



Australian
National
University

THESES SIS/LIBRARY
R.G. MENZIES LIBRARY BUILDING NO:2
THE AUSTRALIAN NATIONAL UNIVERSITY
CANBERRA ACT 0200 AUSTRALIA

TELEPHONE: +61 2 6125 4631
FACSIMILE: +61 2 6125 4063
EMAIL: library.theses@anu.edu.au

USE OF THESES

This copy is supplied for purposes
of private study and research only.
Passages from the thesis may not be
copied or closely paraphrased without the
written consent of the author.

FS7

SUMMARY

Chapter I. Sites Excavated in Hoa Binh

A resolution defining the Hoabinhian culture, passed by the First Congress of Prehistorians of the Far East in 1932, is discussed in the light of the relevant excavation reports. Of these the most important is Colani's report published in 1927 describing the excavation of nine sites in Hoa Binh. Colani attempted to set up a typological classification for the collections of stone tools from these sites. This classification is examined and found to be inadequate. Colani further divides the collections into three parts which are supposed to represent three chronological phases. These are examined in the light of the published evidence and found to be unsatisfactory. Other material recovered from these sites is then described.

Further sites excavated in Hoa Binh and region are then examined. None of the excavation reports confirm the conclusions reached by Colani in 1927 - conclusions which Colani herself seems to have abandoned.

The results of a brief visit to Hoa Binh by Boriskovsky in 1960 are given.

A suitable vocabulary for the description, analysis and synthesis of the data of prehistoric archaeology is briefly

described, and Colani's reports examined in the terms of that vocabulary.

Chapter 2. Sites Excavated in Bac Son

Reference is made to thirty-two sites excavated in Bac Son. Mansuy considered that two cultures were present, one being the fully developed neolithic. The other is divided by him into three phases, and this division is examined in the light of the reports. A resolution passed by the First Congress of Prehistorians of the Far East is discussed. It is concluded that the reports are deficient in descriptive content, and that they do not substantiate the proposed divisions.

A general account of the collections excavated in Bac Son is given, and an open site at Da But is described.

The material from the excavations in Hoa Binh is compared with that from excavations in Bac Son, although the unsatisfactory nature of the reports for the latter region makes comparison difficult. The collections exhibit some similarities, although the various elements appear to be present in different proportions in the two areas.

An attempt by Dani to improve the original synthesis of the material from Bac Son and Hoa Binh is examined and found to be unsatisfactory.

Suggestions are made about the cultural situation that may be represented by the sites in Bac Son and Hoa Binh.

Chapter III. Hoabinhian Collections from Other Parts of South East Asia

An attempt is made to trace the distribution of cultures with affinities to the Hoabinhian of northern Indo-China.

From southern China, similar collections are reported from Kwangsi, and Szechwan has produced industries with a major component of pebble tools.

Unifacially and bifacially flaked pebble tools are mentioned from Thailand.

A site in Laos where recent and Pleistocene deposits overlies Pliocene sediments is described. Artefacts and habitation remains were recovered from the superficial levels.

The evidence from Malaya is reviewed. The industries have similarities with the collections from Hoa Binh, although unifacially flaked tools are confined to the western part of the Peninsula. The relationship of the pebble tools and pottery in Malaya is discussed. Human remains have been found at several sites, and various writers have identified racial types.

Surface sites on the north coast of Sumatra have produced large numbers of pebble tools, mainly unifacially flaked. The excavation of three shell mounds is mentioned. The

affinities of these collections with those from Indo-China are explored.

In a summary review, it is concluded that although the pebble tool is a type fossil of limited utility for indicating cultural unity, there does seem to be continuity from southern China, through Indo-China and Malaya, including Thailand, to Sumatra. Geographical and chronological differentiation is present within this cultural continuum, although it is not possible to trace such change with any precision on the evidence available at present.

Chapter IV. Japan, the Philippines and Australia

Hoabinhian affinities have been claimed for collections beyond south east Asia. These claims are examined for a site in central Japan and for an area in Batangas Province, Philippines.

For Australia, McCarthy has suggested that sites in New South Wales contain Hoabinhian collections and according to Tindale the pebble tools element of the Kartan collections can be directly related to the pebble tools of the Hoabinhian.

The published evidence on the Australian sites is reviewed and the collections from them compared in a general way with the south east Asian industries and the problem of a possible cultural connection between the two is discussed.

Chapter V. Some Analytical Techniques

The requirements for stratigraphic information about archaeological deposits are discussed. The defects of a record made entirely from the visible strata in a deposit are outlined, and a case made for the separate record of sedimentary structures and the positions of artefacts.

Descriptions of archaeological collections are contrasted with descriptions of archaeological types. Taxonomy, classification and systematics are defined in terms of Simpson's definitions for zoology.

Gilmour's remarks on the nature of the basic taxonomic unit are quoted and relevant archaeological discussions by Willey and Phillips, MacWhite and Rouse are mentioned. Finally, classificatory procedures are reviewed in terms of Krieger's scheme.

The advantages of quantitative methods of analysis are discussed, and reference is made to Spaulding's demonstration of the utility of statistical analysis.

The coded record devised by Gardin is examined and mention is made of the forms of mathematical analysis that might be appropriate to archaeological classification. Sneath and Sokal's work on numerical taxonomy is mentioned, and the difficulties met by Gardin in an attempt to extract typological information from a coded record are described.

Clarke's application of a method (called 'matrix analysis') devised by Tugby is critically examined.

Chapter VI. The Flaked Stone Component of the Collections at Sai Yok, and the Code used for their Analysis

In the absence of adequate collections of Hoabinhian material in European museums newly excavated material from the site of Sai Yok, in Thailand, was made available through the kindness of the excavator. The Sai Yok collections were examined at Leiden. A descriptive code devised for this examination is explained and an example of its application is given.

A preliminary classification of the pebble tool component of the Sai Yok is described. This groups the artefacts into uniface pebble tools, bifacially worked pebble tools, truncated pebble tools, tools made on split pebbles, hammerstones and ?? tools. The latter are large and crude, and may be either cores or crude implements.

A quantitative comparison is made of primary flakes from two parts of the excavation: section C, dug in a rock-shelter and section X placed at the foot of the talus slope below the rock-shelter.

Chapter VII. The Stratigraphy of the Deposits at Sai Yok

The nature of the Sai Yok site is described in the light of the preliminary reports.

The distribution of the artefacts in the deposit is examined. Three elements are recognised, historic, neolithic and mesolithic. The hypothesis of occupational disturbance is introduced to explain the stratigraphic overlap of these elements. The problem of the origin of the artefacts in section X, at the foot of the talus slope, is discussed, as this deposit may not be a habitation deposit. An analysis of variance is carried out for seven variables on the unifacially flaked pebble tools to test for significant differences between the vertical distribution and the horizontal distributions in two planes. The results support the contention that section X represents a habitation deposit, and that occupational disturbance could account for the overlap between the various cultural elements in this section.

Chapter VIII. The Pebble Tool Industry at Sai Yok

The relationship of two groups distinguished in the preliminary classification, the ?? tools and the unifacially flaked tools is discussed.

A detailed analysis is carried out on the unifacially flaked pebble tools, to discover if any types can be isolated. A quantitative method has been devised, and this is illustrated by the analysis of a collection of Chione valves which does demonstrate separate types.

Various parameters are examined for the collection of unifacially flaked pebble tools, first on a random sample from all levels in the deposit, and then, in the light of these results, on selected samples from different levels.

It is concluded that the unifacially flaked pebble tools at Sai Yok cannot be grouped into types.

The information gathered from the analysis of the Sai Yok collection is used to compare the assemblage from this site with those from Indo-China, Malaya and Sumatra. It is concluded that there are marked similarities with the Hoabinhian represented at Sai Yok and Hoa Binh, but that two regional aspects are probably represented. The data from Malaya are not sufficiently detailed to allow of similar comparison, and the same holds for Sumatra. Nevertheless, it is suggested that the Sai Yok collection has closer similarities with the material from Malaya than with that from Sumatra.

Chapter IX. The Investigation of the Hoabinhian Affinities of some Australian Collections

The examination of two samples of Kartan collections in the South Australian Museum is described. One sample is taken from Kangaroo Island and is morphologically distinct from the other, taken from the Wakefield River. The samples are compared in terms of various parameters, and it is concluded that although the sample

contains different kinds of artefact, they can be considered to contain the same kind of implement.

The examination of samples of pebble tools from Yamba and Seelands is described.

The samples from Kangaroo Island, Yamba, Seelands and Sai Yok are then compared in terms of length, breadth, thickness, weight and length/breadth index, and it is concluded that the Kangaroo Island sample is distinct from the others. The nature of the relationships of the other sites is explored.

Chapter X. Conclusions

The analytical techniques that have been developed and used in the present study are contrasted with the subjective approach of Colani and Dani. The advantages of the quantitative method are pointed out, both for detecting types and describing collections.

The point is stressed that the methods presented allow analysis to proceed beyond mere typologies, and to foster the investigation of the more important phenomena, of which types are but an expression.

positive microfilm:

Syracuse Univ. Lib (14/3/67)

Bernice P. Bishop Museum, Hawaii (5/2/68)

Univ. of Malaya Library (22/12/69)

Xerox copy to National Museum, Malaysia 14/1/70

Pos. film to Univ. of Singapore 1/6/70 (on exchange)

" " " Univ. of Stago 24/8/70

" " " Auckland Institute Museum 18/8/71

" " " London University Institute of Archaeology 12/1/72

" " " Univ. of Auckland (15/3/72)

" " " MS BARBARA THIEL, (1209 HILLTOP DRIVE, PARK HILLS, KENTUCKY, USA 41011)

1/6 " " " British Library Lending Division Yorkshire, U.K.

1/6 " " " Center for Research Libraries, Chicago, Illinois.

11/77 " " " Dr. H. Looft, Asian Civ. SGS.

1.78 Xerox copy supplied
(prepared by Rehistory Dept
RSLand IAS)

8.79 Pos. m/film copy
supplied to Cornell

to Jan Bay-Petersen
cf. British Institute in S.E.
International Bldg
Singapore
Univ. Libraries, Ithaca, N.Y.

THE
AUSTRALIAN
NATIONAL
UNIVERSITY
LIBRARY

- 14.5.79 Xerox copy supplied to The National Library of the Philippines, Manila.
19.8.79 Positive microfilm copy supp. to the Aust. Institute of Aboriginal Studies
1.9.79 Xerox copy supplied to National Library of Malaysia, Kuala Lumpur
9.1.80 Positive microfilm copy supplied to Univ. of Malaya Library, K.L., Malaysia.
2.12.86 " " " " National Library, Singapore.

The Hoabinhian In South East

Asia and Elsewhere

J.M. Matthews

This work is a thesis submitted for the degree
of Doctor of Philosophy at the Australian National University

This thesis is my own original work.

J. M. Matthews .

J.M. Matthews

17th December 1964

Table of Contents

		Page
	Preface	i
Chapter I	Sites Excavated in Hoabinh	1
Chapter II	Sites Excavated in Bac Son	47
Chapter III	Hoabinhian Collections from other parts of South East Asia	76
Chapter IV	Japan, the Philippines and Australia	114
Chapter V	Some Analytical Techniques	131
Chapter VI	The Flaked Stone Component of the Collections at Sai Yok, and the Code used for their Analysis	146
Chapter VII	The Stratigraphy of the Deposits at Sai Yok	163
Chapter VIII	The Pebble Tool Industry at Sai Yok	183
Chapter IX	An Investigation of the Hoabinhian Affinities of some Australian Collections	216
Chapter X	Conclusions	229

Bibliography of works used

233

Maps 1 - 7

Figures 1 - 68

Tables 1 - 51

Appendix

Preface

I would like to acknowledge the patient attention and supervision that Mr J. Golson has given to all stages of this work.

I must also thank Professor P.A.P. Moran, of the Department of Statistics, the Institute of Advanced Studies, the Australian National University, for reading Chapters VI, VII and VIII; and Mr Warren Ewens, of the Department of Statistics, the School of General Studies, the Australian National University, for reading Chapter IX. However, the views expressed in these chapters are entirely my own. Preliminary discussion with Professor E.J. Hannan, the Department of Statistics, the School of General Studies, the Australian National University, greatly assisted the planning of Chapters VI to IX.

The great kindness of the Committee of the Thai-Danish Prehistoric Expedition, and Mr H.R. van Heekeren, of the Rijksmuseum voor Volkenkunde, Leiden, the Netherlands, in allowing me to examine collections excavated at Sai Yok, Thailand, must be particularly acknowledged.

Mr Warren Ewens, Mr Peter Tindale and Miss Margaret Campbell of the Computer Division, the Research School of Physical Sciences,

the Australian National University, have all rendered great help with the programming and running of the 1620 IBM Computer.

Mr F.D. McCarthy, of the Australian Museum, Sydney, Mr N.B. Tindale, of the South Australian Museum, Adelaide, and Miss I. McBryde, of the Department of History, the University of New England, have given great assistance in discussion and in allowing me to examine their collections.

The Curator of the Museum of Ethnography and Archaeology, the University of Cambridge, the Curator of the Pitt-Rivers Museum, the University of Oxford, and the Director of the Department of Prehistory, the Musée de l'Homme, Paris, kindly granted me access to their collections.

Mrs D. Gregory and Miss H. Skeats both rendered valuable assistance in punching Hollerith cards.

Finally, I must thank Mrs N. Young, of the Typing Pool, the Australian National University, for so carefully attending to the production of this thesis, and Mr J. Peter White for his assistance in checking the final typescript.

CHAPTER I

SITES EXCAVATED IN HOA BINH

On Saturday, 30th January 1932, a special committee set up by the First Congress of Prehistorians of the Far East meeting in Hanoi passed the following resolution:¹

It is proposed to accept the following terminology and to recommend its use to the First Congress of Pre- and Protohistory:

'Hoabinhian: a culture composed of implements that are in general flaked with somewhat varied types of primitive workmanship. It is characterized by tools often worked only on one face, by hammerstones, by implements of sub-triangular section, by discs, short axes and almond-shaped artefacts, with an appreciable number of bone tools.'²

The Hoabinhian is divided into three sub-stages:

Hoabinhian I: flaked implements only, rather large and crude;

Hoabinhian II: somewhat smaller implements of finer workmanship, associated with protoneoliths;

¹ Praehistorica Asiae Orientalis; Hanoi, 1932; 11-12.

² 'Hoabinhien: civilisation à instruments généralement taillés, avec types assez variés et de façonnement assez primitif. Elle se caractérise par des outils souvent taillés sur une face, des percuteurs, des pièces à grande section subtriangulaire, des disques, des haches courtes et des instruments amygdaloïdes, avec un nombre plus ou moins considérable d'instruments en os.'

Hoabinhian III: yet smaller implements, flakes with secondary working; with rare exceptions no protoneoliths.¹

Protoneoliths: simple artefacts fashioned from flaked stone or a pebble, with polish confined to the cutting edge.²

The report describing the excavations in Hoa Binh from which the Hoabinhian is derived was published by Mlle Colani, in 1927.³

In this report Mlle Colani describes some of the sites that she excavated and a proportion of the objects that were discovered, but she does not claim to have described or defined either a culture or three culture periods.⁴ In a note⁵ she points out that she is using the word 'Hoabinhian' to describe all the archaeological deposits which contained a facies peculiar to Hoa Binh Province.

1

'Le Hoabinhien se divise en trois sous-étages:

Hoabinhien I: instruments uniquement taillés, assez grossiers et d'assez grandes dimensions;

Hoabinhien II: instruments moins grossiers, de taille un peu plus petite et mêlés à des protonéolithes;

Hoabinhien III: instruments plus petits encore, éclats retouchés; sauf de rares exceptions, pas de protonéolithes.'

2

'Protonéolithes: instruments formés d'une pierre taillée ou d'un caillou, bruts et polis sur le tranchant seulement.'

3

M. Colani. 'L'Age de la pierre dans la Province de Hoabinh (Tonkin).'
Mémoires du Service Géologique de l'Indochine, 14, 1.

4

The use of the words 'culture' and 'culture period' follows that of Gordon Childe (V.G. Childe. 'Piecing Together the Past'. London, 1956; 16-28.)

5

Colani, op.cit. 6.

The following appreciation of Mlle Colani's account of her excavations is designed to show that the culture (or cultures) to which the assemblages from the sites excavated in Hoa Binh belong have yet to be precisely defined. It is important that the nature of Mlle Colani's report should be clearly understood as comparisons have been drawn between her finds and artefacts discovered in Malaya, Indonesia and elsewhere, including Australia. The assumption that a Hoabinhian culture has been archaeologically established has lent these comparisons weight and significance which they do not deserve.

To illustrate these points, the sites excavated will first be described, then the deposits that they contained will be examined, and finally the conclusions and inferences drawn by Mlle Colani from her examination of the artefacts will be reviewed.

The Sites

The sites, several being rich in artefacts, were not known before Mlle Colani's expedition in 1926. In previous years Mlle Colani, in company with H. Mansuy, had explored archaeological sites, caves and rock shelters, in Bac Son, to the north west of Hanoi (Map 1). She concluded that limestone caves and rock shelters situated 50 metres above sea level and near suitable sources of material for the manufacture of stone artefacts would

be very likely archaeological sites. A study of maps and plans suggested to Mlle Colani that Hoa Binh Province (see Map 2) would be a suitable area for exploration, particularly to the south and south east of the Black River. Here limestone formations are very common, some having considerable extension and rising more than a thousand feet above characteristically narrow valleys. Mlle Colani's field expedition amply justified her assessment of the region, and nine of the twenty sites that she discovered are described in her report. These are listed in Table 1.

These sites are caves that contained an archaeological deposit in areas sufficiently close to the cave mouth to be well illuminated, and in many cases the overhang of the cave mouth gave shelter for habitation deposits to accumulate beneath it.¹

The maximum depth of the deposits excavated at these sites is given in Table 2.

Colani applies the word 'kjökkenmødding' to the archaeological deposits, which were composed of a calcareous cave earth mixed with large numbers of gastropod shells of the genus *Melania*.²

1

Colani calls such cave mouth deposits 'abris sous roche'; it seems advisable to translate this as 'cave mouth deposits'.

2

Melania: a fresh water mollusc with a spiral shell, commonly found in south east Asia. It is eaten by local people today and was a staple diet of many groups in antiquity. The shell forms the bulk of many habitation deposits.

At some of the sites a certain stratification was noted. At Sao Dong¹ the following succession was found in several unspecified areas of the deposit:

- 1st. Recent deposits. A mixture of earth and vegetable detritus.
- 2nd. Deposits containing many flaked stone artefacts, and a few edge-ground tools.
- 3rd. Relatively thick deposits containing flaked stone artefacts and a few edge-ground tools.
- 4th. Deposits containing large and crudely worked flaked stone artefacts.
- 5th. An archaeologically sterile layer, a very hard brown calcareous cave earth.

It must be noted that there seems little to distinguish the 2nd from the 3rd layers; they both contain flaked stone artefacts and edge-ground tools, and no natural stratification is indicated.

A thin layer of unconsolidated and apparently recent material overlying the archaeological deposits seems to be a feature of these sites. The archaeological deposit in the cave at X-Kham was covered with a few centimetres of a fine calcareous clay,² and at M-Kham with a layer of Melania shells, up to 15 centimetres thick.

¹

Colani, op.cit. 9.

²

Colani, op.cit. 19.

A compact yellow clay was noted under the habitation deposits. No mention is made of any stratification at any of the other sites.

It may be noted that, with the exception of the cave at Sao Dong, no stratification within the archaeological deposits is referred to. At Sao Dong this stratification appears to be purely archaeological. Even so, the criterion by which the upper part of the deposit here was divided into layers is not clear.

The Excavation Technique

Unfortunately Mlle Colani does not describe the methods and techniques that were used during the excavations. It was certainly very ambitious to undertake the excavation and exploration of twenty sites in nine months. The excavations must have been carried out with some speed, and it cannot be denied that excavations that took place over thirty years ago lack the refinement and precision of those to which the latest techniques have been applied. However, her report contains almost the only information that exists about the excavation of cave and shelter sites in Hoa Binh Province.

The Collections

A tabulated description of the collections is given in Tables 44-45. The main element of the collections is a flaked stone industry. This is made on rolled river pebbles, and the

naturally polished cortex is retained in differing degrees on one or both surfaces of the artefacts, and commonly incorporated into the cutting edge (see Figures 1 and 2 which represent a selection of the artefacts illustrated by Colani). Present also is a small number of edge-ground tools and sherds of a simple earthenware. A few bone artefacts were also found. Faunal remains are represented by gastropod shells and vertebrate bones. Human remains are also reported.

The Typological Categories

As Bohmers has said:¹

For comparative purposes, no criterion should be used which is not based on an absolute typology, and which could not be verified independently by any observer.

Colani gives no formal definitions for any of the types she distinguishes. Various categories are referred to by name, and these are given below.²

Strikers³

These have various forms; they are crude tools which, it is suggested, might have been weapons or missiles. One face, often convex, is covered by the unflaked surface of the pebble,

¹

A. Bohmers. 'Statistics and Graphs in the Study of Flint Assemblages'. Palaeohistoria, 5; 4.

²

Colani, op.cit. 56-58.

³

'Percuteurs' in the text.

the other being worked into a central prominence which may be high or low.¹

Smaller Strikers

Another kind of striker is worked only at the edge, not on the butt. These are made on pebbles that have been more intelligently chosen and are small, lighter and more skilfully worked than the other kind of strikers mentioned above.²

Points³

These are large natural flakes which have been 'awkwardly' (malhabilement) worked at their edges. They are often thick and more or less triangular.⁴

Almond Shaped Tools⁵

These are said to have various shapes and are irregular, rough and relatively small.⁶

1

Colani, op.cit. 56.

2

'Les galets dont ils proviennent sont mieux choisis, plus petits, moins lourds, la taille est plus régulière, le bord actif mieux arrondis, plus convexe, plus finement retouché.' Colani, op.cit. 56.

3

'Pointes' in the text.

4

Colani, op.cit. 56.

5

'Amygaloides' in the text.

6

Colani, op.cit. 56.

Coup de Poing, or Club¹

Narrow implements, with one convex face entirely flaked; the unflaked pebble surface forms a hump on the other.²

Scrapers³

These are flaked only on the steep functional edge so that the rest of the tool is covered with the unflaked pebble surface.⁴

Perfectly Elliptical Implements

These have one face that is cambered.⁵

Small Implements

These are given various names - scrapers, knives, piercers and pestles.⁶ Small shell tools are also mentioned by Colani in this context, but they seem rather out of place in the typology, which is elsewhere only concerned with stone tools. The 'small implements' are retouched flakes.

Short Axes

These artefacts, called 'haches courtes' in the text, are flaked pebble artefacts that have been abruptly truncated at

1

'Massue' in the text.

2

Colani, op.cit. 56.

3

'Racloires' in the text.

4

Colani, op.cit. 56.

5

Colani, op.cit. 57.

6

'Racloirs, grattoirs, couteaux, perçoirs, pilons.' Colani, op.cit. 58.

one end (Figure 3). They thus have a flat base that is at right angles to the main axis of the implement. Their form makes these artefacts stand rather apart from the other implements, but it is possible that they are merely broken examples of the other types mentioned above. However, the fact that some have been truncated in such a way that the base is almost exactly at right angles to the main axis suggests that they are deliberately fashioned implements, rather than accidents. Some are edge-ground.

In the text of the report, many of the tools are described and illustrated photographically in the plates, some tools are described but not illustrated, and others illustrated but not described. Many of the tools are described in considerable detail. For example, a tool called 'an implement which was intended to be used as a striker or to be thrown' is thus described:

It has a mean length of six to seven centimetres and has been made from a pebble by the removal of large flakes: the skin of the pebble remains only on the part which would fit the palm of the hand: the point is opposite this part.

Another tool, called an 'axe', is described as follows:

Rectangular: it is about 14 centimetres long. The worked face is entirely flaked: only a small quadrilateral, formed of the polished pebble skin, remains towards the top. The opposite face has been partly flaked.

Such descriptions do contain facts which are relevant to a typological classification and which can be objectively verified - measurements of maximum length, for example. But many of the

points contained in the descriptions are not stated with sufficient precision for them to be used in an objective classification.

The lack of precision imported by the absence of definitions is reflected in the number of names used by Mlle Colani. Eighty-two tools from Sao Dong are described in the reports and twenty-eight names are used in the description. Many of the names apply to only one artefact.

Artefact Grouping

Colani states¹ that only seven of the nine sites are important for an interpretation of the artefacts: Sao Dong, Lang Neo, X-Kham, Trieng-Xen, Som-Jo, Lang Vo and M-Khang. Of these, only four contained undisturbed deposits:² Sao Dong, X-Kham, Trieng-Xen and M-Khang. The other deposits had been disturbed, probably at different times. Colani does not describe the nature of this disturbance, nor how it was recognized.

In the four undisturbed sites, a morphological sequence is reported for the artefacts recovered from the deposits. The coarsest, largest and most massive artefacts are reported from the bottom - and the smallest and best made from the top.

¹ Colani, op.cit. 55.

² Colani, op.cit. 55.

Between the extreme sizes there were intermediate types in the intervening part of the deposit, demonstrating that the diminution in the general size of the artefacts had taken place gradually.¹

Colani assembles the artefacts into three groups, for the sake of clarity.² The groups are called early, intermediate and late. This is only a very general grouping; there is no boundary between each period represented.³ The refinement which is reported for the collections, progressing from the lowest parts of the deposits towards the top, is said to be gradual and fairly continuous. 'Early' types are said to be sometimes found high in the deposits, and examples of 'less ancient' types are sometimes found prematurely at lower depths.⁴

Colani⁵ describes the general nature of the artefacts which fall into the three categories.

Group One (Early Period)⁶

Six types are identified in Group One, although many tools described do not appear to fall into any of the types. The striker

1

Colani, op.cit. 55.

2

Colani, op.cit. 55. 'Pour la clarté de notre exposé nous avons catalogue les objets en trois groupes.'

3

Colani, op.cit. 55.

4

Colani, op.cit. 55.

5

Colani, op.cit. 55.

6

Colani, op.cit. 56.

or pyramid is considered to be a missile. Several of the illustrations show that the brief description of the type is fairly apt,¹ although they would appear to be scraping tools rather than missiles. Unfortunately Mlle Colani is inconsistent, as several tools described as strikers could not be described as pyramids.² Another type is the point.

An example of the undesirable use of subjective criteria in the definition of tools types is provided by Mlle Colani's description - almond shaped tools. Although some of the illustrated tools which are said to belong to this type appear almond shaped to the writer, some which do appear to be almond shaped are not so described by Mlle Colani.³ Such differences of opinion can never, of course, be resolved, given the subjective nature of the criterion employed.

The coup de poing or club was perhaps used as some kind of chopping tool rather than as a weapon, as Mlle Colani suggests. The brief description is quite apt, as far as can be judged from the photographs; but some implements which appear from the plates to belong to this type are not included by Mlle Colani in it.⁴

¹ Colani, op.cit., Plate I, 11.

² Colani, op.cit., Plate II, 8; VI, 30.

³ Colani, op.cit., Plate III, 9.

⁴ Colani, op.cit., Plate III, 1.

It would appear from the plates that scrapers are distinguished by having the functional edge parallel to the long axis of the tool, rather than to the short axis.

The final type in this group is the short axe. The abrupt break at the base of the implement gives it a characteristic appearance. However, not all the tools illustrated by Mlle Colani which have this feature are described as short axes.¹

All artefacts from this group are reported to be unifacially flaked.²

Group Two (Intermediate Period)³

Had Colani given more precise definitions of the types included in Group One, then it would be easier to compare them with those of Group Two. This group is said to include some types from Group One, and although not described in any detail these are said to be 'smaller, thinner and more suited to their function'.⁴ New types occur also.

Mlle Colani draws attention to some of the illustrations of the artefacts to demonstrate an improvement in technique, including more skilful retouch. It is, of course, very difficult

1

Colani, op.cit., Plate I, 19.

2

Colani, op.cit. 56.

3

Colani, op.cit. 56-57.

4

Colani, op.cit. 56.

to study such features through the medium of a two dimensional photograph, but even allowing for this difficulty the improvements to which Mlle Colani refers are not apparent in every case.

Five new types are described for this group. One is the perfectly elliptical tool.¹ Of the two implements of this type illustrated, neither appears to be perfectly elliptical.² Another new type is the axe, which is again described as an almond shaped implement. In a footnote,³ Colani mentions that although this type is given the name axe, it includes implements of very different function. It would be possible to contend that many of these tools are not almond shaped.

A third new type is described as large, almost 20 centimetres long, more or less broad and thick. It is said to be often 'remarkably regular', and yet sometimes 'awfully rough'.

Yet another new type is the 'pleasant flat axe',⁴ which is skilfully made. The only example illustrated does not seem to fit this description remarkably well.

¹ 'Pièces à contour parfaitement elliptique' in the text.

² Colani, op.cit., Plate VII, 11; VIII, 7.

³ Colani, op.cit. 56.

⁴ 'La jolie hâche plate' in the text.

Finally there are axes which are polished at the cutting edge.

Many of the tools in Group Two are said to be worked on only one side, although some are worked on two.

Group Three (Late Period)¹

It is said that several older types persist - the heavy axe, the disc, the pyramid and the edge-ground axe. They are said to be smaller and more skilfully made than those in Group Two.

The new types in Group Three are small tools, with maximum length of less than 7 centimetres, the smallest being less than 5 centimetres. Most are said to be made from flakes, although the illustrations would rather seem to indicate that flakes were rare. It is, however, difficult to gain a precise idea of these artefacts from any of the plates.

The artefacts of Group Three from the late period, with a few exceptions, are unifacially worked.²

In summary, it can be said that the absence of concise definitions of types and the lack of any description of objective and measurable characteristics diminishes the typological significance of Mlle Colani's classification. It cannot be said that Colani has established a typology for the collections from

¹

Colani, op.cit. 57.

²

Colani, op.cit. 58.

Sao Dong, or from any other of the nine sites from Hoa Binh. This consideration in turn reflects on the threefold division described above.

Colani only describes a small proportion of the artefacts from the nine sites. For example, only eighty-two artefacts are described from Sao Dong, yet over a thousand tools were found there.¹ She does not state the principles by which the artefacts have been selected for description. The described sample may truly reflect the nature of the collection as a whole; on the other hand it may be seriously biased. The text of the report throws no light on this point.

If the assumption is made that the sample accurately reflects the nature of the whole, then it can be used to judge the assertion that a general morphological sequence was present in respect of the artefacts in the deposits.

The validity of this assumed check is still further limited, however. Colani does not describe the depths at which the described artefacts were found; she only gives the depths limiting each of her three periods. These limiting depths are given for each site. For example, at Sao Dong, the early period was, in the main habitation area, found at depths of 2 metres and a little below.² The

¹

Colani, op.cit. 9.

²

Colani, op.cit. 11.

intermediate period was found between 1.8 metres and 1.2 metres and a little above.¹ The late period was found at depths between 80 and 10 centimetres.²

The apparent presence of sterile bands between the levels attributed to the three periods presumably indicates that the limiting depths are not given with precision. Colani herself states³ that the measurement of the depths in the loose deposits was not exact.

Thus the three periods have to be treated each as a unit, in that it is not possible to differentiate artefacts in terms of the depths at which they were found within the limits that are said to define the categories in the deposits.

Table 3 gives the mean values of the three variables length, breadth and thickness for the three categories represented by the artefacts described from the four undisturbed sites - Sao Dong, M-Khang, X-Khang and Trieng-Xen. Assuming an adequate sample, if the general morphological sequence defined by Colani was present, then the mean values for the three variables will be smaller for the intermediate period than for the early period; and smaller for the late period than for the intermediate period.

¹

Colani, op.cit. 11.

²

Colani, op.cit. 14.

³

Colani, op.cit. 11.

The table shows that this is not the case. The mean values of length for the late, middle and early periods respectively are 64, 100 and 96 millimetres. The mean value for the late period is smaller than that for the intermediate and early periods; but the mean value for the latter two periods is about the same. A similar observation can be made about the mean values for breadth.

It will be noted that the samples used to estimate the values of mean thickness are less than half of those used for the estimation of mean breadth as measurement of thickness is not given for some of these artefacts in the report. It may be, therefore, that the sample used to estimate mean values of thickness has been biased in some way. The trend shown by the mean values for thickness is at variance with that shown by the mean values for length and breadth. The mean values for the middle and the late periods are very nearly the same, while that for the early period is considerably larger. As it is possible that the values of mean thickness have been derived from a biased sample, it will be advisable to ignore them in an evaluation of the general morphological sequence.

Taking then the mean values of length and breadth, there is no indication that the sequence claimed by Colani was present throughout the deposit. There does seem to be some justification for separating the artefacts in the late period from those in the other periods on the grounds of a general diminution in size.

However there is not the same justification for similarly separating the artefacts placed in the intermediate and early periods.

This is only a crude assessment of the situation. Only a small proportion of the excavated artefacts has of necessity been used and these artefacts have been compared as three groups which Colani admits to be essentially an arbitrary division of the collections. Also, the comparison has been made in terms of overall dimensions, which, although certainly an important and explicit element in Colani's sequence, are only some of a number of allegedly changing features.

Although often expressed in subjective terms, showing an improvement in technique, for example, or being better made with fine secondary flaking ('retouche'), some of the other features involved are capable of objective statement. Thus Colani writes that bifacially flaked implements were found only in the upper layers and it is possible to infer that, if the later artefacts are more completely worked than the earlier, then they will have had more of the pebble cortex removed. These observations are capable of being quantified and comparisons could be made between artefacts at different depths throughout the deposits.

It is quite possible that Colani has misunderstood the nature of the pebble tool collections by trying to formulate discrete types. It may be that these artefacts occupy a continuous range

of shape and size. Thus it is possible to select tools that are long and narrow and contrast them with selected tools that are round and flat. However, in order that these may be archaeologically significant types it is important to show that the rest of the collection does not fall into intermediate positions ranging continuously between these two extreme forms. It may be the case that the long and narrow forms and the round and flat forms are in fact quite unusual in the collections, and that the remainder of the artefacts fall into intermediate categories.

As will be demonstrated in Chapter VIII, it is possible to test a collection to see how the artefacts should be grouped by using quantifiable variables (including length, breadth and thickness). But such a test cannot be applied to the collection that Colani describes; the necessary information is not contained in the text of the reports and cannot be derived from the photographs; and, a more severe restriction, only a very small proportion of the collection is mentioned in the text.

In a similar way it should be possible to demonstrate exactly how the proportions of bifacially and unifacially worked tools differ at various depths in the deposit. But again, the necessary information is lacking. It would be extremely interesting to investigate the amount of pebble cortex remaining on tools from the upper levels and compare this with the same observation made

on tools from the lower levels. Again, it would be most interesting to make the same observation on the degree of secondary working; for it would seem that the more that a pebble has been flaked, the more the final form of the artefact will be decided by the artisan and less by the original pebble.

Although it is quite possible that the types isolated by Colani are valid, this cannot be assumed from the data presented in the report. Indeed the apparent discrepancies noted above between Colani's typological attributions and the appearance of the artefacts in question in the illustrations suggest that the types are not well conceived. There is a suspicion that the types described by Colani, including the new types characterising the intermediate and late periods, are selected examples from sequences and ranges. If this is the case then there is no more reason why the sequence should be expressed as threefold, than as twofold, fourfold or tenfold.

There are some artefacts that might stand as distinct types - the short axe and the edge-ground tool. If the sequence could be divided in terms of the appearance or disappearance of such distinct forms, then it would carry conviction.

Unfortunately the text of the report does not throw light on this point. Twenty-nine short axes are described from the nine sites. Of these, two are placed in the early period, twelve in the

intermediate period, and nine in the late period. The only conclusion possible is that short axes are represented throughout any sequence that may be present in the deposits. It would be interesting to know how the degree to which the short axes have been flaked and worked differs with depth in the deposits, so that comparisons could be made with the pebble tools; again, the reports do not contain the information required to make these observations.

The edge-ground tools are particularly interesting, as the technique of applying polish to the cutting edge may be considered to be technologically more advanced than that of flaking. Colani¹ describes two kinds of edge-ground tool. One is an unflaked pebble that has been bifacially polished to produce a cutting edge. The other is a flaked pebble that has been bifacially or unifacially ground to form a cutting edge. However, of the twelve tools of the second kind that are illustrated, only six have been flaked.²

Colani points out that the edge-ground tools form only a very small proportion of the stone tools in the collections. At Sao Dong, eleven only out of more than a thousand tools were edge-ground; at Lang Neo ten out of 600 tools (five of them made on short axes);

¹

Colani, op.cit. 59.

²

Colani, op.cit. Plates III, 30; VI, 17, 18; X, 14, 15.

at X-Kham, three out of over 170; at Trieng-Xen, three out of nearly 170; at M-Khang, two out of nearly 190; at Lang Bay there was one edge-ground tool.

Colani remarks that no edge-ground tools were found in the early period. Though the unsatisfactory nature of the groups must be borne in mind, nevertheless this information indicates that edge-ground tools were never found in the lowest levels of the relevant deposits. Of the edge-ground tools that are described, thirteen are placed in the intermediate period, and twelve in the late period. It would seem that edge-ground tools, although not present in the lowest levels of the deposits, were present in approximately equal numbers in the other levels.

It would be illuminating to know how, if at all, the technology of the edge-ground tools differs at different levels in the deposits. Colani's division of these tools into two kinds is somewhat suspect, since, as has been pointed out, the artefacts which are illustrated to exemplify the varieties do not correspond with the descriptions in some cases. Nevertheless the validity of such a division may be accepted, although the report as it stands cannot allow the point to be developed.

Colani mentions¹ that small worked flakes were found in the late period. She illustrates two such flakes from Lang Neo.²

¹Colani, op.cit. 58.

²Colani, op.cit. Plate IX, 14, 16.

One of these (Plate IX, 14) she describes as follows:¹

A small scraper, less than 4.5 centimetres long. It is the same shape as the last artefact described, but the cutting edge is not sharp. Very fine flaking and retouch on one face. A pleasant piece; it is either contemporary with the scraper illustrated in figure 16, or more recent.²

It is not apparent from the illustration, however, that this artefact is a flake - or indeed that any of the artefacts illustrated as flakes are indeed flakes. Moreover, as the text does not specify the small late period artefacts that are regarded as worked flakes, it is not possible, from the report, to discover how many of these interesting tools were found, the sites at which they occur, and their distributions in the deposits.

The conclusion must be that Colani has neither defined a satisfactory typology for the collections from Hoa Binh Province; nor has she isolated three chronological phases based on the stratification of the excavated deposits. It must be borne in mind, however, that Colani's classification into three periods was put forward as an aid to the description of the artefacts. This is an important point, and it would be ungracious for it to be

1

Colani, op.cit. 43.

2

Un autre grattoir ne mesure guère que 5 centimètres de long. Il a même forme que le précédent, mais le tranchant n'est pas acéré. Taille et retouche sur une seule face, très fines. Jolie pièce; elle est contemporaine du grattoir figuré en 16 ou est plus récente.

neglected. It has been necessary to examine the text of the report closely as other interpretations have subsequently become attached to it.

It has been pointed out above that collections from one site or area can only be compared validly with collections from other sites or areas on the basis of an objectively derived typology. The full significance of Mlle Colani's report will only be apparent in the light of comparative work based on objective typologies. If the results of such comparative work agree with the general sequence that Mlle Colani has suggested in her report, then such agreement will be a tribute to Mlle Colani's insight.

Other aspects of Colani's report will now be considered.

Stones with Circular Depressions

Two varieties are distinguished. The first comprises flat pebbles with a number of small depressions on two sides. These depressions are about 2 centimetres in diameter, and 1 centimetre deep. They appear to have been made by the rotation of some kind of blunt point. In contrast to these pebbles with multiple depressions are those with only a single large depression on each face. The diameter of the depression may be as much as 12 centimetres, and the depth about 2 centimetres. It would appear that some substance has been ground on these pebbles, and that the depressions are the result of that grinding.

Sixteen pebbles bearing depressions were found; twelve at Lang Neo and four at M-Khang. These are placed in Mlle Colani's Groups Two and Three; none are placed in Group One.

Worked Bone and Shell

Only fifteen bone implements are described and almost half of these are from one site Trieng-Xen. Some are spatulate implements with a polished blade; others appear to be splinters which may or may not have been worked into tools. They are all made from mammalian long bones.

Apparently long strips taken from the natural edge of the shells of large freshwater Lamellibranches were used as implements. Shell tools were not common.

Neither shell or bone implements were found in the lowest levels of the deposits.¹

Grinding Stones, 'Pestles' and 'Mortars'

Grinding stones, 'pestles' and 'mortars' are reported from eleven sites (Tables 44-45).

Red Ochre

Fragments of red ochre (haematite) were found at Sao Dong, where some tools had been stained with this substance.² At Trieng-Xen, human bones were found that had been similarly treated, as well as some artefacts.³

¹

Colani, op.cit. 65-66.

²

Colani, op.cit. 9.

³

Colani, op.cit. 25.

Faunal Remains

Although faunal remains are reported from some of the sites, only a few of the species represented are identified. Animal bones are said to have been rare at Sao Dong¹ and a few were found at X-Kham,² including a rhinoceros molar and vertebra. At Trieng-Xen³ numerous animal bones were found, some burnt, and elephant and rhinoceros were represented. A collection of bones found at one place in the deposit under a rock at a depth of about a metre seems to represent three large animals, one being rhinoceros. More bone fragments were found at M-Khang⁴ and many of these had been burnt. A few mammalian bones were found at Lang-Neo⁵ and also a carnivore canine which had been pierced at the root so that it might have been suspended from a cord.

These bone fragments are presumably food remains. Apparently such bone was confined to the upper part of the deposits.⁶

1

Colani, op.cit. 9.

2

Colani, op.cit. 19.

3

Colani, op.cit. 25.

4

Colani, op.cit. 31.

5

Colani, op.cit. 37.

6

Colani, op.cit. 69.

Mlle Colani suggests¹ that the occurrence of Auricula Auris Judae (See Table 4), a brackish water species, in some of these sites indicates that the sea, now about eighty miles from Hoa Binh, must have been closer in antiquity. She considers that the shells would not have been passed over this distance by human agency to sedentary groups living in the caves. Such a suggestion may well underestimate the facility with which small objects can pass over long distances by the medium of exchange between one group and another. The ability of primitive groups to travel over relatively large distances may be similarly underestimated.

Human Remains

Human remains are found at a number of sites. Fragments of long bones and the remains of a maxilla were found at Sao Dong.² Human bones are reported from Trieng-Xen³ and four human jaws and skeletons from M-Khang⁴ are said to represent burials, although there is nothing associated with them to date them. A fragmentary human skull was found at Lang-Neo⁵ although this disintegrated after excavation. Another skull from the same site is said to be

¹ Colani, op.cit. 71.

² Colani, op.cit. 9.

³ Colani, op.cit. 25.

⁴ Colani, op.cit. 31.

⁵ Colani, op.cit. 37.

the result of a recent burial. Two fragments of the same jaw were found at Som-Jo,¹ in a fair state of preservation and another jaw is reported from Lang Bay.²

Pottery Sherds

At Sao Dong a few sherds were found in the upper part of the deposit.³ These are said to be 'recent'. Some sherds, also described as 'recent', were found in the lower parts of the deposit. It is suggested that these had gravitated to this position through the loose and shifting deposit. 'Recent' sherds are also reported from Lang-Vo⁴ and Lang Bay⁵ and M-Khang.⁶

Mlle Colani does not describe the nature of this pottery. It is not possible to decide from the evidence whether pottery is in primary association with flaked or edge-ground tools at these sites.

Copper Vessels

A few very deformed copper utensils are reported from Lang Neo.⁷ As this deposit is reported to be disturbed, these objects have little significance in this context.

¹Colani, op.cit. 45.

²Colani, op.cit. 51.

³Colani, op.cit. 9.

⁴Colani, op.cit. 50.

⁵Colani, op.cit. 51.

⁶Colani, op.cit. 31.

⁷Colani, op.cit. 37.

In summary, various points can be made about Colani's description of the excavation of nine sites in Hoa Binh. Although she has suggested a typological classification for the pebble artefacts, this classification has been found to be unsatisfactory. In order to assist the description of the artefacts, Colani has divided the collections into three groups, which are supposed to have chronological significance; the early period appears below the intermediate period; and the intermediate period below the late period. But, as has been pointed out, these groupings are not satisfactory in the light of the general nature of the information contained in the reports.

Nevertheless, some positive information emerges from the investigations. The sites are caves and cave mouths. Colani suggests that all these sites are suitable dwelling places, and she suggests that the people who were living in these caves and shelters must have been fairly sedentary as the surrounding countryside is covered with dense undergrowth, marshy in places harbouring leeches and wild animals.¹ This opinion underestimates the ability of aboriginals to feel at ease in these conditions and it is more likely that the sites were used as temporary shelters by groups who wandered through quite an extensive area. Such has been the practice of aboriginal groups in Malaya and elsewhere up to the present century.²

1

Colani, op.cit. 6.

2

Cf. G. de G. Sieveking. 'Excavations at Gua Cha, Kelantan, 1954. Part I.' Federation Museums Journal, 1954, new series 1 and 2; 193.

The vertebrate faunal remains attest to hunting, and the gastropod remains to food gathering. There is a suggestion that food debris represented by bone remains was confined to the upper parts of the deposits. This distribution may point to a shift in the importance of hunting; on the other hand it may result from a more complete decay of organic remains in the older, lower parts of the deposits.

The presence of pebbles bearing depressions on their surfaces may point to the grinding of seeds and the preparation of vegetable foods gathered from a forest environment.

There is no evidence for the dating of these deposits. The faunal remains such as have been described are those of recent species. The human remains are those of Homo sapiens.

The stone industries seem to have been composed almost entirely of flaked pebble tools that may have served as general cutting and scraping implements. It appears that the tools in the lower parts of the deposits are larger than those in the upper parts, and that the gradual diminution in size is a gradual process and not an abrupt change. It also seems probable that there are no bifacially flaked pebble tools in the lower parts of the deposits, bifacially worked pebble tools being found only in the higher levels. It may be the case that the amount of flaking, reflected in the proportion of the tool surface that still retains the pebble cortex, and the extent of secondary working increases in the deposits with decreasing depth.

Short axes were apparently present in all levels of the deposits, although only a small number was found.

Edge-ground artefacts are not reported from the lower levels of the deposits. Two kinds are mentioned; one is merely a river pebble that has been edge-ground to form a cutting edge; the other is a flaked river pebble that has been similarly edge-ground. Edge-ground tools are rare. At Sao Dong they formed some 1 per cent of the stone tools recovered; at X-Kham, where they were found in greatest proportion, they were only 2 per cent of the total number of stone tools found.

Retouched flakes, that is, flakes which have been worked after their detachment from the parent core, are reported in small numbers from the upper parts of the deposits. No blades are reported.

Bone tools are described; these are either polished, or simply splinters that may have been worked into tools. Only fifteen bone implements were found. Shell tools were not common, but there is some indication that some shells were used as implements.

Red ochre is reported from two sites. Stone artefacts were stained with this substance at one site, and human bones and some stone tools at the other.

Earthenware sherds were found at four of the sites. The nature of this pottery is not described. Colani suggests that pottery is confined to the later, upper levels although sherds were found at Sao Dong in the lowest parts of the deposit.

A few deformed copper vessels were found at Lang Neo; these are presumably elements of a later metal-using culture.

Other Sites in Hoa Binh and Region

Colani continued her work of archaeological exploration and excavation, excavating cave and shelter sites in Ninh-Binh Province during November, 1927.¹ Although situated in an adjacent administrative province, the sites are associated with the same limestone formations as those previously described from Hoa Binh. Their exploration can be treated as an extension of the Hoa Binh excavations.

Three sites are mentioned in this report,² Tchong Doi (shelter); Yen Luong (shelter); Nhan (cave).

No plans or sections are published for any of the sites, with the exception of a sketch section of the cave at Nhan. No mention is made of the method of excavation. The nature of the deposits is not described nor are any references to stratification made. There is no indication of the numbers of artefacts found.

Neither edge-ground tools nor pottery were found at Tchong Doi or Yen Luong. Colani³ states that the tools from these two sites were either naturally flaked pebbles, or naturally flaked pebbles that had been modified with a minimum of retouch. However,

¹Colani, M. 'Notice sur la préhistoire du Tonkin.' Bulletin du Service Géologique de l'Indochine; 1928; 17, 1.

²Colani, 1928; 41.

³Colani, 1928; 42.

photographs of a number of artefacts from the sites¹ would indicate to the writer that Colani is incorrect in suggesting that any of the flaking on the tools could be ascribed to natural causes.

The cave at Nhan² produced three edge-ground axes.

Colani supposes that the collections from Tchong Doi and Yen Luong provide support for her division of the collections from Hoa Binh³ discussed above. The collections from Tchong Doi and Yen Luong are supposed to belong to the early period, and the collection from Nhan to the intermediate period.

It has already been concluded that Colani failed to support the tripartite division of the Hoa Binh Collections with convincing evidence. Her descriptions of the sites at Tchong Doi, Yen Luong and Nhan are not sufficiently detailed to substantiate her suggestion that the collections from these sites confirm that division.

Indeed, Colani herself seems to have entertained some doubts of her tripartite theory, for she states⁴ that the divisions, established for extremely loose deposits where it was almost impossible to see any stratification, would appear to be somewhat artificial without the evidence provided by the sites at Tchong

¹

Colani, 1928; Plates 13, 14.

²

Colani, 1928; 41.

³

Colani, 1928; 43.

⁴

Colani, 1928; 43.

Doi and Yen Luong.¹ But, as pointed out above, the three new sites as reported can provide little evidence to support Colani's hypothesis.

From March to May 1929, Colani undertook the excavation of seven other sites in Hoa Binh Province² (see Table 5).

With the exception of Lang Vanh and Da Phuc, no separate mention is made of the collections from individual sites, although a brief general summary is given.³ No descriptions of individual artefacts are given for the two sites named above, nor is any indication provided of the numbers of artefacts found. However, fifty-four edge-ground tools from Lang Vanh are said to be 9 per cent of the stone artefacts, indicating a total of 600; and thirty-seven edge-ground tools from Da Phuc are said to be 3 per cent of the total, or about 1,200 stone artefacts in all.

Although the collections from these sites are not described, Colani does draw conclusions about them.⁴ Only three of the sites are said to have produced significant collections: Lang Vanh, Da Phuc and Dong Noi. These collections are attributed by Colani

¹'Ces divisions, établies avec des dépôts extrêmement meubles, où à peu aucune stratification n'est discernable, pourraient paraître assez artificielles sans la decouverte des kjokkenmoddingen...'

²M. Colani. 'Quelques stations hoabinhiennes.' Bulletin de l'Ecole Francaise de l'Extreme Orient; 29; 261-272.

³Colani, 1939; 268.

⁴Colani, 1929; 270-272.

to her intermediate period. The deposit at Lang Vanh, however, is said to have been disturbed.

Colani states that there is no suitable source of river pebbles for the manufacture of stone tools near to the site at Da Phuc. In consequence, bone was used as a raw material instead; however, apparently some 1,200 stone artefacts were discovered at this site, so that Colani's statement gives rise to some surprise.

A concentration of edge-ground tools is noted in the lower parts of the deposits at Lang Vanh and Da Phuc, although the former deposit had, as mentioned, been disturbed. Edge-ground tools are reported to have been rare or absent from the upper parts of these deposits. The collections are described as being composed in the main of tools made on rolled river pebbles; only a few retouched flakes are noted¹ and no blades were found. Short axes were present.

The collections from Dong Noi are said to be archaic, but no description is given in the report.

In 1930, Colani² published an extensive account of investigations of sites in Thanh Hoa Province. These again are geographically

¹

'En quantite infime.' Colani, 1929; 271.

²

M. Colani. 'Recherches sur la Préhistoire Indochinoise.' Bulletin de l'Ecole Française d'Extreme-Orient, 1930, 30; 299-422.

contiguous with those of Hoa Binh Province. Four other sites are also described from limestone formations further south, in the Qui Dat region, Quang Binh (see Map 2). The sites are listed in Table 6.

Colani describes artefacts from four of these sites: Yen Lac, Kim Bang, Duc Thi, and Lang Bon; for the rest only a general summary is given. No direct mention is made of the number of artefacts that were found, except for the site at Lang Bon. Only fifty artefacts are described from this site, yet it is said¹ that 2,378 artefacts of bone, stone and shell were found. It may well be that similarly small samples are described from Yen Lac, Kim Bang and Duc Thi.

The depths in the deposits at which the artefacts described were found are given, but not with precision. Colani² states that depths could not be measured accurately in the loose and shifting deposits, so spits rather than exact points are indicated. This is not very exact information, she says, but the error is almost nil.³ However, even with plans and one longitudinal and one

1

Colani, 1930; 364.

2

Colani, 1930; 323.

3

'Les profondeurs ne peuvent guère être mesurées avec exactitude dans ces masses croulantes; aussi les mentionnons-nous par tranches; renseignement peu rigoureux, mais erruer presque nulle.'

transverse section of the deposits given for each site, the information is not sufficiently precise for any stratigraphical inferences to be made. The diagrams indeed do little more than indicate the irregular nature of the deposits, which are in effect loose shell middens situated in caves and rock shelters.

Colani makes no attempt to classify or categorize the artefacts from any of these sites. She uses various names to refer to them, although no definitions are given. These names are those used previously by her.¹

Perhaps the most significant feature of this report is that Colani does not make any mention of the three periods she previously postulated for the collections from Hoa Binh² and to which she referred on subsequent occasions.³ As no attempt is made to place any of the collections, or parts of the collections, described in 1930 into the categories described in 1927, it must be supposed that by this time Colani had herself decided that these divisions were not supported by the facts of excavation.

The salient features of the collection from these new sites are set out in Tables 44-47 and 51. They cannot be said to differ, in terms of the general descriptions given by Colani, from those previously described from Hoa Binh Province.⁴

¹Colani, 1927.

²Colani, 1927; 55.

³Colani, 1928; 43: 1929; 270-272.

⁴Colani, 1927.

The artefacts are made on rolled river pebbles, unifacially or bifacially worked. A few retouched flakes are mentioned, and bone and shell tools are represented. Fragmentary human remains are associated with some of the collections. One point of interest is that two sites, Lang Vanh and Da Phuc, produced a rather higher proportion of edge-ground tools - those at Lang Vanh being 9 per cent of the total. The edge-ground tools are reported from the lower parts of these deposits, although the sediments at Lang Vanh are reported as being disturbed.

Elements of a more developed, neolithic phase, quadrangular polished adzes, were found at some sites, as were earthenware sherds.

Recently, between January 1960 and January 1961, Dr P.I. Boriskovsky spent ten days in Hoa Binh Province, examining caves and shelters.¹ A summary translation of Boriskovsky's reports has been given by Solheim.²

1

P.I. Boriskovsky. 'Exploration of ancient sites of the Stone Age in the Democratic Republic of Vietnam.' Soviet Archaeology, 1962, 2; 17-25.

P.I. Boriskovsky. 'Archaeological discoveries in Vietnam.' Herald of the Academy of Science of the USSR., 1962, 4; 98-101.

2

W.G. Solheim. 'Southeast Asia.' Asian Perspectives, 1962, 6, 1-2; 23-31.

Three sites were examined: a cave some hundred metres from the site at Trieng-Xen, excavated by Colani; a rock shelter at Hang Dong; and a small cave at Sao Dong, near to that excavated by Colani in 1926.

The results of the test excavations are not given in detail, but Boriskovsky concludes:¹

Our excavations showed that Colani in her work in the Hoa Binh caves had collected thoroughly and completely cultural remains, and hence her publications give a relatively full and objective picture of the Hoabinh inventory. We are further convinced of this due to the total absence of any sign of fossilization of faunal remains recovered for these caves. This would be another argument in favour of the Hoabinh caves being of Mesolithic and Neolithic age, and not late Palaeolithic.

In order to make a comparison of the collections described above simple and concise, attention will now be paid to a statement of a suitable vocabulary of terms to express such relationships as may be expected. This vocabulary must meet two related needs: it must cater for the range of possible relationships and it must do so in a way appropriate to the purposes of prehistoric archaeology.

The prehistorian is not merely concerned to describe facts, he has to order those facts into a story not only to make it possible to know what happened in prehistory, as far as the surviving record allows, but also to make that story intelligible.

¹

Solheim, 1962; 28.

So that the many facts of prehistory may be reduced to manageable size, the prehistorian thinks in terms of abstract types. The repeated association of types is taken to mean that the phenomena represented by those types are the result of the actions of the same people living at the same time. Recurrent assemblages of types are said to represent cultures.¹ Archaeological cultures represent functioning communities² and the archaeologist classifies the data of prehistory into such assemblages and places these into their correct geographical and chronological settings, in order to study their developments and relationships.³ It may happen that different assemblages of types do not represent different communities with distinct histories, but stages in the development of the same society.⁴ These stages will not require names as separate cultures, but their phylogenetic relationships can be indicated by using one name to indicate the generic culture, and geographical terms or chronological adjectives or numbers for the variations.⁵

¹
Childe, 1956; 16.

²
J. Golson. 'Culture change in prehistoric New Zealand.'
'Anthropology in the South Seas', ed. J.D. Freeman and W.R. Geddes,
1959; 30.

³
G.E. Daniel. 'A Hundred Years of Archaeology.' London, 1950; 318.

⁴
Childe, 1956; 114.

⁵
Childe, 1956; 127-140.

But this procedure contains a fundamental difficulty. As Golson has pointed out,¹ the transformation from the earlier to the later stages of the culture has to be apparent before the implied relationships can be stated and indicated by the nomenclature. In other words, one term or set of terms is required for the analysis of archaeological data, and another for the subsequent synthesis.

Golson² has adapted a scheme described by Willey and Phillips³ to fit a body of archaeological data from New Zealand. Assemblages from sites or parts of sites where there has been more than one occupation are components of aspects. Aspects are defined as independent entities, which have no implied relationships with any other aspects. During the process of archaeological analysis a point may be reached where it becomes apparent that a set of aspects have a genetic relationship. At this point, synthesis is possible, and the aspects so related can be grouped together, such a group being a culture.

Cultures, so defined, may well have considerable range in time and space. In order to simplify the process of synthesis, another category is introduced, the phase. A phase is the chronological

1

Golson, 1959; 30.

2

Golson, 1959; 29-36.

3

G.R. Willey and P. Phillips. 'Method and Theory in American Archaeology.' Chicago, 1958; 11-57.

variation of a culture. But phases will subsume geographical variations, and these variations will be the aspects that were previously described (so that the term 'aspect' can be used both during analysis and synthesis).

These terms, components, aspects, phases and cultures, as here defined, will be used in an attempt to relate the collections previously described. One important point must be borne in mind when such vocabularies are employed: the terminology must be designed to fit the facts - and the facts must not be manipulated to fit the terminology.

The type of archaeological situation met by Colani in Hoa Binh is ideal for an essay in archaeological synthesis along the lines described above. All the sites are of the same kind - habitation deposits in caves and rock shelters. Geographically the sites are contiguous, and the collections seem to indicate the same simple hunting and food gathering economy. The artefacts, whether of stone or bone, are of the same general kind, so that there is no reason to suppose that the collections are not components of the same culture.

