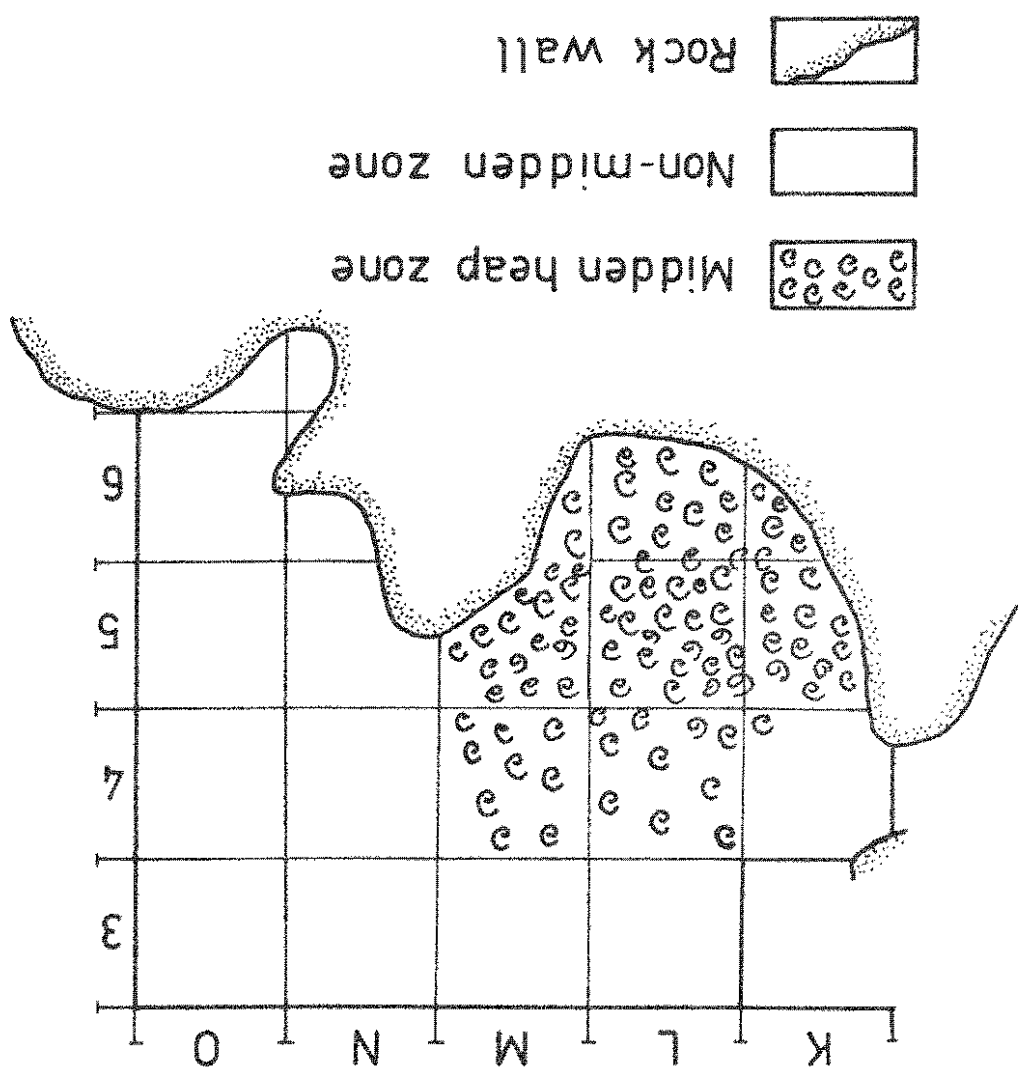


Figure III-4

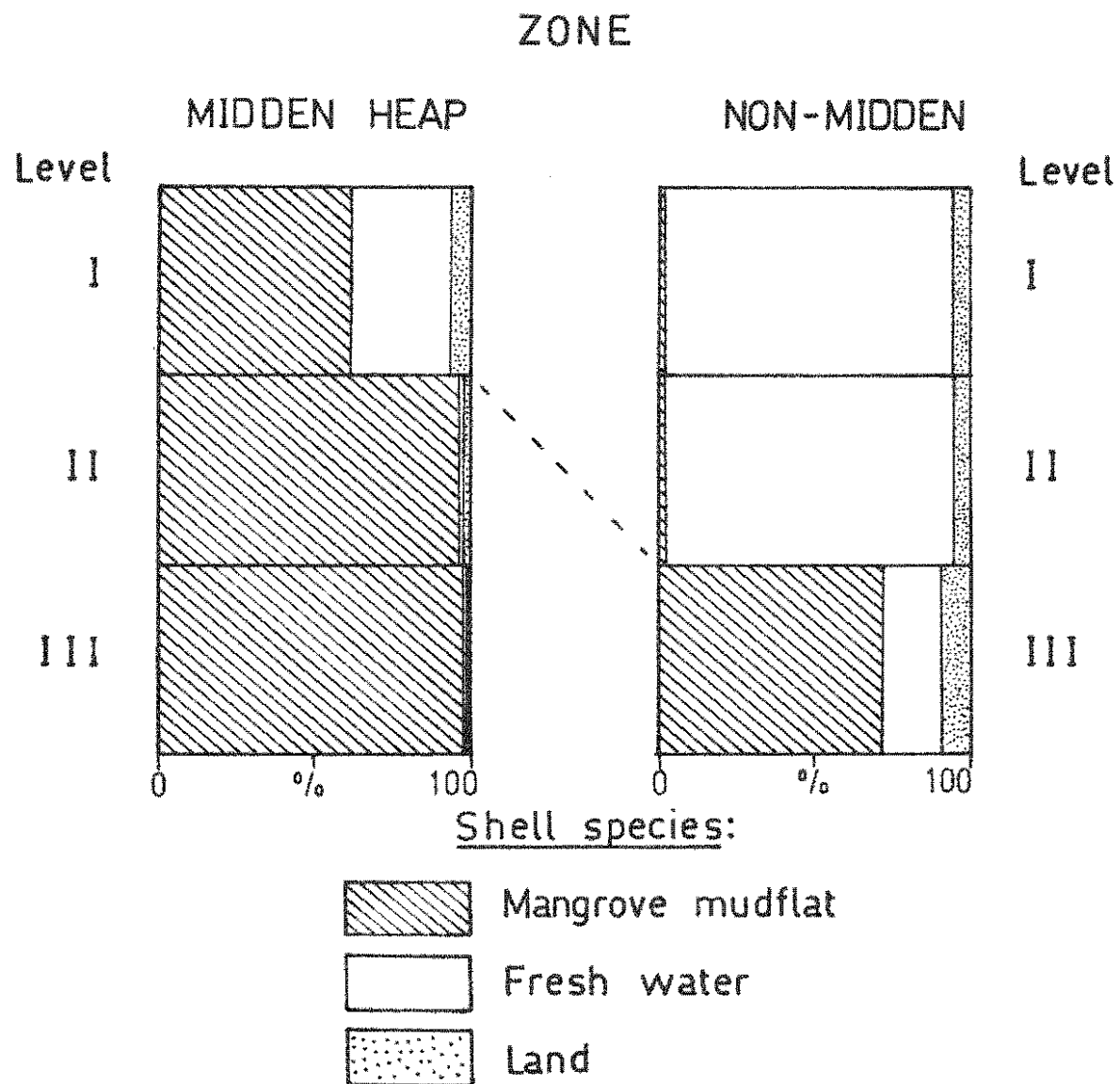


Figure 11-5

Figure III-6

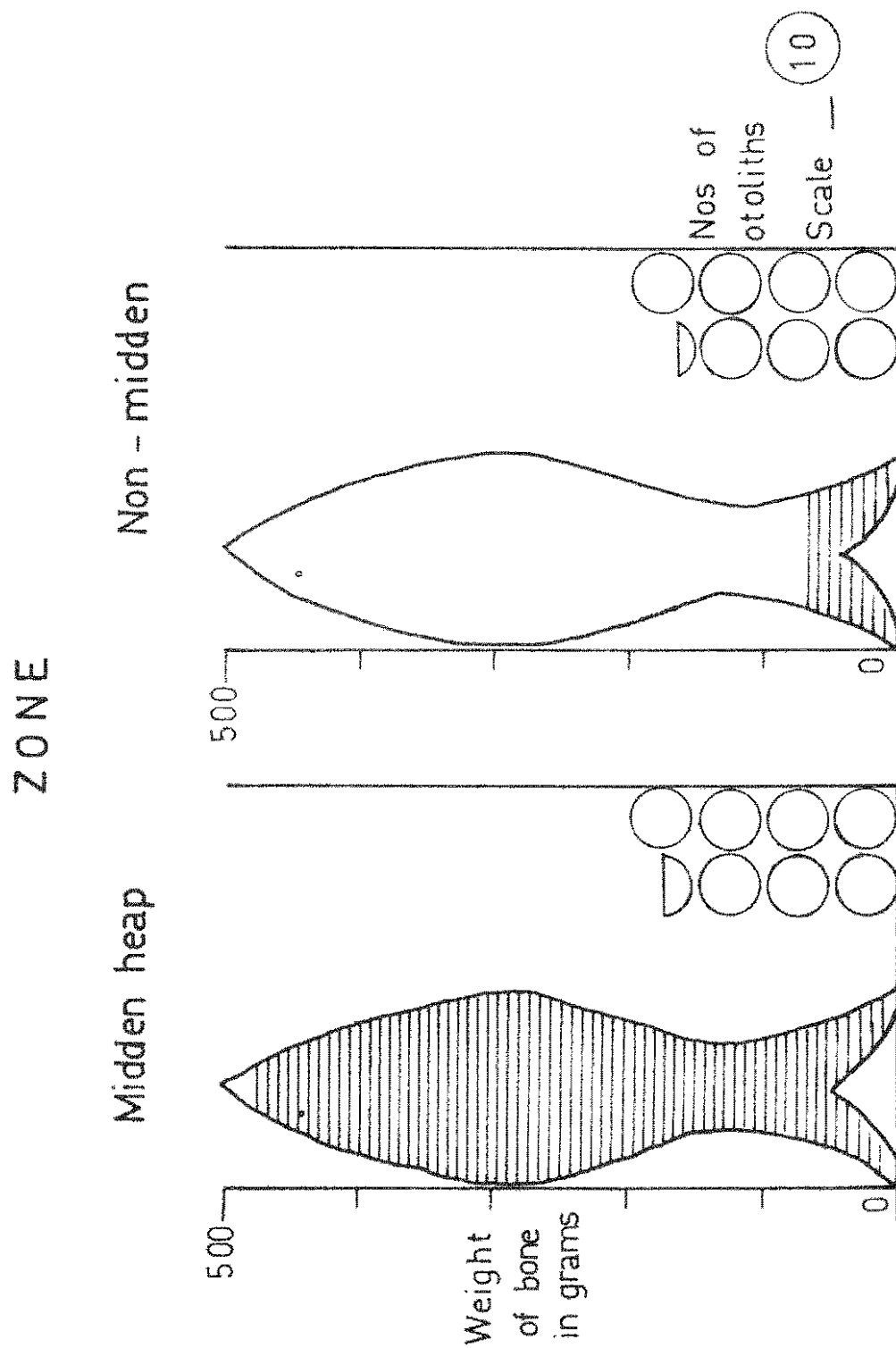


Figure III-7 : Padypadiy

Scale 1:1

- a. Bipoint, intact. M5/2. Level II, midden heap zone.
- b. Bipoint, intact. N6/3. Level III, non-midden zone.
- c. Bipoint, broken. O5/2. Level II, non-midden zone.
- d. Bipoint, broken. O3/2. Level II, non-midden zone.
- e. Unipoint with bevelled tip. Bird bone. K5/2.
Level II, midden heap zone.
- f. Unipoint. N5/1. Level I, non-midden zone.
- g. Unipoint with double bevelled tip. M4/2.
Level II, midden heap zone.
- h. Section. N3/2. Level II, non-midden zone.
- i. Spatulated point. L4/3. Level II, midden heap zone.
- j. Spatulated point. L4/3. Level II, midden heap zone.
- k. Spatulated point. L5/4. Level II, midden heap zone.
- l. Spatulated point broken at one end. L6/1.
Level I, midden heap zone.
- m. Incised fragment with use-polish. O6/1.
Level I, non-midden zone.
- n. Utilised flake. L5/2. Level II, midden heap zone.
- o. Utilised flake. L6/1. Level I, midden heap zone.
- p. Tube. K6/1-5. Level I, midden heap zone.

Figure III-7

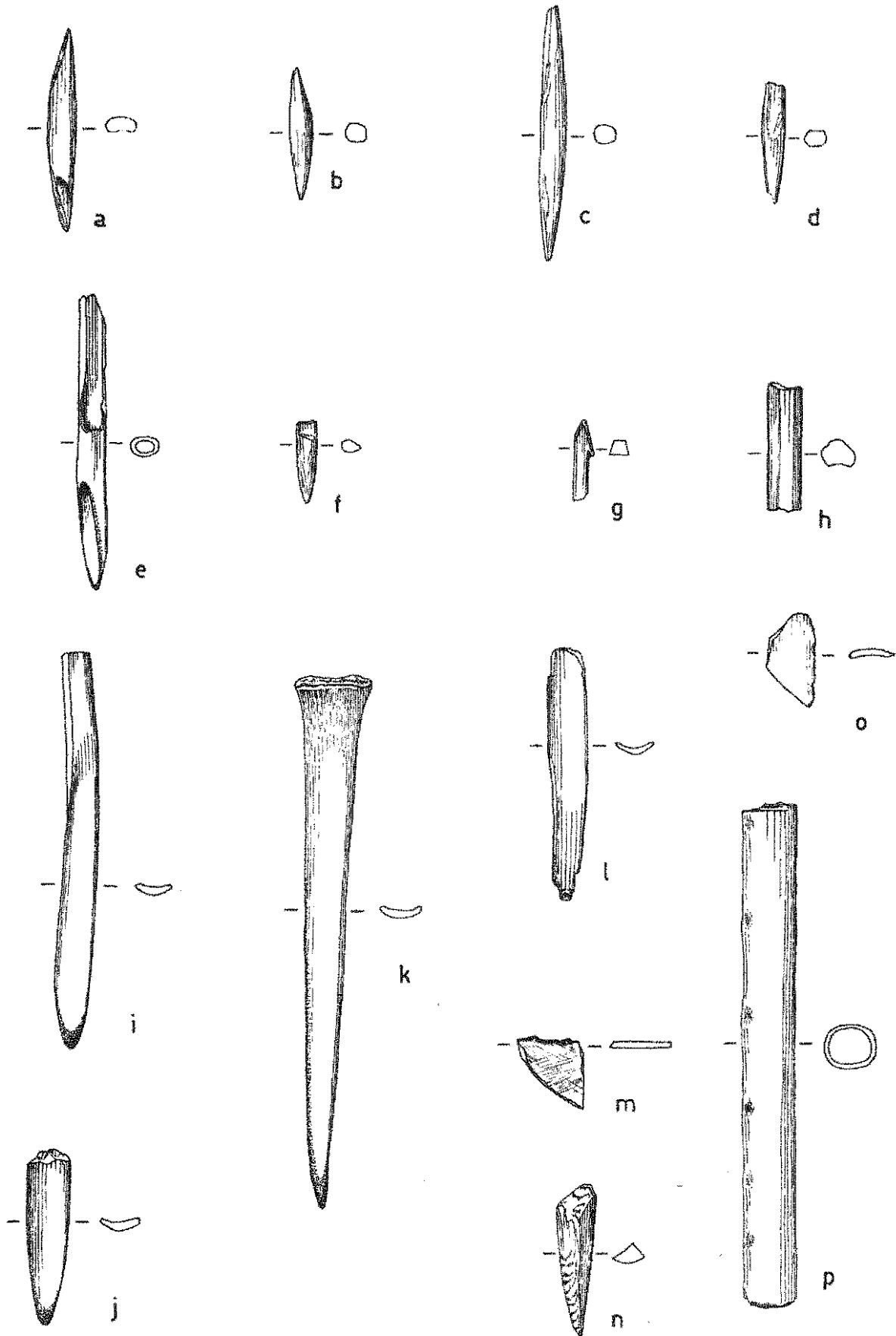
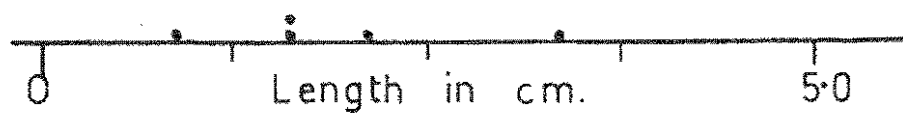


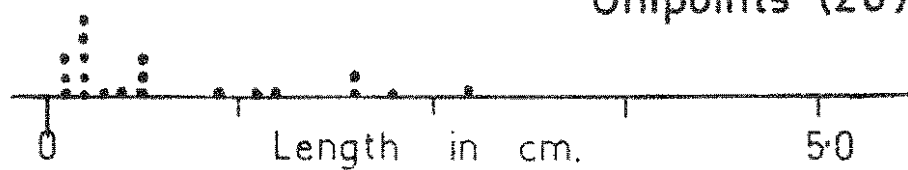
Figure III-8

i. INTACT IMPLEMENTS

Bipoints (5)

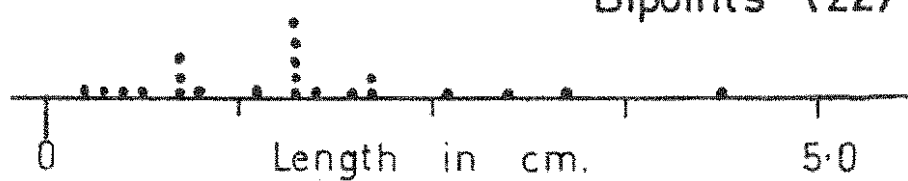


Unipoints (20)



ii ALL IMPLEMENTS

Bipoints (22)



Unipoints (28)

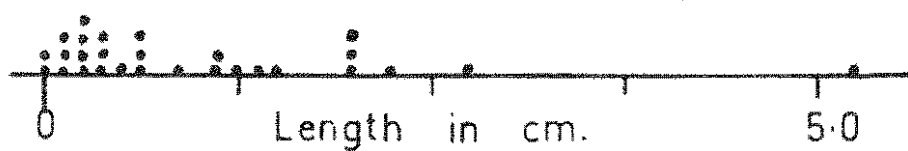


Figure III-9

Distribution of bone implements in Padypadiy

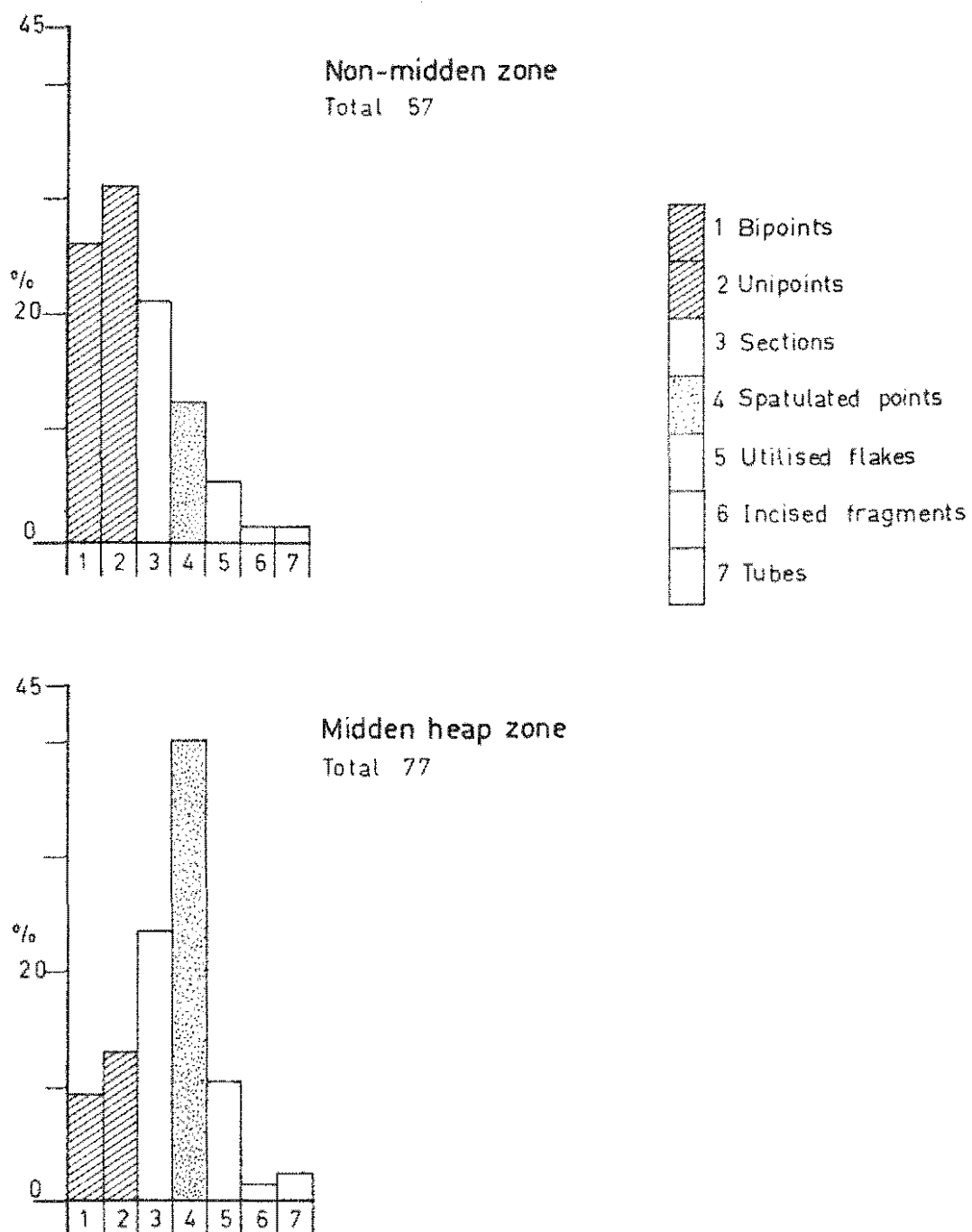
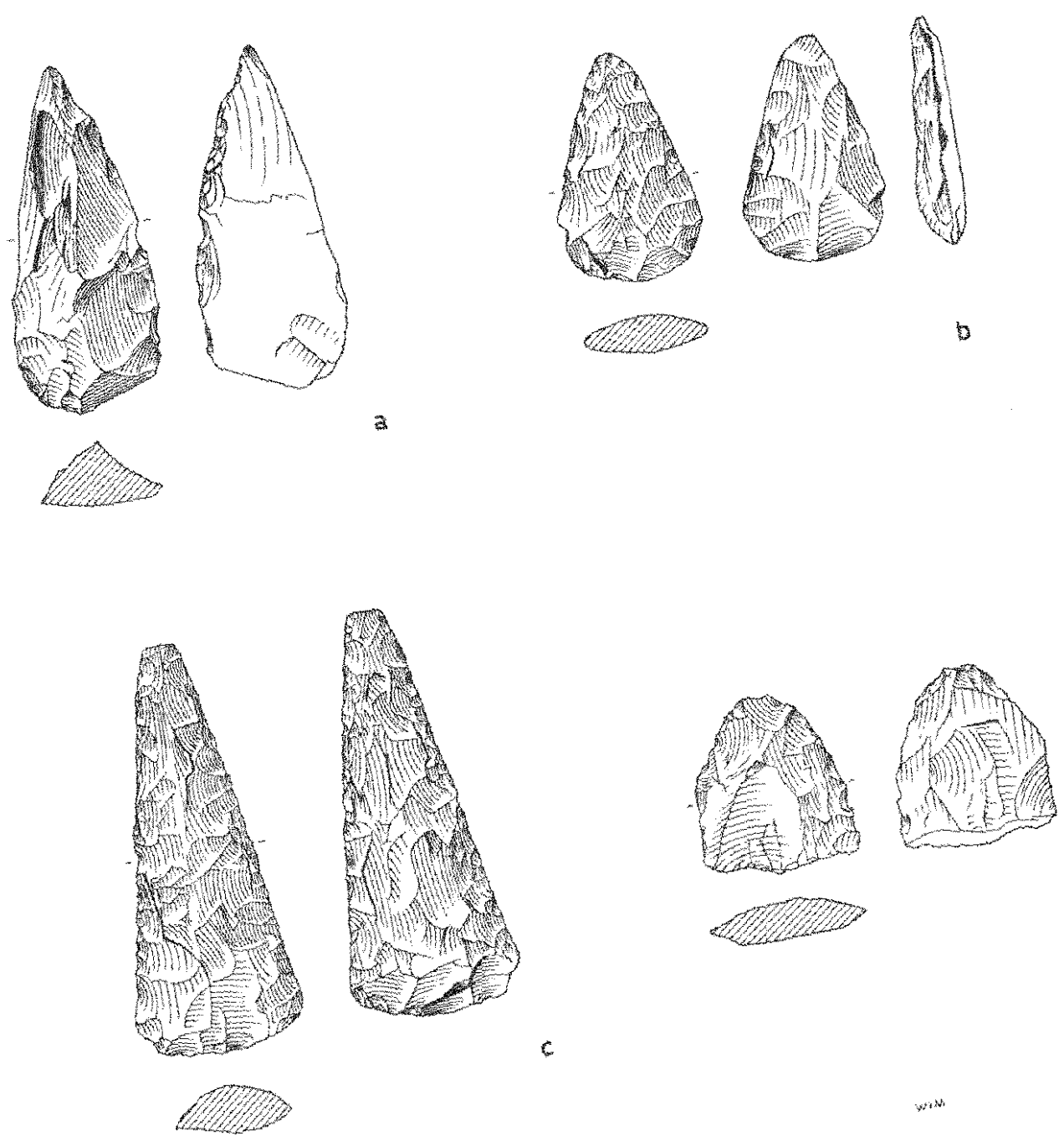


Figure III-10 : Padypadiy

Scale 1:1

- a. Point. Chert, curved butt, bifacial retouch.
N4/3-2. Level III, non-midden zone.
- b. Point. Quartzite, curved butt, bifacial retouch.
Note use-wear on side.
L5/3-15. Level II, midden heap zone.
- c. Butt. Quartzite, curved butt, bifacial retouch.
L5/3-4. Level II, midden heap zone.
- d. Butt. Quartz, square butt, bifacial retouch.
L4/3. Level II, midden heap zone.

Figure III-10



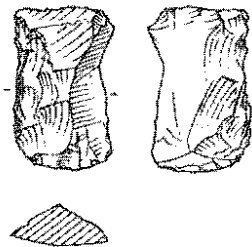
www

Figure III-11 : Padypadiy

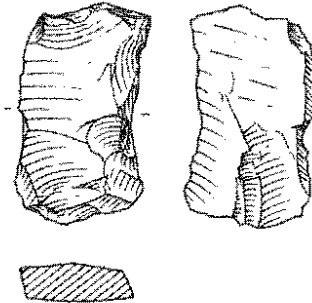
Scale 1:1

- a. Scraper. Chert, rectangular, bifacial retouch.
K5/2. Level II, midden heap zone.
- b. Scraper. Chert, rectangular, unifacial retouch.
04/1. Level I, non-midden zone.
- c. Utilised flake. Quartzite. Use-polish on one
side, mastic on the other.
L6/1. Level I, midden heap zone.
- d. Miscellaneous. Quartzite, with bruising and
smoothing use-wear along one
edge. 03/2. Level II, non-
midden zone.
- e. Utilised flake. Chert. Use-polish along one
side. 04/1. Level I, non-
midden zone.

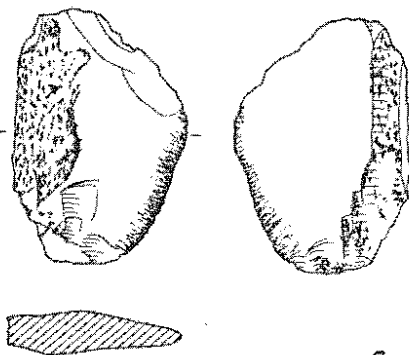
Figure III- 11



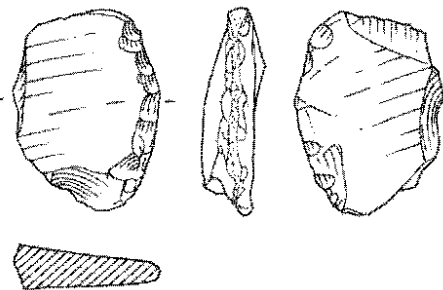
a



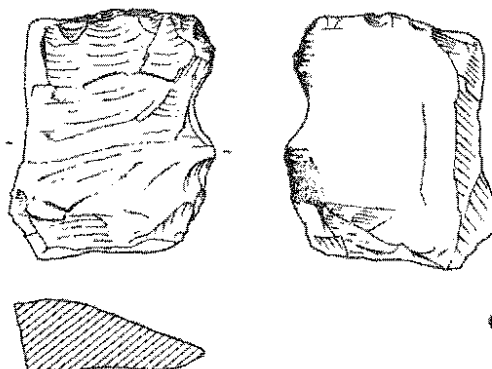
b



c



d



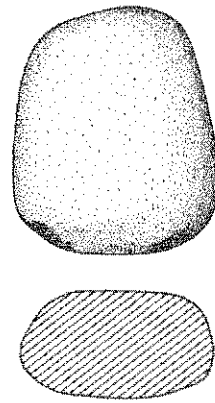
e

Figure III-12 : Padypadiy

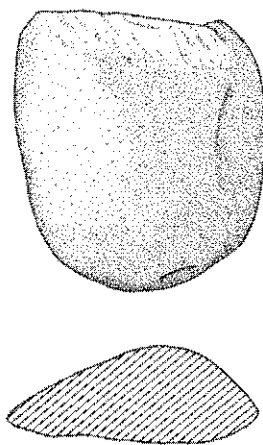
Scale 1:2

- a. Hammer. Quartzite pebble. K6/1. Level I,
 midden heap zone.
- b. Axe. Hornblende schist, edge ground.
 N5/4-4. Level III, non-midden zone.
- c. Axe. Hornblende schist, edge ground.
 L4/4-4. Level III, midden heap zone.

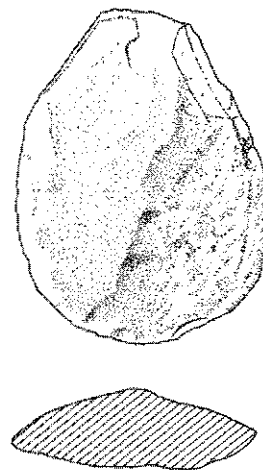
Figure III - 12



a



b



c

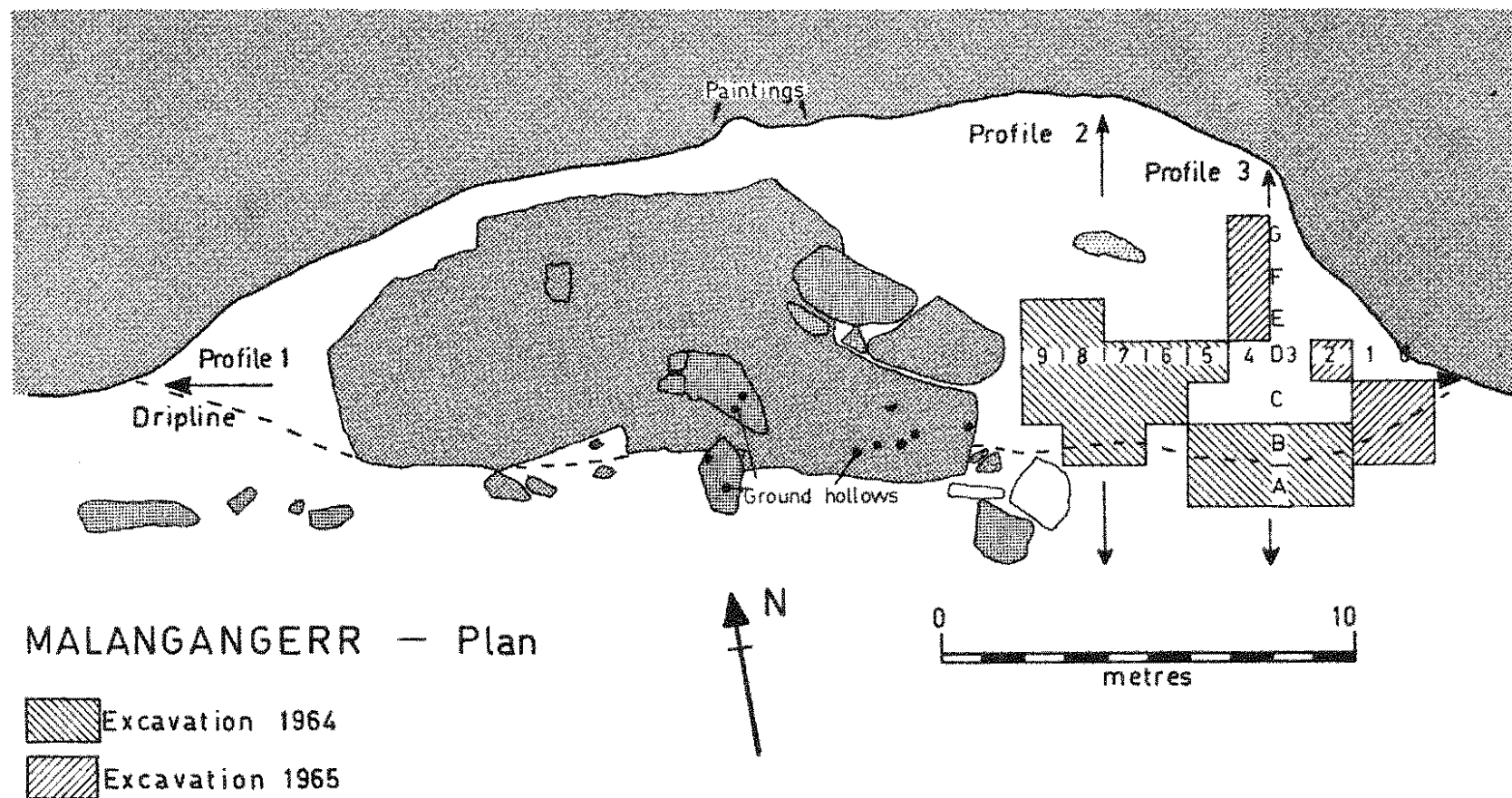


Figure IV-1

MALANGANGERR — Profiles.

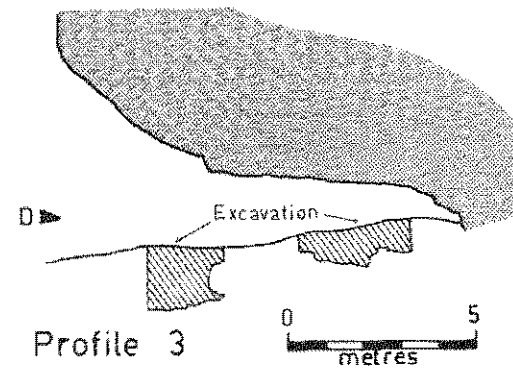
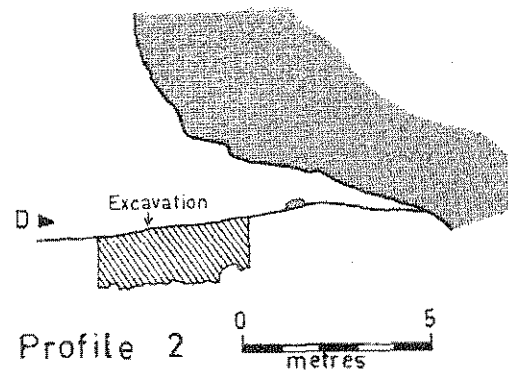
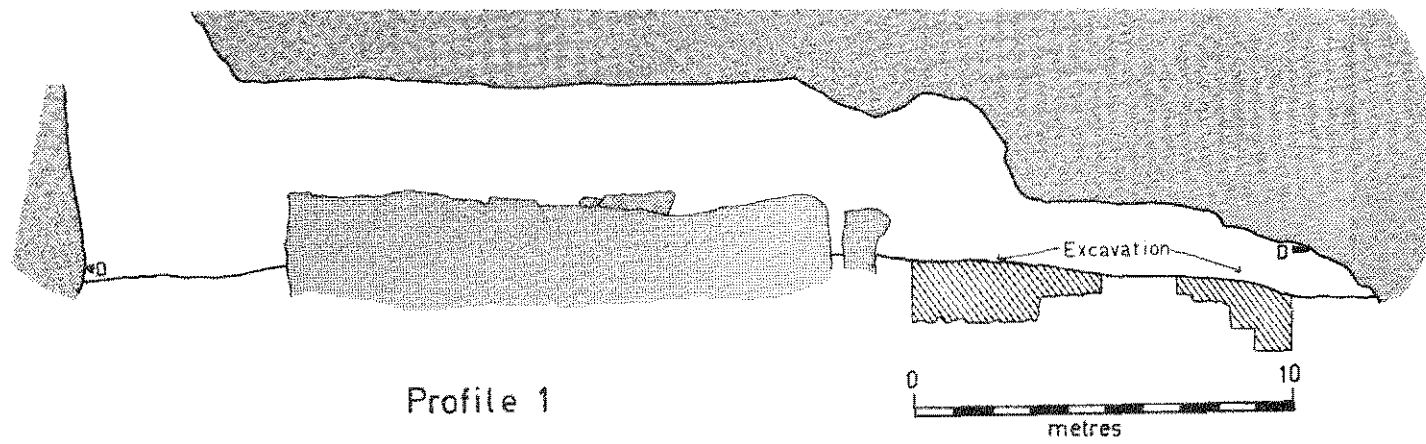


Figure IV-2

Figure IV-3 : Malangangerr

Stratigraphy of 1. North wall of 9E - 8E.

2. North wall of 9D - 2D.

1. Dense, dark grey midden. (10 YR 4/1, 4/2, 3/1).
2. Lenses of charcoal. (10 YR 2/2).
3. Lenses of light grey ash. (10 YR 7/2).
4. Very dark brown midden. (10 YR 2/2).
5. Pale brown lenses containing numerous crab remains. (10 YR 6/3).
6. Dark grey midden containing less shell and bone remains.
(10 YR 4/1-4/2).
7. Small oblique burrow in midden.
8. Very dark brown coarse sand containing bone and a few chalky
fragments of shell. (10 YR 2/2).
9. Brown to greyish brown coarse sand. (10 YR 5/3-5/2).

Figure IV-3

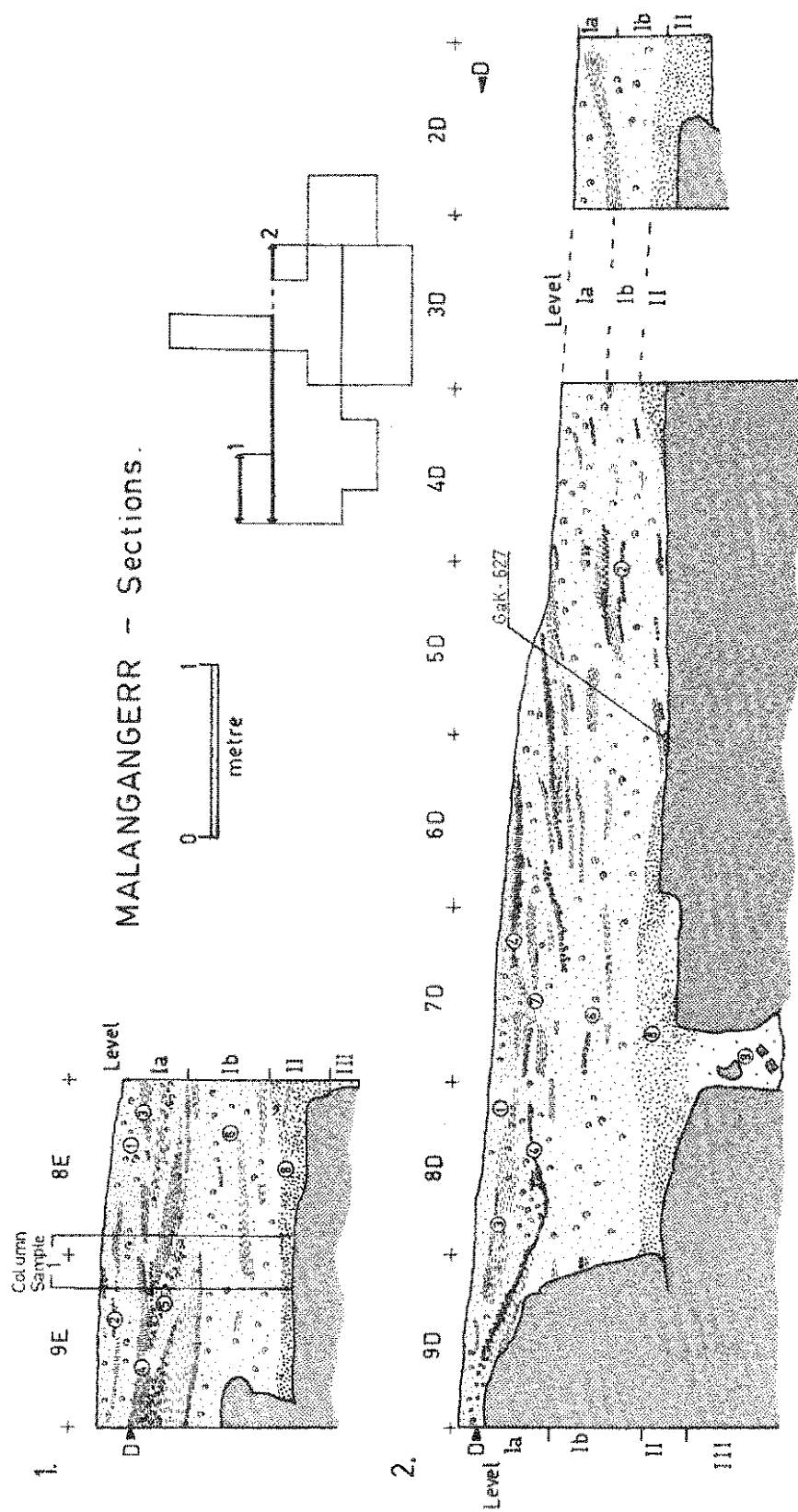


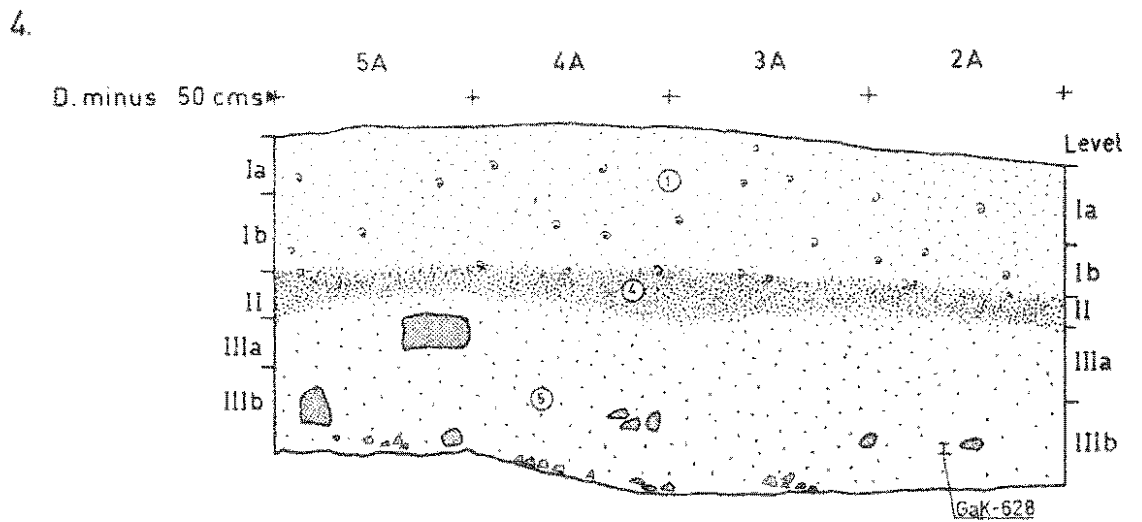
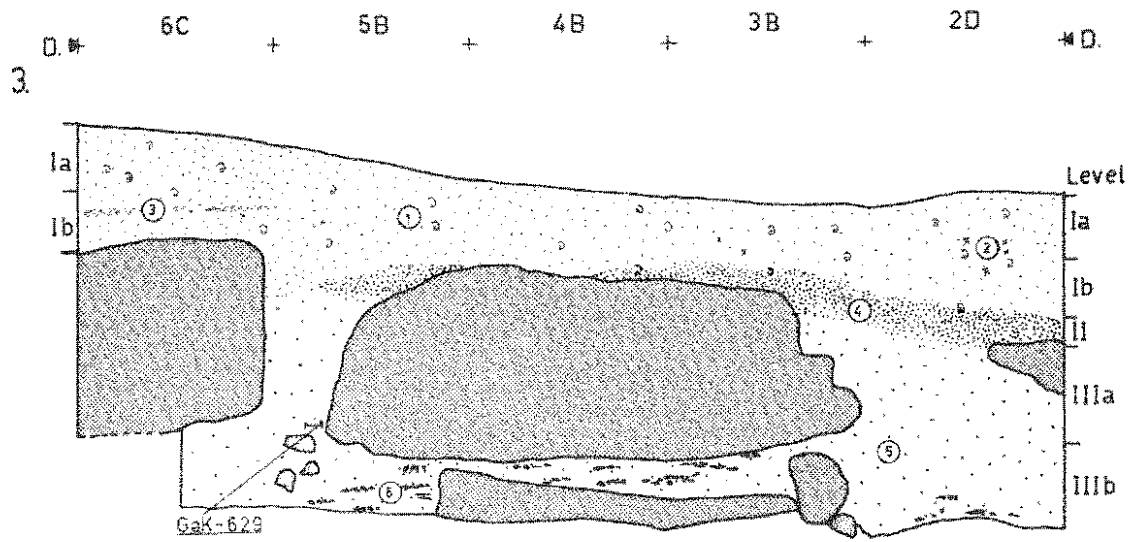
Figure IV-4 : Malangangerr

Stratigraphy of 3. North wall of 6C - 2D.

4. South wall of 5A - 2A.

1. Dark grey midden with local aggregations.
(10 YR 4/1).
2. Lumps of charcoal.
3. Faint lenses of light grey ash. (10 YR 7/2).
4. Very dark brown sand containing bone and a
few chalky fragments of shell. (10 YR 2/2).
5. Brown to yellowish brown coarse sand.
(10 YR 5/3-5/4).
6. Basal mottling in yellowish brown sand.
(10 YR 5/4).

Figure IV - 4



MALANGANGERR - Sections

0 1
metre

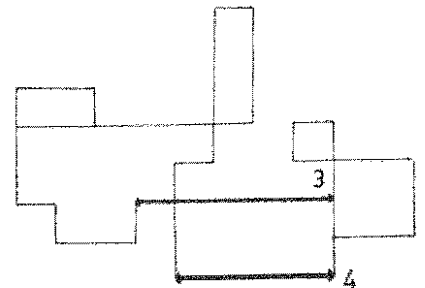


Figure IV-5 : Malangangerr

Stratigraphy of west wall of 4A - 4G.

1. Dark grey midden with dense shell and bone in sqs. 5D-4G, and less in sqs. 4A-4B. (10 YR 4/1-4/2).
2. Lenses of charcoal. (10 YR 2/2).
3. Lenses of light grey ash. (10 YR 7/2).
8. Very dark brown sand, containing bone and a few chalky fragments of shell. (10 YR 2/2).
9. Brown to greyish brown sand. (10 YR 5/3-5/2).
10. Basal mottling in yellowish brown sand. (10 YR 5/4).

Figure IV-5

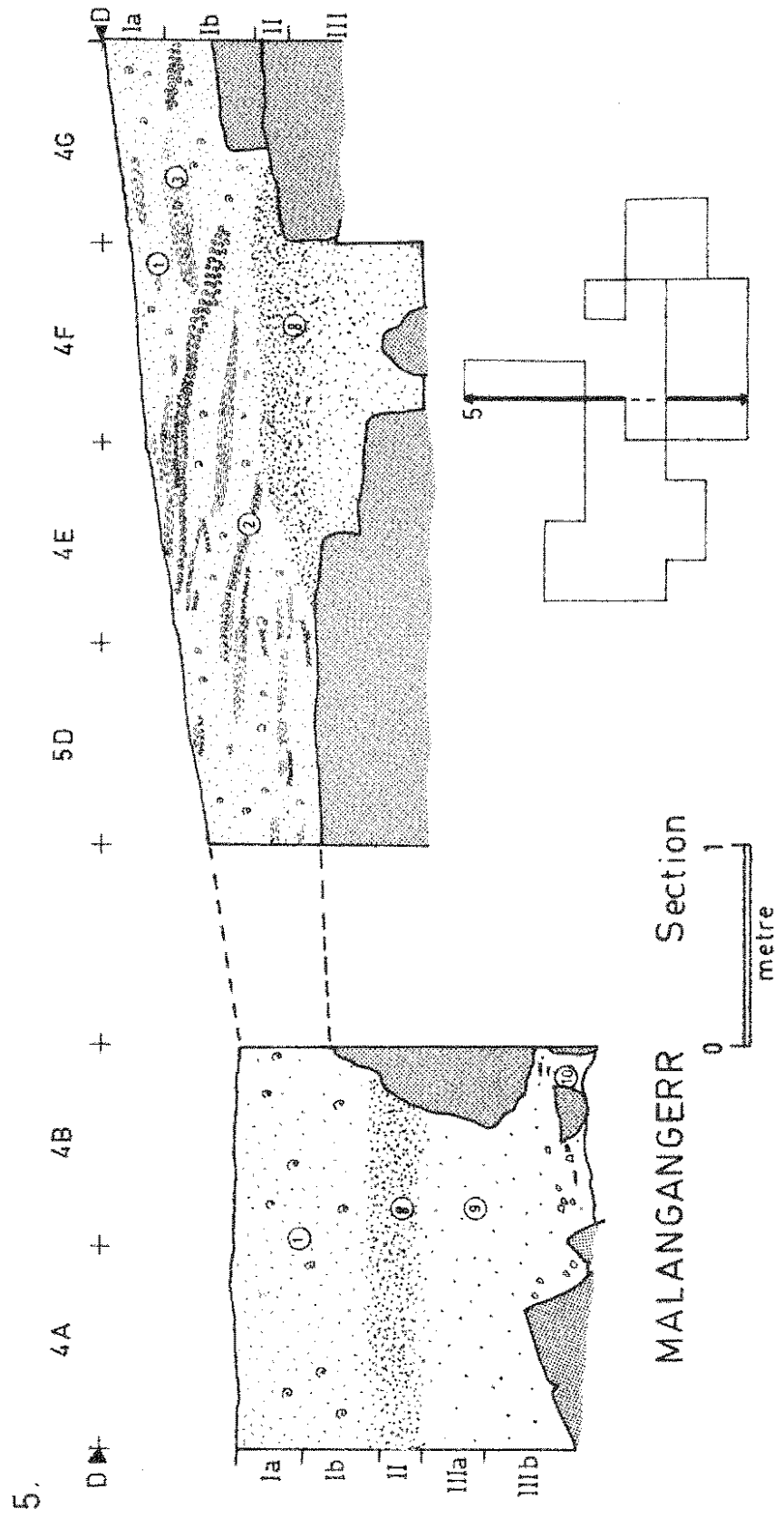


Figure IV-6 : Malangangerr

Scale 1:1

- a. Bipoint, intact. 4F/3. Level Ia.
- b. Bipoint, broken. 8D/5. Level Ib.
- c. Unipoint with cut marks at one end. 4G/3. Level I.
- d. Unipoint with round tip. 8E/3. Level Ia.
- e. Unipoint with sharp tip and cut marks. 4G/3.
Level I.
- f. Unipoint with bevelled tip. Bird bone. 4F/6.
Level Ib.
- g. Spatulated point. 4E/3. Level Ia.
- h. Spatulated point. 4G/3. Level Ia.
- i. Spatulated point, broken at the tip. 4E/2.
Level Ia.
- j. Spatulated point. 4E/3. Level Ia.
- k. Spatulated point. 4G/4. Level I.
- l. Utilised tooth. 4F/7. Level Ib.
- m. Utilised tooth. 8E/2. Level Ia.
- n. Miscellaneous. Fibula covered with red ochre.
7C/3. Level Ia.
- o. Miscellaneous. Bird bone ground at one end.
6D/2. Level Ia.