In her publication of 1927 Colani makes the assumption that all the collections belong to the same culture. Her organization of the material into three chronological groups is in these terms the recognition that three phases of the culture are present, early,

intermediate and late. As she makes no attempt to distinguish between collections placed into any one of these phases, she must consider, in terms of the vocabulary given above, that all the collections belonging to the same chronological phase are components of the same regional aspect.

If her division of the collections were to be accepted, the early phase would be present at Sao Dong, X-Kham, Trieng-Xen, Tchong Doi and Yen Luong; the intermediate phase at Sao Dong, X-Kham, Trieng-Xen, M-Khang, Som Jo, Langh Van, Da Phuc and Dong Noi; the late phase at Sao Dong, X-Kham, M-Khang and Som Jo.

However, there are three major reasons why Colani's threefold division into phases cannot be accepted. First, it is quite clear that only a proportion of the artefacts have been described, and that the descriptions given are inadequate. Second, the stratigraphical information for the deposits, the vital data about the positions in which the artefacts were found, is missing for a number of the sites and inadequate for the rest. The third reason is rather different. Throughout her reports Colani is at pains to point out that the classification that she suggests can be criticized. She therefore does not seem to be convinced of the validity of the divisions herself. Colani's doubts are fully apparent in her publication of 1930. In this, she describes no less than fifteen sites. She not only makes no attempt to attribute any of the described collections

to the three phases mentioned in the earlier publications, she makes no reference to those phases at all.

However, Colani's work has brought to light varied data on a prehistoric way of life that is sufficiently distinct to be looked upon as a culture, exhibiting some chronological development in the geographical area in which it has been studied. The data provided are not susceptible of organization into temporal phases, but are sufficient for general comparisons with other areas to be made.

The very general characterization of the Hoabinhian given by the Committee of the Congress of Prehistorians of the Far East, quoted at the beginning of this chapter, may therefore be accepted. On the published evidence, which has been reviewed above, however, the division of the culture into three parts, Hoabinhian I, II and III, cannot be justified.

CHAPTER II

SITES EXCAVATED IN BAC SON

An appraisal of the excavated sites in Hoa Binh and region would be incomplete without some mention of similar work that was carried out in Bac Son Province (see Map 2). Here caves and rock shelters produced collections that several writers have tried to relate to those from Hoa Binh.

As early as 1909 Mansuy¹ published an account of the excavation of a cave at Pho Binh Gia in Bac Son Province. This site contained a mixed collection of artefacts, some belonging to the classical neolithic, well known at that time from other sites (e.g. Somrong Sen)², and others of a more simple nature. The collections were considered as a whole, and it was not realized that two separate cultures or culture phases were represented.

Fifteen years later, Mansuy conducted an extensive survey of the limestone caves and shelters of Bac Son, in collaboration

1

H. Mansuy, 'Gisement préhistorique de la caverne de Pho Binh Gia (Tonkin)', L'Anthropologie, 1909, 20; 531-543.

2

H. Mansuy, 'Résultats de nouvelles recherches effectuées dans le gisement préhistorique de Semrong Sen, Cambodge. Mémoires du Service Géologique de l'Indochine, 1923, 10, 1; 5-11.

with Colani.¹ From the more detailed information which thus became available followed the realization that more than one culture was represented at some of these sites in Bac Son Province, and the name 'Bacsonian' was coined to distinguish the simple culture from the more advanced neolithic.

In all 27 sites are described from Bac Son. Some were caves, others true rock shelters, and at two sites both a cave and an adjacent rock shelter were excavated. These are listed in Table 7.

Although some description is given of these sites, the majority of the descriptions cannot be considered as excavation reports, as the sequel will show.

No information about the sedimentary or archaeological stratification is given for the majority of sites. However, at

1

H. Mansuy, 'Stationes préhistoriques dans les cavernes du massif calcaire de Bac Son (Tonkin)'. Mémoires du Service Géologique de l'Indochine, 1924, 11, 2.

H. Mansuy, 'Nouvelles découvertes dans les cavernes du massif calcaire de Bac Son (Tonkin)'. Mémoires du Service Géologique de l'Indochine, 1925A, 12, 1.

H. Mansuy, 'Stationes préhistoriques de Keo-Phay (suit), de Khao-Kiem (suit), de Lai-Ta (suit), et de Bang Mac, dans la massif calcaire de Bac Son (Tonkin)'. Mémoires du Service Géologique de l'Indochine, 1925B, 12, 2.

H. Mansuy and M. Colani. 'Néolithique inférieur (Bacsonien) et Néolithique supérieur dans le Haut-Tonkin (Dernières recherches). Avec la description des cranes du gisement de Lang Cuom'. Mémoires du Service Géologique de l'Indochine, 1925, 12, 3.

Keo Phay one metre of deposit is reported to rest on forty centimetres of an archaeologically sterile clay. Horizontal layers of ash in the deposit are interpreted as indications that the site had not been disturbed. At Dong Thuoc also horizontal layers of ash were noticed.

At the following six sites, archaeologically sterile clay is reported to underly the archaeological deposits: Dong Thuoc, Binh Long, Vo Muong, Giouc Giao, San Xa, Suam Son.

The archaeological deposits are said to have been disturbed at four sites, although the nature of this disturbance is not described: Binh Long, Minh Le, Con Ke rock shelter, Con Ke cave.

At Lang Cuom, archaeological stratification was noticed. From the surface to a depth of two metres very numerous and fragmentary human remains were present, together with edge-ground tools that are reported as smaller in the upper layers. Melania shells predominated. Between depths of 2 metres and 2 metres 80 centimetres Cyclophoridae valves were in the majority. At about 3 metres [sic] no shell was found and the few artefacts recovered were coarsely worked.

The depths of the archaeological deposits reported for these sites are tabulated in Tables 48 -50 .

The stratigraphical relationships of the artefacts recovered are only described from the six following sites: Lang Cuom, Lang Rang, Han Moen, Dong Lay, Lang Loi, Na moun.

The absolute depth at which each artefact was found is given for these sites. Absolute depths from the surface of the deposit will, however, only establish stratigraphical relationships if the stratification does not deviate from the horizontal. Except for mention of horizontal ash layers at Keo Phay and Dong Thuoc, this point is not established in the published reports. As no sections or plans (except for a sketch plan of the cave at Dong Thuoc) have been published for these sites, and as no mention is made of the method and techniques used during the excavations, little can be made of the absolute depths reported for the artefacts.

Mansuy makes slight attempt to establish any typology for the collections from these sites. Some artefacts are given names: axe, scraper, pestle, chisel, coup de poing, point. The majority of the artefacts are merely called axes. No definitions are given for any of these categories. Often reference is made to individual artefacts in vague or general terms: for example 'angular implements'¹ or 'a very peculiar axe'² or 'a long narrow thin axe which is a kind of chisel made from phanite'.³

¹

'les instruments anguleux'; Mansuy, 1924; 9

²

'une hâche fort curieuse'; Mansuy, 1924; 12

³

'hâche longue, étroite, et très peu épaisse, sorte de ciseau en p^hanite' (sic); Mansuy and Colani, 1925; 26

The collections fall into two main groups - the edge-ground artefacts and those that are only flaked. The latter include both artefacts made from rolled river pebbles and flakes with secondary working. The great majority of the described artefacts are illustrated by photographs.

Elements of a more advanced technology, quadrangular polished adzes which may or may not be shouldered, are reported from nine of the sites: Pho Binh Gia, Khac Kiem, Dong Thuoc, San Xa, Suam Son, Lang Luc, Minh Le cave, Minh Le shelter, Con Ke shelter. These artefacts are said to represent an upper neolithic stage.¹

The purely flaked tools are placed in a palaeolithic stage; between this stage and the upper neolithic, Mansuy first defines a lower neolithic, represented by the edge-ground tools with polish limited to the cutting edge; and next a middle neolithic, distinguished from the lower neolithic by an increased amount of polish on the edge-ground tools.²

The industry of palaeolithic facies is said to be particularly well represented at Keo Phay, Giouc Giao, Vo Muong and Con Ke.³

¹

H. Mansuy, 1925a; 31

²

H. Mansuy, 1925a: 31 - 38

³

H. Mansuy, 1925b; 32

The lower neolithic is said to be represented in the lower levels of the deposits at Pho Binh Gia and Dong Thuoc¹.

The middle neolithic is said to be represented at Lang Van, although here Mansuy admits that the general attribution of the artefacts to this category is made on morphological rather than stratigraphic criteria².

Patte³ has criticised Mansuy's division of the collections into three cultural stages, palaeolithic, lower neolithic and middle neolithic, on the grounds that there is no stratigraphical evidence that could be used to support the division. As the sequel will show, Patte's criticisms are well founded.

Mansuy does not give any precise analysis of the collections from the sites that are supposed to illustrate the various stages. When it is noted that the ~~21~~ 27 sites excavated in Bac Son produced only 207 stone artefacts between them, that only one site (Keo Phay) produced as many as twenty-seven flaked and edge-ground tools, and that twenty-four sites produced twelve or less flaked and/or edge-ground artefacts, it seems doubtful that any of the sites provided samples adequate for the kind of synthesis that Mansuy has attempted.

1

Mansuy, 1924; 11 - 15

2

Mansuy, 1925a; 32

3

E. Patte, 'L' Indochine préhistorique' Revue Anthropologique, 1936, 46; 10 - 12

Furthermore, as there is no satisfactory information about the stratigraphical distribution of the artefacts in the deposits, it is impossible even to begin to check on the plausibility of the conclusions. It is true that the absolute depths of the artefacts are recorded for six of the sites, but none of these six sites are those to which Mansuy points as representative of his various phases.

The First Congress of Prehistorians of the Far East was equally unimpressed by Mansuy's conclusions. A resolution was passed stating that although the collections discovered in Bac Son form a separate facies from the Hoabinhian further research would have to be carried out before this facies could be adequately defined.¹

The basis of the objection is explained by van Stein Callenfels, who was present at the Congress in Hanoi. He states that the Congress decided that 'the methods of excavation were not sufficiently systematic to allow of any detailed conclusions being drawn on this local facies.'²

1

'La Civilisation découverte dans les cavernes du Bacson forme un facies spécial Il est indispensable de procéder à de nouvelles recherches pour pouvoir fournir une définition adéquate de ce facies.' Praehistorica Asiae Orientalis, 1932; 12

2

P.V. van Stein Callenfels. 'The Melanesoid Civilisation of Eastern Asia'. Bulletin of the Raffles Museum, Series B, 1936 1; 41

In view of these strictures, there would seem little justification in any attempt to proceed to further analysis of the Bac Son collections on the basis of Mansuy's published reports. However, it is possible to acquire some idea of the nature of the material recovered from the sites, if only from the illustrations.

In essence, these collections seem to differ little from those mentioned in the previous chapter. Flaked tools were made from river pebbles; some retouched flakes are present. Simple edge-ground tools also occur, as at the Hoa Binh sites. The proportion of edge-ground tools to flaked tools, taking the sites as a whole, appears to be high. One hundred and ~~twenty~~ ^{nine} flaked tools are described in the reports, and ~~one hundred~~ ^{eighty} ~~by two~~ edge-ground tools. Whether these figures really reflect the nature of the assemblages present at these sites is a matter for conjecture.

Mansuy¹ states that a complete range of ground tools was found, from unflaked pebbles with ground cutting edge to fully polished artefacts. As far as it is possible to judge from the photographs, it would seem unlikely that such a range was present.

1

Mansuy, 1925a; 32. 'Il est possible de sérier les instruments en partant de la hache au corps non retouché et de suivre, sans solutions de continuité, les progrès obtenus, jusqu'aux outils d'une parfaite exécution du Néolithique supérieur.'

To summarise, Mansuy suggests that two cultures are represented at the investigated sites in Bac Son. One, a neolithic culture, is later than the other. This latter is represented by three phases. The earliest is characterised by collections of flaked pebble tools; the next by collections containing flaked pebble tools and edge-ground tools with grinding confined to the cutting edge; and the last as the former, except that the grinding extends over a greater part of the surface of the ground tools.

Although it cannot be denied that the collections may represent three such phases, it cannot be said that the analysis given in the reports is satisfactory, or that the postulated phases can be accepted on the evidence presented.

Some general remarks about the Bac Son sites can conclude this discussion. Human remains were found at many of these sites: Tables 48 - 50 give the relevant data. Mansuy described the human material from two caves in detail: Dong Thuoc¹ and Khac Kiem.² The human remains from Pho Binh Gia were examined by Verneau³.

¹ H. Mansuy, 1924; 15 - 26

² H. Mansuy, 1925a, 13 - 17

³ R. Verneau. 'Les caranes humains du gisement de Pho Binh Gia (Tonkin)'. L'Anthropologie, 1909, 20; 545 - 549

20

No attempt will be made to evaluate the studies of the human material here, but some points of interest may be noted. Mansuy was perhaps a little optimistic in the range of some of the generic relationships that he reported. For example, he was prepared to accept the hypothesis that indigenous Melanesian elements are present in populations from Patagonia, California and Columbia¹. He is presumably likewise incorrect in accepting the suggestion that the individuals reported at Pho Binh Gia had European affinities, particularly with the individuals from Cro-Magnon². On the other hand, it may well be that he is correct in assuming affinity with Oceanic Negroes for the individuals from Khac Kiem and Dong Thuoc³.

Mansuy⁴ supposed that the Melanesian type preceded the European, and that the latter introduced the technique of edge-grinding. Even should the ethnic identifications be accepted, there is no evidence that the one type is chronologically earlier than the other and none therefore to associate the introduction of edge-grinding with the appearance of a particular ethnic type.

1

H. Mansuy, 1925a; 16

2

H. Mansuy, 1925b; 37

3

H. Mansuy, 1925b; 37

4

H. Mansuy, 1925b; 36

Faunal identifications were made from the rather inadequate material excavated from the sites, mainly as a result of the study of teeth:¹ Tryonix sp. (fresh water turtle); Rhinoceros sp.; Cervus sp. (deer); Cervulus sp. (deer); Bos sp. (cattle); Hystrix subcristata (porcupine); Ursus tibetanus (bear); Macacus nemestrinus (monkey); Hylobates sp. (gibbon).

There is no indication of domestication, and the species seem to be randomly distributed between the sites.²

The last site in Indochina to have interest in this context is that at Da But, excavated by Patte³ in December 1926 and January 1927 (see Map 2). The site is a shell mound, three kilometres from a river of moderate size, the Song Ma Giang. The mound is composed of river shells, the majority being Corbicula. Cyrena and Cyclophorus are amongst the other species represented.

The mound covered an area 50 metres by 30 metres. The top was flat and stood 3 metres 30 centimetres above the level of the water flooding the adjacent rice fields at the time of the

¹
H. Mansuy, 1935b; 35

²
H. Mansuy, 1925b; 35

³
E. Patte, 'Le Kjökkenmödding Néolithique de Da But et ses Séphlchres.' Bulletin du Service Géologique de l'Indochine, 1932, 19, 3.

excavation. Soundings indicated that shell continued below this level for a depth of 1 metre 50 centimetres, where a substratum of weathered rock was reached. Patte¹ points out that the present water level in the rice fields is artificially determined by cultivation.

The site is only 30 kilometres from the sea as the crow flies, and the Song Ma Giang is only 40 kilometres from its mouth at Da But. Patte concludes that sea level could not have been higher than at present when the shell mound was being formed, as the level of the river at Da But could not rise more than a metre without flooding the site. However, this argument implies a tectonic stability that is not demonstrated by Patte.

In Patte's opinion² the most interesting feature of this site was the burials that it contained. However, none of these appear to have been complete or well preserved. Although twelve are reported, the number of individuals represented is presumably larger, as one interment is described as a child's skull, crammed with the bones of younger infants. Some of the skeletal remains had been stained with red ochre. The ethnic type present is reported to be Melanesian.³

¹
E. Patte, 1932; 6

²
E. Patte, 1932; 6

³
E Patte, 1932; 51

Patte states¹ that the archaeological material was homogeneous, there being no change with depth. No indication is given of the numbers of artefacts found, or the position in the deposit at which artefacts were discovered.

The stone tools are identified with the collections found by Mansuy in Bac Son Province². No detailed descriptions of the artefacts are given, but the hope is expressed that photographs illustrating some of the artefacts will give an impression of the industry³.

Flaked implements were present, being made from pebbles. Often a minimum of flaking appears to have been used to produce an implement whose form consequently was determined primarily by the original shape of the pebble from which it was made. Long and narrow forms are called picks⁴. Others, of less elongated shape, are called oval specimens⁵. Several coarse striking stones were found and these could have been used in the manufacture of the pebble artefacts⁶.

¹
E. Patte, 1932; 37

²
E. Patte, 1932; 37

³
E. Patte, 1932; 38

⁴
E. Patte, 'pics', 1932; 38

⁵
E. Patte, 'pieces ovales', 1932; 38

⁶
E. Patte, 1932; 38

The cutting edge of many of the artefacts was formed by polishing and in general this was confined to the immediate area of the cutting edge. A small, unspecified, number of completely polished tools was found.

Bone artefacts are reported. Several pieces of worked antler were found, as well as fish spines with traces of use. A few wild boar tusks were present.

Utilized shells occurred. A valve of Cyreana sumatrensis had been used as a scoop for red ochre, and a valve of Meretrix petechialis had been pierced with a hole for suspension.

Pottery was present in the deposit. Large and small vessels were represented, the surfaces of the sherds bearing basket work impressions.

Faunal remains were fragmentary and difficult to identify, but the species present indicate a hunting/food gathering economy.¹ Dog is reported. Twenty-one species of mollusc are identified and fish remains were present, pointing to the exploitation of a riverine environment.

The reports on excavations in Hoa Binh and Bac Son have been reviewed and analysed. The described material is summarized in Tables 44-51. A blank in the Tables indicates that no information

¹

E. Patte, 1932; 48

is to be found in the publications. The descriptions are tabulated under various headings, some of which need explanation.

(a) The heading 'depth of deposit' records the maximum reported depth.

(b) The number of stone tools described in the reports is given under four sub-headings. Under 'F', the number of flaked tools described is given; under 'EG' the number of edge-ground stone tools; under 'P' the number of polished (i.e. neolithic) tools; under 'T', the total number of stone artefacts recovered from the site is given, where the figure is mentioned in the text or can be inferred from it.

(c) Other stone artefacts are described under the heading 'other implements'.

(d) The number of bone artefacts described in the reports is given under the heading 'bone artefacts'; numbers of such artefacts with a polished cutting edge are given under the sub-heading 'P'.

(e) Species of shell not mentioned in the descriptions of the general nature of the deposits are given under the heading 'other shell'.

The Tables are presented according to three geographical groups: Tables 44 - 47 from Hoa Binh; Table 51 from Quang Binh; and Tables 48 - 50 from Bac Son.

With this information, it is possible to attempt some kind of comparison of the material recovered from Hoa Binh and Bac Son - although such comparison cannot be very precise in view of the unreliable nature of the Bac Son reports.

The excavated sites are of the same character. Colani¹ mentions that there are four principal belts of limestone in Indochina, lying roughly with their axis in an east-west direction (see Map 2). It is in these areas of limestone that the cave and shelter sites are found. She also points out that to the south of Quang Binh Province, other sites could only be open habitation deposits as there are no further areas of limestone. Vestiges of such sites have been found in the form of kitchen middens, although the likelihood that archaeological sites of this nature would survive in the open in such a climate is not high.

The excavated sites are found to the east of the central Annamite Chain, a high mountain formation running from north to south² in regions where igneous rocks are found in river beds as water-worn shingle. They are all about 15 metres above the level of the flat alluvial plains. Colani considers that they must therefore be situated close to the shore of an ancient sea of higher level than at the present time.

¹ M. Colani, 'Recherches sur la Préhistoire Indochinoise'. Bulletin de l'Ecole Française d'Extrême-Orient; 1930, 30; 299 - 422

² M. Colani, 1930; 38

The observation that the caves and shelters are generally fifteen or so metres above the level of the flat alluvial plains is interesting and may point to their position along a raised shore. But it does not follow from this that the groups which were responsible for the habitation deposits therefore used the caves at a time of higher sea level. It may be the result of geological circumstance that all the caves and shelters are at a higher level than the surrounding plains. For Colani's point about the occupation of the sites at a time of higher sea level to be accepted it would have to be demonstrated that out of a whole number of caves and shelters situated both at the level of the plains and at various heights above, only those at, or more than fifteen metres contained habitation deposits. Colani has not established this point.

With the exception of two sites, all those from Hoa Binh are described as containing great numbers of Melania shells. Such deposits as are described from Bac Son seem to have had the same general character. On the other hand, the three sites reported from Quang Binh do not seem to have contained as much shell. The open site at Da But was again a kitchen midden, the habitation deposit being mainly composed of shell.

The deposits all thus give evidence of a food gathering economy. This is supplemented by hunting. The species identified

are all recent. The list given by Mansuy¹ including as it does monkey, gibbon, deer, pig and fresh water turtle, seems to require no further comment than that the material represents food remains. The presence of large animals, elephants and rhinoceros may be noted. Colani does not give detailed identifications of vertebrate types found in Hoa Binh, but she does mention that the faunal representation appears similar to that from Bac Son².

Grinding stones, 'pestles' and 'mortars' are reported from ten out of thirty-two sites in Hoa Binh; from eight out of twenty-two sites in Bac Son; and two out of three sites in Quang Binh. The implements are quite well represented; the significance of their occurrence at some sites but not others is not clear. Evidence of grinding is provided by conspicuously flat and abraded surfaces on unworked pebbles. Large flat hollowed pebbles are mentioned, so both upper and lower parts of the grinding apparatus are represented.

Pounding and hammer stones are unworked pebbles bearing marks resulting from percussion. Some hammer stones bear opposed pits, one on each side. These could have been used for breaking bones and other culinary purposes, for flaking tools, or for grinding

¹

H. Mansuy, 1925b; 35

²

M. Colani, 'L'Age de la Pierre dans la Province de Hoabinh (Tonkin)' Mémoires du Service Géologique de l'Indochine, 1927, 14, 1; 68

red ochre which is reported from sites in both Hoa Binh and Bac Son.

Colani¹ refers to pebbles from Bac Son and Hoa Binh bearing lateral and almost parallel grooves. These, she suggests, result from the use of the stones for grinding or polishing bifurcate points. No bifurcate points have been reported from any of the sites. Dr P. Leggo, of the Bureau of Mineral Resources, Canberra, has examined such a grooved pebble from Hoa Binh which is preserved in the collections of the Australian Museum, Sydney. In Dr Leggo's opinion this is a water-worn mudstone and the parallel grooves have an entirely natural origin.

Bone artefacts are reported from thirteen out of thirty-two sites in Hoa Binh; from four sites in Bac Son; and from all three sites in Quang Binh. No more than two bone artefacts were reported from any one site in Bac Son, whereas as many as 150 are reported from Da Phuc, in Hoa Binh, a site also prolific in stone tools. The evidence presented in the reports throws little light on the significance of the different distribution of the bone artefacts.

Shell artefacts are less well represented. It may be noted that at only one site, Hang Co in Hoa Binh, were shell artefacts present but bone artefacts absent.

¹

M. Colani, 1930; 407

Colani¹ considers two ethnic types to have been associated with these collections. Quoting Montadon² she identifies these types as Indonesian and Melanesian. In her view, the technique of edge-grinding was introduced into an area where tools were made solely by flaking pebbles, and one of the ethnic types was responsible for this introduction. But she considers that there is not sufficient evidence to indicate which type was present in the area before the other.

Mansuy, as mentioned above, considers that Melanesian and European elements are present. Patte³ does not attempt to give any precise identification of the human material from Da But, but expresses the opinion that they may have Melanesian affinities.

In a later publication, Patte⁴ says that three ethnic types appear to be represented by the Bac Son and Hoa Binh material (including Da But), and that these are Melanesian, Indonesian, and Negrito. It is not proposed to question the precision of these identifications here, but it must be mentioned that there is no direct evidence to suggest the correlation of any one type with

1

M. Colani, 1930; 321

2

G. Montandon. 'L'Ologenese humaine (Ologenisme)', Paris, 1928; 227 - 8

3

E. Patte, 1932; 47

4

E. Patte, 1936; 308

any one phase of the cultures that may be represented at the sites or even to decide which of the types is antecedent to the others in this geographical area.

Typologically the edge-ground tools of Bac Son appear to be similar to those from Hoa Binh, which fall into two groups: edge-ground only, and flaked and edge-ground.

However, there are significant differences between the proportion of edge-ground to flaked tools as reported from Hoa Binh and Bac Son. Although it is impossible to discover from the reports the total number of artefacts found at many of the Hoa Binh sites, it does seem that only at Lang Vanh was the proportion of edge-ground tools as high as nine per cent of the total number of stone artefacts.¹ At Da Phuc, for example, the edge-ground tools were three per cent of the total². Yet, taking the Bac Son sites as a whole, the edge-ground tools are reported to be some seventy per cent of the total.

Not only do the proportions of edge-ground to flaked tools differ, but the total number of artefacts reported from sites in the two areas is in marked contrast. Colani³ states that Sao Dong,

¹ M. Colani. 'Quelques stations hoabinhiennes'. Bulletin de l'Ecole Francaise de l'Extrême Orient, 1929, 29; 263.

² M. Colani, 1929; 265

³ M. Colani, 1927; 59

Lang Neo, X.Kham, Trieng Xen and M. Khang respectively produced over 1,000 tools, 600 tools, over 700 tools, nearly 170 tools and nearly 190 tools. It can be concluded that Lang Vanh produced 600 stone tools, and Da Phuc 1230. But the thirty-two sites that were excavated in Bac Son are reported to have produced a total of only 189 flaked and edge-ground tools, 207 stone tools in all.

This difference may possibly be reflected in the reported differences in the depths of the cultural deposits in the two areas. For Hoa Binh, the maximum reported depths of deposits range from 10 centimetres to 3 metres 30 centimetres; for Bac Son, from 50 centimetres to 2 metres. Only two depths are reported from Quang Binh, 1 metre 40 centimetre and 2 metres 50 centimetres. Not only do the depths of the deposits from Hoa Binh cover a wider range than those from Bac Son, but they tend in general to be deeper, being mostly between 1 and 3 metres. Eight out of fifteen reported depths from Bac Son are 1 metre or less. This general difference in the maximum reported depths of the archaeological deposits no doubt has much archaeological significance - assuming that the reported depths are accurate. It may be supposed that those for Hoa Binh are reasonably correct, but it would perhaps be unwise to make the same assumption for the Bac Son sites.

It is not to be expected that loose and shifting deposits, as these are generally described, which are less than a metre in depth could give much stratigraphical information in the absence of

rigorous and precise excavation techniques. This is why in the analysis of the shallow deposits reported from Bac Son, with their meagre content of artefactual material, little reliability can be placed on deduced sequences.

On the other hand deposits of greater depth should throw considerable light on problems of cultural stratigraphy. Some indications of this, although imprecisely defined, are to be found in the deeper deposits from Hoa Binh. It seems probable that the size of the pebble tools changes with depth in the deposits, so that the earlier tools are larger than the later. Similarly bifacial work seems to be confined to the upper levels. Also it seems possible that the later tools have been more elaborately flaked (in terms of less cortex remaining and more secondary flaking) so that the earlier tools have a final form that is more closely determined by the original pebble on which they were made. If these trends are present, then they adequately explain Colani's postulated types, which would then merely be individuals selected from continuous ranges.

Furthermore there is some evidence that new elements appear at later stages in the Hoa Binh sequence. Thus it seems that edge-ground tools are confined to the upper parts of the deposits in Hoa Binh. It would be interesting in this regard to know the stratigraphic distribution of edge-ground tools in Bac Son but there is no reliable information available.

A small number of flakes with secondary working are reported from the Hoa Binh sites; these, too, seem to be confined to the upper levels of the deposits. No conclusions can be drawn about the distribution of similar artefacts in the Bac Son sites.

Earthenware sherds are mentioned from several sites in Hoa Binh (see Tables 44-47) and also seem to be confined to the upper levels of the deposits. Of the nine sites described by Colani in 1927, four contained sherds which are said to be found in the upper levels although sherds were in fact found at Sao Dong in the lower levels where, Colani suggests, they may have migrated through the loose deposits. It is possible that all the pottery found in the deposits is the result of subsequent sporadic occupation by neolithic peoples. On the other hand, it is possible that components of the Haobinhian culture do contain pottery.

The descriptions of pottery in the texts of the reports on Hoa Binh are mainly notable for their brevity. Often no mention is made of the kinds of wares represented and the criteria which are said to differentiate more recent from older pottery are not clear. The reports for Bac Son are even less satisfactory. No descriptions of the wares are given, and no conclusions can be drawn from the inadequate stratigraphical information. The quadrangular polished axes would appear to be elements from a later Neolithic culture.

It is very difficult to reach any conclusion about the relationships between the Bac Son and Hoa Binh sites on the published data. The inadequacies of Colani's published reports have been discussed in this and the last chapter. An examination of Mansuy's descriptions of the Bac Son sites and their excavation only serves to endorse the verdict of the First Congress of Prehistorians of the Far East - the need for further work to define the nature and status of the Bacsonian. Only when more careful work is carried out on sites in Bac Son (if suitable sites still remain unexplored) will it be possible to assess their relationships with the sites in Hoa Binh.

Dani¹ however, in an extensive review recently published, makes an attempt to do this. Dani was not able to examine any significant samples of the collections from Indo-China at first hand and so he cannot proceed beyond the published facts. Nevertheless he has attempted to improve upon the analysis given by the original authors and suggests a new synthesis.

In dealing with the reports given by Colani for the material from Hoa Binh, Dani assumes that the described samples give adequate descriptions of the parent populations from which they derive. Furthermore, he proposes a new typology for the artefacts

1

A.H. Dani, 'Prehistory and Protohistory of Eastern India', Calcutta, 1960; 105 - 149

that have been described - a typology that accepts Colani's types without question.

He places the artefacts described by Colani into three groups. Group one contains 'pebble choppers'; group two contains the remainder of the flaked pebble tools described by Colani; and group three contains the edge-ground tools. The criteria by which Dani proposes to distinguish group one from group two are not given with clarity, nor the reasons why the distribution is made.

Although Dani appears at one point to reject Colani's threefold division of the collections from the nine sites in Hoa Binh mentioned in her 1927 report¹, he accepts these phases in the independent analysis that he attempts to make himself², calling the late, intermediate and early periods, stages A, B, and C.

Turning his attention to the sites excavated in Bac Son, Dani³ distinguished five groups of artefacts. The first is the Keo-Phay group; this is represented only at Keo Phay, and is said to contain hand axes and scrapers. The second group is the Dong Thuoc group, found at Dong Thuoc, Nache, Binh Long and Vo Muong. This group is said to contain tools of rough appearance formed by coarse flaking,

¹

A.H. Dani, 1960; 122

²

A.H. Dani, 1960; 109-149

³

A.H. Dani, 1960; 142

as well as edge-ground tools. The Pho Binh Gia (b) group is said to be known from the majority of sites in Bac Son, and to be represented mainly by stone tools [sic], the characteristic type being the 'ciseau'. The Lang Trang group is known from Lang Trang, Giouc Giao, Co Kho and Cou Ke. The stone tools are said to be diversified in techniques and form. The Pho Binh Gia (a) group is said to be represented at Ba Xa, Pho Binh Gia and Dong Thouc. It is said to be represented by stone tools, bone objects, pottery and a terracotta disc.

These five groups are arranged into three stages B, C, and D. Dani then attempts to correlate the collections from Hoa Binh and Bac Son in terms of these groups and stages, but on no clear principles and using a particularly small number of selected artefacts.¹ Eleven artefacts which are said to belong to the early period in Hoa Binh are directly compared with seven artefacts from Bac Son stage B, one from stage C, and two from stage D. Five artefacts from the Hoa Binh early period, group one, are compared with five artefacts from Bac Son, stage C. Two artefacts from Hoa Binh early stage, group two are compared with one artefact from Bac Son, stage C.

It must be admitted that Dani's attempted correlation of the collections from the two areas makes very little sense. Further,

¹

A.H. Dani, 1960; 145

his conclusion that the ground tools of Hoa Binh seem to have been derived from Bac Son, and that the small flake artefacts at Sao Dong are derived from Da But, would seem to be pure conjecture.

It is very hard to know what cultural relations Dani supposes to exist between the Bac Son and Hoa Binh sites. He clearly considers that the sites are contemporary.¹

Dani's synthesis is unsatisfactory for a number of reasons. First, he has not clearly stated the reasons why he wishes to place the various collections into the several groups and stages. Second, he appears to have accepted Colani's original division of the Hoa Binh collections into three phases. Third, he has not questioned the validity of Colani's typological classification, nor clearly defined the principles by which he has established the types that he wishes to introduce himself. Fourth, he has assumed without question that the artefacts described are an adequate sample of the collections as a whole. Finally, he has attempted to make correlations between Bac Son and Hoa Binh in terms of a very small number of selected artefacts from the two areas.

The relationships of the Bac Son and Hoa Binh collections would, in the terms of the vocabulary proposed in Chapter one,

1

A.H. Dani, 1960; 147

appear to exhibit three possibilities. Either the sites from Bac Son and Hoa Binh represent different regional aspects or different temporal phases of the same culture; or they represent aspects and phases of two different cultures.

The reported proportions of the edge-ground to flake tools are so different in the two regions that it would seem unlikely that mere regional variation is responsible. On the other hand, the general nature of the collections is sufficiently similar to make it unlikely that two different cultures are present. In consequence, the third possibility, that the sites in Hoa Binh and Bac Son represent different phases of the same culture would seem to be the most probable.

Despite the unsatisfactory nature of the published material, the excavations in Indo-China have sketched the outlines of a distinctive culture, with flaked stone artefacts primarily made on pebbles, based on a hunting and food-gathering economy. It is a mesolithic culture in that it exhibits no evidence of agriculture, and the rather inadequate faunal data would seem to indicate a post Pleistocene date. It is commonly called the Haobinhian, a name that is acceptable in a general way on the basis of the Indo-Chinese evidence, although even in Indo-China the status of related collections like those of Bac Son cannot be defined.

CHAPTER III

HOABINHIAN COLLECTIONS FROM OTHER PARTS OF SOUTH EAST ASIA

Other collections in south east Asia and beyond have been called Hoabinhian. These will now be described and their relationship with the culture from Hoa Binh considered. The basic problem is to decide whether it is justifiable to include these other collections under the cultural term 'Hoabinhian', rather than of confining synthesis to the regional level in terms of aspects and phases. Sufficient material has been described from some areas for broader synthesis to be theoretically possible, and attention will be paid to this point in the surveys which follow.

It must be remembered that the result can hardly be considered as a precise cultural distribution. The focus of attention on northern Indo-China is an accident. The number of sites excavated there is much larger than the number of sites examined in any comparable area. In Cambodia and Burma exploration for similar sites has hardly begun.

In areas where archaeologists have been active, the search is particularly difficult outside areas of limestone or other rock formation, because open sites will probable be masked by vegetation and habitation deposits obliterated by the effects of a wet tropical climate.

China

Cheng te-K'un¹ reports sites from southern China that seem to contain collections comparable to the Hoabinhian. In the province of Kwangsi (Map 3), the upper Sikiang basin is an area geographically close and physiographically similar to northern Indo-China. It is a karstic area, with many limestone caves. Often these caves contain slightly consolidated loamy deposits. In some of these deposits are large amounts of ash, many burnt bones as well as great quantities of fresh-water gastropod shells, chiefly Paludina, with some Lamprotula and Melania. None but recent species are represented by the faunal remains. No pottery or edge-ground tools have been reported from these sites. The artefacts are described as pebble tools which have been simply trimmed to produce a cutting edge of a desired shape. Grinding stones, hammer stones, and pitted stones are also reported. A few bone and antler implements have also been found.

As Cheng te-K'un suggests,² these sites appear to contain materials similar to those from northern Indo-China. The absence

¹

Cheng te-K'un. 'Archaeological studies in Szechwan.' Cambridge University Press, 1957; 51-83.

Cheng te-K'un. 'Prehistoric China.' Cambridge, 1959; 38-52.

²

Cheng, 1959; 50.

of edge-ground tools and pottery from the Kwangsi sites must be noted. It is possible that the preponderance of Paludina over Melania shells reflects differences in the fresh water ecology of the two areas.

Chia and Chiu¹ report more recent discoveries of early post-Pleistocene cultural remains associated with mollusc shells and a modern mammalian fauna from widely scattered limestone caves in Kwangsi. Two sites excavated in 1959, Ya-p'u-shan and Ma-lang-ch'uan-San, in western Kwangsi² contained similarly stratified deposits. Top soil is reported to have covered a stratum of shell containing pottery and (unspecified) neolithic implements. Under this was a layer containing shell and concretions with abundant chipped implements, which lay directly on the sandstone bed-rock. The chipped implements were core tools, many retaining the cortex of the pebbles from which they were made. The associated fauna represents recent species.

1

Chia Lan-Po and Chiu Chung-Lang. 'On the age of chipped stone artefacts in Kwangsi caves.' Vertebrata Palasiatica, 1960, 4, 1; 39.

2

Kwang-Chih Chang. 'The Archaeology of Ancient China.' Yale University Press, 1963; 48.

Fourteen sites discovered since 1955 on the slopes of an extinct volcano at Hsi-chiao-shan, in Kwangtung¹ have been divided into three groups: pre-ceramic, sub-neolithic and neolithic. Flaked stone implements found in both the pre-ceramic and the sub-neolithic collections include both flake and core implements of sandstone and flint. The core tools are apparently pebble tools, while some of the flakes have facettled platforms and have been described as endscrapers, points and flake-blades. As Chang² has pointed out, the appearance of flake elements in an area predominantly characterized by pebble tools is difficult to explain.

Chipped stone implements, said to be of a Palaeolithic/Mesolithic typology have been reported from fairly high altitudes on the eastern fringes of the Tibetan plateau.³

About a hundred sites have been reported from Szechwan.⁴ These are mainly open sites on the banks of rivers and small streams, although some are caves. The industry is loosely

1

Mo Chih. K'ao-ku-t'ung-hsun, 1959, 4; 1-15.

Peng Ju-tze and Wang Wei. Wen-wu, 1959, 5; 75.

2

Chang, 1963; 49.

3

Chiu Chung-Lang. 'Discovery of palaeoliths on the Tibet-Tsinghai Plateau.' Vertebrata Palasiatica, 1958, 2; 157-161.

4

Cheng, 1959; 47-48.

described as being composed of chipped pebble tools. Types mentioned include axes, picks, scrapers and knives as well as the 'shouldered axe'. The latter is best represented as a heavy flake trimmed at one end with two shoulders and a neck for hafting. Another characteristic type is the 'short axe', produced by the truncation of a pebble at right angles to the longitudinal axis. The cutting edge is formed by alternate flaking.

It would seem that the Hoabinhian collections in Indo-China do have affinities with these from Szechwan, for both would seem to be predominantly composed of similarly flaked pebble tools. However, the shouldered axe and the short axe with alternately flaked cutting edge do not seem to be present in Hoa Binh. Perhaps the collections from Szechwan represent a regional aspect of the Hoabinhian, though more information is required for this point to be followed further.

Thailand

A small number of unifacially flaked pebble tools was found by Sarasin¹ during the excavation of caves near Chengmai in the north and Ratburi in the south (Map 4). Van Heekeren, while imprisoned by the Japanese, was able to preserve six unifacially worked pebble or flake tools found near the Kwai Noi river.²

¹

F. Sarasin. 'Recherches préhistoriques en Siam.' L'Anthropologie, 1933, 43; 1-40.

²

H.R. van Heekeren. 'Prehistoric discoveries in Siam.' Proceedings of the Prehistoric Society, 1948, 14; 24-32.

Heider¹ collected 104 unifacially worked pebble tools and four flake tools during a surface survey of the Kwai Noi valley.

These reconnaissances resulted in the excavation of a site in the Kwai Noi valley by van Heekeren during the course of the Thai-Danish Prehistoric Expeditions of 1960-61 and 1961-62,² which produced an industry with undoubted affinity with the Hoabinhian. This industry will be the subject of detailed analysis in a later chapter.

1

K.G. Heider. 'A pebble-tool complex in Thailand.' Asian Perspectives, 1957, 2, 2; 63-67.

2

E. Nielsen. 'The Thai-Danish Prehistoric Expedition 1960-1962. Preliminary expedition 1960-1961.'

Journal of the Siam Society, 1961, 49, 2; 47-57.

E. Nielsen. 'The Thai-Danish Prehistoric Expedition 1960-1962.' Journal of the Siam Society, 1962, 50, 1; 7-15.

E. Nielsen. 'The Thai-Danish Prehistoric Expedition 1960-1962.' Folk, 1962, 4; 22-27.

H.R. van Heekeren. 'A preliminary note on the excavation of the Sai-Yok rock shelter.' Journal of the Siam Society, 1961, 49, 2; 99-109.

H.R. van Heekeren. 'A brief survey of the Sai Yok excavations 1961-1962 season of the Thai-Danish Prehistoric Expedition.' Journal of the Siam Society, 1962, 50, 1; 15-19.

H.R. van Heekeren. 'The Thai-Danish Prehistoric Expedition, 1960-1962.' Journal of the Siam Society, 1963, 51, 1; 79-84.

E. Knuth. 'Further report on the Sai-Yok excavations and on the work at the picture cave.' Journal of the Siam Society, 1962, 50, 1; 19-32.

P. Sorensen. 'The Thai-Danish Prehistoric Expedition 1960-1962.' Folk, 1962, 4; 28-45.

Laos

Fromaget¹ has described the excavation of a rock shelter at Tam Hang, near P'ou Loi in central Laos. The deposits were stratified. Above a yellow clay said to be of Pliocene age were found successively a calcareous tuff and a brick red clay, both attributed to the Pleistocene. These were followed by a brown clay said to belong to the Holocene and topped by recent hill-wash.

There were two horizons in the calcareous tuff. The lower was characterized by Simia satyrus (orang utan), Aeluropus fovealis (panda), Hyena ultima (hyena). This level also contained bruised and split bone. The upper did not contain broken bone, but fairly abundant stone tools which are described as points made of schist and quartz. Breuil, who saw these, considered them to be comparable with artefacts from Chou Kou Tien. In both layers, Stegodon sinensis (Pleistocene elephant), Elephas cf. namadicus (elephant), Tapirus augustus (tapir), and a hominid (but not H. sapiens) were represented.

The brick red clay, attributed to the later part of the Pleistocene, contained coarsely made implements of sandstone and schist.

The brown clay was not visibly stratified, but Fromaget recognizes three cultural stages: first, at the lowest level, a stage characterized by large unifacially worked pebble tools; next a stage with edge-ground

¹

J. Fromaget. 'La stratigraphie des dépôts préhistoriques de Tam Hang (Chaîne Annamitique septentrionale) et ses difficultés.' Proceedings of the Third Congress of Prehistorians of the Far East, 1940; 60-71.

tools; and finally, one characterized by quadrangular neolithic axes.

None of the artefacts are described in detail or illustrated. The site has interest, however, for two reasons. First it demonstrates the possibility of a western extension of the Hoabinhian, and second, assuming the cultural and geological identification to be correct, it shows that, for Tam Hang at least, the Hoabinhian appears in recent deposits, and is not represented in deposits of the middle and late Pleistocene.

Malaya

Tweedie,¹ Dani² and the writer³ have all summarized the excavated evidence of the Malayan mesolithic. The survey that follows will make no attempt to repeat the details.

Thirteen mesolithic sites have been excavated in Malaya (see Table 8). All are cave and shelter sites - with the exception of Guak Kepah, an open shell midden. The sites are distributed about the central mountain formation that runs along the axis of the Malay Peninsula; they are confined to the northern parts, their distribution following that of the limestone (see Map 5).

¹M.W.F. Tweedie. 'The stone age in Malaya.' The Journal of the Malayan Branch of the Royal Asiatic Society, 1953, 26, 2; 10-18.

²A.H. Dani. 'Prehistory and Protohistory of Eastern India.' Calcutta, 1960, 176-211.

³J.M. Matthews. 'A check-list of Hoabinhian sites excavated in Malaya 1860-1939.' Papers on South East Asian Subjects, Department of History, University of Malaya, 1961, 3.

The sites contained habitation deposits often characterized by large numbers of Melania shells. They probably represent the temporary resting places of nomadic food gathering groups and there is no reason to suppose that such groups would have been confined to the areas of limestone formation. Tools collected from alluvial deposits in Pahang¹ attest to this point.

No stratification has been reported from some of these sites. The maximum reported depths are given in Table 9. They range from between three to over twelve feet. The significance of this range is not clear.

Stratification is best described by Sieveking for Gua Cha. A compact yellow clay, the consistency of brick, overlay the rock floor of the shelter and was followed by a closely packed yellow clay. These sediments are taken to be waterlain deposits.² The shelter is adjacent to the River Nengirri, and the modern surface of the shelter deposits is thirty-four feet above the level of the river at the present time. Next is a layer of chocolate brown earth, assumed to be a humus formed during a long period of fairly dry conditions. The earliest habitation remains are

1

H.D. Collings. 'A collection of stone tools in the Raffles Museum from the Kuantan District, Pahang.' Bulletin of the Raffles Museum, Series B, 1937C, 1, 2; 124-137.

2

G. de G. Sieveking. 'Excavations at Gua Cha, Kelantan, 1954, Part I.' Federation Museums Journal, 1954, 1, 2; 83.

found in the middle and upper parts of this layer. Above again are waterlain silts and current bedded sands, containing archaeological materials.

At Gua Debu Collings¹ noted a succession in the sediments, the top habitation layer, two and a half feet thick, lay on a five foot layer of fallen rock and rubble in a matrix of red earth, which in turn lay on a red clay-like earth that was excavated to a depth of twenty-two feet. Archaeological material was only found in the habitation layer.

At Gol Ba'it, Callenfels and Noone² report that artefacts were found in the top $3\frac{1}{2}$ metres of a deposit that was excavated to a depth of 5 metres.

Tweedie³ mentions that at Bukit Chintamani the main habitation layer, $1\frac{1}{2}$ metres thick, was covered with a surface layer of recent vegetable detritus. Under a habitation layer was a red cave earth, extending to the floor of the cave.

¹
H.D. Collings. 'Report of an archaeological excavation in Kedah, Malay Peninsula.' Bulletin of the Raffles Museum, Series B, 1936, 1, 1; 6.

²
P.V. van Stein Callenfels and H.D. Noone. 'Report on an excavation in the rock-shelter Gol Ba'it, near Sungei Siput.' Proceedings of the Third Congress of Prehistorians of the Far East; 1940, 120.

³
M.W.F. Tweedie. 'Report on cave excavations carried out in Bukit Chintamani, near Bentong, Pahang.' The Bulletin of the Raffles Museum, Series B, 1936, 1, 1; 19.

With the exception of Sieveking, who implies that occupation of the shelter at Gua Cha began in a relatively dry period, the excavators have not attempted to interpret any sedimentary stratification that they may have observed.

Animal bone is reported from all the sites. The species represented are all recent, and are listed in Table 10.

Melania shell occurred at all sites except Gunong Cheroh. Unio seems also to have been frequently found. This common element of diet is consistent with a food gathering economy. At some sites Melania shell was particularly abundant; Collings¹ reports that at Gua Debu 548 Melaniid shells were counted in an area six feet by eight feet and six inches deep.

Collings identifies marine and freshwater molluscs from Bukit Chuping,² which are listed in Table 11. Bukit Chuping is now eleven miles from the sea. Collings suggests that as marine and freshwater species seem to be represented equally, the sea must have been closer to the site at the time of occupation. Collings cites Scrivenor's account³ of the morphology of the littoral areas of Perlis, which suggests that the configuration of this part of the Malayan coast is the result of marine denudation.

¹ Collings, 1936; 10.

² H.D. Collings. 'An excavation at Bukit Chuping, Perlis.' Bulletin of the Raffles Museum, Series B, 1937A, 1, 2; 98.

³ J.B. Scrivenor. 'The Geology of Malaya.' London, 1931; 122-3.

Tweedie mentions an interesting distribution of food remains in the deposits at Gua Madu.¹ Here vertebrate remains were abundant in the upper layers which were rich in artefacts. Below a depth of a metre bones became rare and Melania and Unio shells very common. Tweedie suggests that this indicates that the site was first occupied by food gatherers and then at a later stage by hunters. A parallel situation is reported from some sites in Hoa Binh.²

The predominant tool is the flaked artefact made on a rolled river pebble (see Figure 4 for an illustrated selection). The total numbers recovered from the sites, as far as this information is given in the reports, are tabulated in Table 12. The publication³ describing the excavation at Gua Cha is only the first of two parts. The flaked stone from Sieveking's excavation at Gua Cha is treated in detail in the second part of the report which is to be published in the near future.⁴

¹ M.W.F. Tweedie. 'Report on excavations in Kelantan.' Journal of the Malayan Branch of the Royal Asiatic Society, 1940, 18, 2; 9.

² M. Colani. 'L'age de la Pierre dans la Province de Hoabinh (Tonkin).' Mémoires du Service Géologique de l'Indochine, 1927, 14, 1; 70.

³ Sieveking, 1954.

⁴ Sieveking, private communication.

As Tweedie has pointed out,¹ unifacially flaked tools in Malaya appear to be confined to sites in Perak - Gua Kajang, Gua Kerbau, and Gol Ba'it. At the latter site, Callenfels and Noone² report a development in the industry. In the lower parts of the deposit the artefacts were unifacially worked on quartz, chert and other non-fissile pebbles; in the upper part of the deposit they were bifacially worked on fissile pebbles, such as slate and schist.

None of the excavators have attempted to produce a typological classification for the pebble tools recovered from the sites.

Tweedie³ reports that the pebble tools from the upper levels of the deposit at Gau Madu were much better finished than those from the lower levels.

For Bukit Chuping, Collings⁴ suggests that two phases are represented, and that a flaked stone industry was followed by a polished bone industry. The distribution of the bone and stone artefacts by six inch layers is:

¹ Tweedie, 1953; 12.

² Callenfels and Noone, 1940; 121.

³ Tweedie, 1940; 9.

⁴ Collings, 1937A; 114.

<u>Layer</u>		<u>Percentage</u> <u>bone</u>	<u>Percentage</u> <u>stone</u>
Top Layer	I	23	18
	II	8	32
	III	33	24
	IV	18	13
	V	10	7
	VI	8	6

The distribution does not support Colling's contention that two phases are represented at the site.

Collings¹ has given a detailed description of 291 artefacts collected by G.W. Thomson in 1921-3 from Chinese alluvial tin workings in the Kuantan District of Pahang. These were mainly found between three and seven feet below the surface. Collings found that, with one exception, the original labels for the tools had been lost so that it was not possible to determine their associations or exact provenance.

Two hundred and twenty tools are described as edged cutting tools; the rest are hammerstones and grinding stones. Collings divides the edged cutting tools into three main series. First are large and crudely made bifacially worked tools, which are said to appear to be larger than any reported from cave excavations in Malaya. A second group contains smaller and better made tools. Collings considers these to be more like those artefacts from cave excavations. The third group comprises edge-ground and neolithic tools.

¹
Collings, 1937C.

Short axes are not reported in the texts of the Malayan reports. However, two artefacts illustrated by Tweedie¹ appear to be short axes. Dani² states that a short axe was found at Gua Cha in a trial trench dug by Noone in 1935. It is not clear why Dani makes this statement, as Noone³ neither describes or illustrates any short axes from Gua Cha.

Flakes are reported from all of the sites. Tweedie reports⁴ that worked flakes were common at Gua Madu. At Bukit Chuping, Collings⁵ found an unspecified number of worked flakes. Five of these are said to have polish resulting from use on their scraping surfaces. Collings reports similar worked flakes from Gua Debu.⁶

Edge-ground tools are reported from six of the sites, which are listed in Table 13. Like the Indo-Chinese specimens, some of the edge-ground tools are made on pebbles that have been flaked; others are simply made on rolled river pebbles.

1

Tweedie, 1940; Plate I, figures 2, 3.

2

Dani, 1960; 186.

3

H.D. Noone. 'Report on a new neolithic site in Ulu Kelantan.' Journal of the Federated Malay States Museums, 1939, 14, 4; 170-174.

4

Tweedie, 1940; 5.

5

Collings, 1937A; 103.

6

Collings, 1936; 8-9.

The specimen from Gunong Cheroh¹ was found at a depth of two feet in a deposit six feet deep. Those from Gua To'Long² came from a depth of two feet in a deposit four feet deep. At Gua Kerbau,³ an edge-ground tool was found at a depth of seven feet, and others were found throughout the rest of the deposits, to a depth of fourteen feet. The example from Gol Ba'it⁴ was found in the lower levels of the deposit. The implications of these occurrences and distributions are not clear.

Pounding stone and grinding slabs are reported from all the sites. Pounding stones from Gua Kerbau, Gua Debu, Gol Ba'it, Bukit Chintamani, and Gua Madu bore one, or two opposed, depressions. These can be compared with similar pounding stones reported by Colani from Hoa Binh.⁵

1

L. Wray. 'Further notes on the cave dwellers of Perak.' Journal of the Federated Malay States Museums, 1905, 1, 1; 13-15.

2

I.H.N. Evans. 'Cave dwellings in Pahang.' Journal of the Federated Malay States Museums, 1920, 9, 4; 267-270.

3

P.V. van Stein Callenfels and I.H.N. Evans. 'Report on cave exploration in Perak.' Journal of the Federated Malay States Museums, 1928, 12, 6; 145-159.

4

Callenfels and Noone, 1940; 119-130.

5

Colani, 1927; 63.

Bone artefacts were found at Gua 'To Long,¹ Gol Ba'it,² Bukit Chintamani,³ and Bukit Chuping.⁴ Those from Bukit Chuping are said to be remarkable for the degree of precision with which they were ground and polished.

Shell artefacts were represented at Gol Ba'it,⁵ where a triangular fragment of a marine shell was seen to have a sharpened cutting edge. Eight shell knives formed from broken Cyrenid shell were found at Bukit Chuping.⁶

Sherds of simple earthenware were found at all the sites. A stratigraphic break between the mesolithic and neolithic levels reported from Gua Cha⁷ demonstrates that, at least for this site, the mesolithic levels did not contain sherds.

At Gua Kajang, Kota Tongkat, Gua Kerbau and Bukit Chuping sherds were concentrated towards the upper parts of the deposits. At Bukit Chuping⁸ 343 earthenware sherds were found, and their distribution in six inch layers was:

1

Evans, 1920; 37-52.

2

Callenfels and Noone, 1940; 119-130.

3

Tweedie, 1936; 17-25.

4

Collings, 1937A; 100.

5

Callenfels and Noone, 1940.

6

Collings, 1937; 101.

7

Sieveking, 1954; 86.

8

Collings, 1937A; 99.

<u>Layer</u>	<u>Percentage</u>
I	53
II	43
III	3
IV	1
V	0.5
VI	0

However, at Gol Ba'it sherds were found at all levels in the deposit. Notwithstanding this, Tweedie¹ considers that pottery sherds should not be seen as associated with the mesolithic artefacts found at these sites. To him all such pottery is truly neolithic and the mixing of cave deposits, particularly at shallow depths, will account for the apparent occurrence of earthenware in a mesolithic context. As the excavators at Gua Cha have shown,² neolithic burials are a source of earthenware in at least some Malayan cave and shelter sites.

The occurrence of neolithic habitation at Hoabinhian sites is reflected in the discovery of polished neolithic axes at Gua Cha, Gua Debu, Gol Ba'it, Bukit Chuping and Gua Madu. Those at Gua Cha were associated with neolithic burials, as were complete pots and other grave goods. At Gua Debu one axe was found just below the surface of the deposit, and at Gol Ba'it two axes were found in a similar position. At Bukit Chuping, one axe was found at a depth of twelve inches, and one on the surface at Gua Madu.

¹ Tweedie, 1953; 45.

² Noone, 1941; Sieveking, 1954.

The infrequent occurrence of these axes and their position in the superficial levels of the deposits would seem to indicate that they are intrusive elements from a later culture. At Gua Cha the neolithic levels were marked from the mesolithic by a break in the stratigraphy.¹

Haematite is reported from all the sites. At Gua Kerbau some of the grinding stones were stained with this red pigment, and pieces of haematite had surfaces flattened and worn by rubbing. Many pieces from Gua Madu are reported to be similarly ground on one side.

With the exception of Gau Debu and Kota Tongkat, fragmentary human remains are reported from all the sites. The mesolithic burials excavated at Gua Cha are in a far better state of preservation than those from other sites, a circumstance that probably owes much to the skill of the excavators.

Duckworth reported on skeletal material sent to him by Evans from Gua Kerbau, Gua Kajang, Gua To 'Long and Bukit Chuping.² However, the confusion of the remains was so complete that a final allocation of limb bones to crania was almost impossible. In

1

Seiveking, 1954; 86.

2

W.L.H. Duckworth. 'Human remains from rock-shelters and caves in Perak, Pahang and Perlis and from Selensing.' Journal of the Malayan Branch of the Royal Asiatic Society, 1934, 22, 2; 149-167.

spite of the unpromising nature of the material, Duckworth felt able to point to similarities with Dravidians, Veddas and Palaiyans of south India. He also considers that the fossil skulls from Wadjak in Java have affinities with those from Malaya and that certain Australian aboriginals could even be considered in the comparison.

Callenfels and Noone¹ claim that a stratigraphical sequence could be seen in the burials at Gol Ba'it. A flexed burial was reported from the lowest levels; secondary burials from the middle levels; and extended burials in the upper part of the deposits. These remains were examined by Snell² who found all but the flexed burial from the deeper levels in Jakarta after the Japanese occupation, the material having been previously sent there for examination. Snell reports that no physical difference can be seen between the burials from the middle and upper levels. He also suggests that there was in fact no difference in the method of burial; two of the three burials which were described as extended contained remains of two individuals. One burial described as secondary contained remains of four individuals. Two skulls

1

Callenfels and Noone, 1940; 119-130.

2

C.A.R.D. Snell. 'Human skeletal remains from Gol Ba'it, Sungei Siput, Perak, Malay Peninsula.' Acta Neerlandica Morphologicae Normalalis et Pathologicae. 1949, 6, 4; 1-25.

were sufficiently complete for comparisons to be made, and Snell came to the conclusion that the combination of features present are characteristic of present day Melanesians, particularly New Caledonians.

It is interesting to note that human remains were first recovered from the shell middens at Guak Kepah in the latter half of the last century.¹ These were sent to Professor F.W. Huxley, who came to the conclusion that they represented a type allied to the present Papuan peoples of New Guinea.² At a later time, Mijsberg³ examined other human remains excavated from this site by Callenfels, Tweedie and Collings.⁴ Although this site has only marginal affinities with the mesolithic sites described above, Mijsberg's conclusions are of interest. He found that all the most conspicuous features present in the one lower jaw that was

1

G.W. Earl. 'On the shell-mounds of Province Wellesley, in the Malay Peninsula.' Transactions of the Ethnological Society, New Series, 1860, 11; 19.

2

F.W. Huxley. Letter on the human remains found in the shell mounds at Province Wellesley. Transactions of the Ethnological Society, New Series, 1863, 2; 265-266.

3

W.A. Mijsberg. 'On a Neolithic Palae-Melanesian lower jaw found in a kitchen midden at Guak Kepah, Province Wellesley, Straits Settlements.' Proceedings of the Third Congress of Prehistorians of the Far East, 1940; 100-118.

4

P.V. van Stein Callenfels. 'An excavation of three kitchen middens at Guak Kepah, Province Wellesley, Straits Settlements.' Bulletin of the Raffles Museum, Series B, 1936A, 1, 1; 27-37.

found in a sufficiently complete state of preservation at Guak Kepah to be reconstructed are also found in the mandibles of recent New Caledonians and Loyalty Islanders.

As Tweedie has pointed out¹ three of the four anatomists who examined human material prior to 1954 suggested that the types represented had affinities with Melanesians.² From these conclusions it could follow that the mesolithic collections from Malaya should be equated with a Melanesoid population. Callenfels put forward such a proposition,³ but his presentation of the evidence was severely criticised by Collings⁴ and Evans.⁵ Tweedie, however, is of the opinion that the Malayan mesolithic collections could be correlated with Melanesoid populations, although this is only a matter of a probable association.⁶

¹ Tweedie, 1954; 18.

² Huxley, 1863; Mijsberg, 1940; Snell, 1949.

³ P.V. van Stein Callenfels. 'The Melanesoid civilisation of Eastern Asia.' Bulletin Raffles Museum, Series B, 1936, 1, 1; 41-51.

⁴ H.D. Collings. 'Notes on a recent paper: "The Melanesoid civilizations of Eastern Asia".' Bulletin of the Raffles Museum, Series B, 1937, 1, 2; 122-123.

⁵ I.H.N. Evans. '"Melanesoid" culture in Malaya.' Bulletin of the Raffles Museum, Series B, 1, 2; 141-146.

⁶ Tweedie, 1954; 18.

The most complete and interesting study of human remains from a Malayan cave site is that published by Trevor and Brothwell,¹ describing the material excavated by Sieveking at Gua Cha. The remains of twenty-four individuals were examined, fourteen from the mesolithic levels of the deposit, ten from the neolithic levels. One of the most interesting conclusions arising out of the investigation is

that it is impossible to maintain from the present evidence that any appreciable divergence in physical type exists between the people who were buried in the Gua Cha rock shelter in mesolithic and neolithic times.²

Although a most exhaustive study has been made of the human material from Gua Cha, only the most tentative conclusions have been reached.

The investigators report that

while certain physical features of the Gua Cha people, as now known, appear to be paralleled among modern Oceanic Negroes (i.e. Papuans, Melanesians and Tasmanians) rather than the Australian aboriginals, to venture any definitive opinion regarding their racial status would be premature.³

Biochemical analysis of a sample from the material excavated by Sieveking at Gua Cha⁴ indicates that the Hoabinhian and neolithic

¹J.C. Trevor and D.R. Brothwell. 'The human remains of Mesolithic and Neolithic date from Gua Cha, Kelantan.' Federation Museums Journal, 1962, 7; 6-23.

²

Trevor and Brothwell, 1962; 8.

³

Trevor and Brothwell, 1962; 11.

⁴

K.A.R. Kennedy. 'A biochemical analysis of human remains from Gua Cha, Kelantan, Malaya.' Man, 1964, No. 92.

burials have a striking similarity in their nitrogen contents and in their frequencies of A and B antigens. These observations are consistent with the opinion of Trevor and Brothwell that no appreciable divergence can be detected in the physical types represented by the mesolithic and neolithic burials.

Various authors have drawn parallels between the collections from Malayan sites and those from Indo-China. Callenfels and Evans¹ mention that the collections from Gua Kerbau have similarities with both the 'Bacsonian' and with the 'Hoabinhian' of Indo-China. Callenfels and Noone² mention that the collections from Gol Ba'it have affinities with 'Hoabinhian' collections, and Sieveking mentions the parallels between the mesolithic collections from Gua Cha and those from Indo-China.³ Tweedie assumes⁴ that the succession in Perak is very similar to that in Hoabinh, but not to that in Pahang, Kelantan and Kedah, where unifacially flaked tools are absent.

Indonesia

Van Heekeren has published a precise summary of the mesolithic cultures that are known from Indonesia.⁵ Pebble tool industries

¹Callenfels and Evans, 1928; 145-159.

²Callenfels and Noone, 1940; 121.

³Sieveking, 1954; 80.

⁴Tweedie, 1953; 74.

⁵H.R. van Heekeren. 'The Stone Age of Indonesia.' Sgravenhage, 1957; 67-115.

are confined to Sumatra (Map 6), although some collections from Java and the Celebes have been at times included with those from Sumatra in a general comparison with the collections from Indo-China.

The Sumatran sites are open shell middens, and many artefacts have been gathered from surface collections. Shell mounds, some 30 metres in diameter and 4 metres high were first reported near Seruwai, East Sumatra, in 1917.¹ These mounds extend for some 130 kilometres along the coast, and are all now 10 to 15 kilometres inland. Van Heekeren mentions that these sites presumably lie along a former beach line that has subsequently been raised as a result of isostatic emergence.

Three shell middens have been excavated. The results of one excavation, conducted by Callenfels near Medan, in East Sumatra, have never been published; but van Heekeren² has been able to extract some information from Callenfels's note books and an article in the Illustrated London News. The other sites were excavated by Schurmann³ in Atche. The upper part of one shell mound on the Saentis Estate had been dug away as a source of lime. In the remaining part of the mound, layers and lenses of ash and habitation remains were found in the shell matrix. The shell

¹Van Heekeren, 1957; 70.

²Van Heekeren, 1957; 71.

³H.M.E. Schurmann. 'Kjokkenmoddinger und palaolithikum in Nord-Sumatra.' Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig. Genootschaf, 1931, 48; 905-923.

is reported to have been 93 per cent Meretrix meretrix and 6.5 per cent Ostrea, both marine species. The other site in Atche at Bindjai-Tamiang¹ also produced shell that was mainly Meretrix. The faunal remains from this site represent recent species, including elephant, deer and bear.

The predominant tool from the two Atche sites is the unifacially flaked pebble tool. Muhlhofer² has divided the collection from Bindjai-Tamiang into three groups: large, unifacially worked tools; large narrow unifacially worked tools of similar length; and small uniface tools.

Grinding slabs and stones were also found in some numbers at the Saentis Estate.

Considerable numbers of unifacially worked pebble tools have been found on surface sites on the north coast of Sumatra.³ Van Heekeren⁴ mentions that some thousands have been found.

1

Schurmann, 1931; 905-23.

2

F. Muhlhofer. 'Steinwerkzeuge aus dem muschelhugel von Bindjai-Tamiang in Nord-Sumatra.' Wiener Prähistorische Zeitschrift, 1938, 25; 30-34.

3

H. Kupper. 'Paleolithische werktuigen uit Atjeh. Nord Sumatra.' Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap, 1930; 985-988.

4

Van Heekeren, 1957; 73.

Lebzelter¹ has described these collections, dividing the tools into oval, disc-shaped and elongate pick like pebble tools; flakes from pebbles and broad facettled flakes.

The majority of the pebble tools from Sumatra are reported to have been unifacially worked so that no cortex remains on the flaked face. Callenfels and Evans² gave such unifacially flaked tools a name, calling them 'Sumatra-types', a name that has become 'Sumatraliths' by subsequent usage. However, although it might be the case that the coastal middens in Sumatra present collections with an unusually high proportion of such unifacially flaked tools, it is quite clear that this kind of artefact is not confined to these sites, but occurs also in Malaya and Indo-China, for example. As Mulvaney³ has pointed out in connection with Australia, the name 'Sumatra-type' is unfortunate in its implication of direct cultural connection.

One broken uniface pebble tool is reported from the Saentis Estate. This could be a short axe, but as it would be the only example among some thousands of artefacts, it would be unwise to assume that this type is present in Sumatra.

¹ V. Lebzelter. 'Palaeolithische funde aus Atjeh (Nord Sumatra).' Archive für Anthropologie, 1935, 23; 318-325.

² Callenfels and Evans, 1938; 145-159.

³ D.J. Mulvaney. 'The Stone Age of Australia.' Proceedings of the Prehistoric Society, 1961, 20; 67.

Human remains from Bindja-Tamiang have been called Melanesoid by Wastl.¹

Van Heekeren remarks² that although open sites provide ample evidence of a mesolithic pebble industry on the north coast of Sumatra, no similar sites or collections are reported from other parts of the Indonesian archipelago.

Callenfels described a collection of stone tools from Sakang, western Borneo, as pebble tools; but van Heekeren³ considers that these are unfinished neolithic axes.

In the Lawa Cave near Sampung, east Java, an industry composed mainly of worked bone was discovered. Callenfels states that these include awls, daggers, fish hooks, and implements for digging yams and roots.⁴ Two kinds of polished bone tools are reported. One, of concave-convex section, is made from long bones split lengthways and has a polished cutting edge. The other of flat oblong polished bone, has a rounded cutting edge. Similar bone industries were found at other sites in Java, near Bodjonegoro,

1

J. Wastl. 'Prähistorische menschenreste aus dem muschel hugel van Bindjai-Tamiang in Nord Sumatra.' Kultur und Rasse, 1939; 237-43.

2

Van Heekeren, 1957; 74.

3

Van Heekeren, 1957; 74.

4

Van Heekeren, 1957; 76.

in the Semanding District, and in Besuti.¹ Mijsberg² examined a skull from the Lawa Cave and concluded that it had affinities with Melanesian and Australian types.

Sarawak

Harrisson³ mentions that an unspecified number of 'pebble tools' was found at diggings in a large cave near Niah. Harrisson gives no clear description of these artefacts; some were apparently edge-ground, others unifacially flaked, and others retouched flakes. Harrisson states 'these pebble tools are not nearly related to the "Sumatran" nor to the widely distributed "Hoabinhian"'. Perhaps this statement should read 'these pebble tools are not clearly related...'.

In summary, the most persistent elements of these collections under review is the flaked pebble, either bifacially or unifacially worked. This might be considered as a 'type fossil' of limited

1

Van Heekeren, 1957; 75-85.

2

W.A. Mijsberg. 'Recherches sur les restes humains trouves dans les fouilles des abris-sous-roches de Goew-Lawa a Sampoeng et des sites prehistoriques a Bodjonegoro (Lawa).' Hommage du Service Archaeologique des Indes Neerlandaises au Premier Congress des Prehistorians d'Extreme Orient a Hanoi, 1932; 39-54.

3

T. Harrisson. 'The Great Cave of Niah; A preliminary report on Bornean Prehistory.' Man, 1957; 161-166.

utility for indicating the cultural unity of the collections in question. As Childe¹ has pointed out, the significance of a type fossil is proportional to its improbability; but the simple flaked tools made on rolled river pebbles might be presumed to have a high probability.

The Hoabinhian, as defined by the collections from Indo-China, does not consist entirely of such flaked pebble tools. Short axes, pounding and grinding stones - particularly those with opposed depressions - and edge-ground axes are also represented. This evidence of material culture has been recovered from habitation deposits offering evidence of hunting and food gathering activities, deposits in which burials were presumably made.

This is a generalization from a number of Hoabinhian sites in northern Indo-China which may well cover a considerable period of time. Cultural variation within and between these sites, which is to be expected, is indicated by the excavated materials. It seems probable that in the pebble tool industry of the northern Indo-Chinese sites the later tools are smaller, have had more flakes removed, and have a greater tendency to be bifacially worked than the earlier tools. Although types have been suggested for these

¹

V.G. Childe. 'Piecing Together the Past.' London, 1956; 35.

Hoa Binh tools, it is premature to accept these types as they may be selected elements from continuous ranges.

It is possible that the appearance of edge-ground tools at Hoa Binh sites may represent a later phase of the culture, as may that of worked flakes. Pottery is reported from some of the sites, but it is not clear if it is an integral part of the culture in northern Indo-China.

It would seem that the collections from Hoa Binh represent phases in cultural development in northern Indo-China but, as has been stressed, the published information is not sufficient for these to be defined. The existence of such regional developmental trends must be borne in mind, however, when comparison is made between Indo-Chinese and other collections. These other collections, themselves, from Indonesia and Malaya for example, may well represent local and chronological variation of a type and degree very difficult to assess in the absence of information about the regional sequences to which they belong.

In Kwangsi, in south China, the stone tools are typically river pebbles that have been simply flaked to produce a cutting edge, associated with grinding stones and hammerstones, some of the latter with pitted surfaces. Here would seem to be definite cultural similarity with Hoa Binh, an area which is geographically close to Kwangsi. However, neither edge-ground tools nor pottery

have been reported from the Kwangsi sites. Whether the Kwangsi collections represent an early phase present in Hoa Binh, or whether they stand apart as regional aspects, are questions which cannot be decided on the published evidence. Sites from Szechwan, to the north of Kwangsi, have again produced similar flaked pebble tools, but these are accompanied by two elements that have not been reported from Hoa Binh - the 'shouldered axe' and the short axe with alternately flaked cutting edge. The collections from Szechwan would thus perhaps represent a regional aspect.

It is difficult to compare the pebble tools from Tam Hang in Laos, as these have not been described in any detail. However, the early stage, characterized by unifacially worked pebble tools, and the later stage with edge-ground tools bear a general and intriguing similarity to the collections and suggested sequence from Hoa Binh.

The Malayan sites again have industries predominantly composed of flaked pebble tools, but there are obvious differences from the situation in Hoa Binh. Unifacially flaked tools seem to be confined to a geographical area to the west of the peninsula. Two explanations are possible. Either two contemporary but distinct regional aspects are represented, or else two related phases. The published data cannot decide between these alternatives. The succession noted at Gol Ba'it is interesting, for here a

predominantly unifacially worked industry appears to give way to a predominantly bifacially worked industry - recalling somewhat the situation at Hoa Binh.

The short axe may be present in Malaya, and hammerstones and grinding stones are common, including those with opposed pits. Edge-ground tools were found in Malaya, and seem to represent the two types that have been described from Hoa Binh: the edge-ground pebble and the flaked and edge-ground pebble. Worked flakes are reported from the peninsula, particularly from Bukit Chuping. Pottery is also reported from Malayan sites. Tweedie is of the opinion that this is an intrusive element from a later culture. Pottery does appear to be present only in the upper levels of some deposits, although sherds are reported from all levels at Gol Ba'it. Pottery was not associated with the mesolithic layers at Gua Cha.

It is obvious that the Malayan Hoabinhian collections exhibit internal variation of a regional and/or chronological nature, though these cannot be defined or ordered on the available evidence. This makes any comparison with the Hoa Binh sites difficult, beyond noting that virtually all the elements in the Hoa Binh sequence are present in Malaya.

The predominantly unifacially flaked pebble tool industry from Thailand, containing some short axes and bifacially worked tools,

will be discussed in a later chapter in terms of the collections from Sai Yok and the general relationships of the industry will be explored.

The coastal sites in Sumatra again may have cultural connections with Hoa Binh, as the industry is composed predominantly of unifacially flaked pebble tools, associated with hammerstones and grinding stones. Lebzelter reports reworked flakes from surface collections made on the north coast of Sumatra. Neither short axes, edge-ground tools nor pottery are, however, reported from Sumatra. If the succession in Hoa Binh is valid, then the unifacially worked tools without edge-grinding could represent the establishment of the culture in Sumatra at an early phase of its development. On the other hand, in view of the absence of short axes, the Sumatran collections might represent a specifically regional variant.

Closer comparison in terms of the stone industries is unfortunately impossible. It must be remembered that the difficulties attendant on an analysis of the collections from Hoa Binh apply also to considerations of collections from the other areas. The descriptions of the artefacts and stratigraphy are inevitably deficient in detail. Consequently it is difficult, for example, to assess the validity of the typologies suggested by Muhlhofer and Lebzelter for Sumatra. In a similar way, analysis of the stone collections from Malaya is hampered. Sieveking's

forthcoming publication on the Gua Cha excavation will help considerably to rectify this situation.

It does seem that there is a certain amount of variation displayed in these collections of pebble tools. Colani, for example, has suggested that collections from Indo-China can be classified into types. It must be pointed out, however, that variation is to be expected in such simple tools so that a wide variety of forms could be classified as the same type. The finished form of the pebble tool is, by its very nature, determined to some extent by the form of the original pebble from which it is made. Further, there may be no archaeologically significant difference between pebble tools which have different proportions of their surfaces flaked. For example, a pebble tool with only four flakes removed from one face may be an artefact made from a pebble with the maximum of economy to produce a working edge - and then it may have been discarded by the maker. On the other hand, a pebble tool that is extensively worked all round the periphery may just be a tool of the same type that was retained in use for a longer time, so that continual flaking to resharpen and preserve the working edge leaves the artefact with rather a different appearance. But such conjectures are premature; for the collections have yet to be appropriately described.

It would seem highly probable that, as the form of a pebble tool is to some extent determined by the form of the pebble from

which it is made, so also it will be in part dependent on the nature of the rock of which the pebble is composed. In other words, the final form of the artefact will be to some extent determined by the nature of the raw material.

In Malaya, at Gol Ba'it, a development was noticed in the industry. In the lower part of the deposit the tools were unifacially worked, while higher up they were bifacially worked. This development is correlated with a change in the raw materials from which the tools were made: quartz, chert, and other non-fissile rocks for the unifacial tools, fissile rocks like slate and schist for the bifacials. No evidence is available to indicate why such a change was made in the choice of the raw material. Colani¹ mentions that a wide range of raw material was used to produce pebble tools in Indo-China, including porphyrites, rhyolites, microgranites, granites, schists, sandstones and other sedimentary rocks. For Malaya, Tweedie² mentions quartzite, fine grained igneous and metamorphic rocks, chert and schist.

One of the most significant features of the collections under review is that none from areas outside Indo-China contain elements that are not present in Hoa Binh. It may well be,

1

M. Colani. 'Recherches sur la Prehistoire Indochinoise.' Bulletin de l'Ecole Francaise d'Extreme Orient, 1930, 30; 6.

2

Tweedie, 1953; 13.

therefore, that these collections represent components of various phases and aspects of a general mesolithic culture that had its boundaries to the north of Kwangsi in south China, extending down the mainland of south east Asia, covering Indo-China in the east and Thailand in the west and including the Malaya Peninsula and at least the north west coastal area of Sumatra.

Other comparisons may be mentioned to this end. Bone tools are reported from Kwangsi, Hoa Binh, and Malaya. Polished bone tools are particularly well represented at Da But in Indo-China and Bukit Chuping in Malaya. The presence of haematite is reported for Hoa Binh, Malaya and Sumatra.

The faunal remains are all of recent species. The vertebrate bone and the mollusc remains all point to a simple hunting and food gathering economy. Fresh water molluscs, mainly Melania, were clearly an important diet of the inland groups; in Sumatra, coastal regions provided good supplies of marine molluscs, principally Meretrix.

Human remains are common at all sites. Their attribution to racial types is of very great interest, although the very fragmentary nature of the material makes precise identifications impossible. An Indonesian type has been identified from sites in Indo-China. But apart from this, all the remains that have been studied from Indo-China, Malaya and Sumatra (with the

exception of those seen by Duckworth) have been compared with the Oceanic Negroes (i.e. Papuans, Melanesians and Tasmanians).

There is no evidence for the precise dating of the collections under review. In terms of fauna, however, all appear to belong to the Holocene and in terms of technology and subsistence activities to precede the introduction of neolithic economies into the areas where they were found. In this sense they are truly mesolithic and the culture under whose rubric they seem to belong, the Hoabinhian, may be looked upon as representing the major element in the mesolithic prehistory of mainland south east Asia.

CHAPTER IV

JAPAN, THE PHILIPPINES AND AUSTRALIA

Hoabinhian affinities have been claimed for collections from areas somewhat further flung than those hitherto discussed.

Japan

Maringer has reported on eighteen associated stone tools from a site at Gongenyama, in Gumma Prefecture, Central Japan.¹ He classifies these into pebble tools, unifacially worked; hammerstones or fabricators; cores or nuclei; flakes and flake tools; blades and blade tools.

Although the interpretation of the geological stratification at the site is at present uncertain, Maringer suggests a geological age either near to the Pleistocene-Holocene boundary, or at an early post-Pleistocene date.

Maringer is of the opinion that the tools from Gongenyama represent an industry that is similar to that from northern Indo-China. It must be noted that there are elements in his classification, cores, flake tools, and blades not typical of the Indo-Chinese sites. Maringer's comparison is based on the presence of a hammer-stone or fabricator and pebble tools in Indo-China and at the Japanese site. The hammer-stone

¹

J. Maringer, 'Some tools of early Hoabinhian type from Central Japan', Man, 1957, 57; no.4.

is merely a crudely flaked core tool, with signs of bruising at one end. Only two pebble tools were found at the Japanese site.

It would seem that a cultural link between Japan and Indo-China cannot be established on the presence of two pebble tools at a single Japanese site.

The Philippines

H. Otley Beyer, in his outline review of Philippine archaeology by islands and provinces, tabulates a list of archaeological stages.¹ One of these stages is called the Mesolithic. This stage is divided into two parts, a large implement culture and one characterized by semi-microliths and microliths.

In Batangas Province, the two elements are found in the same general area. It is not possible to decide from Beyer's account whether or no these artefacts come from excavated sites or surface sites. Neither is it possible to discover if the large implement culture was found at sites which also contained the microliths. It is stated that the large implement culture, which was apparently present in some quantity, showed kinship with the mesolithic of northern Indo-China.

1

H. O. Beyer, 'An outline review of Philippine archaeology by islands and provinces', Philippine Journal of Science, 1947, 77; 208.

Australia

McCarthy¹ expresses the opinion that a cultural link exists between Australia, Malaya and Indo-China, and that this link is the Hoabinhian culture. He states that there is insufficient evidence, particularly from Australia, for comparisons of bone artefacts to be made between these areas² so that the existence of the link must be demonstrated through stone implements.

Tindale³ specifically relates the unifacially flaked pebble tools in Kartan collections from South Australia to the unifacially worked pebble tools from Sumatra. McCarthy⁴ suggests that the culture represented by the south east Asian collections is also present in Australia, referring to two sites on the north coast of New South Wales as representing Hoabinhian I industries. On the other hand, Tindale relates only one element of the Kartan collections, the unifacially worked pebble tools, to apparently similar elements from Sumatra.

1

F. D. McCarthy, 'A comparison of the prehistory of Australia with that of Indo-China, the Malay Peninsula, and the Netherlands East Indies'. Proceedings of the Third Congress of Prehistorians of the Far East, 1940; 33-39.

2

F. D. McCarthy, 1940; 46.

3

N. B. Tindale, 'The relationship of the extinct Kangaroo Island culture with cultures of Australia, Tasmania, and Malaya'. Records of the South Australian Museum, 1937, 6, 1; 47.

4

F. D. McCarthy, 'Two pebble industry sites of Hoabinhien I type on the north coast of New South Wales', Records of the Australian Museum, 1941, 21, 1; 21-27.

The Kartan is an industry that has been defined from extensive collections gathered from over a hundred and thirty surface sites in south eastern South Australia, and Kangaroo Island (Map 7). At only two sites were artefacts recovered from deposits. At Fulham¹ discoveries were made some ten feet below ground surface during the excavation of an artificial lake. A succession was noted in the profile; marine sands overlay freshwater deposits, which in turn lay on a white wind-blown sand that contained the artefacts. Tindale² was subsequently able to examine the artefacts, and to decide that they were elements of the Kartan industry. In 1933 and in 1934 the South Australian Anthropological Society made an extensive series of bores at the site, which confirmed the stratification mentioned by White. During the course of the survey a small surface site was found close to the line of bores which contained pirri points and other elements of a rich stone industry.

At Rainy Creek on Kangaroo Island³ the digging of a ditch across a flat caused the stream to cut into beds of silt and clay to a depth of two metres. Kartan implements were found in these sediments at depths of 1 metre 30 centimetres and 80 centimetres.

1

S. A. White, 'Notes on the occurrence of aboriginal remains below marine deposits at the Reedbeds, Fulham, near Adelaide', Transactions of the Royal Society of South Australia, 1919, 43; 77-80.

2

Tindale, 1937; 54

3

Tindale, 1937; 41

Apart from these two sites, all collections of Kartan implements have been made from surface scatters, sometimes, as at Hallett Cove,¹ exposed by the plough.

One of the main elements of the Kartan² is the unifacially flaked pebble tool (Figure 5), often large and with final shape determined by secondary trimming which produces a fairly thin and often stepped working edge.³ Pitting and bruising on the unworked surface often indicates that such pebble tools have been used as hammers.

Tindale⁴ describes the unifacially flaked pebble tool, as known from sites on Kangaroo Island, as being flaked along one margin. On the other hand, Cooper⁵ implies that pebble tools which have one

1

N. B. Tindale, 1937; 54.

2

N. B. Tindale and B. G. Maegraith, 'Traces of an extinct aboriginal population on Kangaroo Island', Records of the South Australian Museum, 1931, 4, 3; 244-275.

N. B. Tindale, 1937.

H. M. Cooper, 'Large stone implements from South Australia', Records of the South Australian Museum, 1943, 7, 4; 343-369.

H. M. Cooper, 'Large archaeological stone implements from Hallett Cove, South Australia', Records of the South Australian Museum, 1959, 82; 55-60.

H. M. Cooper, 'The archaeology of Kangaroo Island, South Australia', Records of the South Australian Museum, 1960, 13, 4; 481-503.

H. M. Cooper, 'Archaeological stone implements along the Lower River Wakefield, South Australia', Transactions of the Royal Society of South Australia, 1960, 84; 105-118.

3

H. M. Cooper, 1960; 484.

4

N. B. Tindale, 1937; 46.

5

H. M. Cooper, 1960; 492.

surface completely flaked are present in the Kangaroo Island collections. Tindale¹ calls the unifacially flaked pebble tools from Kartan collections 'sumatras', after the unifacially flaked pebble tools from Sumatra previously described. The disadvantages of such a name have been pointed out (page 102), and in any case, the name cannot be legitimately applied to the Kartan tools if they are not completely flaked over one surface, as are the pebble tools from Sumatra after which they are named.

Frequency distributions of the weights of Kangaroo Island unifacially worked pebble tools indicate two groups² which can be called light and heavy. However, the frequency distribution of the length breadth ratio ($\frac{Br \times 100}{L}$) indicates that a ratio of 60 is the mean, with little spread. Tindale notes that it would be interesting to compare these parameters with those for collections from south east Asia.

Other tools are large artefacts made mainly from angular blocks (Figure 6). Their sub-oval outline shape and flat base has led to their being called 'horsehoofs'. The working edge appears to form an angle of 90° in many cases, and often secondary trimming cuts back the working edge so that it is overhung by the main body of the artefact.

¹

N.B. Tindale, 1937; 47.

²

N.B. Tindale, 1937; 48.

At two sites on the Wakefield River¹ it is said to be impossible completely to separate the horsehoof cores from implements made on pebbles and angular blocks. An unbroken series is reported, with these two types at the extremes and intermediary stages between.

Another element of the Kartan is the karta, a discoidal implement worked on a flake.

Although originally defined in terms of the artefacts mentioned above, it appears² that a few small but well defined implements of quartzite were found in association with the larger artefacts on Kangaroo Island. Cooper mentions trimmed end and 'nosed' scrapers, discoidal and irregular shaped adzestones, knives/saws, awls and prepared cores. Most of these implements are reported to be flake tools struck from prepared cores.

Hammerstones are commonly associated with Kartan artefacts, some with single or opposed depressions. According to Tindale³ hammerstones were the most abundant element in collections from Kangaroo Island. Twenty-five large hammerstones were found at Hallet Cove⁴ and these are contrasted with smaller hammerstones found in association with cultures that are presumed to be later. Large numbers of slightly used hammerstones were found in collections along the lower River Wakefield.⁵

1

H. M. Cooper, 1961; 114.

2

H. M. Cooper, 1960; 486-488.

3

N. B. Tindale, 1937; 46.

4

H. M. Cooper, 1959; 59.

5

H. M. Cooper, 1961; 108.

Marine shell has been found in association with pebble tools on three eroded camp sites on Kangaroo Island.¹ However, Cooper suggests that these camp sites may have been left by early nineteenth century wanderers who are known to have visited the island in company with women from Tasmania.

The only other report of Kartan elements in association with food remains is given by Cooper² who mentions the discovery, on the eroded summit of a red sand-dune west of Port Augusta, of a hearth of burnt stones, apparently recently uncovered. Twelve well preserved teeth as well as bone fragments, some showing evidence of fire, were found nearby. Large stone implements, similar to examples from Hallett Cove, were scattered about on the adjoining surface. The faunal remains have been identified as Diprotodon Owen, a small phase e.g. D. minor. Cooper considers that although the association of the teeth and the artefacts may be coincidental, it may equally well be an indication of the contemporaneity of the Kartan culture and the extinct Diprotodon.

No human remains have been found with Kartan implements.

As Kangaroo Island was uninhabited at the time of its discovery, the surface sites there must have a certain antiquity. Tindale suggests a late Pleistocene date,³ on several grounds that have been questioned

¹

H. M. Cooper, 1960; 490.

²

H. M. Cooper, 1959; 58.

³

N. B. Tindale, 1957; 6.

by Mulvaney.¹ In Tindale's view the site at Rainy Creek demonstrates that the Kartan implements are related to a raised beach, while the distribution of artefacts along the shore of a lake at Hawke's Nest shows that the water in the lake was some three meters above its present level when the artefacts were discarded. As Mulvaney points out, insufficient physiographic evidence has been presented to support these claims.

Tindale² considers that the absence of beach pebbles from the collections from Hallett Cove suggests that when the Kartan site was occupied the present beach deposit was covered with a talus slope at a time of lowered sea level. In Tindale's view³ the stratigraphy at Fulham again indicates that Kartan artefacts are associated with a lowered sea level. However, Mulvaney has pointed out⁴ that the beach pebbles at Hallett Cove may have been covered by a higher sea level and that, the south Adelaide plains being a region of tectonic instability, it does not necessarily follow that eustatic changes account for the rise in sea level since the deposition of the Kartan implements at Fulham.

¹
D. J. Mulvaney, 'The stone age of Australia', Proceedings of the Prehistoric Society, 1961, 20; 70.

²
N. B. Tindale, 1957; 5.

³
N. B. Tindale, 1937; 52.

⁴
D. J. Mulvaney, 1961; 70.

The similarities of Kartan collections with collections from Hoa Binh are not marked. The only common elements would seem to be the unifacially worked pebble tool and the hammerstone, with and without opposed pits - unreliable type fossils for the reasons that have been pointed out above. Other elements of the Hoabinhian collections, the short axes, the edge-ground tools, are not found in Kartan collections and bifacially worked pebble tools only rarely. Again, elements of the Kartan, the horsehoof and the karta are not found in Hoa Binh. The possibility that the worked flakes, mentioned by Cooper from Kangaroo Island and the worked flakes mentioned by Colani from Hoa Binh have affinities must remain an open question until more precise descriptions of these artefacts from both areas are available. Haematite is not associated with the Kartan.

Just as the descriptions of sites in Hoa Binh were found to be inadequate for detailed analysis, so the descriptions of Kartan collections are similarly deficient. It is possible that evolutionary trends, similar to those suggested for Hoa Binh, are present in the South Australian collections: in terms perhaps of a reduction of the overall size of the pebble implements, and an increase in the number of flakes removed and the amount of secondary flaking used to form the artefacts. However, as none of the Kartan sites have any stratigraphy, evolutionary trends in the industry will be somewhat difficult to trace. On the other hand some of the open sites may represent discrete

components of the culture, making it possible to contrast collections from different places to discover what differences are present.

However, it is not possible to postulate phases and aspects for the Kartan collections on the evidence that has been published so far. More information is required about the distribution of the sites and the detailed nature of the collections for any further analysis to be possible.

Reference is made by McCarthy¹ to two open sites on the north coast of New South Wales (Map 7) which are said to be representative of the Hoabinhian culture. At Yamba Head, artefacts were collected over an area of some acres. This site produced cores, one being identified as a horsehoof core; bifacially worked pebble artefacts; artefacts called karta which are said to be made either from the core or slice portion of a split pebble, and are, in terms of this description, difficult to compare with the karta of South Australia; and uniface pebble implements². Eighty-six specimens of the latter were collected and comprise the larger part of the collection. Primary flakes were also collected.

The same kinds of artefacts are reported from a quarry site at Crescent Head. An adjacent midden again produced the same range of

¹

F. D. McCarthy, 1941; 21-27.

²

F. D. McCarthy, 1941; 22.

artefacts, with edge-ground tools, side scrapers made on flakes, and worimi in addition. The latter is described as a large crescent shaped implement, triangular in section. One of the sides is a cleavage surface, and the other the original cortex surface of the parent pebble. The thick crescentic back is carefully shaped and bears percussion marks.

McCarthy¹ has also described a collection from the Kempsey district on the north coast of New South Wales in a preliminary note. Implements were collected from middens, apparently over a considerable area, and are classified as: cores (five collected); blocks, karta type (two collected); blocks, worimi type (two collected), uniface pebble implements (three collected); blocks (three collected); scrapers (two collected).

Although this collection is very small, McCarthy relates it to the Kartan industries from South Australia. The middens lie along an ancient shore line, and Professor Cotton² considered that their accumulation might relate to a period as far back as eleven thousand years ago.

1

F. D. McCarthy 'Trimmed pebble implements of Kartan type from ancient kitchen middens at Clybucca, New South Wales', Records of the South Australian Museum, 1943B, 21, 3; 164-168.

2

McCarthy, 1943B; 166.

Unifacially and bifacially flaked pebble tools are also reported by McCarthy from other surface collections in New South Wales, from the south coast,¹ from the north coast² and from the Bathurst district.³ However, these pebble tools are minor elements of composite collections that have been gathered by several people over a length of time, and their archaeological context is unknown. McCarthy does not suggest that these pebble tools should be related to the Kartan.

Edge-ground tools are known from almost all parts of Australia⁴ but hardly a single example has been found in context. McCarthy⁵ has described several types, including the unifacially edge-ground Windang axe, and the bifacially edge-ground axe head which is made on a bifacially flaked pebble. That edge-ground tools from Australia and south east Asia have a remarkable similarity cannot be denied; however,

¹

F. D. McCarthy, 'An analysis of the knapped implements from eight Eloma industry stations on the South Coast of New South Wales', Records of the Australian Museum, 1943A, 21, 3; 127-154.

²

F. D. McCarthy, 'An analysis of the large stone implements from five workshops on the north coast of New South Wales', Records of the Australian Museum, 1947, 21, 8; 411-431.

³

F. D. McCarthy 'Coroid and knapped stone implements of the Bathurst District', Records of the Australian Museum, 1943C, 21, 4; 199-210.

⁴

Mulvaney, 1961; 93.

⁵

F. D. McCarthy, 'The Stone Implements of Australia', Australian Museum Memoir, IX, 1946; 44-57.

the cultural implications of this similarity will not be apparent until a complete analysis has been made of edge-ground tools from south east Asia, and edge-ground tools have been found in carefully controlled excavations in Australia.

In a discussion of percussion and abrading implements, McCarthy¹ mentions that many edge-ground tools from Australia bear signs of percussive use and may have pits on their upper and lower surfaces. McCarthy² also describes the so-called kuliki percussion stone, whose upper and lower surfaces often bear centrally placed anvil pits. Similarity can be noted with the hammer stones with opposed pits reported from Hoa Binh and Malaya.

Recent work in northern New South Wales, directed by Miss Isabel McBryde, has included excavation at three rock shelter sites.³ At one of these sites, Seelands, in the Clarence valley west of Grafton, large uniface pebble tools associated with a few microliths were found in sequence below a layer containing microliths, adze flakes and bone points. The layer containing the uniface pebble tools has been dated by a carbon 14 sample to 1920 BC[±]80. One edge-ground implement came from below this layer.

1

F. D. McCarthy 1946; 58.

2

F. D. McCarthy 1946; 59.

3

McBryde, 'Archaeology in New England'. In Studies of Environment in Northern New South Wales, University of New England, 1963; 63-70.

The inherent difficulties of assessing the cultural affinity between the Hoabinhian and Australian pebble tool collections are enhanced by the remoteness of the areas from each other. It is only to be expected that by the time a culture has diffused over a distance comparable to that separating south east Asia and Australia it will have undergone considerable change in respect of tools form and their associations.

No collections from Australia can be compared in their entirety with the Hoabinhian. On the other hand artefacts are found in Australia which seem to be very similar to Hoabinhian artefacts. Thus hammerstones with opposed pits found in Indo-China and in Malaya in Hoabinhian contexts are known in Australia in association with Kartan implements. This may indicate a cultural connection; on the other hand it may merely indicate that hammerstones have been used for similar purposes in south east Asia and Australia - a common usage that need not necessarily have cultural implications, or only perhaps very indirect ones.

That edge-ground tools from Australia and Hoa Binh are similar in form is strikingly obvious. On the other hand, edge-ground tools are not an element of the Kartan culture. Although it is possible that edge-ground tools in Australia do have cultural connections with the Hoabinhian types, it is not possible to assess the nature of this connection which may have been of the most indirect kind. Although the edge-ground tool may have survived in company with the pebble tool,

it may have diffused as an isolated element from south east Asia to Australia. It is not impossible of course that it was introduced into both the Hoabinhian and Australian cultures from some external source.

It is the pebble tool itself, however, that is usually taken to indicate cultural community between Australia and the south east Asian Hoabinhian. Now, as has been stressed above, the pebble tool as a type fossil has very limited utility. Two hypotheses are therefore possible: one that the presence of pebble tools in south east Asia and Australia is the result of diffusion; the other that it is the result of independent invention. There seems to be no a priori reason why one hypothesis should be preferred. The diffusionist answer to problems of this kind has a plausibility that is proportional to the 'improbability' of the artefacts under consideration. In the same way, the independent evolutionist answer becomes more plausible in proportion to the 'probability' of the artefacts.

The solution to the problem of the origin of the Australian pebble tools will not be found in the study of the artefacts themselves. However similar Australian examples are shown to be to Hoabinhian tools, the independent evolutionist can argue that such similarity merely reflects the inherent 'probability' of this kind of artefact. In the same way, however dissimilar the pebble tools from two regions may be, the diffusionist can argue that such differences are the result of adaptation of a common tradition to different environments and its rendering in different raw materials.

It will only be possible to attempt a satisfactory answer to this question when there is a more detailed understanding of the cultures and the culture sequence in these two areas, and the regions in between. The solution then must await the time when synthesis is undertaken; the initial stages of analysis are unlikely to decide which of the two hypothesis is correct.

The two following sections, the first describing collections excavated in Sai Yok, in Thailand, and the second some pebble tool collections from Australia will help to carry this analysis to a further stage.

CHAPTER V

SOME ANALYTICAL TECHNIQUES

The reports analysed in the previous chapters lack two fundamental kinds of information that are essential to the proper interpretation of an archaeological deposit. They do not present accurate and detailed descriptions of the collections that were recovered from the deposits; and they do not give precise stratigraphical information about the deposits, or data from which stratigraphical information could be inferred.

In a site where the deposits have grown vertically over time, stratigraphical information is to be derived not merely from an examination of the spatial distribution of the artefacts at the site but also, and more importantly, from a precise analysis of the depositional or sedimentary history of the deposit. The archaeologist not only has to know with precision the positions of the artefacts in the deposits that are excavated, but also has to know how the artefacts came to occupy those positions.

In order to acquire stratigraphical information, appropriate procedures for recording the positions in which artefacts are found have to be devised¹ and pedological and geomorphological

¹

A. Detweiler 'A manual of archaeological surveying'. American Schools of Oriental Research. 1948; 26-31.

observations have to be made. Expert assistance is usually required for the interpretation of the sedimentary history, although it is to be hoped that in time archaeologists themselves will acquire the appropriate training for this kind of study.

Some writers have stressed that it is desirable to excavate a deposit according to the observed stratigraphy that may be present, and to assume that each visible stratum can be considered to represent a separate stage in the history of a deposit.¹ However, serious misinterpretations may result from the rigid application of this principle, as Cornwall has pointed out.² Cornwall mentions the activities of earthworms and describes how these animals may cause the stratification of a deposit to become compressed. Even so, the seriation of the objects in the deposits should not be altered by this factor, so that objects that are stratified high in the deposit arrived at a later time than those objects that are stratified below them. But, as will be demonstrated in Chapter VII, it does appear that at least in some circumstances the seriation of objects in deposits, particularly of the kind that have previously been described from caves in south east Asia, may become disturbed as a result of occupational disturbance.

1

Sir Mortimer Wheeler, 'Archaeology from the Earth' Oxford, 1954; 40-61.

2

I. W. Cornwall, 'Soils for the Archaeologist', London, 1958; 53.

There is another serious difficulty that can arise when sites are excavated according to visible strata. It is often impossible to determine the sedimentary nature of a stratum in the field, as laboratory work may be necessary. Consequently, it may not be possible to determine, during the course of an excavation, the real nature of a stratum that contains archaeological material (a difficulty that can also arise out of the excavator's inexperience). In such cases the significance of a thin stratum, which had in fact taken a considerable time to accumulate, might be missed, for example. Similarly the horizons in a soil profile may be taken to be archaeological layers.

It is therefore suggested that the practice of excavating sites with sole regard to their visible stratification should be treated with caution. A more appropriate procedure is to make a separate record of both the positions of the artefacts and the positions of the pedological and sedimentary structures in a deposit. Subsequent analysis of these records will reveal the extent to which the seriation order of the objects in the deposit has become disturbed, and the extent to which visible strata can be taken to represent separate stages in the history of the deposit. Note must, of course, be taken of the relationship between artefacts and strata observed during the course of excavation.

For many of the deposits that have been described from south east Asia, where no visible strata are present, the positions of artefacts have to be recorded directly in reference to a datum, the accuracy of

such a record being preferable to the less precise information provided by excavation in arbitrary spits. But the reports that have been examined are, in the main, quite deficient in adequate descriptions of the sedimentary situation, artificial and natural, in the deposits, and there is little information about the spatial distribution of the artefacts.

Only when the number of artefacts in a collection is small will it be possible for every artefact to be described in detail. But, in general, small collections which can be described in this way may have restricted archaeological relevance, particularly when the collections contain simple stone artefacts of the kind described previously.

The prehistorian is not concerned so much with the individual artefacts that make up a collection, but with the types that are represented by those artefacts. In fact, the archaeologist must deal only with abstractions.¹ But here are two separate tasks that confront him - the description of collections, and the description of the types represented by those collections. These two procedures, although related, are not identical; the first is concerned with the description of a discrete and unique collection of objects, the latter with generalized categories.

¹

V. G. Childe, 'Piecing Together the Past', London 1956; 4.

Simpson¹ has defined the terms 'taxonomy', 'classification' and 'systematics' for zoological use. His definition, with appropriate modification, can be used in the analysis of the data of prehistoric archaeology.

Taxonomy is the theoretical study of classification, including its basis, principles, procedures and rules.²

Archaeological classification is the ordering of archaeological data into groups (or sets) on the basis of their relationships, this is, of associations by contiguity, similarity, or both.³

Association by contiguity is a cultural relationship between things that may be quite dissimilar, or in any event their similarity may be irrelevant.⁴

1

G. G. Simpson, 'The Principles of Animal Taxonomy', London, 1961.

2

Simpson, 1961; 11.

3

'Zoological classification is the ordering of animals into groups (or sets) on the basis of their relationships, that is, of associations by contiguity, similarity, or both.' (Simpson, 1961; 9)

4

'Association by contiguity is a structural and functional relationship among things that may be quite dissimilar, or in any event their similarity is irrelevant.' (Simpson, 1961; 3)

Systematics is the scientific study of the kinds and diversity of archaeological data and of any and all relationships among them.¹

Prehistoric archaeology is very greatly concerned with systematics. Often little attention is paid to taxonomy, although classification is one of the principle objectives of archaeological analysis.

As the animal taxonomist has to define the basic unit of classification - the species - so the archaeologist has to define a suitable unit - the type. There are two parts to the definition; first, that which says what a type is; second, that which says how a type is recognized.

Gilmour² points out that there are many philosophical difficulties attendant on a precise definition of the ontological nature of the basic taxonomic unit, and that any given series of data can be classified in a number of ways according to the purpose of the classifier.³

Archaeologists generally ignore such epistemological problems. However, Phillips and Willey⁴ point out that there are two ways in

1

'Systematics is the scientific study of the kinds and diversity of organisms and of any and all relationships among them.' (Simpson, 1961; 7)

2

J. S. L. Gilmour, 'Taxonomy and Philosophy', in The New Systematics, Oxford, 1939; 463.

3

Gilmour, 1940; 465.

4

P. Phillips and G. R. Willey, 'Method and theory in American archaeology: an operational basis for culture historical integration', American Anthropologist, 1953, 55; 617.

which types can be considered. The first takes types to result from the archaeologist's segmentation of a continuous stream of culture change into units which are devised to suit best his purpose. The other view holds that typology is concerned with the recognition of a situation that once existed.

MacWhite¹ steers a central course, suggesting that types may be observer-imposed, or real, or mixed. Rouse,² who suggests that a type is a conceptual pattern set up by the archaeologist to represent ideas possibly held by the artisan who made the artefact, covers all the possibilities.

Rouse³ considers that an artefact is the product of a number of factors. These are: the individual quirks of the artisan; the physical capacities of the artisan; the potentialities of the environment; elements of culture; and chance. These factors may be presumed to reach

1

E. MacWhite, 'On the interpretation of archaeological evidence in historical and sociological terms', American Anthropologist, 1956, 58; 12.

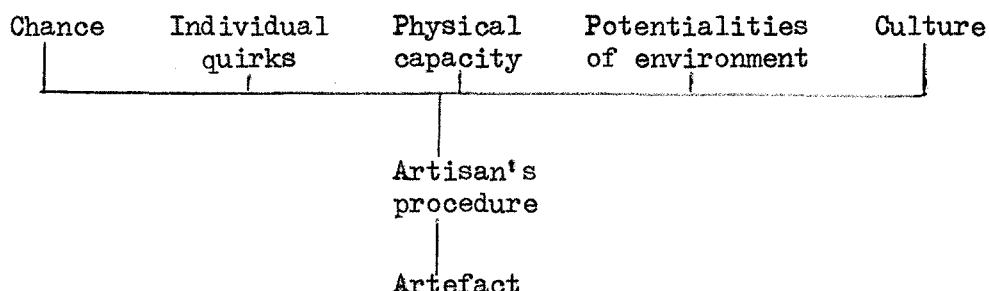
2

I. Rouse, 'Prehistory in Haiti; a study in method', Yale University Publications in Anthropology, 1939, 21; 15.

3

Rouse, 1939; 15.

an equilibrium in an artefact:¹



Each type is a pattern of artefact characteristics which constantly recurs on a given kind of artefact. The archaeologist, when setting up a typological pattern, has to eliminate such observable characteristics as may be due to chance, individual quirks, the physical capacity of the artisan and the potentialities of the environment; the residue can be taken to represent elements of culture.

Krieger has outlined² a procedure for archaeological classification. The procedure progresses through a number of stages. First comes a somewhat subjective stage which sorts the artefacts into major groups which look as though they have been made according to the same or a similar structural pattern. Then follows the examination of the major groups produced by stage one for the constant combination of attributes. No attributes have a priori significance: specific combinations of attributes have greater value than any single feature. As Krieger points

¹

Rouse, 1939; 18.

²

A. D. Krieger, 'The typological concept', American Antiquity, 1944, 9, 3; 279-283.

out, care must be taken to exclude attributes that may only indicate individual quirks or physical capacities, chance or the potential of the environment.

The third step is the recombining of the groups produced in stage two according to their geographical and temporal distribution, and their association in collections. The fourth stage is concerned with the testing of the types isolated in the third stage with whatever further information may become available.¹

Typological classifications can only be accepted when precise descriptions of the collections are given; descriptions which validate the classification. The terms in which collections are described will depend on the position from which the archaeologist approaches an analysis. There has been a tendency for prehistoric archaeologists to concern themselves primarily with the qualitative aspects of the artefacts that they study at the expense of the quantitative. This is to be regretted, for the quantitative approach to the analysis of archaeological data depends on the proposition that anything that can be expressed in numerical terms is a potential source of knowledge. As Heizer and Cook² have pointed out, the techniques and procedures

1

Referring back to the first chapter, it is difficult to resolve the taxonomic problems raised by Colani's typology. She does not give any indication herself of her epistemology, and her typological descriptions are too confused for this to be inferred.

2

R. F. Heizer and S. F. Cook, 'Some aspects of the quantitative approach in archaeology', South Western Journal of Anthropology, 1956, 12, 3; 230-23

available for the analysis of archaeological data fall into four categories: mensuration, involving distances, areas and volume; mechanical or physical analysis, requiring the measurement of specific continuously distributed variables in a deposit; chemical analysis of various kinds applied to soil, bones, organic remains and so forth; and, slightly apart from the first three but appertaining to them all, the statistical analysis of archaeological data.

One of the most important points about statistical analyses, a point that is often overlooked, is that they can only be aids to the understanding of sets of data. No statistical method can be blindly applied to a problem and produce an answer to apparently insoluble questions. As has been well said, statistics are no substitute for thought.

Statistical methods fall under two headings. First, descriptive statistics, methods concerned with collecting and summarizing data; second, statistical inference, methods concerned with drawing conclusions about the source of the data. Methods of statistical inference can be applied to the results of descriptive statistics.

Descriptive statistics provide an ideal way in which archaeological assemblages can be described. By using statistical methods, much of the search for graphical and visual methods for the presentation of

archaeological data derived from the analysis of assemblages to which reference has been made by Bohmers¹ can be eliminated.

Spaulding² has illustrated by examples some of the applications of statistical methods to archaeological problems. He makes the admirable observation that only to the statistician do statistical techniques have special or inherent value: in prehistory their use is only justified by the demonstration that the same result could not be attained, or attained so economically, by other methods.

When the prehistorian makes a quantitative analysis of archaeological data, then descriptive statistics provide descriptions that cannot be bettered.

At the beginning of this study it was hoped that some form of mathematical analysis could be used as an aid to the determination of types. Sneath and Sokal³ have outlined the basic ideas of numerical taxonomy. Although their work demonstrates that these procedures have some utility, the problems that they undertake are not analagous to those of archaeological typology. For Sneath and Sokal are concerned

1

A. Bohmers, 'La valeur actuelle des methods de la Typologie Statistique', Atti del VI Congress Internazionale delle Scienze Preistoriche e Protostoriche, 1962, 1; 12-20.

2

A. C. Spaulding, 'Statistical description and comparison of artefact assemblages', in The Application of Quantitative Methods in Archaeology, 1960; 60-93.

3

P. H. Sneath and R. R. Sokal, 'Numerical taxonomy', Nature, 1962; 193, 4818.

to group species in terms of indices of likeness, whereas archaeological typologies are designed to isolate types. Sneath and Sokal are not attempting to define species, but to classify species into taxonomic groups. No doubt there are possible applications to archaeology of the techniques that Sneath and Sokal have described, for example the grouping of archaeological assemblages into larger cultural units.

But they could only be applied with great difficulty to the problem of defining types, as each artefact in a collection would have to be treated as a unit, and contrasted with every other artefact in a collection in terms of all the various attributes that the artefacts may possess. It is unlikely that even the most elaborate computer could handle all the configurations that would be present even in a collection of a hundred artefacts of moderate complexity.

Clarke¹ has used an analytical technique devised by Tugby² in conjunction with an electronic computer for the isolation and ordering of types. The writer has pointed out³ that Clarke has not given an adequate description of the method he attempts to use. Clarke states

¹
D. L. Clarke, 'Matrix analysis and archaeology with particular reference to British beaker pottery', Proceedings of the Prehistoric Society, 1962, 28; 371-388.

²
D. J. Tugby, 'A typological analysis of axes and choppers from south-east Australia', American Antiquity, 1958, 24; 24-33.

³
J. M. Matthews, 'The application of matrix analysis to archaeological problems', Nature, 1963, 198, 4884; 930-934.

that he follows Brainerd and Robinson,¹ using a contoured matrix which is supposed to display clusters of attributes that can be taken to represent types. However, Brainerd and Robinson were concerned to order collections of artefacts in a chronological series - an operation that is quite different from the typological examination conducted by Clarke. If Clarke gives a more careful description of his method, then it will be possible to evaluate its archaeological implications - but, as the writer has pointed out (see Appendix) the kind of approach to typological problems that he advocates would seem to be fraught with difficulties.

Gardin² describes an attempt that was made to extract typological information from a coded record of some five hundred socketed Bronze age axes from seven areas - Eurasia (Europe, Siberia, Mongolia), China (north, west and centre) and Indo-China.

Using an IBM 650 computer, an attempt was made to obtain a representation of the 'average type' in each of the known groups. The mathematical treatment of this and the two following problems has been

1

G. W. Brainerd, 'The place of chronological ordering in archaeological analysis', American Antiquity, 1951, 16, 4; 301-313.

W. S. Robinson, 'A method for chronologically ordering archaeological deposits', American Antiquity, 1951, 16, 4; 293-301.

2

J. C. Gardin, 'On three computer projects in the field of archaeology and anthropology', Wenner-Gren Foundation for Anthropological Research, Symposium 18, 1962.

described by Ihm.¹ A second step was the attempt to use the mean vectors previously obtained in order to place objects of unknown origin into their correct provenance. A final attempt was made to classify all the artefacts purely on internal data, taking no regard of their provenance or associations. Gardin, reviewing the results of these analyses, concludes that:²

Many more trials would have to be made with subtler methods before such formal results can be granted the same value as the more refined empirical techniques of present day archaeology.

Gardin³ has pointed out the utility of codes for describing artefacts. By using a code, archaeological information can be preserved and disseminated with economy. Coded descriptions of artefacts are particularly suited to the operation of mechanical aids, such as systems of punch-card indices. Green⁴ has outlined the various matrix index systems that can be applied to archaeological problems. However, a code may be elaborate and, if it is to include all the information about a collection that might possibly be of archaeological interest, then it

1

P. Ihm, 'Le problème de la découverte automatique des groupes culturels', Comptes-rendus du Séminaire sur les Modèles Mathématiques dans les Sciences Sociales, 1960-1, 3; 27-33.

2

Gardin, 1962; 3.

3

J. C. Gardin, 'Four codes for the description of artefacts: an Essay in archaeological technique and theory', American Anthropologist, 1958, 60; 335-357.

4

R. C. Green, 'The application of matrix index systems to archaeological materials', paper read to the 10th Pacific Science Congress, 1962.

will be a long and difficult process to set it out. In addition, it must be realised that such a code can only be complete when all the possible varieties of archaeological information that may be presented by a collection are known. In other words, a collection must be analysed and described in detail before a comprehensive coded record can be made.

In addition, the transfer of the coded record to punch cards is costly and time consuming, and although sets of punch cards can be duplicated, this can be expensive. Only time will tell whether or no the advantages of coded records outweigh their disadvantages, so that they come into general use. However, there is certainly a place for such records in specific instances, as the next chapter will show.

CHAPTER VI

THE FLAKED STONE COMPONENT OF THE COLLECTIONS

AT SAI YOK, AND THE CODE USED FOR THEIR ANALYSIS

As the published data was inadequate, a detailed study of the Hoabinhian called for first hand analysis of the material itself, with two main aims: first the accurate and detailed description of the collections; and, second, from such descriptions a reassessment of the published reports to discover how justified the evaluations made of them in the previous chapters might be. It was also possible that a new examination of the collections, taken together with the published reports and any information that might be contained in catalogues and notes accompanying the collections, might allow seriation or stratigraphical inferences to be made.

It is clear that many of the sites excavated by Colani in Hoa Binh produced large numbers of artefacts. These collections are still housed in Hanoi, but the writer was unable to obtain a visa which would have allowed him to examine them.

The writer, from personal experience, also knew that neither the Perak Museum nor the National Museum in Singapore contained complete collections together with the necessary field data from any of the sites excavated in Malaya.

A search for collections in European institutions failed to find any of significance. There is a small collection from Indo-China in the Musée de l'Homme in Paris (see Table 14). A few artefacts from south east Asia are in the collections of the British Museum.¹ There are also small collections in the Pitt Rivers Museum, Oxford and the University Museum of Archaeology and Ethnography, Cambridge (see Table 14).

The situation was saved by Mr H. R. van Heekeren of the Rijksmuseum voor Volkenkunde, Leiden, who very kindly extended an invitation from the Council of the Thai-Danish Prehistoric Expedition for the writer to examine extensive collections excavated by the Expedition at the site of Sai Yok.

Here two associated caves and a rock shelter in a limestone hill (see Figure 7) were excavated during two seasons.² The writer was able to study the collections from section X and from section C in the rock shelter (see Figure 7). The collections were being unpacked at Leiden while the study was carried out, and lack of time prevented the examination of artefacts from other parts of the excavation. This

1

A. H. Dani, 'The Prehistory and Protohistory of Eastern India', Calcutta, 1960; 208-210.

2

H. R. van Heekeren, 'A preliminary note on the excavation of the Sai Yok rock shelter', Journal of the Siam Society, 1961, 49, 2; 99-109.

H. R. van Heekeren, 'A brief survey of the Sai Yok excavations: 1961-1962 season of the Thai-Danish Prehistoric Expedition', Journal of the Siam Society, 1962, 50, 1; 15-19.

unavoidable restriction is to be regretted, but an attempt has been made to examine the pebble industry represented at this site on the basis of the data that it was possible to record. This record was confined to the flaked stone tools from sections X and C.

The method of examination

All the flaked stone artefacts from sections X and C were examined individually. Measurements of length, breadth and thickness were taken on teak measuring boards. Two boards were used: one for larger implements and one for smaller. The boards are simple rectangular bases with a raised border along two adjacent sides. A centimetre scale is marked on the raised borders, so that the dimensions of an artefact placed against them can be read directly.

A code was devised for recording relevant information about the flaked pebble tools. The utility of codes for recording archaeological information has been ably demonstrated by Gardin¹ and discussed above (page 144). As in this case the collections had to be examined in Holland and analysed in Australia the use of a coded record had essential advantages. The code was not used for primary, unworked flakes, as the simple measurements that were made could be recorded directly.

1

J. C. Gardin, 'Four codes for the description of artefacts: an essay in archaeological technique and theory', American Anthropologist, 1958, 60; 335-357.

A code may be more or less elaborate according to the use for which it is intended. Gardin has produced a code for pottery that has well-nigh universal application.¹ The present code, however, is restricted in scope, and devised to assist the study of the material examined by the writer from Sai Yok and its comparison with similar material from other sites. From a preliminary and general examination of the collection variables appropriate to the kind of analysis that was to be made were selected. The subsequent analysis will demonstrate that this information is sufficiently complete for present purposes. There is no intention that the code should be considered to have any general application.

Seventeen observations were made on each artefact. The artefacts were oriented with the butt towards the observer (see Figure 8). The butt is identified as that end of the artefact which has not been fashioned into a cutting edge. In many cases the implement had been worked entirely over one face so that it was not possible to distinguish a butt. In such cases, one end was arbitrarily chosen as the butt - and this orientation was retained throughout the observations.