Figure IV-6

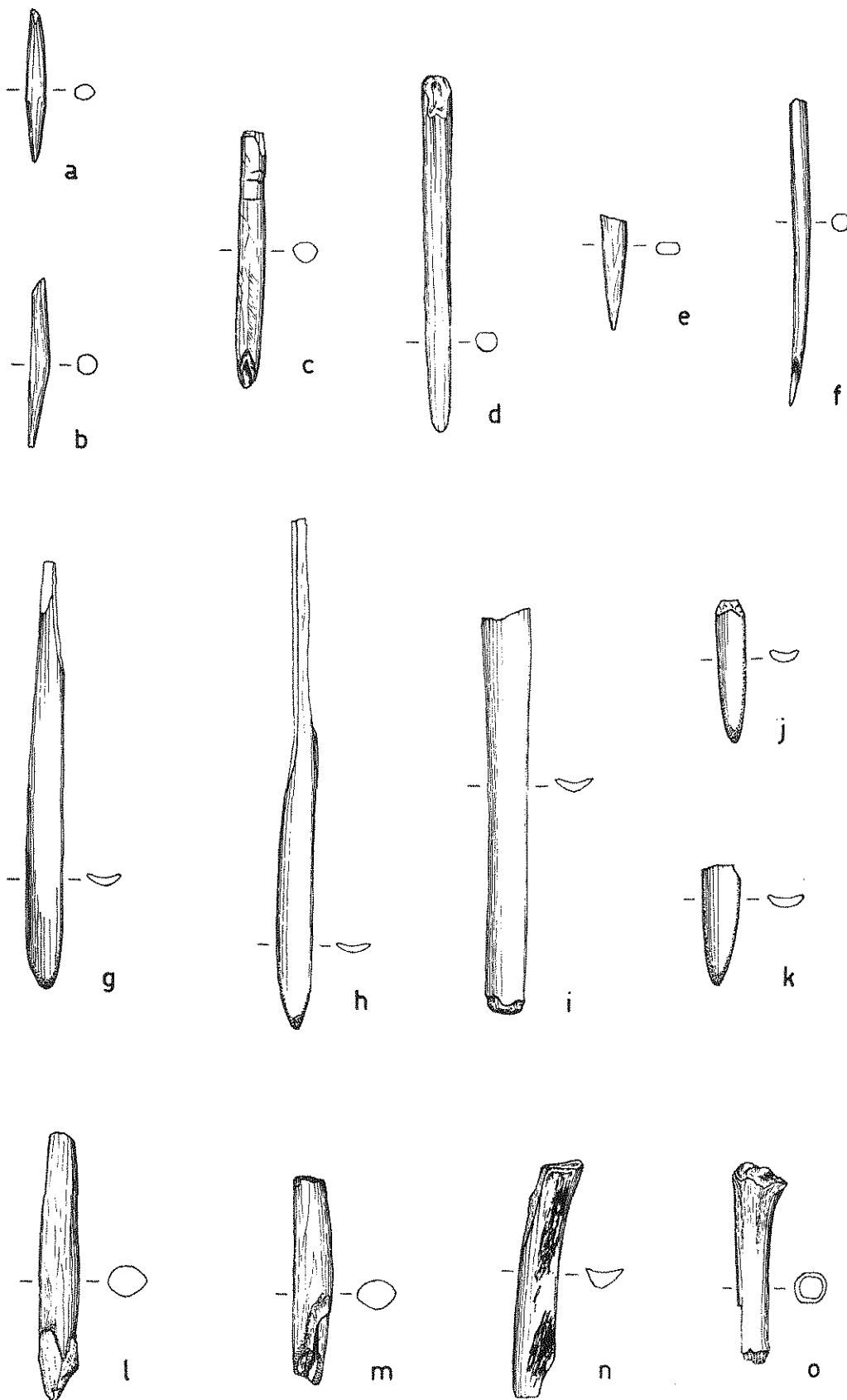


Figure IV-7 : Malangangerr

Scale 1:1

- a. Point. Quartzite, curved butt, bifacial retouch.
2D/2. Level Ia.
- b. Point. Chert, square butt, bifacial retouch.
8C/1-60. Level Ia.
- c. Point. Chert, squarish butt, bifacial retouch.
5D/1-122. Level Ia.
- d. Tip. Quartzite, unifacial retouch.
6C/2-444. Level Ia.
- e. Butt. Quartzite, curved butt, bifacial retouch.
8D/1-11. Level Ia.

Figure 1

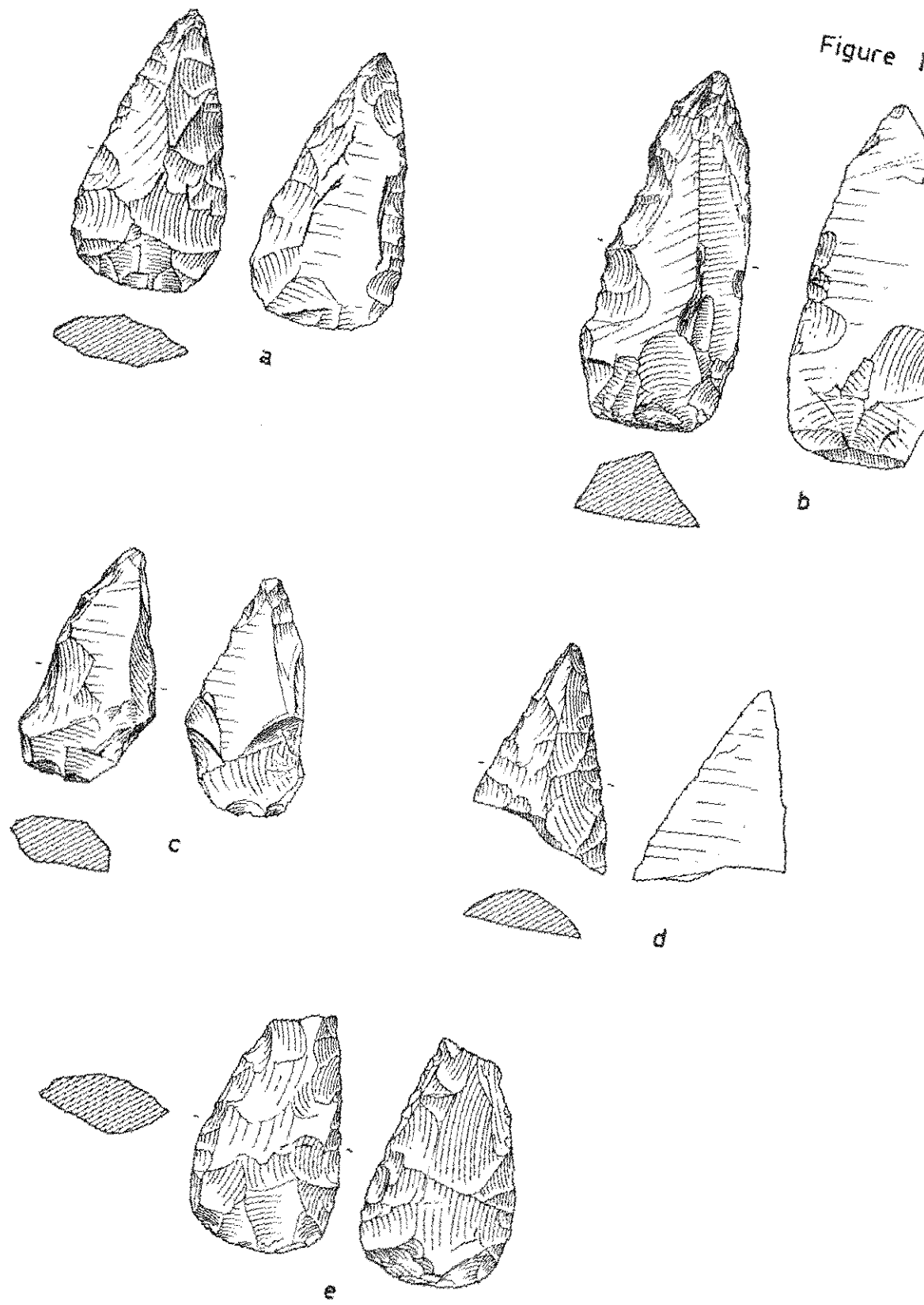


Figure IV-8 : Malangangerr

Scale 1:1

- a. Scraper. Quartzite, round, unifacial retouch
 on one side, bifacial retouch on
 another.
 9D/4-91. Level Ib.
- b. Scraper. Chert, rectangular, bifacial retouch.
 0C/1. Level I.
- c. Scraper, broken. Quartzite, unifacial retouch
 with a length of bifacial retouch.
 7D/1. Level Ia.
- d. Miscellaneous. Chert, showing 'burin' spall.
 4F/1. Level Ia.
- e. Core/Core scraper. Quartzite. 2A/1-368. Level Ia.

Figure IV-8

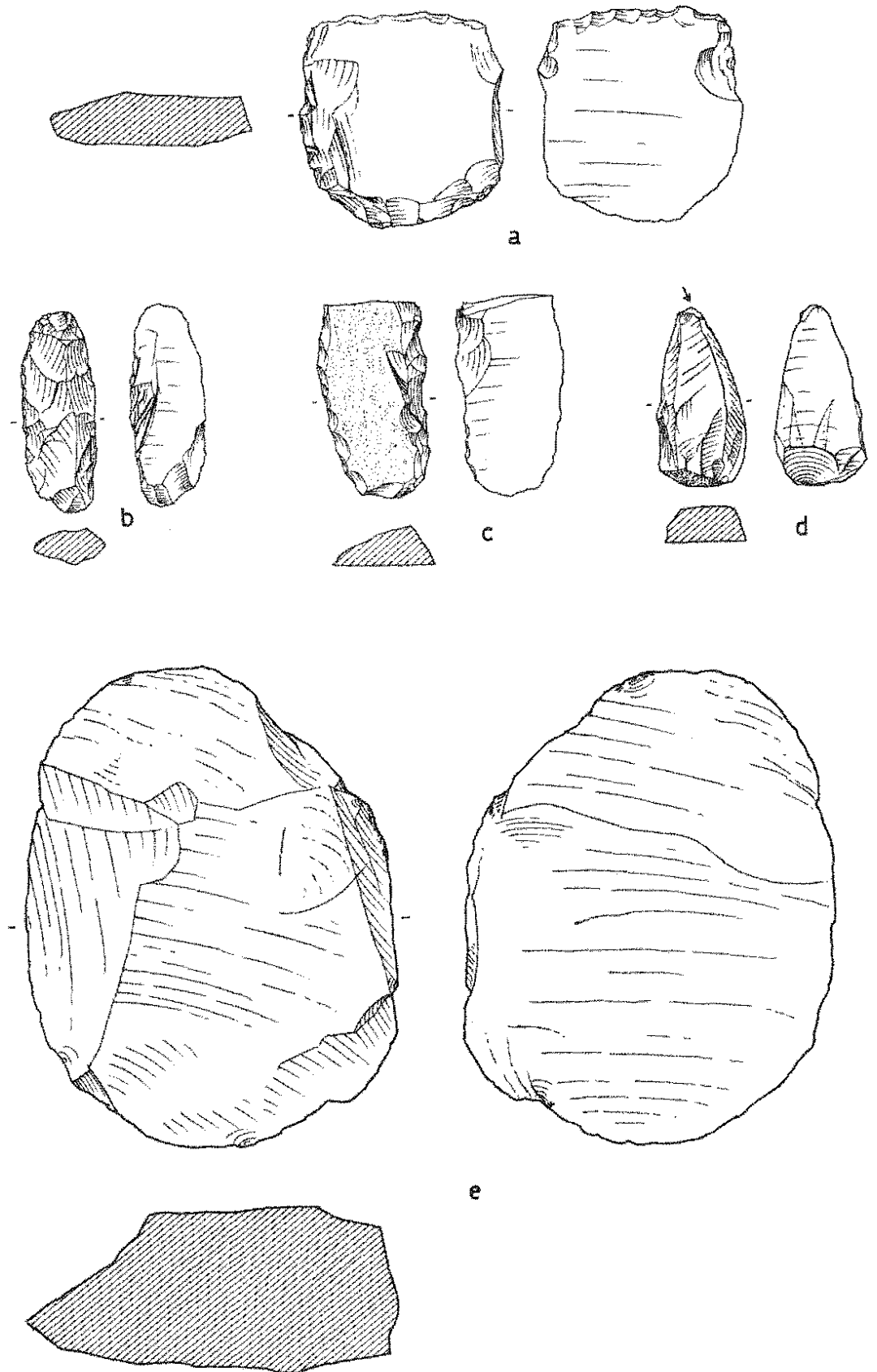


Figure IV-9 : Malangangerr

Scale 1:1

- a. Abraded fragment. Schist, covered with red
ochre. 8C/3-81. Level Ia.
- b. Abraded fragment. Sandstone. 4E/7. Level Ib.
- c. Hammer/Pounder. Quartzite, resembling 'kulki'.
1B/1. Level I.

Figure IV-9

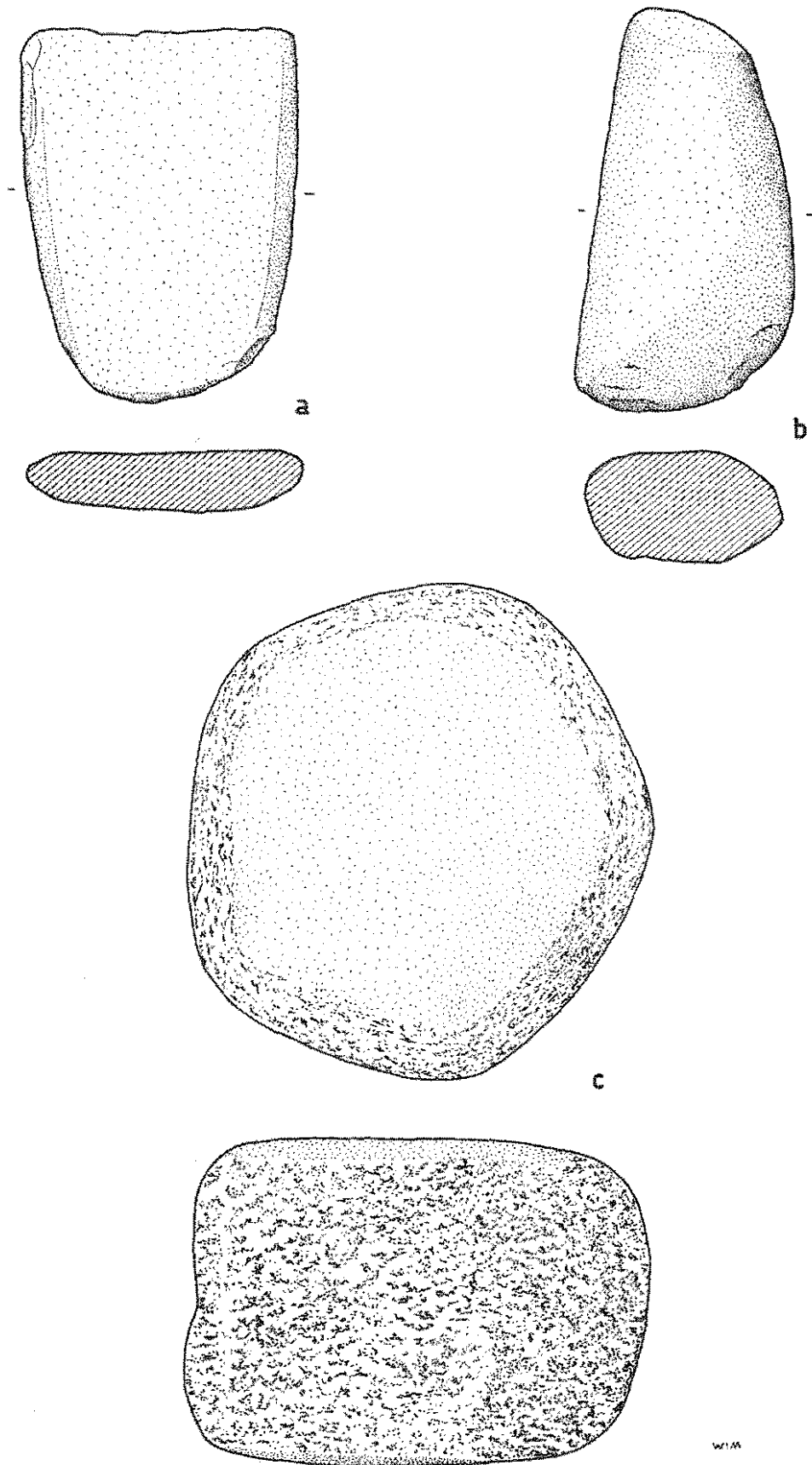


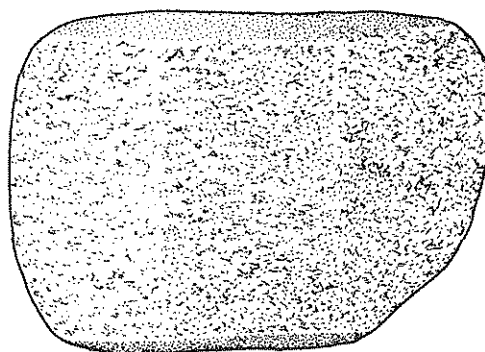
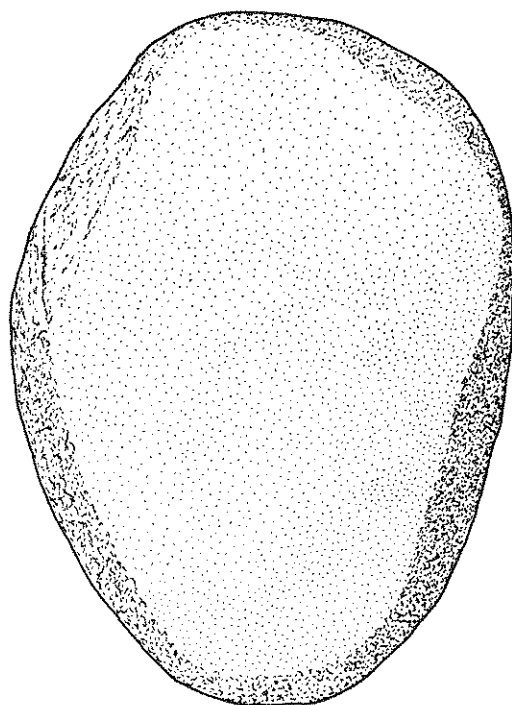
Figure IV-10 : Malangangerr

Scale 1:1

Hammer/Pounder. Quartzite, resembling 'kulki'.

8C/7-165. Level II.

Figure IV-10



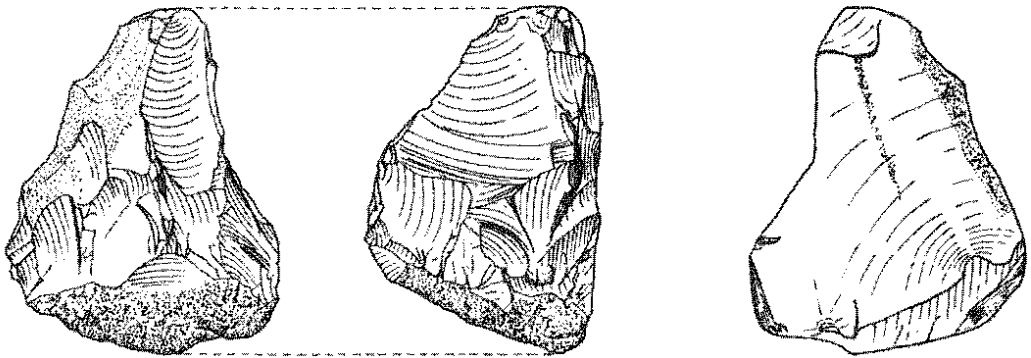
WIM

Figure IV-11 : Malangangerr

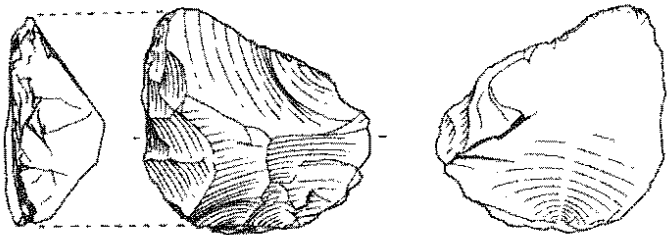
Scale 1:1

- a. Scraper. Chert, triangular, unifacial retouch.
4F/12. Level III.
- b. Scraper. Chert, oval, unifacial retouch.
4B/5-433. Level IIIa.
- c. Scraper, broken. Quartzite, unifacial retouch.
5A/8-453. Level IIIb.

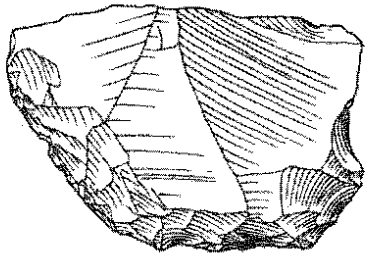
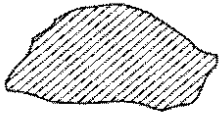
Figure IV-11



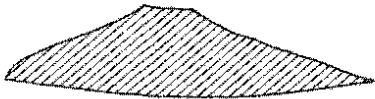
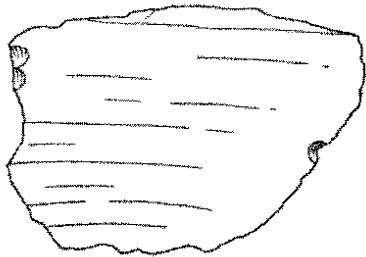
a



b



c

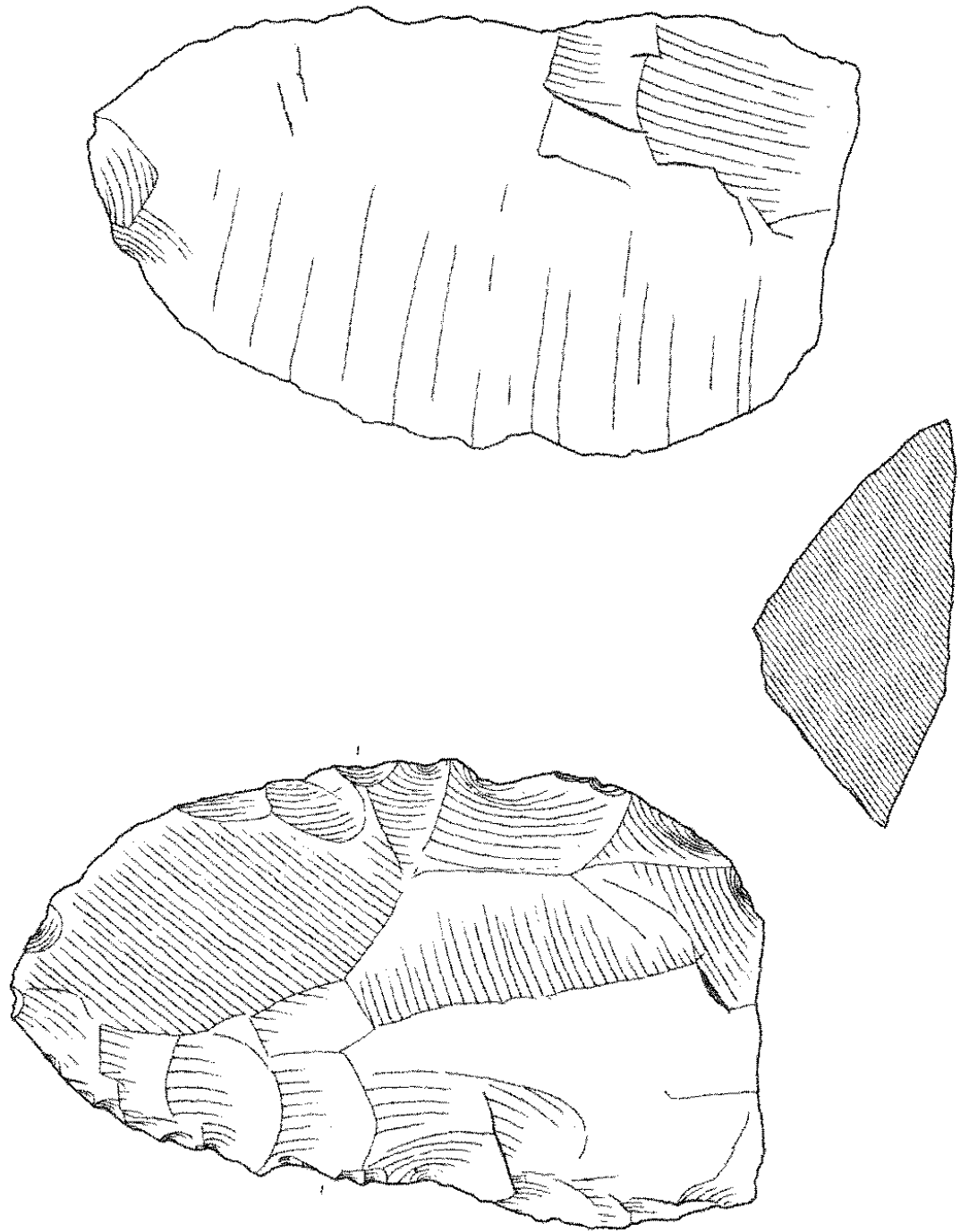


W141

Figure IV-12 : Malangangerr

Core/Core scraper. Quartzite, mainly unifacial
retouch.
7C/10-270. Level III.
Length 16.5 cm.

Figure IV-12



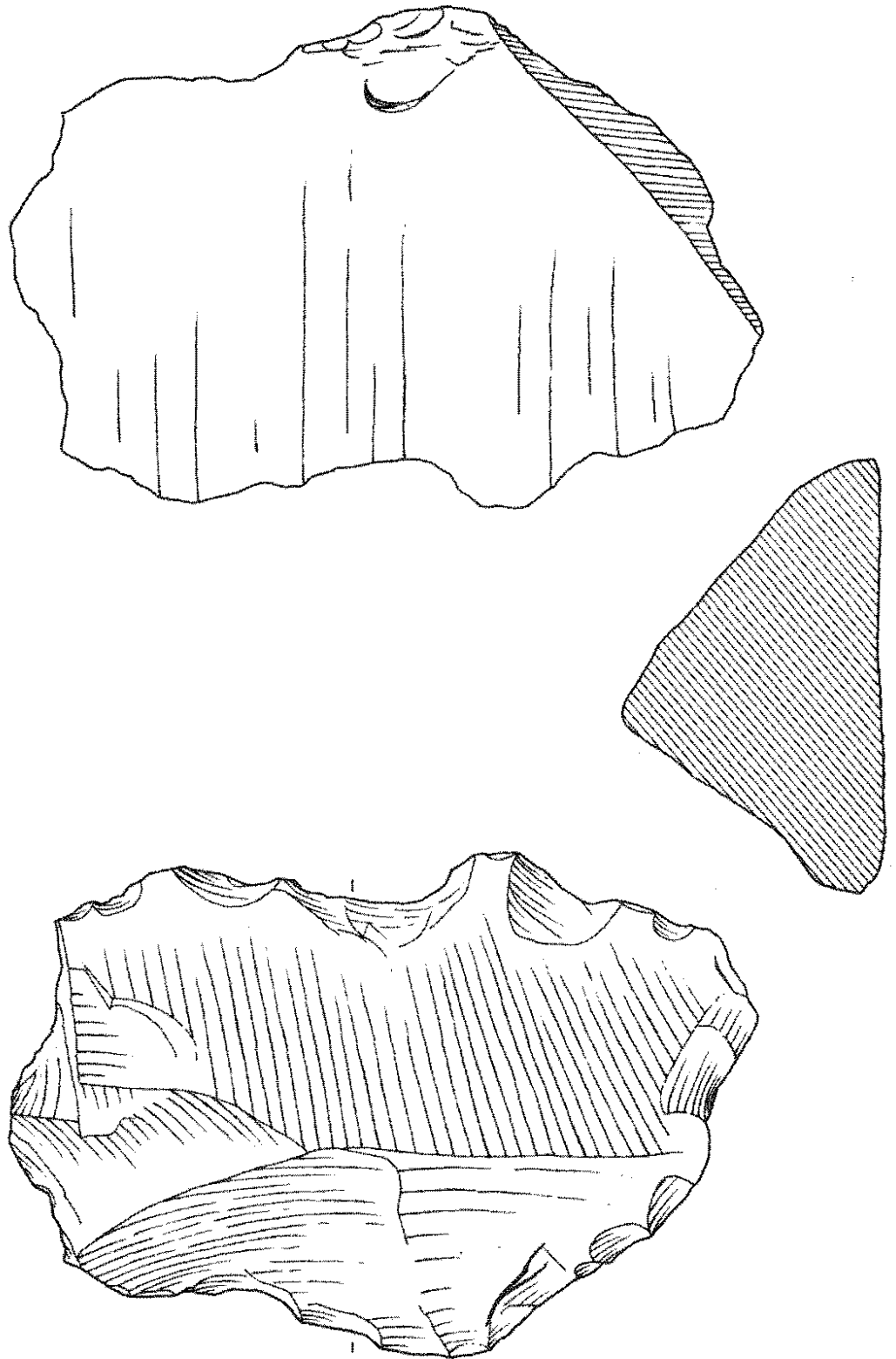
W. M.

Figure IV-13 : Malangangerr

Scale 1:1

Core/Core scraper. Quartzite, mainly unifacial
retouch.
7D/10-286. Level III.

Figure IV-13



W18

Figure IV-14 : Malangangerr

Scale 1:1

- a. Core/Core scraper. Quartzite, bifacial retouch.
5B/6-414. Level IIIb.
- b. Core/Core scraper. Quartzite, mainly unifacial
retouch.
4B/6-424. Level IIIb.
- c. Utilised flake. Chert, mainly unifacial use-
wear.
7D/10-288. Level III.

Figure IV-14

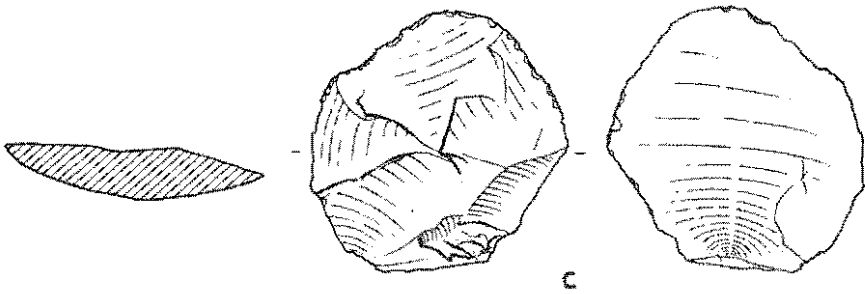
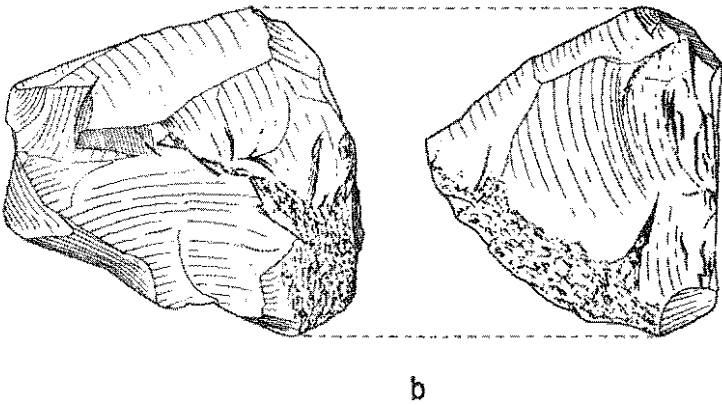
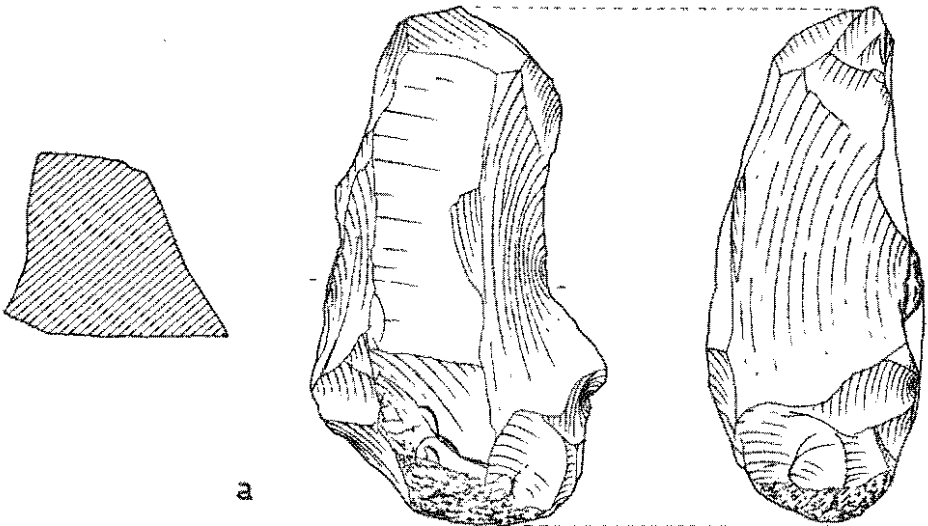


Figure IV-15 : Malangangerr

Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
4B/5-324. Level IIIa.
- b. Axe. Quartz dolorite, edge ground.
1C/3. Level III.
- c. Axe. Hornfels, edge ground, ? waisted
on one side.
5A/8-452. Level IIIb.

Figure IV-15

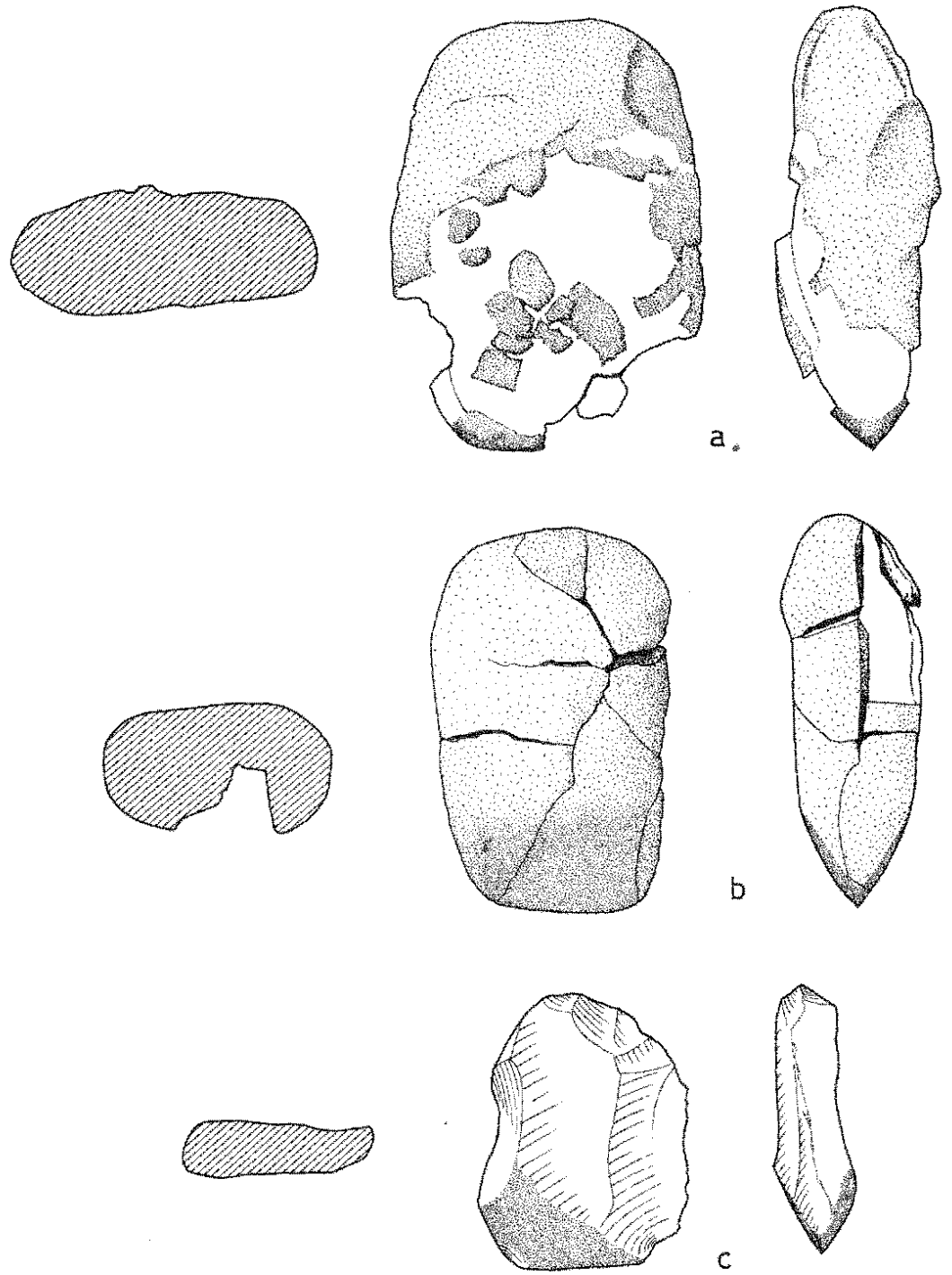
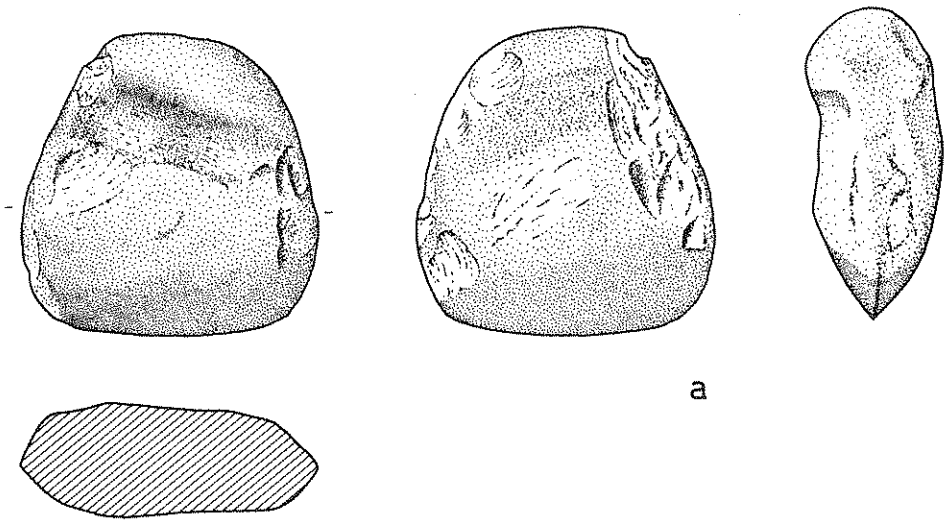


Figure IV-16 : Malangangerr

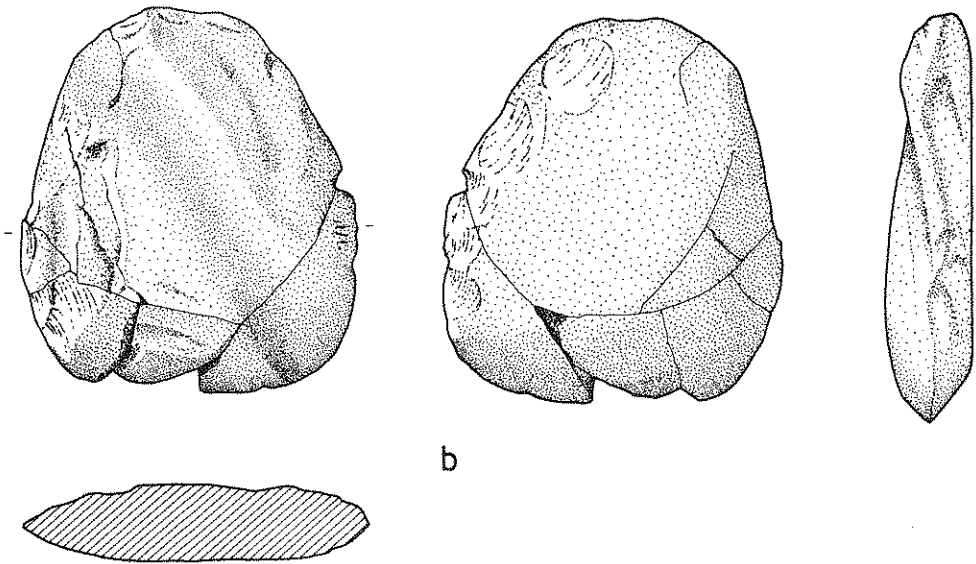
Scale 1:2

- a. Axe. Hornfels, edge ground, grooved on
 one surface.
 2A/7-428. Level IIIb.
- b. Axe. Hornfels, edge ground, diagonal
 ?groove.
 2A/8-431. Level IIIb.

Figure IV-16

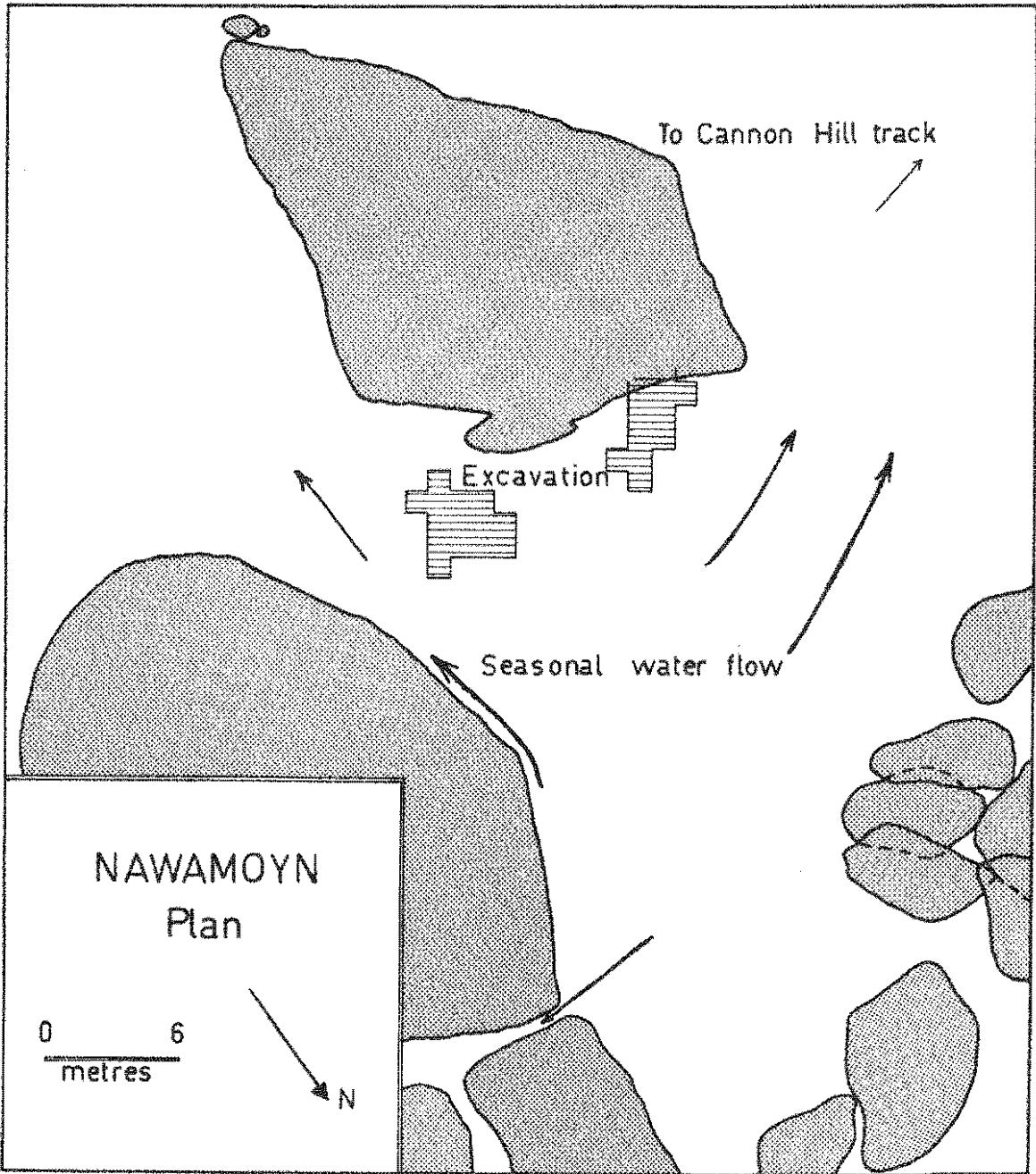


a



b

Figure V-1



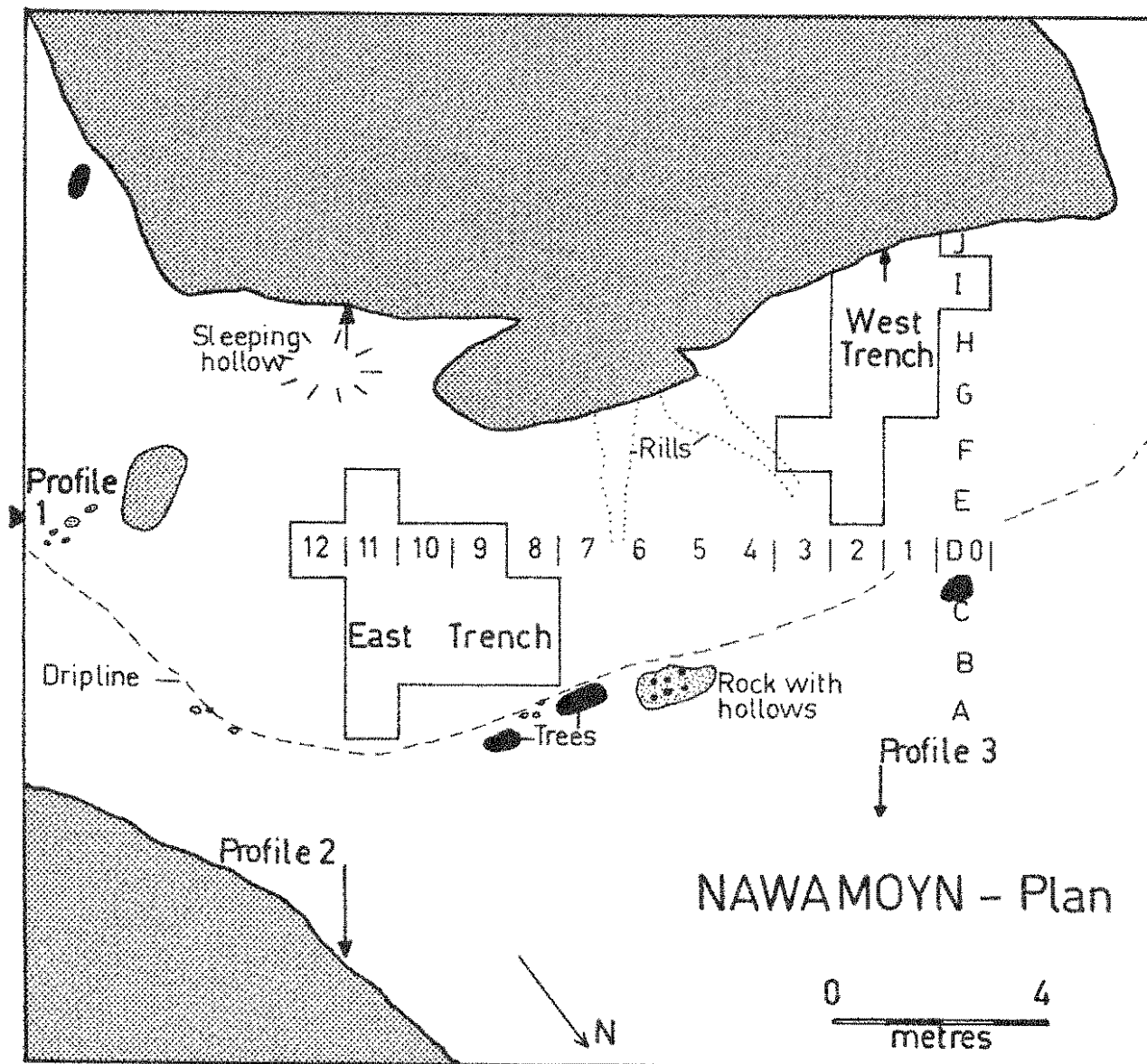
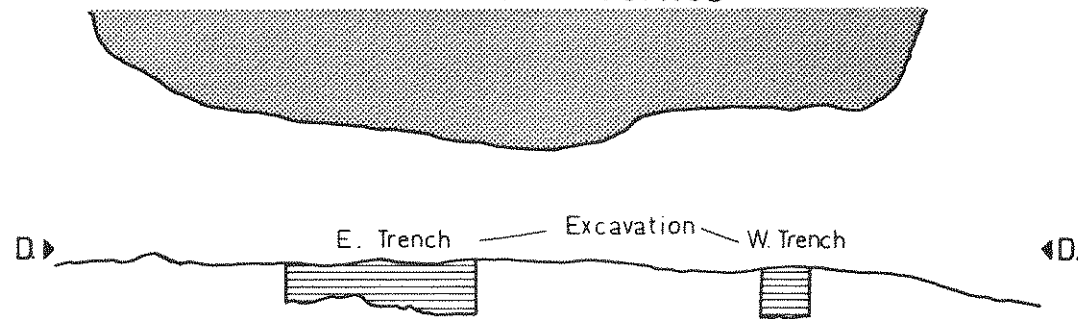
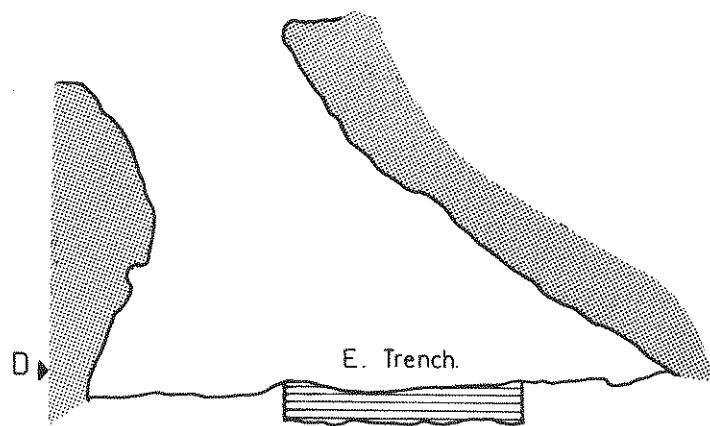


Figure V-2

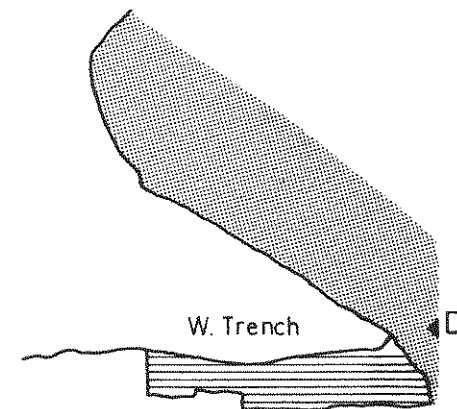
NAWAMOYN - Profiles



Profile 1.



Profile 2.



Profile 3.

Figure V-3

Figure V-4 : Nawamoyu

- Stratigraphy of
1. East wall of A11-E11.
 2. West wall of B10-D10.
 3. West wall of B8-C8.
 4. East wall of E2-J2.