It was also necessary to distinguish between the two faces. In the case of unifacially worked tools, the unflaked face was called face

1

J. C. Gardin, 'Project de code pour l'analyse des formes de poteries', Centre d'analyse documentaire pour l'archaeologie, Paris, 1962.

one, and the flaked face, face two. With bifacially worked implements, one face was arbitrarily called face one and this designation was retained throughout the observations.

The first seven observations are measurements of continuous variables (see Figure 9). These measurements can be directly recorded in the code as numbers. Measurements of maximum breadth, length and thickness are taken from the dimensions of the 'containing rectangle' in the appropriate plane. In the horizontal plane, the containing rectangle is orientated around the longitudinal axis of the implement. This axis is defined by the largest measurement that can be made in this plane.

The observations are as follows:

1. Maximum breadth.
2. The position of maximum breadth in relation to the longitudinal axis of the artefact.
3. The maximum length of the artefact.
4. The breadth of the artefact at $1/5$ of the maximum length, measured from the apex.
5. The breadth of the artefact at $4/5$ of the maximum length, measured from the apex.
6. The maximum thickness of the artefact.
7. The weight of the artefact.
8. Records the flake scars in each quadrant (see Figure 10) that are longer than $1/4$ the maximum breadth of the artefact. This

observation only takes note of those flake scars that do not appear to have been truncated by subsequent flaking and is entered in the code as 'A', 'S' or 'N'. (Throughout the code, 'A', 'S' and 'N' stand for 'All', 'Some' or 'None' respectively.)

It must be pointed out that this does not rate as a very precise observation, as the outline of flake scars was often difficult to detect. The majority of artefacts are made of an intractable quartzite, on which the ideal accompaniments of flake scars, the negative bulb of percussion and its ripples, could not be seen and the flake scars themselves were never clearly defined.

9. Records the flake scars in each quadrant of face two that are longer than a quarter the maximum breadth of the artefact; scored as 'A', 'S' or 'N'.

10. Records the flake scars on face one that are shorter than a quarter of the maximum breadth of the artefact; scored as 'A', 'S' or 'N'.

11. Records the flake scars on face two that are shorter than a quarter of the maximum breadth of the artefact; scored as 'A', 'S' or 'N'.

12. Records the outline shape of the artefact, as viewed from above face two. The observations are again made for each quadrant, and scored in four ways - concave, convex, straight and irregular. These scores are represented in the code by 'CV', 'CC', 'S' and 'I'.

13. Records the nature of the cutting edge in the four quadrants. In each quadrant, the condition of faces one and two are observed and scored 'flake' or 'cortex'. These are represented in the code as 'F' or 'C'. Thus a unifacially flaked artefact that is entirely worked over one surface will score C/F for each quadrant.

14. Records the amount of pebble cortex remaining in each quadrant of face one. These observations are scored as 'A', 'S' or 'N'.

15. Records the amount of pebble cortex remaining in each quadrant of face two, scored 'A', 'S' or 'N'.

16. Records the longitudinal curvature of face one and face two. These are scored 'CC', 'CV', 'F' and 'I', representing 'concave', 'convex', 'flat' and 'irregular'.

17. Records the transverse curvature of face one and face two. These are scored as 16 above.

Maximum length, breadth, thickness and weight were selected as variables of primary importance for any analysis. The position of the maximum breadth in relation to length and the breadth at 1/5 and 4/5 of the length of the artefact are variables used in a system devised by Mr D. Roe of the Faculty of Archaeology, University of Cambridge, to record the various outline shapes which may be found in Acheulean hand axes. This system can also record the varieties of outline shape that are found in Hoabinhian collections. The writer is very grateful to Mr. Roe for permission to use his system.

Observations 8 and 9, and 10 and 11, are devised to record primary flaking and secondary retouch. The preliminary investigation demonstrated that by defining two groups of flake scars in terms of the maximum breadth of the artefacts, primary and secondary flaking could be distinguished.

Observation 12 gives information about the outline shape of the artefacts and the remainder simply records the specified information.

Figure 11 demonstrates the application of the code.

Observations 8 to 17 are clearly estimations, rather than precise measurements. However, even in this simple form, the variety of combinations that can be represented in the code is very large. By dividing the observed faces of the artefacts into quadrants, an element of quantification is introduced. This was adjudged sufficient for the proposed typological examination. No doubt, work carried out at a later stage may benefit from precise quantification, but for the preliminary investigations the present scheme is suitable.

The process of examination

It was found convenient to record data for each artefact on a 8" x 5" record card. Measurements of breadth and thickness were taken with the measuring boards, and the artefact was weighed. An outline drawing was then traced on the back of the record card. Observations 8 to 17 were made and recorded in code. Note was taken of the date of the examination and the catalogue number of the artefact.

Measurements 2 to 5 were taken directly from the outline drawing at a later time. It was found that measurements taken from a careful outline drawing did not differ significantly from those taken directly from the artefact.

Observations 1 to 7, and the catalogue number of the artefact, were subsequently transferred to Holerith cards to be used as data in computations made with an IBM 1620 computer.¹

The Typological Examination

As Kreiger has pointed out² the first stage of a typological classification sorts artefacts into major groups which look as though they have been made according to the same or similar structural patterns. Tables 15 and 16 list the major groups into which the artefacts from Sai Yok seemed to fall.

These groups are such as result only from a preliminary general sorting. Furthermore the intention is merely to indicate the range of artefacts that accompany the major class of flaked tools, as the latter alone is the object of the typological study. The full analysis of the material recovered in the Sai Yok excavations is, of course, the privilege of the excavator, Mr van Heekeren. The descriptions of the other groups are therefore given with brevity.

¹

The writer is indebted to Mrs D. Gregory and Miss H. Skeats for their patient work in punching the Holerith cards.

²

A. D. Kreiger, 'The typological concept', American Antiquity, 1944, 9, 3; 279-283.

Flaked tools

The first group, which is called flaked tools, can be sub-divided into four categories: unifacially flaked pebble tools; truncated pebble tools; bifacially flaked pebble tools; and split pebbles.

1. Unifacially flaked pebble tools

These are rolled river pebbles, usually of quartzite, that have been flaked on one face so that contiguous flake scars form a cutting edge. The degree to which the pebbles have been worked differs - some have been completely worked on one face so that none of the pebble cortex remains, others have only been partially worked around their periphery, so that varying amounts of the original cortex may remain.

These tools are simply made. A series of flakes are detached from the worked surface, the direction of the blow being radially directed towards the central point of the pebble. Secondary working flakes detached in order to improve the cutting edge by removing irregularities or shaping the outline, follow a similar pattern. The cutting edge of unifacially flaked pebble tools is formed by the juxtaposition of the flake scar on one surface and the naturally polished pebble cortex on the other.

2. Truncated pebble tools (short axes)

These are pebble tools that have been abruptly truncated at the butt, the truncation producing a flat surface that tends to be at right angles to the longitudinal axis of the tool in both the

horizontal and vertical planes. Careful examination of the truncated surfaces for indications of the method of truncation failed to produce significant observations. Consequently it is difficult to know if the truncation is deliberate, or whether the short axes are merely broken pebble tools.

3. Bifacially flaked pebble tools

These are similar to unifacially flaked pebble tools, except that they have been worked on two faces.

4. Split pebbles

Except for the fact that they are made on split pebbles, these artefacts are not to be distinguished from pebble tools. They may be bifacially or unifacially worked. It is possible that implements classed as unifacially flaked pebble tools may also have been made on split pebbles, but the flake scars entirely covering one face may have obliterated all trace of the cleavage surface.

?? cores

The second group is comprised of artefacts that may have been cores from which flakes were struck. Since the intractable nature of the rock does not allow their positive identification as cores, they are called ?? cores.

?? tools

The third group contains large and irregularly flaked artefacts. The majority have only a few flakes removed. Their function is not obvious, for they do not appear to have been flaked in order to produce

a definite or continuous cutting edge; on the other hand, if they are cores from which flakes have been struck, it is difficult to understand why they have been discarded as further flakes could have been detached with ease.

Hammerstone

The one hammerstone, a bruised but unworked river pebble, constitutes a fourth group.

?? artefacts

The fifth group comprises a small number of river pebbles that could have been naturally broken.

Comparison of Tables 15 and 16 reveals several points. First, although the two excavations appear from the provisional plans and sections available to the writer to have comparable volumes, section X produced many more artefacts than section C, the totals being 1,336 and 124 respectively. On the other hand, the same general range of tools is represented in both sections, although no ?? cores or hammerstones were found in section C. At the same time the proportions in which the different kinds of artefact occur are not the same. Thus in section X, flaked tools were 52.9 per cent of the total, in section C 93.4 per cent, while in section X ?? tools were 44.6 per cent of the total, but only 6.6 per cent in section C.

Truncated pebble tools were present in the two sections in about the same proportions, but split pebble tools were more common in section C than in section X.

The difference in the total number of tools recovered from these two sections highlights one of the problems of the excavation - the origin of the artefacts in section X, which is sited at the junction of the talus slope with the upper of two river terraces. There would seem to be two possibilities: either the rock shelter was the focus of activity and tools were thrown out of the shelter when discarded to accumulate on the terrace, or men were active both on the terrace and in the shelter in antiquity.

In the former case, it would be reasonable to expect that the majority of the artefacts would be found in the shelter, those on the terrace merely representing a small proportion that were actively cast out of the habitation area for some reason. However, it is clear from the totals given for sections X and C that there are about ten times as many artefacts on the terrace as there are in the shelter, assuming comparable volume for the two sections. Furthermore, as van Heekeren has mentioned¹ the number of artefacts in a trench dug from the shelter down the talus slope to the terrace (see Figure 12) was found to increase towards the terrace and away from the shelter.

Again, as the lower section is some 15 metres from the shelter, a conscious effort would be needed to hurl the artefacts down the slope. On the other hand the artefacts may have merely been displaced from the shelter, to roll down the slope under their own momentum; or they may

¹

H. R. van Heekeren, 1962; 17

have migrated down the slope under less direct circumstances, being incorporated in slowly moving soil creep. A study of the slope and the pedological conditions might throw some light on this point. It is to be expected that under the latter circumstances the tools on the terrace would show signs of being rolled - although the intractable nature of the material from which they are made lessens the chances of this observation being made with confidence. In the absence of such information the presence of a much larger number of artefacts on the X terrace suggests to the writer that these tools were found in situ.

Even if the artefacts on the terrace are displaced from the shelter, their stratigraphical succession has not been drastically altered: the earliest artefacts would have been thrown out of the shelter first and would therefore be found at the bottom of the terrace accumulation, while the youngest artefacts, thrown out last, would be found at the top of the accumulation. The seriation of the artefacts in the terrace deposit could, however, have become blurred to some extent as the result of differential rates of travel down the slope.

Unworked flakes

A number of primary flakes were found in both sections; 117 flakes were found in section C, and 539 in section X. The number of flake scars on 161 uniface pebble tools from section X was estimated, and the mean number of observable flake scars was found to be 24.5. It is to be expected, however, that the mean number of flakes removed from

uniface pebble tools would be in excess of this figure, as the scars remaining from the initial removal of flakes may themselves be removed in later stages of the formation of the tool.

As 528 unifacially worked pebble tools were found in section X, more than 12,936 flakes must have been produced during their manufacture. Only 539 flakes were found in section X, so it follows that the majority of the tools must have been made elsewhere: the same holds for section C, where 113 uniface pebble tools were accompanied by only 117 flakes.

In Figure 13 the frequency distribution of the length of flakes from both sections is given. Although the range of length from section C is slightly greater and the modes of the two distributions do not coincide, the two distributions appear to be similar.

The mean length of flakes from section X is 48 millimetres, and from section C 51 millimetres. The difference between these means is 3 millimetres, and the standard error of the difference is 2.4. As the difference is less than twice the standard error, the means could come from samples randomly selected from the same population.

In Figure 14 the frequency distribution of the breadth of flakes from both sections is given. Although the range from section C is slightly greater, the modes of the two distributions coincide, and the two distributions appear to be similar.

The mean breadth of flakes from section X is 40 millimetres and from section C is 44 millimetres. The difference is 4 millimetres, and the standard error of this difference is 2.0. As the difference is not more than twice the standard error, the two means could come from samples randomly selected from the same population.

In Figure 15 the frequency distribution of the thickness of flakes from both sections is given. Although the range of the two distributions is the same, the modes do not coincide.

The mean thickness of flakes from section X is 17 millimetres and from section C is 15 millimetres. The difference is 2 millimetres and the standard error of the difference is 0.89, so that the difference is more than twice the standard error. It would therefore appear likely that the two means do not come from two samples randomly selected from the same population.

In Figure 16 the frequency distribution of the length/breadth index ($\frac{\text{length}}{\text{breadth}} \times 100$) from both sections is given. Although the range of the length/breadth index is slightly greater for section X, the two distributions are similar.

From section C, 42.7 per cent of the flakes, and from section X 58.9 per cent of the flakes had striking platforms composed of the rolled cortex of the pebble from which they had been struck.

It can be concluded that the flakes from section C tend to be slightly longer than those from section X, and that the flakes from section X tend to be slightly thicker than those from section C.

There is no significant difference between the means for length and breadth, although there is for thickness. Thus, although the activities which produced the flakes in section C cannot be precisely the same as those which produced the flakes in section X, no great difference is indicated.

CHAPTER VII

THE STRATIGRAPHY OF THE DEPOSITS AT SAI YOK

Van Heekeren briefly describes some of the material found during the excavations at Sai Yok in two preliminary reports.¹ In one cave, a deposit one metre thick was excavated, in which wooden coffins containing mortuary gifts of fine Sawankolok ware and bronze lime containers were found. Pottery, beads and a decorated bronze bell came from the upper layers of the deposit. Two neolithic burials were found on the rock floor of the cave. Associated were grave goods - intact pots, quadrangular axes and one small shouldered axe. The human remains had decayed almost completely.

In the other cave a thin layer of habitation deposit was found to contain pebble tools.

A deep deposit in the rock shelter was found to be well stratified. The deposit contained a pebble tool industry, the tools being made of quartzite. Occasional bifacially worked tools were found. Two edge-ground tools are reported from the upper layers. Potsherds were concentrated towards the surface, and were not found below a depth

1

H.R. van Heekeren. 'A preliminary note on the excavation of the Sai-Yok rock shelter.' Journal of the Siam Society, 1961, 49, 2; 99-109.

H.R. van Heekeren. 'A brief survey of the Sai-Yok excavations 1961-1962 season of the Thai-Danish Prehistoric Expedition.' Journal of the Siam Society, 1961, 50, 1; 15-19.

of 75 centimetres. Bone points, fire-hardened, were also present. Towards the upper part of the deposit, a horizon containing small narrow flakes with relatively long parallel sides associated with well defined bulbs of percussion was noted.¹ At 3.75 metres a lateritic red rubble was encountered, which contained shell refuse and stone artefacts.

Many large freshwater mussel shells were present, but vertebrate remains were rare.

An ill-preserved adult burial was found 150 centimetres below the surface of the deposit. A heavy slab of quartzite had been placed over the upper part of the body. The bones were partly stained with haematite.

A trench was opened down the talus slope below the shelter (see Figures 7 and 12). A large number of pebble tools was collected from this trench. These increased in number down the slope and there was an accumulation at the junction of the slope with the upper terrace. A large trench, section X, was sited at this junction. Neolithic potsherds, an iron axe, a polished axe and neolithic tools were found in this area of the excavations.

1

These intriguing objects have not been considered in the following discussion, as to do so would anticipate Mr van Heekeren's own appraisal of them.

The Distribution of Artefacts in Section X

No visible stratification was observed in the deposit during excavation. The position of every excavated object was determined by three co-ordinates, vertically (below a datum point) and horizontally in two planes. Mr van Heekeren very kindly gave the writer a copy of a diagrammatic projection in one profile of the artefacts found in section X. This projection is reproduced as Figure 17. Mr van Heekeren places the artefacts into three groups: historic artefacts, represented by pottery and iron objects; neolithic artefacts, represented by earthenware and a polished stone axe; and mesolithic artefacts, represented by flaked stone artefacts.

'Mesolithic' is used throughout the following discussion, although to do so at this stage may appear to prejudge the issue, to denote levels below the appearance of pottery and characterized by tools of flaked stone. Flaked tools are called for convenience 'mesolithic' tools wherever they occur. The levels characterized by earthenware pottery are again for convenience called 'neolithic'. The various issues raised by this terminology are treated, where appropriate, in the sequel.

In Figure 18 four independent horizons have been drawn on the projection given in Figure 17: ground surface followed by the lower limits of the historic, neolithic and mesolithic elements. Four straight lines have been drawn through these horizons, and these

lines are parallel and inclined 10° from the horizontal. It would appear that the stratification in section X should not be taken to be horizontal but to have a declination of 10° . Such inclined stratification here is not surprising as cutting X is placed at the junction of the talus slope and the upper terrace.

Correction should therefore be made for declination in the plot of the distribution of the various elements in the cutting, and Figure 19 gives this distribution after that correction has been made. The distribution of the three elements presents a picture of the cultural sequence. It appears that there is no overlap between the neolithic and the historic elements. However, the mesolithic elements, although concentrated towards the bottom of the deposit, are found in all levels.

One possible interpretation of this distribution is that there is indeed no clear cultural break between the three elements: that pebble tools remained in use during a period of supposed neolithic occupation characterised in the main by earthenware potsherds and continued in use after earthenware pottery had itself been replaced.

On the other hand it is possible to argue that pebble tools may have become mixed with neolithic and historic elements as a result of their all having been thrown out of the shelter to accumulate on the slope.

At this point, however, it becomes appropriate to consider the circumstances that accompany the occupation of a regularly

inhabited site. A rock shelter can be taken as an example. Occupation debris will begin to accumulate as the shelter is used as a living place. Whatever the sedimentary processes behind the accumulation of the deposit may be, so long as the shelter is a living place there will be one constant factor - the continuous activity of the people inhabiting the shelter. This activity involves not only the accumulation of refuse from a variety of activities, culinary, tool-making and the like, but also the use of the shelter as a living floor on which the various activities take place. The constant movement of people about the shelter, the secretion of tools, the inevitable scavenging of children and dogs, and the hollowing of hearths and resting places can only lead to considerable disturbance of the deposit. This disturbance may well be confined to the superficial layers, although burials, where they take place, might penetrate deeply into the deposit.

It is impossible to predict the depth through which occupational disturbance might act, but it is not unreasonable to assume that it would affect the top foot or so of a habitation deposit. This zone of disturbance will move upwards as the deposit grows.

Initial occupation of our shelter, we may suppose, has left a foot or so of occupational deposit. This, for the reasons given, may have undergone considerable occupational disturbance. It is

unlikely that such disturbance will have completely and homogeneously mixed the deposit; although there will have been considerable mixing, the oldest objects will tend to be found towards the bottom of the deposit, and the youngest towards the top. However, it may well be that chance has placed the oldest object, the first to be discarded in the shelter, at the surface of the deposit. Although the overall trend of seriation will remain, it seems unlikely that an object will long remain in the precise position to which it fell or in which it was placed.

If culture A is followed in the shelter by culture B, occupational disturbance may cause elements of culture A to become mixed in the deposit with elements of culture B. Assuming that the rate at which objects are deposited is constant throughout, elements of B will always tend to be stratified above elements of A, although mixing has taken place. As the deposit of culture B accumulates, so the proportion of elements of A in the ascending zone of disturbance will decrease. For example, when two feet of deposit B overlies deposit A, then the occupational mixing, which is assumed to be active in the top foot or so, will no longer involve elements in deposit A, which will be out of reach.

The proportion of objects in the assemblage belonging to culture A that may be carried upwards as the deposit accumulates in such a situation is a matter for conjecture, as the quantitative

observations that would help have been so seldom made. Likewise, the distance through which objects can be carried is unknown. It may be supposed, however, that the factors affecting such proportions and such distances will be many and will vary from one context to another.

One factor inhibiting upward movement in the deposit would be a period during which the site was not occupied, and a sterile sediment was naturally deposited. If this were sufficiently thick or sufficiently hard for the disturbance attendant on subsequent occupation to be unable to penetrate it to the layers beneath, then it would form a barrier to upward migration.

It can be postulated that in habitation deposits at regularly reoccupied sites, particularly those in cave and rock shelters, there will be a zone of occupational disturbance affecting what is at any one time the upper part of the deposit. As the deposit accumulates, so this zone of disturbance will rise, carrying with it elements from the lower layers. The mere presence of a visible stratum in the stratigraphy, an unbroken layer of ash for example, may not necessarily indicate that no disturbance has taken place. Such a layer of ash is more likely to indicate a period of intense fire making activity, rather than to be the undisturbed remains of a fire or fires. Where it can be demonstrated that a layer or lens of ash is an undisturbed hearth, then it might be concluded

that occupational disturbance had not taken place at that spot to any great extent.

Occupational disturbance has been introduced as a postulate. It is difficult to test the hypothesis as the appropriate observations are not readily available. However, other writers have considered such disturbance to be a factor that has to be taken into account in the interpretation of deposits. Phillips, Ford and Griffin¹ mention that migration, particularly upward migration, of material in midden deposits due to occupational disturbance seriously affects the stratigraphic interpretation of sites in the lower Mississippi alluvial valley. Brainerd² also suggests that occupational disturbance should be taken into account in the analysis of stratified deposits.³

1

P. Phillips, J.A. Ford, and J.B. Griffin. 'Archaeological survey in the lower Mississippi alluvial valley, 1940-1947.' Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, 1951; 232.

2

G.W. Brainerd. 'The place of chronological ordering in archaeological analysis.' American Antiquity, 1951, 16, 4; 309.

3

Mention must be made of the fact that just as occupational disturbance may cause the upward migration of objects in a deposit, so the activities of burrowing fauna and, to a lesser extent in cave deposits, the plants growing on the surface may also result in movement of objects within the deposit and may well act in the opposite direction.

It is conceivable that occupational disturbance might give rise to horizontal as well as vertical movement. However, this factor will have a reduced importance for the stratigraphical interpretation of horizontally stratified deposits.

It is therefore a mistake to imagine that a habitation deposit is a static system in which successive strata are laid one on top of the other like layers in a cake. A habitation deposit is a dynamic thing, with constituent elements changing position as the deposit accumulates, a system that may never reach equilibrium - just as a soil profile evolves as the soil matures.

If occupational disturbance does take place in the way suggested, then the distribution of cultural elements in a deposit will tend to assume a characteristic form. In a situation where culture A is followed by culture B, the mixing effect will tend to draw elements of culture A upwards through the deposit (and in their turn elements of culture B). The result will be that although the main distribution of culture A will lie below that of culture B, there will always be some elements of A in stratigraphical association with elements of B; but the proportion of A in such association will decrease as the deposit builds up.

Returning to Figure 19, we see that the distribution of the mesolithic elements in the main follows this pattern;¹ the bulk

¹An abnormal feature of the curve in Figure 19, the very low value at 200 centimetres depth, will be discussed on page 180.

of the collection lies between 200 and 300 centimetres, but a gradually decreasing proportion is present in the layers above. The histograms given by Phillips, Ford and Griffin¹ for sites in the lower Mississippi valley which are interpreted as representing upward migration resulting from occupational disturbance disclose distributions of the same pattern.

The distribution curve for the neolithic elements does not have this distinctive form. Here, however, the size of the samples may be important, for there are 858 objects in the mesolithic sample, but only thirty-nine in the neolithic sample. Approximately 13 per cent of the mesolithic objects appear to have migrated as a result of occupational disturbance. It would be logical to suppose that a similar proportion of the neolithic objects would be displaced. Since this would involve only one or two neolithic elements the absence from the historic levels of so small a number of earthenware potsherds has little significance.

The curve for the historic elements does perhaps conform to the distribution pattern for occupational disturbance. However, this sample is again small and it would perhaps be injudicious to infer much from it.

¹

Phillips, Ford and Griffin, 1951. Figures 25 and 27.

Although occupational disturbance has only been introduced as a postulate, the distribution of the mesolithic elements in section X conforms to the hypothesis. However, it must be remembered that the deposit is not certainly a habitation deposit. The case for accepting it as such was argued in the last chapter, the main point being that section X contains more artefacts than section C in the rock shelter and the connecting trench discloses an increasing number of tools down the slope between the two. At this point, additional evidence can be brought to bear on the problem. When correction has been made for declination in the deposit, as in Figure 19, there is surprisingly little overlap between the three main elements of the sequence, whereas more confusion might be expected if the artefacts in section X had been thrown out of the shelter to roll down the slope to their present position. What confusion is evident, the presence of mesolithic tools in the neolithic and historic levels, could be neatly explained by the hypothesis of occupational disturbance, for which support from American excavations has been quoted. The close similarity of the Sai Yok and the Mississippi distributions is a strong argument for considering section X a habitation deposit.

Bearing the tentative nature of these conclusions in mind, the interpretation of the distribution in Figure 19 would seem to be that three separate cultures are represented at section X; first,

a mesolithic culture represented by flaked pebble tools; next a neolithic culture represented by earthenware potsherds and a polished stone axe; finally a historic culture, represented by the later artefacts. Accepting the postulated action of occupational disturbance, there is no reason to suppose that the mesolithic culture includes pottery.

An Analysis of Variance in the Collection of Uniface Pebble Tools in Section X

I

At this stage in the analysis it was felt that an independent check on the distribution of the artefacts was advisable. The numerous class of unifacially flaked pebble tools was chosen as the vehicle for this exercise. The aim was to look for change not only vertically through the deposit but horizontally within it. Vertical change in a deposit is usually taken to represent change as a function of time. However, if horizontal change in a deposit is equal to or greater than the vertical change, the time factor cannot be accepted as an explanation of the latter without further validation. In the present case, horizontal change, if present, might allow interpretation as to how the artefacts in section X came to occupy their positions, for example as a result of their discard from the shelter and their displacement down the talus

slope. In such a case grading according to size in relation to the distance down the slope would be expected.

An analysis of variance in the collection of unifacially flaked pebble tools in section X was therefore carried out.

The distributions given in Figures 17 and 19 are taken directly from the projection kindly supplied by Mr van Heekeren. For the analysis of variance, and for all the following analytical procedures, the distribution of the artefacts in section X was derived from a catalogue which listed the three coordinates fixing the position of every artefact in the deposit. A copy of the catalogue was again supplied by Mr van Heekeren.

Mr W. Ewens¹ devised a function² which would correct for the declination already noted for the section. Mr Ewens also wrote a programme for an I.B.M. 1620 computer, so that the computation could be made for every artefact that was found in the deposit.

For the analysis of variance, section X was divided into three parts, first vertically, and then horizontally in two planes (see Figure 20). Each part was so devised that it contained an approximately equal number of unifacially flaked pebble tools.

1

Department of Statistics, School of General Studies, Australian National University.

2

$x = X - Y \sin 10^\circ$, where X is the position along the vertical coordinate, and Y the position along the appropriate horizontal coordinate.

For each of the three divisions of the deposit, the analysis of variance was calculated seven times, once for each of the seven measurements which are the first seven observations entered into the coded record of pebble tools. Miss M. Campbell¹ wrote a programme so that these calculations could be made with an I.B.M. 1620 computer. Tables 17, 18 and 19 list the results of this analysis for the divisions along the X, Y and Z coordinates respectively. Table 20 gives the numbers of uniface pebble tools in each part of the three arbitrary divisions.

The 5 per cent level value of F for $n_1 = 2$, and $n_2 = 513$ is 2.99. From the values listed in Table 17, it is seen that the observed variance ratio indicates a significant difference for all of the seven variables. The variance ratio for breadth at $1/5$ of length is considerably smaller than that for any of the other variables.

For the division along the Y coordinate, Table 18 demonstrates that no variance ratio is significant at the 5 per cent level, although the variance ratio for breadth at $1/5$ length is larger than that for any of the other variables.

Table 19 demonstrates that for the division along the Z coordinate no variable has variance ratio significant at the 5 per cent level, with the exception of breadth at $1/5$ length.

¹Computer Division, Research School of Physical Sciences, Australian National University.

The conclusion to be drawn from these tables is that all the variables demonstrate a significant difference for the horizontal division of the deposit, but none shows significant difference for the two divisions in the vertical plane - with the exception of breadth at $1/5$ of length. This variable appears to differ for the calculated variance ratio appears to be of the same order for all of the three divisions.

The distribution of breadth at $1/5$ of length appears to be somewhat haphazardly distributed through the deposit; the other variables demonstrate, however, that whereas there is significant change vertically through the deposit, there is no significant horizontal change. Both these circumstances may support the hypothesis that Section X is in fact a habitation deposit in situ.

An analysis of variance of this provides a useful demonstration of the distributions of variables in a deposit and a valuable check on assumptions made about their significance - a check that should perhaps be made more often in the analysis of archaeological deposits.

II

The analysis of variance carried out on seven variables for the unifacially flaked pebble tools demonstrates significant change about the X coordinate for section X. The means of the variables for each of these three arbitrary divisions have been calculated, and these are given in Table 21. For the first five

variables, the mean for division three, the lowest division, is always greater than that for divisions two and one, but the means for the two latter divisions are just about the same. However, the mean for division two is always slightly greater than that for division one.

For variable six, maximum thickness, the mean for division three is again larger than that for divisions two and one, but that for division one is slightly larger than that for division two.

For variable seven, weight, the mean for division three is again larger than those for divisions two and one, but that for division one is larger than that for division two.

Table 22 lists $\frac{\text{difference}}{\text{s.e. difference}}$ between pairs of the arbitrary divisions. At the 5 per cent level, if the difference between two means is more than twice the standard error of the difference, then the means are significantly different. Table 22 demonstrates that the difference between the means for divisions one and two is not significant for any of the variables, but that the difference between the means for divisions one and three and divisions two and three is significant in every case.

The conclusion to be drawn is that the unifacially flaked pebble tools become progressively smaller from bottom to top of the deposit, and that the difference between the artefacts in arbitrary divisions three and two is much more marked than that

between divisions two and one. There is not much difference in this sense between divisions two and one although artefacts in the latter tend to be slightly smaller.

The Distribution of Artefacts in Section X

It is necessary to know, however, just what the conclusions given above in terms of the three arbitrary divisions mean in terms of the cultural situation in the deposit at Sai Yok.

The vertical distribution of the archaeological objects in the deposit was analysed according to 10 centimetre layers, using the catalogue fixing the position of each object along three coordinates and not the projection given in Figure 17.

Figure 21 expresses the frequency distribution of historic artefacts, neolithic artefacts, unifacially flaked pebble tools and ?? tools. The profile has been divided. Zone I contains the historic artefacts and is sub-divided into subzones IA containing only historic objects and IB containing both historic and mesolithic artefacts. Zone II contains all the neolithic artefacts as well as some mesolithic tools. Zones III and IV contain unifacially flaked pebble tools and ?? tools.

Figure 22 gives the relative frequencies of these elements in the deposit. It will be seen that the distributions of unifacially flaked tools and ?? tools are complementary. In Zone III the unifacially flaked tools predominate; in Zone IV the ?? tools predominate.

There is some difficulty in defining with confidence the upper limit of mesolithic occupation. There are few mesolithic artefacts in layers 19 and 20, which might be taken as indicating a period of reduced mesolithic activity before the onset of the neolithic. However, the number of mesolithic tools increases in layers 17 to 18, in association with the first earthenware sherds, and stays larger throughout the remaining neolithic layers (13-16). It is difficult to suggest the precise circumstances in which this particular effect, the dilution of the upper mesolithic levels and the enrichment of the neolithic in mesolithic tools, might have been produced by occupational disturbance. An alternative suggestion in terms of the true association of flaked implements and earthenware might be considered appropriate.

Can either of these alternatives be put to the test? The means given in Table 21 and the significance of the difference between those means given in Table 22 indicate that the unifacially flaked pebble tools in the bottom division tend to be markedly larger than those in the middle division, while the means for all the variables surveyed in the top division are not significantly different from those surveyed in the middle division.

Figure 23 shows the relationships between these arbitrary divisions of the Sai Yok deposit utilised for the analysis of variance and the organization of the deposit by 10 centimetres

layers and cultural zones as discussed above. From this it becomes possible to suggest an explanation in terms of occupational disturbance for the agreement between the means of variables in the top and middle arbitrary divisions. If the unifacially flake pebble tools above layers 19-20 have in fact migrated to their present position by occupational disturbance, they must be derived from the upper layers of mesolithic occupation, layers 19-20 and immediately below. They could hardly have been derived from the lower layers, except in so far as at earlier stages of the occupation, material from these lower layers had been upwardly displaced, and such material would become increasingly unimportant in amount.

The problem can be approached from yet another direction. Figure 24 gives the mean length of unifacially flaked pebble tools in layers 1-34. The mean length seems to fall more or less consistently from layer 34 to layer 22; thereafter it appears to fluctuate. This may indicate that whereas below layer 22 the artefacts are in their correct stratigraphical positions, those above layer 22 are not. The distribution is in fact consistent with the hypothesis of occupational disturbance.

Figure 25 gives the distribution of the mean weight of unifacially flaked pebble tools in layers 1-34. Here there is a uniform fall in the mean weight from layers 29 to 24. However, the mean weight also drops below layer 29; a possible explanation

of this feature will be suggested below (page 187). Above layer 24 the weights fluctuate.

The Distribution of Artefacts in Section C

Theoretically the indubitable habitation deposit in the rock shelter, tested by section C, should provide evidence to test the hypothesis of occupational disturbance. Unfortunately this is not the case. Figure 26 gives the distribution of historic and neolithic artefacts and unifacially flaked pebble tools and ?? tools in section C in the rock shelter (see Figure 7). This distribution, in 10 centimetre layers, is derived from a projection of the artefacts in this cutting against the south eastern profile, which was supplied by Mr van Heekeren. Unlike section X, this is the only information about the distribution that was available to the writer.

The distribution is not exactly that of section X. Historic objects do appear to be stratified about neolithic objects, but the latter do not overlie the bulk of the mesolithic collection. However, the projection locates only a small number of artefacts in section C: fifteen historic artefacts, one neolithic artefact, forty-five unifacially flaked tools and seven ?? tools. It is unlikely that such a small sample can be usefully compared with the distribution from section X.

CHAPTER VIII

THE PEBBLE TOOL INDUSTRY AT SAI YOK

The analysis of the pebble tool industry at Sai Yok is for obvious reasons confined to the artefacts recovered from section X. The boundary between layers 20 and 21 is, in the light of the discussion in the last chapter, taken to approximate to the upper limit of mesolithic occupation: occupational disturbance, such as has been invoked, will have left a transitional zone rather than a sharp division.

Figure 27 gives the distribution of ?? tools, unifacially flaked tools, truncated pebble tools, bifacials and split pebbles. In order to test for the significance of these distributions, the mean number of artefacts occurring in paired layers was calculated. χ^2 was then used to test the proposition that none of the observed numbers of artefacts occurring in a given pair of layers differed significantly from the calculated mean. Table 23 gives the results of these calculations and demonstrates that the variations in the distributions of truncated pebble tools, bifacials and split pebbles do not appear to be significant. The variation in the distribution of the unifacially flaked pebble tools and the ?? tools does appear to be significant.

Apparently, the mesolithic industry contained a uniform proportion of truncated tools, bifacials and split pebbles throughout the period represented by layers 21 - 34. The relative proportions of ?? tools and unifacially flaked pebble tools changed during this period.

Unifacial tools and ?? tools

During the preliminary examination of the collections from Sai Yok in Leiden, a distinction was made between unifacially flaked pebble tools and ?? tools. The latter were separated out as rough implements which had received little flaking; the flakes that had been removed did not seem to have produced either a very extensive or a very effective cutting edge. At the same time the limited flaking made it difficult to regard them as cores.

It must be stressed that this distinction between two categories was made during the initial stage of classification when, as Krieger¹ says, artefacts are placed into major groups which look as though they have been made according to the same or a similar pattern.

Krieger's second stage involves the examination of the initial groups for the constant combination of attributes. In order to

¹

A.D. Krieger. 'The typological concept'. American Antiquity, 1944; 9,3; 279

achieve this for the material under discussion, two specific observations were made. The cutting angle was measured with a goniometer on a sample of 183 unifacially flaked pebble tool and 155 ?? tools. A multi-use rule and gauge produced by the General Hardware Manufacturing Company, New York, was used. This tool has various functions, one as a bevel protractor. Since considerable variation in angle over the whole extent of the cutting edge of any artefact occurred, it was decided to measure the most acute angle present. As this angle could not, in the majority of cases, be measured with any degree of precision, it was called the mean cutting angle.

The number of flake scars was also recorded for each artefact in the same samples. It was only possible to estimate this number, since flake scars appeared indistinctly on the intractable material from which the artefacts were made.

The distributions of mean cutting angle for unifacially flaked pebble tools and ?? tools is given in Figure 28. It will be seen that the two distributions cover the same range, although the modes of the two distributions do not coincide. It would appear that the ?? tools tend to have a more obtuse cutting edge but that mean cutting angle by itself does not support the division into two classes. This is surprising as it appeared during the initial classification that the mean cutting angle would have been a differentiating factor.

Figure 29 gives the distributions of the estimated number of flake scars on artefacts in the two presumed classes. Here the ranges of the distributions do not coincide - although there is some overlap. This again is surprising, as it appeared in the initial classification that the number of flake scars would clearly place the artefacts into two groups.

These parameters cast doubt on the validity of the preliminary classification, which may have arbitrarily divided a range of pebble tools into two groups, small and well worked tools on the one hand and larger and coarser tools on the other. However, Figure 30 gives the distribution of the weight/scar index for the two categories. This index is calculated as the weight of an artefact in grams divided by the estimated number of flake scars, so relating the amount of flaking to the bulk of the implements. The two distributions do not appear to overlap to any great extent and the index does place the artefacts into two groups.

As the proportions of truncated tools, bifacials and split pebbles do not appear to differ significantly at different levels, it would appear that the mesolithic industry is homogeneous in respect to the artefacts. This fact, taken with the parameters given in Figures 28 and 29, is sufficient to question the validity of the initial categories unifacially flaked pebble tools and ?? tools, even though Figure 30 does indicate a separation between the groups.

Here is an example of Krieger's second stage refining a classification produced by the first, suggesting in this case the amalgamation of groups rather than producing further subdivisions. This function of Krieger's second stage is of course no less important than the other.

Arriving at this juncture, the classifier needs to make a fresh examination of his material. Clearly this was impossible for the writer, as the collections were in Leiden and he was in Australia, and the coded information was confined to the unifacial pebble tools.

Returning to the distribution of mean length for the various layers in the section as given in Figure 24, it is now possible to appreciate that the fluctuations in the means for layers below 29 could reflect the selective nature of the category unifacially flaked pebble tools. If this is so and the ?? tools are as a result to be included with the unifacial tools in the analysis, the distribution of mean weight also, as given in Figure 25, is unlikely to give an adequate representation of the situation below layer 29, as only the smaller artefacts would have been weighed, and the proportion of these decreases with depth.

The Unifacial Pebble Tools

In the initial classification of the artefacts the pebble tools were grouped as: unifacially flaked tools, bifacially flaked

tools, truncated tools and split pebbles. The three latter categories, quite simply defined, are sufficient for the purposes of the present analysis. They comprise only a small proportion of the whole (Table 15). The unifacially flaked tools have to be examined further, for it is possible that distinct types are included under this general heading.

From the initial examination of the collection it was clear that some of the unifacially flaked artefacts were long and narrow, such as might be called 'picks'; others were flat and round - these could be called 'discs'. Similarly, other shapes could be picked out by eye and named. However, it was not clear whether such forms were distinct groups, or types or whether an arbitrary selection was being made from a continuous range of shapes.

If an artisan wishes to make 'picks' and 'discs', the industry resulting from his artefacts will be composed of these two types, with very probably a small number of artefacts of intermediate form. On the other hand the products of an industry may fall predominantly into the intermediate position, with a few artefacts at one extreme that could be called 'picks', and a few at the other that could be called 'discs'. In such a case it would hardly be legitimate to assume that 'picks' and 'discs' were the objectives of the artisan.

The analysis that follows is primarily designed to distinguish between these two situations.

I

In order to demonstrate the simple but effective method that has been chosen for the examination of the unifacially flaked pebble tools from section X at Sai Yok, a sample of Chione stutchburyi, the New Zealand cockle, has been classified. The shells come from a midden deposit associated with a pa site at Kauri Point, Tauranga Harbour, New Zealand, North Island.¹ The writer is indebted to Mr Golson and Mr Ambrose for permission to examine the sample in Canberra and to make use of their recorded measurements and observations.

The sample contained 71 valves. Mr Ambrose took three measurements on each valve: length measured from the hinge to lip, width measured at right angles to length and weight. He also made an observation of the configuration of the rays and ridges on the outer surface of the shell, and the configurations were placed into four groups, A, B, C and D. The object of the present analysis is to discover if the shells can be grouped according to any or all of the measurements or observations.

¹ J. Golson. 'Investigations at Kauri Point, Katikati' New Zealand Archaeological Association Newsletter, 1961, 4, 2; 18 - 28.

W. Ambrose. 'Further investigations at Kauri Point'. New Zealand Archaeological Association Newsletter, 1962, 5, 1; 56 - 66.

At this point it is appropriate to mention that in nature, continuously variable quantities often have high peaked, unimodal, symmetrical distributions which approximate to the normal curve. Such a curve is typically bell-shaped, so that the great majority of the observations of a variable will fall at or near the mean: the more the value of the variable differs from the mean, the less likely it is to be observed in the population.

An example is provided by the height of a human population. It is found that the height of European males between the ages of twenty and twenty-one years of age is 67.5 inches.¹ If a random sample of individuals taken from this population is measured for height, it will be found that most subjects tend to measure about 67.5 inches. Some will be taller, but their number will decrease as height increases beyond the mean, so that less than one in a hundred will be taller than 74 inches. Similarly, less than one in a hundred will be shorter than 61 inches. But such a population with normally distributed height will not fall into two or more distinct groups in relation to this variable. There is one average height, and most of the individuals will approximate to it, although there may be some who are rather shorter and some who are rather taller.

If therefore the lengths of the valves in the shell sample are found to follow a unimodal distribution, it is unlikely

¹

M.J. Moroney. 'Facts from Figures', Penguin Books, 1956; 56.

that this quantity will be of much use as a criterion for the division of the sample into separate groups. Similarly, if the distribution does not approximate to such a curve, then it is possible that the quantity may be a useful criterion for the division of the sample. However, such observations do not carry any air of finality; they are only aids to the classifier, although aids of considerable utility.

Figure 31 gives the distribution of length for the Chione sample; Figure 32 gives the distribution of width; Figure 33 gives the distribution of weight. In order to learn more about the sample the length/width index of the valves was calculated: this is $\frac{\text{length}}{\text{width}} \times 100$ (Figure 34).

Any sample is a representation of the population from which it is drawn, and the accuracy with which it represents that population will be in proportion to the size of the sample. The larger the sample, the more likely it is to reflect the parent population with precision. When the sample is small, random causes may produce a bias, so that the parent population is misrepresented. However, it is possible to test the distribution of a variable for normality and to take into account the random variation that can be expected with samples of varying size.

As the normal distribution is a symmetrical, unimodal distribution, any test for normality will also be a test for the kind of distribution that has been mentioned above. However, none

of the distributions of length, width or weight for the Chione valves appears to be a high peaked, unimodal curve - with the possible exception of that for the length/width index.

This curve was tested for normality and found to differ significantly.¹

It appears that the four quantities, length, width, weight, and length/width index may all be appropriate attributes for separating the valves into groups.

Figure 31 would seem to indicate that the valves fall into three groups according to length: one with length below 20.4 millimetres; a second with length 20.4 to 27.4 millimetres; and a third with length above 27.4 millimetres.

For width, Figure 32 would seem to indicate that there are again three groups: one with width below 24.2 millimetres; one with width between 24.2 and 31.7 millimetres; and another with width above 31.7 millimetres.

Figure 33, which gives the distribution of weight, would again seem to indicate three main groups: one of weight less than 19 grams perhaps; one with weight between 19 and 43 grams; and one with weight between 59 and 63 grams.

¹ A normal curve was constructed with $\bar{x} = 77.5$ and $s = 2.6$. The distribution was compared with the curve, and the calculated value of $\chi^2 = 137.0$. At the 5 per cent level of significance, the appropriate value of $\chi^2 = 19.7$.

Figure 34 would also indicate that there are three main groups in terms of the length/width index; one of index below 79.5; one of index between 79.5 and 82.0; and one of index above 82.0.

It would be quite legitimate to divide the sample into three groups according to each of these four variables. However, it is important to know whether the three groups defined in terms of any one variable are identical with those defined in terms of any other.

A simple test takes the three groups formed by one variable and plots the distribution of one of the other variables for each of the groups. If the three groups defined by length are the same as the groups defined by width, then when the distribution of width for each group is drawn, the three distributions should be distinct.

As the distribution of the length/width index seems to have three marked peaks, it will be appropriate to begin by taking the three groups so indicated and plotting the distribution of one of the other variables for each of these groups. Figure 35 gives the distributions of length for these groups. Clearly, the three groups distinguished by the length/width index are not the same as the three groups distinguished by length.

Taking the three groups which appear to be indicated by the distribution of length, Figure 36 gives the distribution of width for each of them. As the distributions are distinct, it can be assumed that the three groups formed by length and by width are the same groups and that length is correlated with width.

Figure 37 gives the distribution of weight for the three groups formed on the basis of length. There is a slight overlap between two of the distributions, but this overlap is not marked and it would certainly appear that length and weight are correlated. However, the distribution of weight for the third and heaviest of the groups based on length exhibits two parts: it looks as though some of the valves included in this third group could in fact be placed in the second group.

Figure 37 thus demonstrates that some of the valves may have been placed in inappropriate groups. However, if the valves in the first and shortest group with weights of 15 grams or more are removed from the sample, and the valves in the third, longest group with weight of 43 grams or less are removed, then the distributions will not overlap.

The next step is to discover whether the three groups which have now been defined in terms of length, width and weight are related to the four kinds of surface configuration distinguished by Mr Ambrose.

Table 24 gives the numbers of valves with each of the four observed surface configurations that fall into the three groups. Clearly, group one (short) is also defined by surface configuration A or B; group two (intermediate) by configuration D; and group three (long) by configuration C. However, four of group two do not have configuration D, and one of group three does not have

configuration C. The five valves that are anomalous in terms of surface configuration can also be removed from the sample and the three groups can be defined as in Table 25. Eleven valves have no place in the groups so defined, but it would be quite possible to examine the valves and to come to an opinion as to which of the three groups each could belong to.

There is nothing mechanical about this classificatory procedure; as each step proceeds, so the classifier is able to form an opinion about the variables that define the sample, and his judgement is allowed full rein. Not only is the procedure simple and speedy, but the distributions that are produced give excellent descriptions of the variables that are examined.

It must be pointed out that had it been decided to divide each of the four variables into three ranges and to consider these ranges as attributes, named, perhaps, A to L, it would have been possible to place the valves into groups according to constant combinations of those attributes. Figure 35, however, demonstrates the confusion that might be introduced by such a procedure: in this case the valves fall into three groups in terms of the length/width index and into three different groups in terms of length, width and weight. Here are two independent classifications, one in terms of size and the other in terms of shape. There is no necessary reason for the two classifications to be the same, and whichever is preferred will depend on the purposes for which the classification is made.

II

A sample of uniface pebble tools was taken from all levels in section X. The Holerith cards, on which the first seven coded observations had been entered for all the pebble tools in the section were divided into five packs. Each pack was then shuffled and cut, and half of each pack was placed on the next pack in the series, the cards from the pack at the end being placed on the pack at the beginning. This procedure was repeated five times. The top twenty cards from each of the five packs were then taken to make up a sample of 100 cards. As there is no reason to suppose that the cards were initially in any particular order, this sample has been assumed to be a random sample.

Figures 38 and 39 give the distributions of length, breadth and thickness for this sample. The distribution of breadth (Figure 38) appears as a steep, unimodal curve. It would seem that there is little variation in the breadth of the tools in the sample. The distribution of length again appears as a unimodal curve, although the distribution is not symmetrical. In comparison with Figures 31, 32 and 33 none of these distributions appears to be particularly suitable for grouping the artefacts. Figure 39 gives the distribution of thickness for the sample. This distribution does not appear as a high peaked unimodal curve but seems almost bi-modal. Thickness does appear to be a suitable attribute for grouping.

Figures 40, 41, 42 and 43 give histograms for the distribution of length, breadth, thickness and length/breadth index. The latter is calculated as $\frac{\text{breadth}}{\text{length}} \times 100$. In these figures, the histograms are super-imposed on the appropriate normal curves. Table 26 gives the calculated values of χ^2 to test how significantly each distribution departs from the normal curve.

The table demonstrates that all the distributions depart significantly from normality, with the exception of thickness. This latter point would seem to reduce the apparent utility of the thickness variable for grouping. Although the distributions of the other variables do depart significantly from normality, in no case would this departure appear to be great. Table 26 may indicate that the distribution of the length/breadth index, which departs furthest from normality, owes this departure to the large number of observations which form the mode of the curve - a feature that is hardly likely to assist the grouping of the artefacts.

In summary, it appears that none of the variables will assist the grouping of the sample from all levels of the deposit.

III

It has been previously shown (p.181 above) that there is a size gradient in the artefacts in the deposit, with larger unifacially worked tools at the bottom of the deposit. It may

therefore be that the random sample discussed above, taken from all levels of the deposit, has obscured significant peaks in the distributions of the variables that have been examined, peaks that would be apparent if the sample were drawn from restricted levels in the deposit.

Consequently, distributions have been drawn of variables for three samples. The first is taken from layers 1-20, to which the artefacts are supposed to have been displaced by occupational disturbance and which cover an indistinct zone (layers 19-20); the second from layers 21-28, in which the uniface pebble tools predominate over the ?? artefacts; the third from layers 29-33 where ?? tools predominate over unifaces.

Figure 44 gives the distribution of weight for these three layers. It has been demonstrated (page 181) that the tools become lighter as depth decreases in the deposit. The distribution in Figure 44 reflects this. However, as the second arbitrary division is known to contain lighter tools than the third, it is to be expected that the distributions of weight for these divisions could be used to form groups. But such groups will presumably arbitrarily separate smaller artefacts and larger artefacts from a continuous range. It is to be expected, therefore, that the lighter artefacts, which will predominate in the second division, will tend to be shorter, narrower and thinner than the heavier tools

in the third division. Figure 45, in which the distributions of length, breadth and thickness for two series of tools one of weight less than 100 grams and the other of weight from 200 to 300 grams, demonstrates that this is the case.

Figure 46 gives the distribution of length for the three divisions. The distributions for the first and second samples approximate quite closely, but the median and the range of the distribution of the third sample is displaced to the right. This is to be expected, as the third sample contains larger artefacts. The distribution for the first sample, from layers 1 - 20, has two peaks, as does that for the third sample, although the peaks are not so marked in the latter. It is thus possible that the artefacts from the first and third samples may fall into two groups on the basis of their length.

Figure 47 gives the distributions of breadth for the three samples. The three unimodal distributions are very similar, indicating little variation in the breadth of the artefacts. Breadth does not appear to be an attribute that will assist the grouping of the artefacts.

Figure 48 gives the distributions of thickness for the three samples. The distributions for the first and the third samples have three peaks; it is thus possible that thickness may aid the grouping of the artefacts.

Figure 49 gives the distribution of the length/breadth index for the three samples. Each is a high peaked unimodal curve, holding little promise that this index will be an aid to grouping.

Figure 50 gives the distribution of the length/thickness index for the three samples. It appears as though the curve for the third sample has a secondary peak; it is possible that this index may assist the grouping of the artefacts from this sample.

As it appeared from Figure 47 that the artefacts from the first sample might group themselves in terms of length, two groups were selected from layers 1-20, the first with length less than 70 millimetres, and the second length between 71 and 100 millimetres. The distribution of thickness was then plotted for each of these two groups, the distributions being given in Figure 51. Clearly any grouping based on length is not reflected in groups based on thickness, and these two variables are not correlated.

Again, Figure 48 seemed to indicate that the artefacts from layers 1-20 might group in terms of thickness. Two groups were selected from these layers with length less than 35 millimetres and between 36 and 50 millimetres and the distributions of length drawn for each, Figure 52. Although it is possible to select these groups in terms of thickness, this grouping is not reflected in terms of length.

The distribution of the length/thickness index for layers 1-20 (Figure 50) is a high peaked unimodal curve. However, it was

considered useful to attempt on this distribution, although this variable would appear most unsuitable for this purpose. The artefacts were divided into two groups, one with index less than 50, the other with index more than 50. Figures 53 and 54 give the distributions of length and thickness for these two groups. These distributions confirm the supposition that the length/thickness index is not relevant to the grouping of the artefacts.

Figure 46 indicated that it might be possible to group the artefacts from layers 21-28 in terms of length. Consequently, two groups were chosen from these layers, one with length less than 80 millimetres, and the other with length from 81 to 110 millimetres. The distribution of thickness for these two groups is given in Figure 55. Although it would appear that there is a tendency for the longer artefacts to be thicker than the shorter artefacts, the distributions show that grouping based on length is not reflected by groups based on thickness.

It would appear that none of the variables length, breadth, thickness, length/breadth index, length/thickness index can be usefully combined to group the unifacially flaked artefacts from section X: it is possible to group the artefacts in terms of length, for example, but the grouping is not reflected in terms of breadth. The impression is left by these tests that these variables, by themselves, are not relevant to a typological

classification of these artefacts. However, the distributions that have been graphed serve also to describe the samples in terms of the variables that have been examined.

Variations in outline shape are registered by a number of observations in the coded record: observation 2, the relation of maximum breadth to length: 4, breadth at $1/5$ of length: and 5, breadth at $4/5$ of length. These variations may be expressed in terms of indices. Thus the B_1/B_2 index, calculated as $\frac{\text{breadth at } 1/5 \text{ of length}}{\text{breadth at } 4/5 \text{ of length}} \times 100$ taken together with the L_1/L index, calculated as $\frac{\text{length at position of maximum breadth}}{\text{maximum length}} \times 100$ represent the range of outline shapes that can be anticipated. This range can be expressed in terms of two models: one, variation ranging from a triangle with apex upwards, passing through a circle to a triangle with apex downwards; the other, variation ranging from a horizontal straight line, passing again through a circle to a vertical straight line. Of course, the extreme forms represented by these models will never be found.

The distribution of the B_1/B_2 index for the sample derived from all levels of section X is given in Figure 56. This distribution would appear to be of little assistance in the grouping of the artefacts. The mean values of this index were then calculated for layers 1 - 20, 21 - 28, and 29 - 33, being respectively 102.0, 118.2, and 98.8. This would seem to indicate no significant change at different depths in the deposit.

The distribution for the L_1/L index, given in Figure 57, appears to be bi-modal. Since two groups could be derived from this distribution, the distributions of length and breadth were drawn for both of these groups (Figures 58 and 59): it appears that the L_1/L index is not of great assistance for the grouping of the artefacts. The mean values of this index were then calculated for different levels in the deposit. The mean for layers 1 - 20 is 196.4; for layers 21 - 28 is 183.7; and for layers 29 - 33 is 189.2. No significant change is indicated for different depths in the deposit.

In view of the above a classification of the Sai Yok collection into picks and discs would appear to be straining the facts. Although pick-like and disc-like shapes can be separated out by eye, they represent only the extreme of a continuous range of shapes.

So far the examination of the collection of unifacially flaked tools from section X has produced little indication of how these artefacts should be classified. However, the variables that have been examined are only some of the observations that were made on the artefacts under study. The other observations do not concern continuously variable quantities, but they may none the less be criteria for placing the artefacts into groups.

One observation concerns the amount of cortex remaining on the flaked surface of the tools. It will be remembered that the

The distribution for the L_1/L index, given in Figure 57, appears to be bi-modal. Since two groups could be derived from this distribution, the distributions of length and breadth were drawn for both of these groups (Figures 58 and 59): it appears that the L_1/L index is not of great assistance for the grouping of the artefacts. The mean values of this index were then calculated for different levels in the deposit. The mean for layers 1 - 20 is 196.4; for layers 21 - 28 is 183.7; and for layers 29 - 33 is 189.2. No significant change is indicated for different depths in the deposit.

In view of the above a classification of the Sai Yok collection into picks and discs would appear to be straining the facts. Although pick-like and disc-like shapes can be separated out by eye, they represent only the extreme of a continuous range of shapes.

So far the examination of the collection of unifacially flaked tools from section X has produced little indication of how these artefacts should be classified. However, the variables that have been examined are only some of the observations that were made on the artefacts under study. The other observations do not concern continuously variable quantities, but they may none the less be criteria for placing the artefacts into groups.

One observation concerns the amount of cortex remaining on the flaked surface of the tools. It will be remembered that the

surface of the artefact was divided into four quadrants and that the amount of cortex remaining in each quadrant was scored A, S, or N (All, Some or None). The observed combinations for the random sample taken from all levels of the deposit are given in Table 27. It will be seen that the majority of the artefacts have no cortex remaining on the worked surface (NNNN). A number of artefacts have a small central area of cortex remaining (SSSS).

It might be supposed that those artefacts with a central area of residual cortex would tend to be thicker than the others and thus less easily flaked over an entire surface. The mean thickness of the NNNN group from the sample is 3.68 centimetres, whereas the mean for the SSSS group is 3.75 centimetres.

Table 27 shows that five per cent of the sample has the configuration SSAA, indicating artefacts that have only been flaked at one end. Laterally flaked artefacts - flaked along one side only - are represented by the configuration NAAN. Five per cent of the sample has an area of cortex remaining only in the bottom right hand quadrant - the NNSN group. The other configurations represent further possibilities that can be represented by the code.

Table 27 may thus be interpreted as tending to indicate the existence of a range of configurations rather than a number of discrete groups. Since, however, the observation of remaining

cortex by quadrants is not precise quantification, this must remain a provisional conclusion. At the same time the various recorded configurations can be regarded as indicating that the main object of the artisan was to produce a unifacially flaked tool that was totally worked around the periphery over the worked surface. In some cases an area of cortex does remain and this is usually a patch centrally placed on the worked face.

It was decided to see whether any significant variation in the amount of cortex remaining occurred with time. This was also intended as a check on the possibility, suggested by Colani's claims for Hoabinh, that the earlier unifaces might exhibit less complete flaking than the later ones. It has already been demonstrated for Sai Yok that the unifacial tools increase in size with depth and Colani claimed this as a feature of the Hoabinh sites.

A simple test is given if the observations All, Some and None, for each quadrant on the worked face, are given the scores 2, 1 and 0 respectively. Thus, an artefact with no cortex remaining on the worked face will be recorded in the code as NNNN for observation 15, and this will score 0. An artefact which has a central patch of cortex remaining will appear in the code as SSSS, and will score 4. An artefact with only one flake removed from one quadrant will be recorded as AAAS, and will score 7.

The mean scores for layers 22 - 32 have been calculated and are given in Figure 60. Although for layers 22 to 24 they are lower than for the rest, it cannot be said that any marked decrease in the amount of cortex remaining takes place with increasing depth in the deposit.

Other observations that were made concern the presence of flakes more than $1/4$ of the maximum breadth of the artefact - primary flaking - (observation 9); and flakes less than $1/4$ of the maximum breadth - secondary flaking - (observation 11). The various configurations of primary and secondary flaking that were found in the sample from all levels in the deposit is given in Table 28. The great majority of the artefacts have some flakes greater than $1/4$ the maximum breadth, and some less, in all four quadrants. This may indicate that the artefact was formed in the main by the primary flakes, and that secondary flaking merely served to remove irregularities that might remain. The other configurations observed are probably best taken to represent more or less random examples of the other configurations that can be represented in the code.

Observations were also made on the longitudinal and transverse curvature of both faces of the unifacially flaked pebble tools. The recorded configurations, observations 16 and 17, are given in Table 29. The great majority of the artefacts fall under the observations F/I or Cv/I for both faces, that is with face one

(the unflaked face) as flat and face two (the flaked face) irregular; or face one as convex and face two as irregular. Even though the simple record lacks precision and must obscure a range of surface shapes, it is possible that the observed configurations may assist the grouping of the artefacts. Consequently the distributions of length and thickness (which have appeared as likely variable for grouping) and breadth (which has not) have been drawn for the two groups with configuration F/I and Cv/I. These distributions are given in Figures 61, 62 and 63 and indicate no separation.

IV

The foregoing analysis of the unifacially flaked pebble tools from Sai Yok has failed to reveal any significant groups that can be defined in terms of constantly recurring attributes. On the other hand the analysis has given a description of the total collection in terms of the variables that have been examined, variables suitable for the definition of typological groups if such occurred. It is not proposed, therefore, to subdivide the unifacially flaked pebble tools into further categories.

The classification given in Table 15 would thus appear to give suitable cover for all the artefacts from section X - with the proviso that the nature of the ?? artefacts, and their relation with the unifacially flaked pebble tools, needs attention. This

cannot be undertaken without further examination of the collections. It would appear, from the analysis given above, that the original distinction drawn between these two kinds of artefacts may have been mistaken, and that a continuous range has been arbitrarily divided into two parts.

Conclusions

I

Be this as it may, the following general conclusions can be made about the mesolithic collections from section X at Sai Yok.

It appears that the mesolithic deposit is homogeneous with regard to the short axes, the bifacially worked tools and the tools made on split pebbles, as these are consistently distributed through depth. The proportions of the ?? tools and the unifacially worked pebble tools are complementary, the problem of their true relationship being irrelevant in this connection.

Although there is no reason to divide the neolithic deposits in terms of any cultural stratification it does appear that the unifacially flaked pebble tools tend to become smaller as depth decreases in the deposit. The other elements, the short axes, the bifacials and the tools made on split pebbles are not present in sufficiently large numbers for significant observations concerning change in size with change in depth to be made.

There is no indication of the lapse of time during which the mesolithic deposits were laid down. As there is no marked change

in the flaked stone industry, it can be concluded that there was no marked change in the environmental, economic or technical background of the people who made those artefacts. What change did take place appears to have been of a gradual and consistent nature.

Referring to Rouse's scheme, mentioned in Chapter V (pages 137-38) it can be pointed out that by taking the collection as a whole, the effect produced by variations in the skill of the individual artisans and their quirks have been minimized. The gradual change in the size of the unifacial tools may therefore reflect a gradual change in the raw material available, or in the purpose for which the tools were made, or in the traditions of the people who made them, or in the collective skill of the artisans. It is not possible to decide which of these alternatives, either singly or together, may have been responsible for the change in the data that has been presented above.

II

The analysis of the mesolithic tools from section X at Sai Yok has demonstrated obvious similarities with the Hoabinhian collections discussed in previous chapters. However, as the writer has been concerned only with the analysis of one element of the Sai Yok collections - the stone tools - from only one part of the

excavations - section X - only the most superficial attempt to relate these collections to other mesolithic assemblages from south east Asia is justifiable.

In section X, the majority of tools are unifacially worked; some bifacials are represented, as also are short axes. Only one hammerstone was found in this cutting. This assemblage cannot be considered to represent all the cultural material from Sai Yok. van Heekeren¹ in his preliminary account of the excavations mentions, for example, shells, bones, burials and red ochre from the rock shelter.

There is no indication that the portion of the deposit that has been exhaustively studied here is anything but mesolithic, in that the economy would seem to have been that of simple hunting and gathering type, that there is apparently no evidence of a pleistocene age for the deposits, and that surviving elements of material culture are flaked stone artefacts.

1

H.R. van Heekeren. 'A preliminary note on the excavation of the Sai Yok Rock-Shelter'. Journal of the Siam Society, 1961, 49, 2; 99 - 109

H.R. van Heekeren. 'A brief survey of the Sai Yok Excavations 1961 - 1962 season of the Thai-Danish Prehistoric Expedition'. Journal of the Siam Society, 1962, 50, 1; 15 - 19

It is possible to zone the mesolithic collections at Sai Yok into two phases in terms of the relationships between the unifacially flaked tools and the ?? tools, whatever these may be. The earlier phase would be characterised by a preponderance of ?? tools. Caution should be exercised in any attempt to use these artefacts for comparisons. There would be no justification, for example, in assuming that these represent a category of 'primitive' tools, not reported elsewhere, so that the lower levels of section X represent an early prototype of the whole Hoabinhian sequence. Such may indeed be the case, but the analysis that has been given above cannot provide the supporting evidence.

The later phase, characterised by a preponderance of unifacially flaked pebble tools, would seem to be more closely related to the collections discovered in Hoa Binh. This can only be expressed in general terms since the validity of Colani's conclusions cannot be checked from the reports and no quantified data of the kind used in the Sai Yok analysis are available.

Nevertheless, the demonstration that the uniface pebble tools decrease in size with diminishing depth in the deposit in section X is in agreement with Colani's suggestion that the later tools in Hoa Binh tend to be smaller than the earlier. Short axes are present throughout the sequence at Sai Yok, and appear to be similarly represented at the Hoa Binh sites. Edge-ground tools are present only in small numbers at the Hoa Binh sites - at Sao Dong

they only formed 1 per cent of the total number of stone tools, and at X. Kham 2 per cent (page 23). For section C at Sai Yok van Heekeren¹ reports that two edge-ground tools were found in the upper levels. It has been argued here that there is no primary association of pebble tools and pottery. The evidence is not clear from Hoa Binh, but Colani² appears to consider that pottery in the mesolithic deposits at Hoa Binh is an intrusive element from a later culture.

On the other hand, it is possible to see differences between the Sai Yok collection and the reported assemblages from Hoa Binh. Colani claims that bifacial work is confined to the upper levels of the Hoa Binh sites, whereas bifacial work is present throughout the deposit at Sai Yok. Colani claims that the tools in Hoa Binh become not only smaller but also 'better made'. It cannot be said that this situation is not present at Sai Yok, for if the ?? tools prove to be one end of a range of unifacially flaked pebble tools, then improvement in terms of flaking which would remove more cortex would be present. However, there is no evidence that such a tendency is present in the unifacially flaked pebble tools themselves at Sai Yok.

¹ H.R. van Heekeren, 1961; 104.

² M. Colani, 'L'age de la pierre dans la province de Hoabinh (Tonkin)', Mémoires du Service Géologique de l'Indochine, 1927, 14, 1; 68.

Although appearing close to the Hoabinh sites, there are some differences which might justify the contention that the Sai Yok collections represent a regional aspect of Hoabinhian culture. This similarity of the Sai Yok to the Hoa Binh sites emphasises the special character of the Bac Son sites, with which Sai Yok has little in common. The Bac Son collections would thus be confirmed as a highly localised regional or temporal variant of the Hoabinhian.

III

It is very difficult to make even general comparisons with the Malayan mesolithic collections, as sequential data, in terms of change over time in a deposit, are almost totally lacking. However, Callenfels and Noone¹ do report that at Gol Ba'it the lower levels contained unifacially worked tools made on non-fissile pebbles; and that the upper levels contained bifacially worked implements made on fissile pebbles. Such a sequence is not present at Sai Yok.

Regional variation is apparently present in Malaya, as bifacially flaked implements are confined to the east of the

1

P.V. van Stein Callenfels and H.D. Noone. 'Report on an excavation in the rock-shelter Gol Ba'it, near Sungur Siput'. Proceedings of the Third Congress of Prehistorians of the Far East; 1940; 119.

peninsula (page 88). The Sai Yok collections would not, therefore, have close similarity with the western variant, which contains no bifacials. But the Sai Yok collections would appear to be superficially similar to the eastern Malayan aspect, as both contain unifacially worked and bifacially worked pebble tools, edge-ground tools and short axes. Pottery is associated with the Malayan mesolithic collections, but their primary association is in doubt. Tweedie¹ suggests that pottery occurs as an intrusive element of a later culture, a contention that is in agreement with the point of view that has been argued for the Sai Yok collections. No closer comparison can be made between the Sai Yok and the Malayan collections, as the appropriate quantitative and descriptive data is lacking for Malaya.

Just as the lack of data makes any detailed comparison with Malaya impossible, so the record for Sumatra leaves only the possibility of a general discussion. The Sumatran collections appear to be comprised almost entirely of unifacially worked implements; no bifacials, edge-ground tools or short axes being reported. The Sumatran collections would therefore appear to

1

M.W.F. Tweedie. 'The stone age in Malaya'. Journal of the Malayan Branch of the Royal Asiatic Society, 1953, 26, 2; 45.

represent a regional aspect that differs from that of Sai Yok. The absence of pottery from the Sumatran sites could be taken as evidence to support the view that the mesolithic tools and the pottery at Sai Yok are not in primary association.

CHAPTER IX
AN INVESTIGATION OF THE HOABINHIAN AFFINITIES
OF SOME AUSTRALIAN COLLECTIONS

In Chapter IV, the claims made by Tindale¹ and McCarthy² for Hoabinhian affinities of elements of the Kartan and collections found on the north coast of New South Wales have been particularised. The present chapter aims to explore the validity of these claims.

The writer was able to examine the Kartan collections in the South Australian Museum and to make observations on samples of this industry.³

The mainland collections are formed of two main types:⁴ the horsehoof-shaped implements, and pebbles and angular blocks of casual

1

N. B. Tindale, 'The relationship of the extinct Kangaroo Island culture with cultures of Australia, Tasmania and Malaya', Records of the South Australian Museum, 1937, 6, 1: 41-60.

2

F. D. McCarthy, 'Comparison of the prehistory of Australia with that of Indo-China, the Malay Peninsula and the Netherlands East Indies', Proceedings of the 3rd Congress of Prehistorians of the Far East, 1940; 33-38.

3

Mr H. M. Cooper, the Honorary Associate in Archaeology at the South Australian Museum, who has an intimate knowledge of the Kartan collections, was unfortunately away from Adelaide at the time of the writer's visit.

4

H. M. Cooper, 'Archaeological stone implements along the Lower River Wakefield, South Australia', Transactions of the Royal Society of South Australia, 1961, 84; 108.

shapes possessing a simple flaked working edge. The pebbles, as Mr. Tindale pointed out to the writer, are often not the rolled pebbles on which the 'sumatras' are made, but blocks with weathered and rounded outline. Cooper¹ sees these two main types at the Wakefield River as ends of a range, with a complete series of intermediate forms.

A few horsehoof-shaped artefacts have been found on Kangaroo Island, but as they form a small proportion only of the collections, they have not been included in the studies that follow.

The Kartan collections at the South Australian Museum are divided into three categories: specimens that have been illustrated in various publications, the best of their kind; 'firsts', particularly good examples of various implements; and 'seconds', the remainder and the bulk of the collections. The 'firsts' and 'seconds' are further classified into artefacts from Kangaroo Island, and those not from Kangaroo Island - with the exception of the series from the Wakefield River sites² which are stored together.

In order to obtain representative samples it seemed advisable to ignore the illustrated specimens as being carefully selected.

With the Kangaroo Island collections, as these are not arranged according to provenance, it was decided to use a sample of 100 artefacts,

¹ H. M. Cooper, 1961; 108

² H. M. Cooper, 1961.

one third being 'firsts' and two thirds being 'seconds'. The 'firsts' are stored in metal trays. The labelling of the trays, the number of artefacts that they contained, and the number taken for the sample are given in Table 30. The disposition of the artefacts allowed them to be placed in rows in the trays, and the sample was taken by counting along each row, starting from the top left hand corner. Every eighth artefact was selected. Thus where two artefacts had to be selected from a total of 26, the eighth artefact and the eighth after that were taken. The artefacts were taken from the other trays in similar fashion - except for the tray with only seven artefacts, where the fifth artefact was taken. As the artefacts had to be retained in groups according to their particular trays, such a method seemed the most convenient way to take a sample that could be considered as a random sample.

The 'seconds' from Kangaroo Island are stored in wooden crates. One crate was found to contain eighty-four artefacts, and the first seventy removed were taken.

All the implements come from surface collections made sporadically over the last thirty years, and so many factors have influenced their accumulation at the South Australian Museum that the sample of 100 flaked pebble artefacts can be taken as a random sample. This should represent not only the range of the collections in the South Australian Museum, but also the range of the material present on surface sites on Kangaroo Island.

The measurements and observations listed in Chapter VI were taken for all the pebble artefacts in the Kangaroo Island sample. The cutting angle, in the shape of the most obtuse angle presented by the cutting edge, was recorded in addition.¹

The artefacts collected by Mr Cooper from the Wakefield River sites are stored separately, so this seemed a good source for a sample of mainland Kartan implements. Seven metal trays contained an average of forty implements. A sample of 100 was obtained by taking every third artefact, counting in rows as before. The maximum breadth, length and thickness, the weight and the cutting angle were recorded for all the artefacts.

Only horsehoofs and artefacts made on weathered blocks were included in this sample. Although Cooper² indicates that an ample supply of rolled river pebbles was adjacent to at least one of the sites, artefacts made on rolled pebbles (sumatras) only form a very small proportion of the Wakefield River collections that were available for examination by the writer in the South Australian Museum. Thus the two samples represent morphologically distinct collections. The island and the mainland collections have been taken

1

As a distinctive feature of the horsehoof is the cutting angle that approaches a right angle, the most obtuse angle is clearly the significant measurement for these collections, rather than the most acute angle that was observed for the Sai Yok collections.

2

Cooper, 1961; 107

to represent different aspects of the same industry.¹ If this is in fact the case, then the variables related to use and function should have similar distributions for both samples.

Although the samples are derived from surface collections which may well possess both regional and chronological variation, it is possible to test the proposition here put forward for the industry as a whole. With large implements of the type in question, the weight of the artefacts should be an important characteristic. Figure 64 gives the distribution of the weights of the two samples. The distributions of this variable are very similar. Figures 65 and 66 give the distributions of breadth and thickness. Again, the distributions are very similar.

All the Kangaroo Island pebble tools in the sample are unifacially worked. Table 31 lists the various configurations for observation 13, described in Chapter VI. This observation records the nature of the junction of face one and face two of the artefacts, whether either or both are flaked or cortex covered. The observation is made for each of the four quadrants. Thus an artefact that has been flaked on one face, but only at one end, would be recorded 'CF CF CC CC'. Artefacts that have been worked along one edge only

¹ N. B. Tindale, 'Culture succession in South Eastern Australia from the Late Pleistocene to the Present', Records of the South Australian Museum, 1957, 13; 5-9.

were orientated so that the worked edge was to the right, so appearing in the record 'CC CF CF CC'.

It is clear from Table 31 that the majority of the Kangaroo Island implements are worked only along one edge. As the Wakefield River tools are typically flaked to a rounded cutting edge, which may complete a circle in the extreme form of the horsehoof, it is to be expected that the pebble tools will be longer than those from the mainland. Figure 67, which gives the distributions of length, demonstrates that this is the case.

By the evidence of the two samples, the industries from Kangaroo Island and the Wakefield River, although morphologically different, have similar distributions for the variables of weight, breadth and thickness. The discrepancy in the distributions of length is moreover easily explained. As a result we may accept the two as geographical aspects of the same industry.

The distributions of cutting angle for the two samples are given in Figure 68. The Wakefield River sample has a much higher proportion of tools with cutting angle of 90° . It is to be expected that as the cutting angle becomes more obtuse, so the breadth of the artefact will decrease, the more obtuse angle indicating that a greater proportion of the original pebble or block has been flaked away. Table 32 demonstrates that this is the case. The absence of artefacts with cutting angle more than 90° undoubtedly reflects the fact that it is very difficult to strike off a flake when the angle

between the striking platform and the side of a core exceeds a right angle.¹

Two circumstances can explain the distributions in Figure 68. Either the makers of the artefacts required tools with a range of cutting angle for various purposes; or alternatively, although the cutting angle could lie between 50° and 90° , continual resharpening of an implement tended to give a final cutting angle of 90° when the tools were discarded. It would be interesting to investigate the correlation between the mean cutting angle of collections and the distance of the relevant sites from the raw material. If the obtuse angle does result from resharpening, then those collections which lie farthest from the sources of raw material should tend to have more obtuse cutting angles.

The artefacts collected from the surface site at Yamba, on the northern coast of New South Wales² described in Chapter V, were examined to provide a further series of Australian pebble tools for comparison with those from Kangaroo Island. Eighty artefacts were examined, of which nine were large tools made on split pebbles.

1

H. Hodges, Artefacts, London, 1964; 102.

2

F. D. McCarthy, 'Two pebble industry sites of Hoabinhian 1 type on the North Coast of New South Wales', Records of the Australian Museum, 1941, 21, 1; 21-27.

These latter have been omitted from the following comparison, as similar artefacts are not represented in the Kangaroo Island sample.

Table 31 gives the various configurations for observation 13 in the coded record. Over half of the implements have the configuration CC CF CF CC, thus being laterally worked, while a third have the configuration CF CF CF CF, being worked all round the periphery. It seemed desirable to try to discover whether the two groups could be considered different kinds of implements made for different purposes, so the mean length, breadth, thickness and weight of the two were calculated (Table 33). The significance of the differences between the means has been examined with the *t* test. As *t* must be more than 2.00 for the difference between two means to be significant at the 5 per cent level of probability when *N* = 60, the two groups cannot be distinguished in terms of the variables length, breadth, thickness or weight.

A third series of Australian pebble tools, from the rock shelter at Seelands in northern New South Wales mentioned in Chapter V, was excavated by Miss Isabel McBryde.¹ Six levels contained pebble tools: levels II, III, IV, IIIA, IVA, VA in order of increasing age. An interesting feature of these collections is the presence of truncated

1

I. McBryde, 'Archaeological field survey work in Northern New South Wales', Oceania, 1962, 33, 1; 12-17.

pebble tools recalling the short axes of the Indochinese sites, Malaya and Sai Yok.

Table 34 lists the number of pebble tools not made on split pebbles and those made on split pebbles; the number of truncated pebble tools not made on split pebbles and those made on split pebbles; and the number of bifacially worked tools. The means of length, breadth, thickness, weight and cutting angle have been calculated (Table 35) for these layers, less the truncated tools. The latter have been omitted as they may be merely broken pebble tools, so that their inclusion would bias the sample means.

Analyses of variance have been carried out for these six variables and the calculated variance ratios are given in Table 36. Some variation in these samples must be accepted as there is no information about the archaeological significance of the variables, so the 1 per cent level of probability has been taken. None of the calculated variance ratios indicate significant departure from homogeneity.

The unifacially flaked tools from Seelands will therefore be taken as a group in the following observations, except that the truncated pebble tools have been omitted, as similar artefacts are not included in the other samples.

Tables 37 to 42 compare the collections in terms of length, breadth, thickness, weight, cutting angle and length/breadth ratio. They include

the Wakefield River sample of tools made on angular blocks for general interest and exclude from the cutting angle comparison Sai Yok, for which the most acute angle was measured. Although an analysis of variance could be carried out for all these variables, the means calculated for the various samples indicate that such tests would give extremely significant results.

If the samples can be considered to have come from the same parent population then the difference between the means should not be significant at the 5 per cent level of probability. The difference between means standard error of the means must be more than 2.00 for this to be the case.

Tables 37 to 42 demonstrate that the Kangaroo Island sample is to be distinguished from the Yamba, Seelands and Sai Yok samples in terms of all the variables. The Yamba, Seelands and Sai Yok samples are not directly related in terms of weight (Table 40). However, the samples from Kangaroo Island and the Wakefield River are not to be differentiated by this variable. These two samples are considerably heavier on the average than the others. As has been suggested above (page 220), the weight of these large and heavy tools may be an important element in their use, when the force of the cutting or chopping blow will be proportional to the mass of the artefact and the distance through which it has moved. The lighter pebble tools of the other samples do not have comparable mean weights, although there are consistencies between the

means for the other variables. This may suggest that the mass of the artefacts in the samples from Yamba, Seelands and Sai Yok is not so critical for the cutting effect; the users of the tools may have used their forearms as fulcrums with more effect, or perhaps the artefacts may even have been hafted to handles.

The samples from Yamba and Seelands cannot be differentiated in terms of cutting angle (Table 41) and have comparable mean breadth (Table 38). The Yamba and Sai Yok and the Seelands and Sai Yok samples have comparable thickness (Table 39). The Yamba and Seelands and the Sai Yok and Seelands samples are comparable in terms of $\frac{\text{length}}{\text{breadth}} \times 100$ (Table 42).

The inference would seem to be that the uniface pebble tools from Kangaroo Island are not to be related to those from Yamba, Seelands or Sai Yok.

The relationships between the Yamba, Seelands and Sai Yok tools, tabulated in Table 43, would seem to indicate that, in terms of the variables examined, the Seelands and Yamba samples are more closely related than either is with Sai Yok, a relationship of course to be expected from their provenance.

However, the Seelands and the Sai Yok samples are further related by a common possession of truncated tools, and similar proportions for observation 13 in the coded record (Table 31). On the other hand, the

Seelands artefacts are reported to be associated with microliths.¹ Clarification of the cultural situation represented by the Seelands excavation may be expected from Miss McBryde's site report.

However, caution should be exercised in any attempt to see cultural relationships between these three samples of pebble tools.

The artefacts have been considered in isolation from their natural settings. One of the results of the present study has been to underline the necessity for considering the material of prehistoric archaeology in relation to the ecology of the groups that produce it. In the present case, for example, the samples have been considered without regard to the nature of the raw materials from which the artefacts were made, or to the location of suitable sources of such material in relation to the sites on which the artefacts were found. The nature of the environments which confronted the makers of the tools have not been considered, and the particular purposes for which these tools were made are not known. Information about the activities that led to the accumulation of the tools on the sites is missing, so that it is not known if the samples represent some of the range of tools that were made, or whether they represent some

1

I. McBryde, 'Archaeology in New England', in New England Studies ed. R.F. Warner. University of New England, 1963; 68-69.

specialized range of activities. There is little information about the age of the samples.¹

Field studies, using the appropriate techniques, could help to solve these problems.

¹

Miss McBryde, 1963; 68, gives a date of 1920 B.C. $\pm$ 120 for layer IIIA from Seelands. However, this has not yet appeared in any official list of C 14 dates.

CHAPTER X

CONCLUSIONS

Archaeological analysis begins with the analysis of types. The techniques that have been used in the present study have been devised as a means of checking the validity of types and of extending analysis beyond that possible in terms of the typological concept.

Criticism has been levelled at Colani's typology, which is based on subjective criteria. Ample support for these criticisms is given by the reports for Hoa Binh which cannot, by their nature, validate the postulated culture sequence. Similar criticisms have been made of Dani's attempt to provide a fresh synthesis of the south east Asian mesolithic.

A different approach has been used to deal with the mesolithic collections from Sai Yok. A general classification into types was necessary as a preliminary stage to the detailed analysis, but this was carried out only in order to allow the more complete investigation to proceed.

Of the preliminary groups, only that which has been called flaked pebble tools contained sufficient numbers of artefacts for detailed study. Within this group, only the unifacially flaked pebble tools gave a significant sample for precise analysis.

It would have been possible to pick out various shapes and configurations by eye from these unifacially flaked pebble tools and to consider these as types. However, the quantitative analysis has shown that such grouping would not be justified, as individuals from continuous ranges would thus be given typological significance that they did not deserve. The grouping of the Chione valves gives an example of how this method is used in situations where valid types can be determined.

The quantitative analysis that has been presented not only has the function of isolating types or of checking the validity of types that may suggest themselves to the observer; it also provides descriptions of the collections in terms which most readily assist comparisons. By describing collections in terms of parameters, the limitations of describing the general in terms of the particular that so often reduces the significance of the typological concept have been avoided.

That the method can be used to check the preliminary findings of subjective examination has been demonstrated by the case of the ?? artefacts and the unifacially worked pebble tools from Sai Yok. Here the initial classification which places these in two discrete groups may well be mistaken, although the problem cannot be resolved on the evidence available.

By describing types in terms of parameters, there is every chance that the analysis will proceed beyond the simple typological

examination; for there is always the temptation to assume that by subjectively picking out certain examples and naming them as 'types' the analysis is complete. But this is clearly not the case, for the prime task of the prehistorian is to discover the significance of types in terms of the whole spectrum of related factors that are the subject of prehistory - tradition, economy, climate, environment and so forth. Typological studies are not an end in themselves.

The comparison that has been made between the Kangaroo Island and the Wakefield River collections, which are morphologically distinct, demonstrates how parameters can be used to overcome the limitations of the typological approach, and reach beyond to draw on other factors, in this instance related to function and use.

A similar attempt has been made with the collections from Kangaroo Island, Seelands, Yamba and Sai Yok. The situation is not very favourable to any kind of analysis. The collections come from sites that are widely distributed in space, and may be of quite different date, although there is no direct evidence to bear on this point. Even so, the analysis has demonstrated that there are sufficient grounds to differentiate the Kangaroo Island collections from the others. For the present, the Kartan appears to be confined to South Australia.

The relationships between the other collections, those from Yamba, Seelands and Sai Yok, are difficult to assess. Until more

information about cultural connections, chronology and environment are forthcoming, the analysis can proceed no further. Be this as it may, the common occurrence of the edge-ground tool in Australia, and the presence of the short axe at Seelands where an edge-ground tool was also found in the bottom layer,¹ could together be taken to suggest that future work may demonstrate a clear cultural connection between Australia and south east Asia.

¹
I. McBryde. 'Archaeology in New England', in New England Essays, Ed. R.F. Warner, 1963; 68.

Bibliography of works used

- Ambrose, W., 1962. 'Further investigations at Kauri Point'.
New Zealand Archaeological Association Newsletter, 5, 1; 56-66.
- Beyer, H. O., 1947. 'Outline review of Phillipine archaeology by Islands and Provinces'. Phillipine Journal of Science, 77; 205-373.
- Bohmers, A., 1956. 'Statistics and graphs in the study of flint assemblages'. Palaeohistoria, 5; 1-38.
- Bohmers, A. 1962. 'La valeur actuelle des méthodes de la typologie statistique'. In Atti del VI Congresso Internazionale delle Scienze Preistoriche e Protostoriche, 1, Relazioni generali; 12-19.
- Boriskovski, P. I., 1962. 'Exploration of ancient sites of the Stone Age in the Democratic Republic of Vietnam'. Soviet Archaeology, 2; 17-25.
- Boriskovski, P. I., 1962. 'Archaeological discoveries in Vietnam'. Herald of the Academy of Science of the U.S.S.R., 4; 98-101.
- Brainerd, G. W., 1951. 'The place of chronological ordering in archaeological analysis'. American Antiquity, 16, 4; 301-13.
- Callenfels, P. V. van Stein, 1936. 'An excavation of three kitchen middens at Guak Kepah, Province Wellesley, Straits Settlements'. Bulletin of the Raffles Museum, Series B, 1, 1; 27-37.
- Callenfels, P. V. van Stein, 1936. 'The Melanesoid civilisation of eastern Asia'. Bulletin of the Raffles Museum, Series B, 1, 1; 41-51.
- Callenfels, P. V. van Stein and I. H. N. Evans, 1928. 'Report on cave exploration in Perak'. Journal of the Federated Malay States Museums, 12, 6; 145-59.

- Callenfels, P. V. van Stein and H. D. Noone, 1940. 'Report on an excavation in the rock-shelter at Gol Ba'it, near Sungei Siput'. Proceedings of the Third Congress of Prehistorians of the Far East; 119-30.
- Chang Kwang-chih, 1963. The Archaeology of Ancient China. Yale University Press.
- Cheng Te-k'un, 1957. Archaeological Studies in Szechwan. Cambridge University Press.
- Cheng Te-k'un, 1959. Prehistoric China. Cambridge.
- Chia Lan-po and Chiu Chung-lang, 1960. 'On the age of the chipped stone artefacts in Kwangsi caves'. Vertebrata Palasiatica, 4, 1; 39.
- Childe, V. G., 1956. Piecing Together the Past. London.
- Chiu Chung-lang, 1958. 'Discovery of palaeoliths on the Tibet-Tsinghai Plateau'. Vertebrata Palasiatica, 2; 157-61.
- Clarke, D. L., 1962. 'Matrix analysis and archaeology with particular reference to British beaker pottery'. Proceedings of the Prehistoric Society, 28; 371-88.
- Colani, M., 1927. 'L'Age de la pierre dans la province de Hoabinh (Tonkin)'. Mémoires du Service Géologique de l'Indochine, 14, 1.
- Colani, M., 1928. 'Notice sur la préhistoire du Tonkin'. Bulletin du Service Géologique de l'Indochine, 17, 1.
- Colani, M., 1929. 'Quelques stations hoabinhiennes'. Bulletin de l'Ecole Française de l'Extrême-Orient, 29; 261-72.
- Colani, M., 1930. 'Recherches sur la préhistoire indochinoise'. Bulletin de l'Ecole Française d'Extrême-Orient, 30; 299-422.
- Collings, H. D., 1936. 'Report of an archaeological excavation in Kedah, Malay Peninsula'. Bulletin of the Raffles Museum, Series B, 1, 1; 5-16.
- Collings, H. D., 1937. 'An excavation at Bukit Chuping, Perlis'. Bulletin of the Raffles Museum, Series B, 1, 2; 94-119.

- Collings, H. D., 1937. 'Notes on a recent paper: "The Melanesoid civilizations of eastern Asia"'. Bulletin of the Raffles Museum, Series B, 1, 2; 122-23.
- Collings, H. D., 1937. 'A collection of stone tools in the Raffles Museum from Kuantan in Pahang'. Bulletin of the Raffles Museum, Series B, 1, 2; 124-37.
- Cooper, H. M., 1943. 'Large stone implements from South Australia'. Records of the South Australian Museum, 7, 4; 343-69.
- Cooper, H. M., 1959. 'Large archaeological stone implements from Hallett Cove, South Australia'. Transactions of the Royal Society of South Australia, 82; 55-60.
- Cooper, H. M., 1960. 'The archaeology of Kangaroo Island, South Australia'. Records of the South Australian Museum, 13, 4; 481-503.
- Cooper, H. M., 1961. 'Archaeological stone implements along the lower River Wakefield, South Australia'. Transactions of the Royal Society of South Australia, 84; 105-18.
- Cornwall, I. W., 1958. Soils for the Archaeologist. London.
- Dani, A. H., 1960. Prehistory and Protohistory of eastern India. Calcutta.
- Daniel, G. E., 1950. A Hundred Years of Archaeology. London.
- Detweiler, A. H., 1948. A Manual of Archaeological Surveying. American Schools of Oriental Research. New Haven.
- Duckworth, W. L. H., 1934. 'Human remains from rock-shelters and caves in Perak, Pahang and Perlis, and from Selensing'. Journal of the Malayan Branch of the Royal Asiatic Society, 22, 2; 149-67.
- Earl, C. W., 1860. 'On the shell-mounds of Province Wellesley, in the Malay Peninsula'. Transactions of the Ethnological Society, New Series, 11; 119.
- Evans, I. H. N., 1920. 'Cave dwellings in Pahang'. Journal of the Federated Malay States Museums, 9, 4; 267-70.

- Evans, I. H. N., 1937. '"Melanesoid" culture in Malaya'. Bulletin of the Raffles Museum, Series B, 3; 141-46.
- Fromaget, J., 1940. 'La stratigraphie des dépôts préhistoriques de Tam Hang (Chaîne Annamitique septentrionale) et ses difficultés'. Proceedings of the Third Congress of Prehistorians of the Far East; 60-71.
- Gardin, J. C., 1958. 'Four codes for the description of artefacts: an essay in archaeological technique and theory'. American Anthropologist, 60; 335-57.
- Gardin, J. C., 1962. 'On three computer projects in the field of archaeology and anthropology'. Wenner Gren Foundation for Anthropological Research, Symposium 18 (Privately circulated).
- Gardin, J. C., 1962. Projet de code pour l'analyse des formes de poteries. Centre d'Analyse Documentaire pour l'Archéologie, Paris.
- Gilmour, J. S. L., 1939. 'Taxonomy and Philosophy', in The New Systematics, Ed. J. Huxley, Oxford.
- Golson, J., 1959. 'Culture change in prehistoric New Zealand' in Anthropology in the South Seas, Ed. J. D. Freeman and W. R. Geddes, New Plymouth; 29-75.
- Golson, J., 1961. 'Investigations at Kauri Point, Katikati'. New Zealand Archaeological Association Newsletter, 4, 2; 18-28.
- Green, R. C., 1962. 'The application of matrix index systems to archaeological materials'. Paper read to the 10th Pacific Science Congress.
- Harrisson, T., 1957. 'The great cave of Niah; a preliminary report on Bornean prehistory'. Man, 57; No. 211.
- Heekeren, H. R. van, 1948. 'Prehistoric discoveries in Siam 1943-1944'. Proceedings of the Prehistoric Society, 14; 24-32.
- Heekeren, H. R. van, 1957. The Stone Age of Indonesia. The Hague.
- Heekeren, H. R. van, 1961. 'A preliminary note on the excavation of the Sai Yok rock-shelter'. Journal of the Siam Society, 49, 2; 99-109.

- Heekeren, H. R. van, 1962. 'A brief survey of the Sai Yok excavations, 1961-1962 season of the Thai-Danish Prehistoric Expedition'. Journal of the Siam Society, 50, 1; 15-19.
- Heekeren, H. R. van, 1963. 'Thai-Danish Prehistoric Expedition, 1960-1962'. Journal of the Siam Society, 51, 1; 79-84.
- Heider, K. G., 1957. 'A pebble-tool complex in Thailand'. Asian Perspectives, 2, 2; 63-67.
- Heizer, R. F. and S. F. Cook, 1956. 'Some aspects of the quantitative approach in archaeology'. South Western Journal of Anthropology, 12, 3; 229-48.
- Hodges, H., 1964. Artefacts. London.
- Huxley, F. W., 1863. 'A letter on the human remains found in the shell-mounds at Province Wellesley'. Transactions of the Ethnological Society, New Series, 2; 265-66.
- Ihm, P., 1961. 'Le problème de la découverte automatique des groupes culturels'. Comptes-rendus du séminaire sur les modèles mathématiques dans les sciences sociales, 3; 27-33.
- Kennedy, K. A. R., 1964. 'A biochemical analysis of human remains from Gua Cha, Kelantan, Malaya'. Man, 64, No. 92.
- Knuth, E., 1962. 'Further report on the Sai Yok excavations and on the work at the picture cave'. Journal of the Siam Society, 50, 1; 19-23.
- Krieger, A. D., 1944. 'The typological concept'. American Antiquity, 9, 3; 271-88.
- Küpper, H., 1930. 'Paleolithische werktuigen uit Atjeh. N. Sumatra'. Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap, 47; 985-88.
- Lebzelter, V., 1935. 'Paleolithische Funde aus Atjeh (Nord Sumatra)'. Archiv für Anthropologie, 23; 318-25.
- McBryde, I., 1962. 'Archaeological field survey work in northern New South Wales'. Oceania, 33, 1; 12-17.

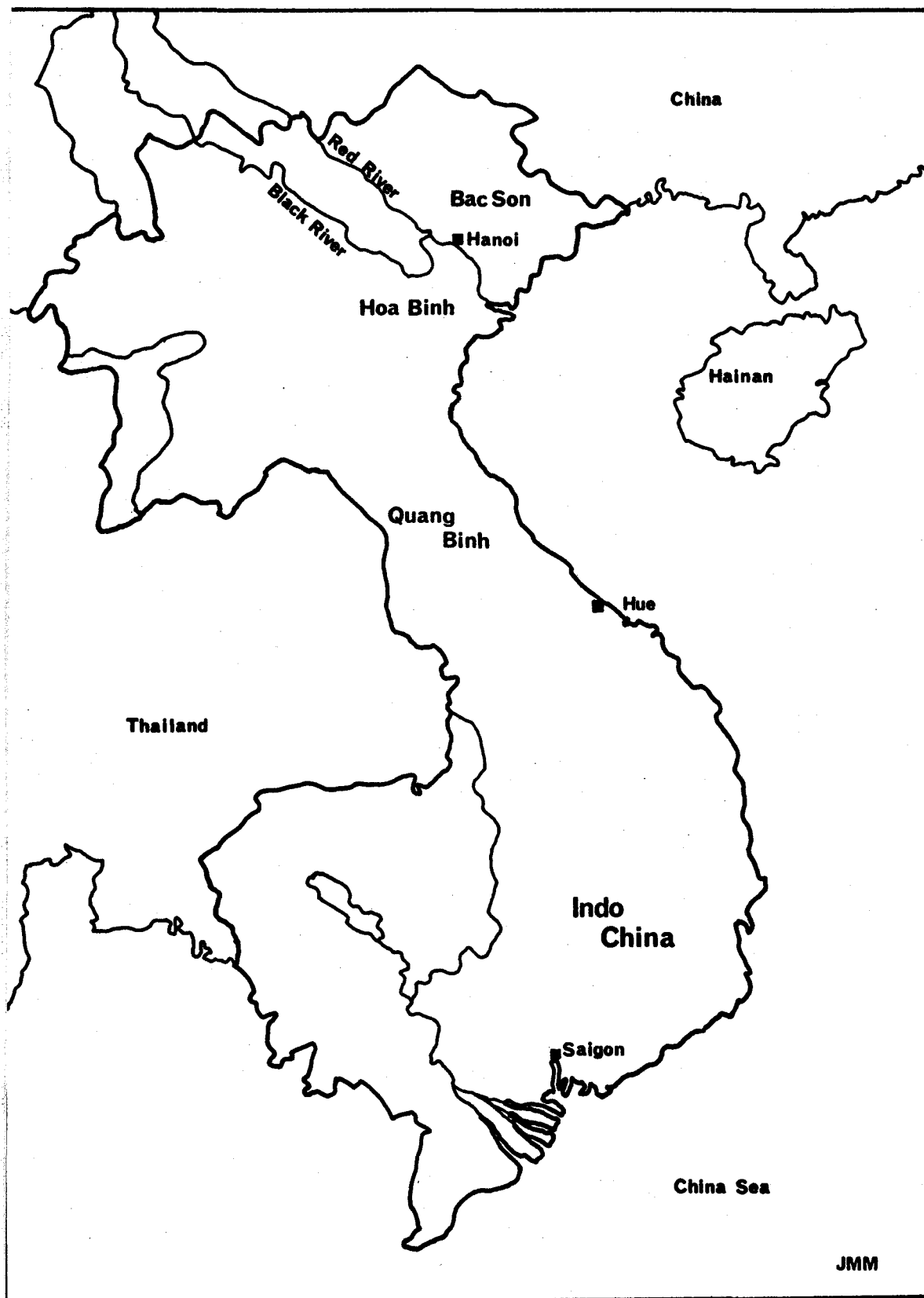
- McBryde, I., 1963. 'Archaeology in New England'. In New England Studies, Ed. R. F. Warner. University of New England; 63-70.
- McCarthy, F. D., 1940. 'Comparison of the prehistory of Australia with that of Indo-China, the Malay Peninsula and Netherlands East Indies'. Proceedings of the Third Congress of Prehistorians of the Far East, 30-50.
- McCarthy, F. D., 1941. 'Two pebble industry sites of Hoabinhien I type on the north coast of New South Wales'. Records of the Australian Museum, 21, 1; 21-27.
- McCarthy, F. D., 1943. 'An analysis of the knapped implements from eight elouera industry stations on the south coast of New South Wales'. Records of the Australian Museum, 21, 3; 127-54.
- McCarthy, F. D., 1943. 'Trimmed pebble implements of Kartan type from ancient kitchen middens at Clybucca, New South Wales'. Records of the Australian Museum, 21, 3; 164-68.
- McCarthy, F. D., 1943. 'Coroid and knapped stone implements of the Bathurst District'. Records of the Australian Museum, 21, 4; 199-210.
- McCarthy, F. D., 1947. 'An analysis of the large stone implements from five workshops on the north coast of New South Wales'. Records of the Australian Museum, 21, 8; 411-31.
- McCarthy, F. D., assisted by E. Bramwell and H. V. V. Noone, 1946. 'The stone implements of Australia'. Australian Museum Memoir, 9.
- MacWhite, E., 1956. 'On the interpretation of archaeological evidence in historical and sociological terms'. American Anthropologist, 58; 3-25.
- Mansuy, H., 1909. 'Gisement préhistorique de la caverne de Pho Binh Gia (Tonkin)'. L'Anthropologie, 20; 531-43.
- Mansuy, H., 1923. 'Résultats de nouvelles recherches effectuées dans le gisement préhistorique de Semrong Sen, Cambodge'. Mémoires du Service Géologique de l'Indochine, 10, 1.

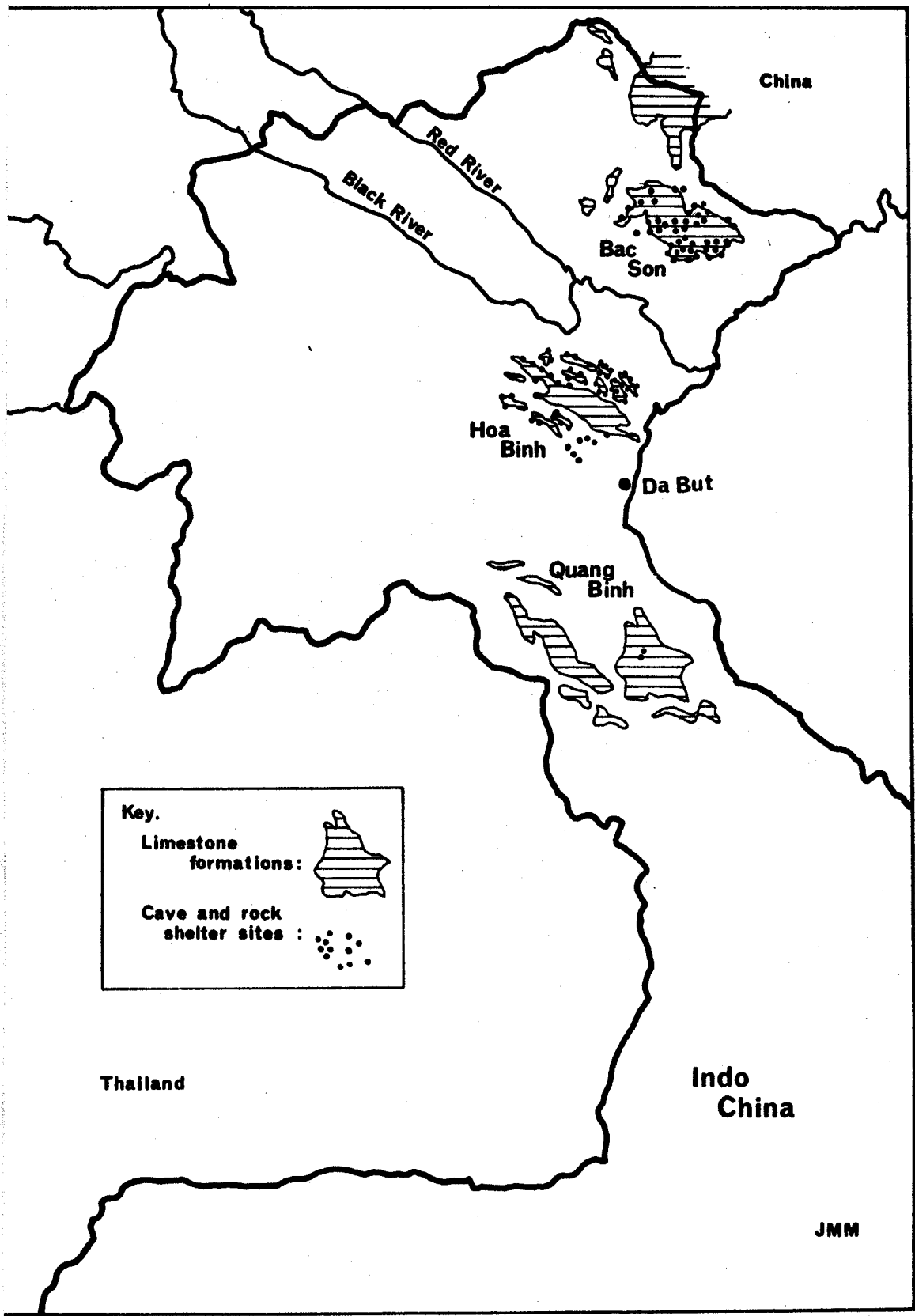
- Mansuy, H., 1924. 'Stations préhistoriques dans les cavernes du massif calcaire de Bac Son (Tonkin)'. Mémoires du Service Géologique de l'Indochine; 11, 2.
- Mansuy, H., 1925. 'Nouvelles découvertes dans les cavernes du massif calcaire de Bac Son (Tonkin)'. Mémoires du Service Géologique de l'Indochine; 12, 1.
- Mansuy, H., 1925. 'Stationes préhistoriques de Keo-Phay (suit), de Khac Kiem (suit), de Lai-Ta (suit) et de Bang Mac, dans le massif calcaire de Bac Son (Tonkin)'. Mémoires du Service Géologique de l'Indochine; 12, 2.
- Mansuy, H. and M. Colani, 1925. 'Néolithique inférieur (Bacsonien) et Néolithique supérieur dans le Haut-Tonkin (dernières recherches). Avec la description des crânes du gisement de Lang Cuom'. Mémoires du Service Géologique de l'Indochine; 12, 3.
- Maringer, J., 1957. 'Some tools of early Hoabinhian type from central Japan'. Man, 57; No. 1.
- Matthews, J. M., 1961. 'A check-list of Hoabinhian sites excavated in Malaya 1860-1939'. Papers on South East Asian Subjects, 3, Department of History, University of Malaya in Kuala Lumpur.
- Matthews, J. M., 1963. 'The application of matrix analysis to archaeological problems'. Nature, 198, 4884; 930-34.
- Mijsberg, W. A., 1932. 'Recherches sur les restes humains trouvés dans les fouilles des abris-sous-roche de Goea-Lawa à Sampoeng et des sites préhistoriques à Bodjonegoro (Java)'. Hommage du Service Archéologique des Indes Néerlandaises au Premier Congrès des Préhistoriens d'Extreme Orient a Hanoi, 39-54.
- Mijsberg, W. A., 1940. 'On a neolithic Palae-Melanesian lower jaw found in a kitchen midden at Guak Kepah, Province Wellesley, Straits Settlements'. Proceedings of the Third Congress of Prehistorians of the Far East; 100-18.
- Mo-Chih, 1959. K'ao-ku-t'ung-hsun, 4; 1-15.
- Montandon, G., 1928. 'L'ologenese humaine (Ologenisme)', Paris.
- Moroney, M. J., 1956. Facts from figures. Penguin Books.

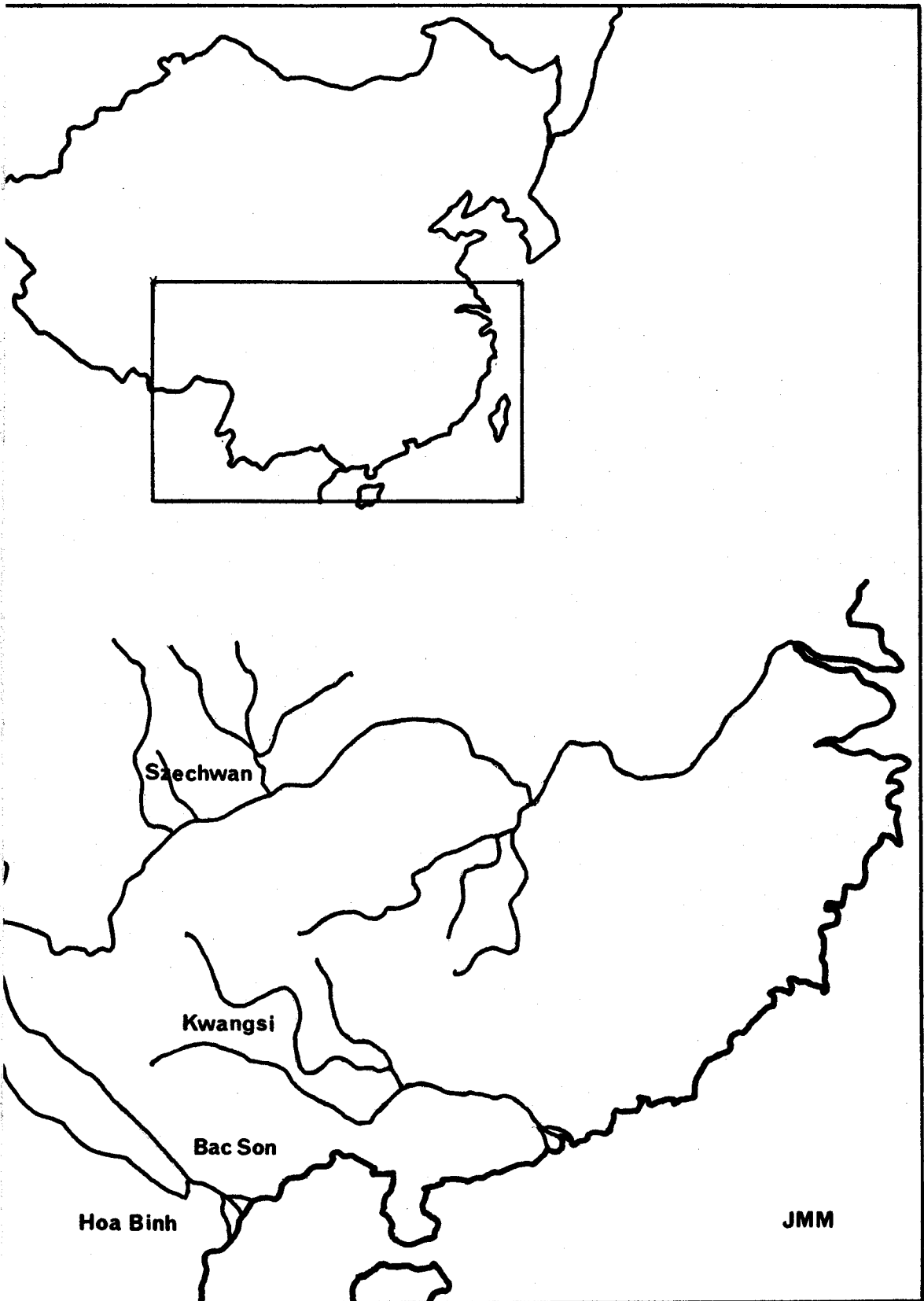
- Mülhofer, F., 1938. 'Steinwerkzeuge aus dem muschelhugel von Bindjai-Tamjang in Nord-Sumatra'. Wiener Prähistorische Zeitschrift, 25; 30-34.
- Mulvaney, D. J., 1961. 'The stone age of Australia'. Proceedings of the Prehistoric Society, 20; 56-107.
- Nielsen, E., 1961. 'The Thai-Danish Prehistoric Expedition 1960-1962. Preliminary expedition 1960-1961'. Journal of the Siam Society, 49, 2; 47-57.
- Nielsen, E., 1962. 'The Thai-Danish Prehistoric Expedition 1960-1962'. Journal of the Siam Society, 50, 1; 7-15.
- Noone, H. D., 1939. 'Report on a new neolithic site in Ulu Kelantan'. Journal of the Federated Malay States Museums, 15, 4; 170-74.
- Patte, E., 1936. 'L'Indochine préhistorique'. Revue Anthropologique; 46, 10-12.
- Patte, E., 1932. 'Le kjökkenmødding néolithique de Da But et ses sépultures'. Bulletin du Service Géologique de l'Indochine; 19, 3.
- Peng Ju-tze and Wang Wei, 1959. Wen-wu, 5; 75.
- Phillips, P. and J. A. Ford and J. B. Griffin, 1951. 'Archaeological survey in the lower Mississippi alluvial valley, 1940-1947'. Papers of the Peabody Museum of American Archaeology and Ethnology, 25.
- Phillips, P. and G. R. Willey, 1953. 'Method and theory in American Archaeology: an operational basis for culture historical integration'. American Anthropologist, 55; 615-33.
- Praehistorica Asiae Orientalis, 1932. Hanoi.
- Robinson, W. S., 1951. 'A method for chronologically ordering archaeological deposits'. American Antiquity, 16, 4; 293-301.
- Rouse, I., 1939. 'Prehistory in Haiti, a study in method'. Yale University Publications in Anthropology, 21.
- Sarasin, F., 1933. 'Recherches préhistoriques en Siam'. L'Anthropologie, 43; 1-40.

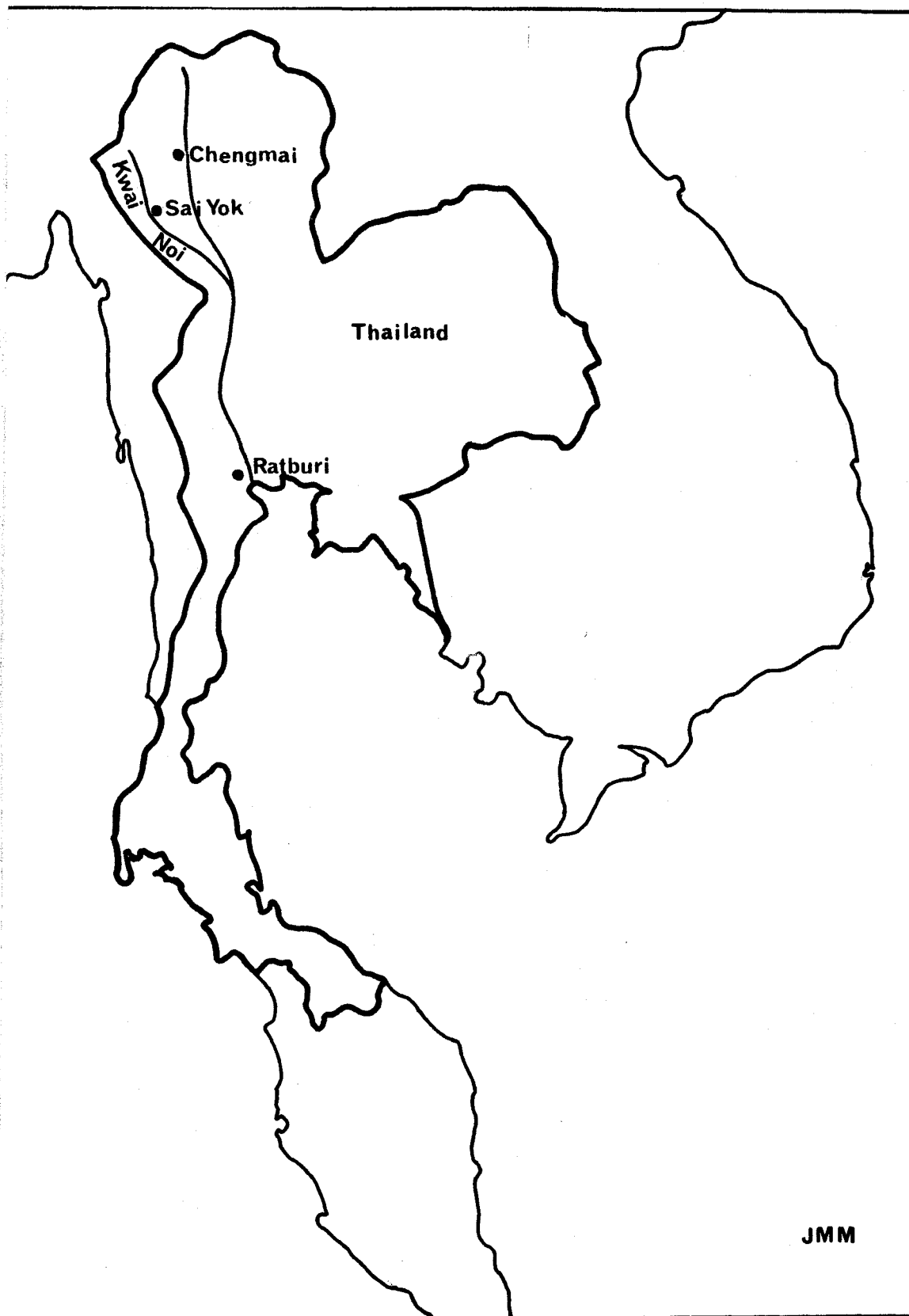
- Schürmann, H. M. E., 1931. 'Kjökkenmøddinger und palaeolithikum in Nord-Sumatra'. Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap, 48; 905-23.
- Scrivenor, J. B., 1931. The Geology of Malaya. London.
- Sieveking, G. de G., 1954. 'Excavations at Gua Cha, Kelantan, 1954. Part 1'. Federation Museums Journal, New Series, 1 and 2; 75-143.
- Simpson, G. G., 1961. The Principles of Animal Taxonomy. London.
- Sneath, P. H. and R. R. Sokal, 1962. 'Numerical Taxonomy'. Nature, 193, 4818; 855-60.
- Snell, C. A. R. D., 1949. 'Human skeletal remains from Gol Ba'it, Sungei Siput, Perak, Malay Peninsula'. Acta Neerlandica Morphologicae Normalis et Pathologicae, 6, 4; 1-25.
- Solheim, W. G., 1962. 'South east Asia'. Asian Perspectives, 6, 1-2; 23-31.
- Sorensen, P., 1962. 'The Thai-Danish Prehistoric Expedition 1960-1962'. Folk, 4; 28-45.
- Spaulding, A. C., 1960. 'Statistical description and comparison of artefact assemblages'. In The Application of Quantitative Methods in Archaeology, Ed. R. F. Heizer and S. F. Cook; 69-93.
- Tindale, N. B., 1937. 'The relationship of the extinct Kangaroo Island culture with cultures of Australia, Tasmania and Malaya'. Records of the South Australian Museum, 6, 1; 41-60.
- Tindale, N. B., 1957. 'Culture succession in south eastern Australia from the late Pleistocene to the present'. Records of the South Australian Museum, 13, 1; 1-49.
- Tindale, N. B. and B. G. Maeagraith, 1931. 'Traces of an extinct aboriginal population on Kangaroo Island'. Records of the South Australian Museum, 4, 3; 244-75.
- Trevor, J. C. and D. R. Brothwell, 1962. 'The Human Remains of Mesolithic and Neolithic Date from Gua Cha, Kelantan'. Federation Museums Journal, New Series, 7; 6-23.