1. Hard thin crust below surface 'bull-dust'.
2. Very dark greyish brown midden. (10 YR 3/2).
3. Dark grey to light grey lenses of ash. (10 YR 4/1-7/2).
4. Light grey aggregates. (10 YR 7/2).
5. Lenses of charcoal.
6. Loose soft midden with dead leaves.
7. Soft powdery midden at the back of the shelter.
8. Very dark brown loamy sand. (10 YR 2/2).
9. Dark yellowish brown to greyish brown aggregates in the loamy sand. (10 YR 3/4-5/2).
10. Fairly marked interface of midden and sand. The upper surface of the sand is slightly runnelled here.
11. Yellowish brown aggregates in the sand. (10 YR 5/4).
12. Yellowish brown to brown coarse, loamy sand. (10 YR 5/4 - 7.5 YR 5/4).
13. Firm patch in the sand.
14. Fine fossil root hole in the sand.
15. Coarse basal gravel.
16. Pit in the midden.

Figure V-4

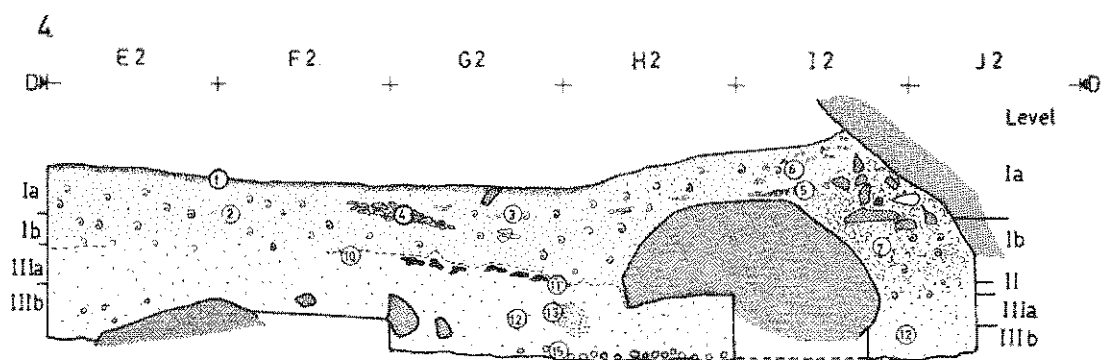
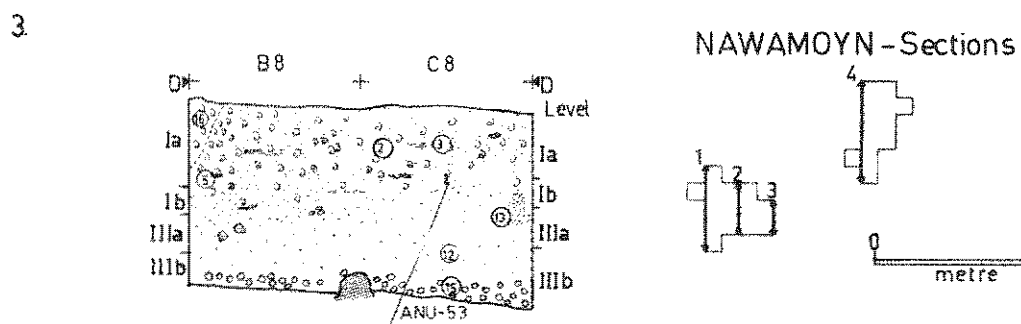
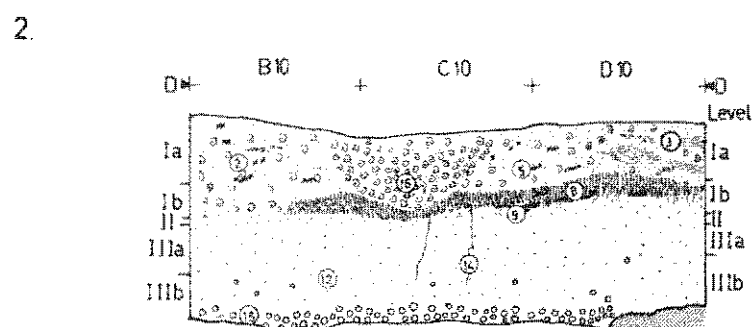
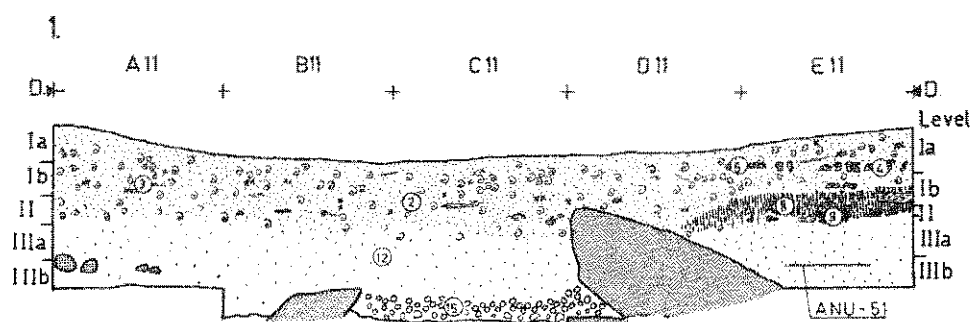


Figure V-5 : Nawamoyyn

Stratigraphy of 5. South wall of D12-D9.

6. North wall of B11-B8.

1. Hard thin crust below surface 'bull-dust'.
2. Very dark greyish brown midden. (10 YR 3/2).
3. Dark grey to light grey lenses of ash. (10 YR 4/1-7/2).
4. Light grey aggregates. (10 YR 7/2).
5. Lenses of charcoal.
8. Very dark brown loamy sand. (10 YR 2/2).
9. Dark yellowish brown to greyish brown aggregates in the loamy sand. (10 YR 3/4-5/2).
10. Fairly marked interface of midden and sand.
12. Yellowish brown to brown coarse, loamy sand. (10 YR 5/4 - 7.5 YR 5/4).
15. Coarse basal gravel.
16. Pit in the midden.

Figure V-5

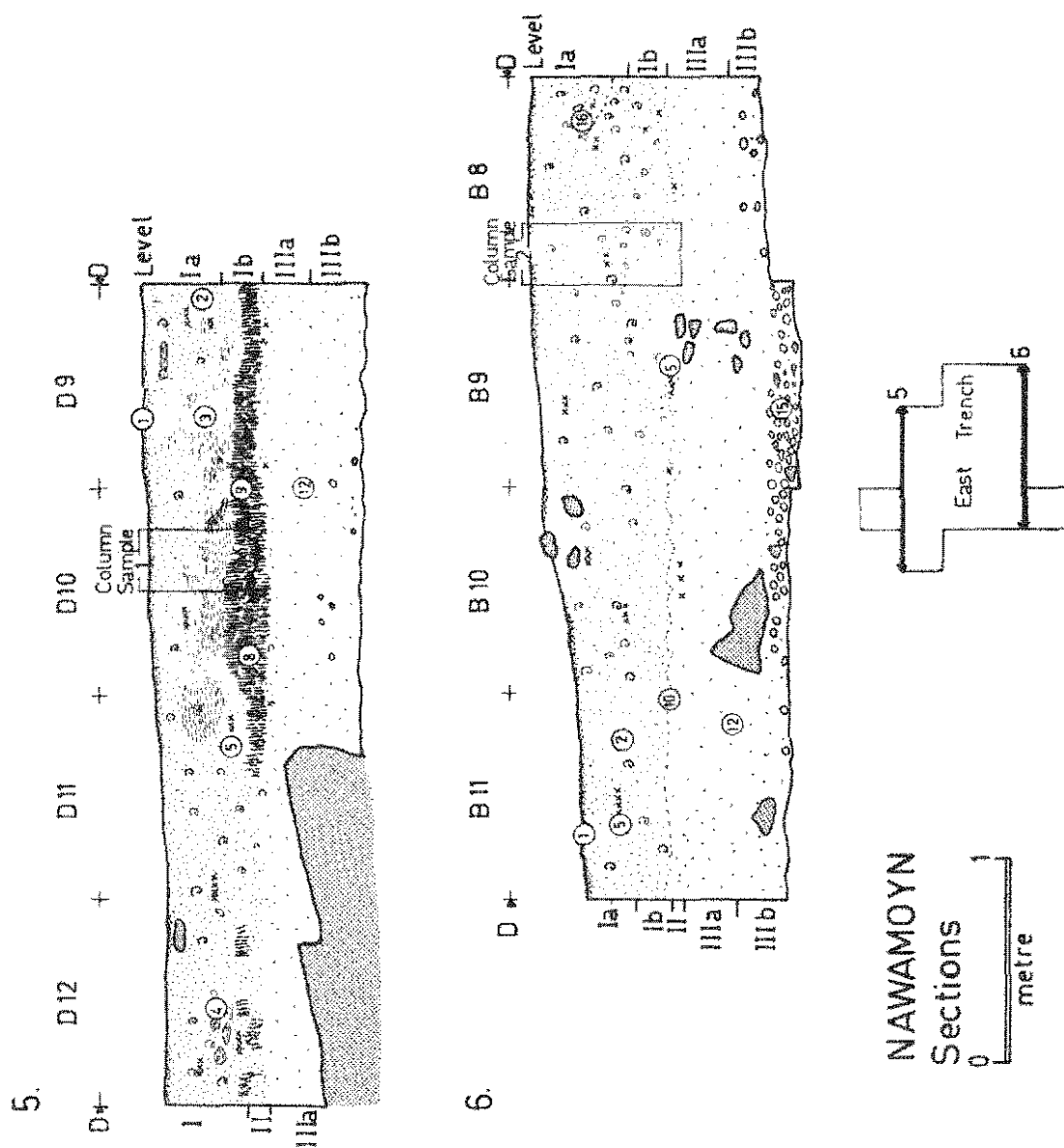


Figure V-6

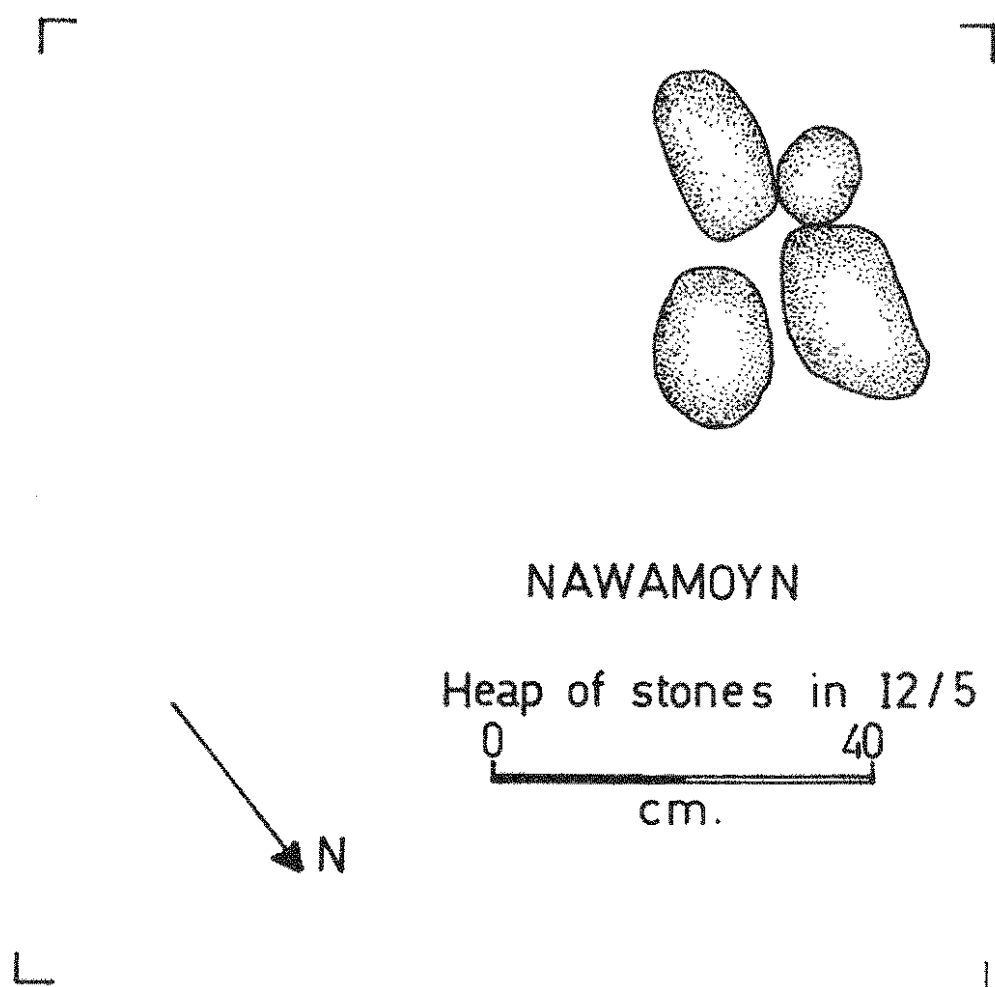


Figure V-7

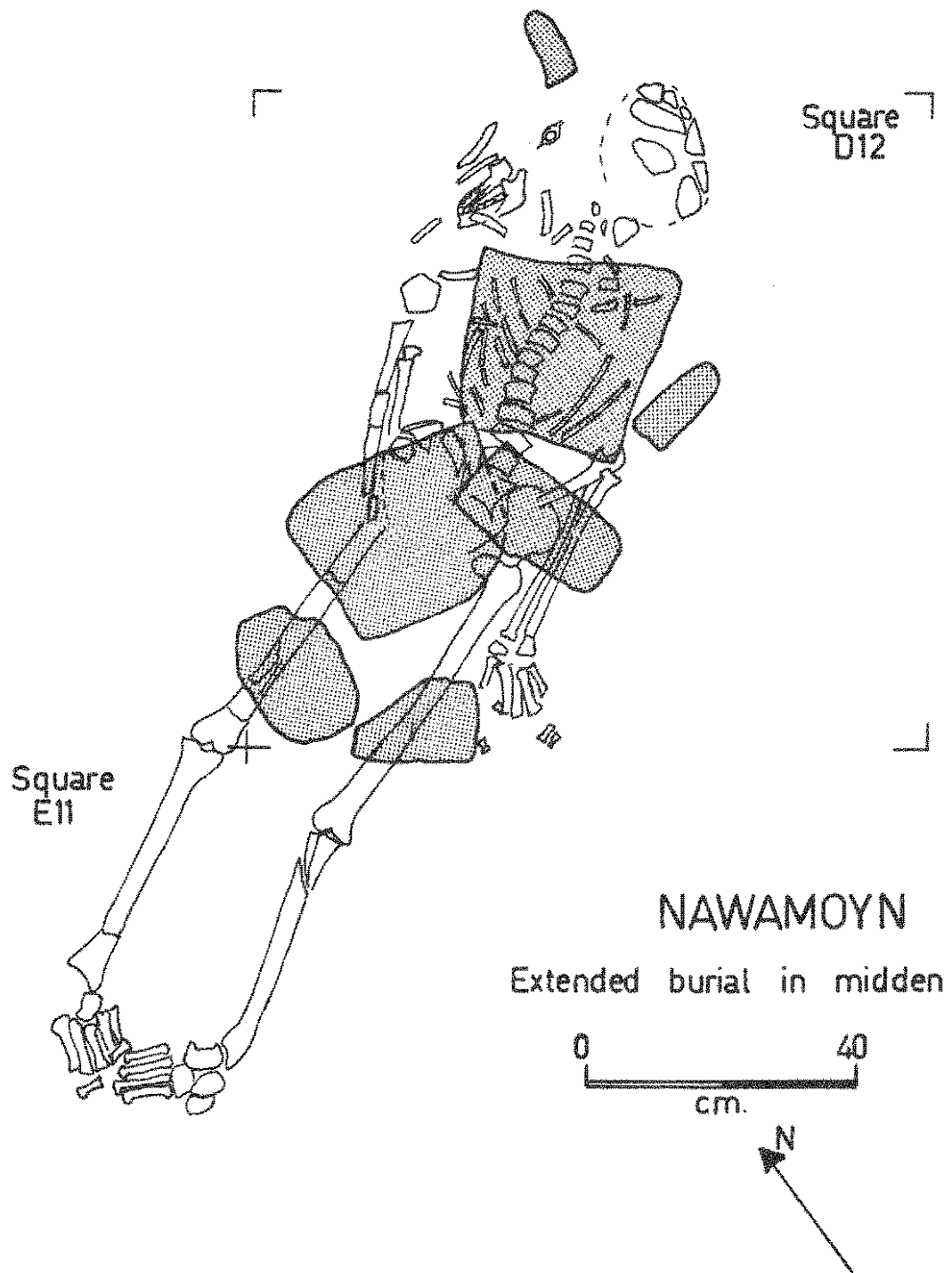


Figure V-8 : Nawamoyyn

Scale 1:1

- a. Bipoint, intact. I0/2. Level Ia.
- b. Bipoint, intact. I2/3. Level Ia.
- c. Bipoint, broken. C8/2. Level Ib.
- d. Bipoint, broken. H1/3A. Level Ib.
- e. Unipoint. D11/4. Level Ib.
- f. Unipoint. E11/3. Level Ia.
- g. Unipoint made of a quill. I0/1. Level Ia.
- h. Unipoint with bevelled tip. Bird bone. G2/4. Level Ib.
- i. Spatulated point. A11/2. Level Ia.
- j. Spatulated point. G2/3. Level Ia.
- k. Spatulated point, broken at the tip. B8/1. Level I.
- l. Spatulated point, broken at the tip. E2/2. Level Ib.
- m. Utilised flake. D11/6. Level II.
- n. Utilised flake. J1/3. Level Ib.
- o. Utilised flake. D10/1. Level Ia.
- p. Utilised tooth. C8/1. Level Ia.
- q. Utilised tooth. D11/3. Level Ia.
- r. Miscellaneous. Note cut marks. H2/4. Level Ib.

Figure V-8

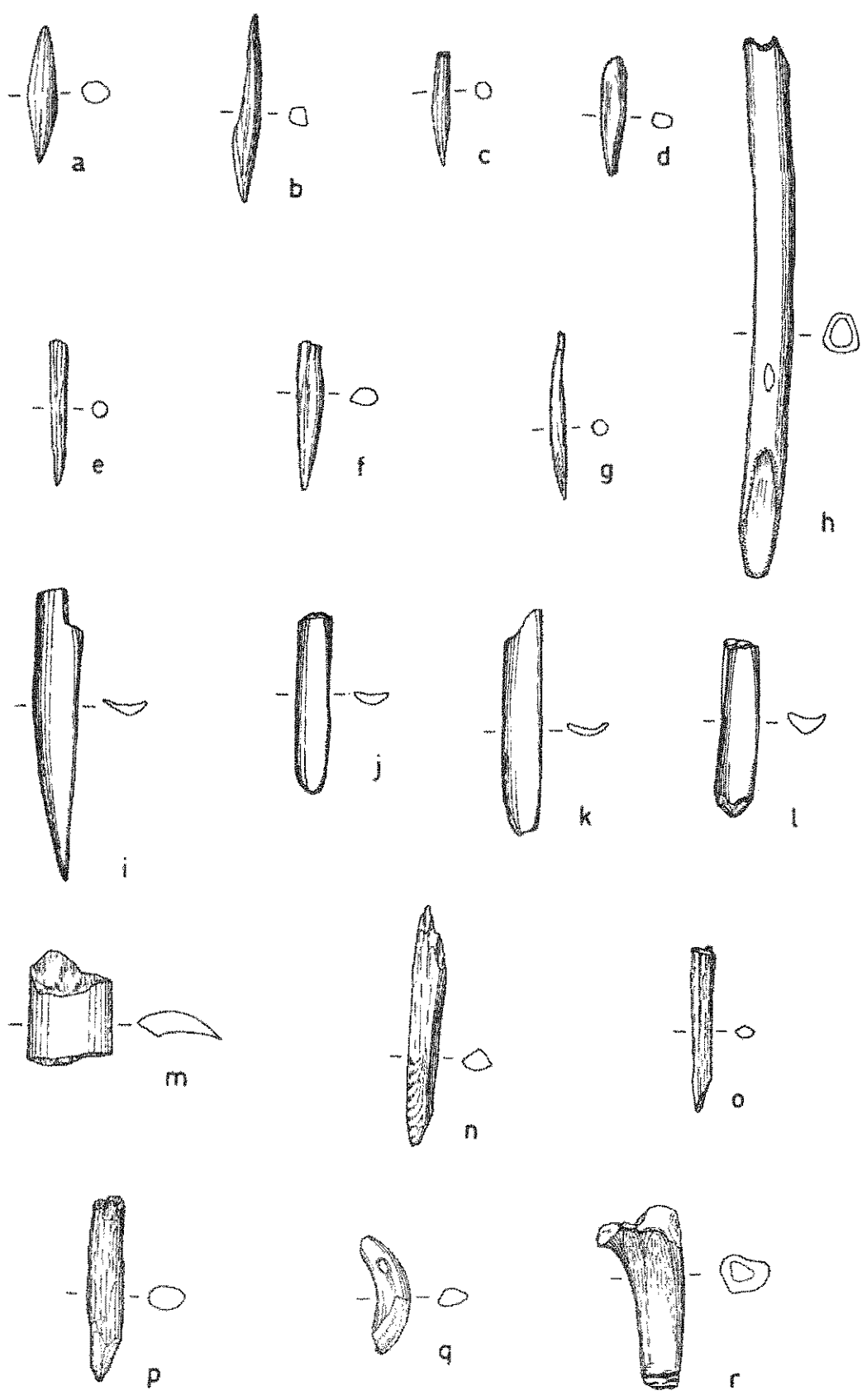


Figure V-9 : Nawamoyyn

Scale 1:1

- a. Point. Quartzite, curved butt, bifacial retouch. G2/1. Level Ia.
- b. Point. Chert, square butt, mainly unifacial, also bifacial retouch. A11/1. Level Ia.
- c. Point. Chert, square butt, mainly unifacial, also bifacial retouch. H1/3A. Level Ib.
- d. Scraper. Quartzite, use-polish along one side. I2/1-1. Level Ia.
- e. Scraper. Quartzite, use-polish along one side. I0/1-2. Level Ia.
- f. Utilised flake. Quartzite, use-polish along one side. E2/1-1. Level Ia.
- g. Utilised flake. Quartzite, smoothing along one side. I2/5-15. Level Ib.

Figure V-9

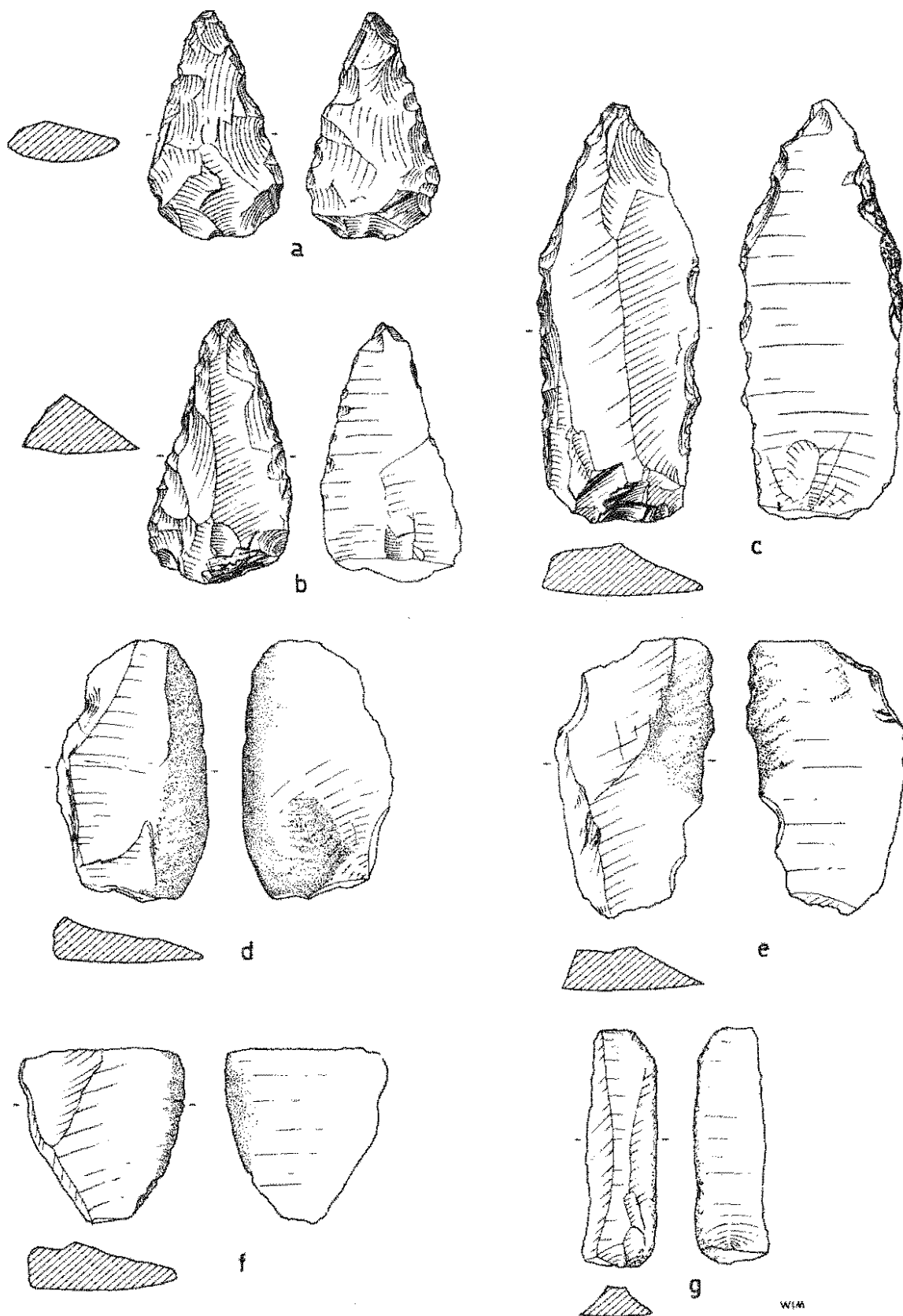


Figure V-10 : Nawamoyu

Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
I1/1-1. Level Ia.
- b. Axe. Hornblende schist, edge ground.
I2/3-4. Level Ia.
- c. Axe. Porphyritic dolorite, edge ground.
A11/2-1. Level Ia.
- d. Axe. Porphyritic dolorite, edge ground.
I2/5-2. Level Ib.

Figure V-10

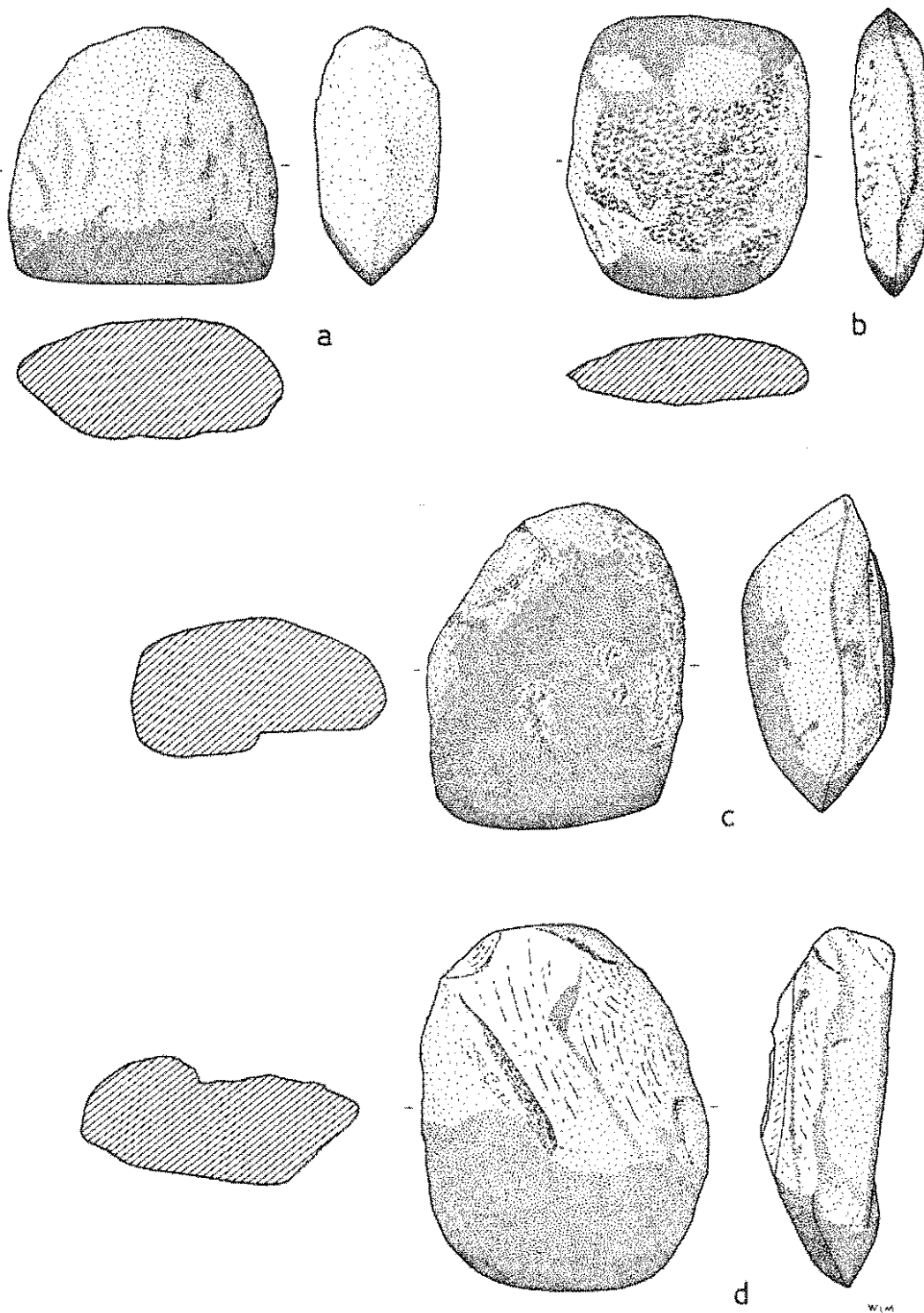


Figure V-11 : Nawamoyu

Scale 1:2

- a. Axe. Porphyritic dolomite, edge ground,
? waisted. I1/3-2. Level Ib.
- b. Axe. Porphyritic dolomite, edge ground.
I1/3-5. Level Ib.
- c. Axe. Quartzite, edge ground. J1/3-2.
Level Ib.
- d. Axe. Porphyritic dolomite, edge ground.
J2/2-1. Level Ib.

Figure V-11

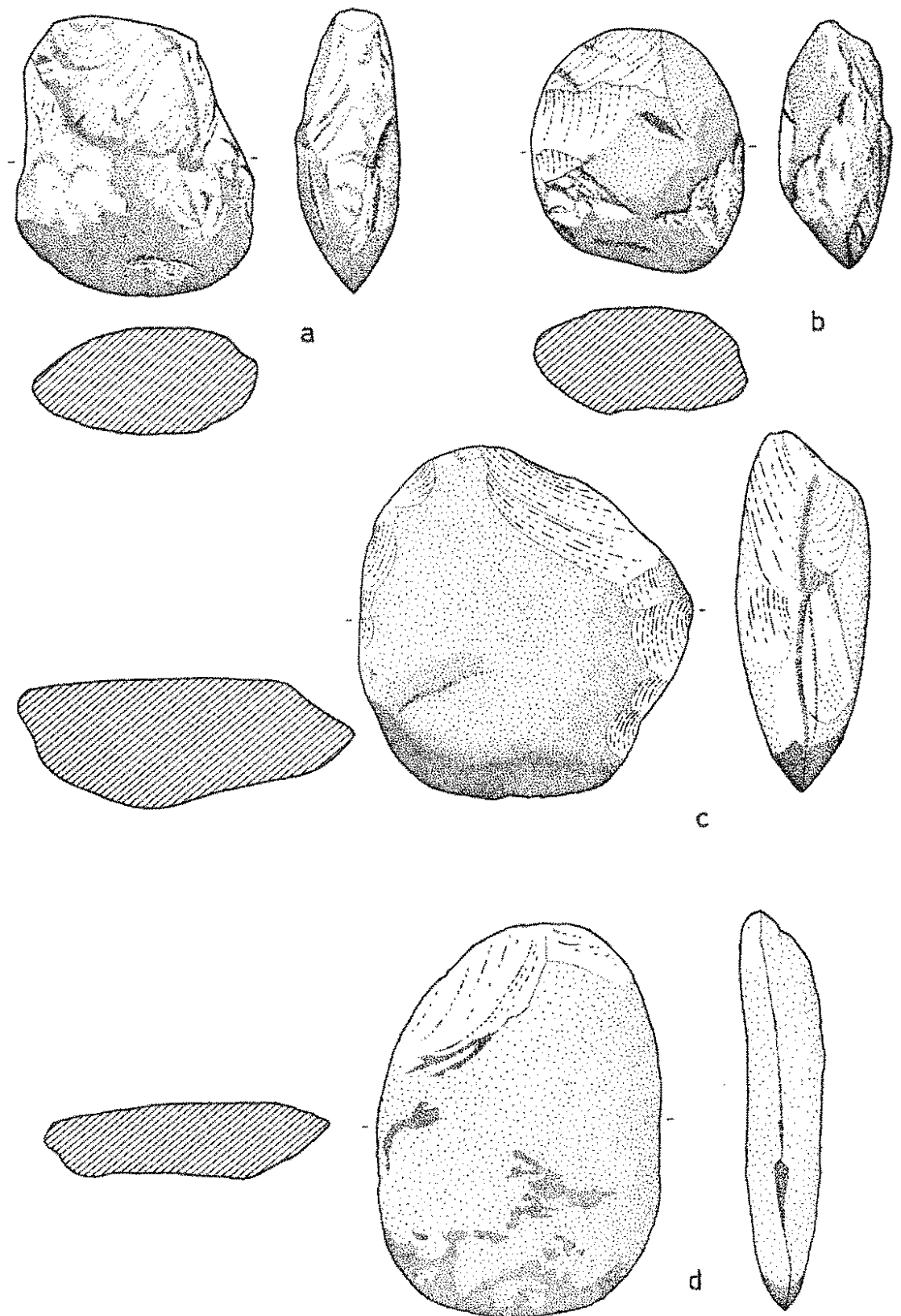
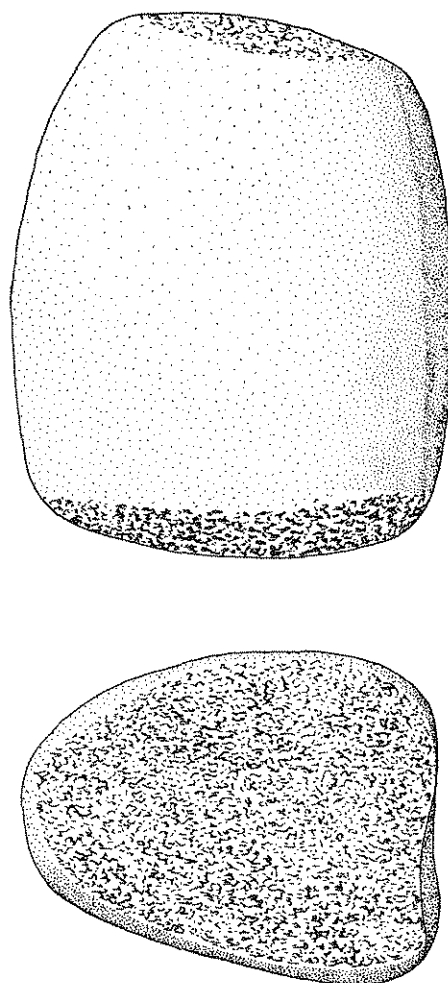


Figure V-12 : Nawamoyu

Scale 1:1

Hammer/Pounder. Quartzite. 12/6-16.
Level Ib.

Figure V-12



WIM

Figure V-13 : Nawamoyu

Scale 1:1

- a. Scraper. Quartzite, unifacial retouch.
Note use-wear at tip.
I1/4-6. Level II.
- b. Core/Core scraper. Quartzite. J1/4.
Level II.
- c. Miscellaneous. Quartz, bifacial retouch,
bruised. IO/4-1. Level II.

Figure V-13

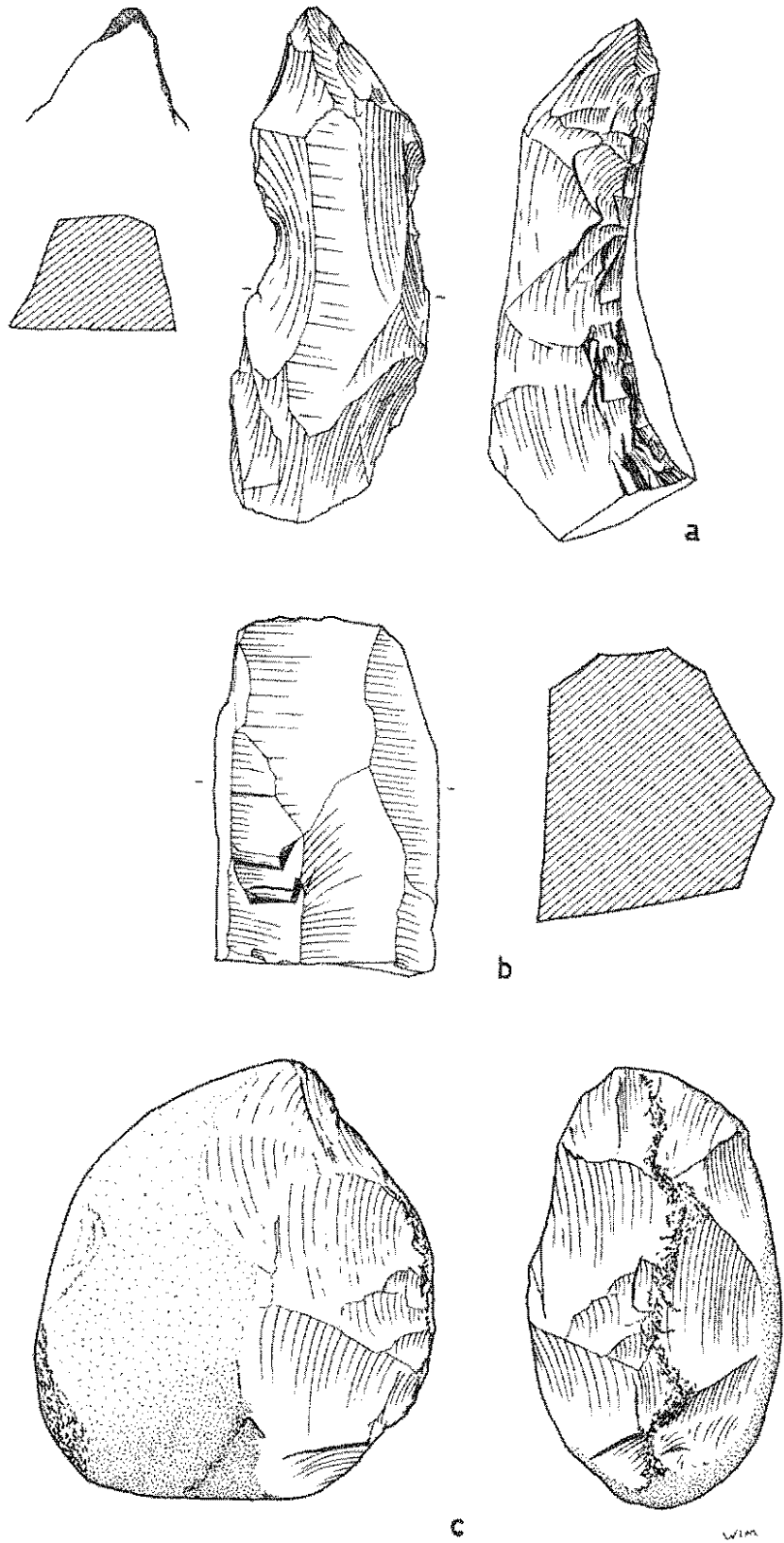
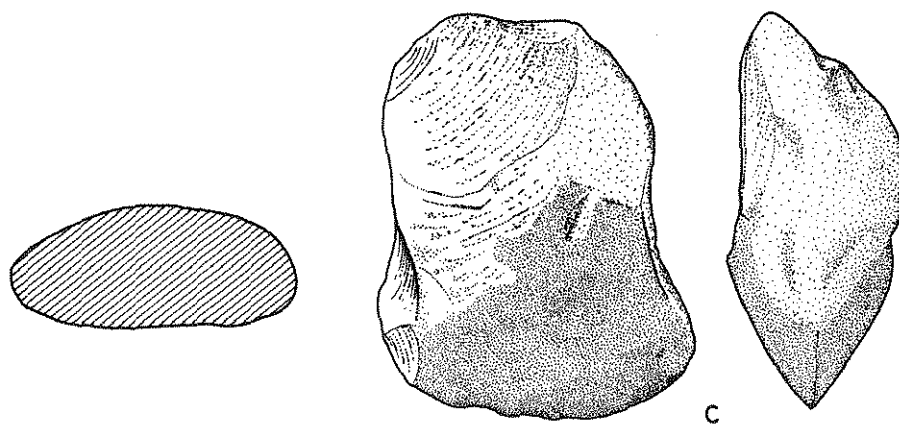
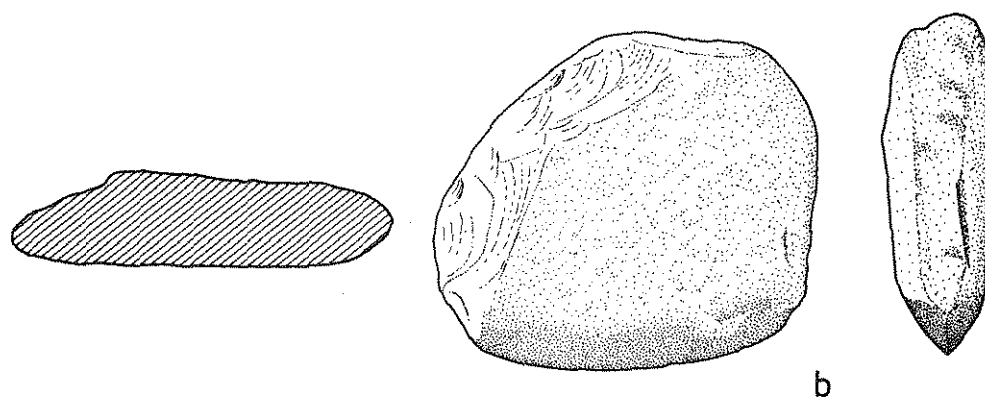
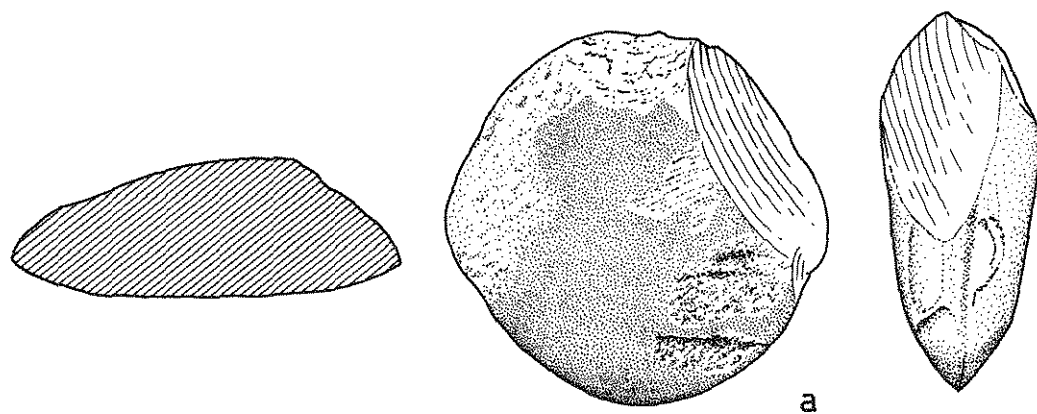


Figure V-14 : Nawamoyu

Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
Note 'ears' on the edges.
H2/7-2. Level II.
- b. Axe. Hornblende schist, edge ground.
IO/4-10. Level II.
- c. Axe. Porphyritic dolorite, edge ground,
? waisted.
J1/6-5. Level IIIa.

Figure V - 14



WIM

Figure V-15 : Nawamoyu

Scale 1:1

- a. Scraper. Quartzite, unifacial retouch.
J2/D. Level IIIb.
- b. Scraper. Quartzite, unifacial retouch.
I0/5. Level IIIa.
- c. Scraper. Quartzite, unifacial retouch.
I0/5-8. Level IIIa.
- d. Scraper. Quartzite, unifacial retouch.
B10/7-3. Level IIIa.
- e. Scraper. Quartzite, unifacial and bifacial
retouch. Note gouge shape at one end.
C10/4. Level IIIa.

Figure V-15

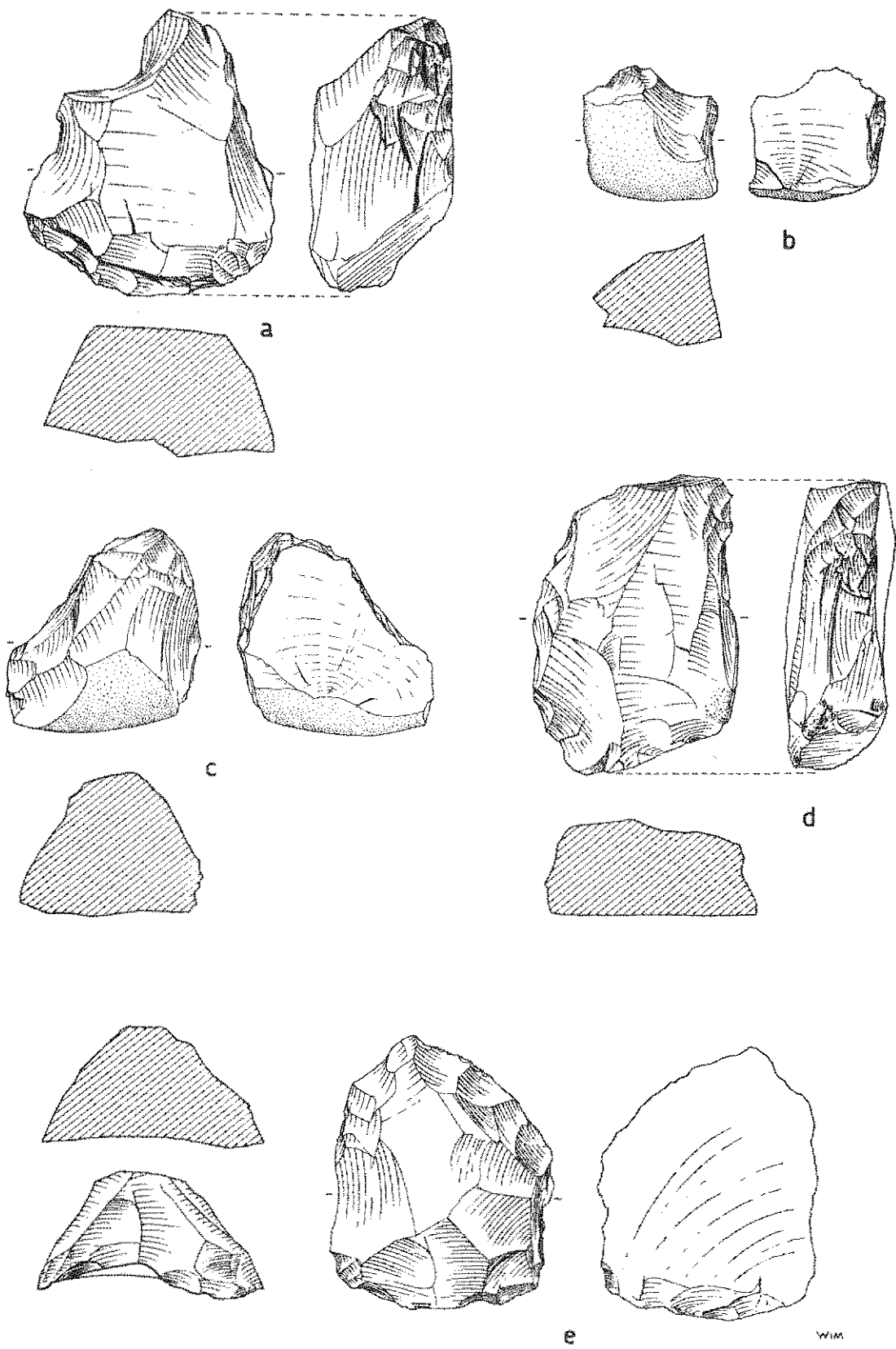


Figure V-16 : Nawamoyyn

Scale 1:1

- a. Core/Core scraper. Quartzite. Note resemblance to 'horsehoof core'. I2/8-18.
Level IIIa.
- b. Core/Core scraper. Quartzite. F3/5. Level IIIb.
- c. Utilised flake. Chert, unifacial use-wear.
I1/5. Level IIIa.
- d. Hammer/Pounder. Quartzite, resembling 'kulki'.
B11/9-8. Level IIIa.

Figure V-16

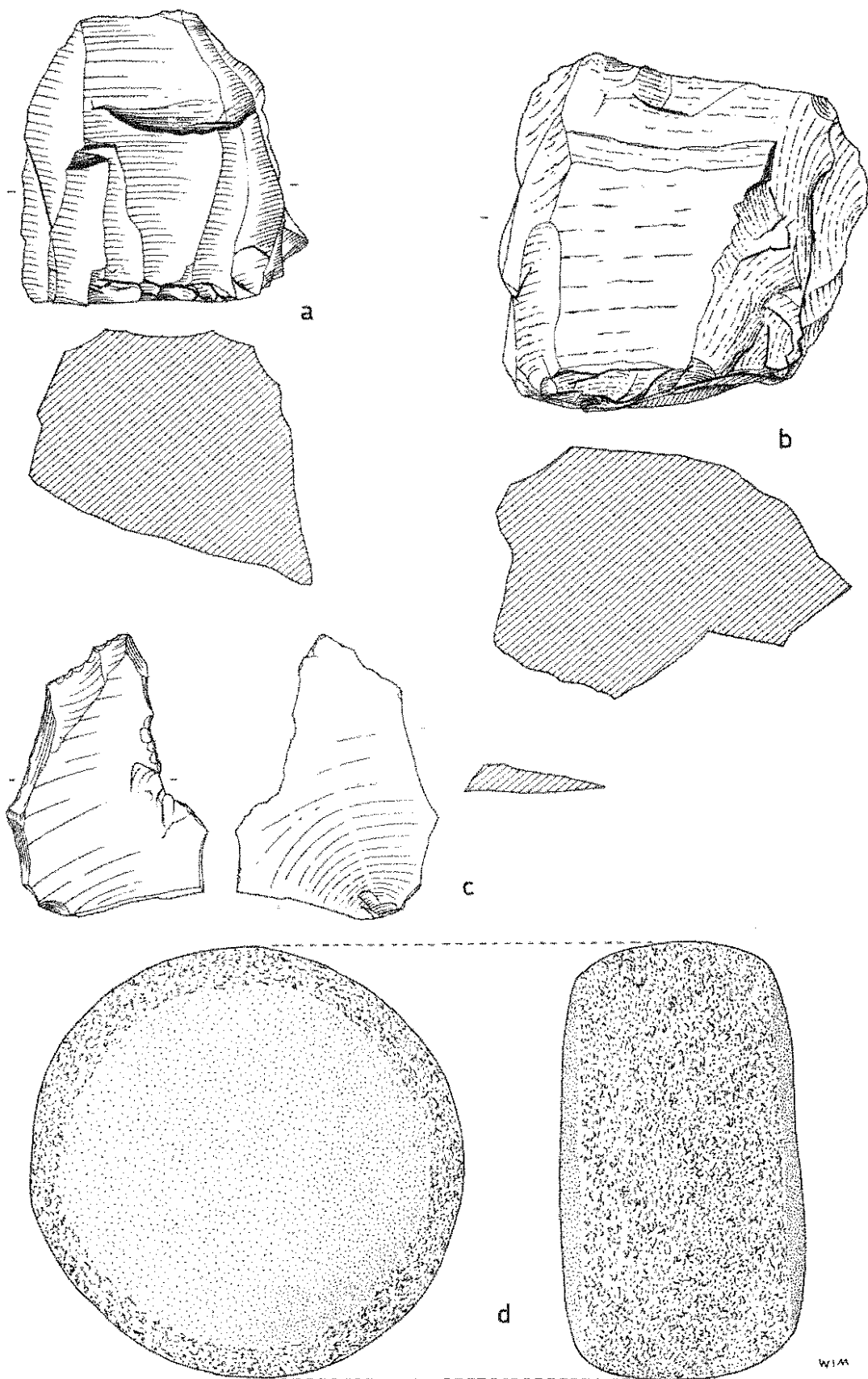


Figure V-17 : Nawamcyn

Scale 1:1

- a. Axe. Hornfels, edge ground. G1/6-3.
Level IIIb.
- b. Axe. Hornfels, edge ground, ?'stemmed'.
G1/6-2. Level IIIb.
- c. Axe. Hornfels, edge ground. E11/9-1.
Level IIIb.
- d. Axe. Porphyritic dolomite, edge ground.
Note horizontal groove. J1/7-8.
Level IIIb.
- e. ?Axe. Quartzite. C11/9. Level IIIb.