- Tugby, D. J., 1958. 'A typological analysis of axes and choppers from south east Australia'. American Antiquity, 24; 24-33.
- Tweedie, M. W. F., 1936. 'Report on cave excavations carried out in Bukit Chintamani, near Bentong, Pahang'. Bulletin of the Raffles Museum, Series B, 1, 1; 17-25.
- Tweedie, M. W. F., 1940. 'Report on excavations in Kelantan'. Journal of the Malayan Branch of the Royal Asiatic Society, 18, 2; 1-22.
- Tweedie, M. W. F., 1953. 'The stone age in Malaya'. Journal of the Malayan Branch of the Royal Asiatic Society, 26, 2; 1-90.
- Verneau, R., 1909. 'Les crânes humains du gisement de Pho Binh Gia (Tonkin)'. L'Anthropologie, 20; 545-49.
- Wastl, J., 1939. 'Prähistorische menschenreste aus dem muschelhugel von Bindjai-Tamang in Nord Sumatra'. Kultur und Rasse, 237-43.
- Wheeler, Sir Mortimer, 1954. Archaeology from the Earth. Oxford University Press.
- White, S. A., 1919. 'Notes on the occurrence of aboriginal remains below marine deposits at the reedbeds, Fulham, near Adelaide'. Transactions of the Royal Society of South Australia, 43; 77-80.
- Willey, G. R. and P. Phillips, 1958. Method and Theory in American Archaeology. Chicago University Press.
- Wray, L., 1905. 'Further notes on the cave dwellers of Perak'. Journal of the Federated Malay States Museums, 1, 1; 13-15.

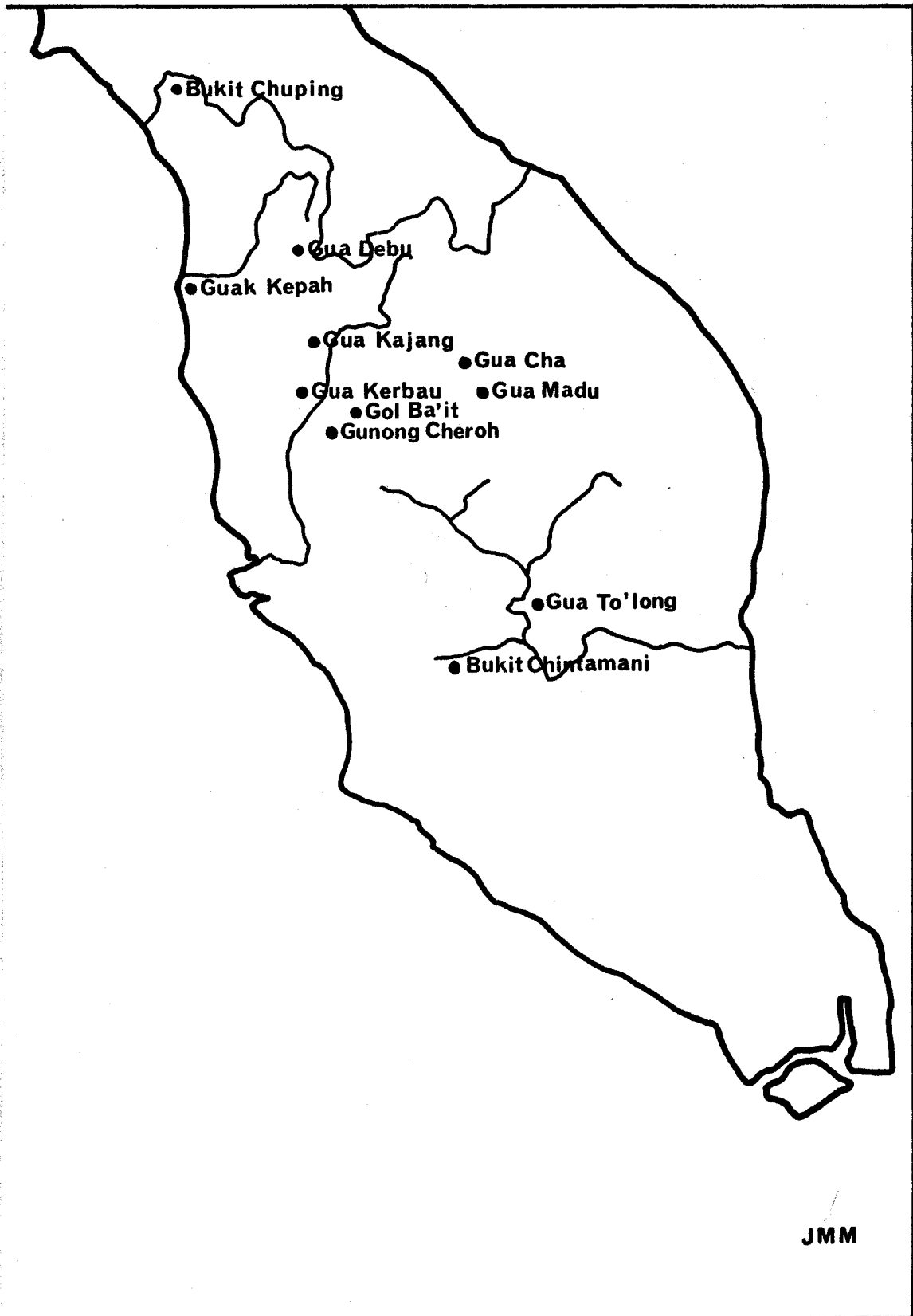




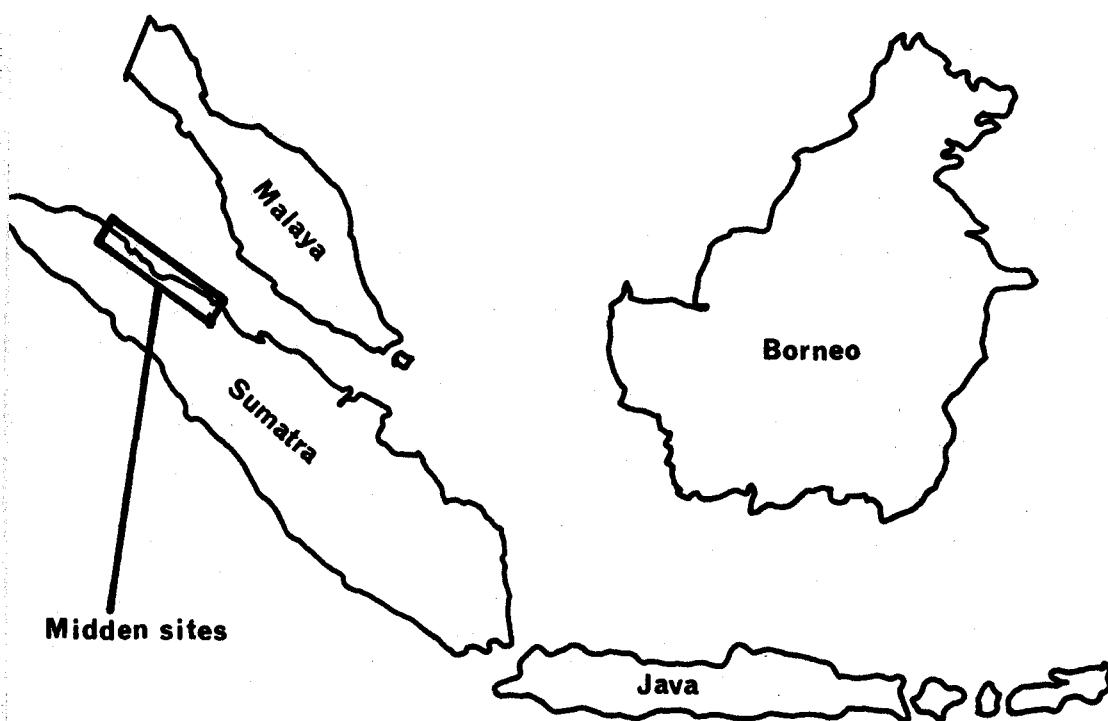




Map 4. Thailand.



Map 5 . Sites in Malaya.



JMM

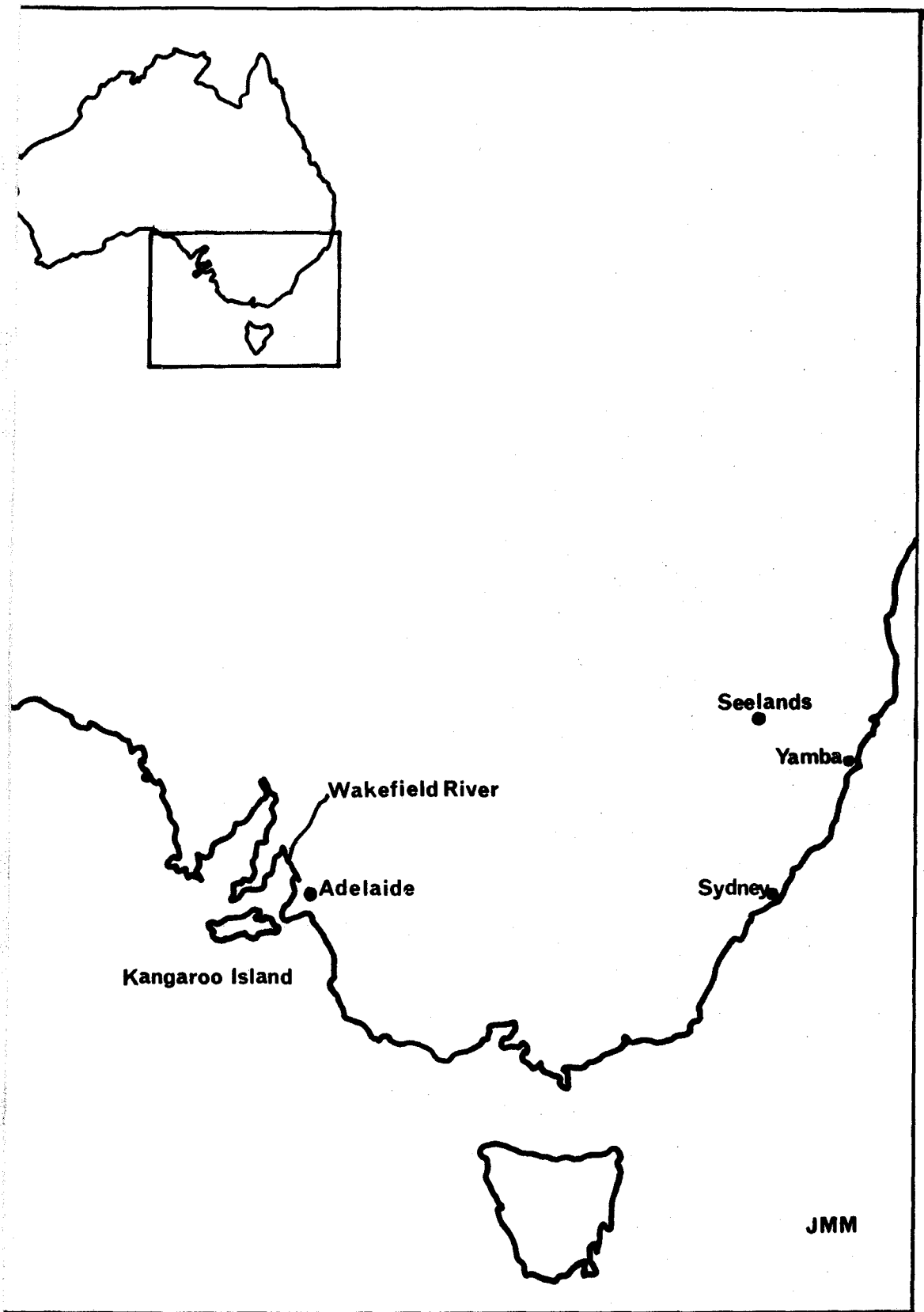


Figure 1

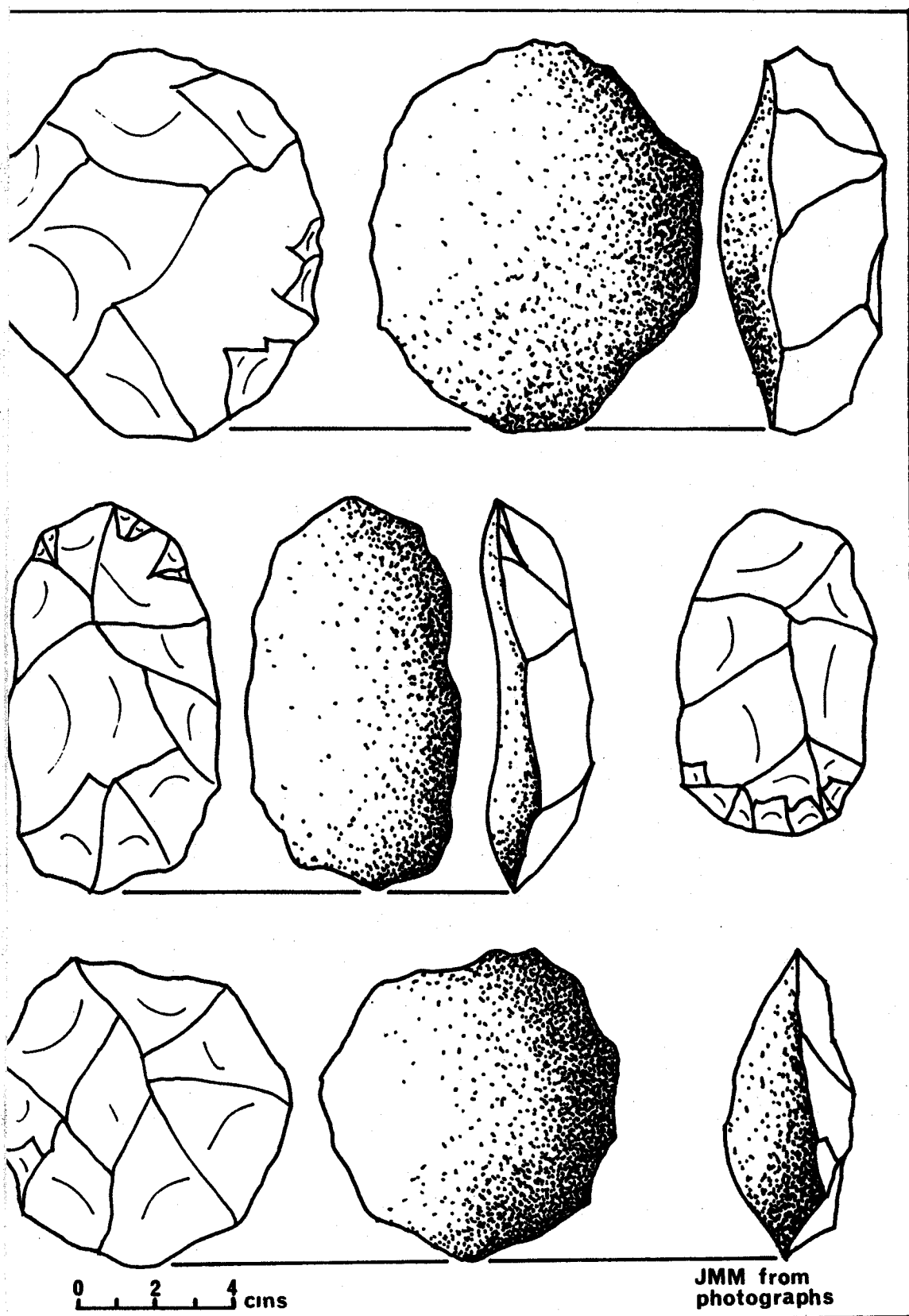


Figure 1 . Pebble artefacts from Hoa Binh.

Figure 2

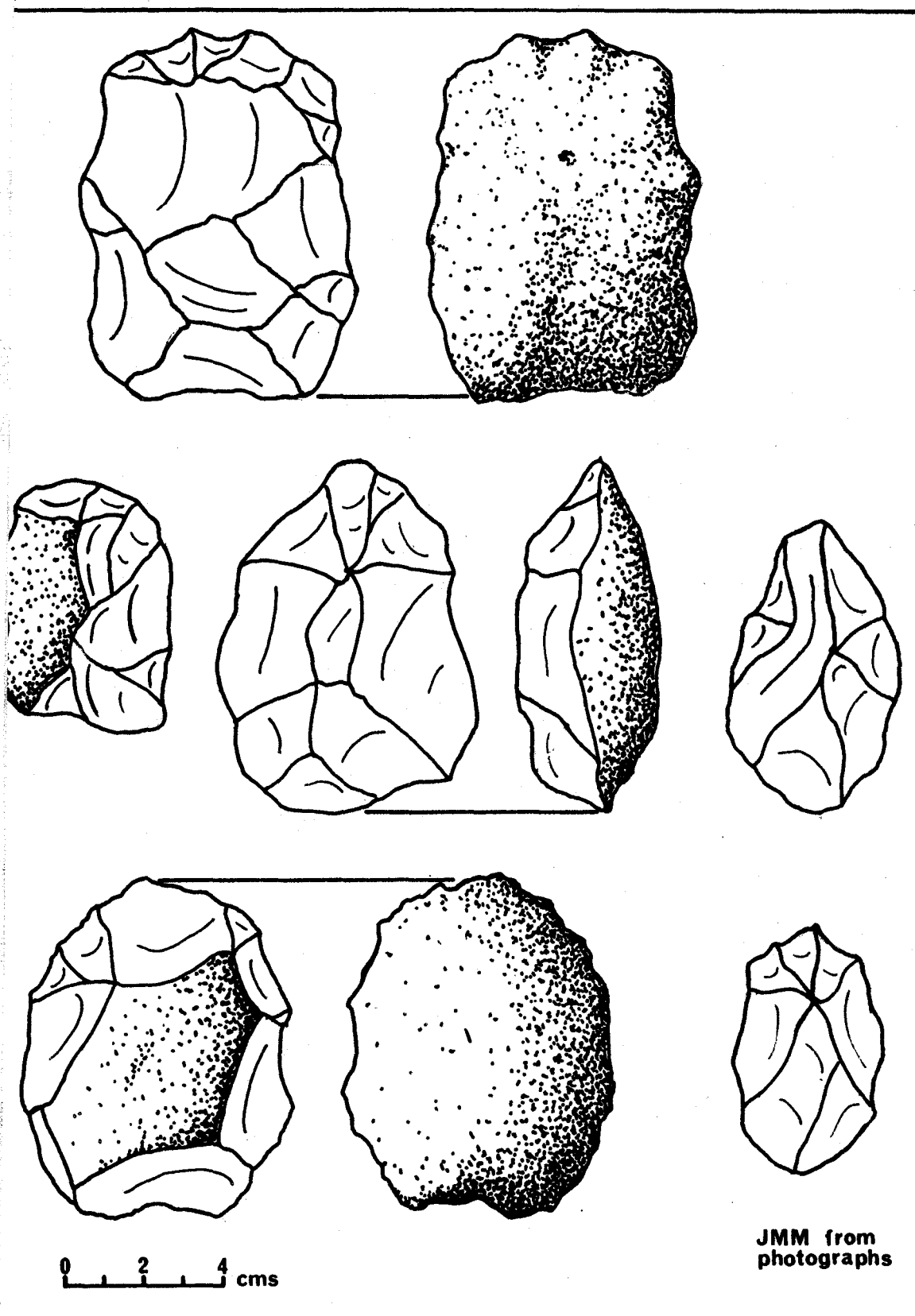
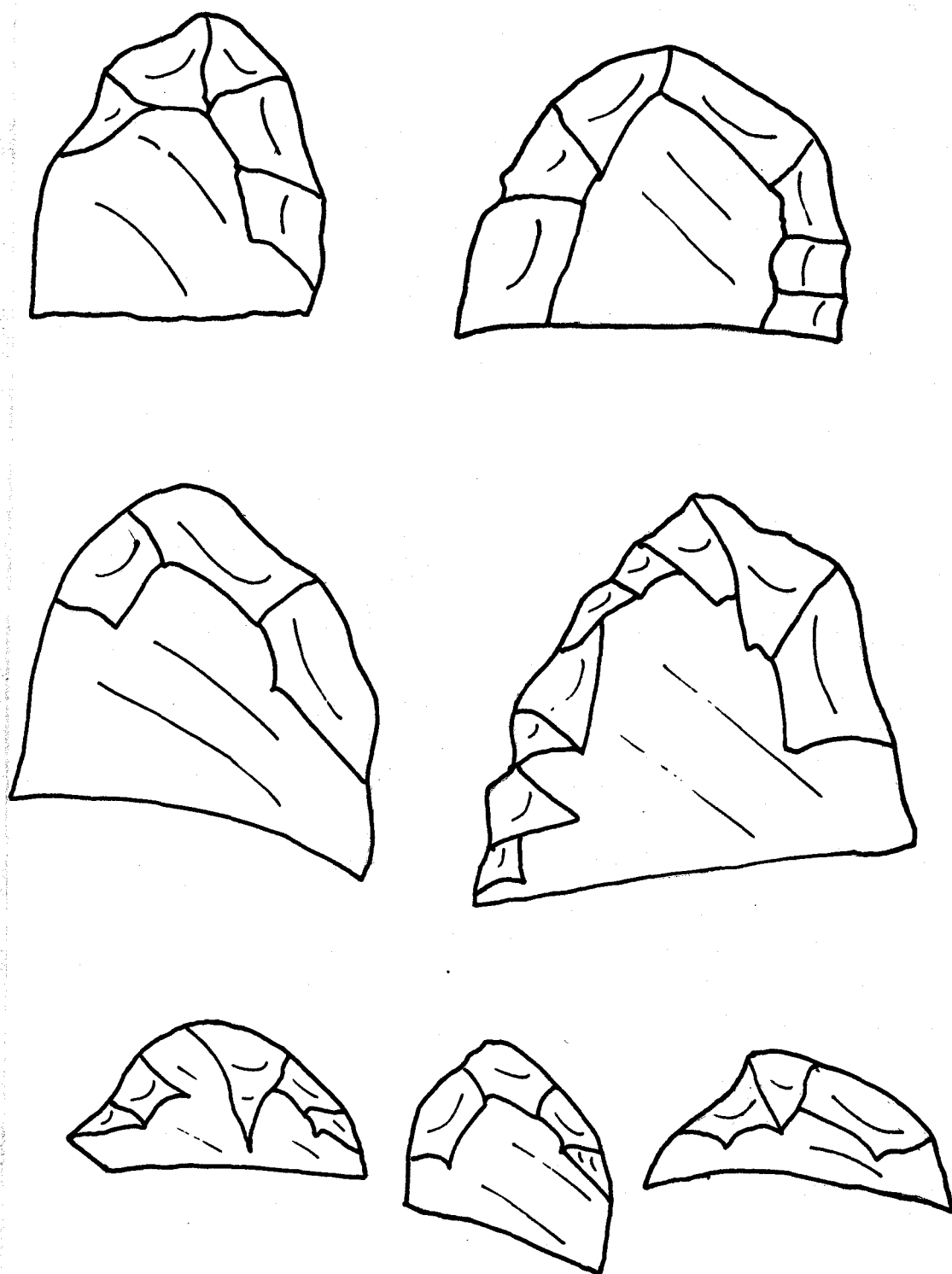


Figure 2 . Pebble artefacts from Hoa Binh .

Figure 3



0 2 4 cms

JMM from
photographs

gure 3 . Short axes from Hoa Binh.

Figure 4

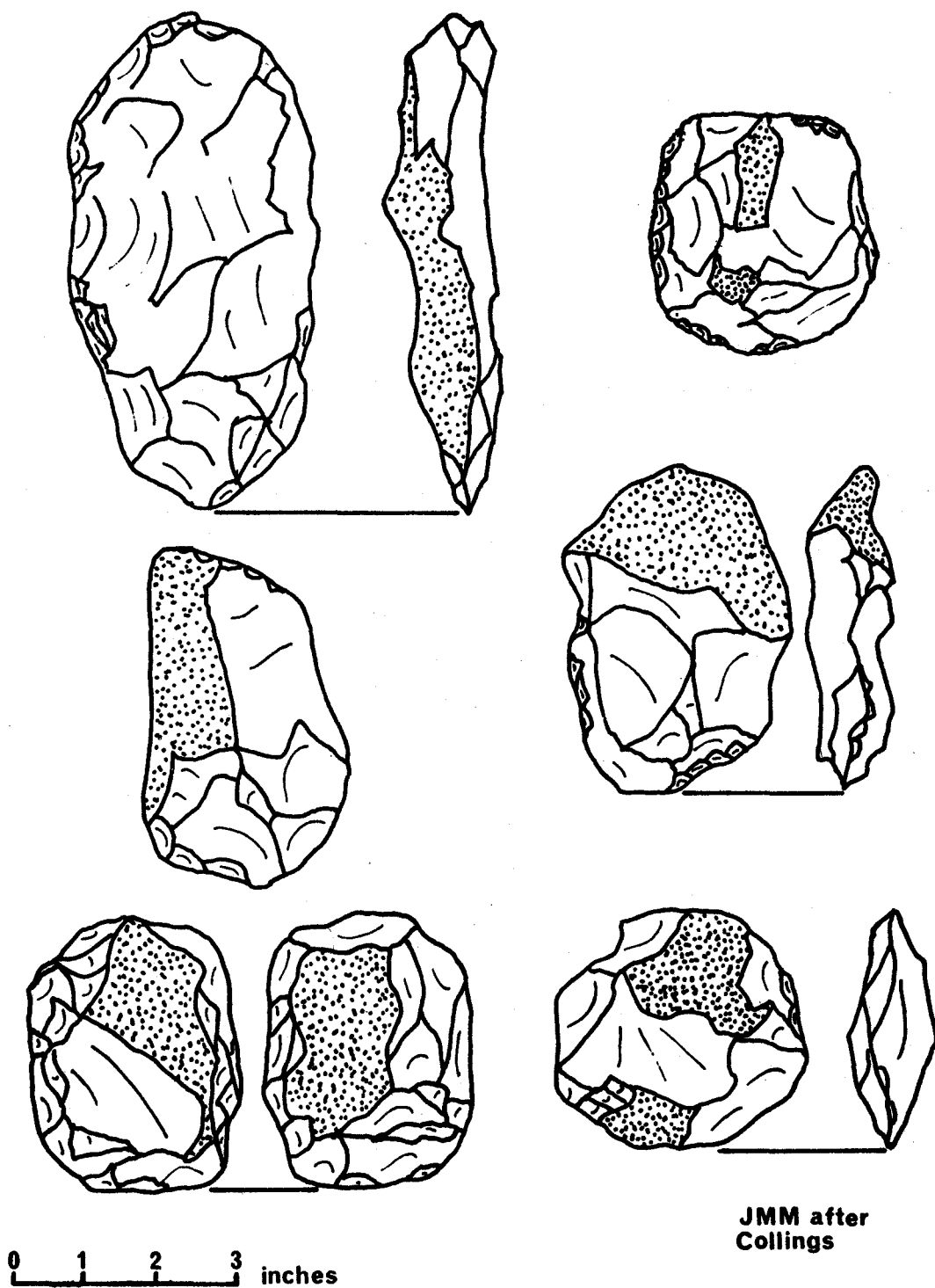


Figure 4 . Pebble tools from Malaya .

Figure 5

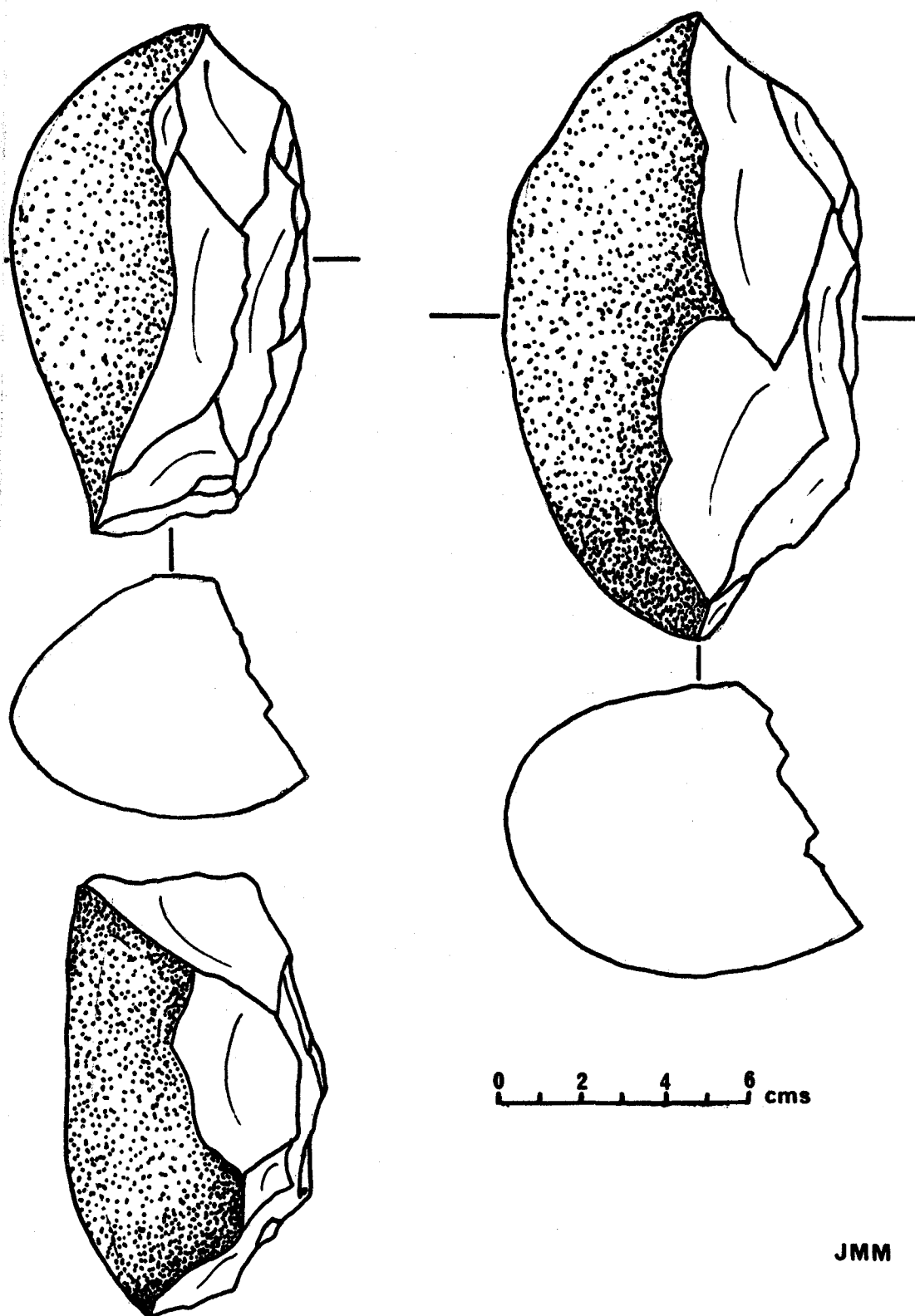


Figure 5 . Pebble artefacts from Kangaroo Island .

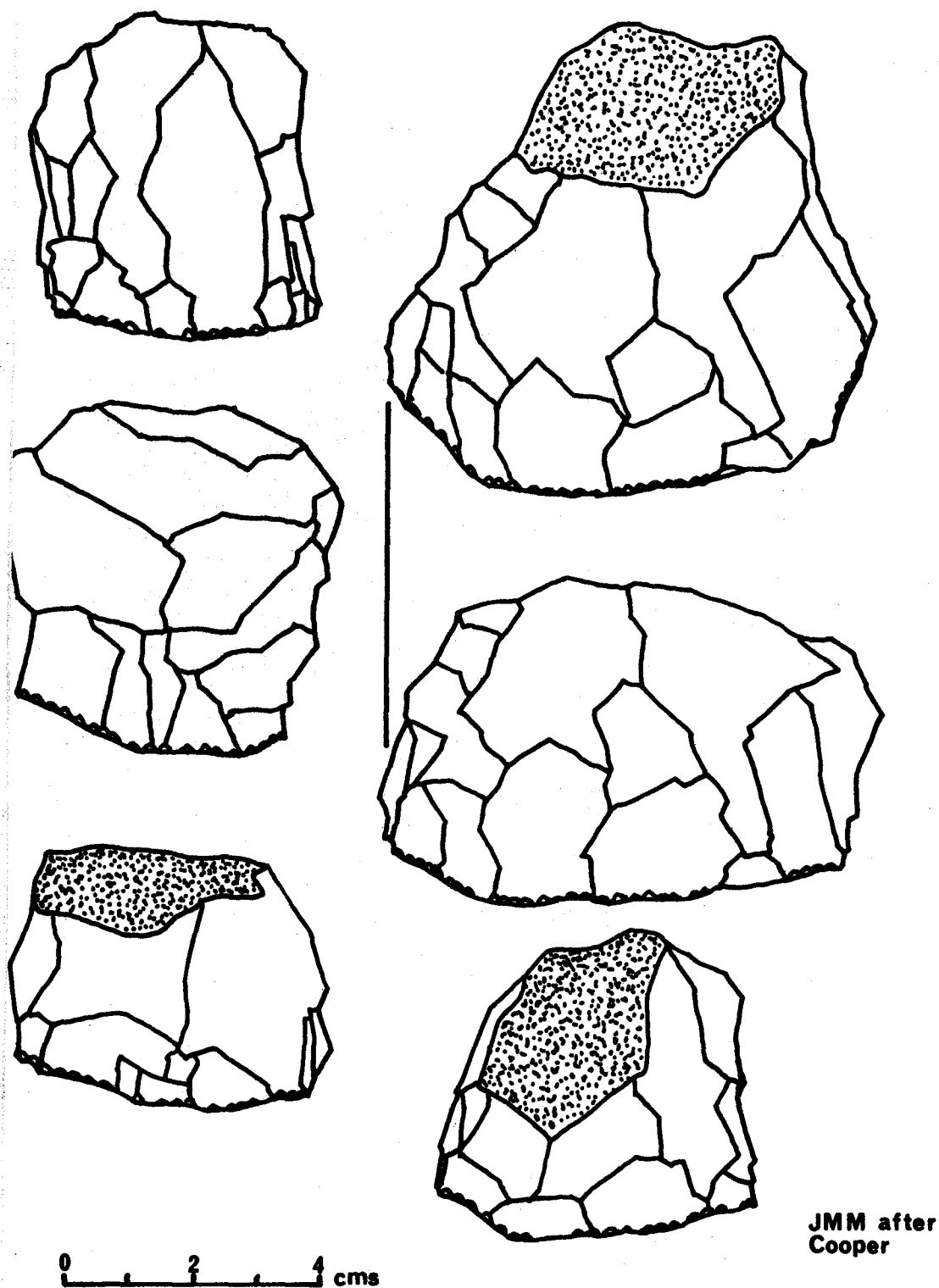


Figure 6 .Artefacts from the Wakefield River.

Figure 7

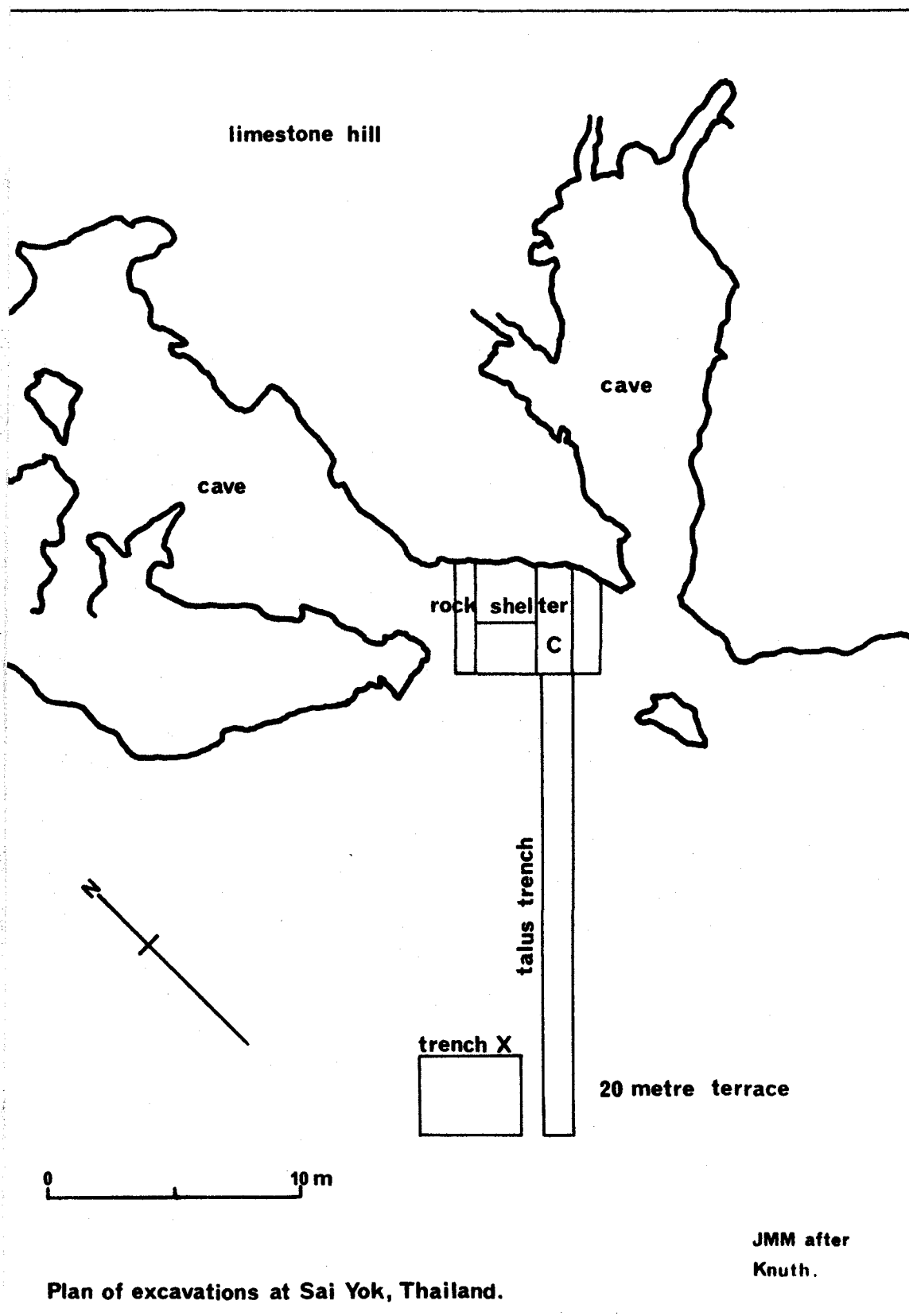


Figure 7.

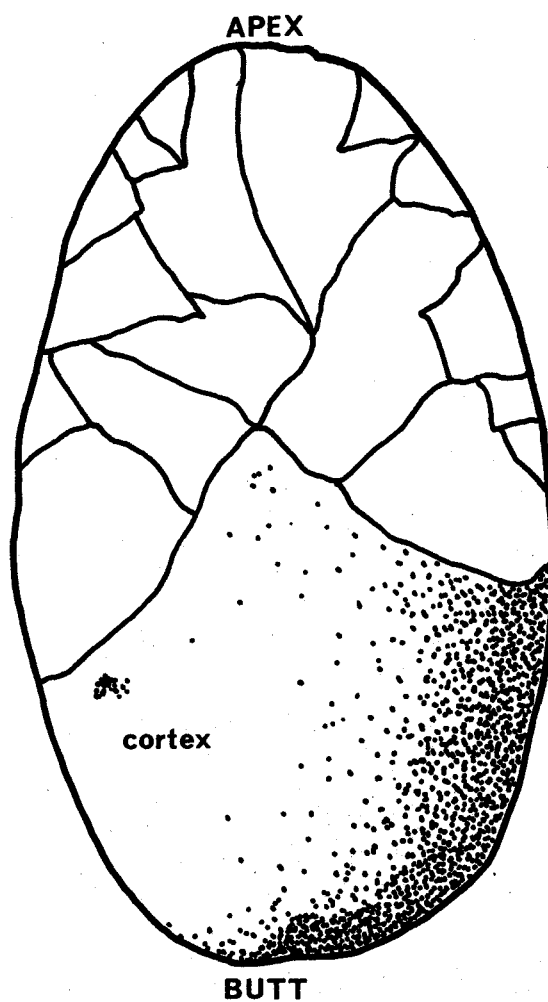


Figure 8 .

JMM

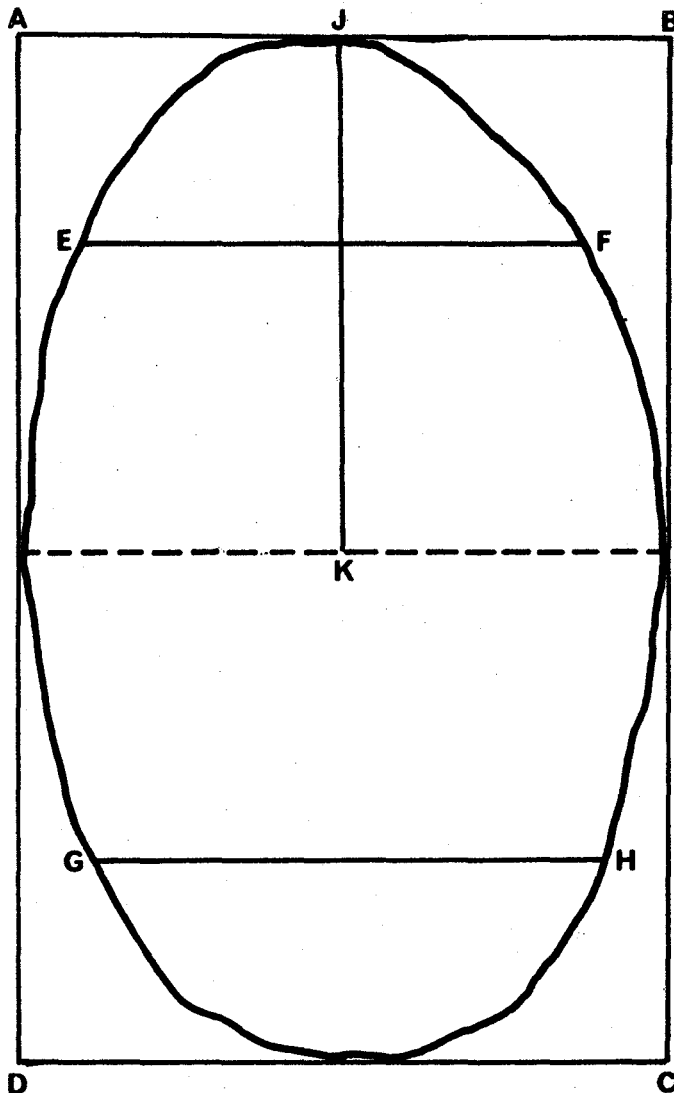


Figure 9. ABCD: containing rectangle.
 AB: max.breadth.
 AD: max.length.
 EF: breadth at $\frac{1}{5}$ length.
 GH: $\frac{4}{5}$
 JK: relation of max.breadth position to length.

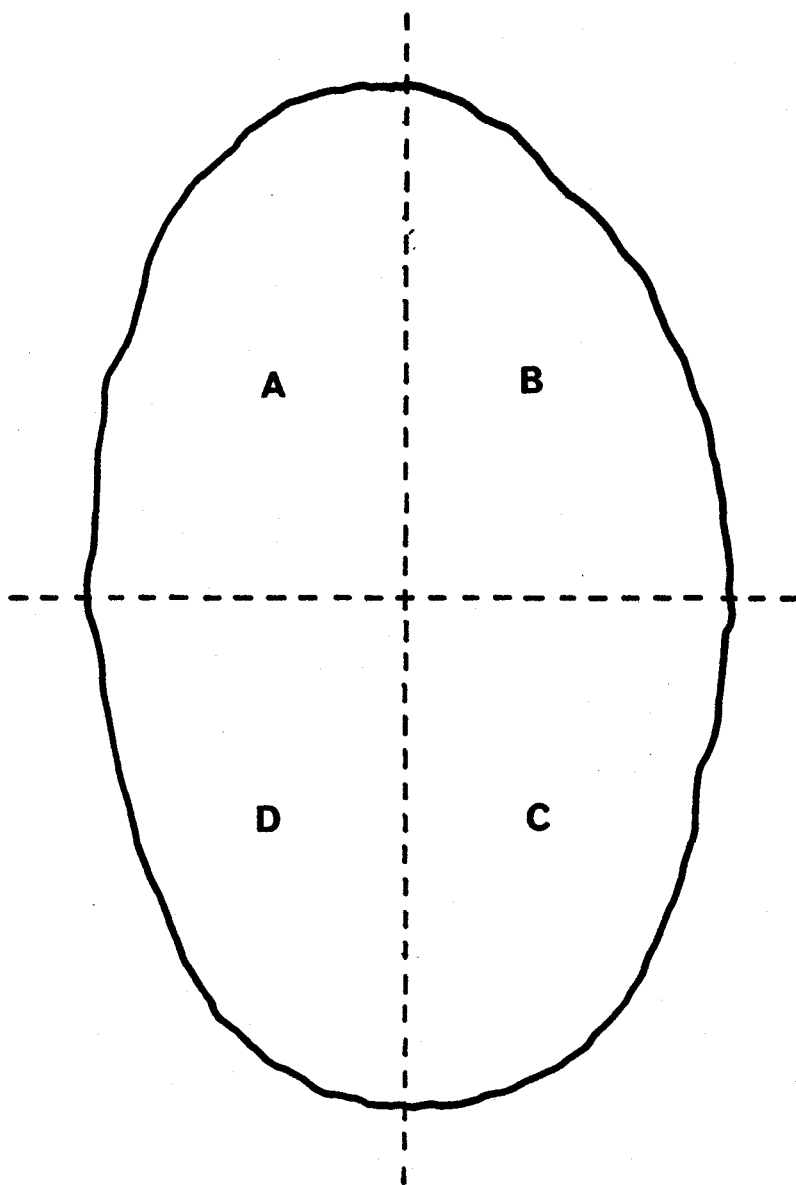
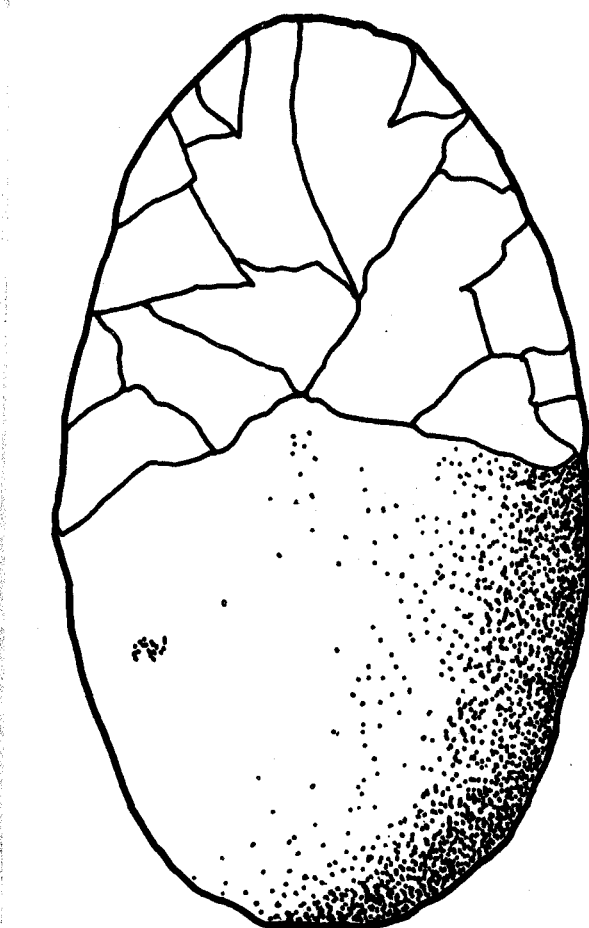


Figure 10 . Quadrants A,B,C and D.



Code :

1. 43
2. 39
3. 73
4. 31
5. 35
6. ()
7. ()
8. NNNN
9. SSNN
10. NNNN
11. SSNN
12. CV CV CV CV
13. CF CF CC CC
14. AAAA
15. NNAA
16. ()
17. ()

0 10 20 30
scale in mms.

Figure 11. Representation of face two of an unifacially flaked pebble tool with coded description.

Figure 12

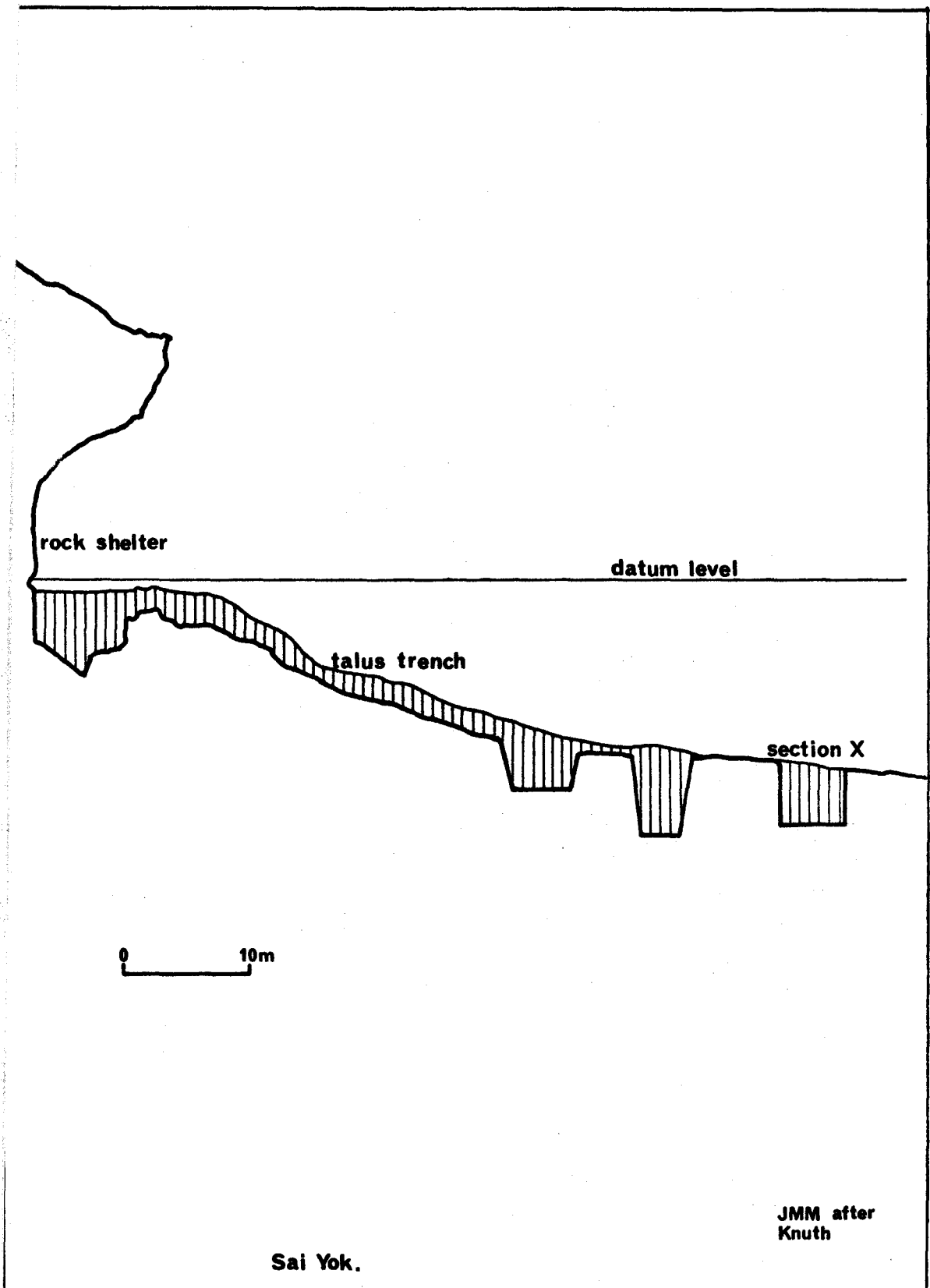


Figure 12.

Figure 13.

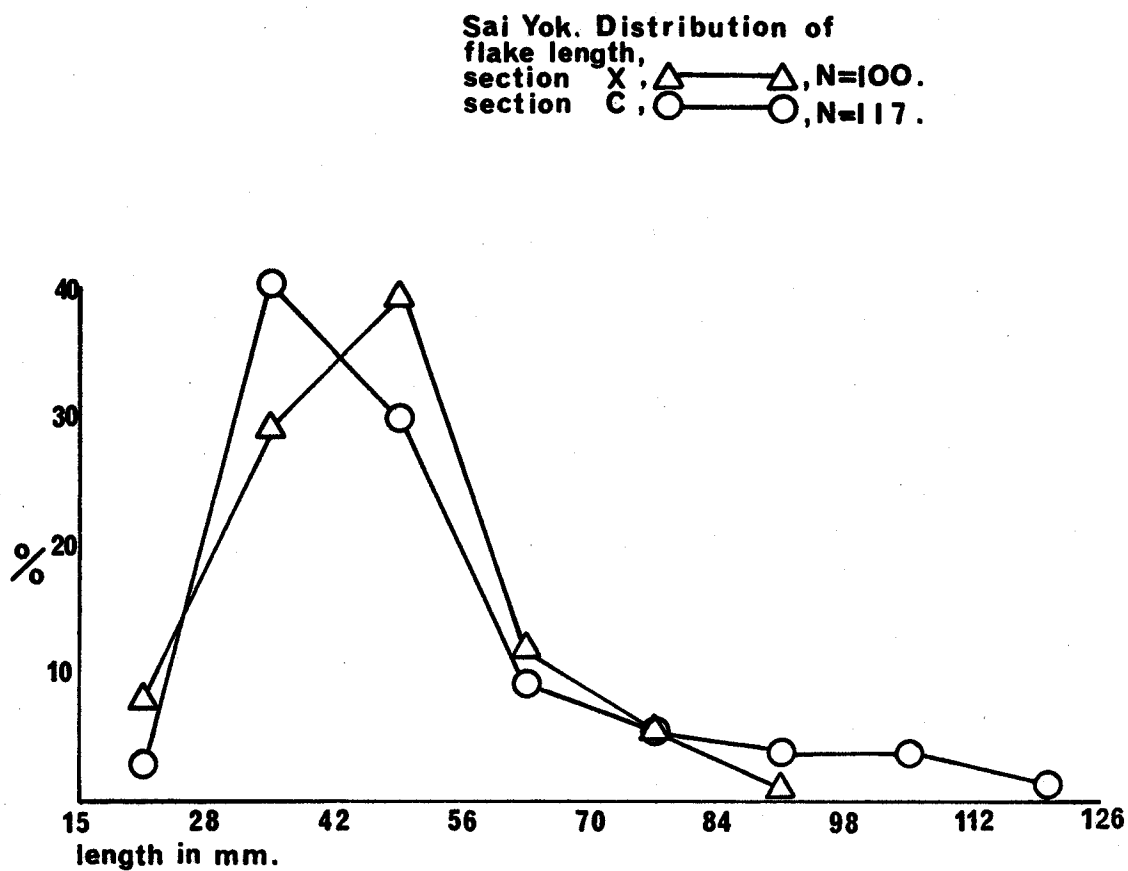


Figure 13 .

JMM

Figure 14

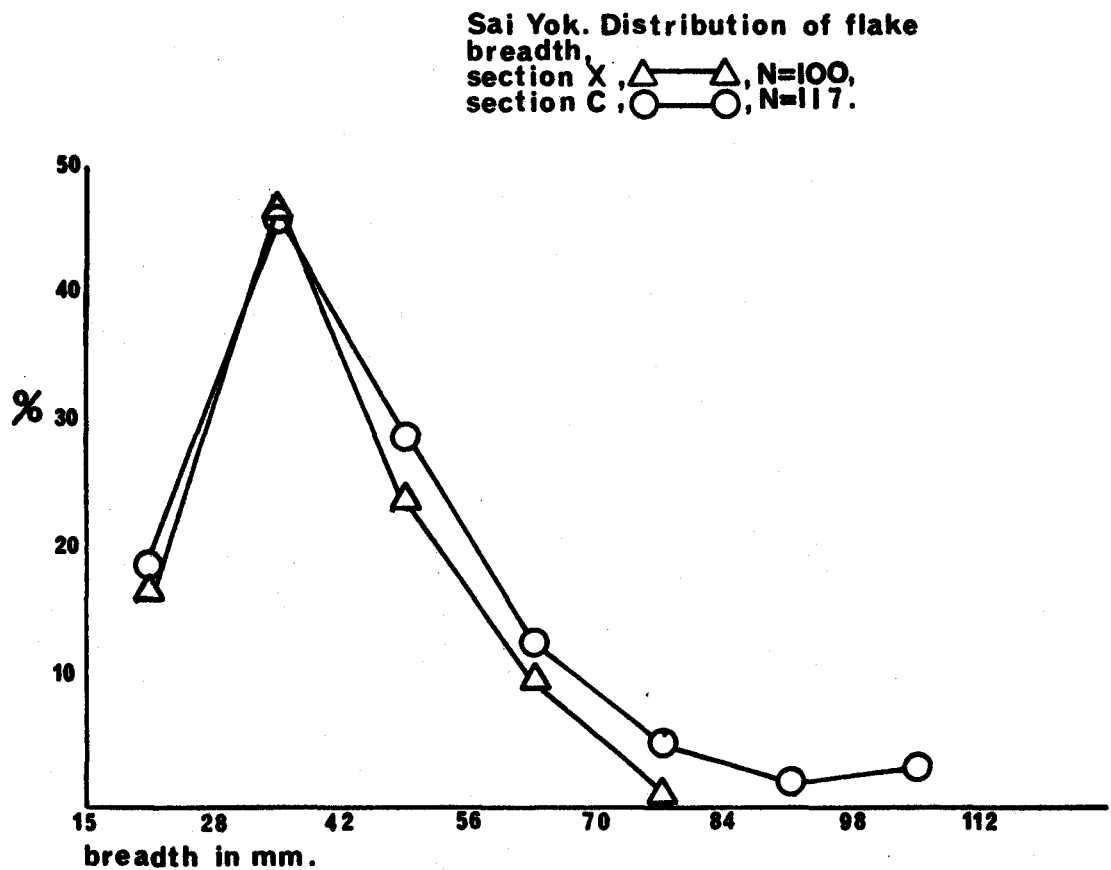


Figure 14.

JMM

Figure 15

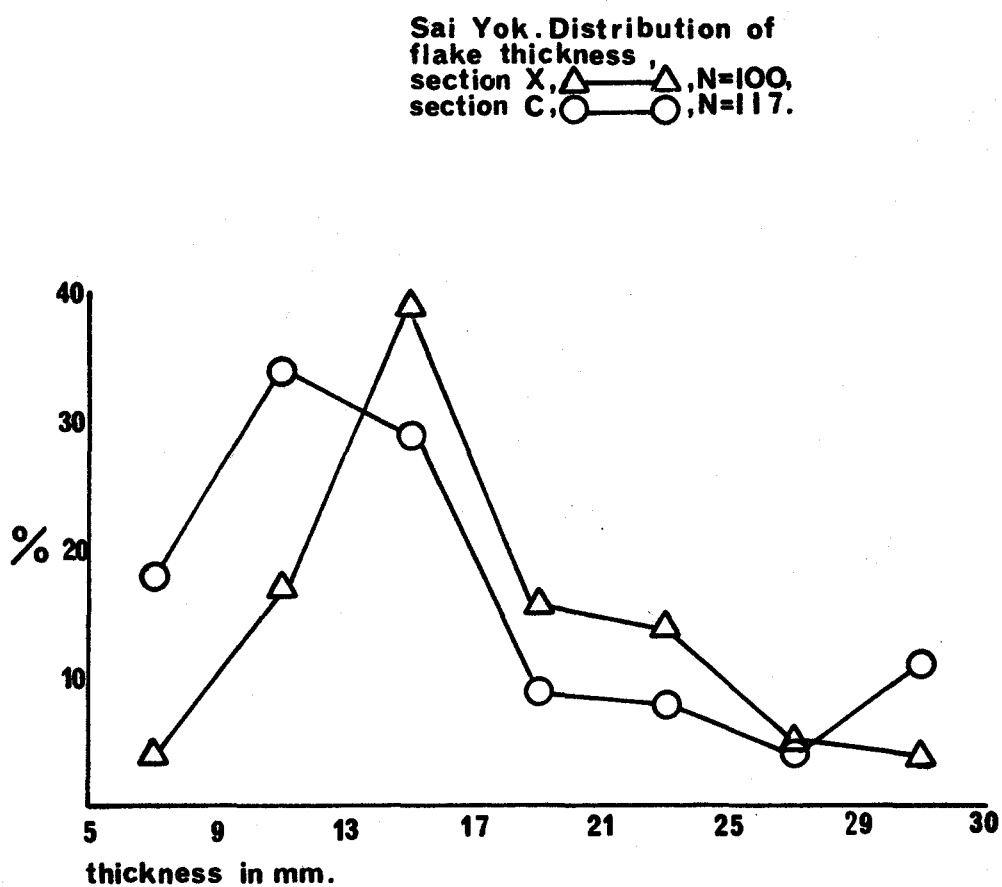


Figure 15 .

JMM

Sai Yok. Distribution of length/breadth
index for flakes,
section X, $\triangle$ — $\triangle$, N=100,
section C, $\circ$ — $\circ$, N=117.

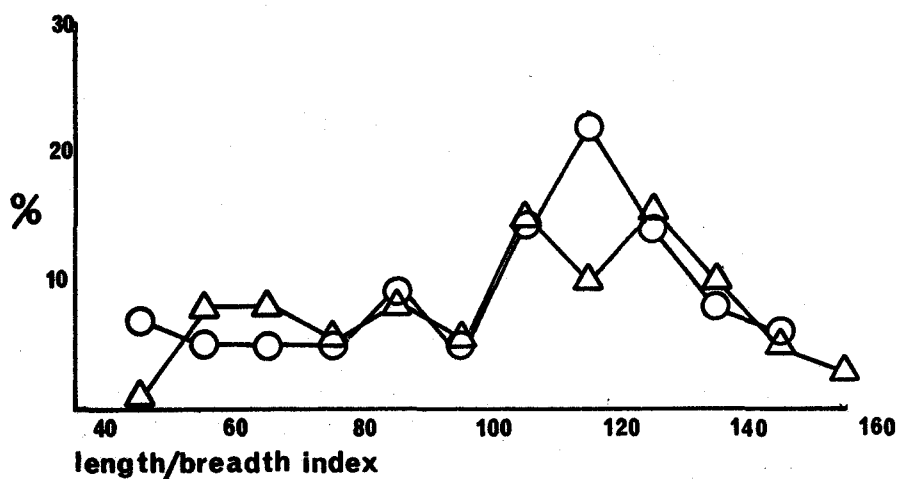
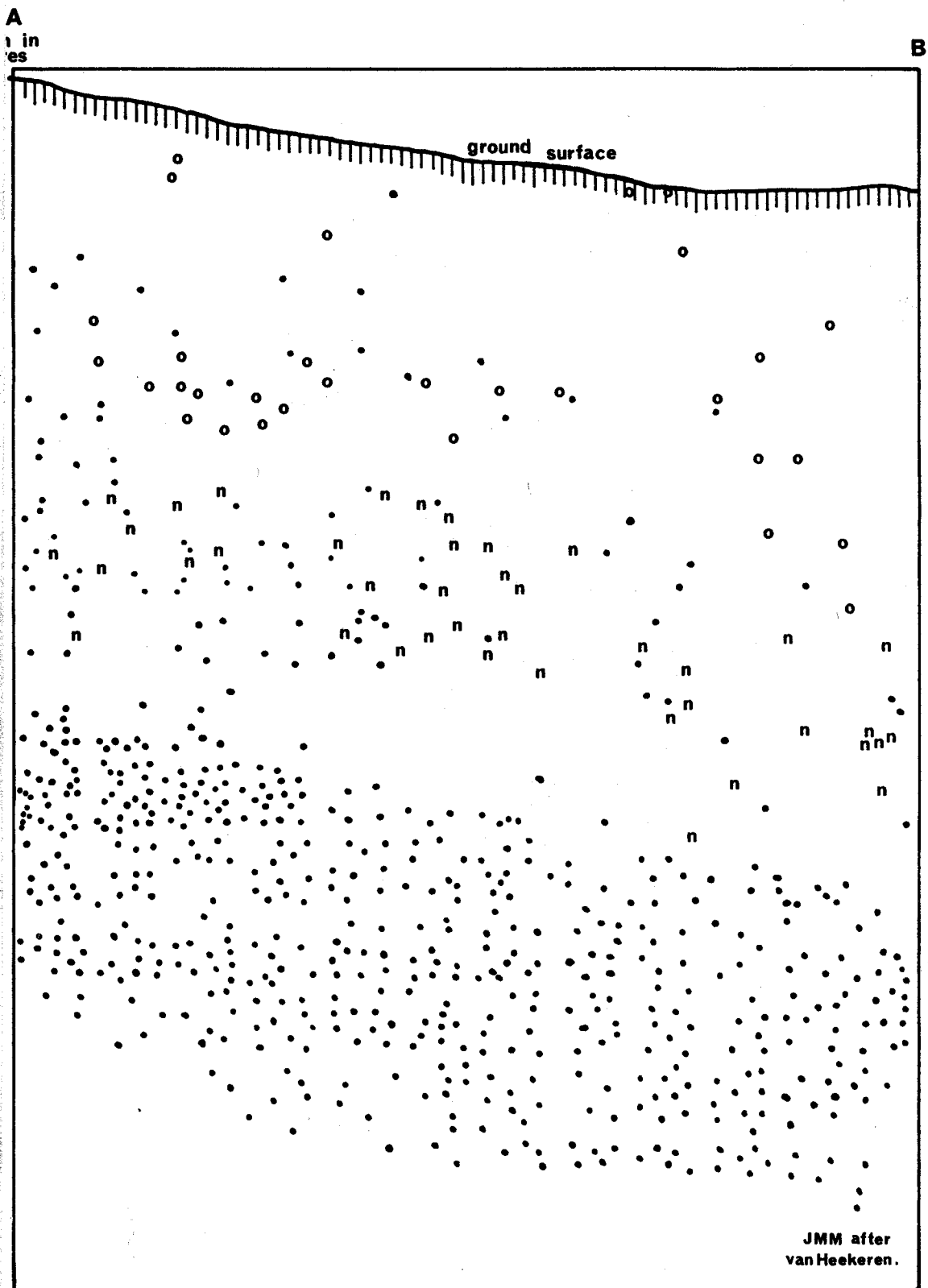


Figure 16.

JMM



Key: o, historic artefacts; n, neolithic artefacts; •, mesolithic artefacts.

Figure 17 . Sai Yok; diagrammatic projection of section X against profile AB to show distribution of artefacts.

Figure 18

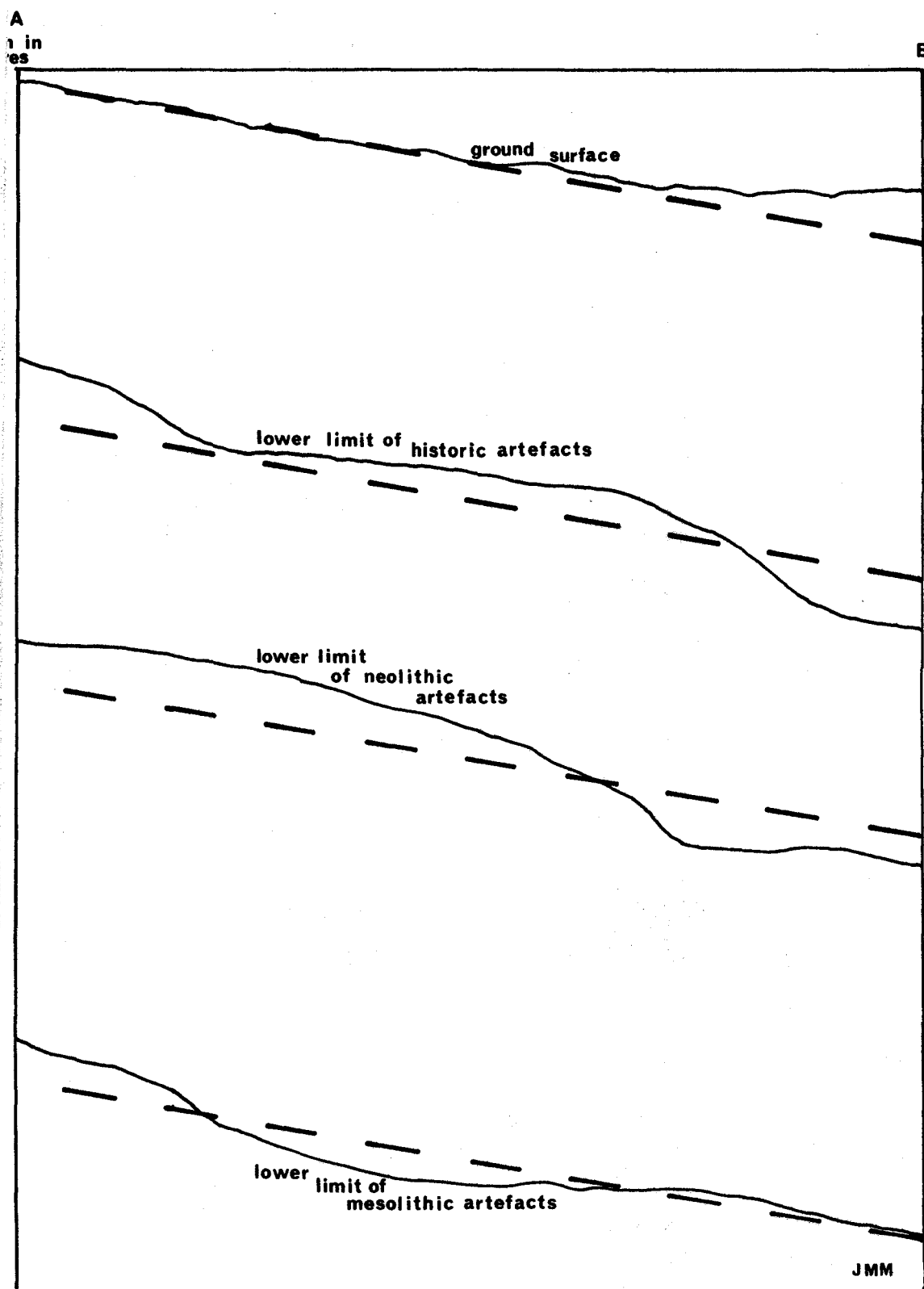


Figure 18 . Sai Yok; digramatic projection of section X against profile AB to show apparent declination of archaeological horizons.

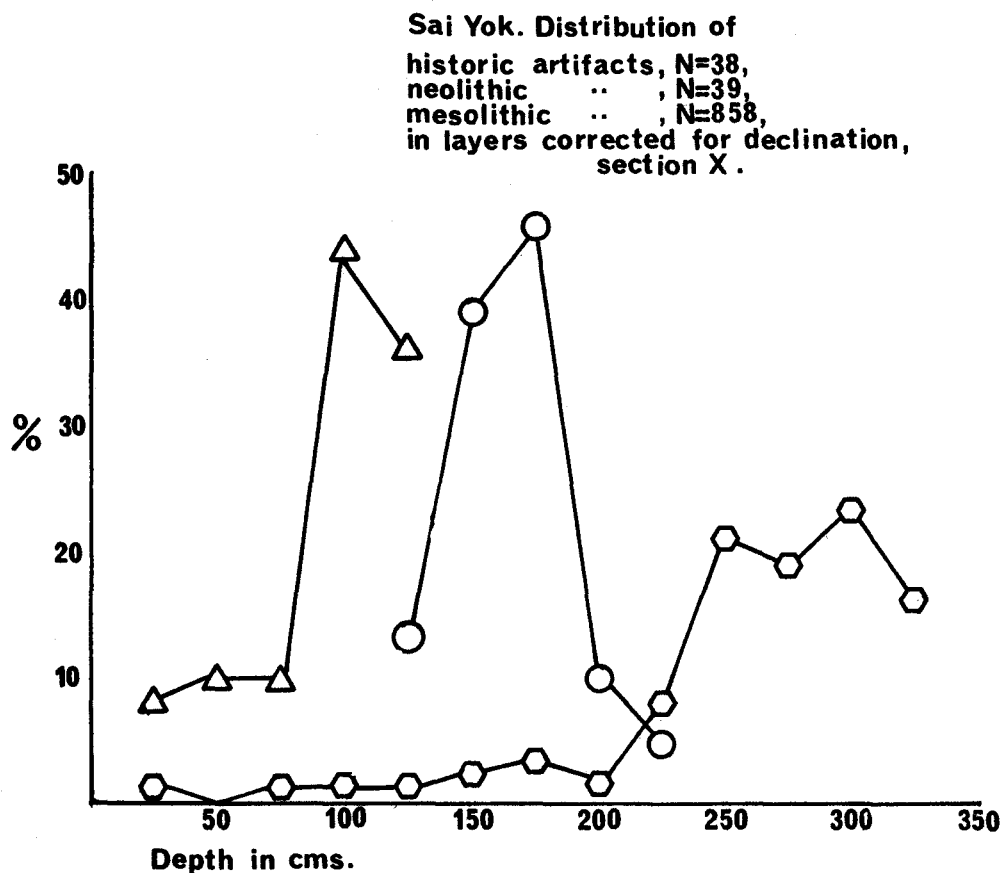


Figure 19 .

JMM

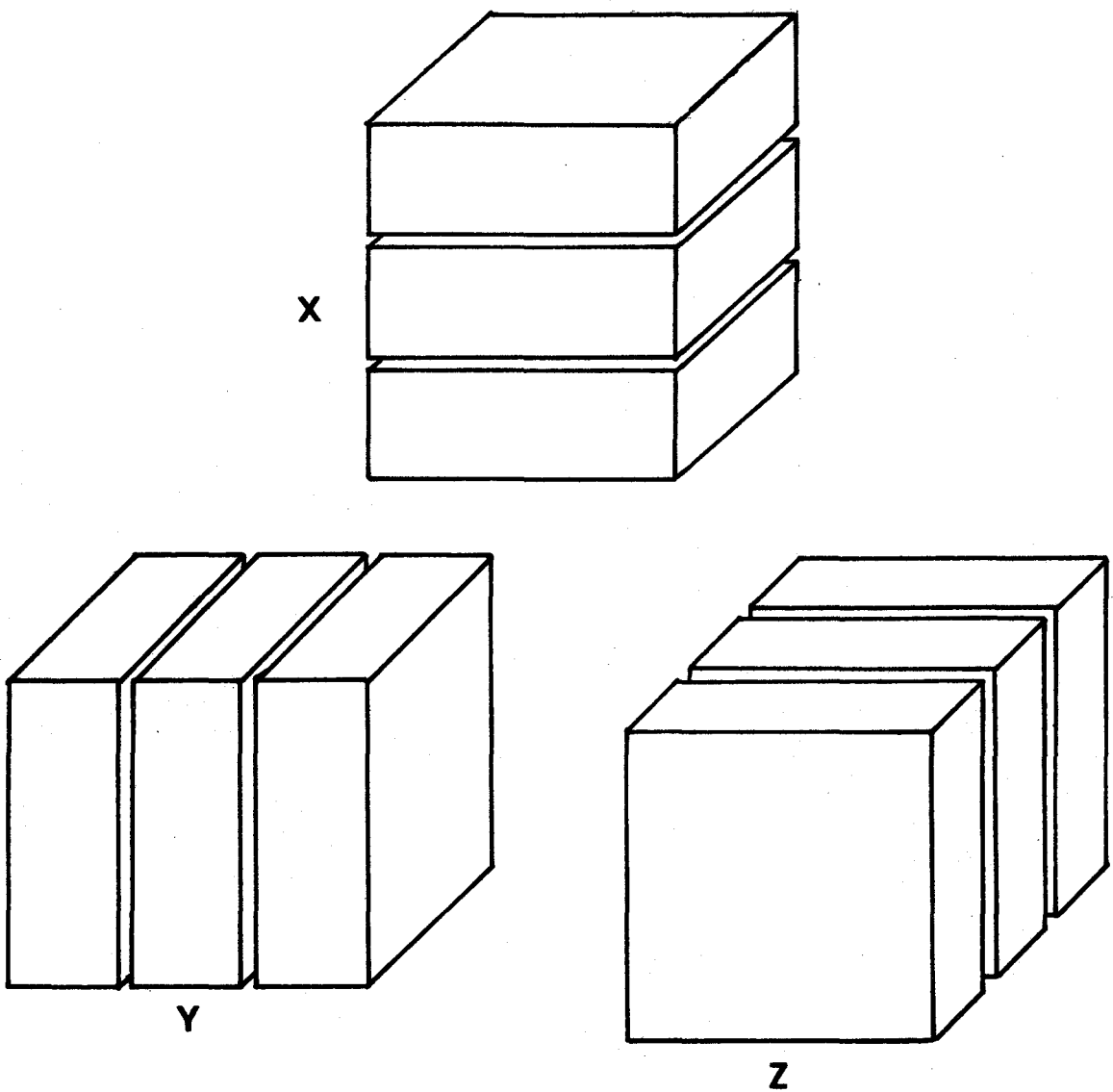
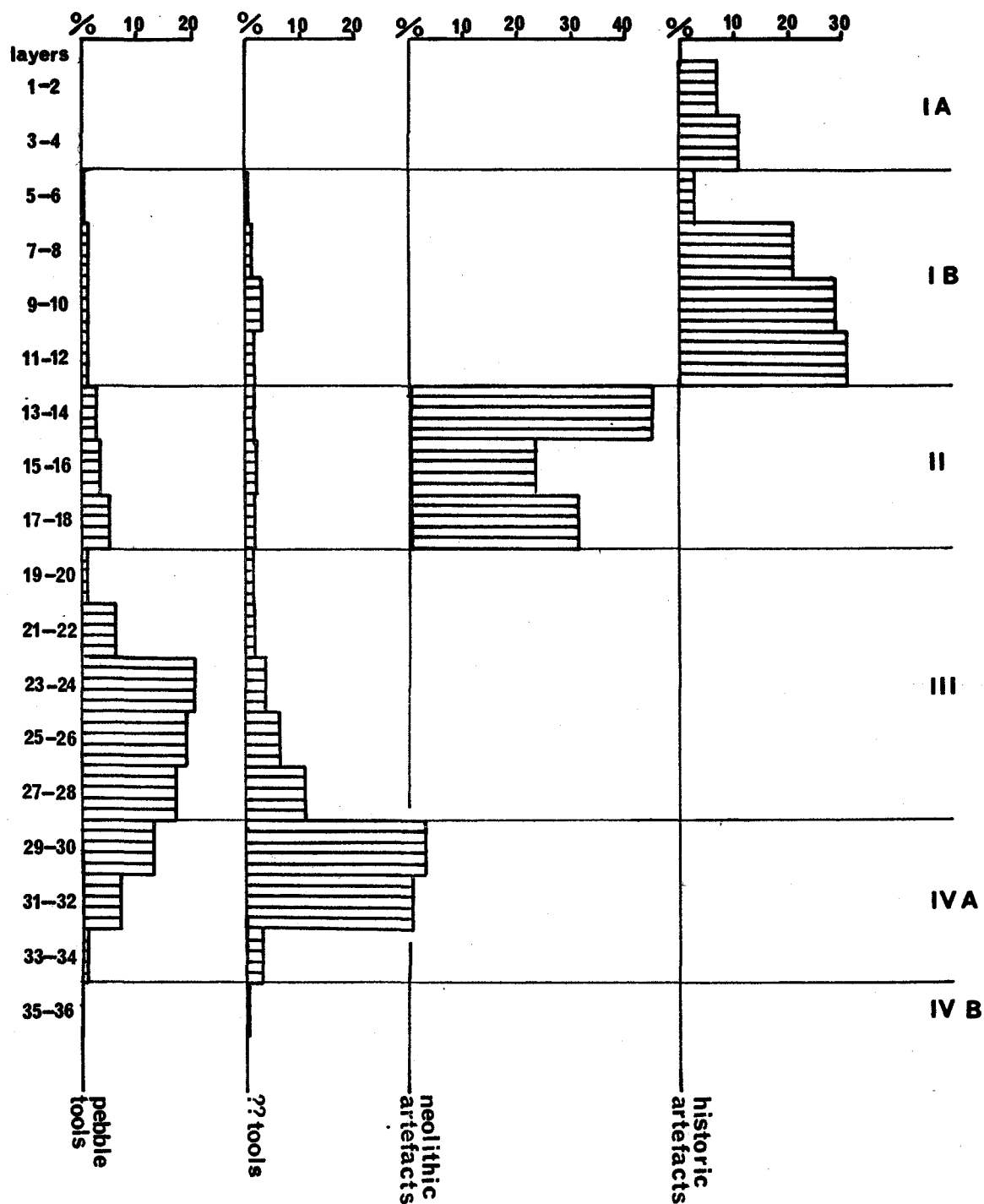


Figure 20. Division of section X along the X, Y and Z co-ordinates.

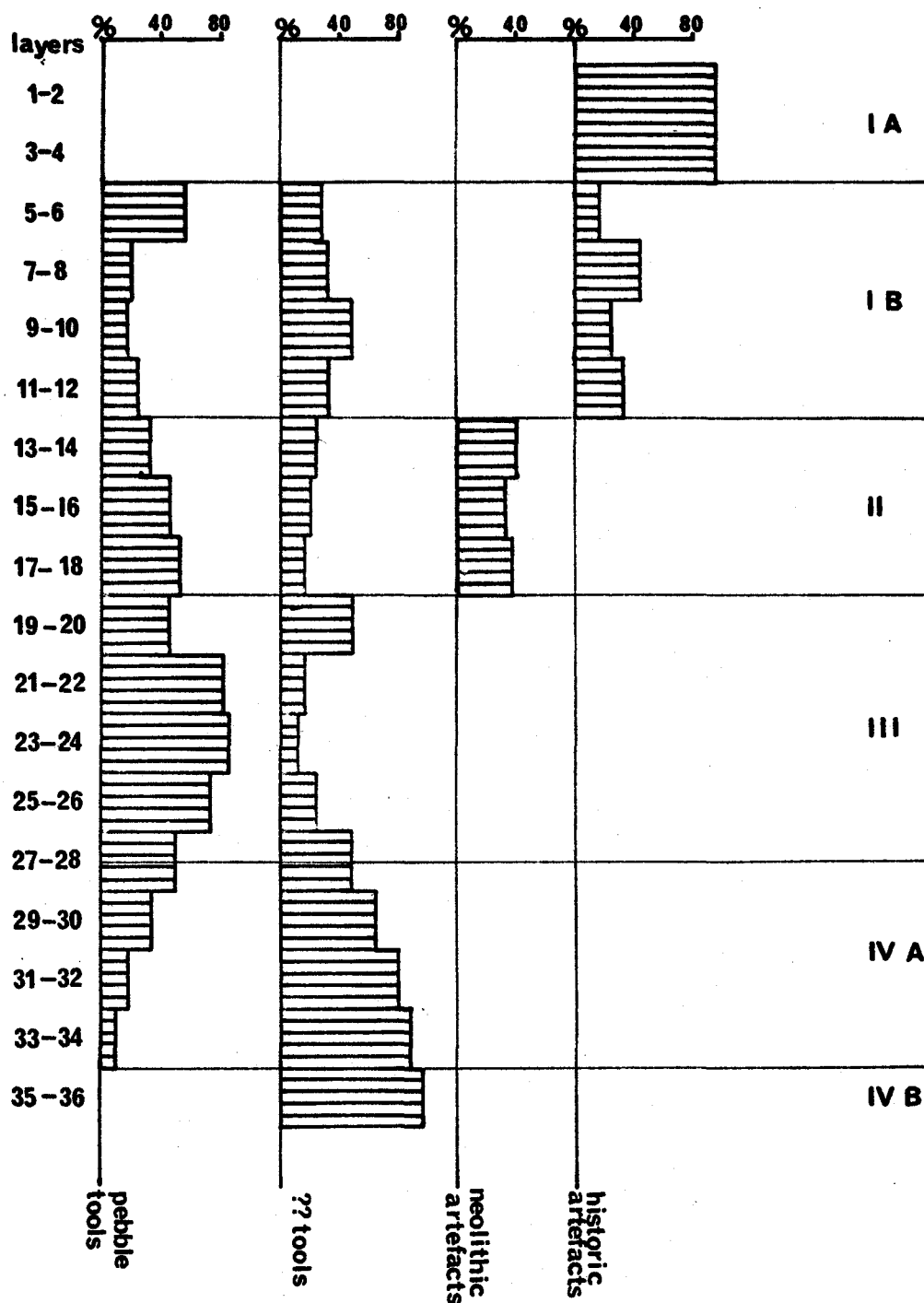
JMM

Figure 21

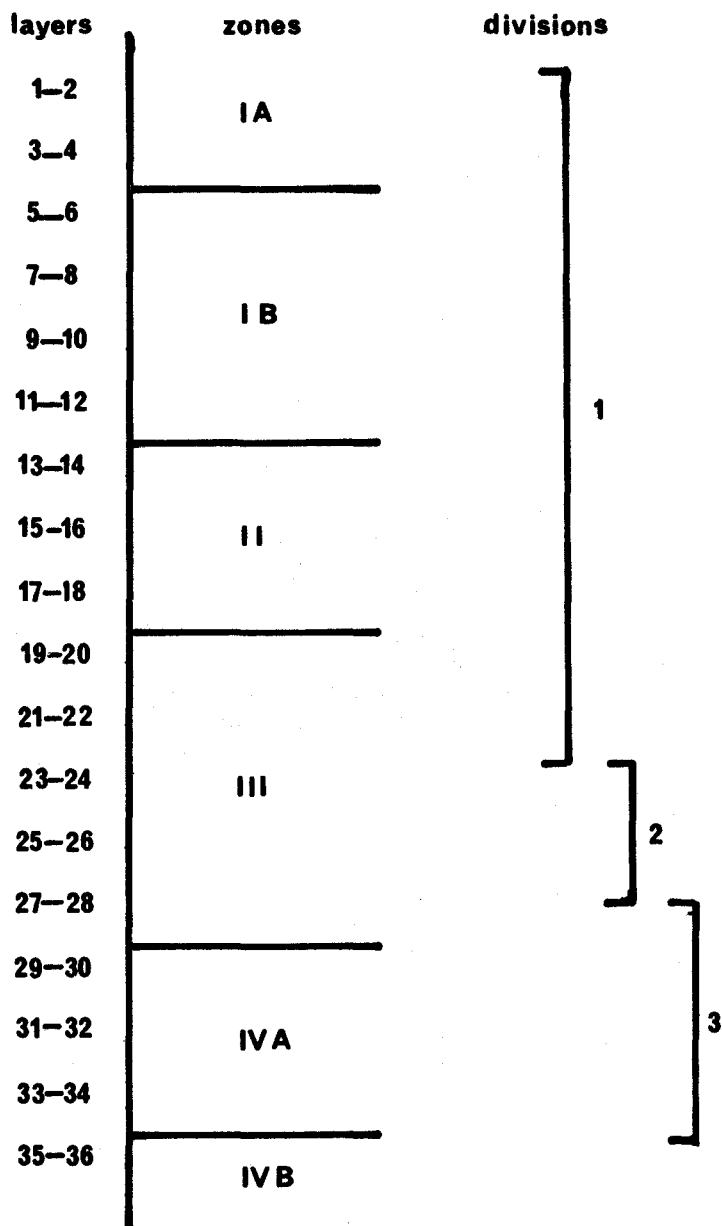


Sai Yok. Frequency distribution of artefacts, section X, in 10 cms.layers corrected for declination.

Figure 22



Sai Yok. Relative frequencies of artefacts, section X, in 10 cms. layers, corrected for declination.



Sai Yok. Section X, cultural zones contrasted with the divisions made for the analysis of variance.

Figure 24

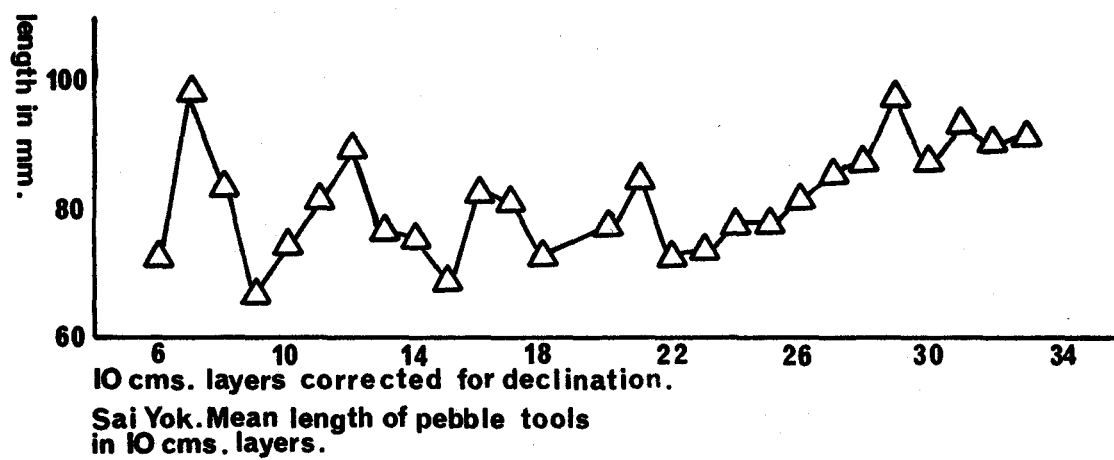
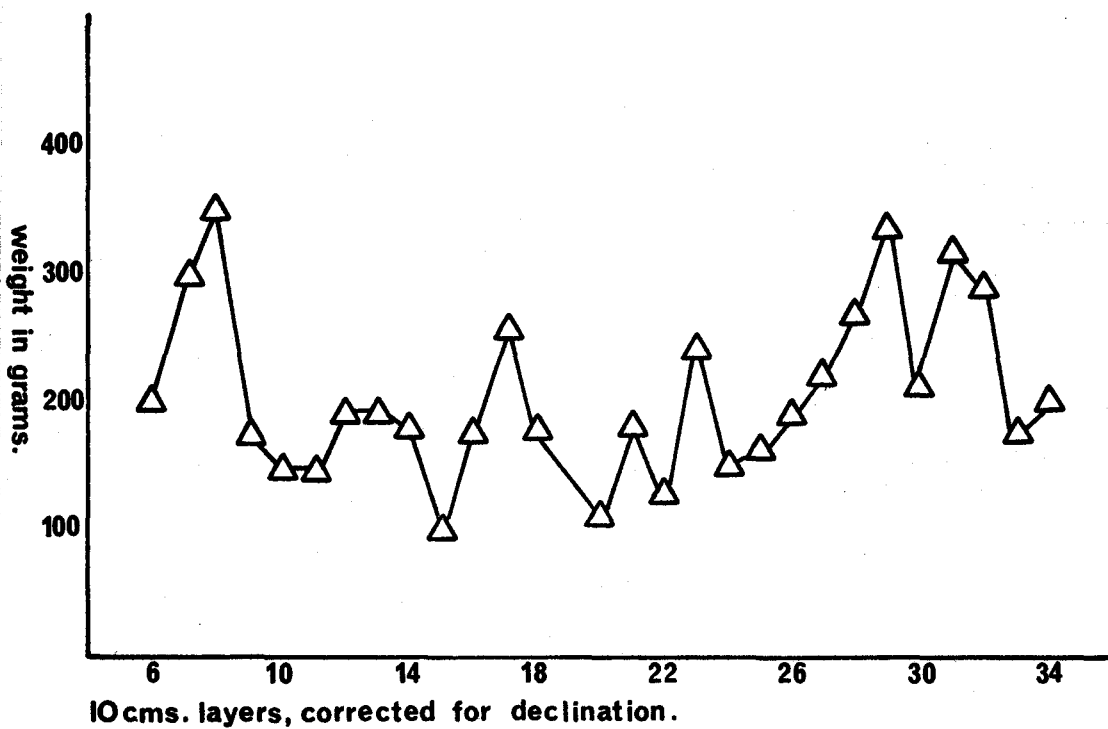


Figure 24 .

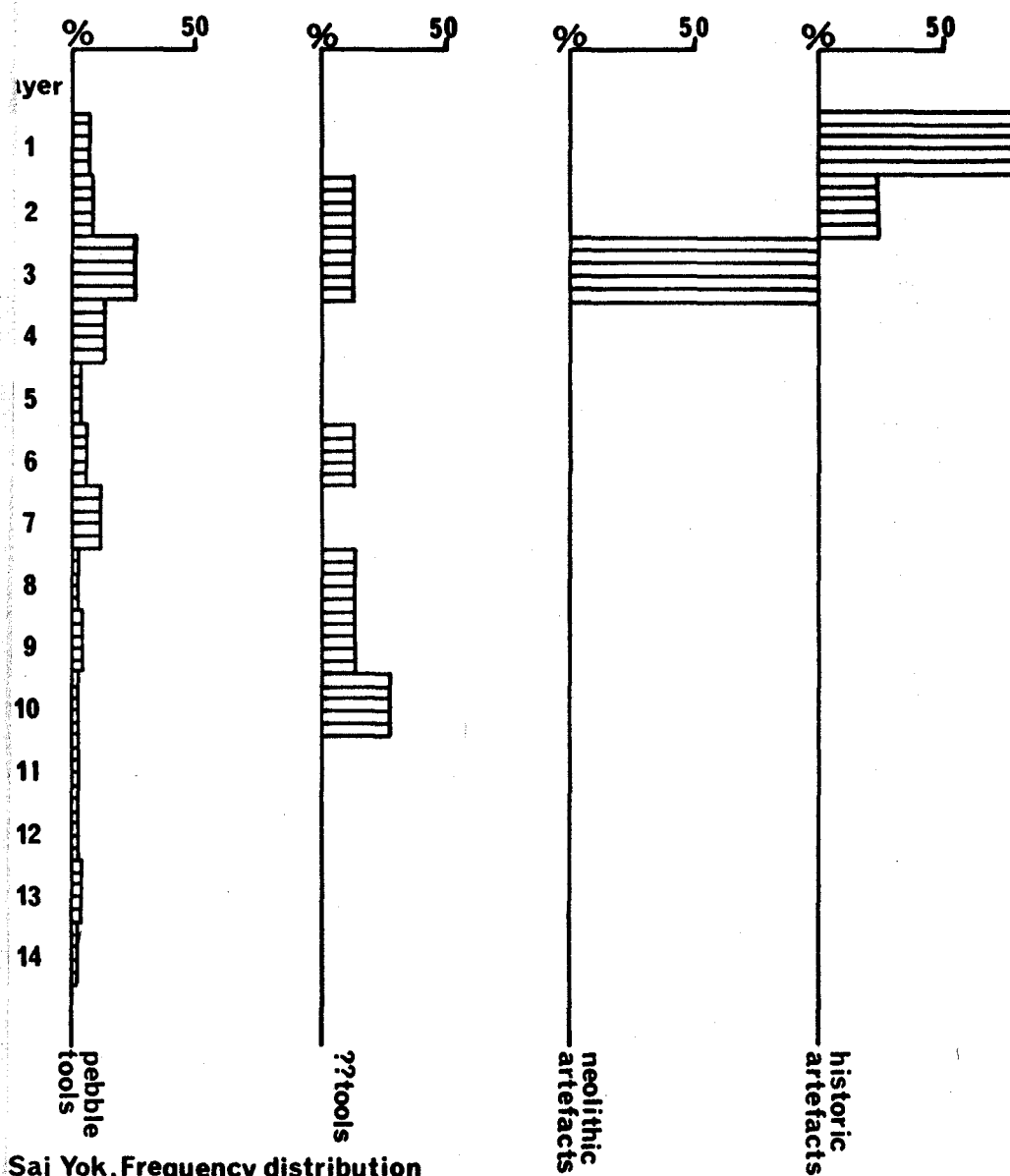
JMM



Sai Yok. Mean weight of pebble tools in 10 cms. layers .

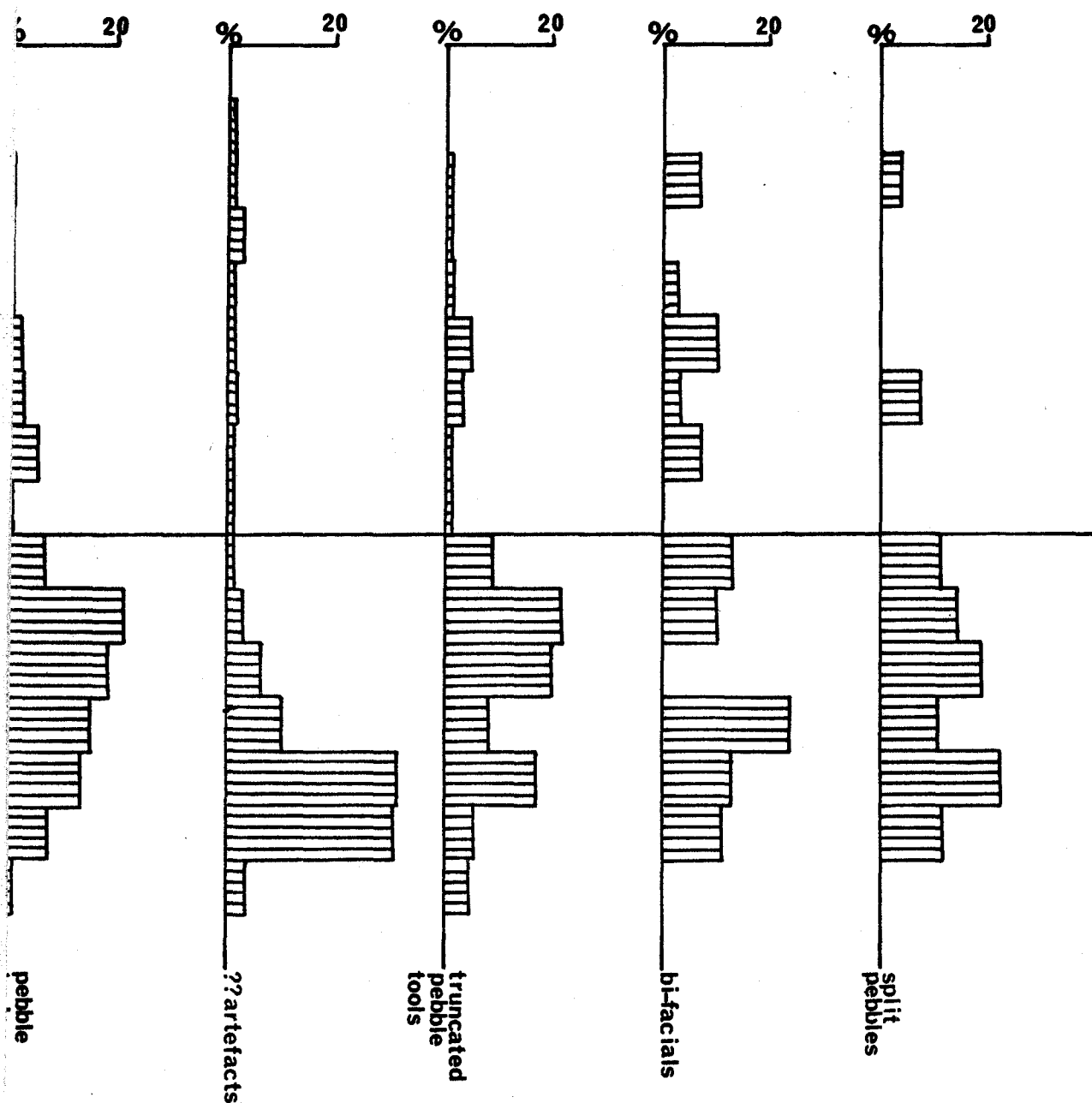
Figure 25 .

JMM



Sai Yok. Frequency distribution of artefacts, section C, in 20 cms. layers.

Figure 27



Yok. Distribution of artefacts, section X, in 10 cms. layers, corrected for declination.

Sai Yok. Distribution of mean cutting angle.

Pebble tools : $\triangle$ — $\triangle$, N=183,
 ??tools : $\circ$ — $\circ$, N=155.

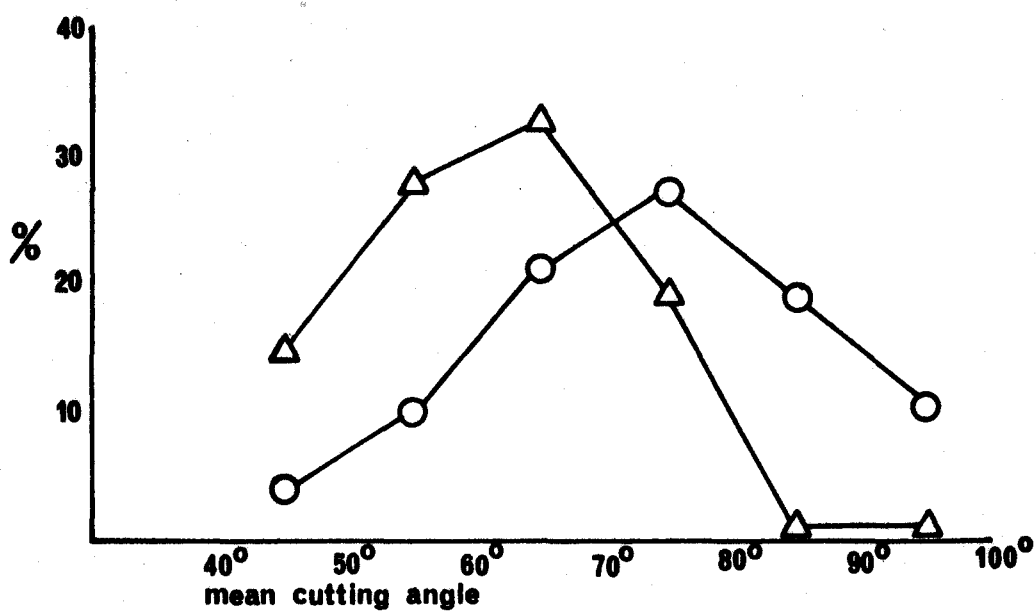


Figure 28.

JMM

Figure 29

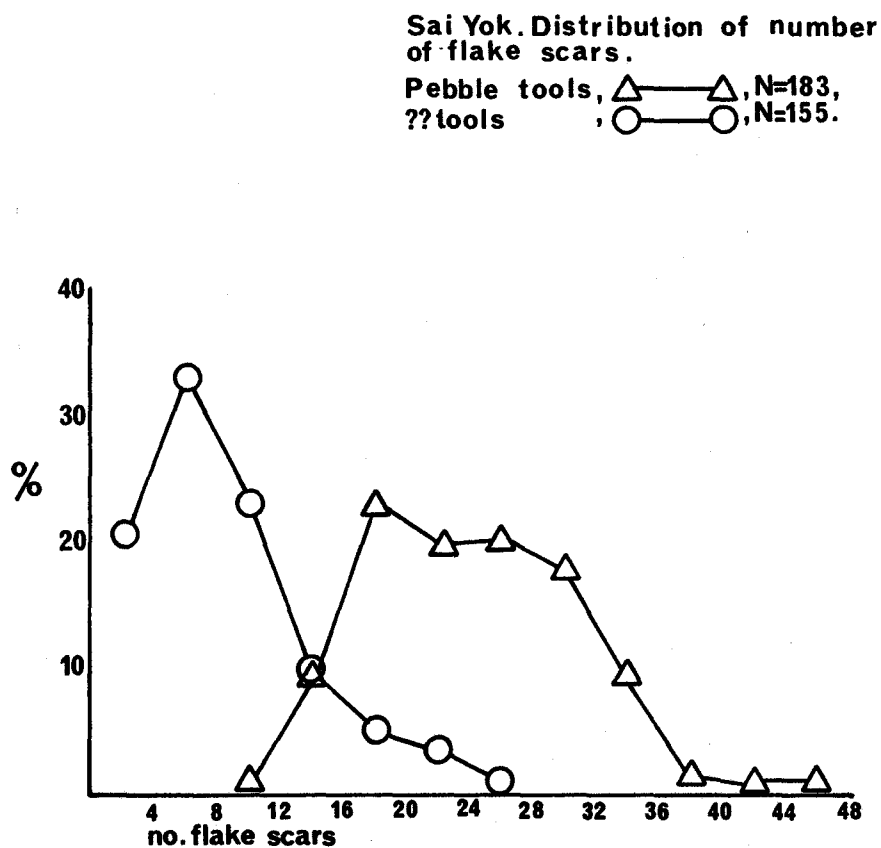


Figure 29.

JMM

Figure 30

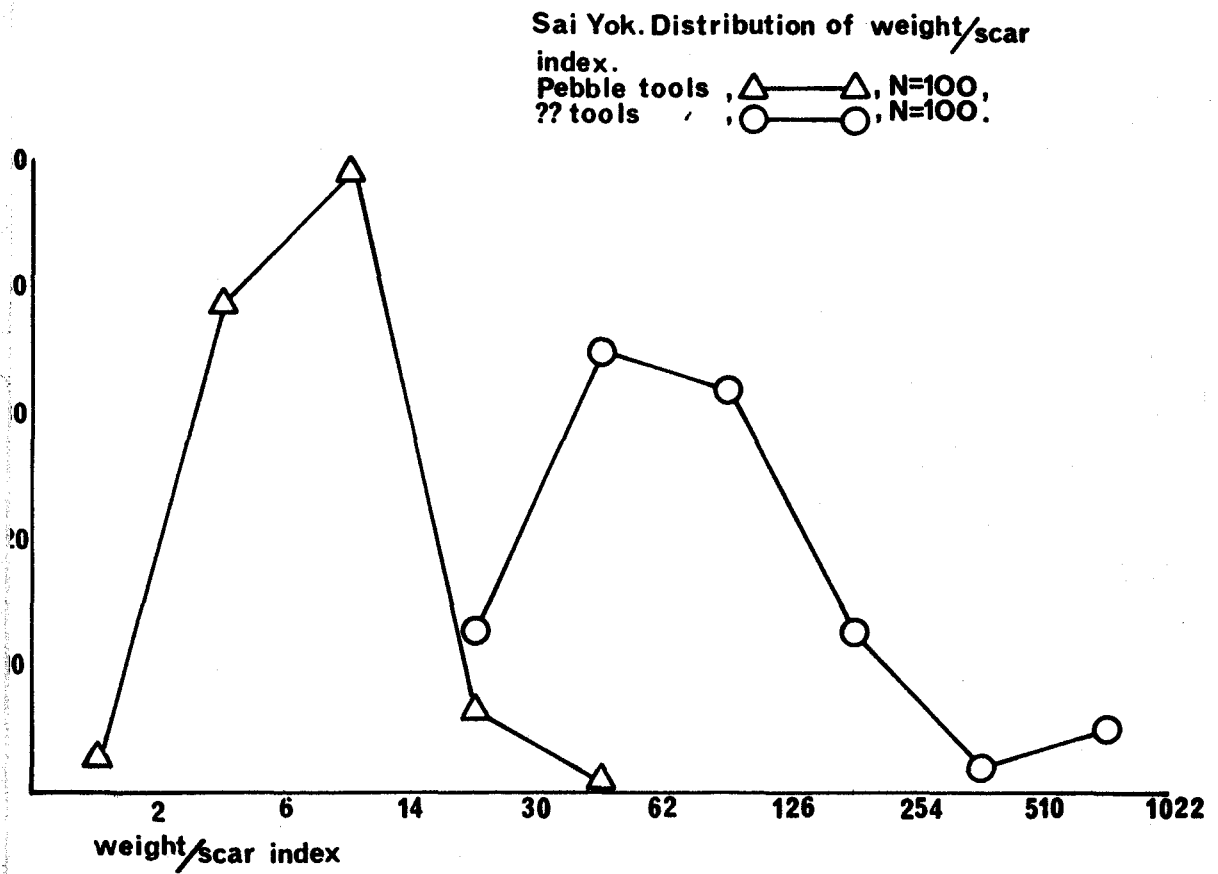


Figure 30.

JMM

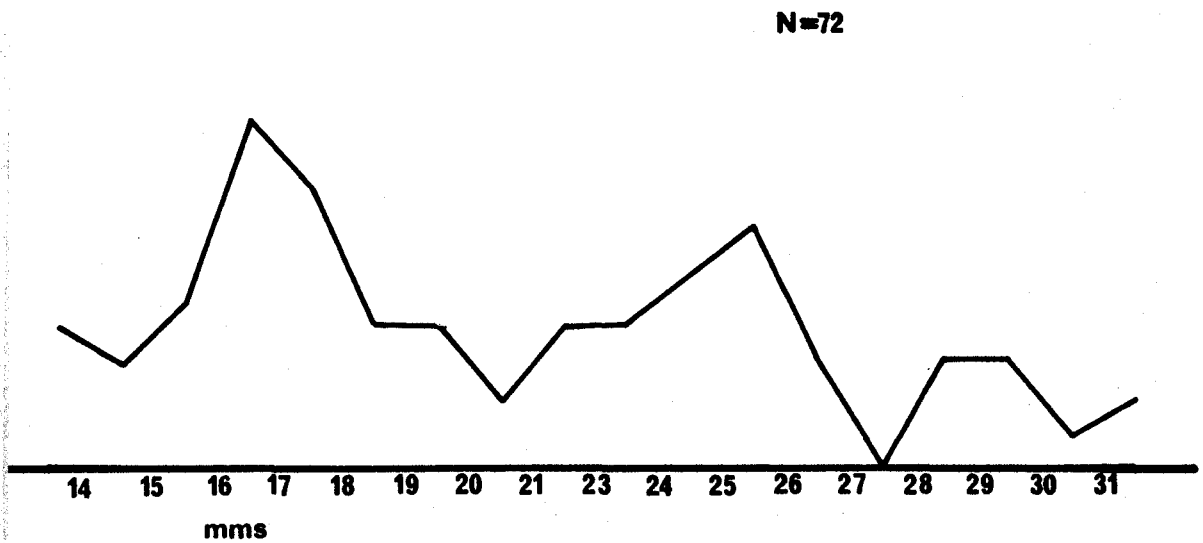


Figure 31. Length of Chione valves from Kauri Point.

JMM

Figure 32

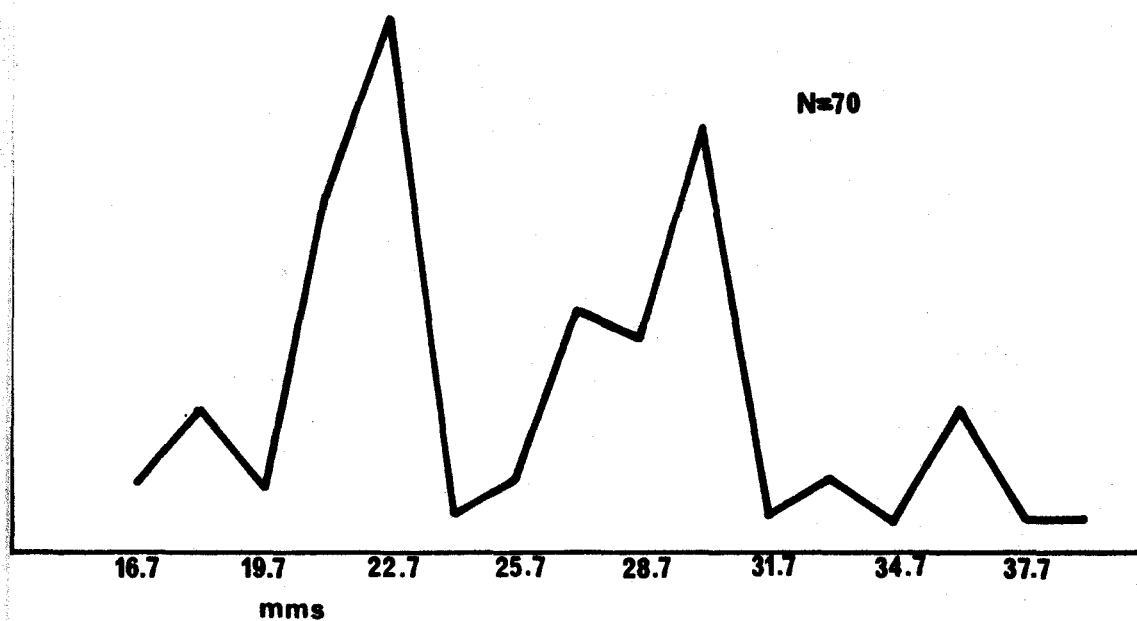


Figure 32. Width of Chione valves from Kauri Point.

JMM

Figure 33

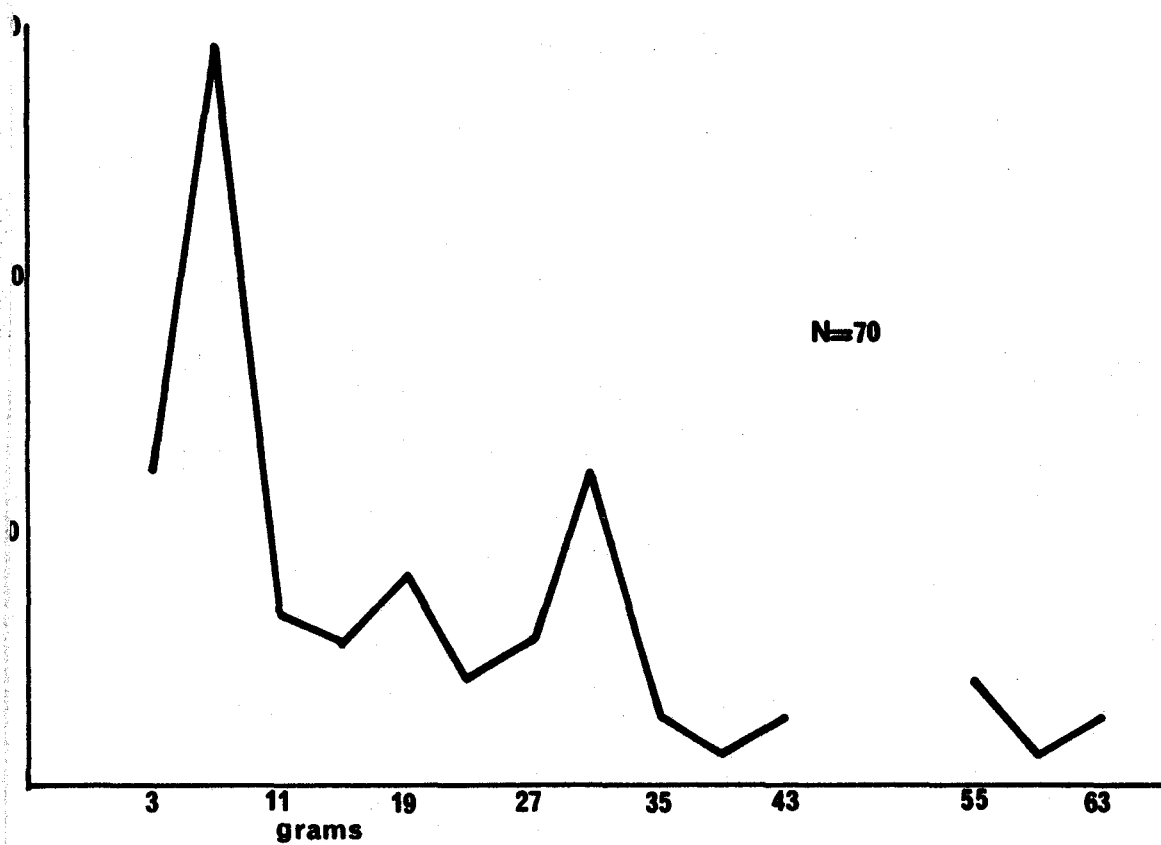


Figure 33. Weight of Chione valves from Kauri Point.