Figure V-17

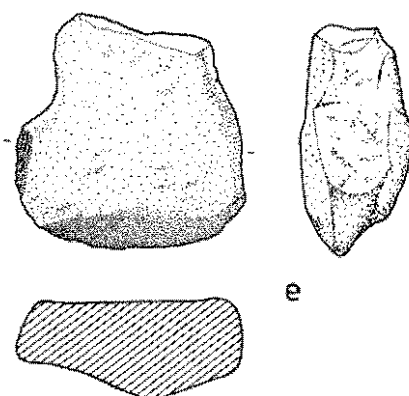
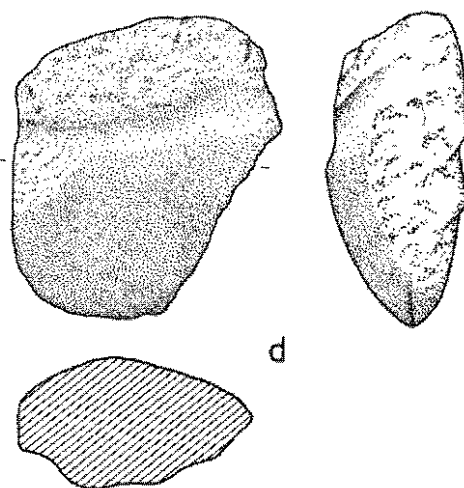
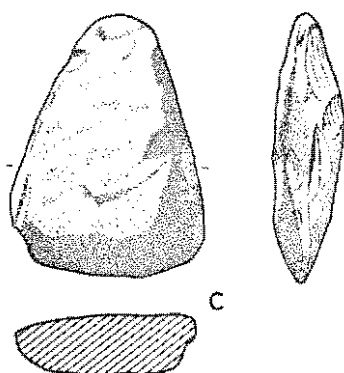
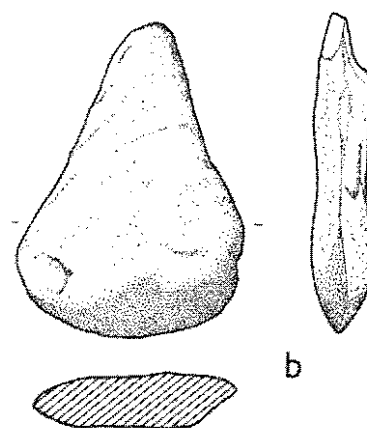
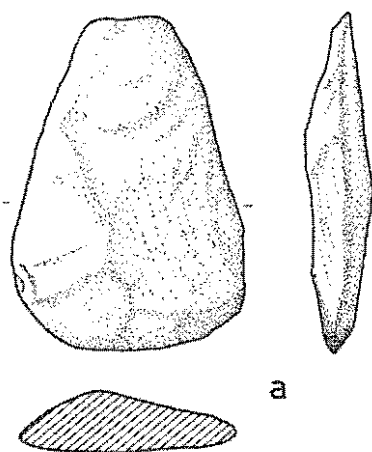
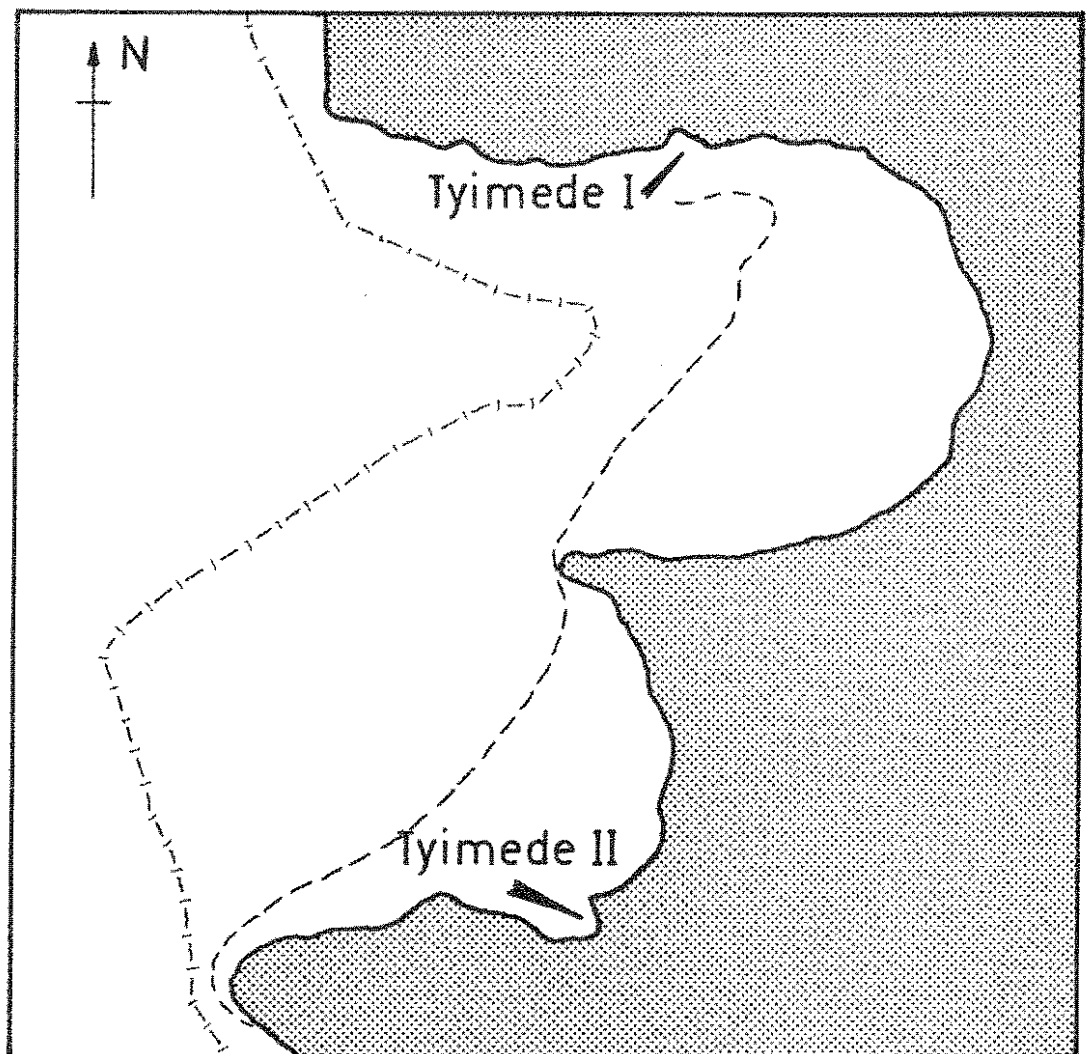


Figure VI-1

TYIMEDE RE-ENTRANT.



—|—|— Limit of scree slope
- - - Limit of heavy rockfall

0 30
metres

Figure VI-2

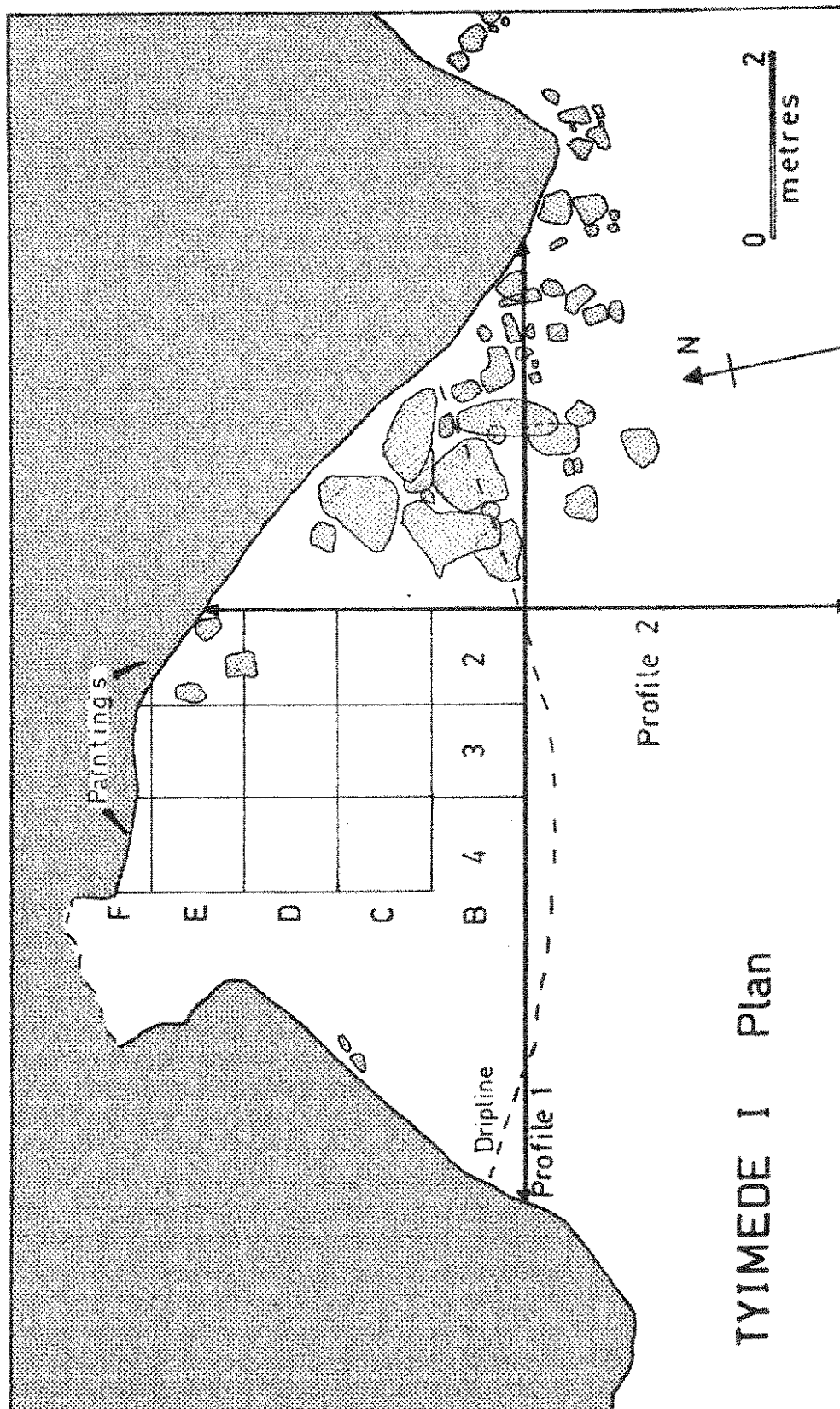
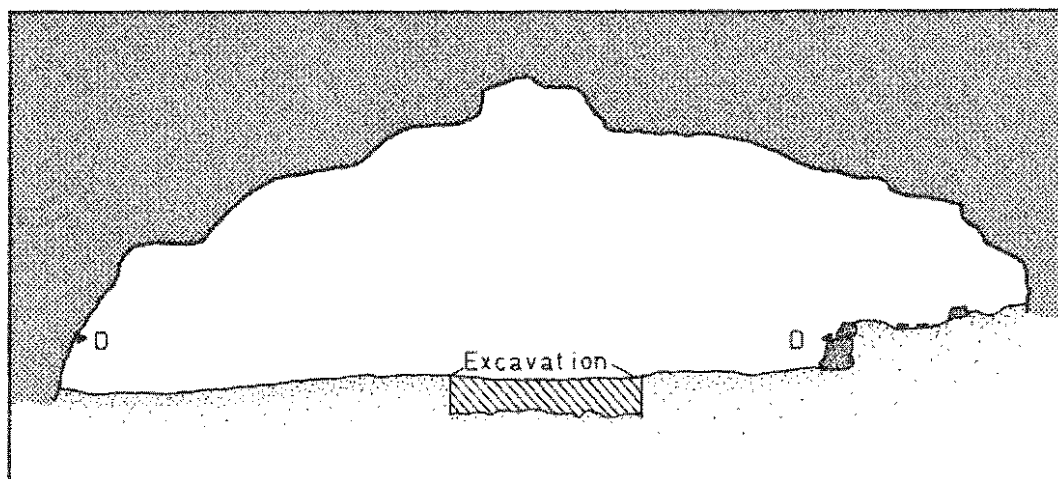
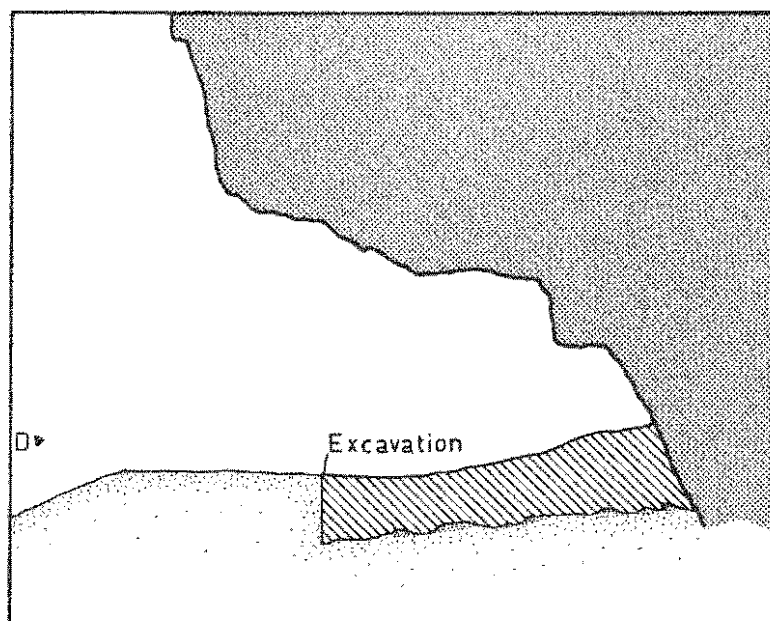


Figure VI-3



TYIMEDE I – Profile 1

0 2
metres



TYIMEDE I – Profile 2

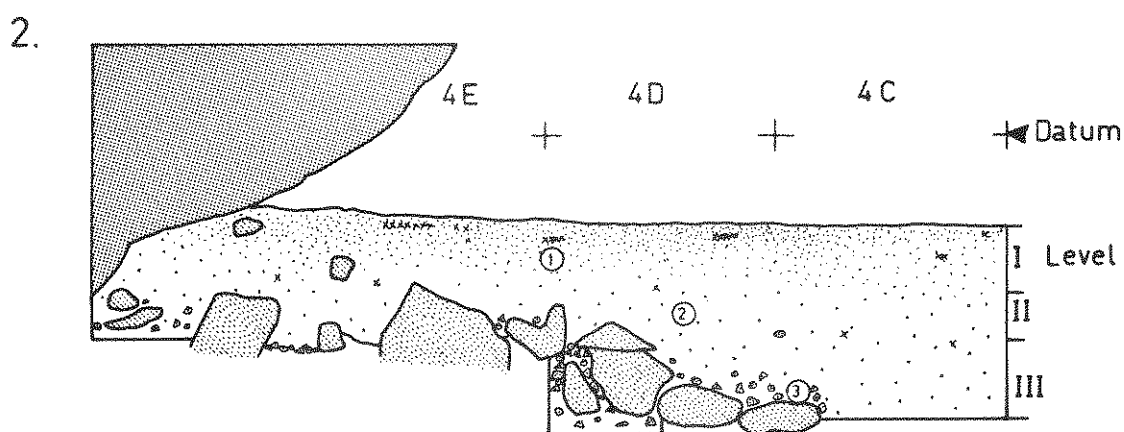
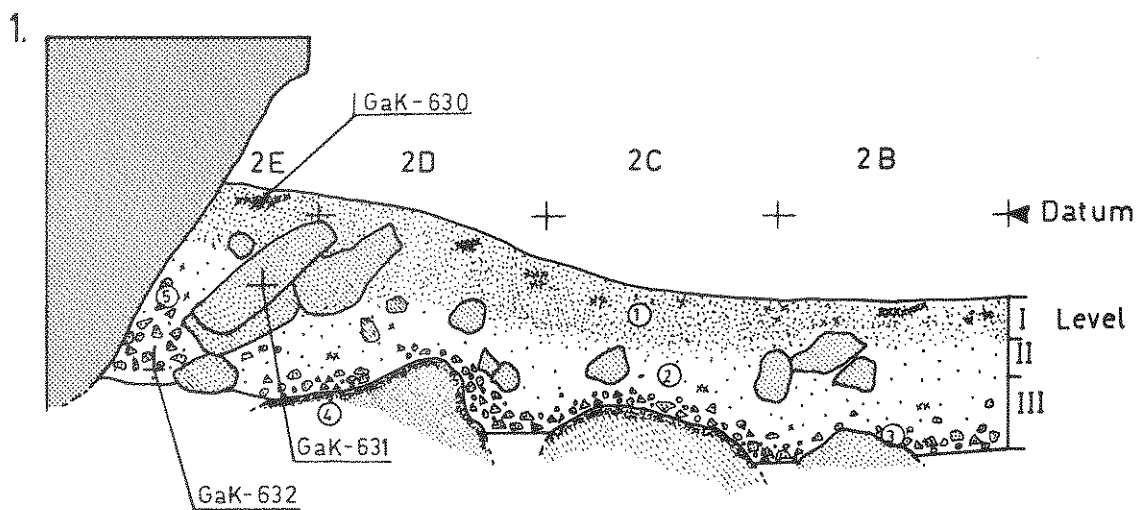
0 2
metres

Figure VI-4 : Tyimede I

Stratigraphy of 1. East wall of 2E-2B.
 2. West wall of 4F-4C.

1. Very dark grey (10 YR 3/1) to greyish brown (10 YR 4/2-5/2) sand, with occasional concentrations of charcoal.
2. Yellowish brown sand. (10 YR 5/4).
3. Basal angular rubble.
4. Blocks of ferruginised sandstone with a crust of haematite and limonite.
5. Brown sand. (7.5 YR 5/6).

Figure VI-4



0 1
metre

TYIMEDE I - Sections.

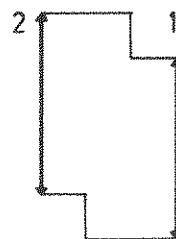
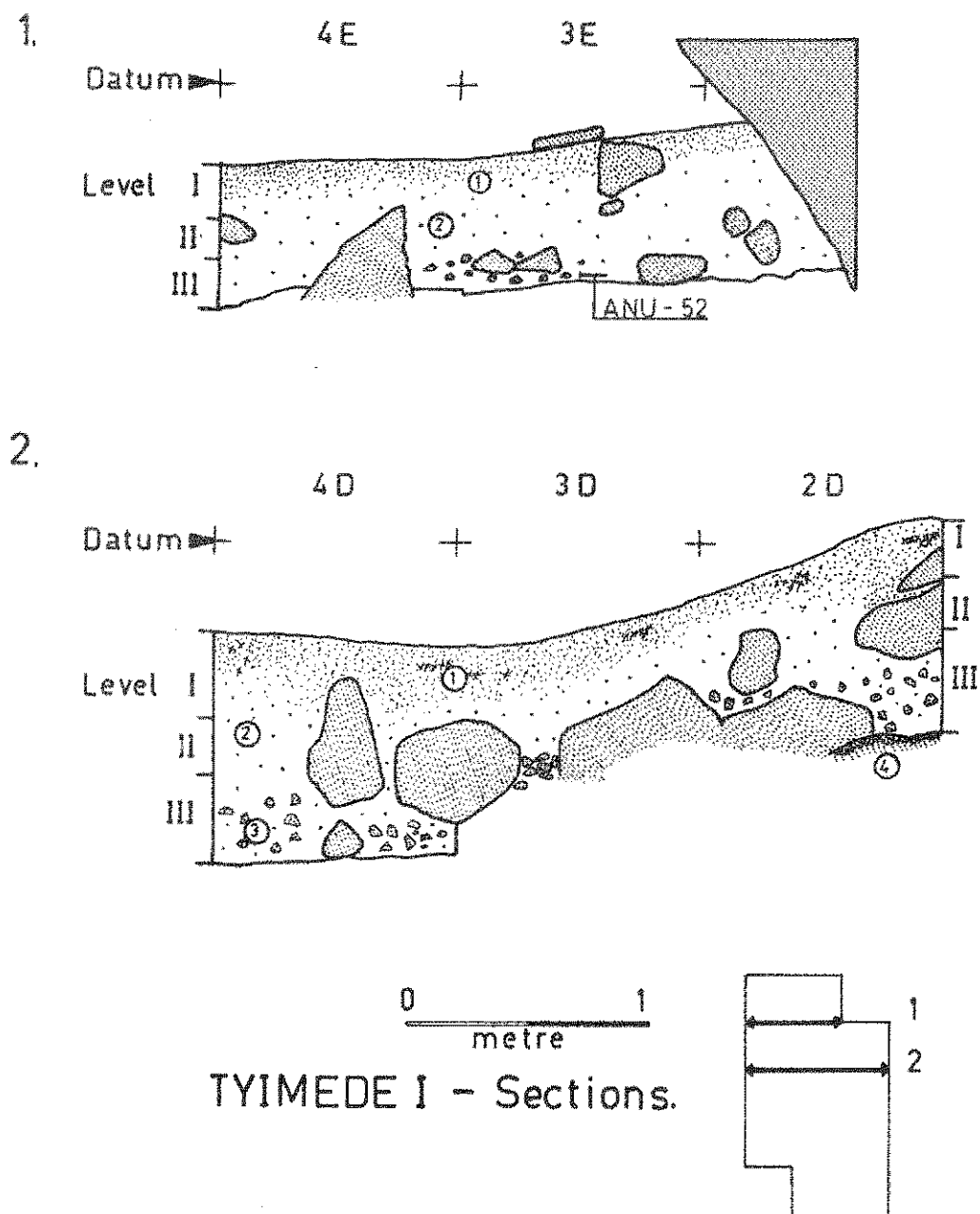


Figure VI-5 : Tyimede I

Stratigraphy of 1. North wall of 4E-2E.
 2. North wall of 4D-2D.

1. Very dark grey (10 YR 3/1) to greyish brown (10 YR 4/2-5/2) sand with occasional concentrations of charcoal.
2. Yellowish brown sand. (10 YR 5/4).
3. Basal angular rubble.
4. Block of ferruginised sandstone with a crust of haematite and limonite.

Figure VI-5



Category	Group 1	Group 2	Group 3
A	1	1	0
B	1	1	0
C	1	1	1
D	1	1	1
E	1	1	1

Scale  4% Total nos 16679

Figure VI - 7

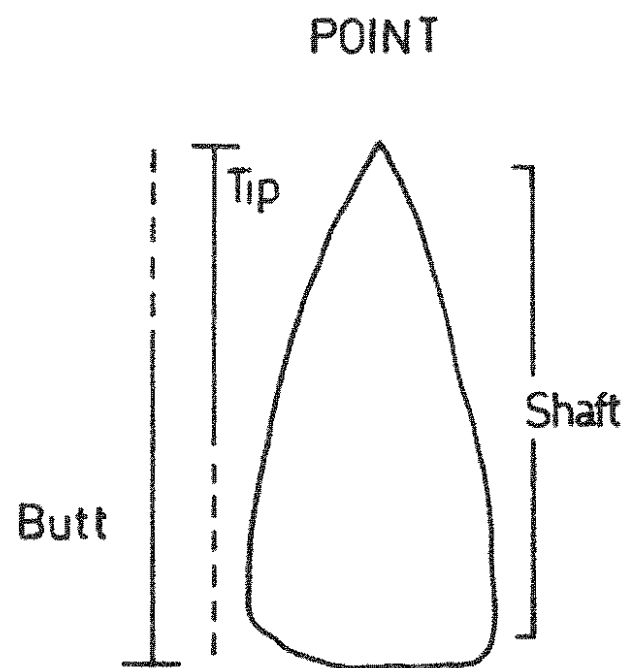


Figure VI-8

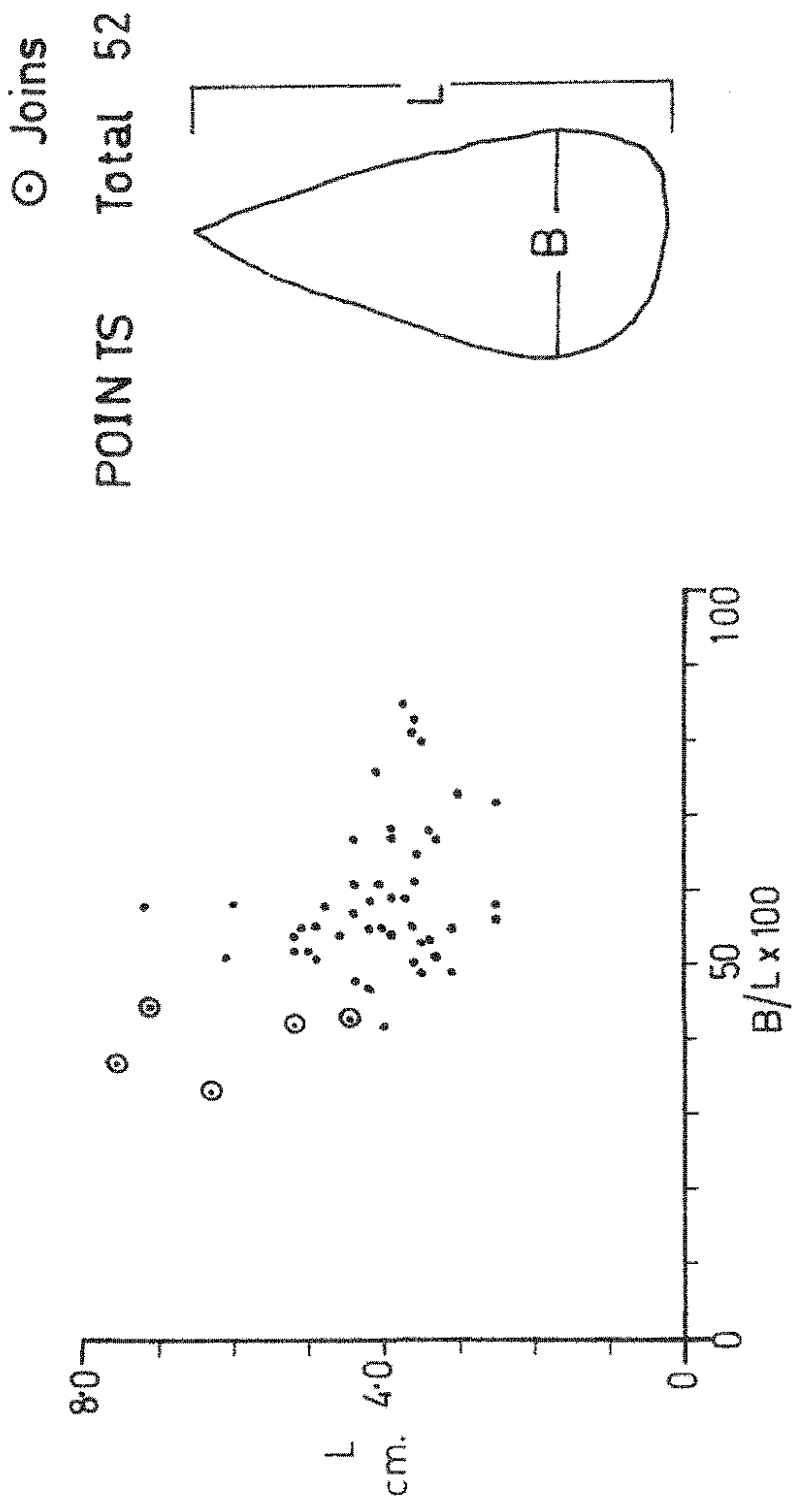
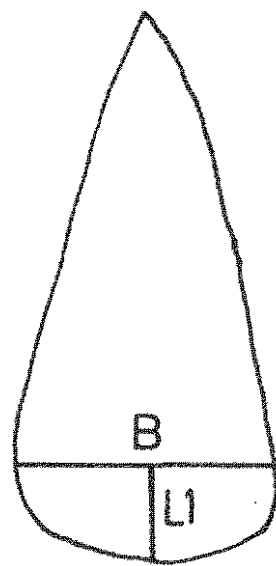
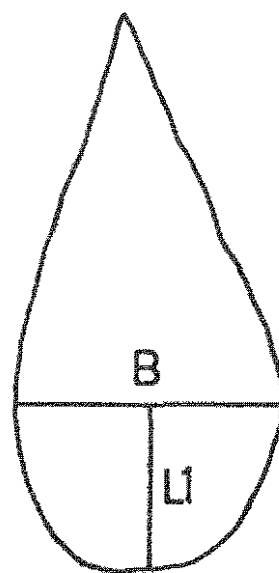


Figure VI-9



L1/B Low



L1/B High

POINTS - Shape of butt

Figure VI-10

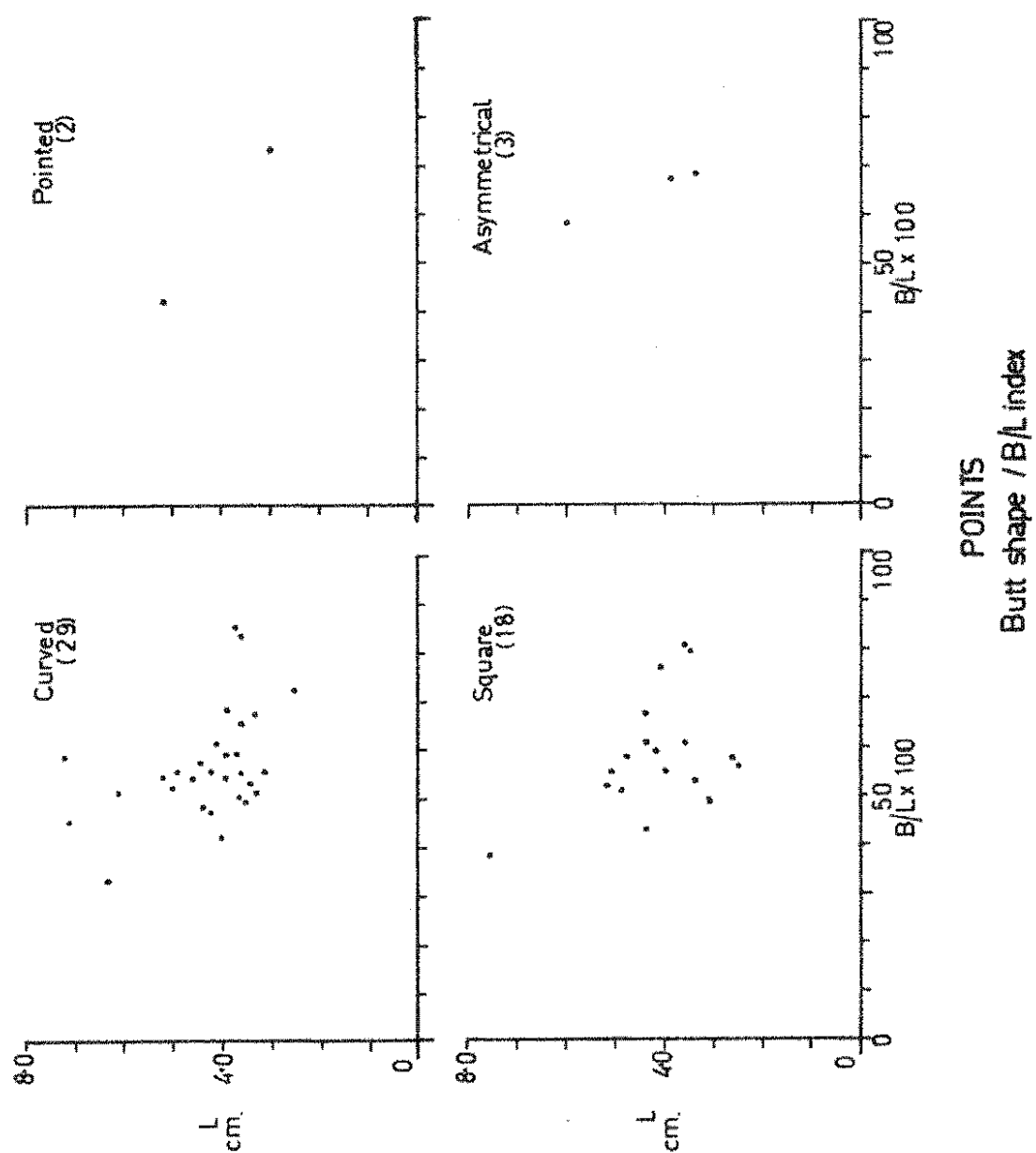


Figure VI - 11

POINTS - Tip shape
Total 52

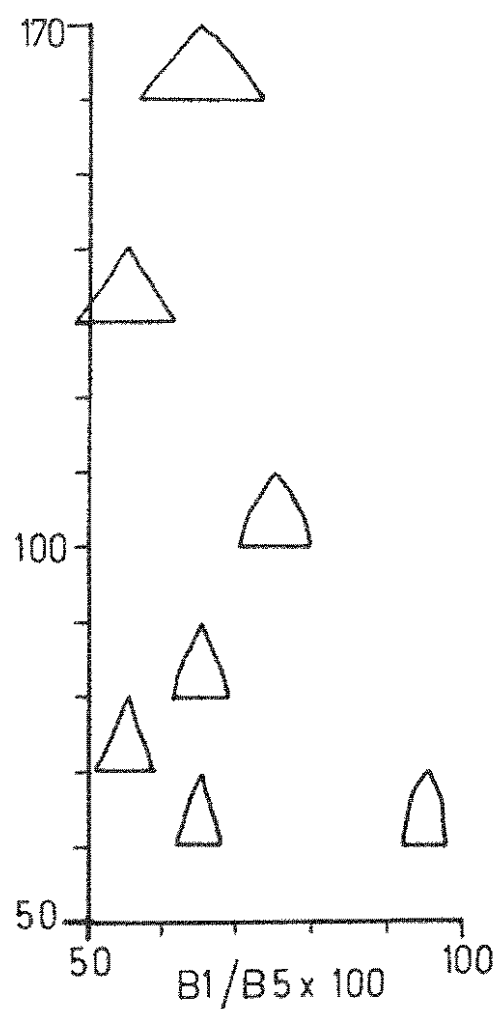
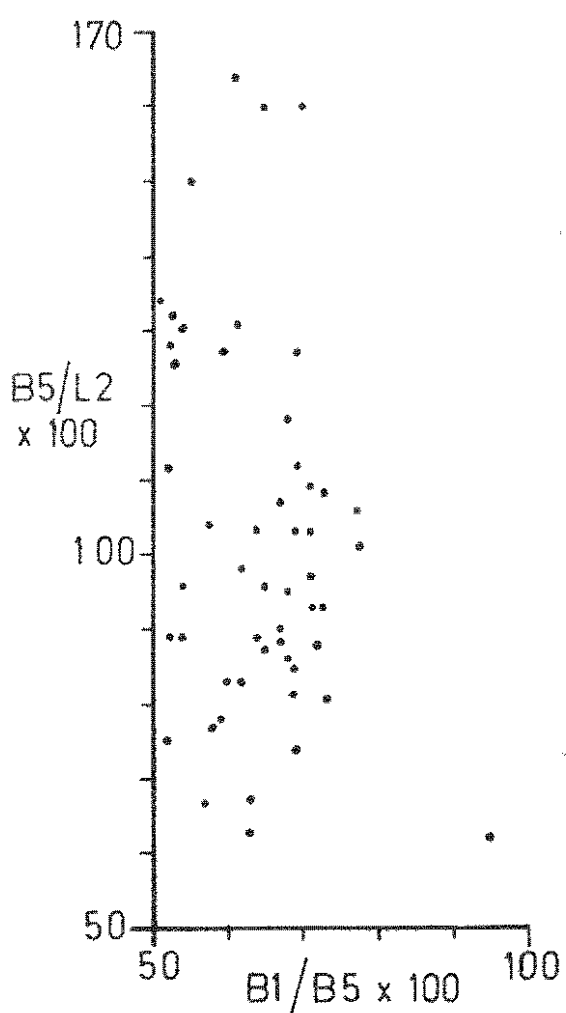
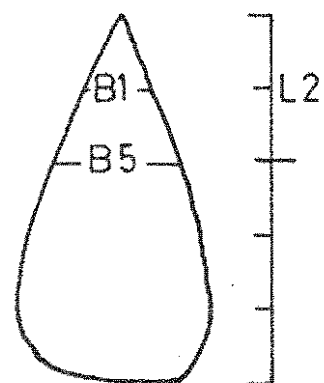


Figure VI-12

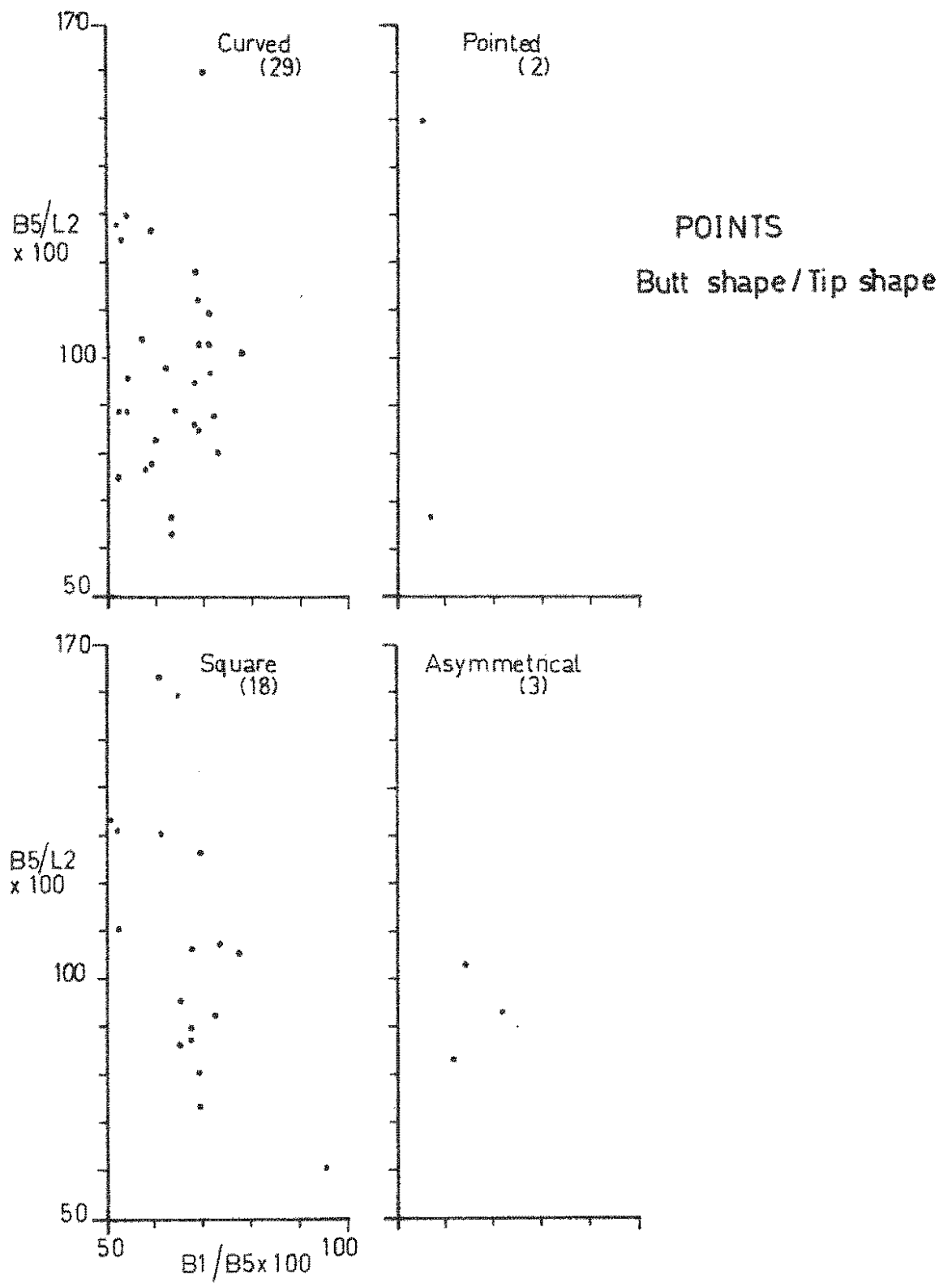


Figure VI-13

BUTTS- shape.

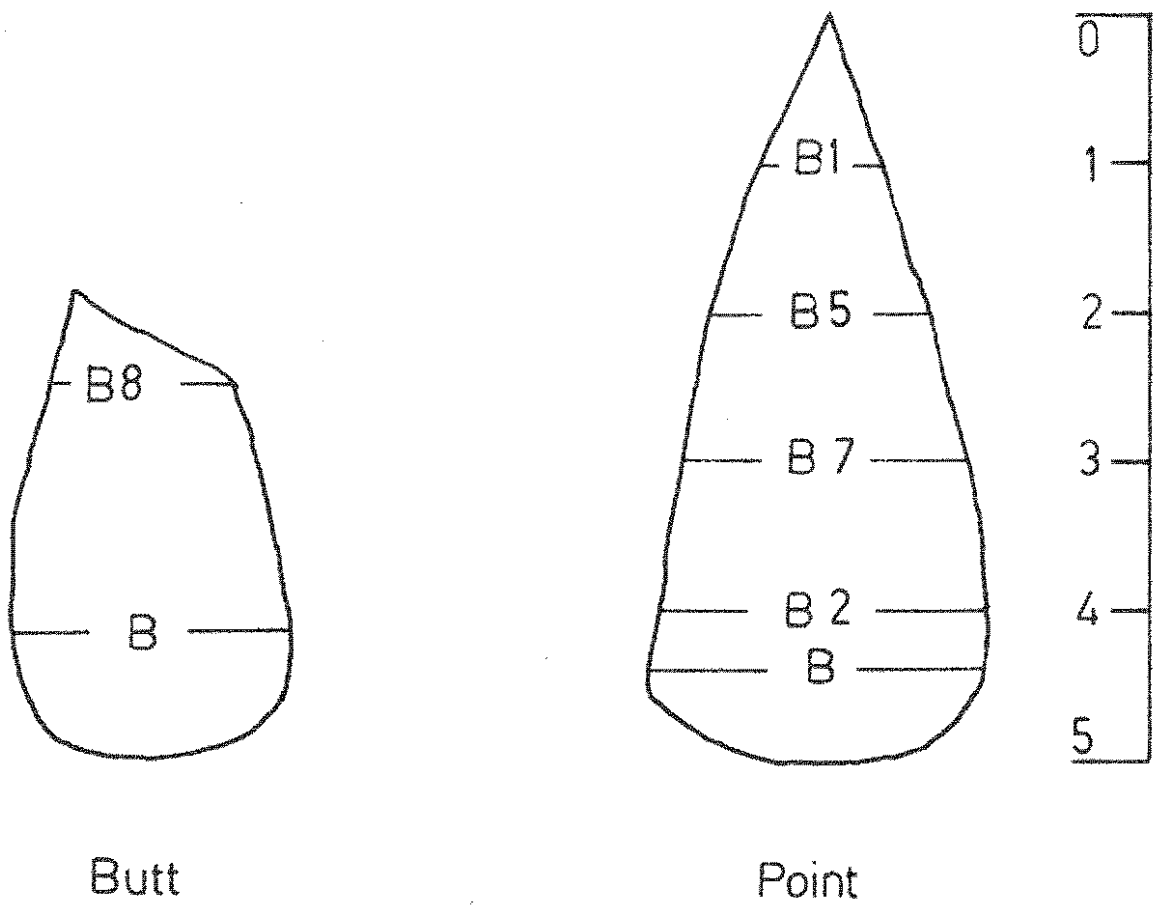
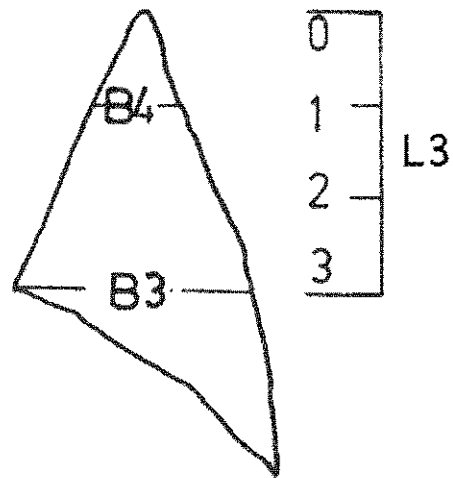
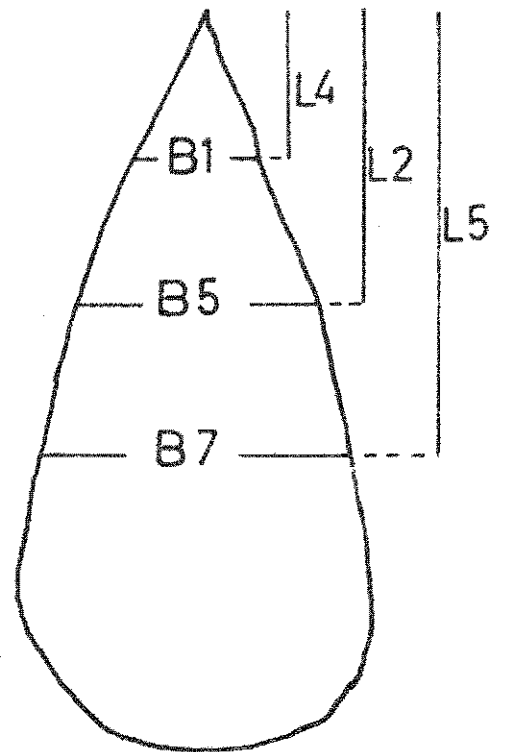


Figure VI - 14



Tip



Point

TIPS - shape

Figure VI-15

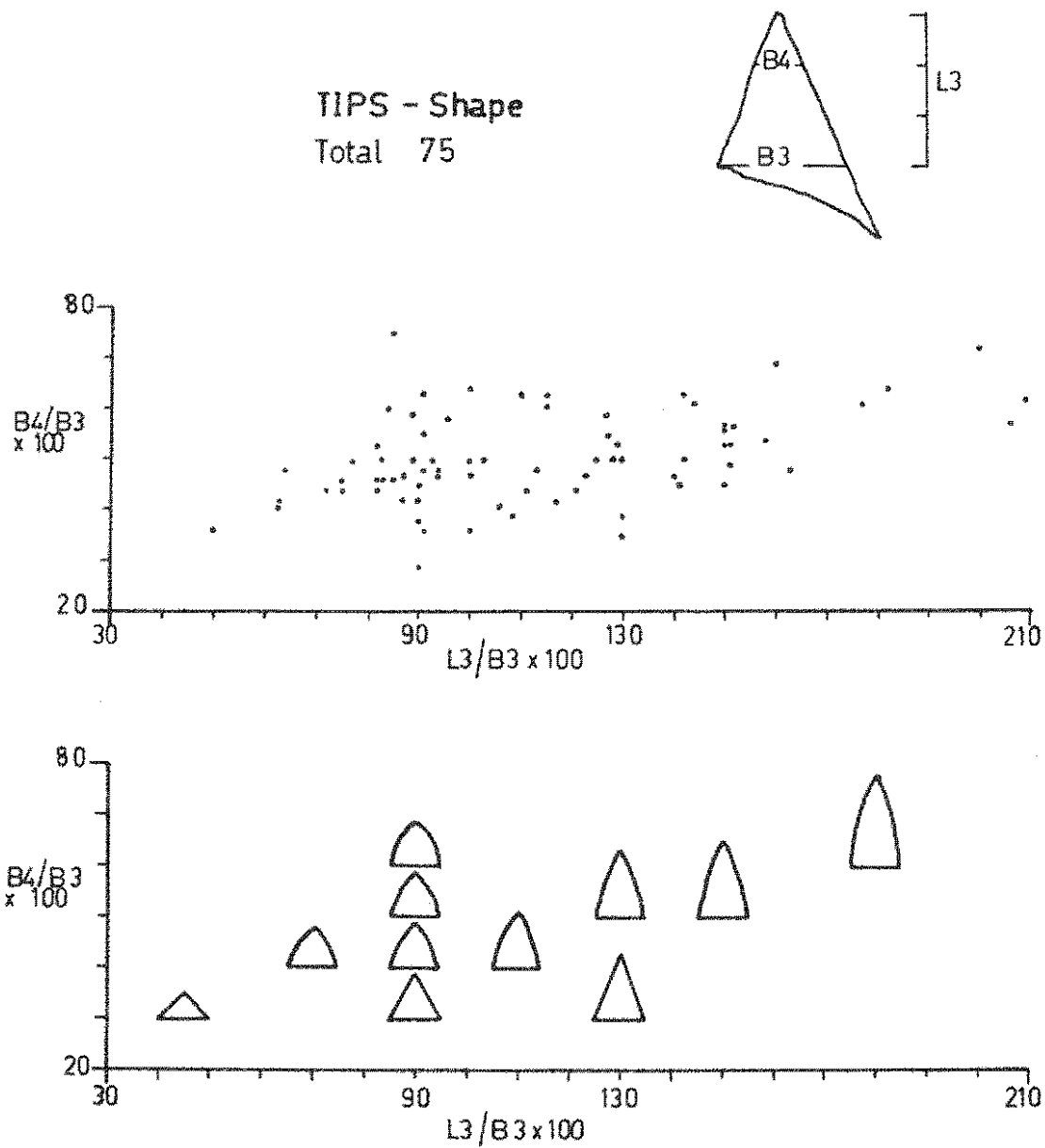
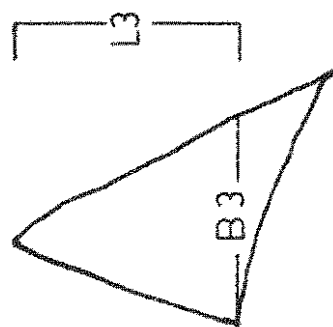
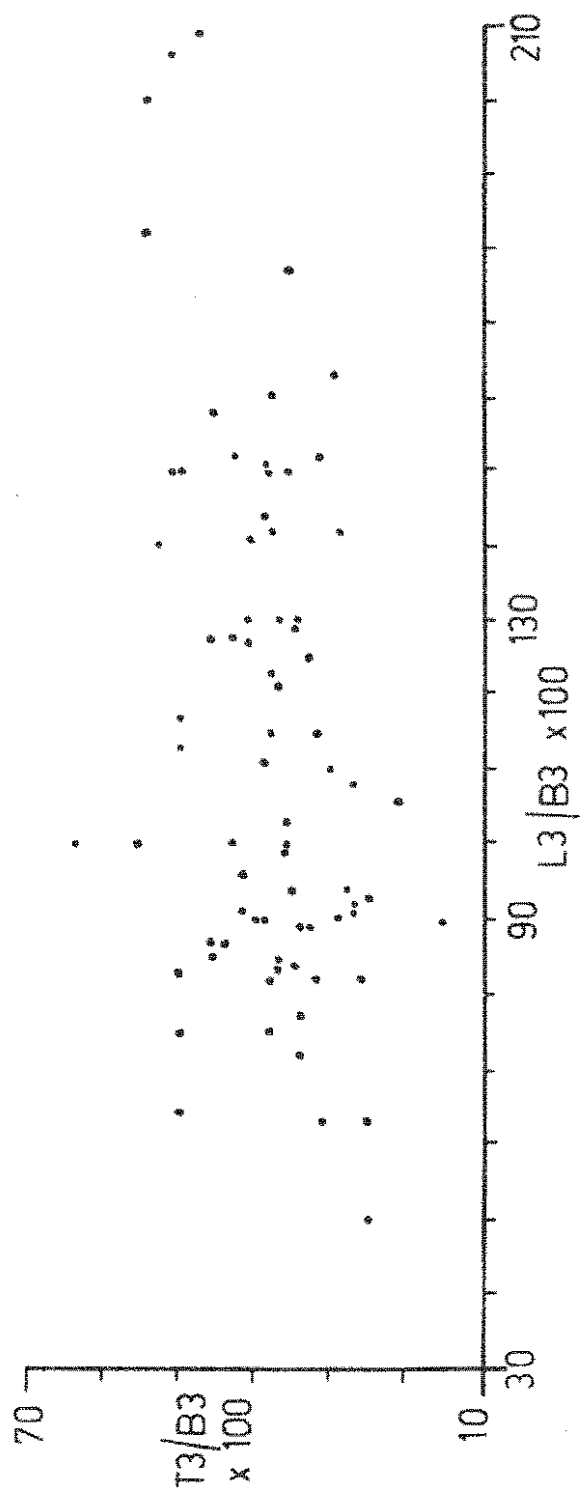


Figure VI-16



TIPS - Shape

Total 75



ENDSTRUCK SCRAPERS — Shape
Total 53

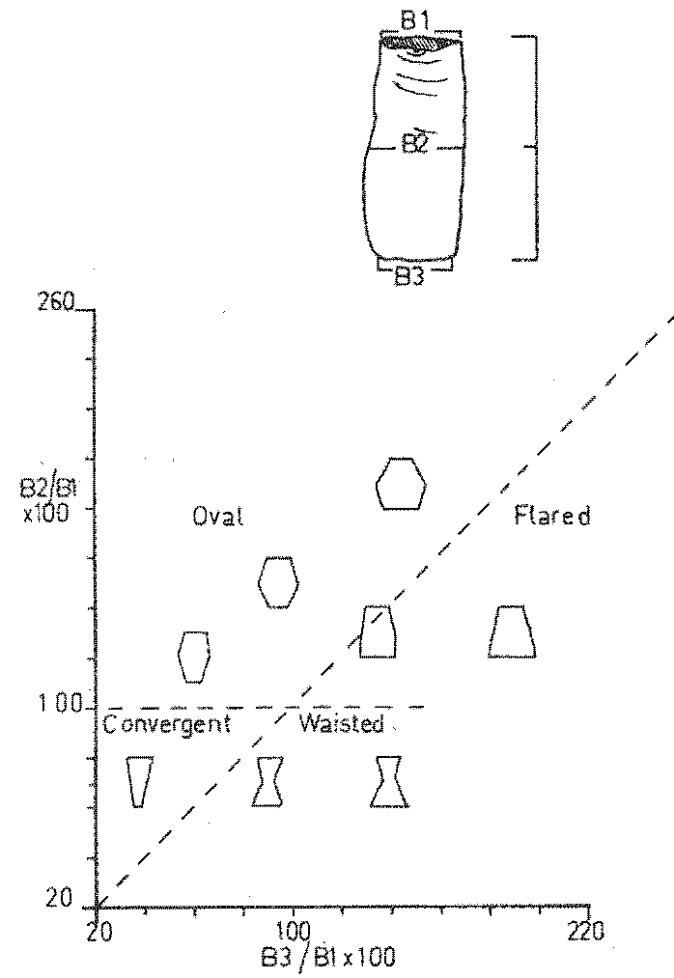
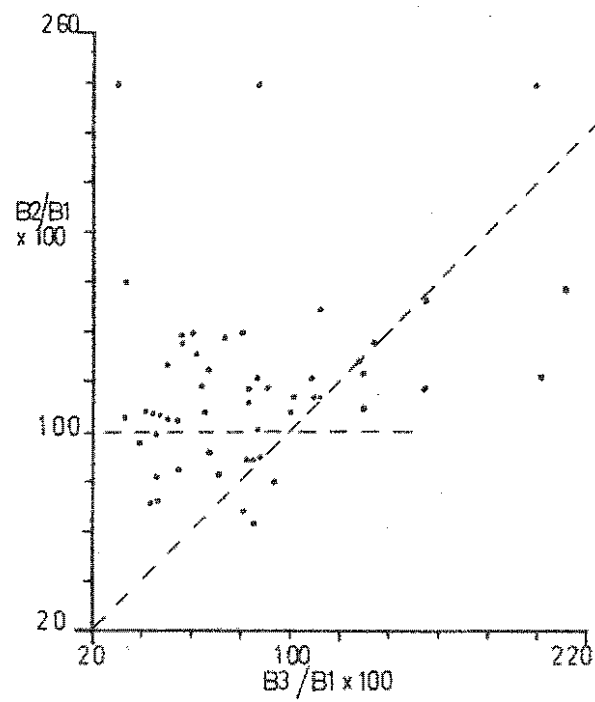


Figure VI-17

Figure VI-18 : Tyimede I

Scale 1:1.

- a. Point. Quartzite, curved butt, bifacial retouch. 4E/5-24. Level II.
- b. Point. Quartzite, asymmetrical butt, bifacial retouch. 2D/7-245. Level III.
- c. Point. Quartz, square butt, bifacial retouch. 2E/8-313. Level III.
- d. Point. Quartzite, curved butt, bifacial retouch. 2D/4-187. Level II.
- e. Point. Quartzite, curved butt, bifacial retouch. 2D/4-291. Level II.
- f. Point. Chert, curved butt, bifacial retouch. 4F/10-52. Level III.

Figure VI-18

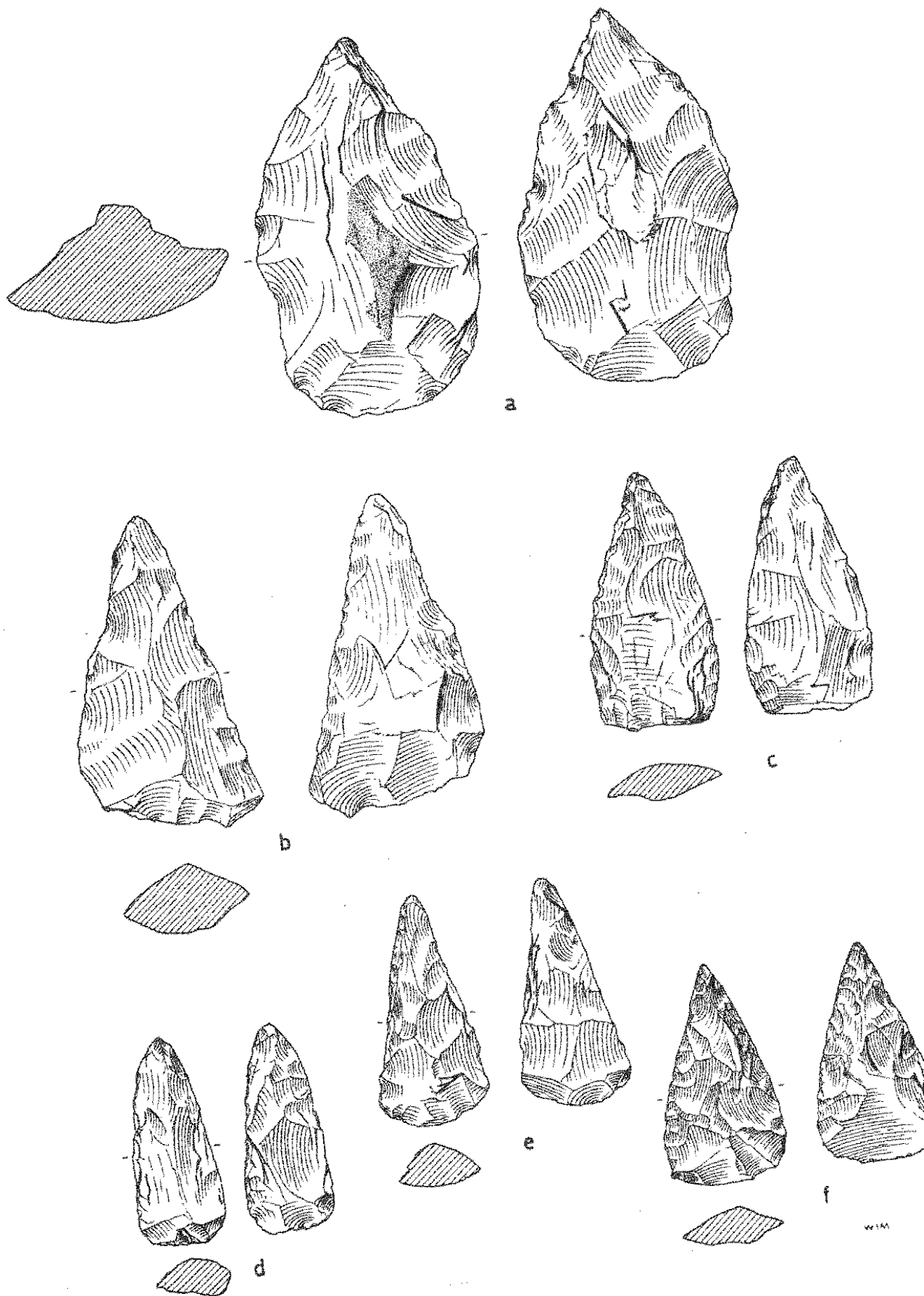


Figure VI-19 : Tyimede I

Scale 1:1

- a. Point. Quartz, square butt, endstruck,
unifacial retouch.
3F/5-36. Level II.
- b. Point. Quartzite, curved butt, endstruck,
unifacial retouch.
2D/4-185. Level II.
- c. Point. Quartzite, pointed butt, sidestruck,
unifacial retouch.
2D/6-219. Level III.
- d. Point. Quartzite, curved butt, endstruck,
bifacial retouch.
3E/7-88. Level III.
- e. Point. Quartzite, square butt, endstruck,
unifacial retouch.
4E/4-9. Level II.

Figure VI - 19

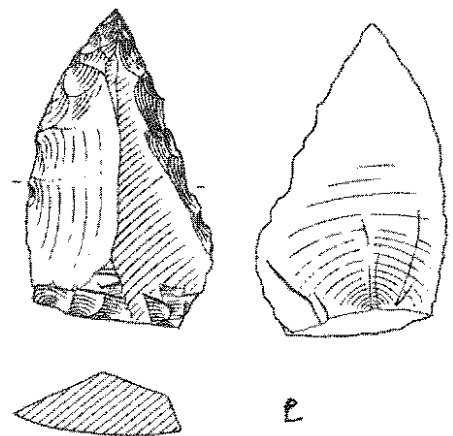
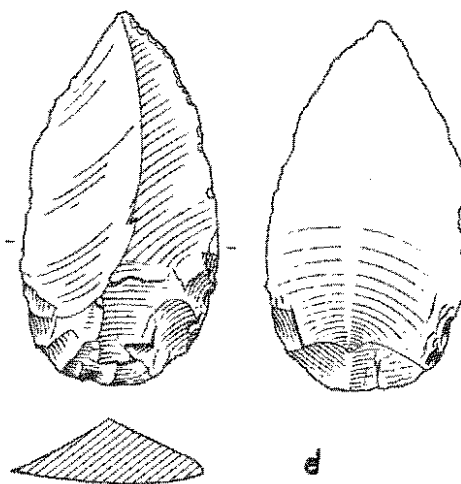
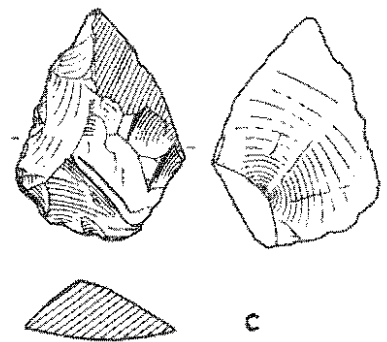
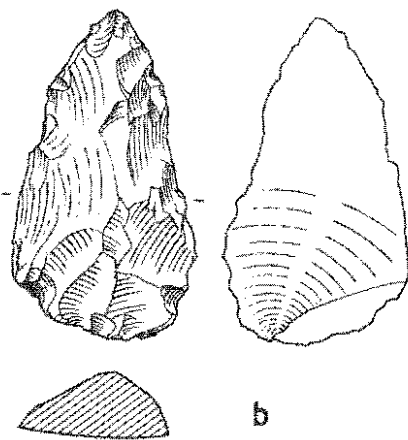
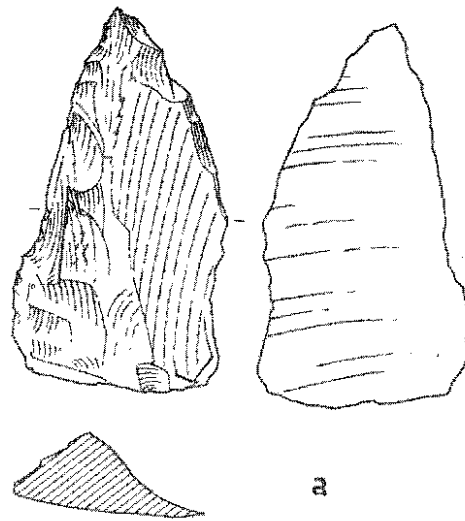
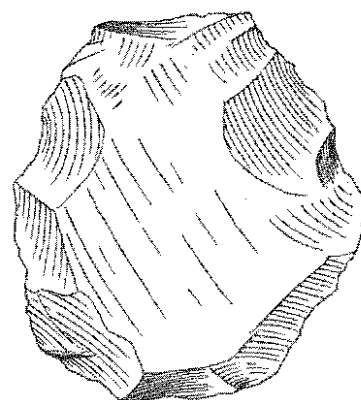
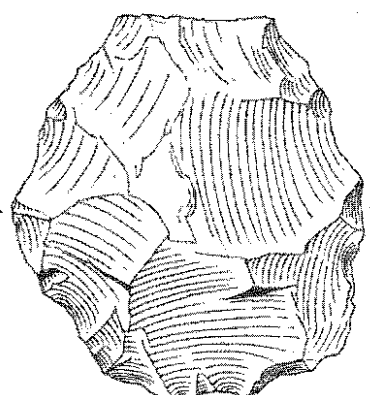


Figure VI-20 : Tyimede I

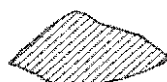
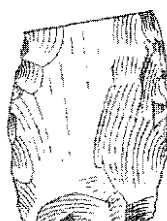
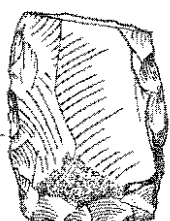
Scale 1 to 5

- a. Butt. Quartzite, curved butt, bifacial retouch. 2D/7-236. Level III.
- b. Butt. Quartzite, square butt, bifacial retouch. 2E/9-335. Level III.
- c. Butt. Quartzite, curved butt, bifacial retouch. 3E/8-115. Level III.
- d. Butt. Quartz, curved butt, bifacial retouch. 3E/7-57. Level III.
- e. Butt. Quartzite, square butt, endstruck, bifacial retouch.
2E/9-329. Level III.

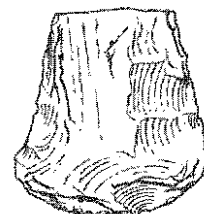
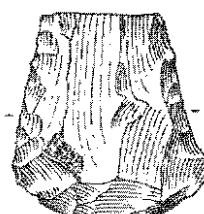
Figure VI- 20



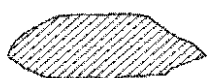
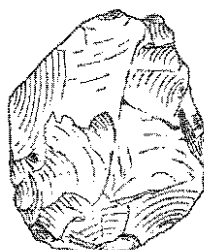
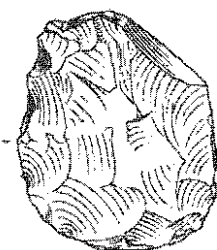
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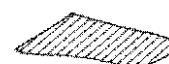
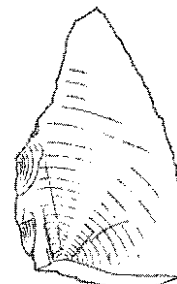
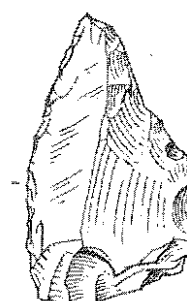
b



c



d



e

Figure VI-24 : Tyimede I

Scale 1:1

- a. Butt. Quartzite, square butt, endstruck,
unifacial retouch.
3F/4-12. Level II.
- b. Butt. Quartzite, curved butt, endstruck,
unifacial retouch.
3F/6-53. Level III.
- c. Butt. Quartzite, asymmetrical butt,
bifacial retouch.
3B/6-118. Level III.
- d. Butt. Chert, pointed butt, endstruck,
unifacial retouch.
3E/7-97. Level III.
- e. Shaft. Quartzite, bifacial retouch.
3C/7-54. Level III.

Figure VI-21

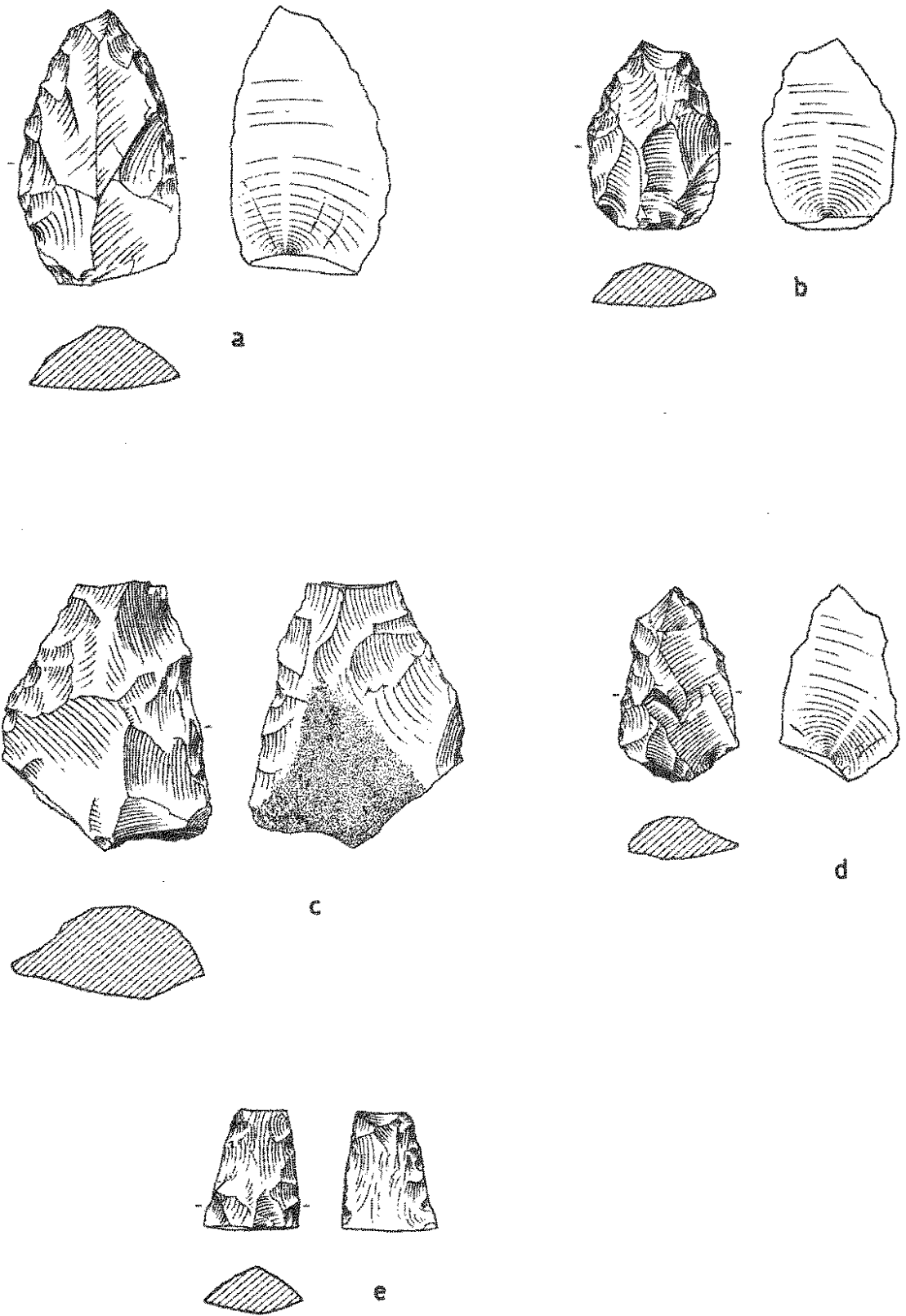


Figure VI-22 : Tyimede I

Scale 1:1

- a. Point broken in antiquity. Quartzite,
square butt, bifacial retouch.
2E/8-311 and 3D/7-160. Level III.
- b. Tip. Quartzite, convex sides, bifacial
retouch. 2D/5-210. Level II.
- c. Tip. Quartzite, concave sides, unifacial
retouch. 2E/10. Level III.
- d. Tip. Quartz, convex sides, unifacial
retouch. 3F/5-33. Level II.
- e. Tip. Chert, convex sides, unifacial
retouch. 2D/6-225. Level III.

Figure VI - 22

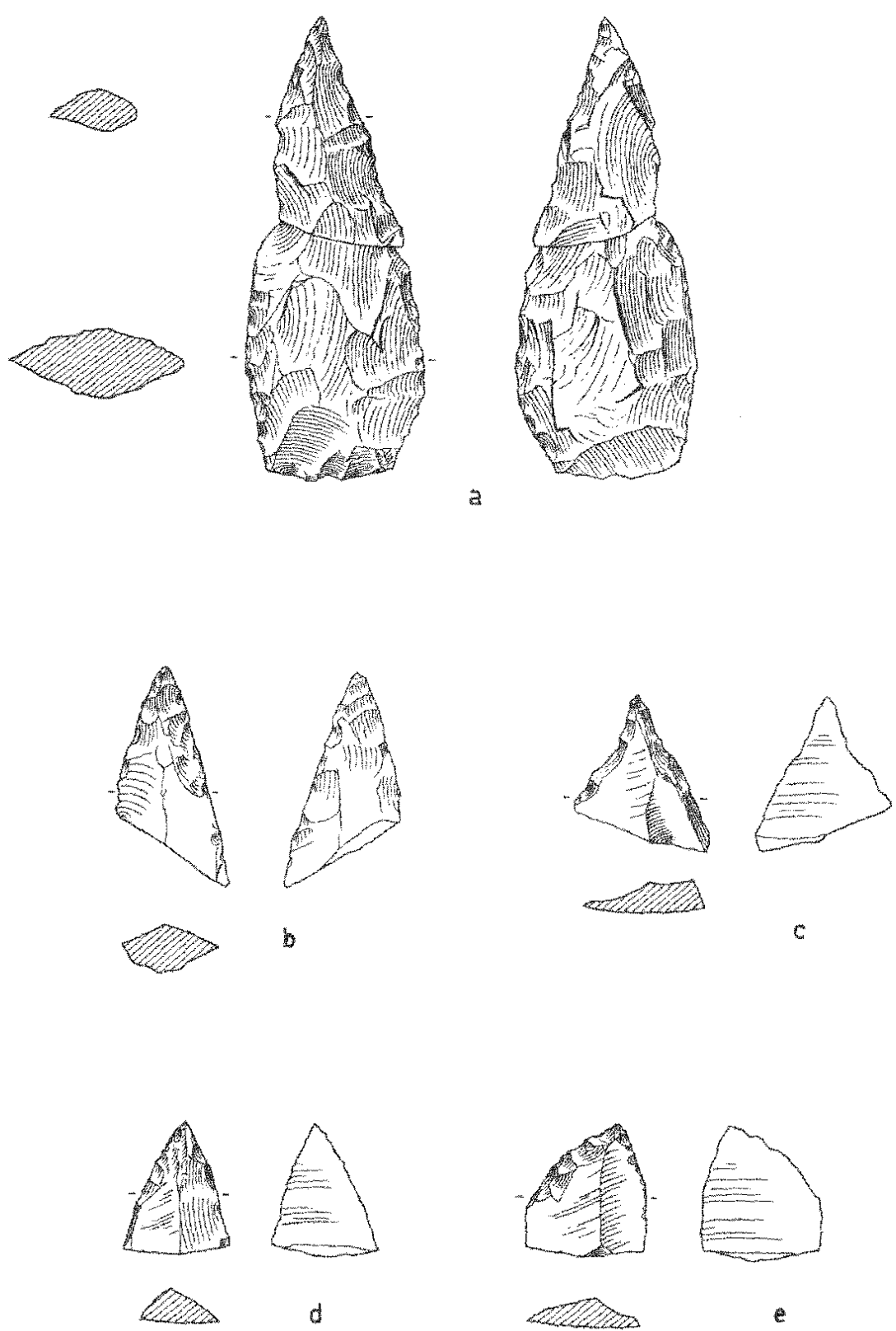


Figure VI-23 : Tyimede I

Scale 1:1

- a. Scraper. Chert, endstruck, unifacial
retouch. 2D/7-231. Level III.
- b. Scraper. Chert, endstruck, unifacial
retouch. 3D/3-145. Level I.
- c. Scraper. Chert, endstruck, unifacial
retouch and inverse use-wear.
2D/7-239. Level III.
- d. Scraper. Chert, endstruck, unifacial and
bifacial retouch.
2D/4-197. Level II.
- e. Scraper. Chert, endstruck, unifacial
retouch and inverse use-wear.
4E/4-7. Level II.

Figure VI- 23

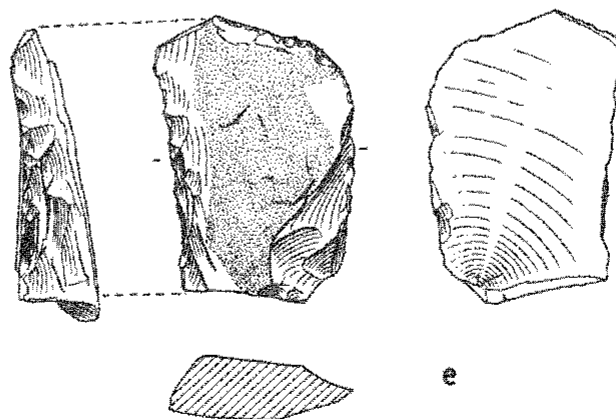
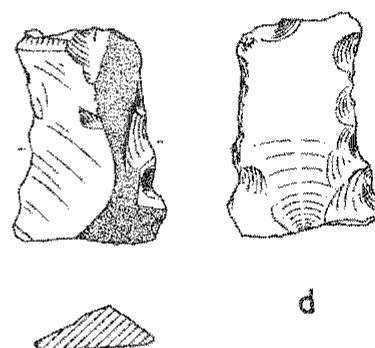
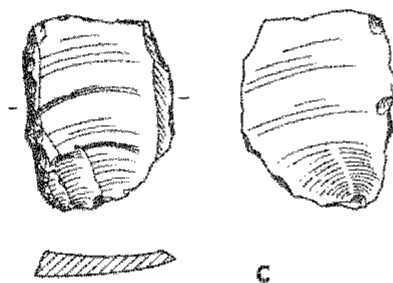
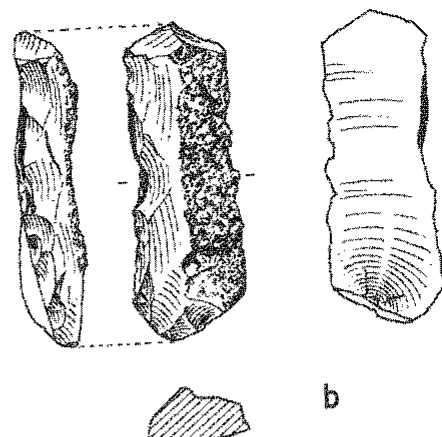
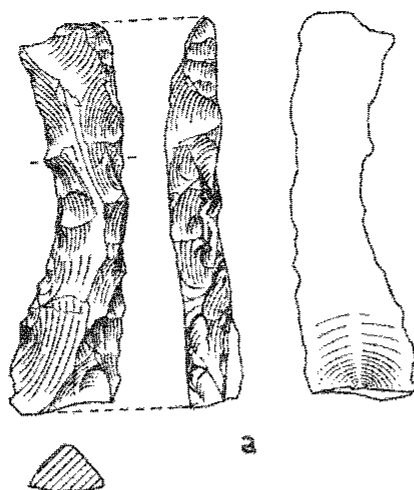


Figure VI-24 : Tyimede I

Scale 1:1

- a. Scraper. Chert, sidestruck, unifacial
retouch. 4D/6. Level III.
- b. Scraper. Quartzite, sidestruck, unifacial
retouch. 2E/1-261. Level I.
- c. Scraper. Chert, unifacial and bifacial
retouch. 4D/5. Level II.
- d. Scraper. Chert, unifacial retouch.
2D/4-186. Level II.
- e. Scraper. Chert, unifacial retouch and
inverse use-wear.
2E/8-325. Level III.
- f. Scraper. Chert, unifacial retouch.
4C/3-124. Level I.

Figure VI - 24

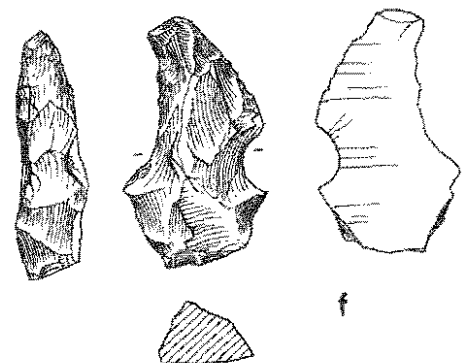
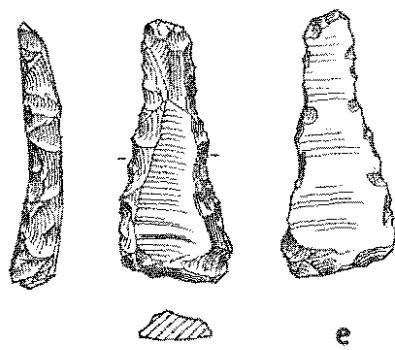
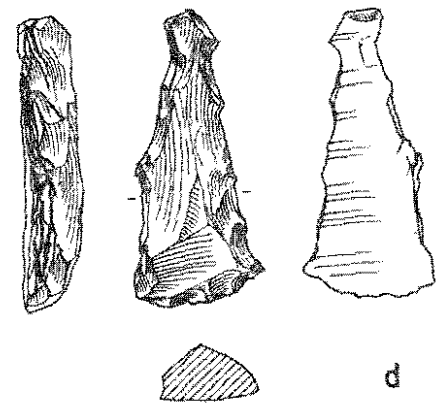
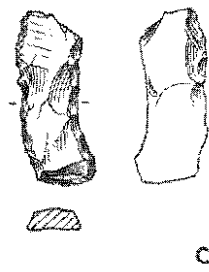
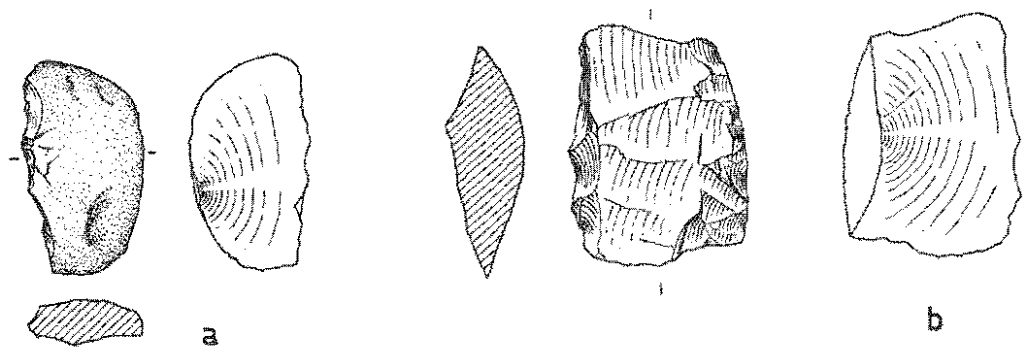


Figure VI-25 : Tyimede I

Scale 1:1

- a. Scraper. Chert, endstruck, unifacial
retouch. 4E/4-6. Level II.
- b. Scraper, broken. Chert, unifacial retouch.
2E/7-301. Level II.
- c. Scraper, broken. Chert, endstruck, unifacial
retouch. 2E/9-337. Level III.
- d. Scraper, broken. Quartzite, unifacial retouch.
4F/5-37. Level III.
- e. Scraper, broken. Chert, endstruck, unifacial
retouch. 3E/6-47. Level II.
- f. Scraper, broken. Chert, unifacial retouch.
2C/3-364. Level II.

Figure VI - 25

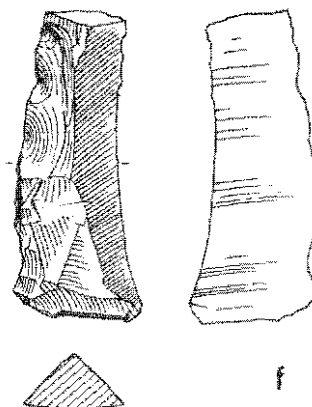
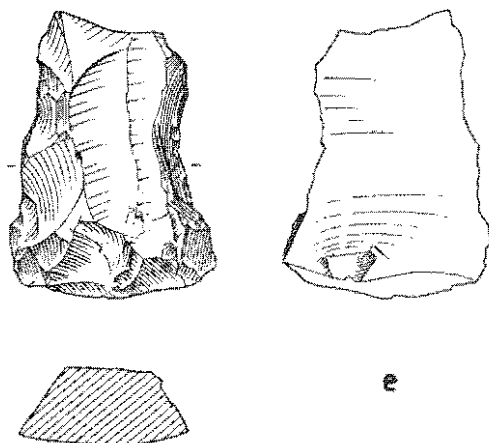
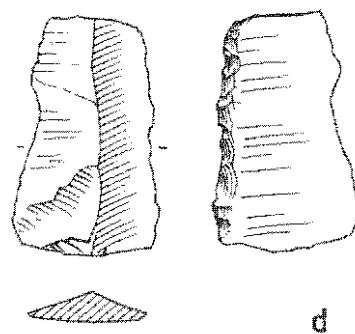
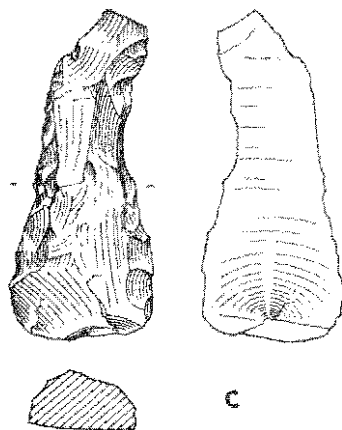
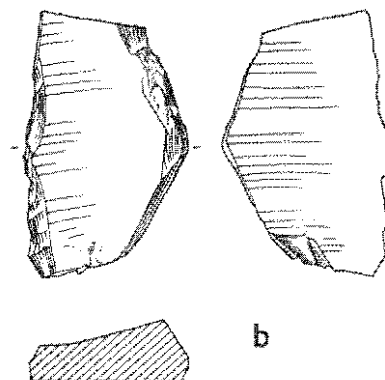
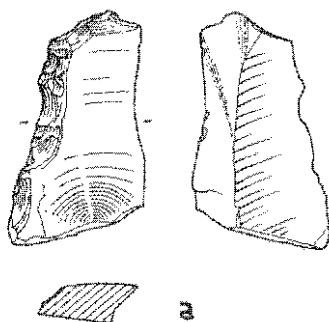


Figure VI-26 : Tyimede I

Scale 1:1

- a. Unfinished point. Quartzite.
2C/2-4. Level I.
- b. Unfinished point. Chert.
3B/5. Level II.
- c. Miscellaneous. Chert.
2D/3-182. Level I.
- d. Miscellaneous. Chert. Note rhomboid
cross-section.
2E/8-287. Level III.

Figure VI - 26

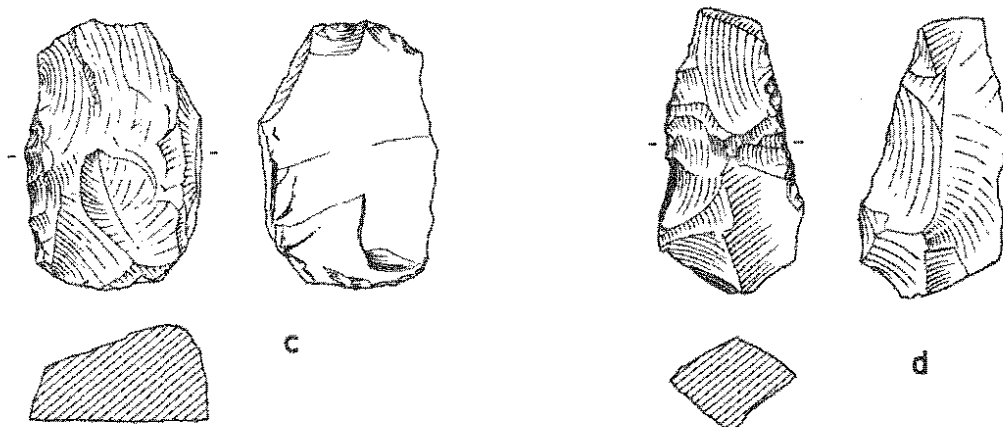
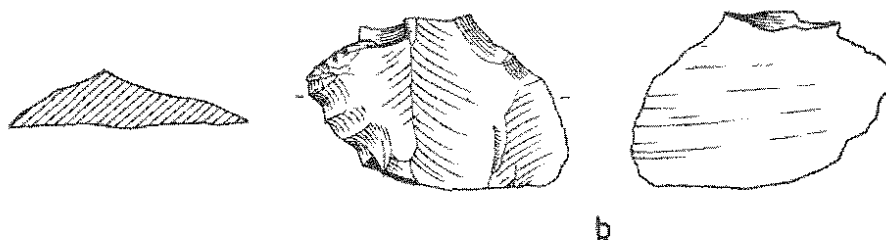
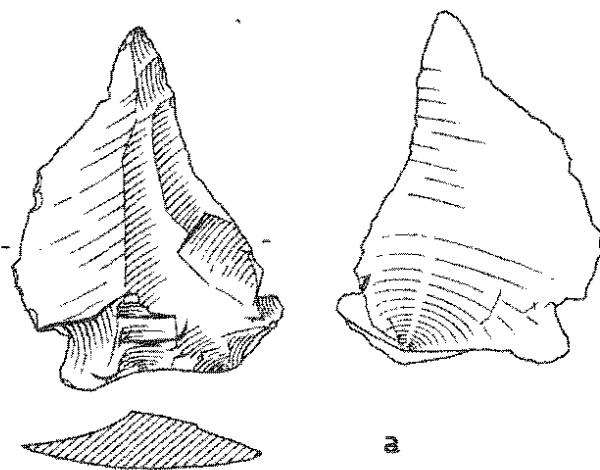
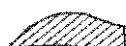
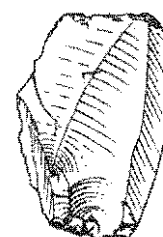
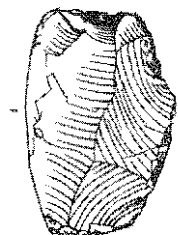
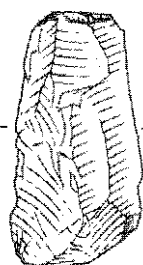


Figure VI-27 : Tyimede I

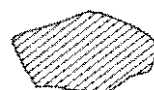
Scale 1:1

- a. Implement with bruised end. Quartz.
2D/4. Level II.
- b. Implement with bruised ends. Chert.
2E/1-264. Level I.
- c. Implement with bruised end. Quartzite.
4E/6. Level III.
- d. Bifacial oval. Chert. 3D/8-164. Level III.
- e. Bifacial oval. Chert. 4D/4-7. Level II.

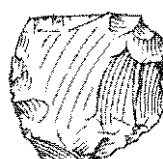
Figure VI - 27



a



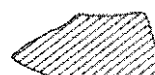
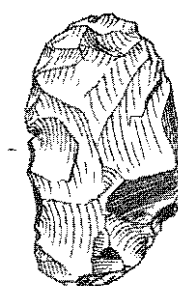
b



c



d



e

Figure VI-28 : Tyimede I

Scale 1:1

Utilised flake. Quartzite, unifacial
use-wear.
4F/1-1. Level I.

Figure VI-28

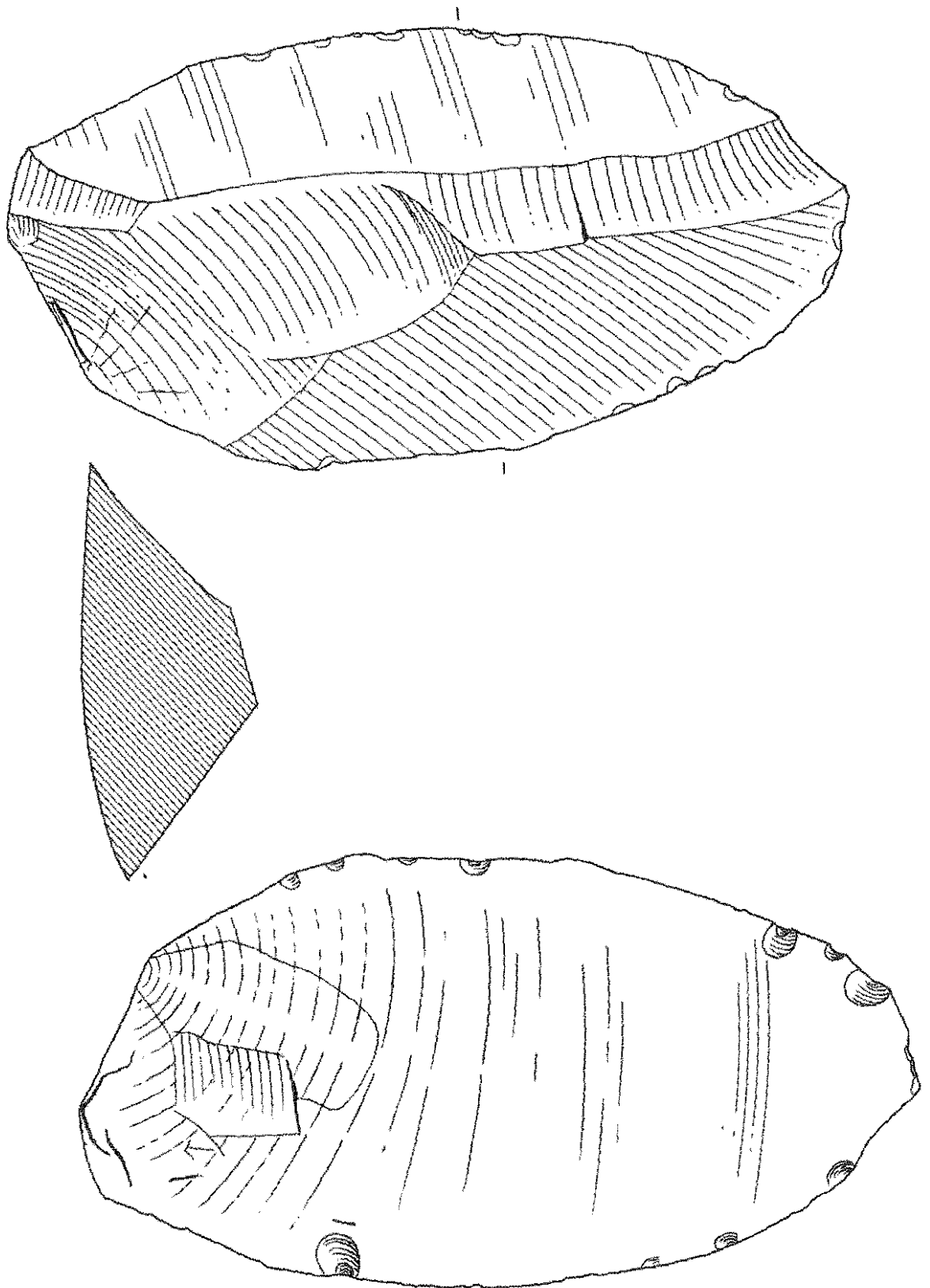


Figure VI-29 : Tyimede I

Scale 1:1

- a. Endstruck quartzite flake. Unifacial
retouch. 3F/1-1. Level I.
- b. Endstruck quartzite flake. Note the
interruption of smoothing
use-wear. 2E/1-263.
Level I.
- c. Endstruck quartzite flake. Note backing
along the side. 4F/5-30.
Level III.

Figure VI-29

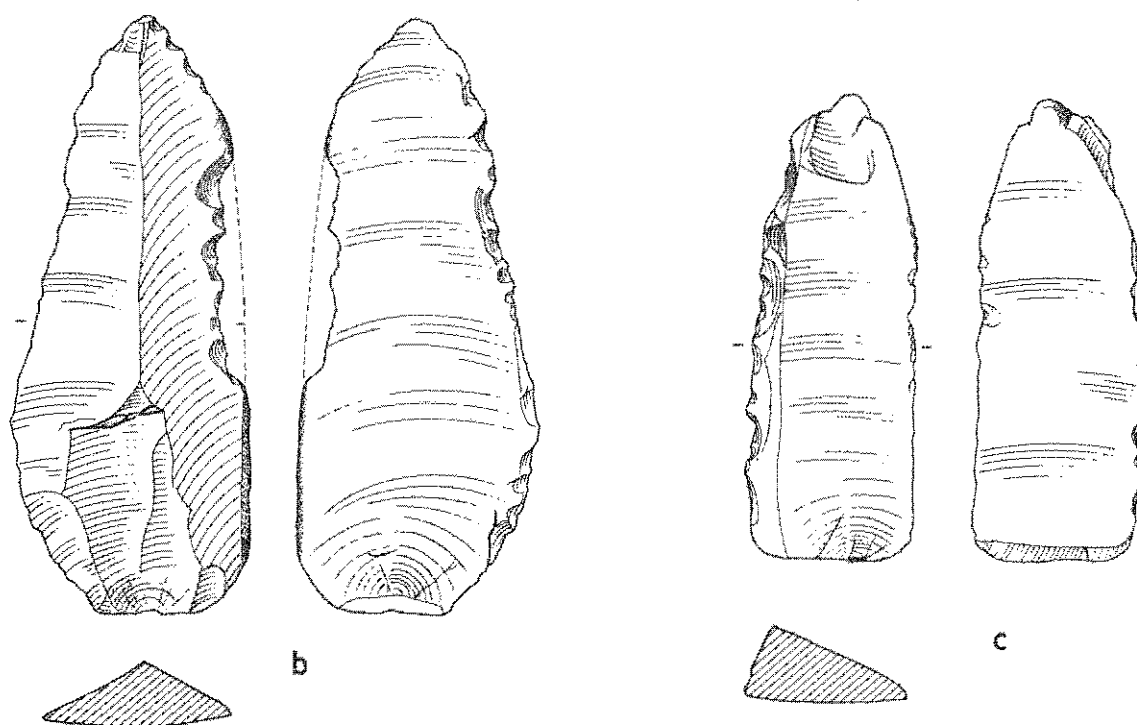
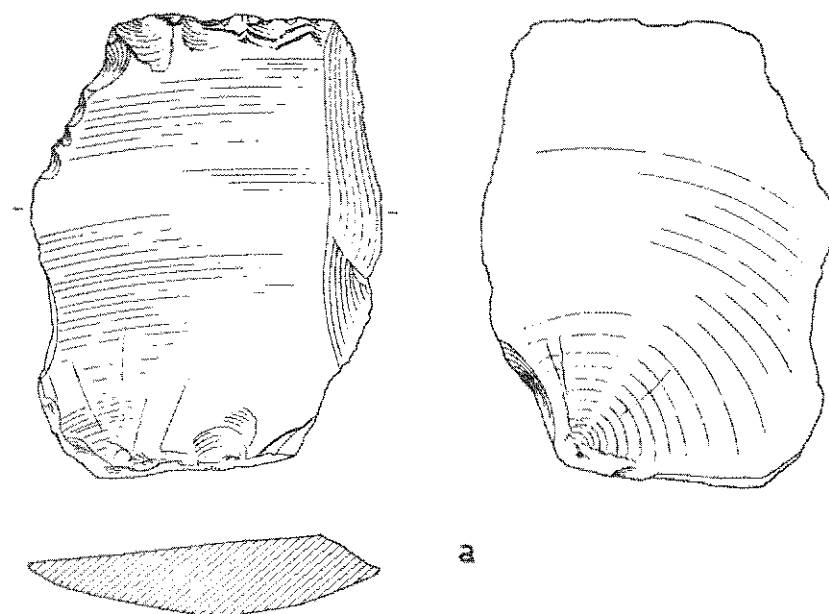


Figure VI-30 : Tyimede I

Scale 1:1

- a. Utilised flake. Chert, unifacial use-wear.
2D/7-233. Level III.
- b. Utilised flake, broken. Quartzite, use-
polish.
3E/4-17. Level II.
- c. Utilised flake, broken. Quartzite, unifacial
use-wear and use-polish.
2D/1-178. Level I.

Figure VI -30

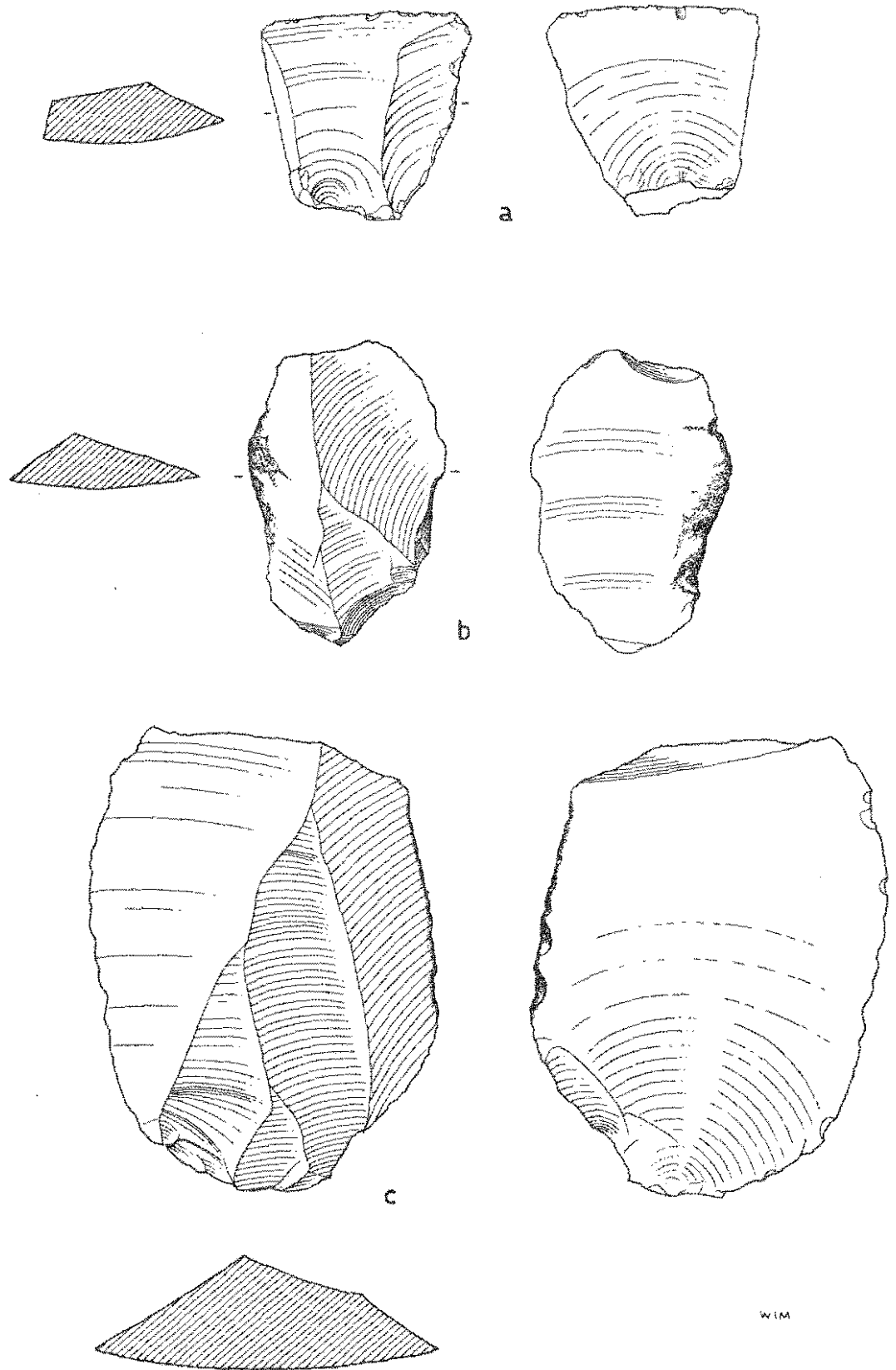


Figure VI-31 : Tyimede I

Scale 1:2

- a. Axe. Porphyritic dolorite, unground.
4E/3-1. Level I.
- b. Axe. Porphyritic dolorite, edge ground.
3E/4-15. Level II.
- c. Axe. Porphyritic dolorite, edge ground.
4E/5-22. Level II.
- d. Axe. Porphyritic dolorite, edge ground.
2E/9-326. Level III.

Figure VI - 31

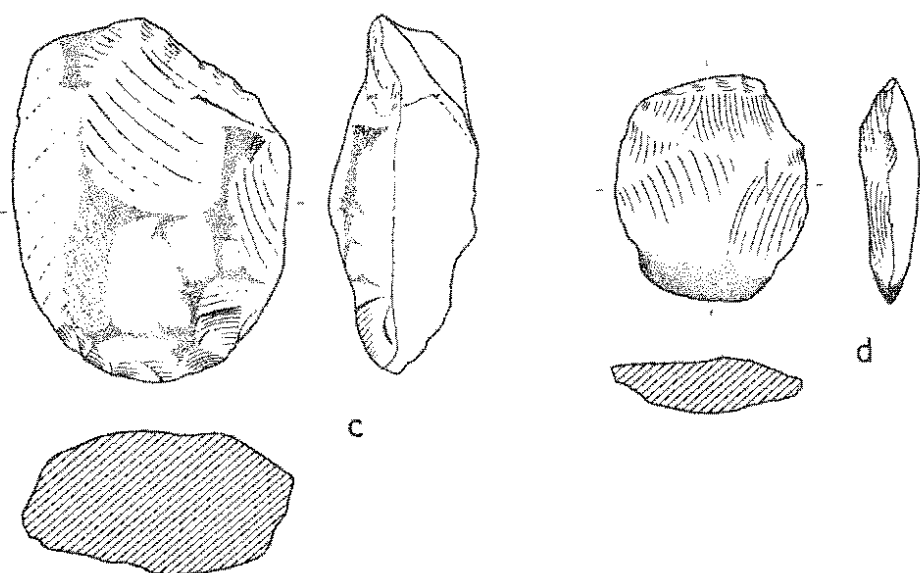
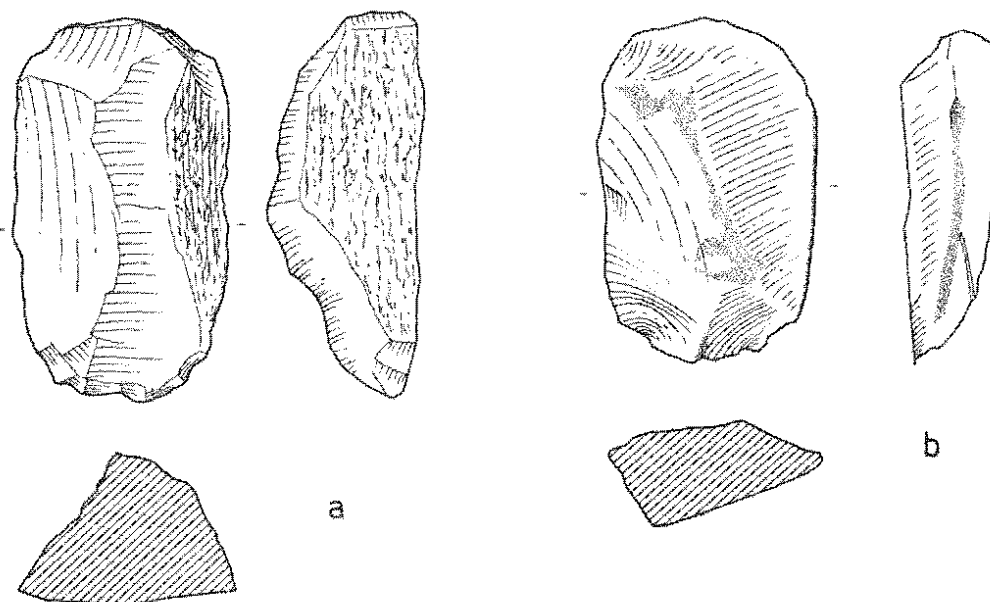
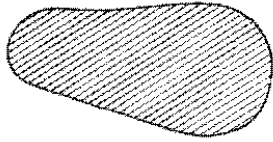
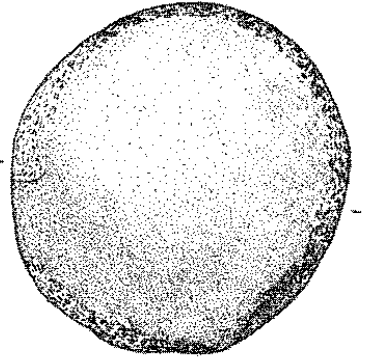
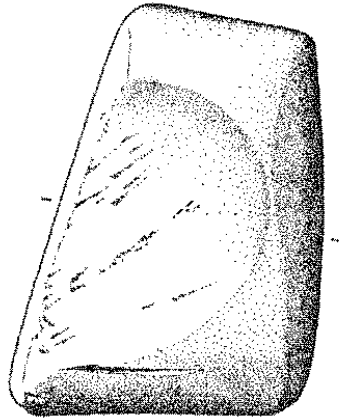


Figure VI-32 : Tyimede I

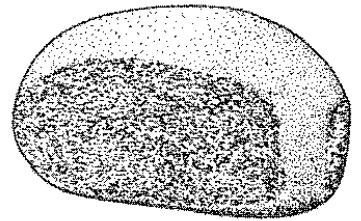
Scale 1:1

- a. Abraded fragment. Sandstone.
4C/11-143. Level III.
- b. Hammer/Pounder. Quartzite, resembling
'kulki'.
3F/4-5. Level II.
- c. Core/Core scraper. Chert, note patinated
flake scars.
3C/12-172. Level III.

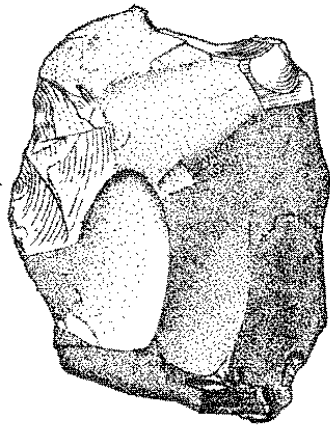
Figure VI - 32



a



b



c

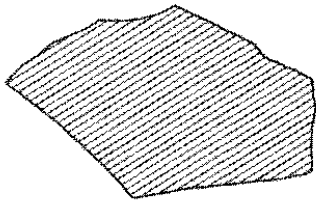
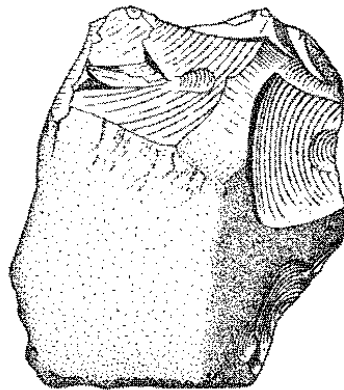


Figure VII-1

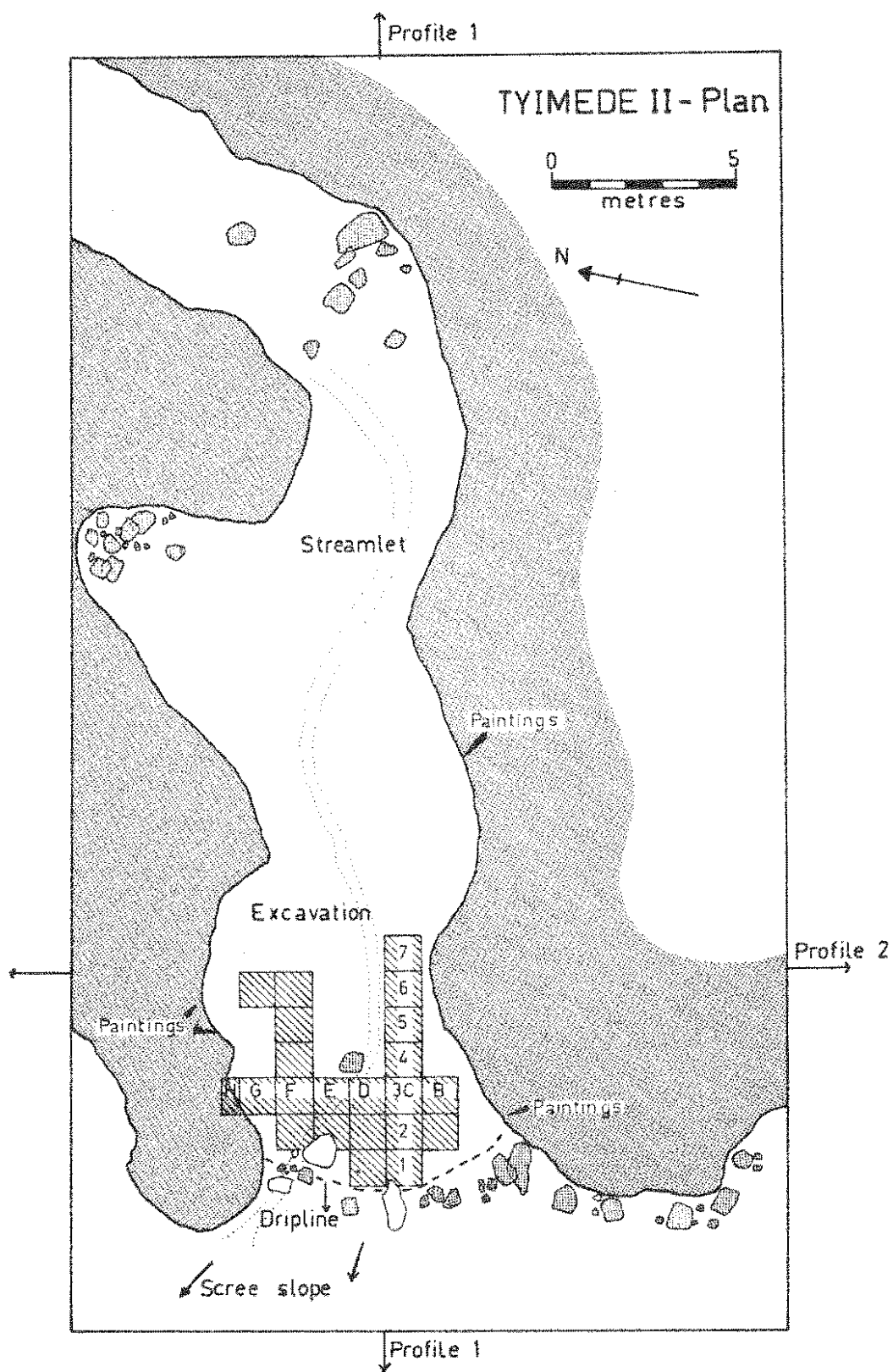


Figure VII-2

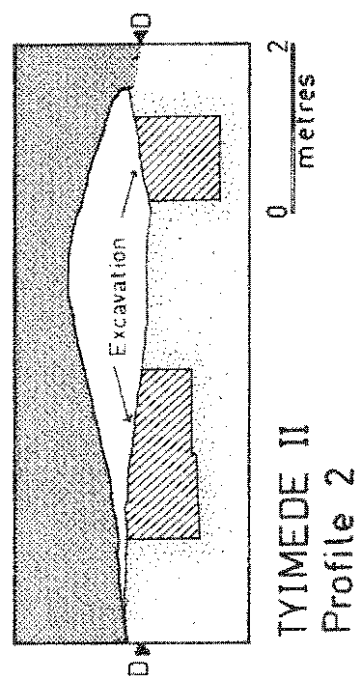
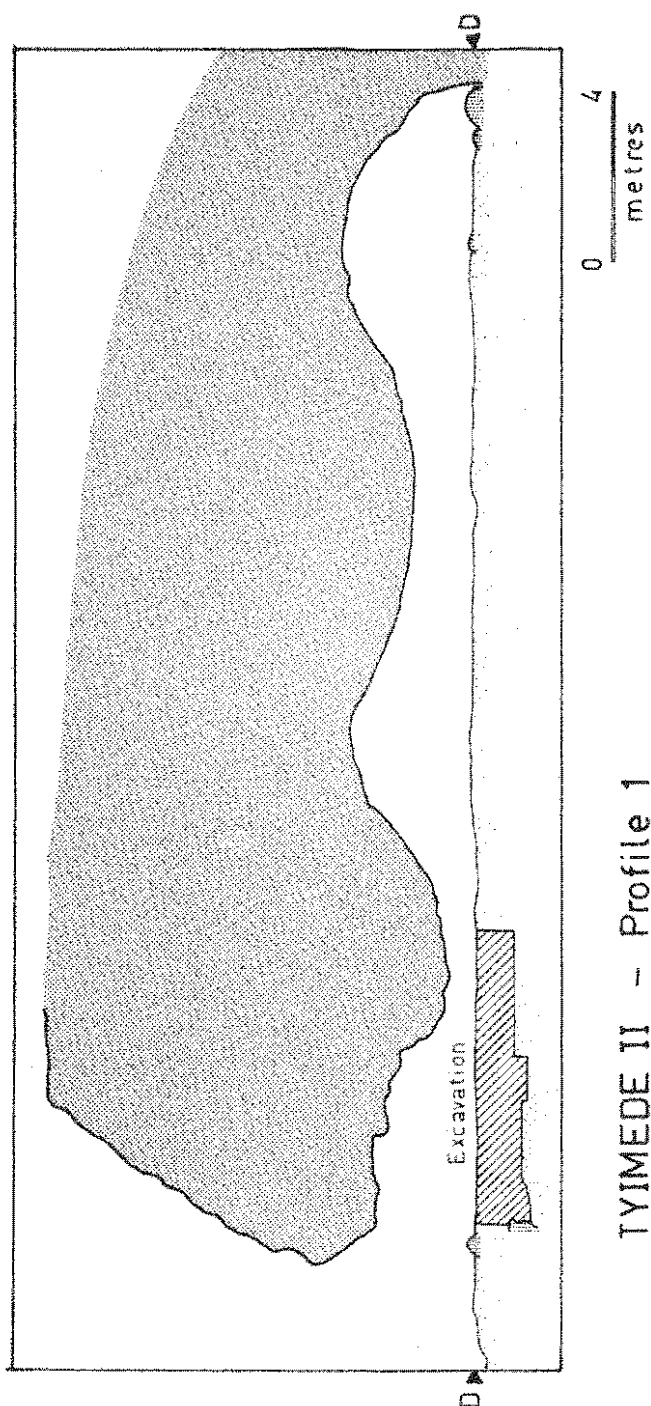
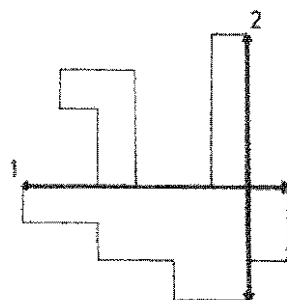
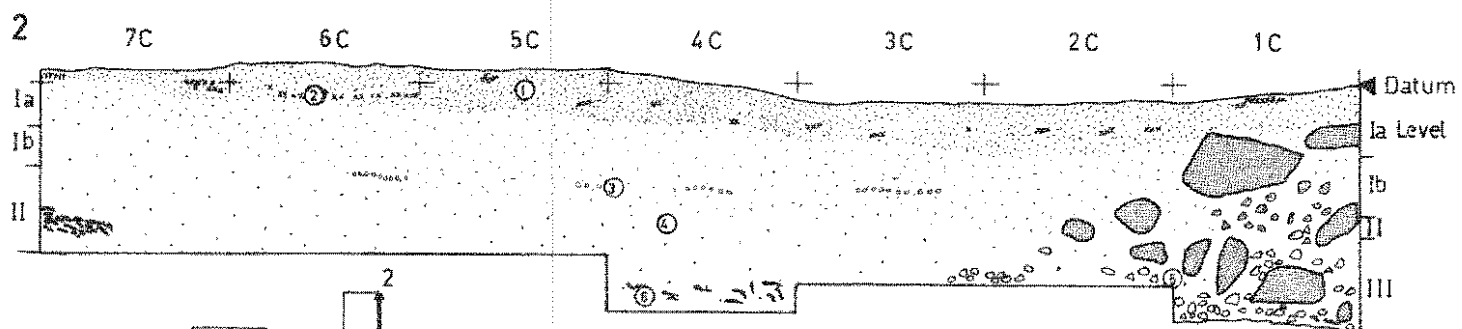
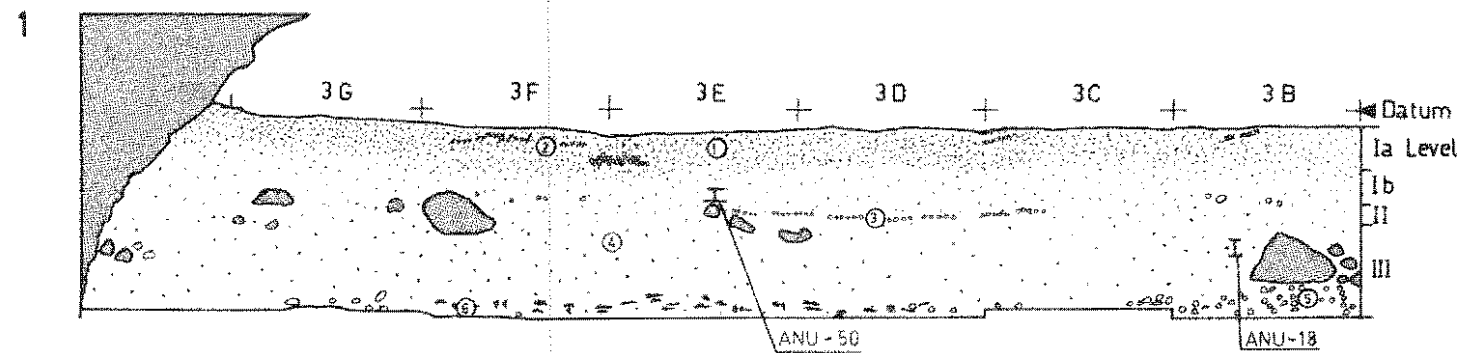


Figure VII-3 : Tyimede II

Stratigraphy of 1. East wall of 3H-3B.
2. South wall of 7C-1C.

1. Very dark grey sand (10 YR 3/1).
2. Concentrations of charcoal.
3. Concentration of tiny, rounded, quartz pebbles.
4. Yellowish brown sand. (10 YR 5/4).
5. Sandstone blocks, angular rubble and quartz pebbles.
6. Small ferruginous aggregations, yellowish brown (10 YR 5/6) to reddish-yellow (7.5 YR 6/6).



TYIMEDE II Sections

0 1
metre

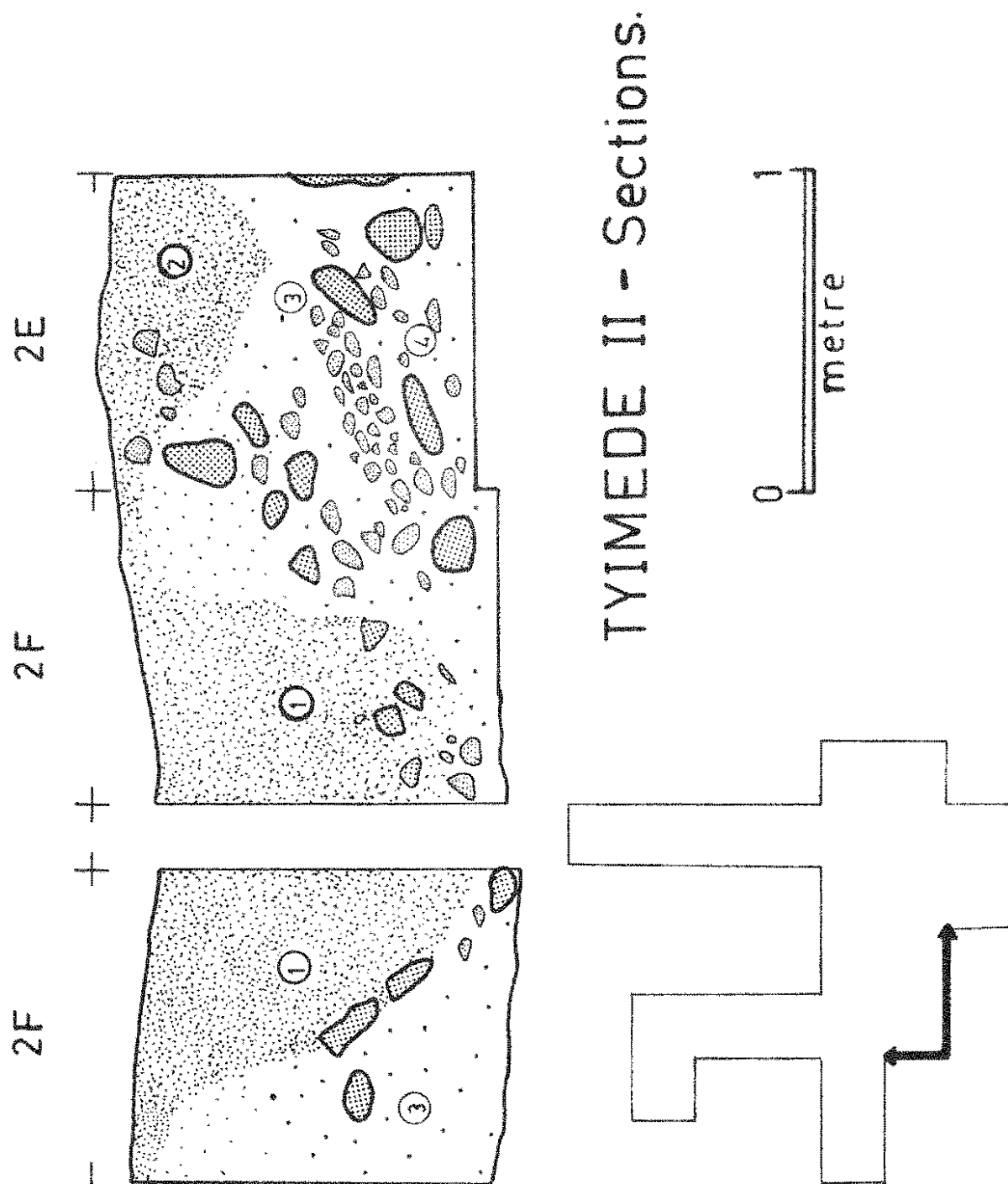
Figure VII-3

Figure VII-4 : Tyimede II

Stratigraphy of north wall of 2F and west wall of 2F and 2E.

1. Main pit, filled with dark greyish brown sand. (10 YR 3/2-4/2).
2. Smaller pit, filled with dark greyish brown sand.
3. Greyish brown sand. (10 YR 5/2).
4. Coarse rubble.

Figure VII-4



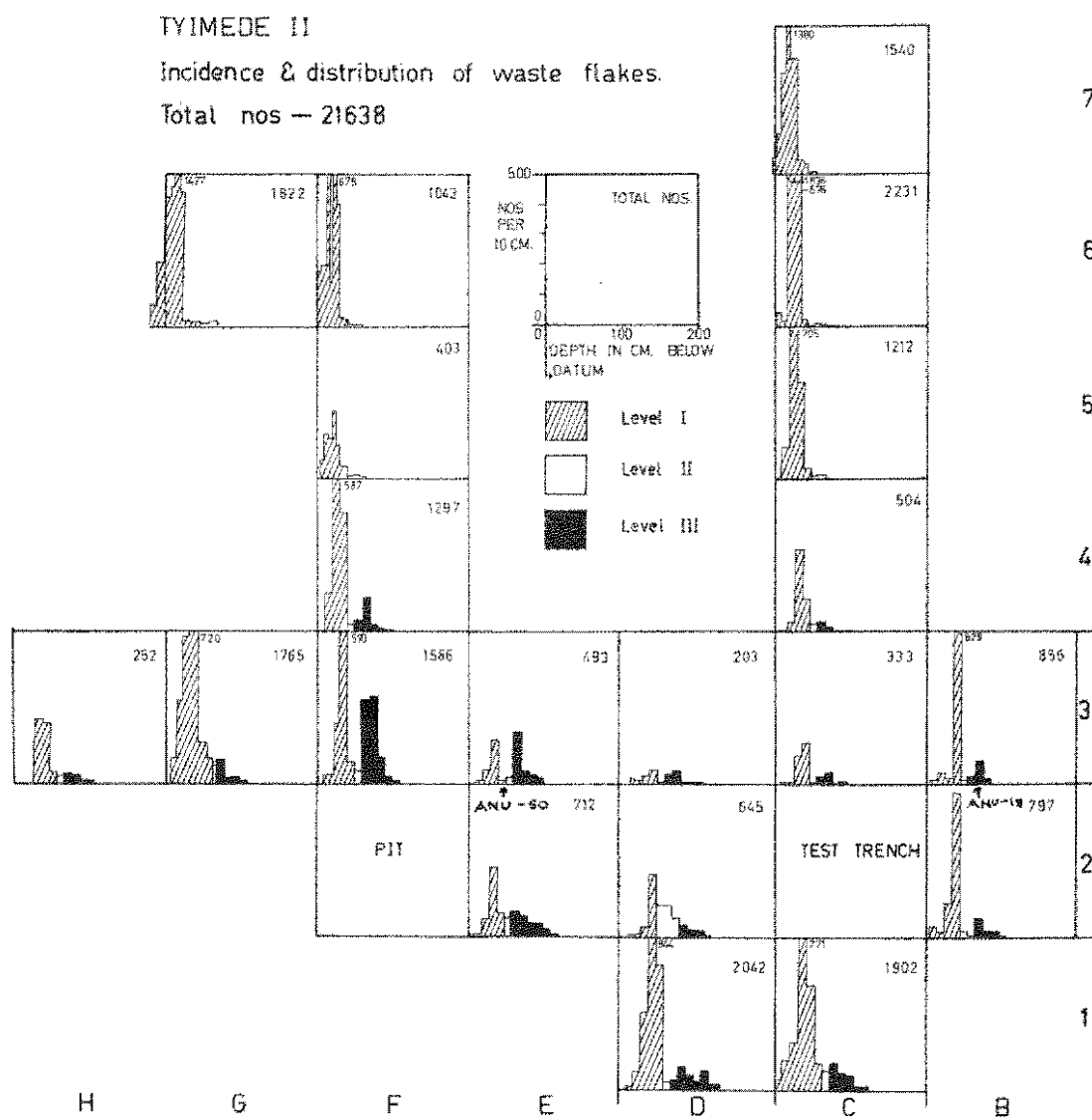


Figure VII- 6

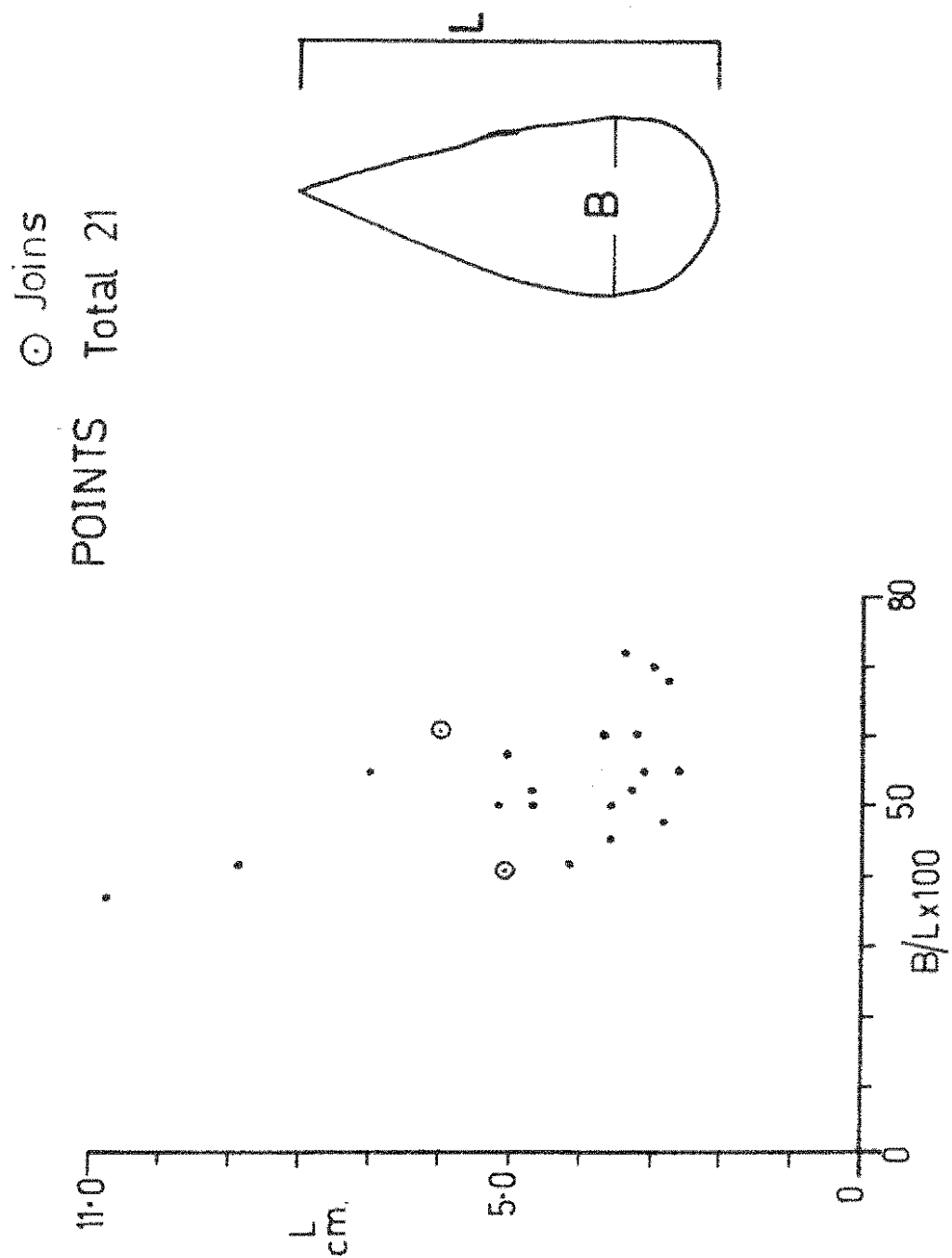


Figure VII-7

TIPS Shape
Total 55

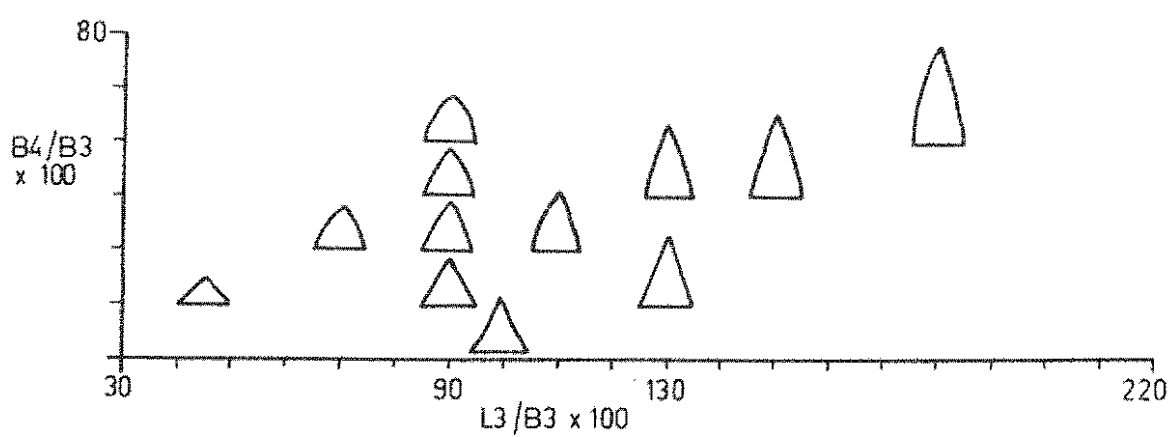
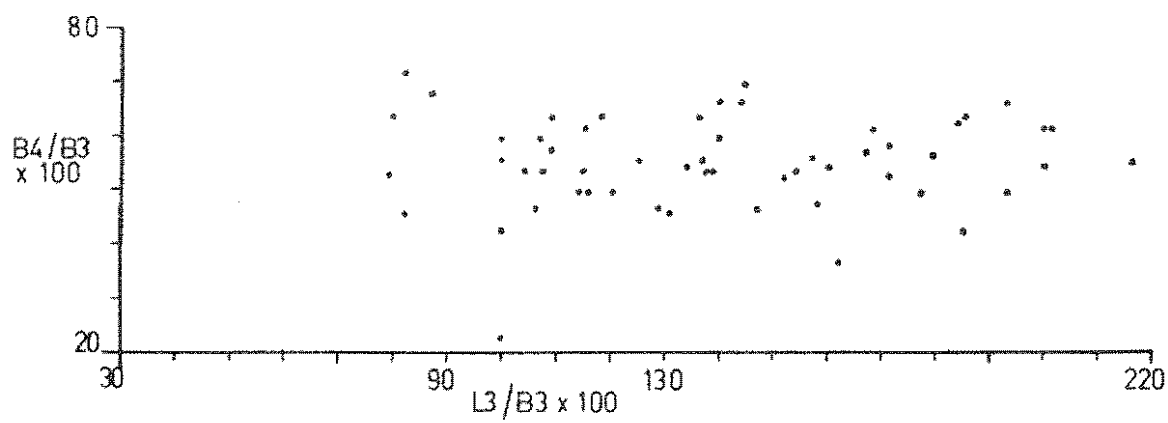
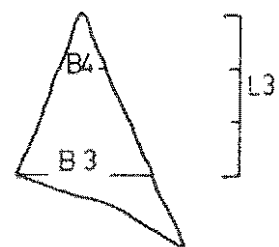
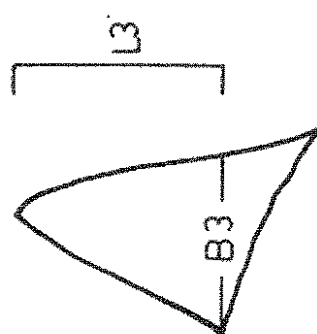


Figure VII-8



TIPS - Shape

Total 55

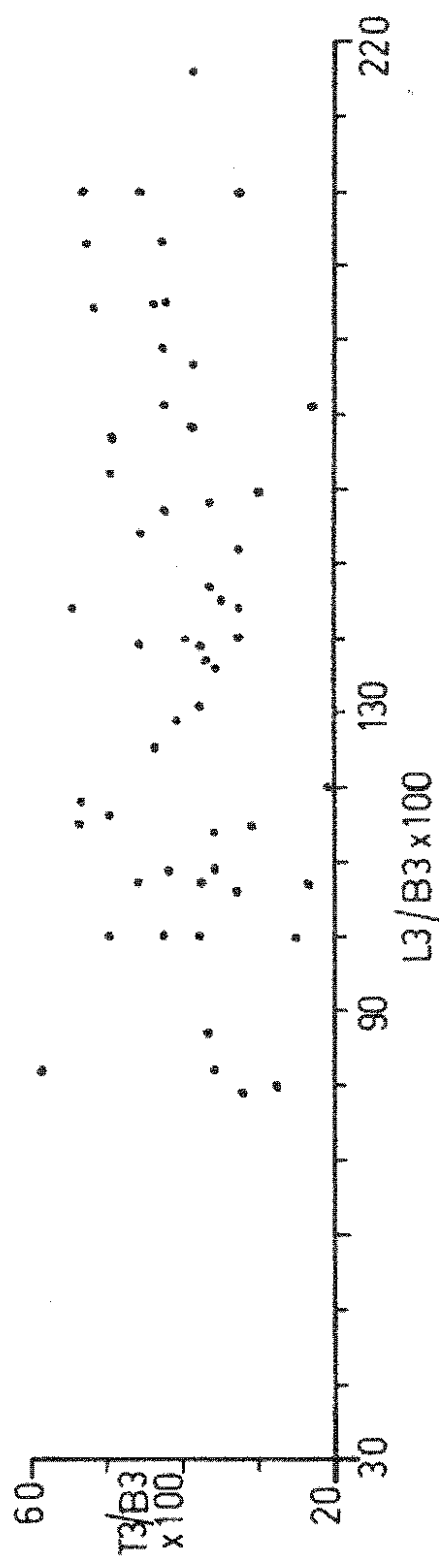


Figure VII-9 : Tyimede II

Scale 1:1

- | | | | | |
|----|--------|--|---------|-----------|
| a. | Point. | Quartzite, curved butt, bifacial
retouch. | 6F/2-1. | Level Ia. |
| b. | Point. | Quartzite, curved butt, bifacial
retouch. | 2D/4-1. | Level Ib. |
| c. | Point. | Chert, curved butt, bifacial
retouch. | 6C/3. | Level Ia. |
| d. | Point. | Quartzite, curved butt, endstruck,
unifacial retouch. | 4F/1-1. | Level Ia. |
| e. | Point. | Quartzite, square butt, endstruck,
unifacial retouch. | 4C/4. | Level Ib. |
| f. | Point. | Quartzite, asymmetrical butt,
bifacial retouch. | 6G/3. | Level Ia. |

Figure VII-9

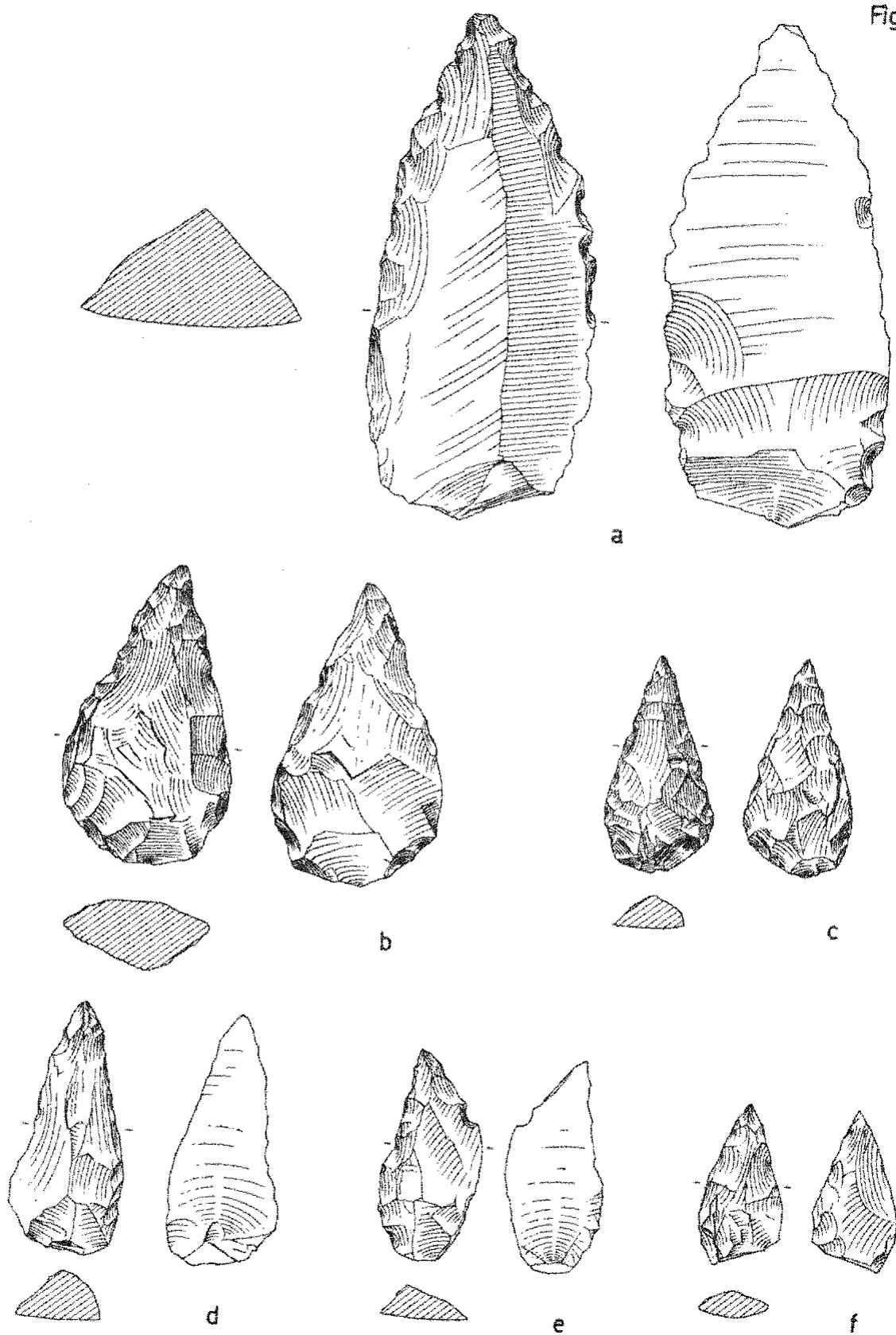
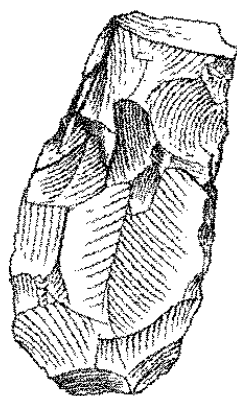
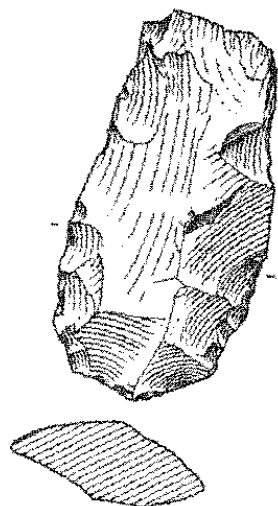


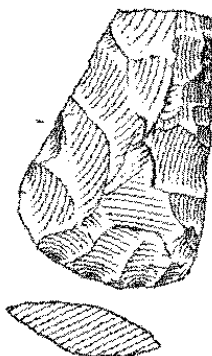
Figure VII-10 : Tyimede II

Scale 1:1

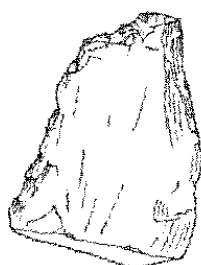
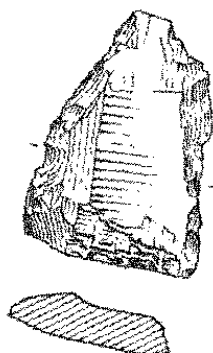
- a. Unfinished point. Quartzite. 6C/3-5.
Level Ia.
- b. Butt. Quartzite, curved butt, bifacial
retouch. 3B/4-1. Level Ib.
- c. Butt. Quartz, square butt, bifacial
retouch. 6F/2-3. Level Ia.
- d. Butt. Chert, asymmetrical butt, bifacial
retouch. 4F/3-1. Level Ib.
- e. Tip. Quartzite, slightly convex sides,
bifacial retouch.
6C/4-4. Level Ib.
- f. Tip. Quartzite, serrated edges, convex
sides, bifacial retouch.
7C/4-6. Level Ia.
- g. Tip. Quartzite, concave sides, bifacial
retouch. 3F/3-4. Level Ib.
- h. Tip. Quartzite, convex sides, bifacial
retouch. 3B/4-9. Level Ib.



a



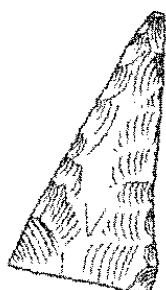
b



c



d



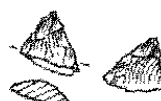
e



f



g



h

Figure VII-11 : Tyimede II

Scale 1:1

- a. Scraper. Chert, unifacial and bifacial
retouch. 6C/3-20. Level Ia.
- b. Scraper. Chert, sidestruck, unifacial and
bifacial retouch.
6G/5-16. Level Ib.
- c. Scraper. Quartzite, unifacial and bifacial
retouch. 6G/5-12. Level Ib.
- d. Scraper. Chert, endstruck, unifacial and
bifacial retouch.
6G/6-4. Level Ib.
- e. Scraper. Chert, unifacial retouch.
6C/3-21. Level Ia.
- f. Scraper. Chert, unifacial retouch.
7C/4-10. Level Ia.

Figure VII-11

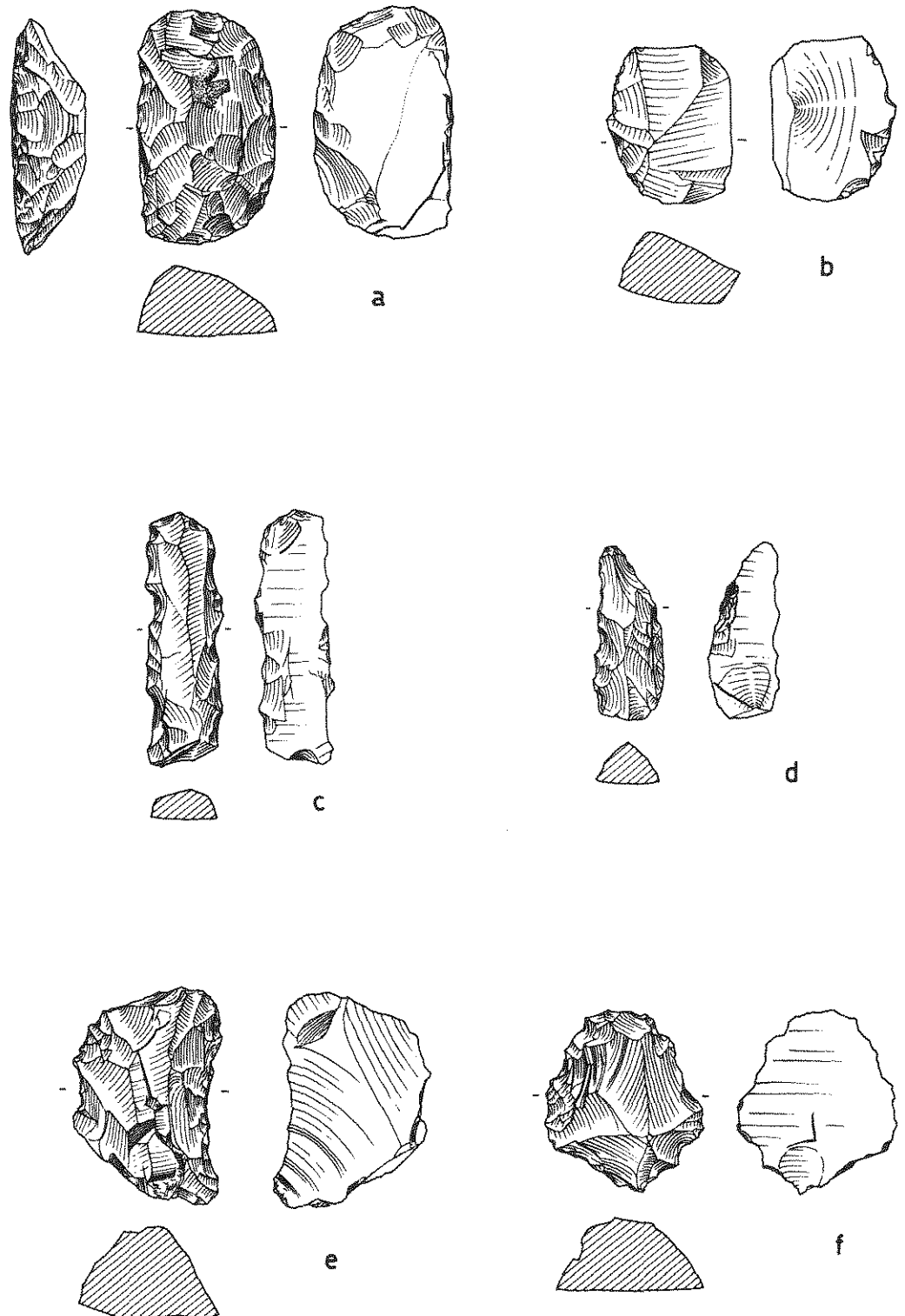


Figure VII-12 : Tyimede II

Scale 1:1

- a. Scraper, broken. Chert, unifacial retouch on alternate surfaces with a short length of bifacial retouch.
1D/5-18. Level Ib.
- b. Scraper. Chert, endstruck, unifacial and bifacial retouch.
3G/4-10. Level Ib.
- c. Scraper, broken. Chert, unifacial retouch with a short length of inverse use-wear.
1D/5-16. Level Ib.
- d. Scraper, broken. Chert, unifacial retouch.
6F/5-7. Level Ib.
- e. Miscellaneous. Quartzite, ?bifacial point, ? oval.
2D/4-2. Level Ib.
- f. Bifacial oval. Quartz. 1D/5-3. Level Ib.
- g. Bifacial oval. Quartzite, 6C/4. Level Ib.

Figure VII -12

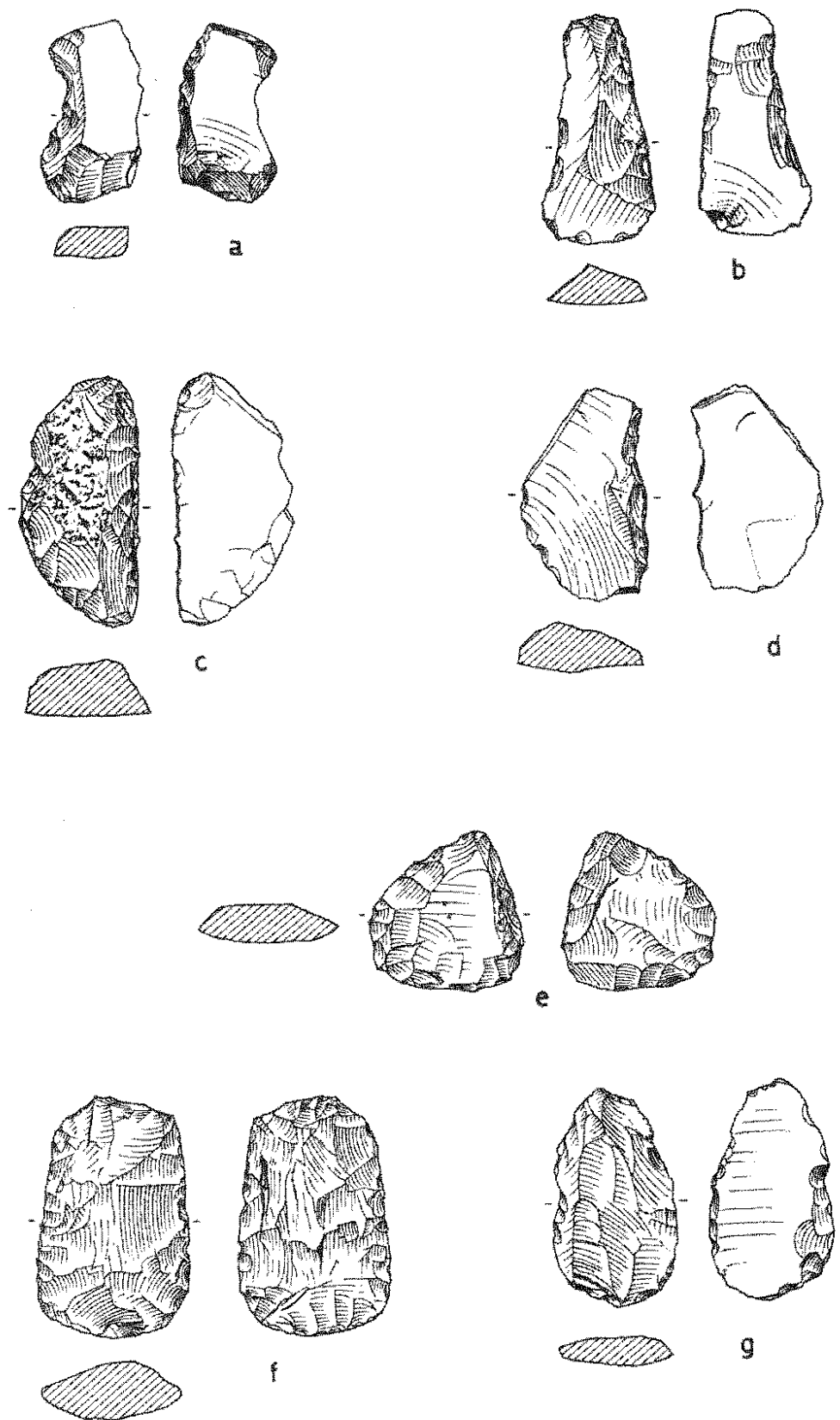
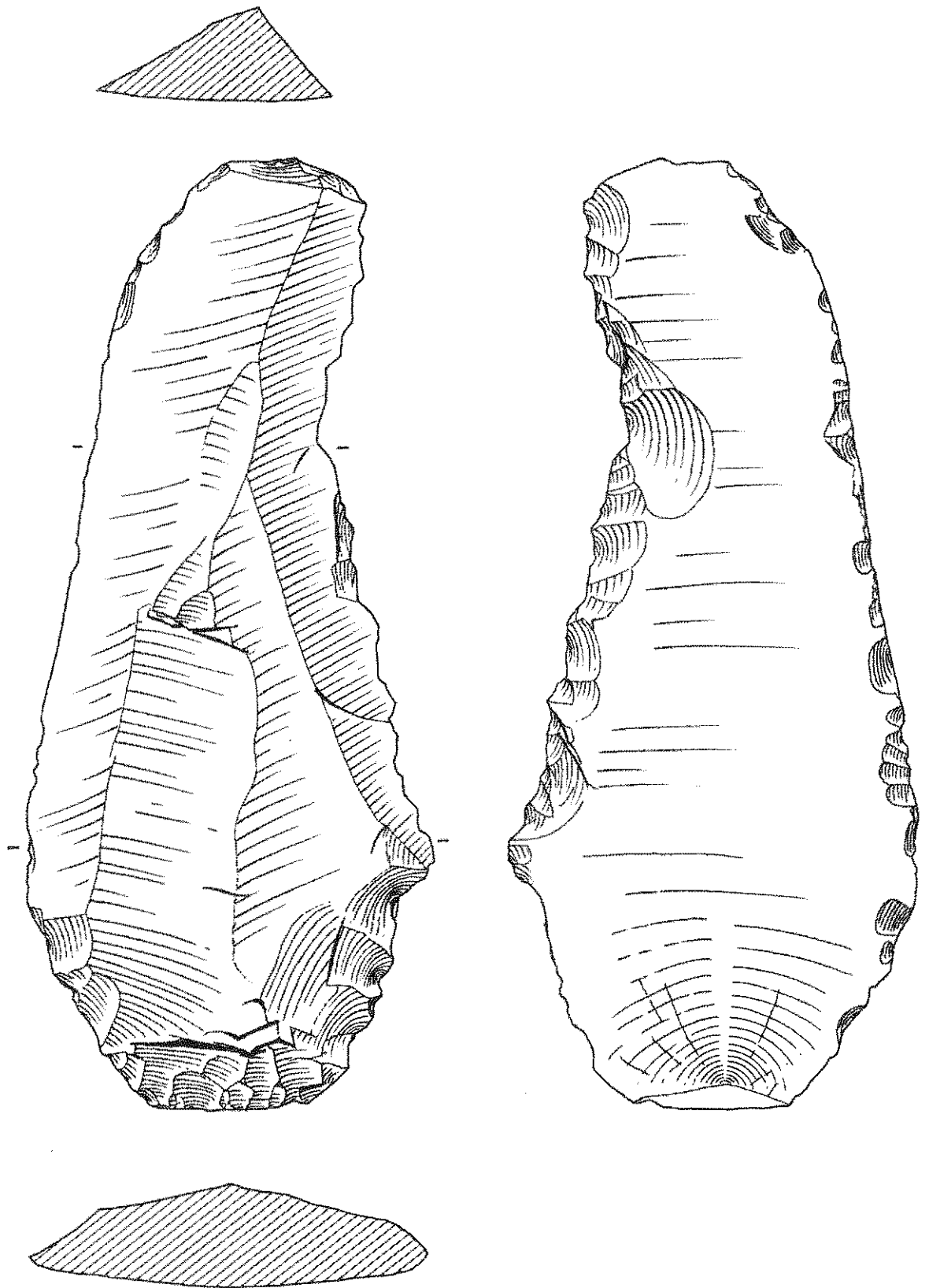


Figure VII-13 : Tyimede II

Scale 1:1

Endstruck quartzite flake. Unifacial retouch.
6C/2-1. Level Ia.

Figure VII-13



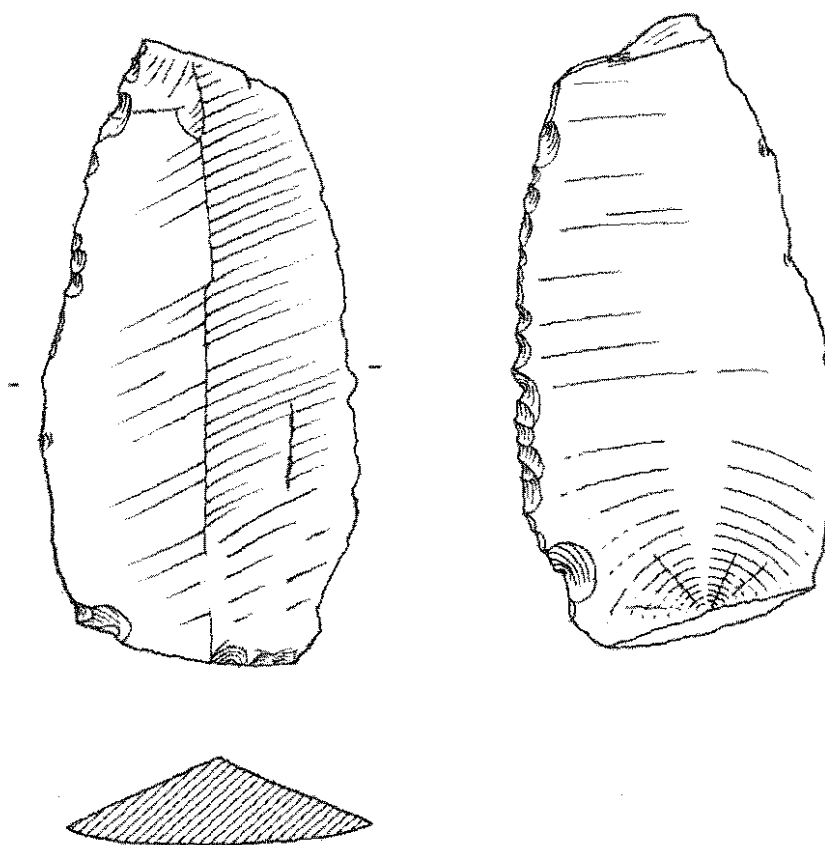
W1M

Figure VII-14 : Tyimede II

Scale 1:1

Broken endstruck quartzite flake. Mainly unifacial
retouch.
3G/3-1. Level Ia.

Figure VII-14



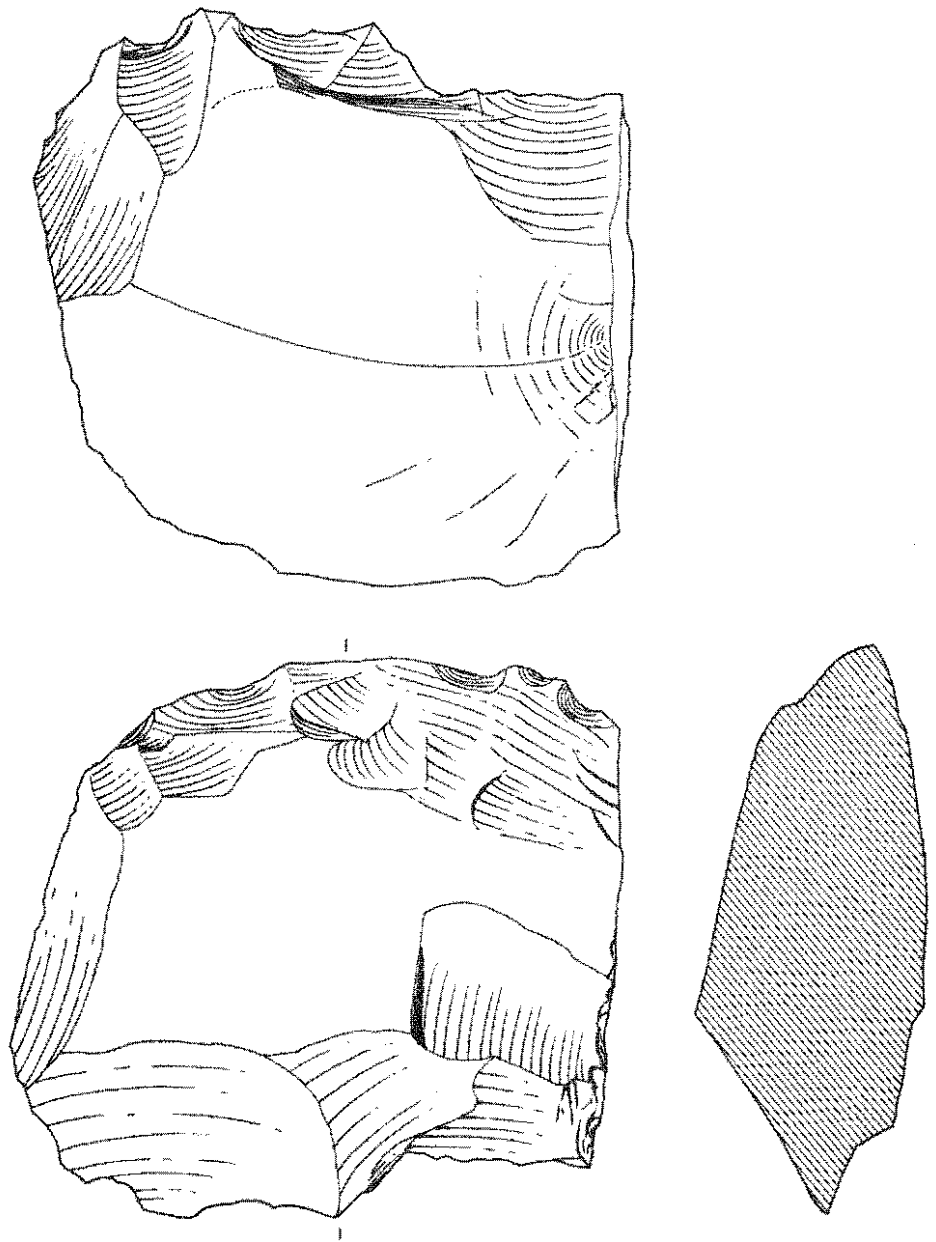
WIM

Figure VII-15 : Tyimede II

Scale 1:1

Core/Core scraper. Quartzite, unifacial
retouch on both surfaces.
7C/4-10. Level Ia.

Figure VII - 15



WIM

Figure VII-16 : Tyimede II

Scale 1:1

- | | | |
|----|------------------|---|
| a. | Scraper. | Quartzite, note cross-section shaped like a right angled triangle.
3G/2-1. Level Ia. |
| b. | Scraper, broken. | Quartzite. Note cross-section shaped like a right angled triangle, and use-polish.
1D/4. Level Ib. |
| c. | Utilised flake. | Chert, unifacial use-wear.
3F/4-5. Level Ib. |
| d. | Utilised flake. | Quartzite, endstruck, use-polish.
6G/3-12. Level Ia. |

Figure VII-16

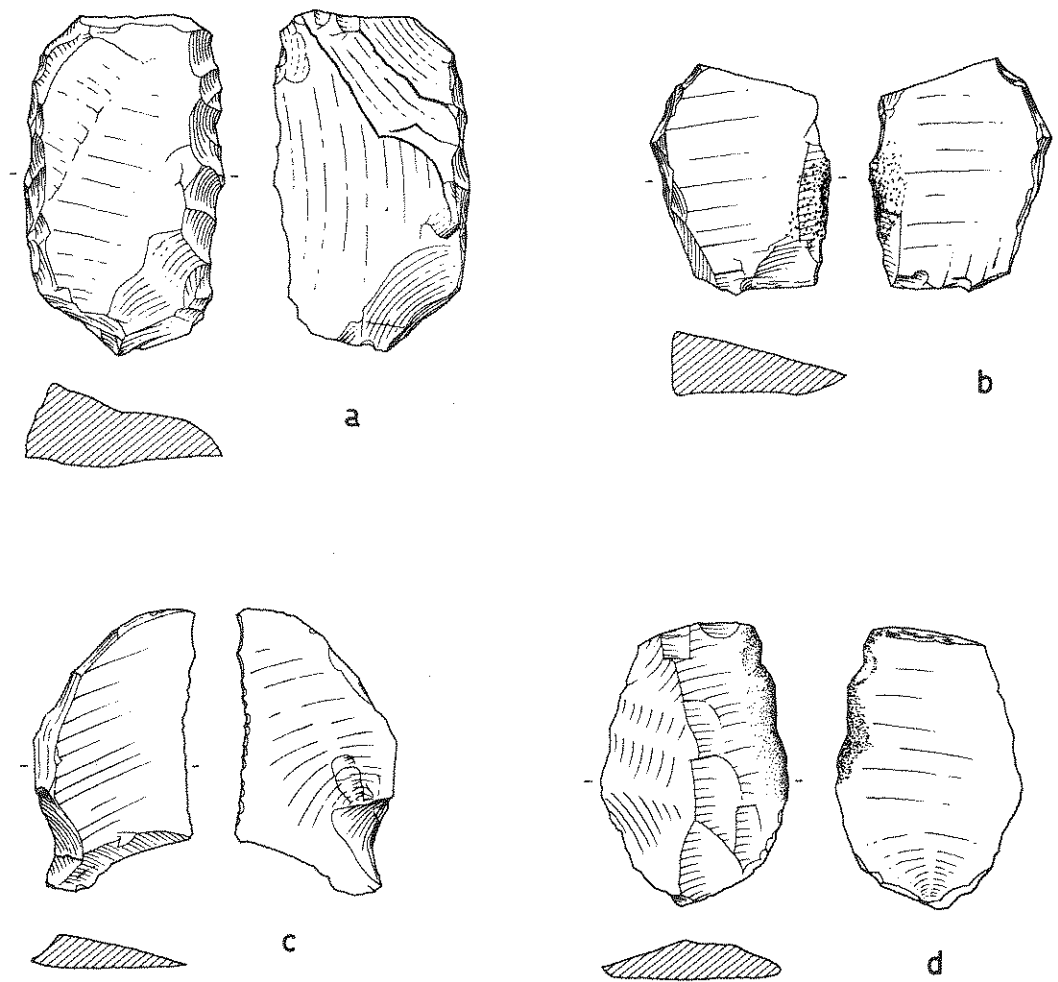


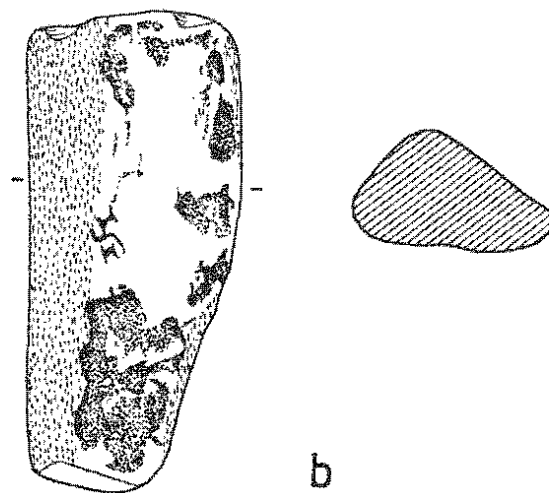
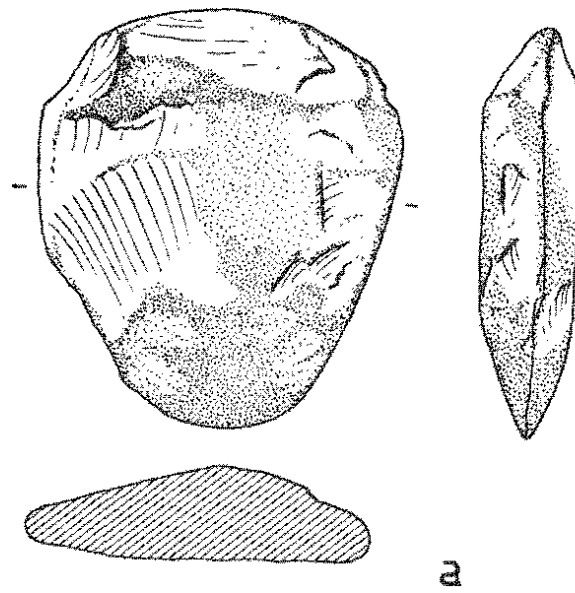
Figure VII-17 : Tyimede II

Scale 1:1

- a. Axe. Porphyritic dolomite, edge ground.
 6G/3-24. Level Ia.

- b. Abraded fragment. Schist, note yellow ochre.
 3F/7-2. Level III.

Figure VII -17



WIM

Figure VII-18 : Tyimede II

Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
 1C/4-20. Level Ib.
- b. Axe. Porphyritic dolorite, edge ground.
 1C/4-19. Level Ib.
- c. Axe. Porphyritic dolorite, edge ground.
 1D/5-2. Level Ib.

Figure VII-18



Figure VII-19 : Tyimede II

Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
 2B/5-1. Level II.
- b. Axe. Porphyritic dolorite, edge ground.
 3F/5-4. Level II.
- c. Axe. Porphyritic dolorite, edge ground.
 3C/4-1. Level II.

Figure VII-19

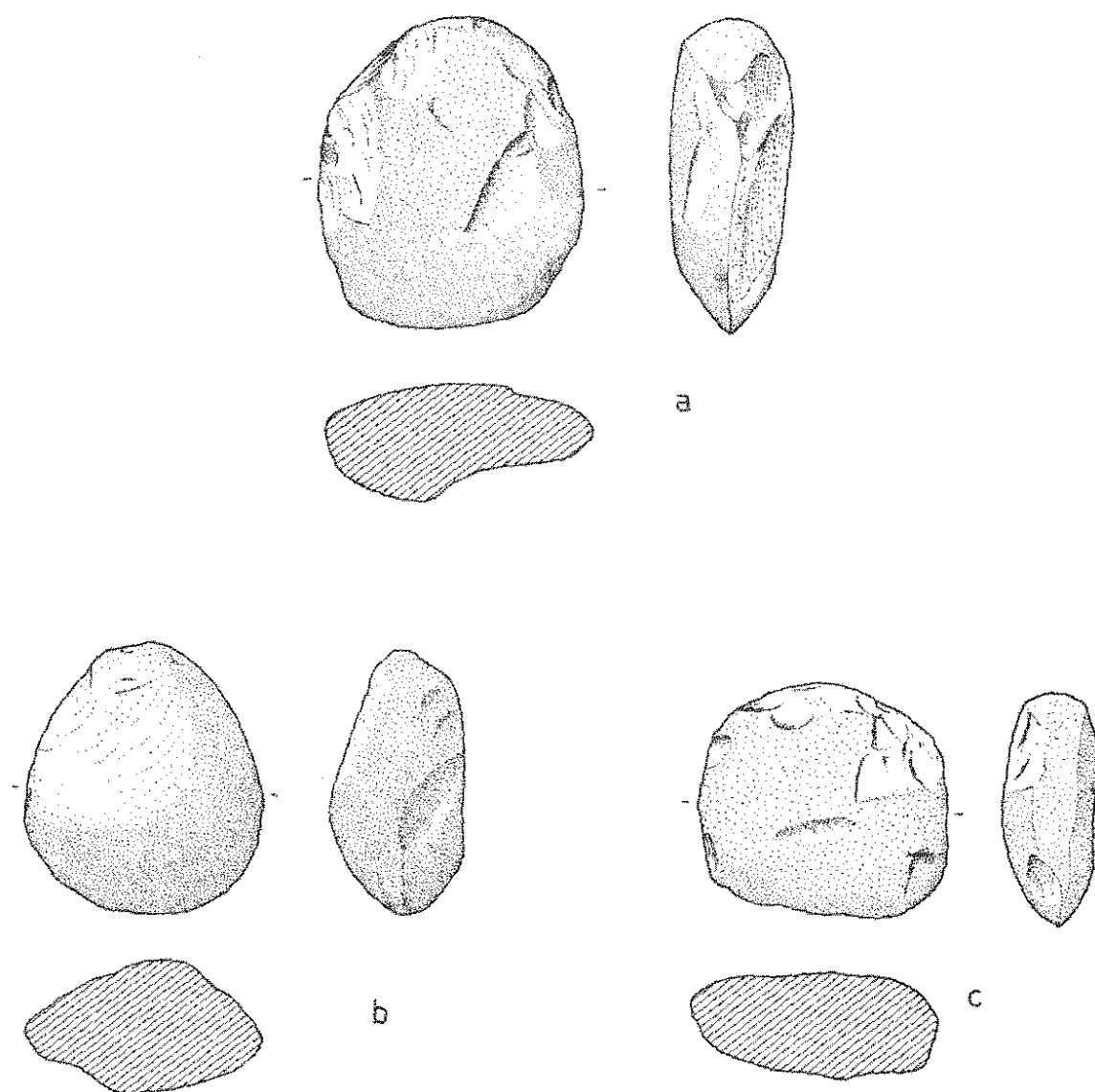


Figure VII-20 : Tyimede II

Scale 1:1

- | | |
|--------------------|--|
| a. Butt. | Chert, curved butt, bifacial
retouch.
2D/6-1. Level II. |
| b. Scraper. | Quartzite, unifacial retouch.
2D/5,6-4. Level II. |
| c. Utilised flake. | Quartzite, thermal fracture,
unifacial and bifacial use-wear.
2E/7-1. Level III. |

Figure VII-20

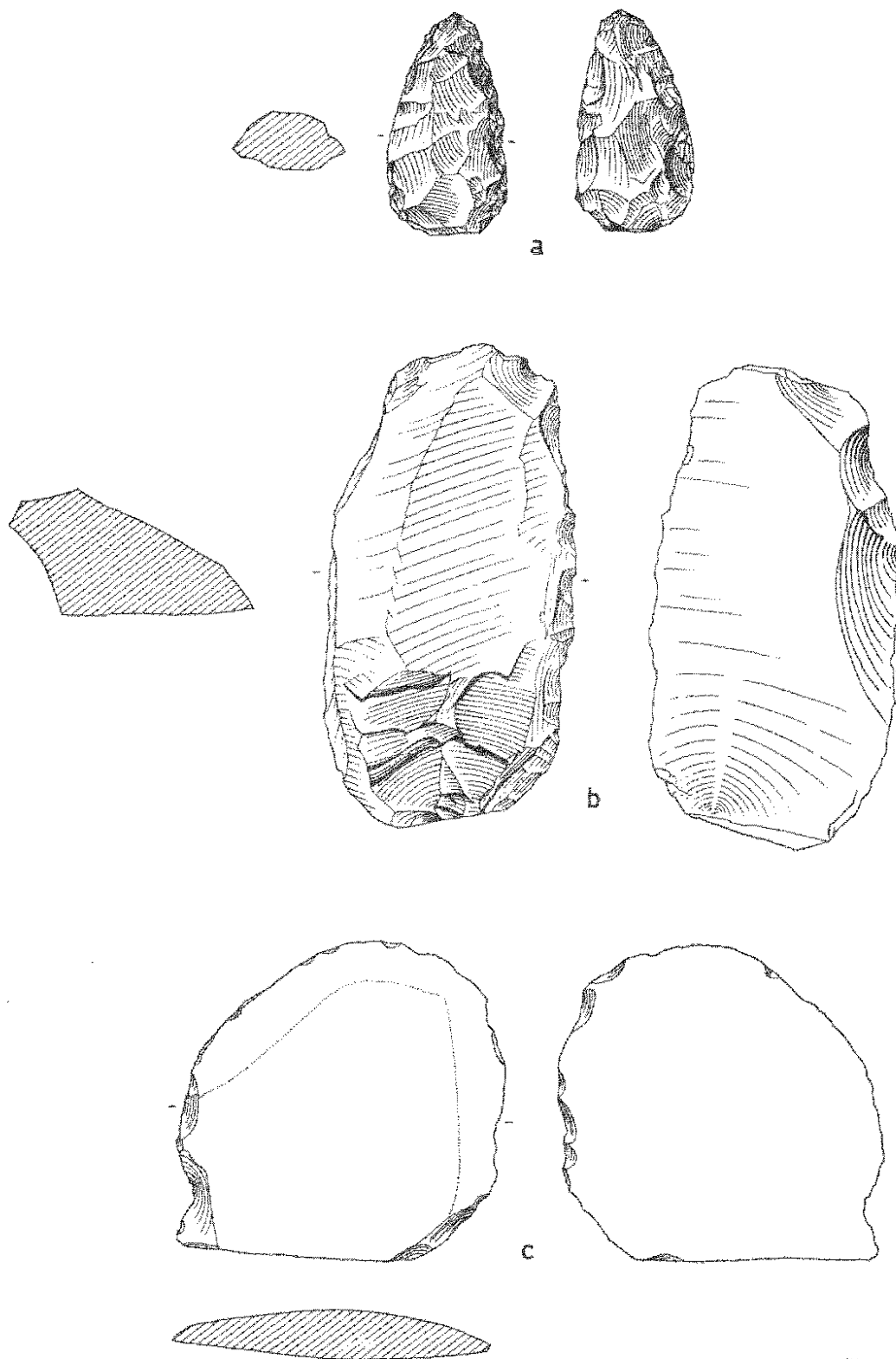
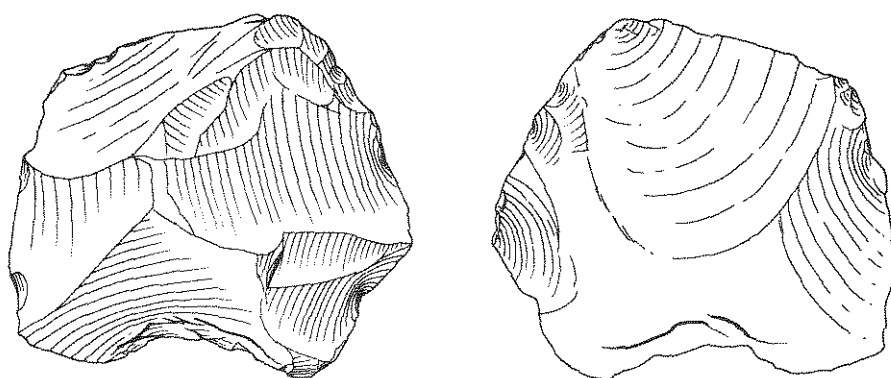


Figure VII-21 : Tyimede II

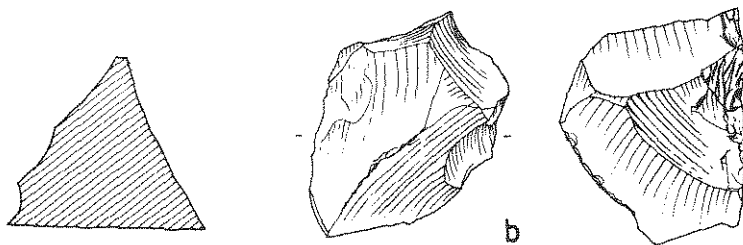
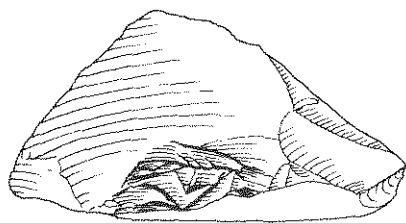
Scale 1:1

- a. Scraper. Quartzite, note heavily step flaked edge.
3G/8-4. Level III.
- b. Scraper. Chert, note heavy step flaking on one edge and unifacial use-wear on crest.
3C/7-1. Level III.
- c. Scraper. Quartzite, unifacial retouch on alternate surfaces. Note heavy step flaking.
3F/6-1. Level III.

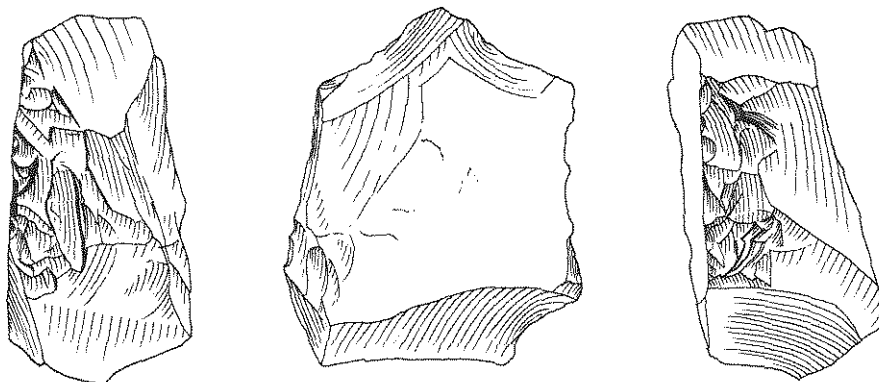
Figure VII - 21



a



b



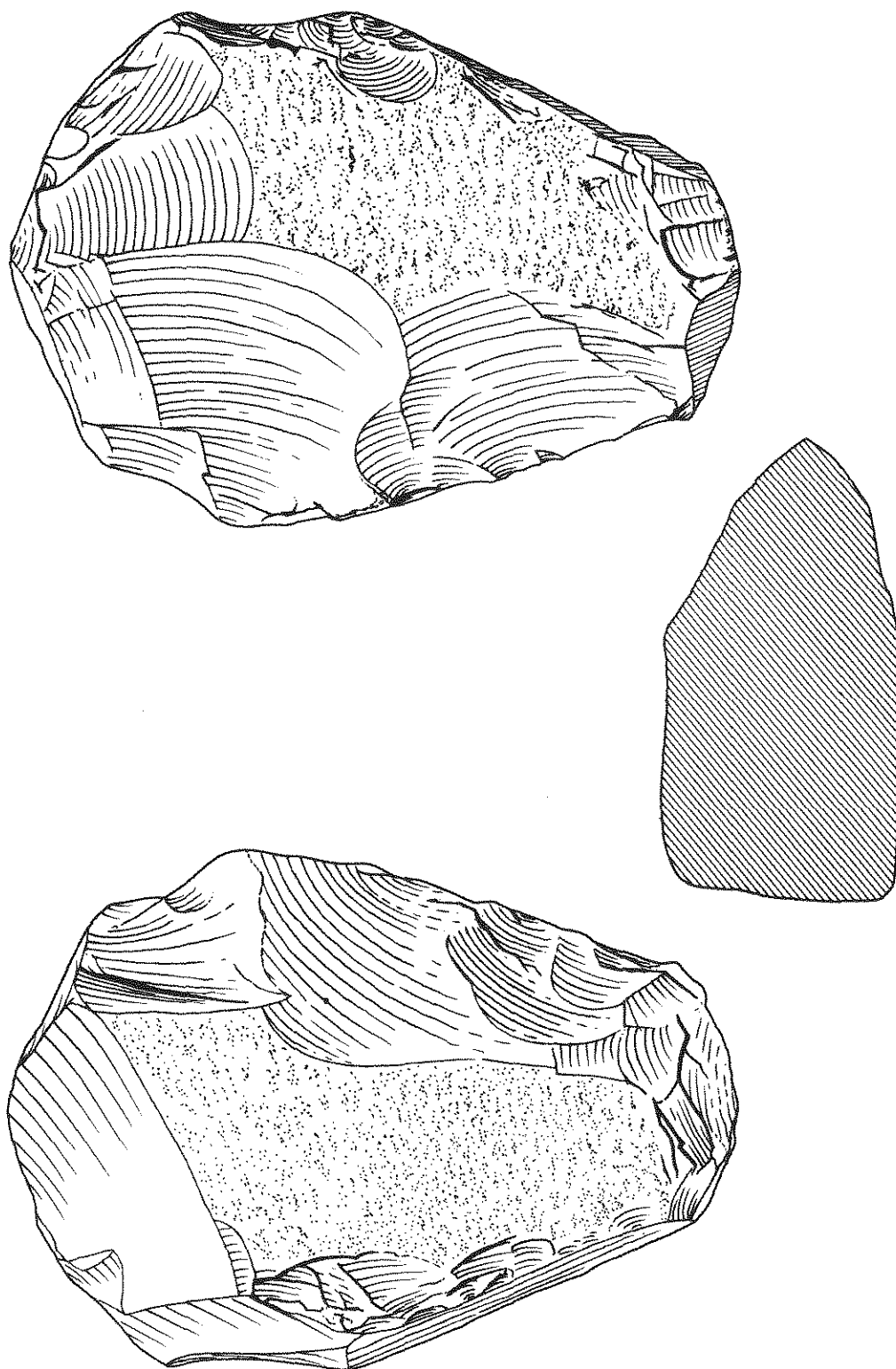
c

Figure VII-22 : Tyimede II

Scale 1:1

Core/Core scraper. Quartzite, bifacial
retouch.
3E/6-1. Level III.

Figure VII- 22



W/M

Figure VII-23 : Tyimede II

Scale 1:1

- a. Utilised lump. Quartzite, with thermal flake scars. Unifacial use-wear.
3G/8-5. Level III.
- b. Utilised flake. Chert, unifacial and bifacial use-wear. The flake is heavily patinated on one surface.
3E/7-1. Level III.
- c. Utilised flake. Chert, unifacial and bifacial use-wear.
2B/8-1. Level III.
- d. Utilised flake. Chert, bifacial use-wear.
1C/9-4. Level III.

Figure VII-23

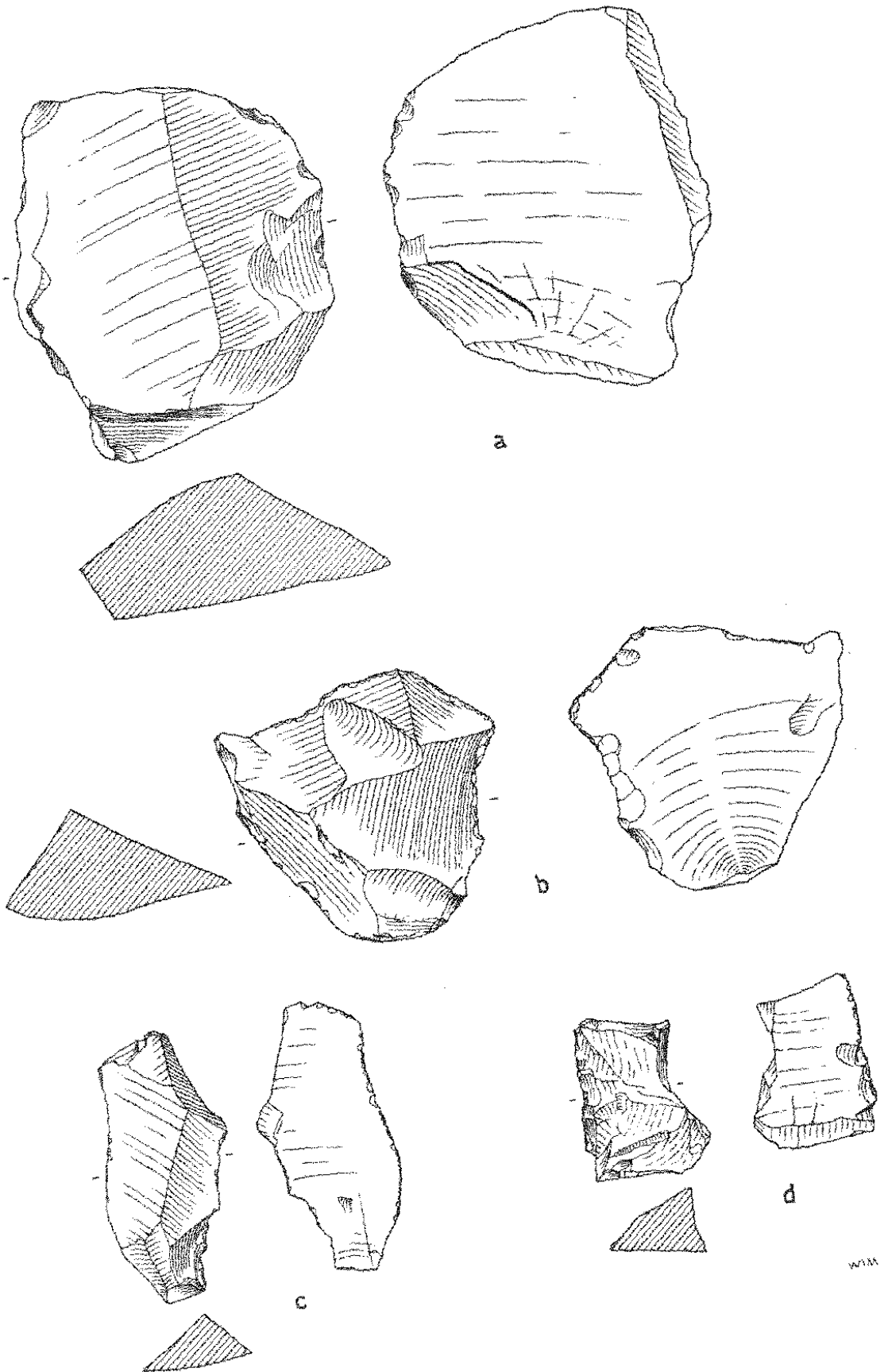
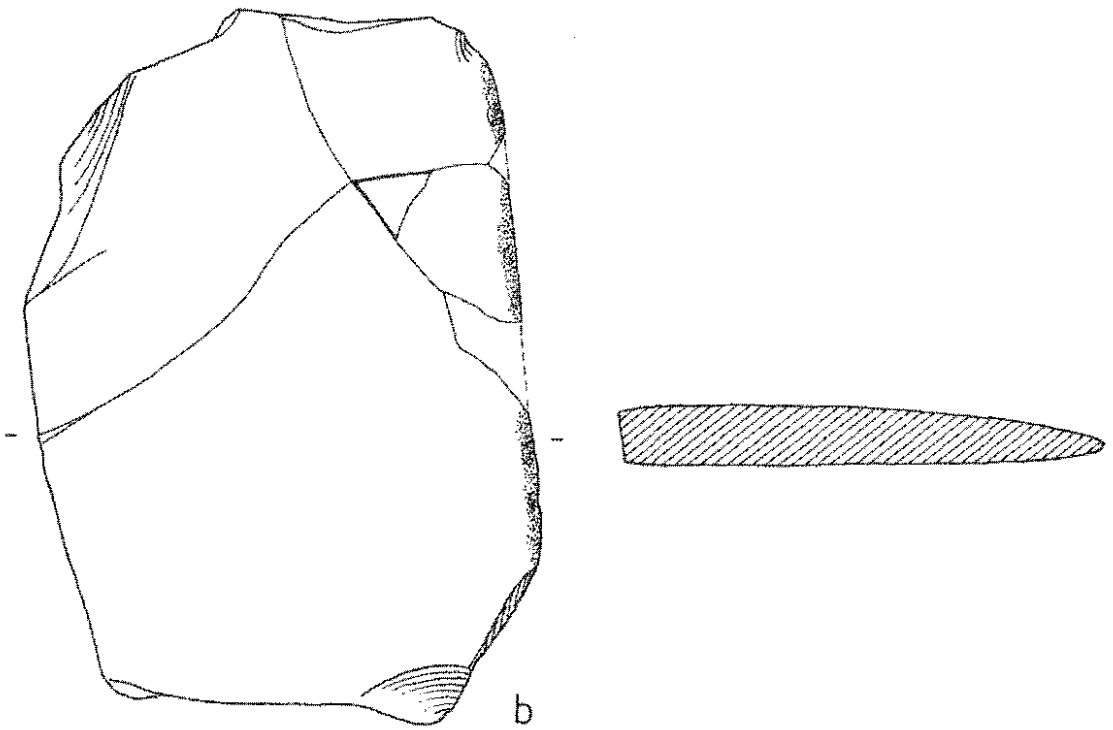
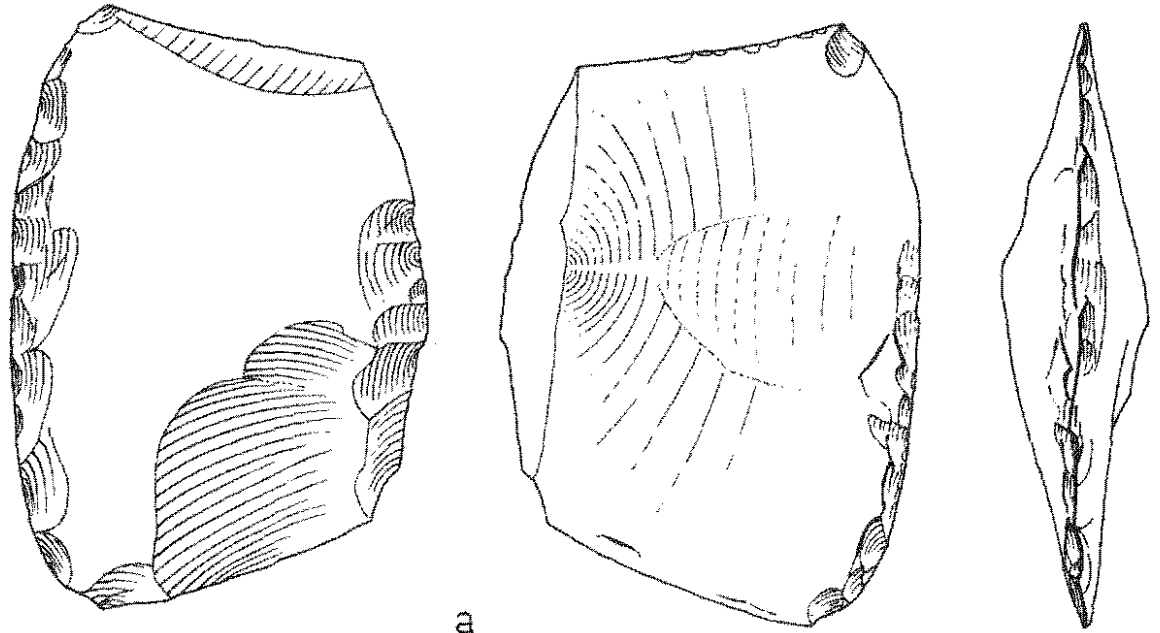


Figure VII-24 : Tyimede II

Scale 1:1

- a. ? Hatchet. Quartzite. 3D/9-1. Level III.
- b. ? Hatchet. Quartzite. 2E/8-8. Level III.

Figure VII-24



WIM

Figure VII-25 : Tyimede II

Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
3G/8-1. Level III.
- b. Axe. Porphyritic dolorite, edge ground.
3G/8-3. Level III.
- c. Axe. Porphyritic dolorite.
3G/8-2. Level III.

Figure VII-2

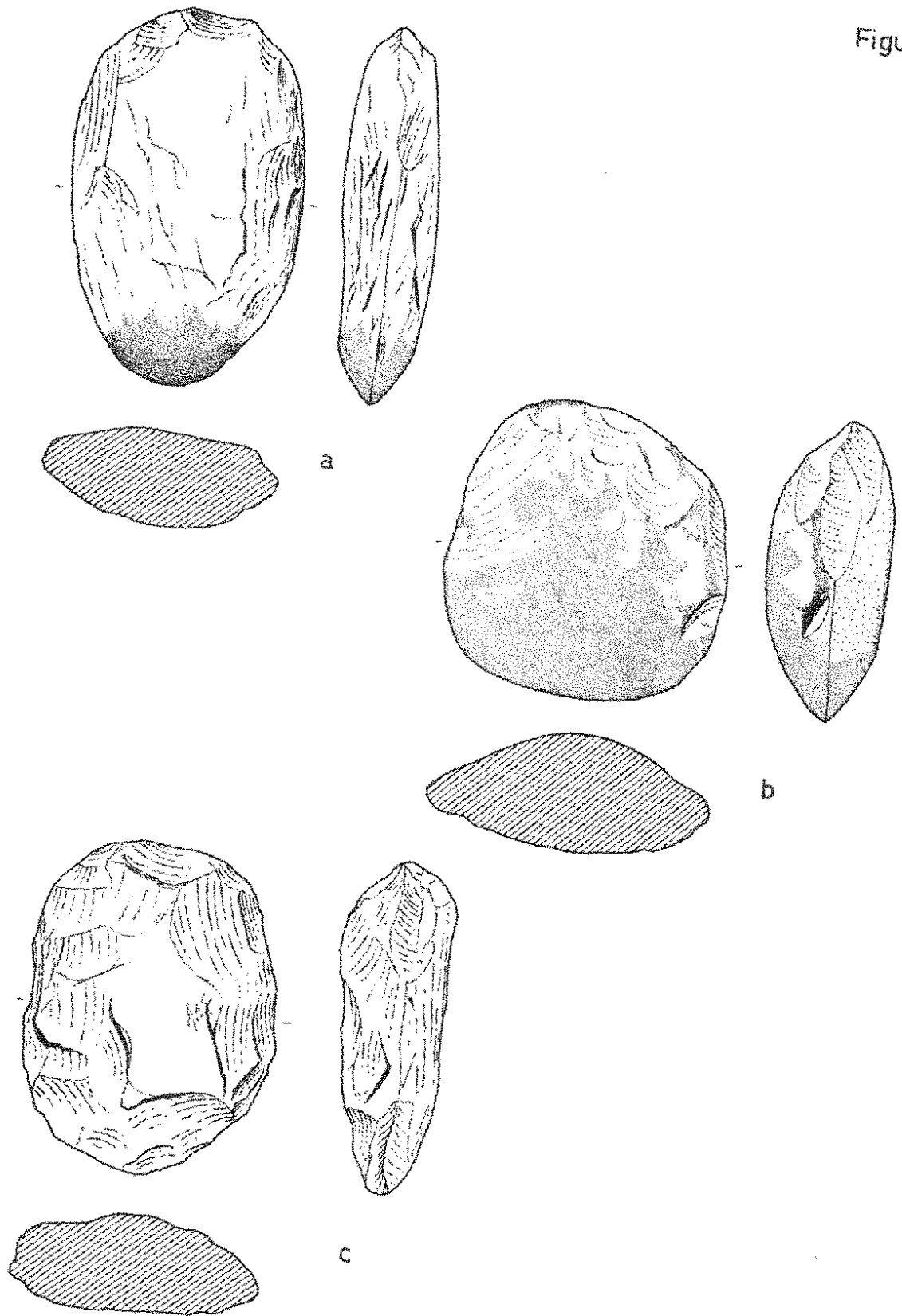
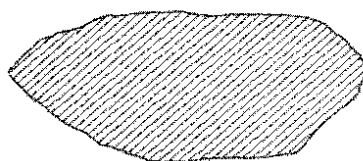
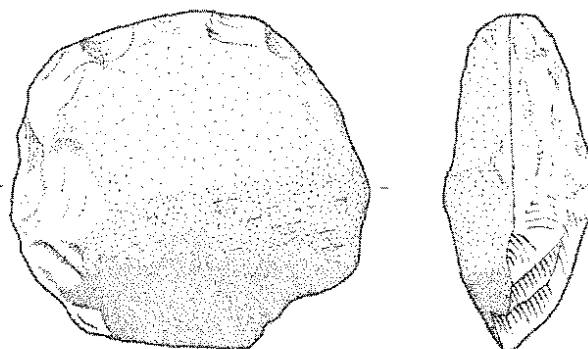


Figure VII-26 : Tyimede II

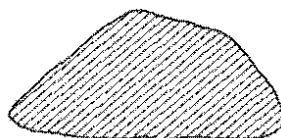
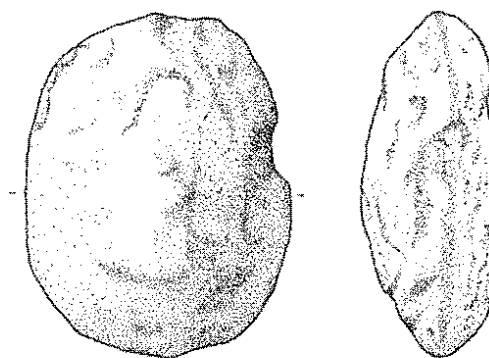
Scale 1:2

- a. Axe. Porphyritic dolorite, edge ground.
2E/6-2. Level III.
- b. Axe. Porphyritic dolorite, ground.
4F/5-1. Level III.

Figure VII - 26



a



b

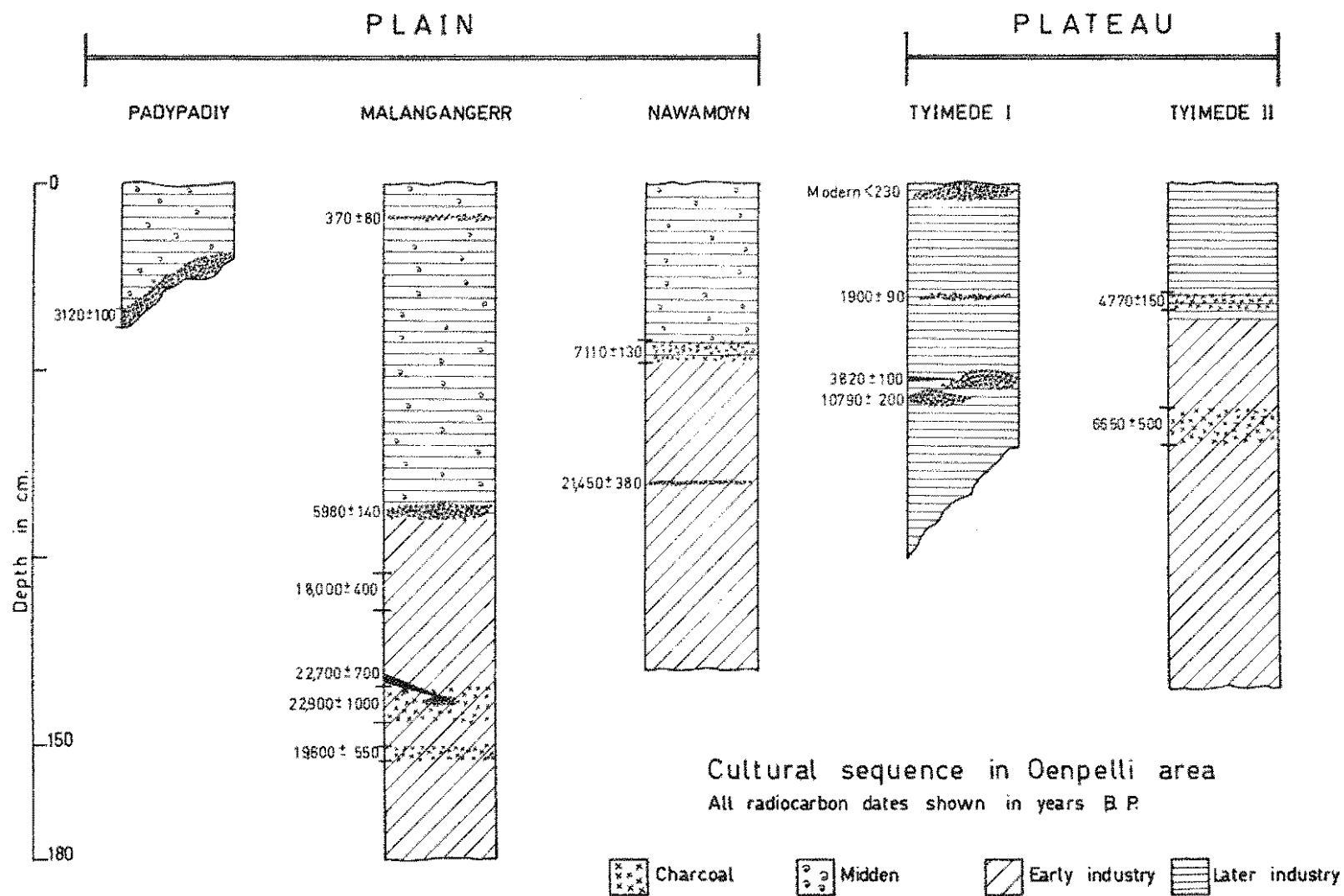


Figure VIII-1

Figure VIII-2

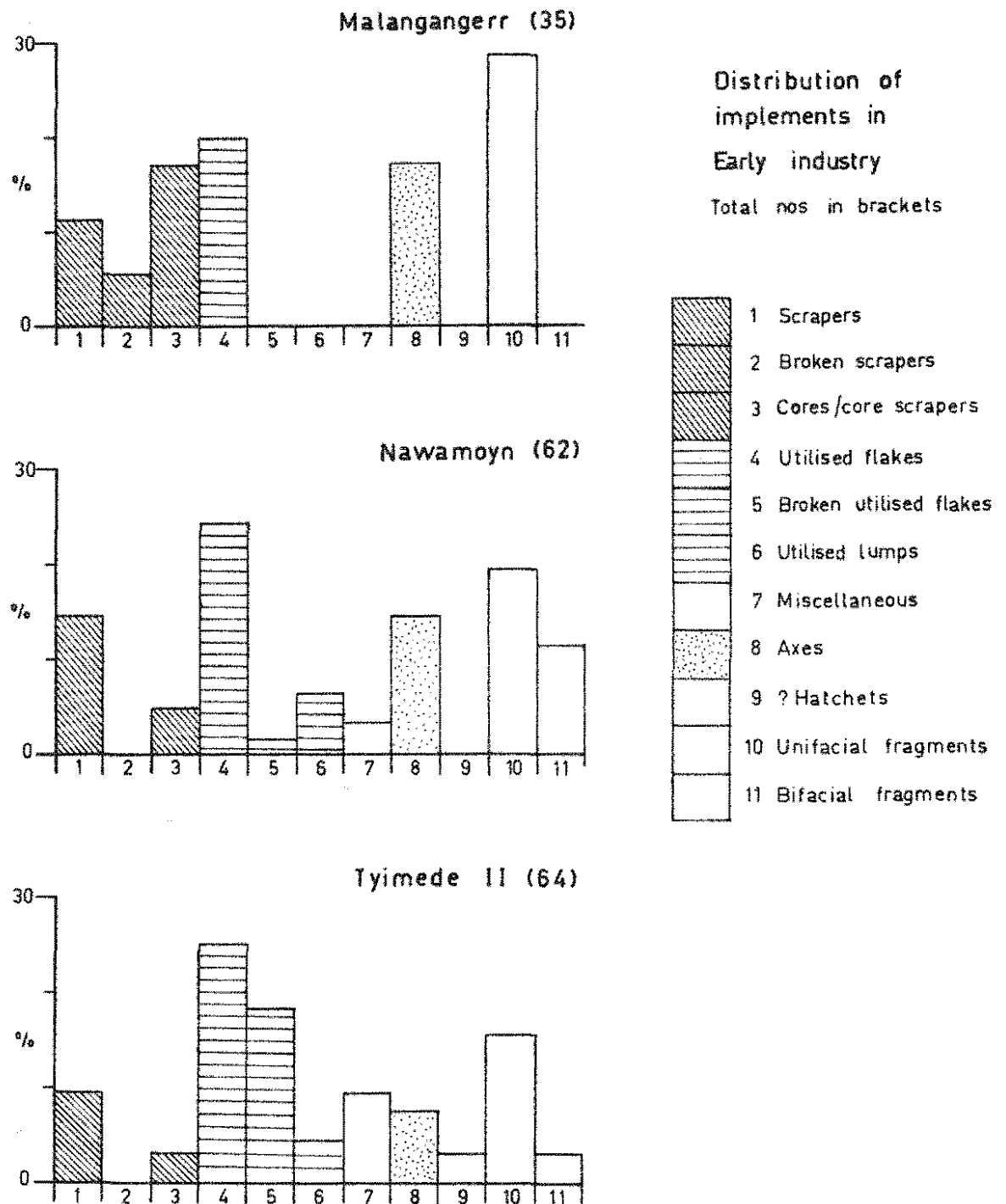


Figure VIII-3

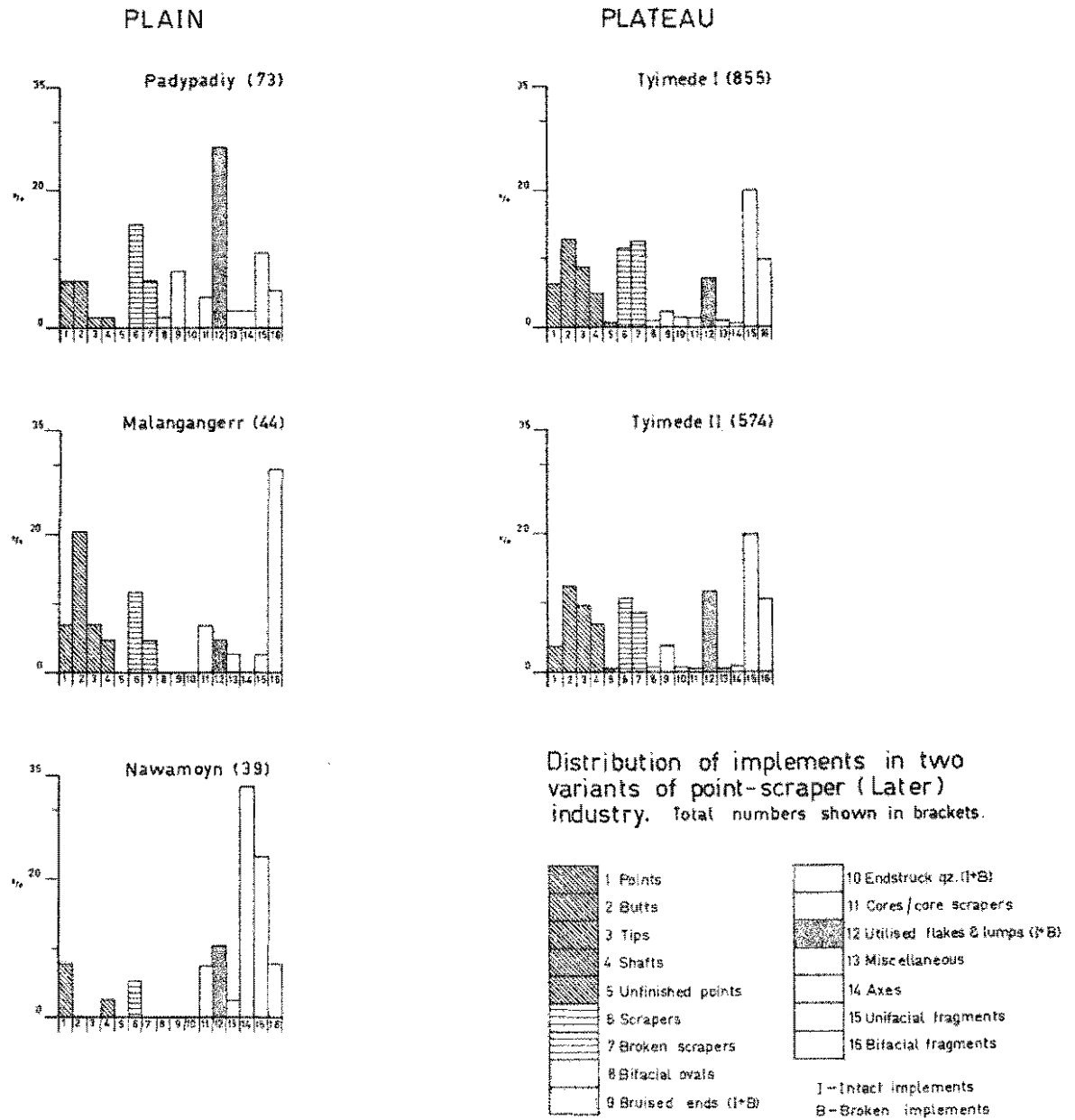




Plate I-1. Cliffs of the Buldiva escarpment seen from the plain about 4 miles south-east of Oenpelli.



Plate I-2. Inyaluk Hill: an erosional outlier of the main Arnhem Land plateau.



Plate I-3. Cannon Hill: an erosional outlier of the main Arnhem Land plateau.

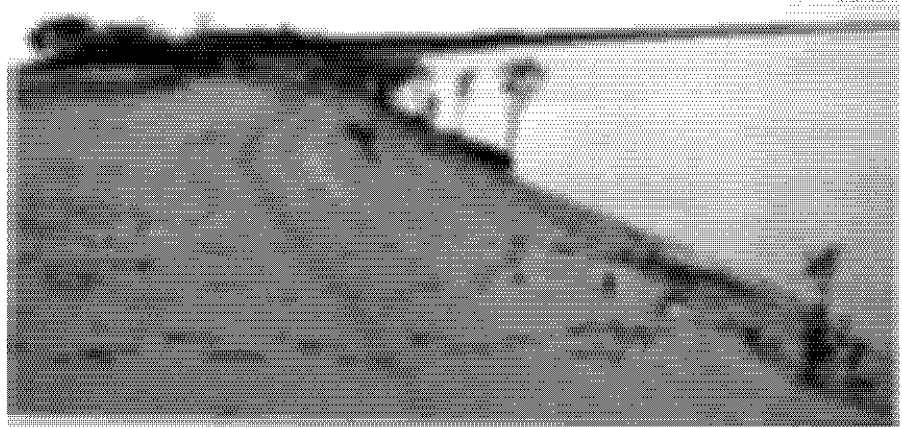


Plate I-4. The mudflats of the East Alligator River,
about 4 miles downstream from the crossing.

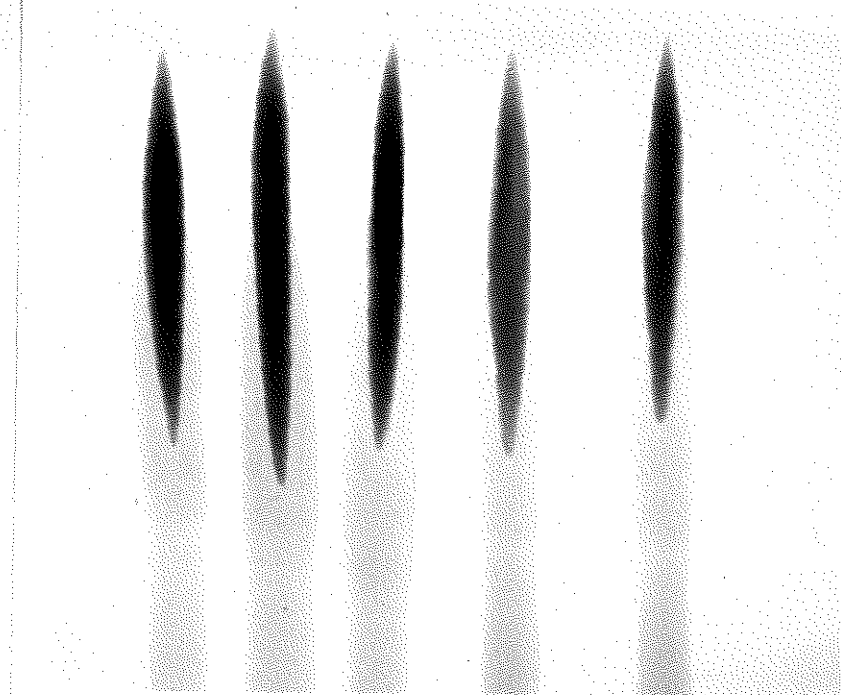


Plate II-1. X-ray of bone tips in multiple pronged fish spear from Oenpelli. (Baldwin Spencer coll., Nat.Mus. of Victoria, no.19359). Scale 1:1.

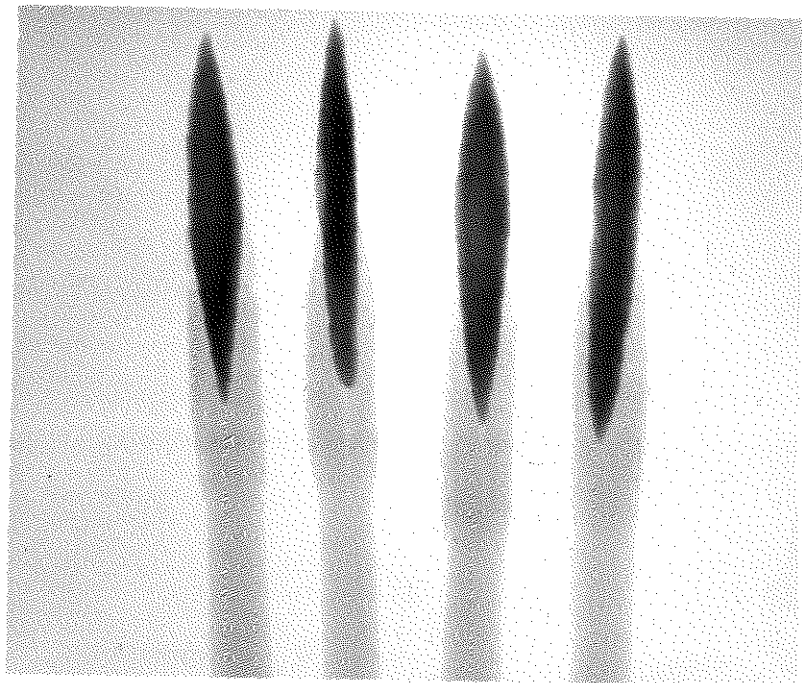


Plate II-2. X-ray of fish spear showing thin cracks in wood below the bone tips. (no.19363).

PADYPADIY



Plate III-2. Padypadiy: showing the main entrance
on the right, and the pillar weathering
on the left.



Plate III-3. Padypadiy before excavation.
Scale in 20 cm.

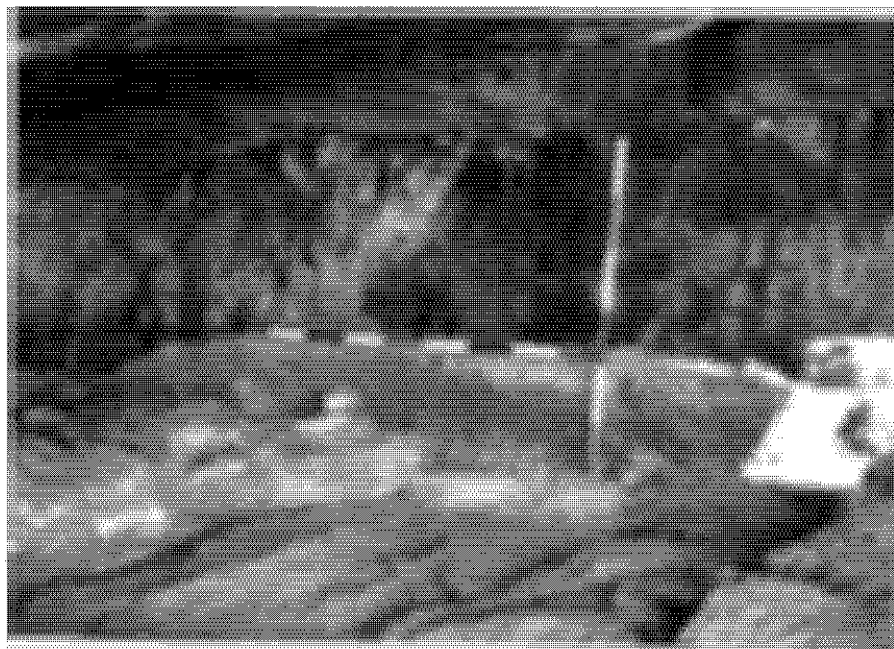
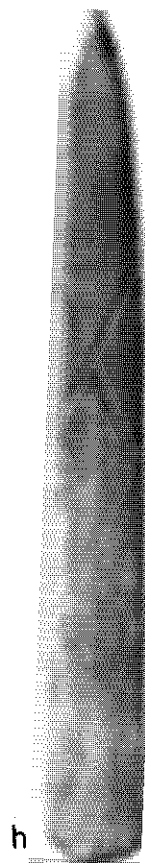


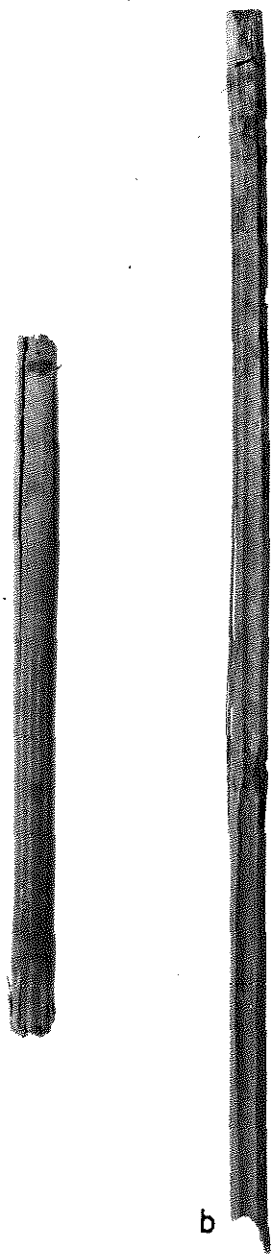
Plate III-4. Padypadiy after excavation, showing the
south wall of squares L3-03. Scale in 20 cm.

Plate III-5 : Padypadiy

Scale in mm.

- a. Point. L5/1-13. Level I, midden heap zone.
- b. Point. L5/1-12. Level I, midden heap zone.
- c. Point. K6/1-7. Level I, midden heap zone.
- d. Firestick (positive). K6/1-4. Level I,
midden heap zone.
- e. Firestick (negative). K6/1-2. Level I,
midden heap zone.
- f. Firestick (negative). K6/1-6. Level I,
midden heap zone.
- g. Spearthrower knob. K6/1-5. Level I,
midden heap zone.
- h. Message stick. L5/1-14. Level I,
midden heap zone.
- i. Hafted stick. K6/1. Level I,
midden heap zone.





a

b

- Plate III-6.
- a. Linkshaft showing mastic at one end.
K5/1-11. Level I, midden heap zone.
L. 26 cm.
 - b. Pipe. K6/1-10. Level I, midden heap zone.
L. 47 cm.



Plate III-7. Woven material from Padypadiy,
Level I, midden heap zone.
Scale in mm.

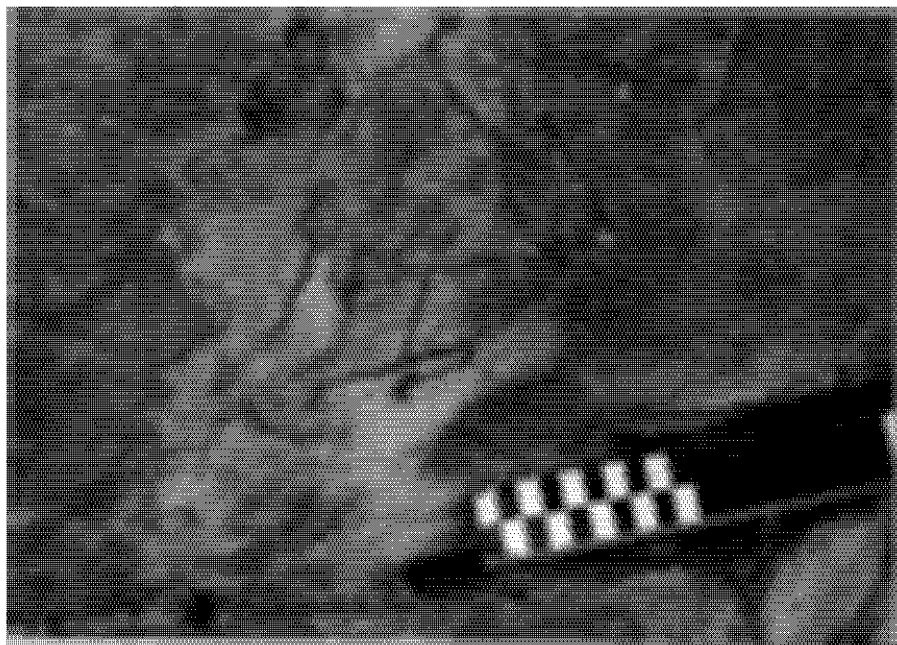


Plate III-8. Padypadiy: running figure (I-1b). Scale in cm.



Plate III-9. Padypadiy: anthropomorphic figure (I-1d). Scale in cm.



3
- Plate III-10. Padypadiy: paintings on roof above
main entrance. Scale in cm.

Plate IV-1

MALANGANGERR

5097



Plate IV-2. Malangangerr shelter viewed from
the eastern end before excavation.
Scale in 20 cm.

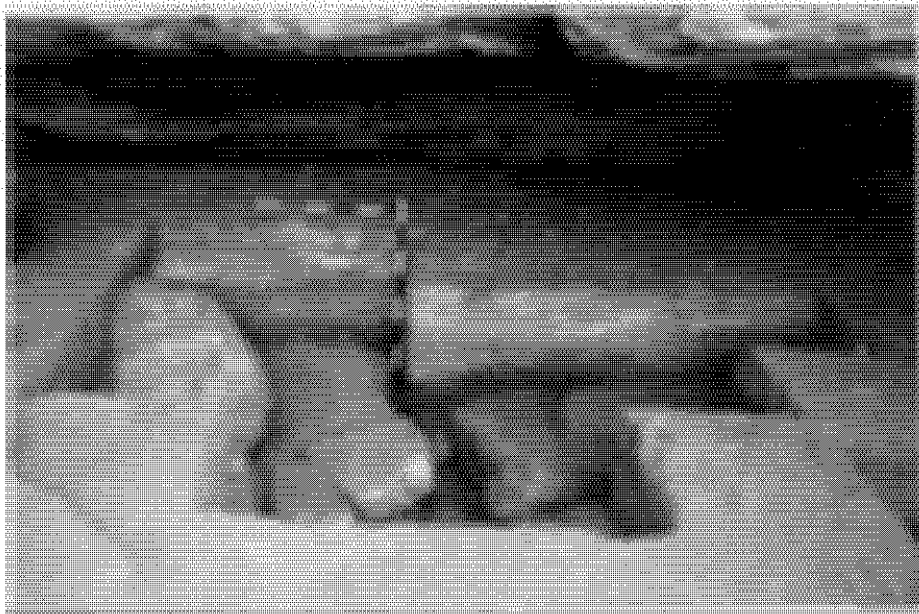


Plate IV-3. Malangangerr: north wall of squares 9E-8E and 7D-5D, showing sands overlain by stratified midden. (See Fig.IV-3). Scale in 20 cm.

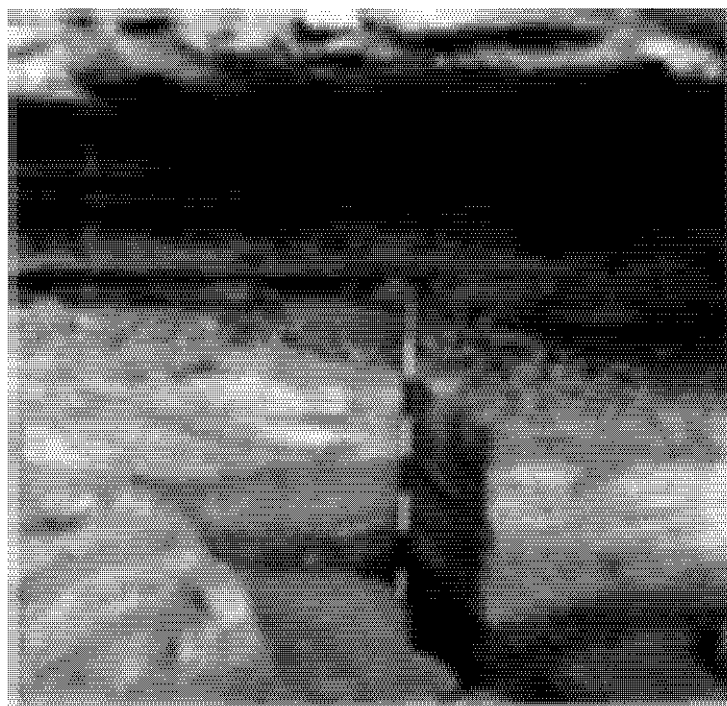


Plate IV-4. Malangangerr: detail of Plate IV-3, above. Note burrow on north wall of square 7D. Scale in 20 cm.



Plate IV-5. Malangangerr: general view of 1964 excavations looking eastwards. Note hollow in rock shelf below midden. Scale in 20 cm.

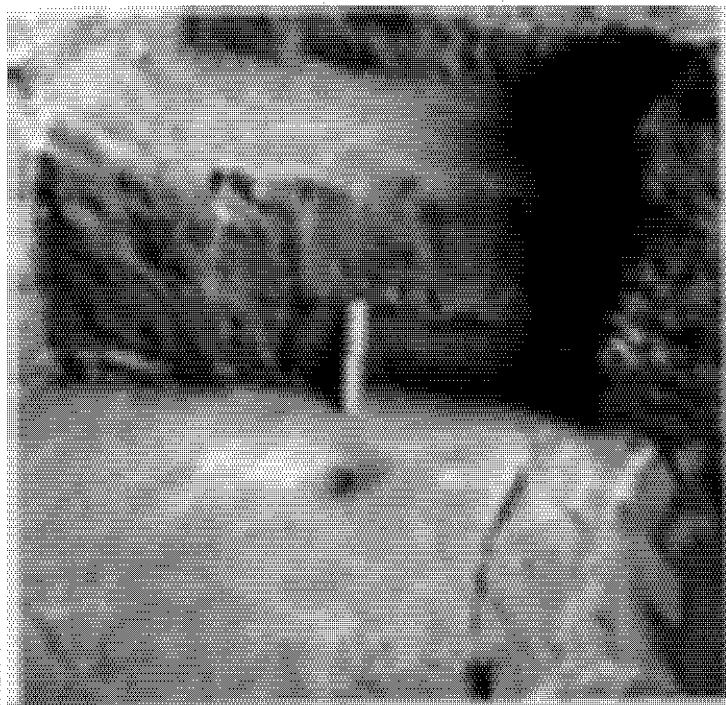


Plate IV-6. Detail of hearth at base of midden in square 6D, from which GaK-627 comes. Scale in cm.



Plate IV-7. Malangangerr: west wall of squares 5A-5B, showing sand overlain by unstratified midden. Scale in 20 cm.

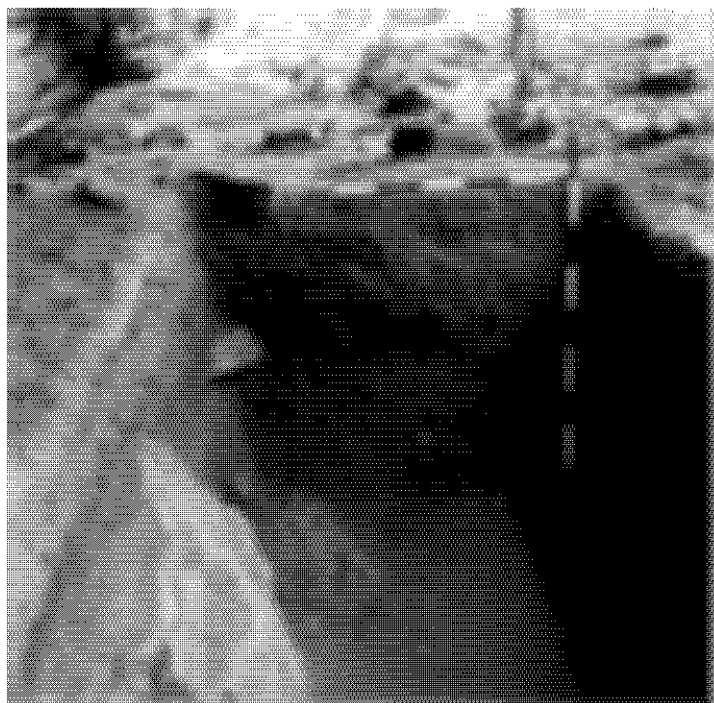
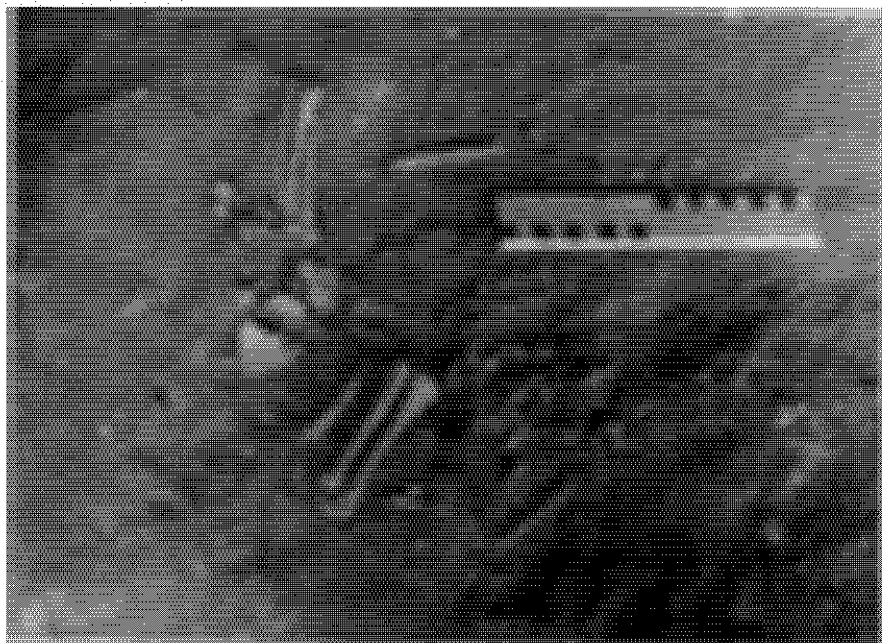


Plate IV-8. Malangangerr: east wall of squares 2A-2B, showing sand overlain by unstratified midden.



. Plate IV-9. Malangangerr: burial of child in 8E/5.
Scale in cm.



Plate IV-10. Malangangerr: fragment of Geloina shell with use-polish along the edge. Scale in mm.



Plate IV-11. Malangangerr: fragment of Geloina shell with use-polish along the edge. Scale 1:6.

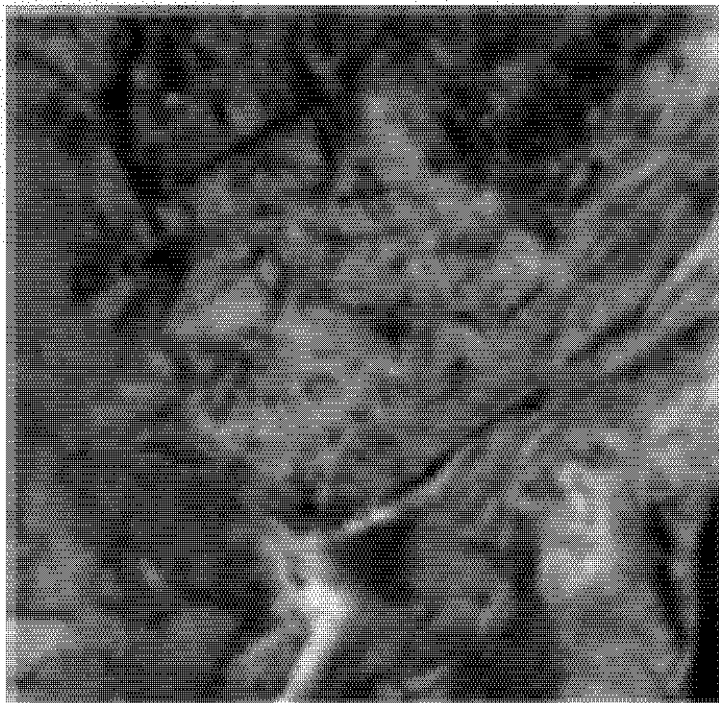


Plate IV-12. Malangangerr: paintings of 'mimis'
in main shelter.

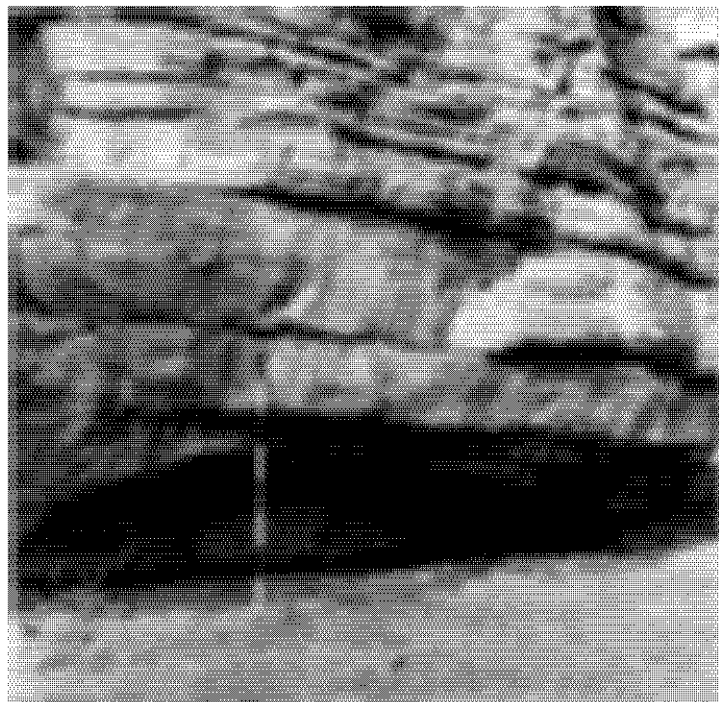


Plate IV-13. Malangangerr: recess with paintings on
north face of block. Scale in 20 cm.

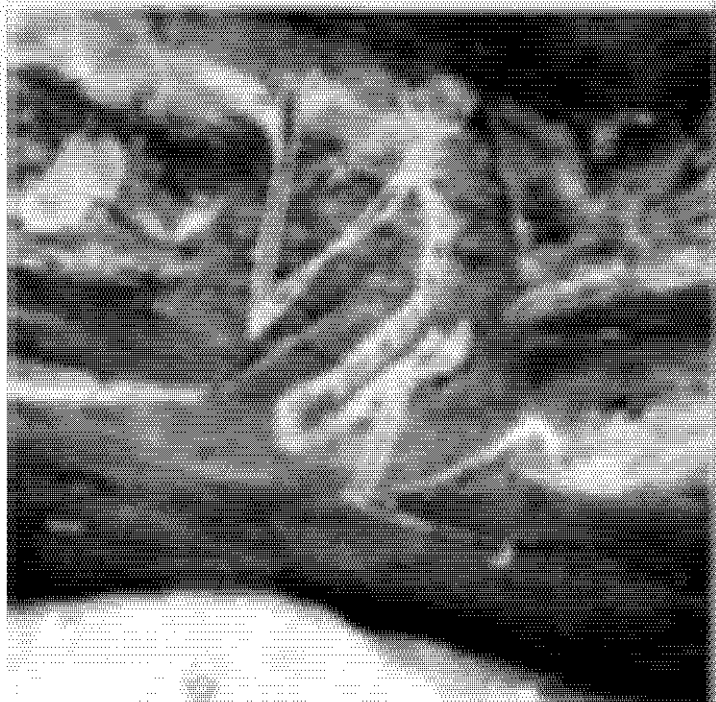


Plate IV-14. Malangangerr: anthropomorphic figure on roof of north recess. L. 82 cm.



Plate IV-15. Malangangerr: anthropomorphic figure and fish on back wall of north recess. L. of figure 42 cm.

NAWAMOYN



Plate V-2. Nawamoyyn shelter viewed from the western end.



Plate V-3. Nawamoyyn shelter viewed from the eastern end before excavation. Scale in 20 cm.



Plate V-4. Nawamoyne: east trench looking southwards. Note the sequence of sands overlain by midden. The position of column sample 1 and soil samples, are evident on the south wall of D10-D9. Scale in 20 cm.

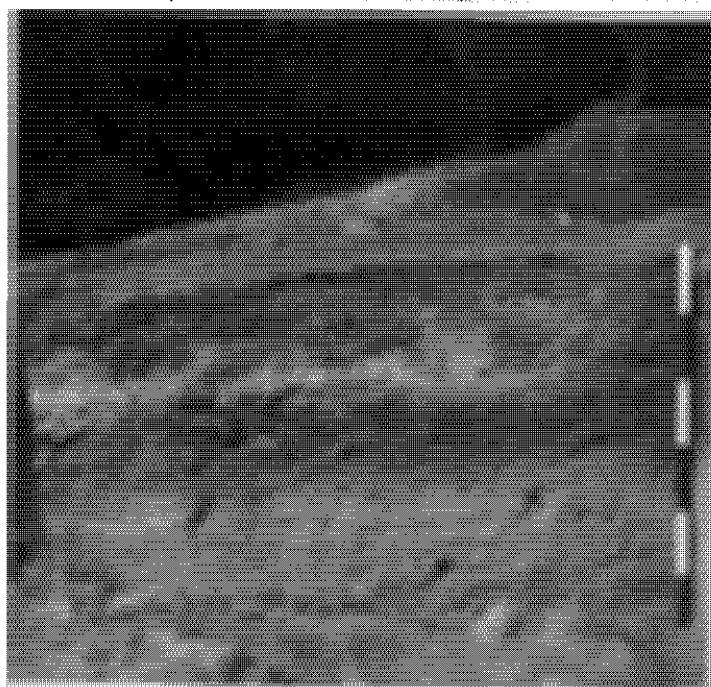


Plate V-5. Nawamoyne: south wall of D10-D9 showing sands overlain by midden. Scale in 20 cm.

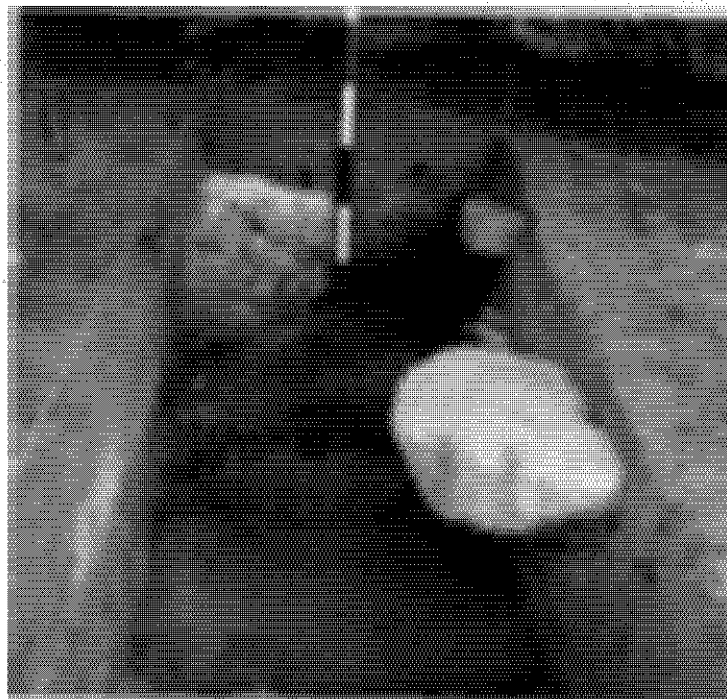


Plate V-6. Nawamoyne: stratigraphy of the west trench, looking southwards along squares G2 and H2. Note the rock with a ground hollow in the west wall of square G2. Scale in 20 cm.

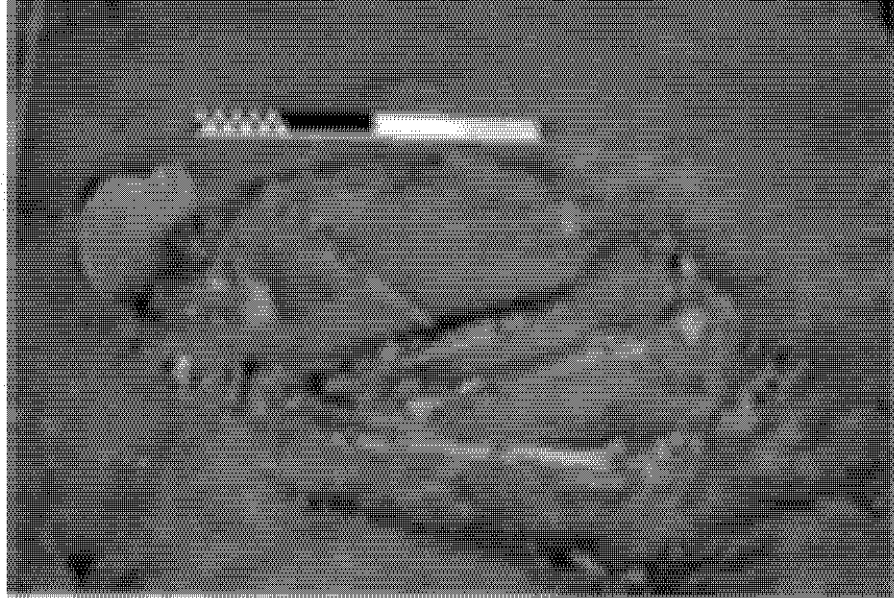


Plate V-7. Nawamoyñ: flexed burial in F3/1.
Scale in cm.



Plate V-8. Nawamoyñ: skull in I1/3, with axe
(I1/3-2) nearby. Scale in cm.

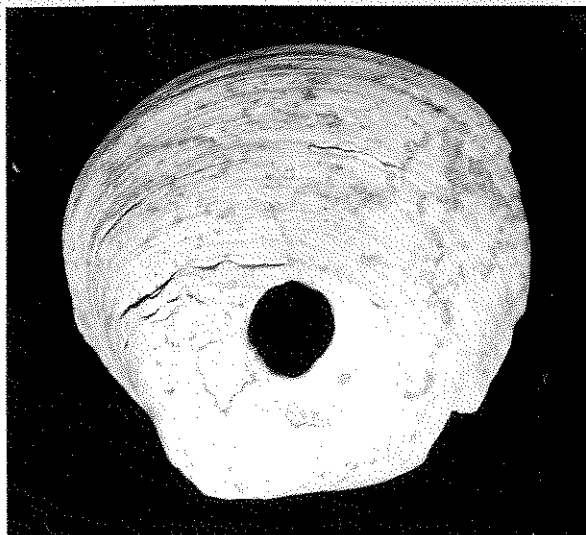


Plate V-9. Nawamoyñ: Geloina shell (J1/3) with a hole in the centre and a smooth margin. Level Ib. Scale 1:1.

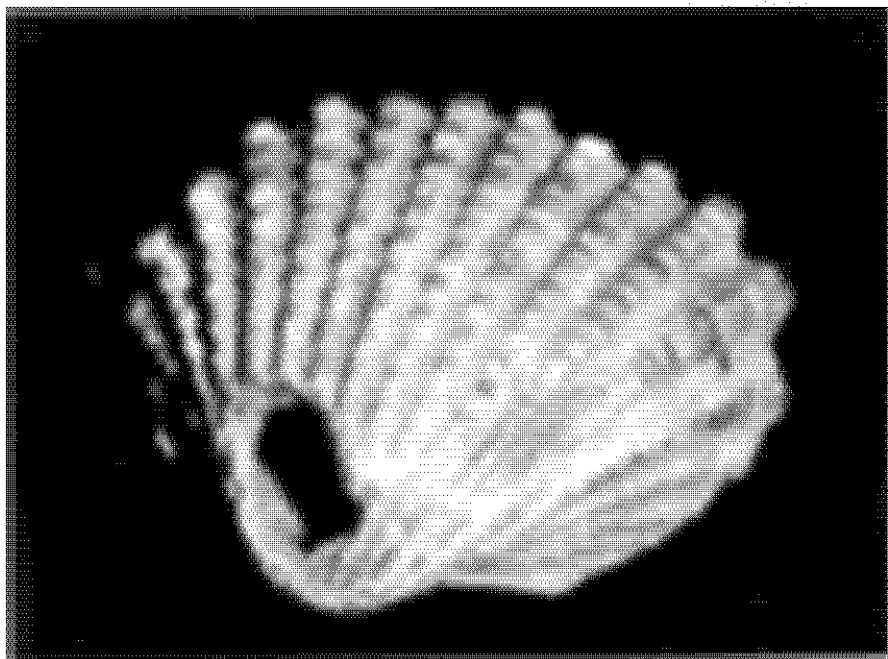


Plate V-10. Nawamoyñ: ark shell (I2/6) with drilled hole and covered with red ochre. Level Ib. Scale 1:3.

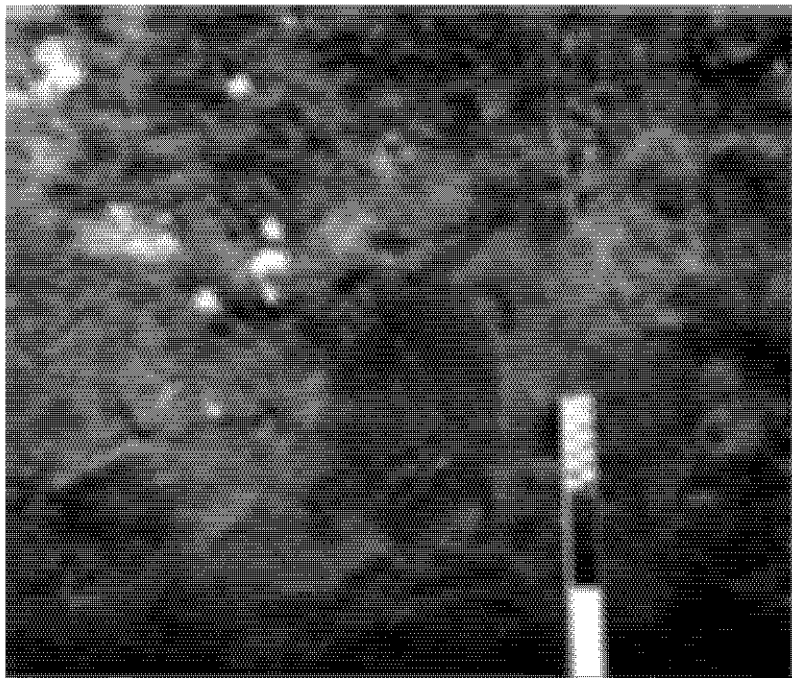


Plate V-11. Nawamoyn: painting of tortoise. Note
the faint white outline of the gut.
Scale in cm.



Plate VI-1. Tyimede: large cavern near the re-entrant,
where permanent water flows. Scale in 20 cm.



Plate VI-2. Tyimede I: shelter before excavation.
Scale in 20 cm.



Plate VI-3. Tyimede I: east wall of 2E-2B showing sandy deposit and basal rubble. Scale in 20 cm.



Plate VI-4. Tyimede I: west wall of 4F-4C. Scale in 20 cm.



Plate VI-5. Tyimede I: paintings on shelter wall. Note 'mimi' with bird's head, drawn head down. Scale approx. 1:15.



Plate VI-6. Tyimede I: fresh water bream. L. 41 cm.



. Plate VII-1. Tyimede II: shelter before excavation.



. Plate VII-2. Tyimede II: view of completed excavation.
Scale in 20 cm.

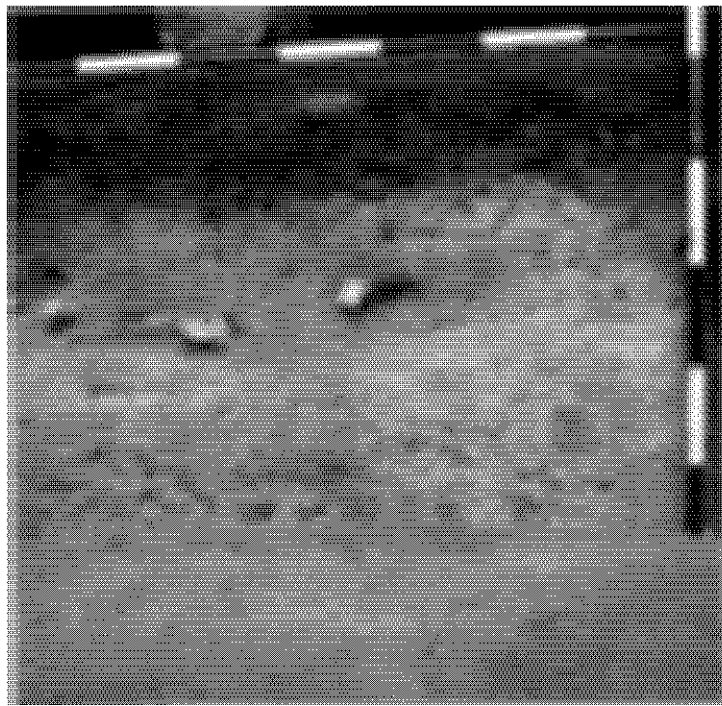


Plate VII-3. Tyimede II: east wall of 3D showing gradual changes in the colour and texture of the sand. Scale in 20 cm.

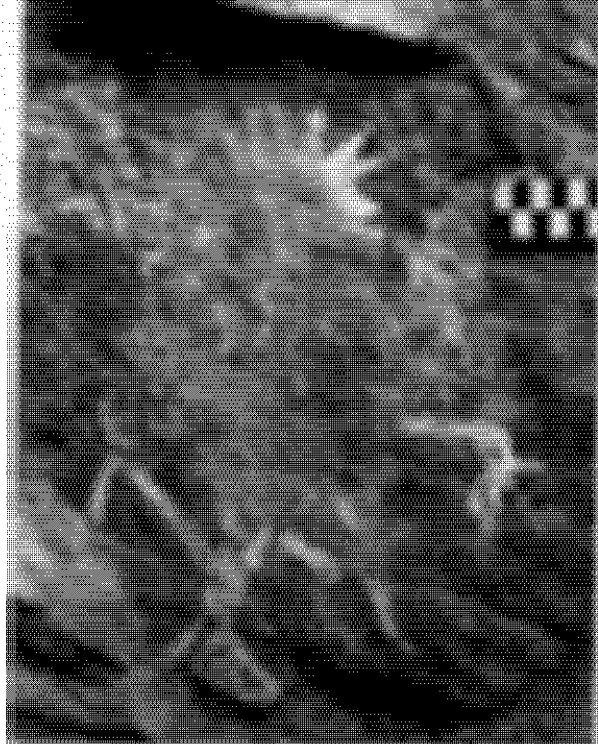


Plate VII-4. Tyimede II: painting of lightning mimi, 'namaragon'. Scale in cm.



Plate VII-5. Tyimede II: painting of night owl, 'goldol'. Scale in cm.

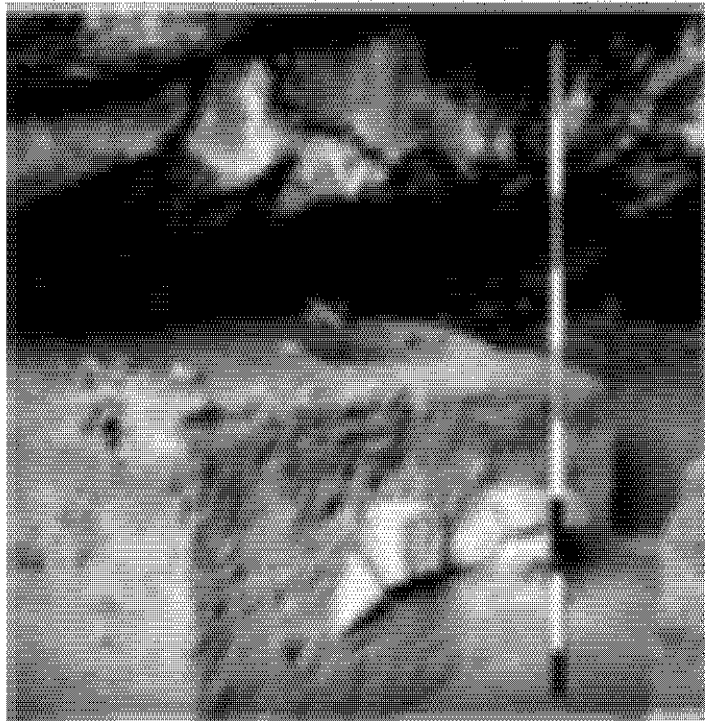


Plate VII-6. Tyimede II: north wall of 4F and 5F showing position of rocks detached from the wall above, and paintings on the exposed rock face. Scale in 20 cm.