JMM

Figure 34

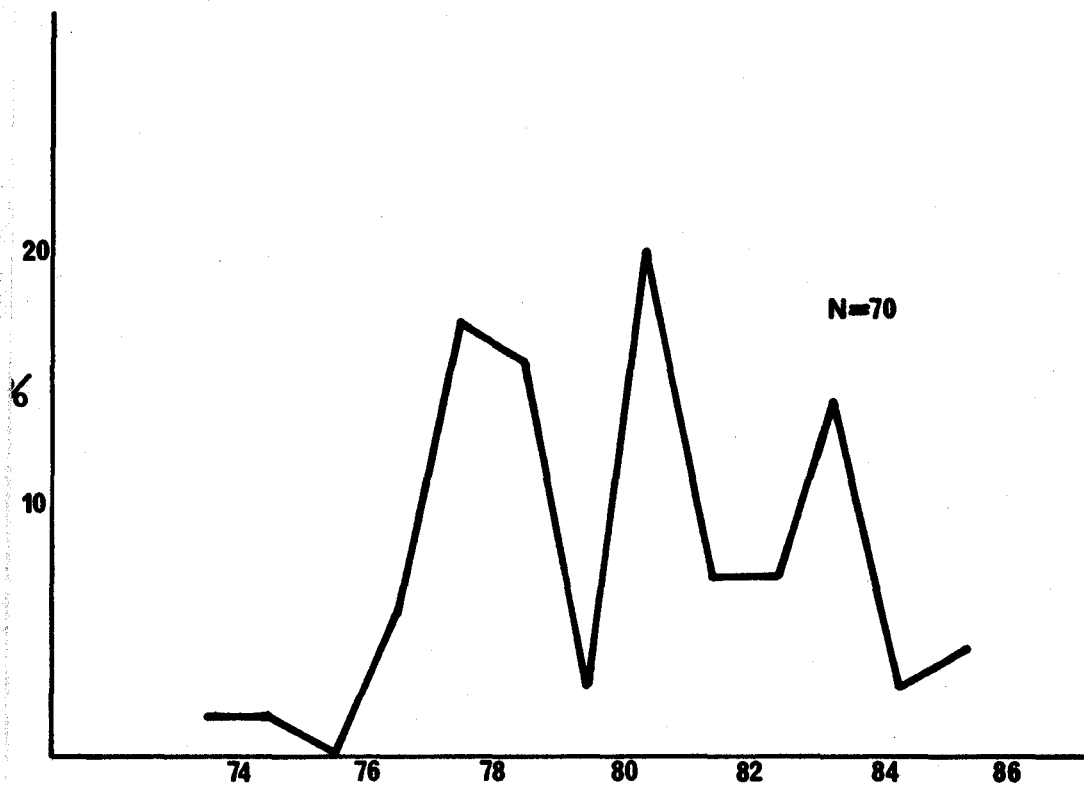
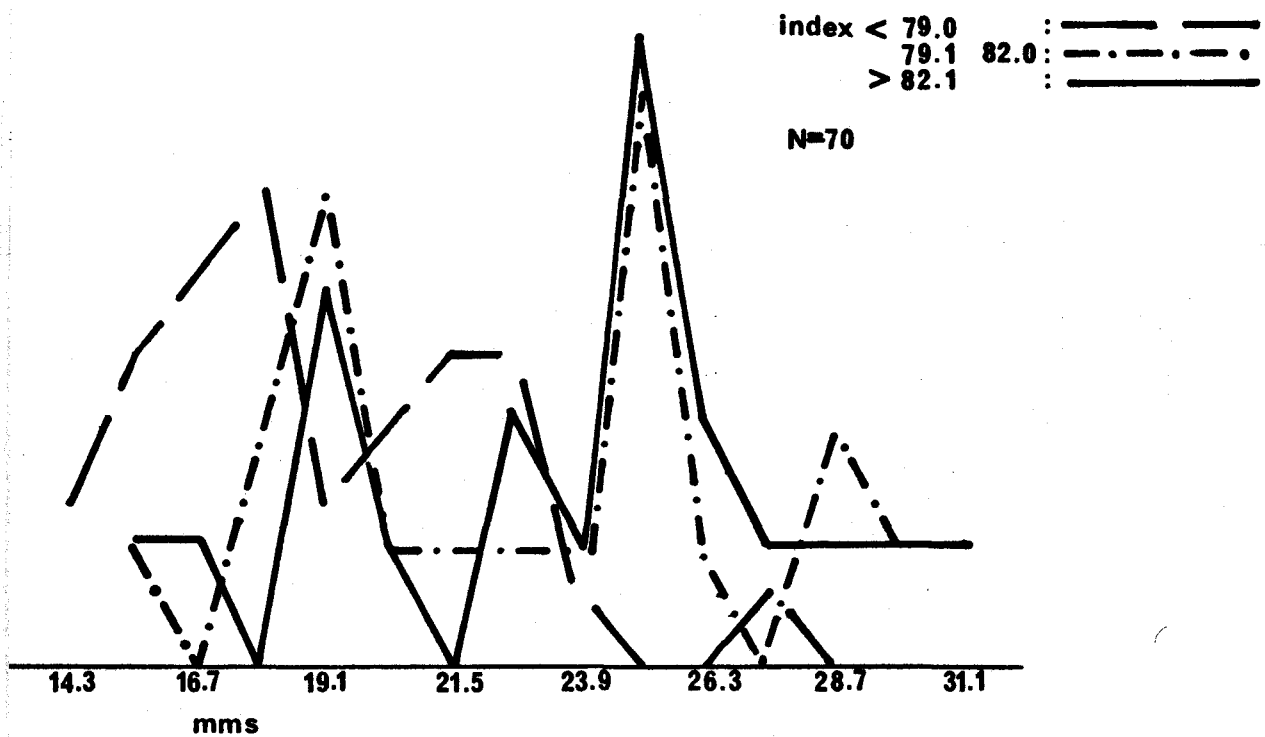


Figure 34 . Length/width index for Chione valves from Kauri Point.

JMM

Figure 35



e 35. Length of Chione valves grouped according to length/breadth index.

JMM

Figure 36

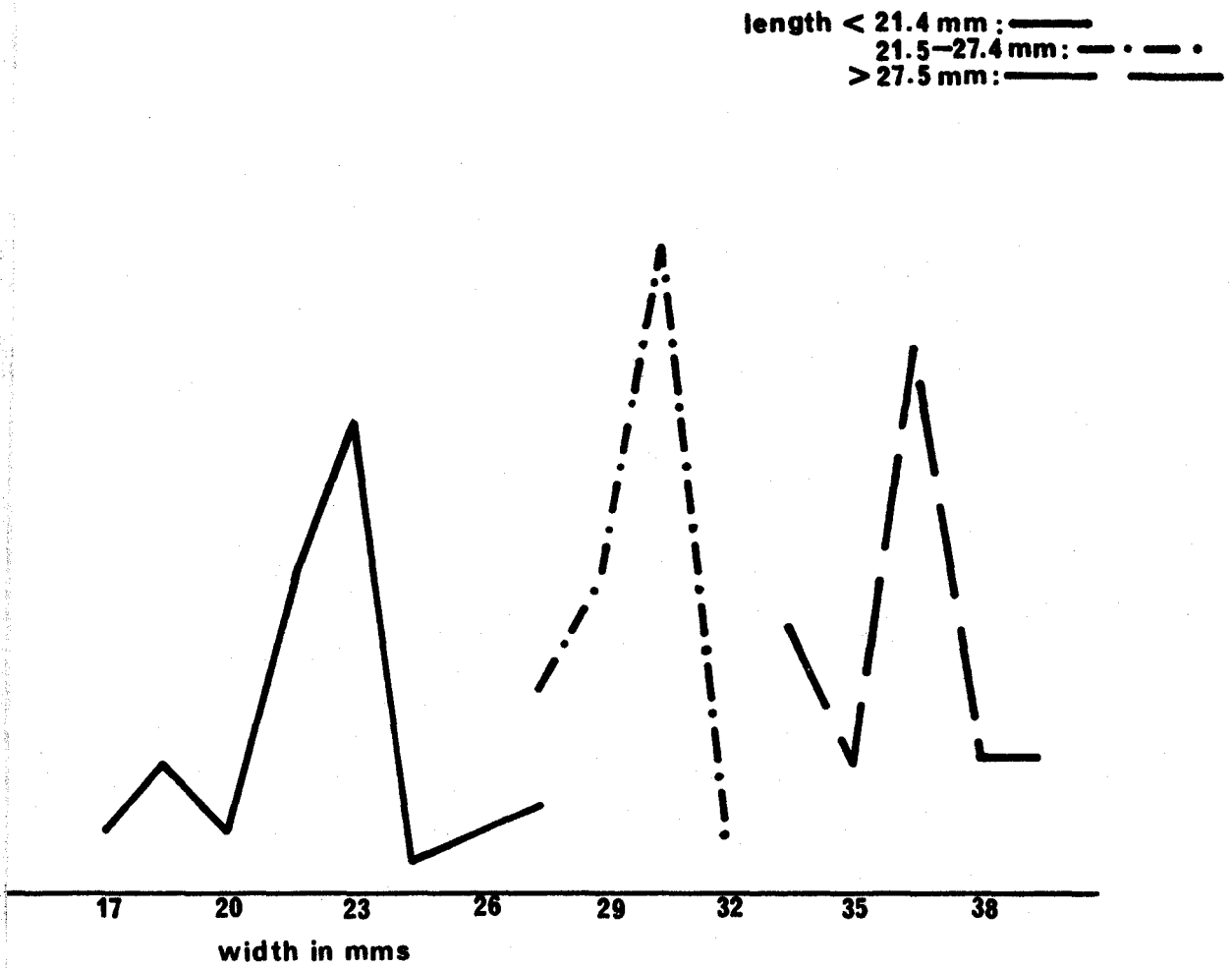


Figure 36. Width of Chione valves from Kauri Point grouped according to length.

JMM

Figure 37

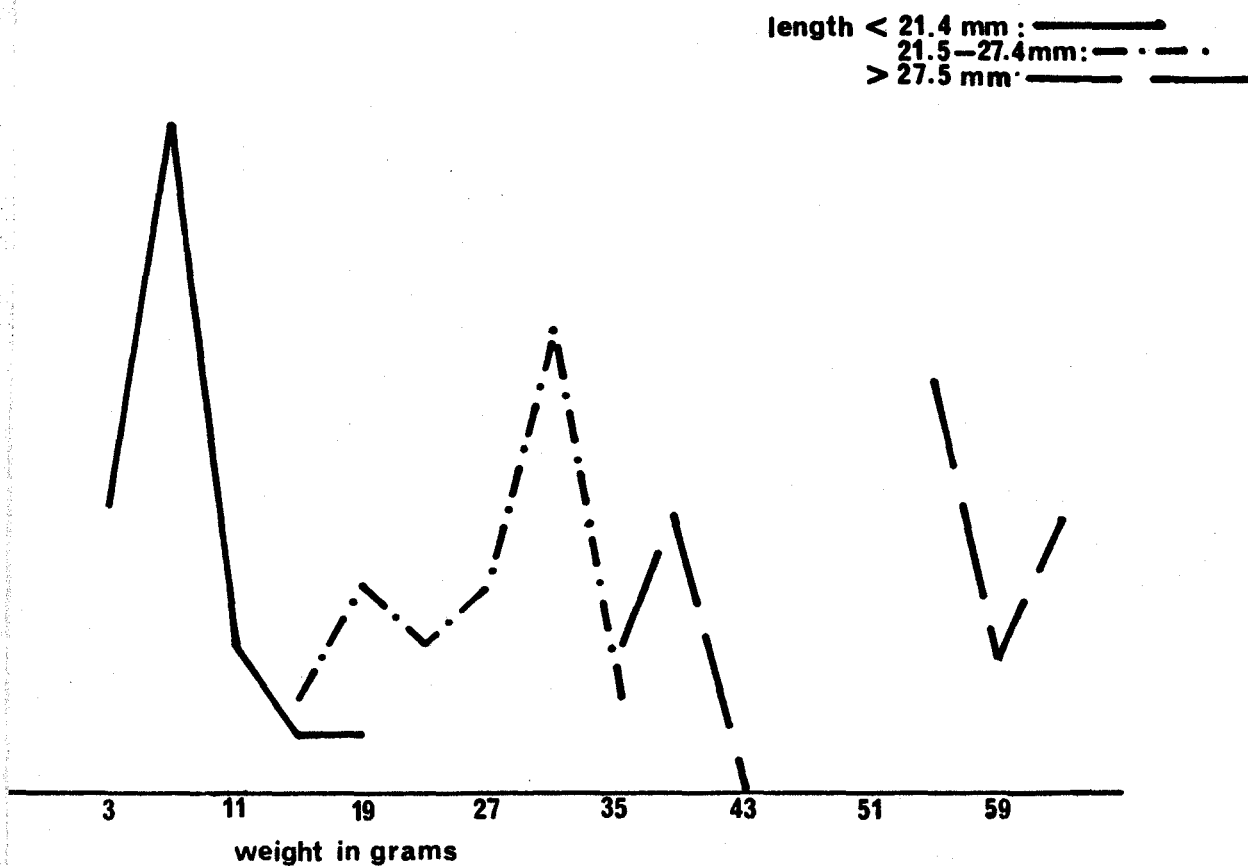


Figure 37. Weight of a sample of Chione valves from Kauri Point grouped according to length.

JMM

Figure 38

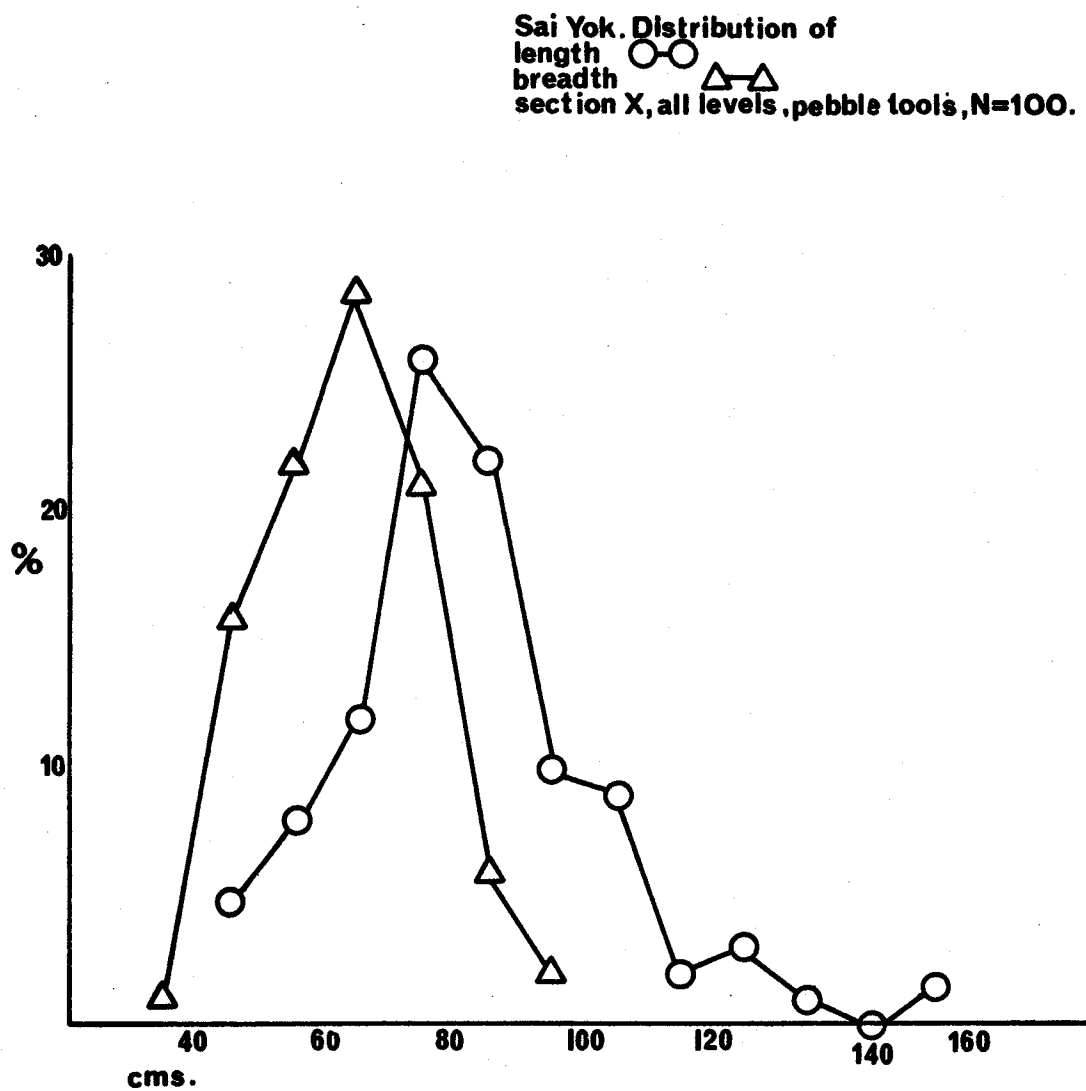


Figure 38 .

JMM

Sai Yok. Distribution of thickness,
pebble tools, section X, all layers,
N 100.

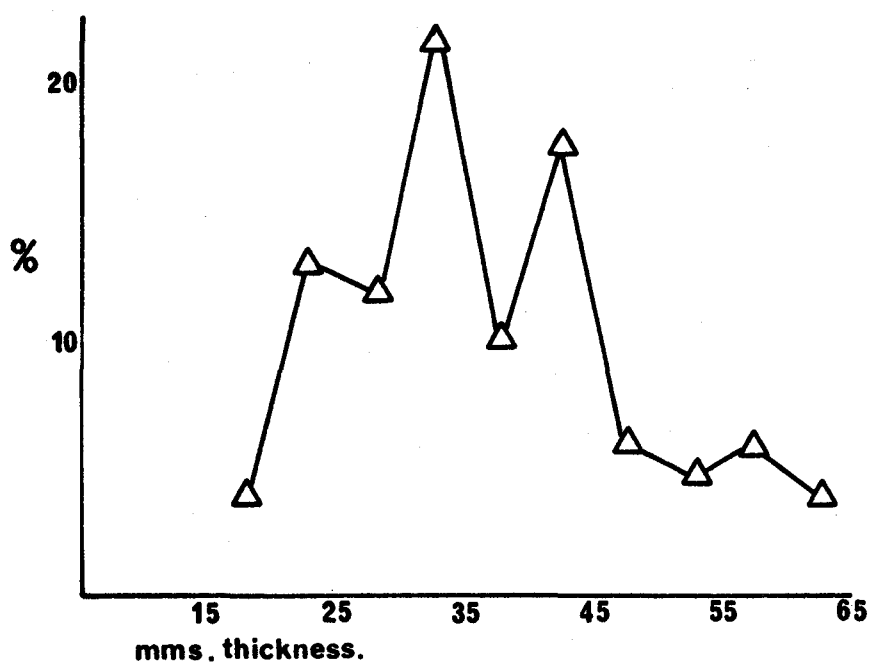


Figure 39 .

JMM

Sai Yok. Histogram for length, pebble tools, all levels, section X, N=100, with normal curve.

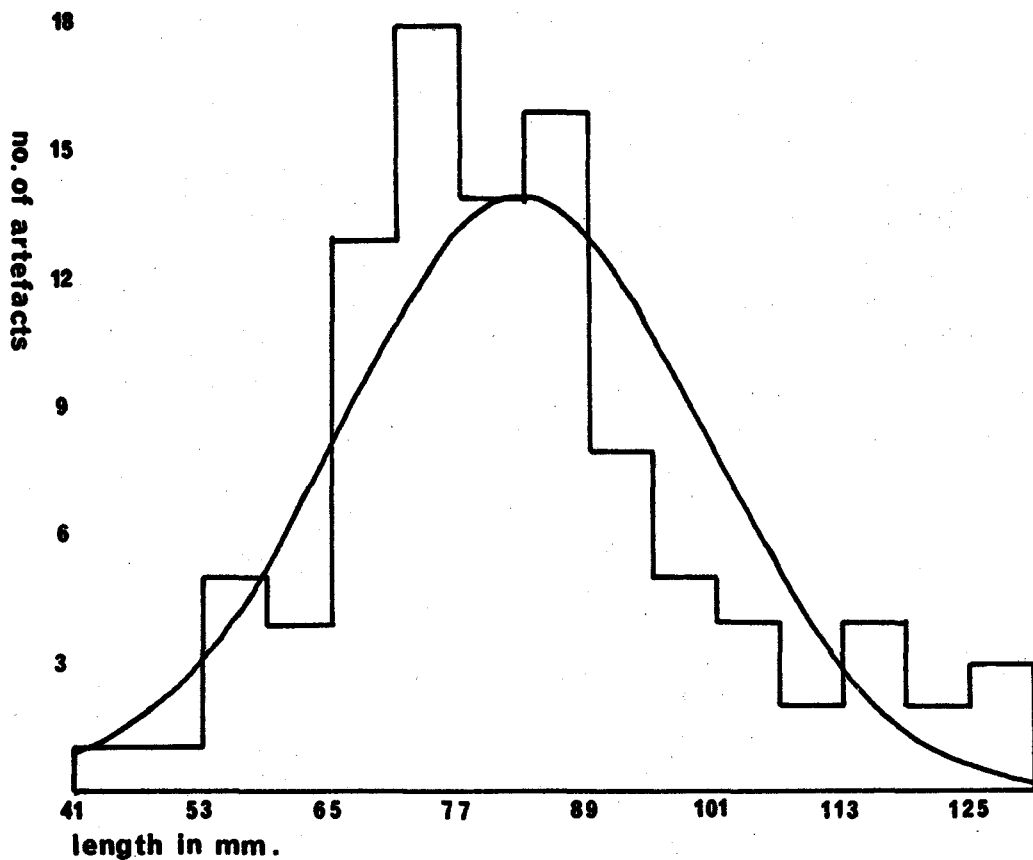


Figure 40.

JMM

Sai Yok. Histogram for breadth, pebble tools, all levels, section X, N=100, with normal curve.

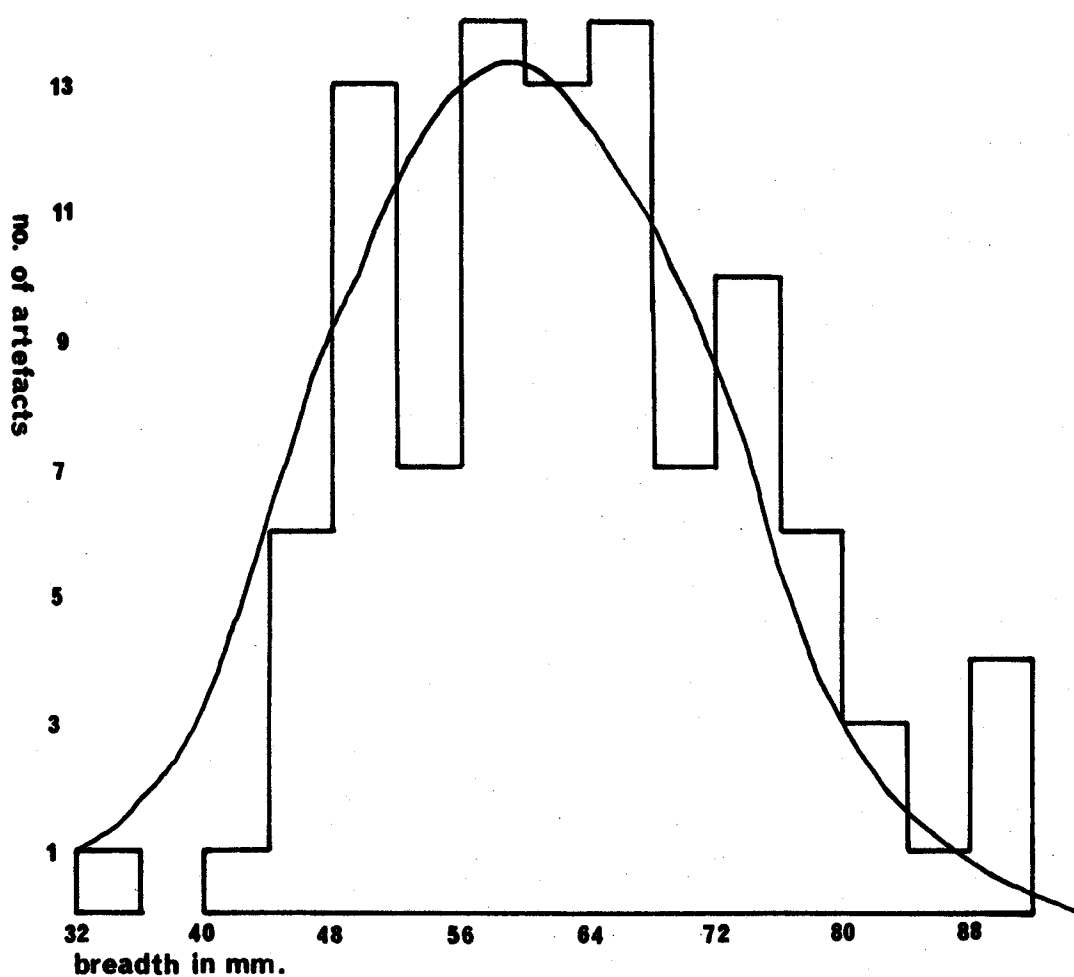


Figure 41.

JMM

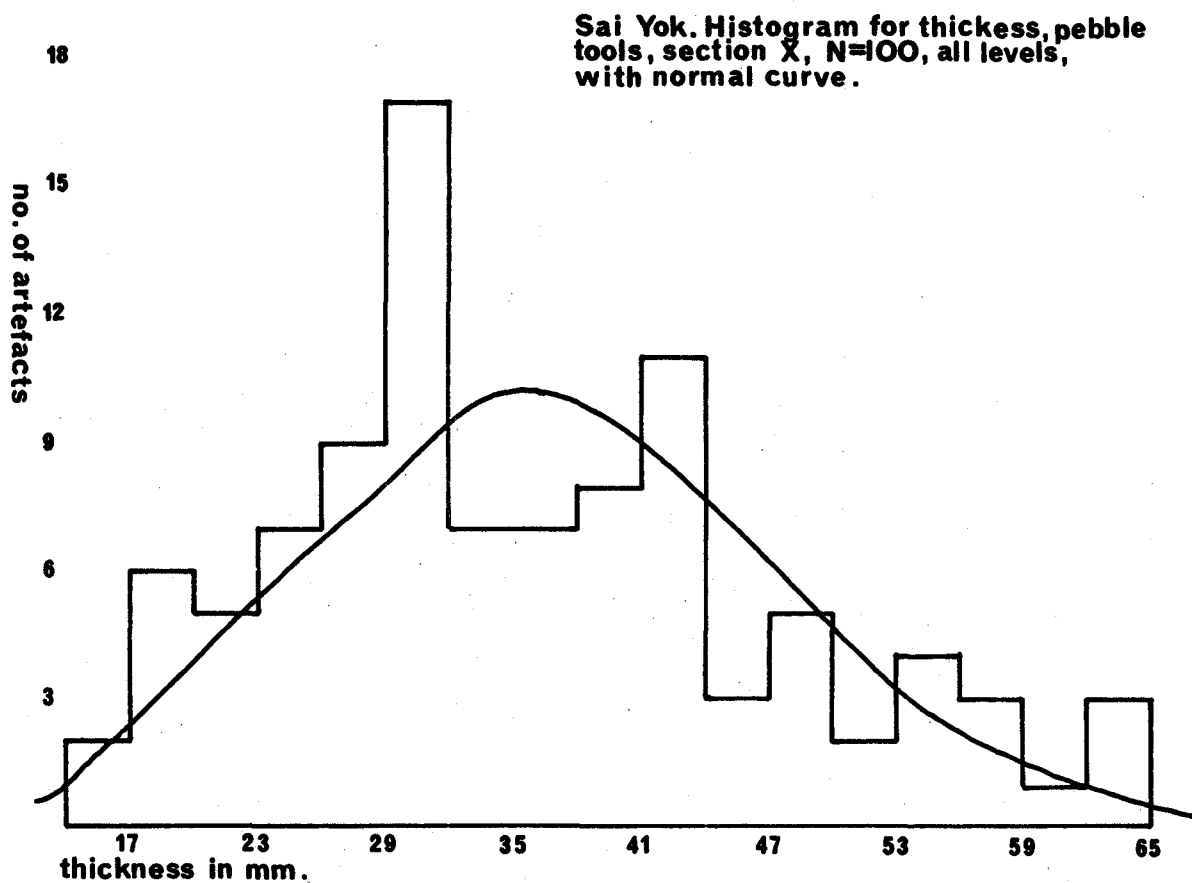


Figure 42 .

JMM

Sai Yok. Distribution of length/breadth index, pebble tools, section X, all levels, N=100, with normal curve.

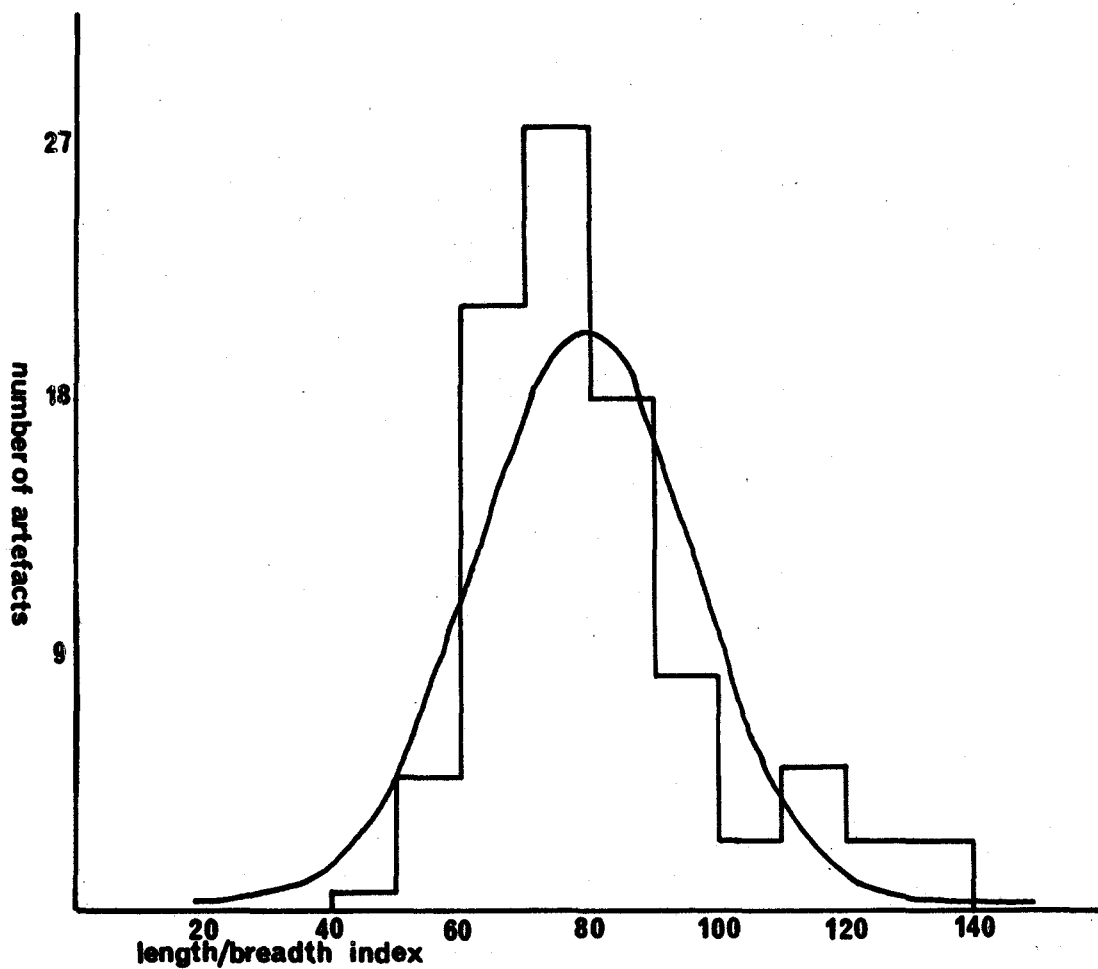


Figure 43.

JMM

Figure 44

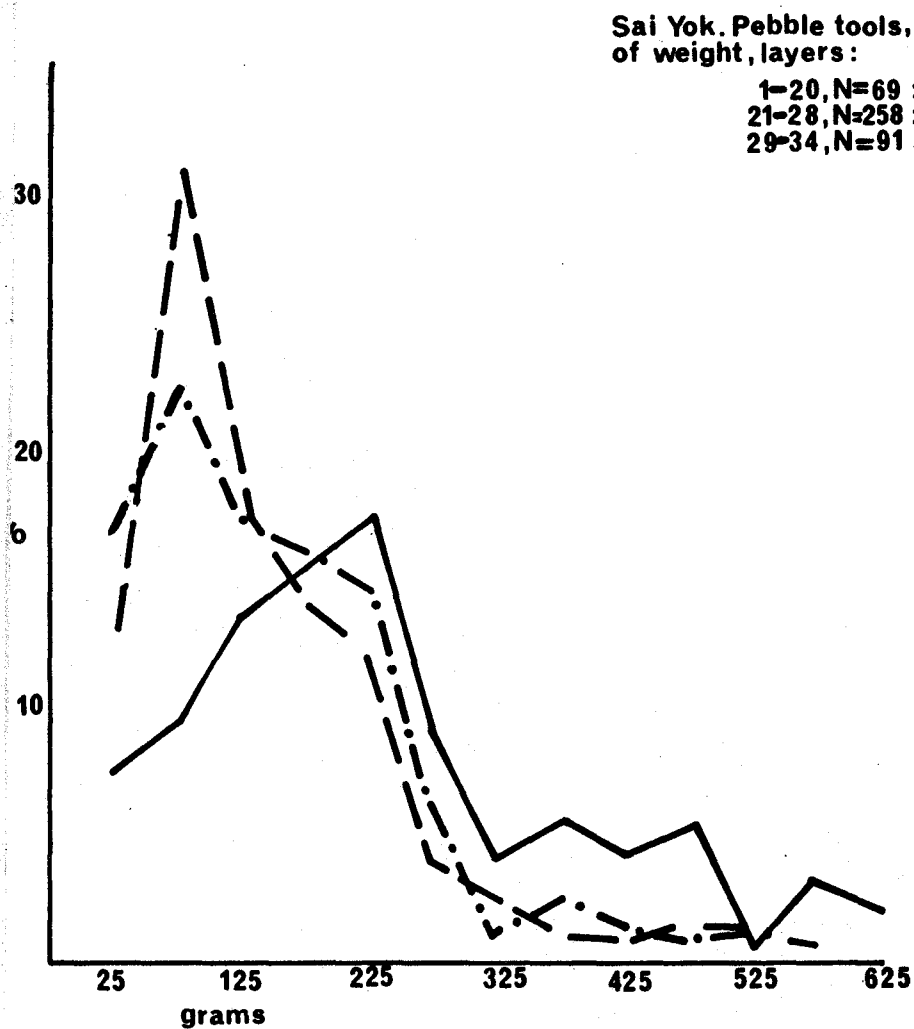


Figure 44.

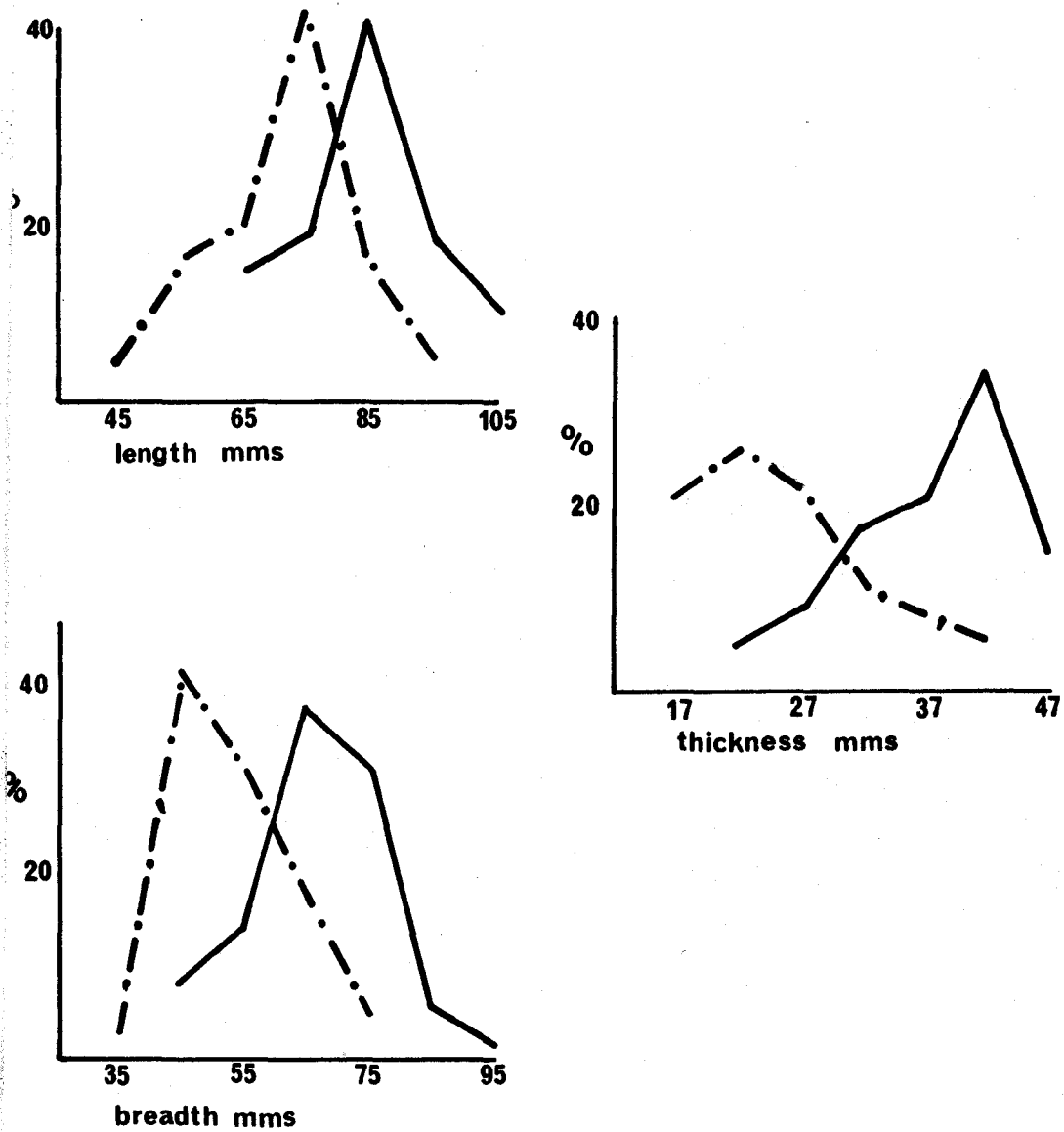
JMM

Figure 45

Sai Yok. Pebble tools, distribution of length, breadth and thickness
for two series from a sample from all levels :

weight < 100 gms, N=32 : - . - .

200—300 gms, N=30 : ———



Sai Yok. Distribution of length
for pebble tools, section X,
layers 0 20: --- · --- · ---
.. 21 28: --- · ---
.. 29 33: —————

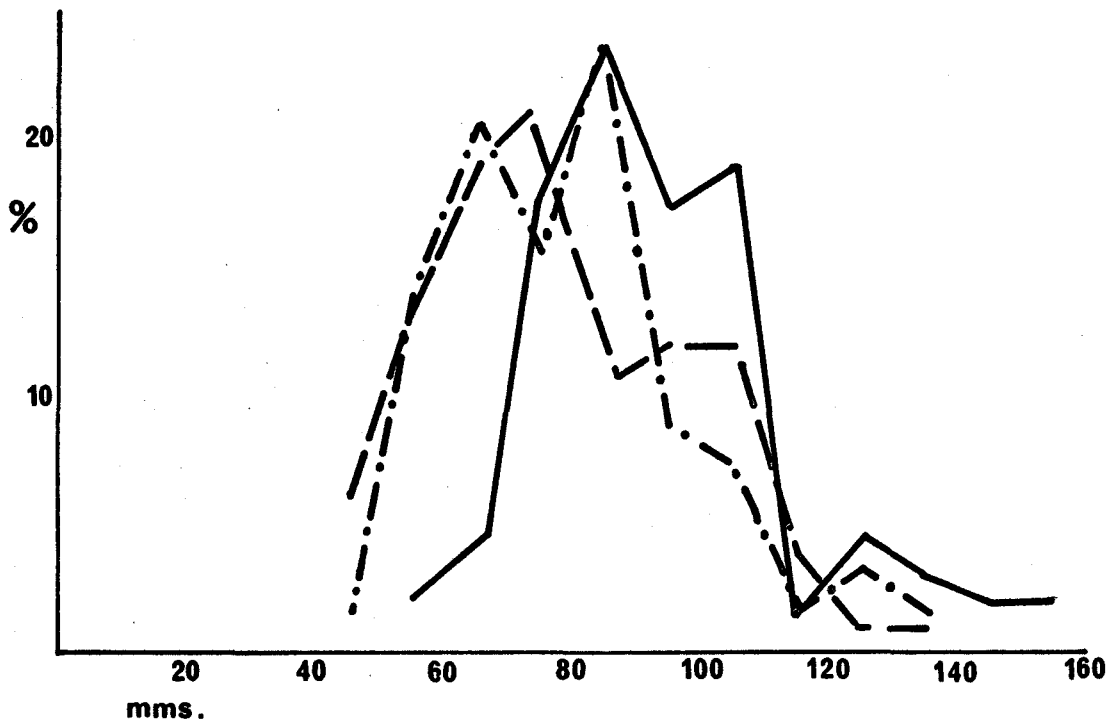


Figure 46.

JMM

Figure 47

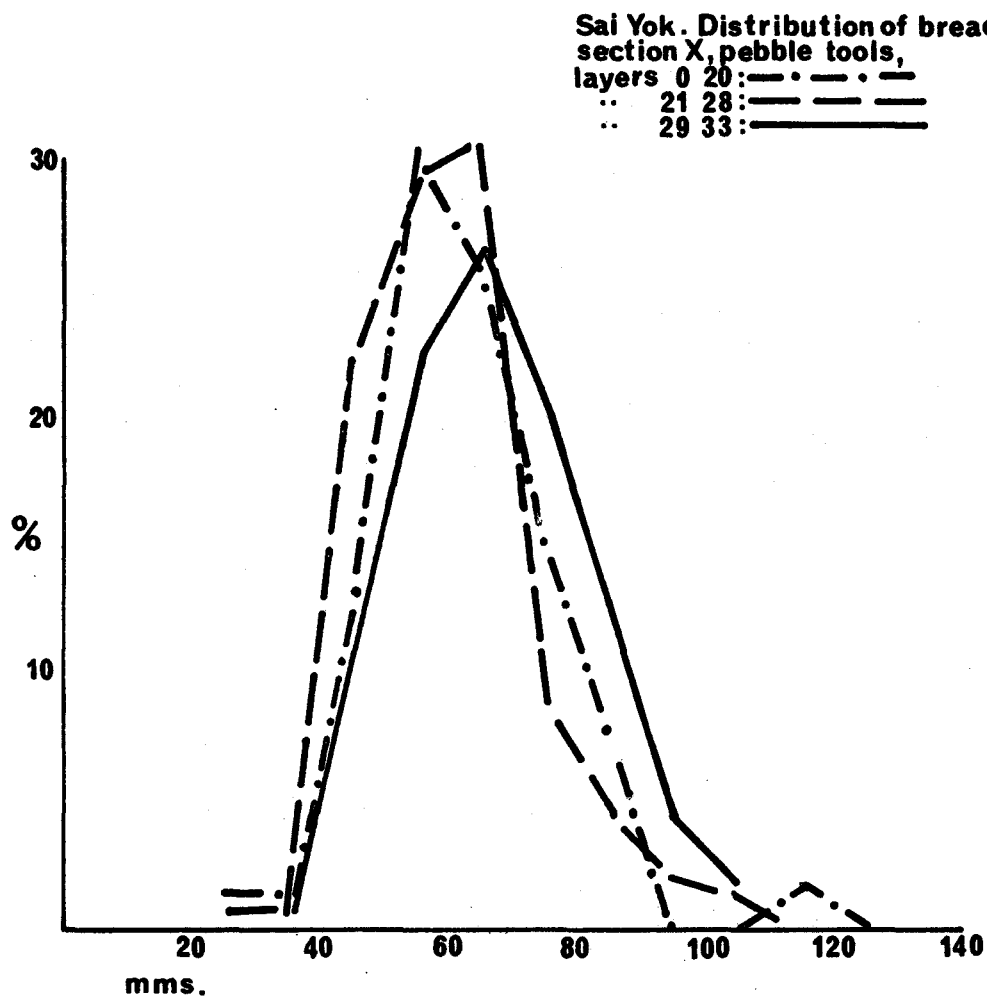


Figure 47.

JMM

Sai Yok. Distribution of thickness,
section X, pebble tools,
layers 1-20: - · - · - ·
.. 21-28: = = = =
.. 29-33: — — — —

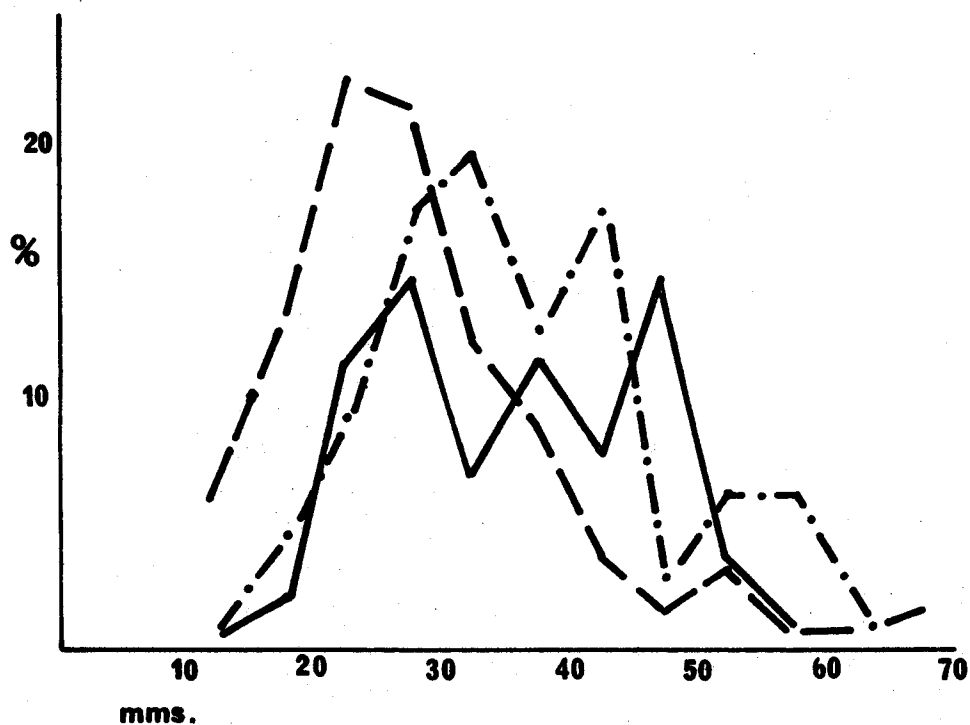


Figure 48.

JMM

Figure 49

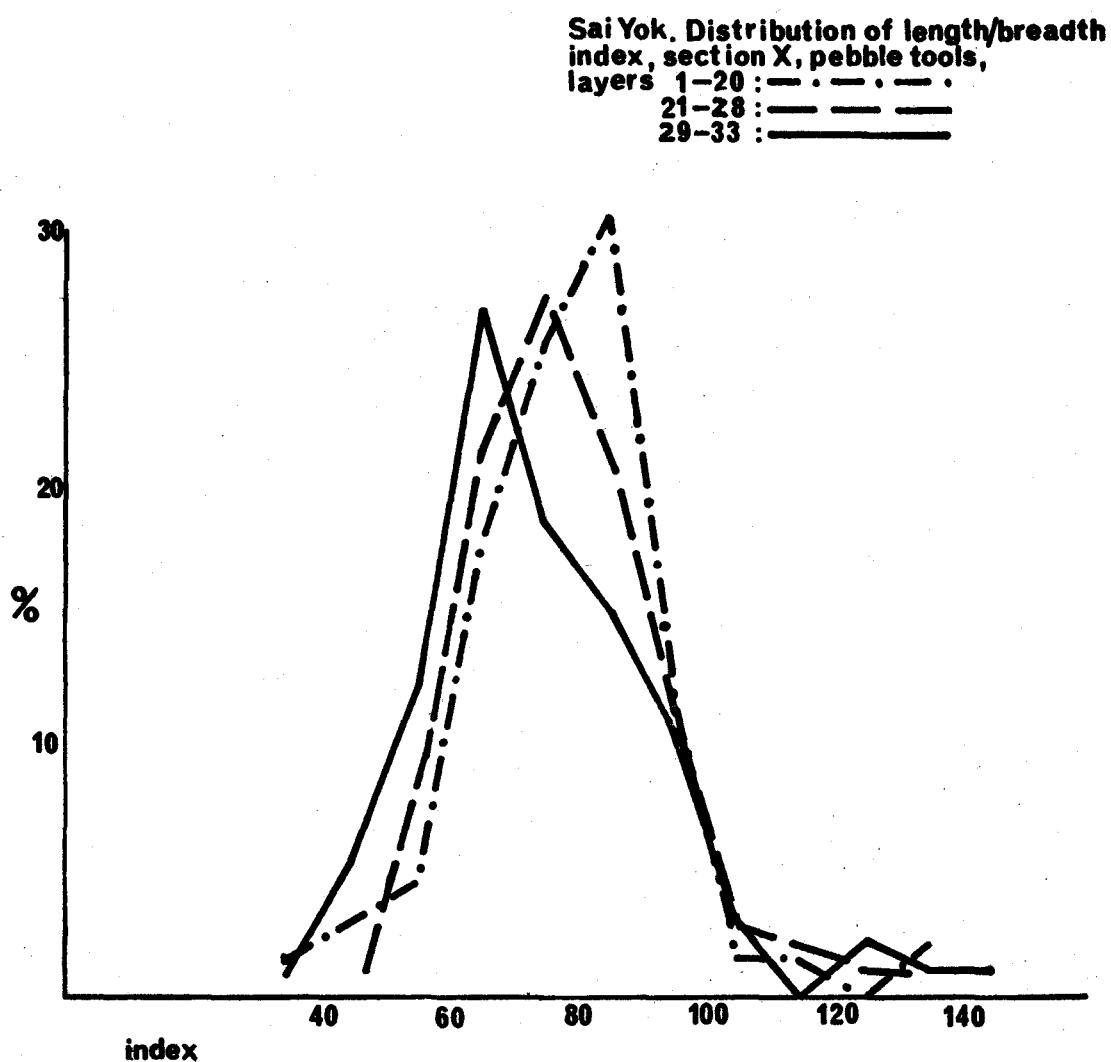


Figure 49 .

JMM

Figure 50

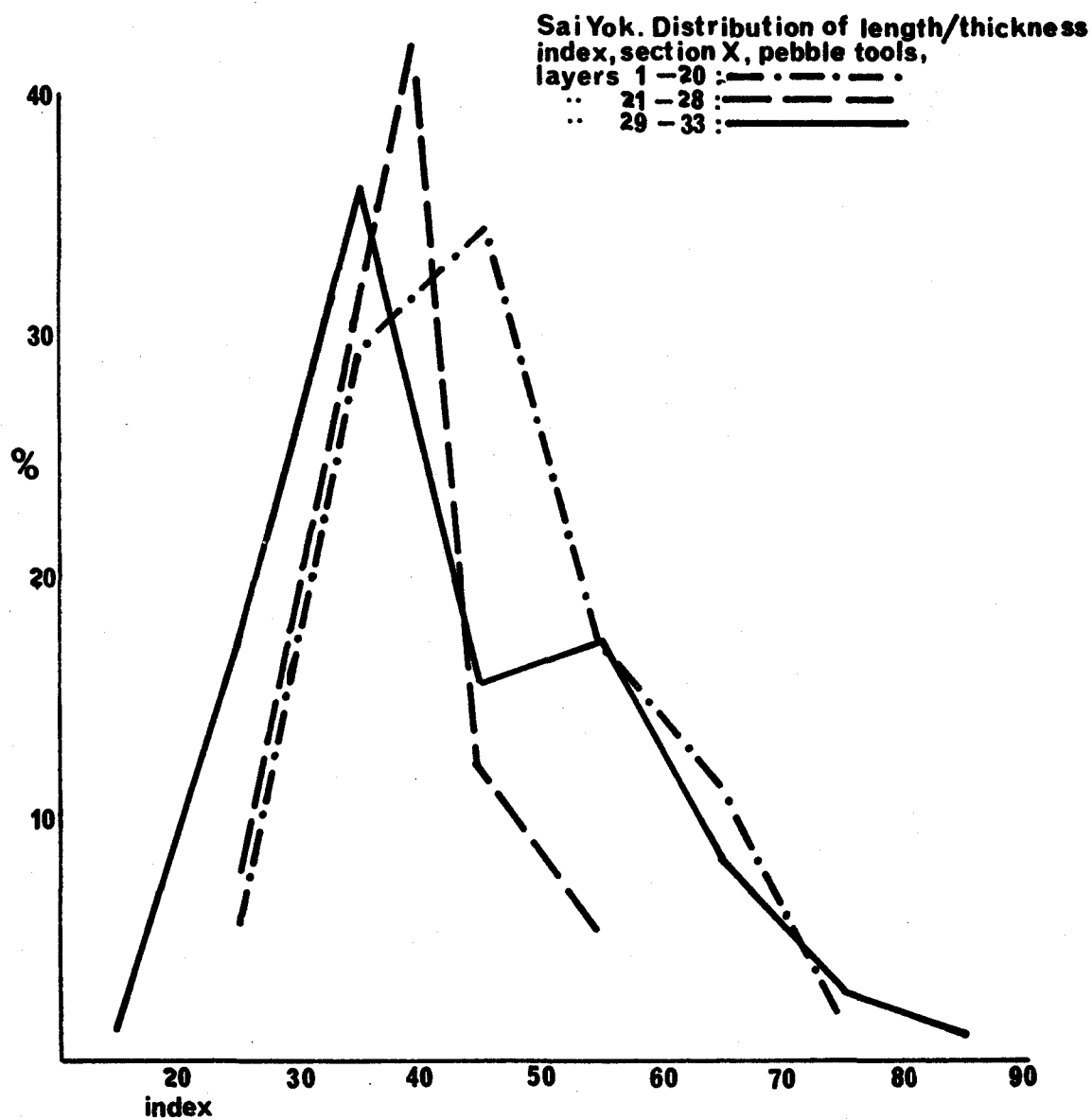


Figure 50.

JMM

Figure 51

Sai Yok. Distribution of thickness,
section X, pebble tools, according to
length less than 70 mm., N=20 : - . - . -
70-110 mm., N=38 : _____
layers 1-20.

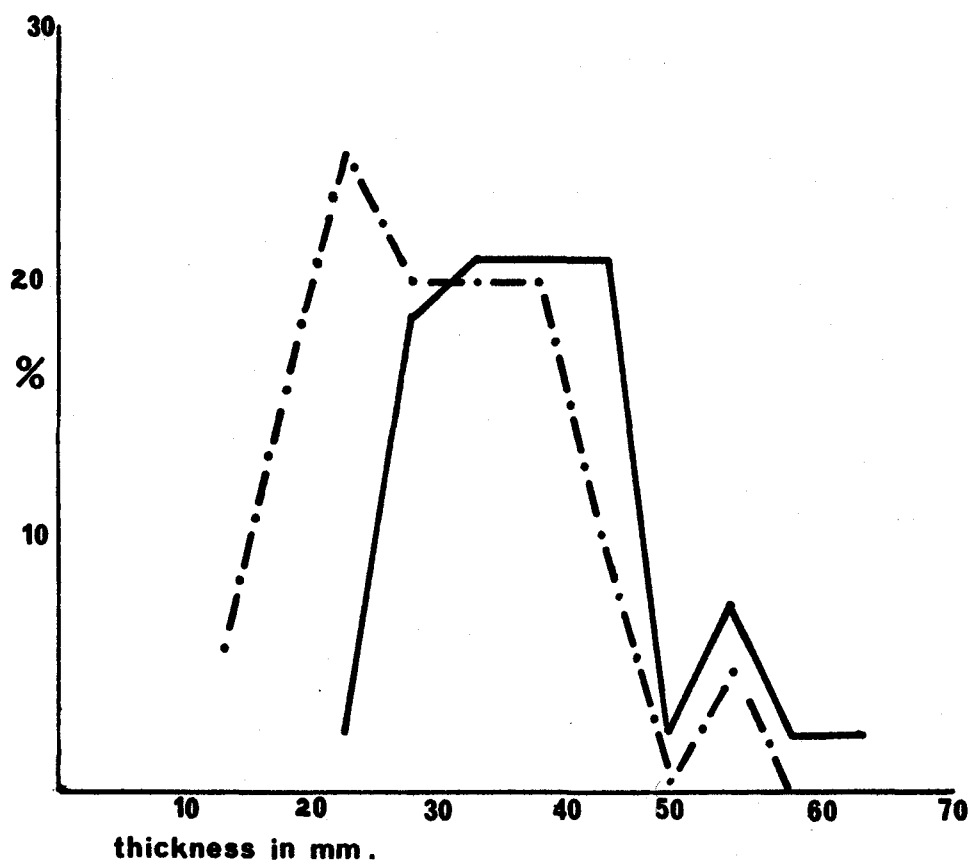


Figure 51.

JMM

Figure 52

Sai Yok. Distribution of length, section X,
pebble tools, according to

thickness less than 35 mm., N=41: — . — . —
.. 36-50 mm., N=29: —————
layers 1-20.

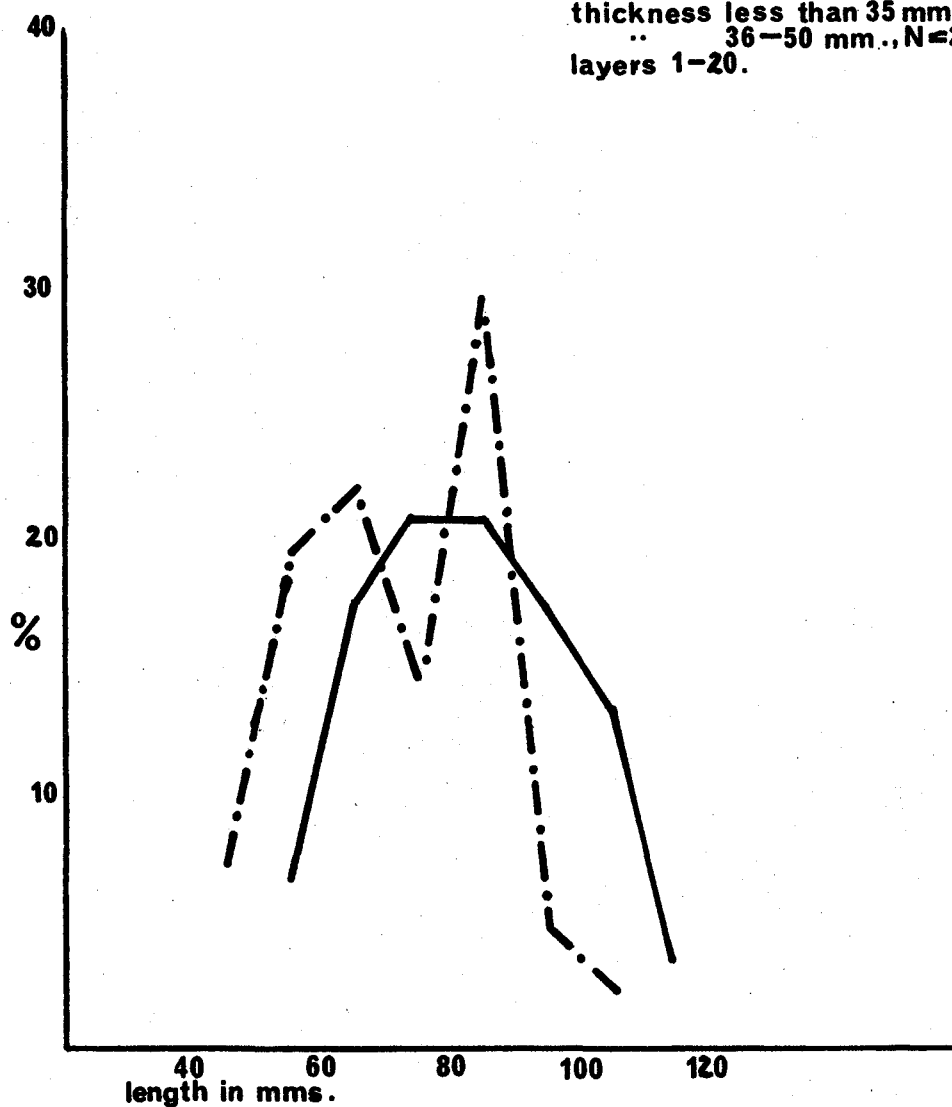


Figure 52 .

Sai Yok. Distribution of length according
to length thickness index
less than 50; N=45: — · — · — ·
more than 50, N=20: —————
pebble tools, layers 1-20.

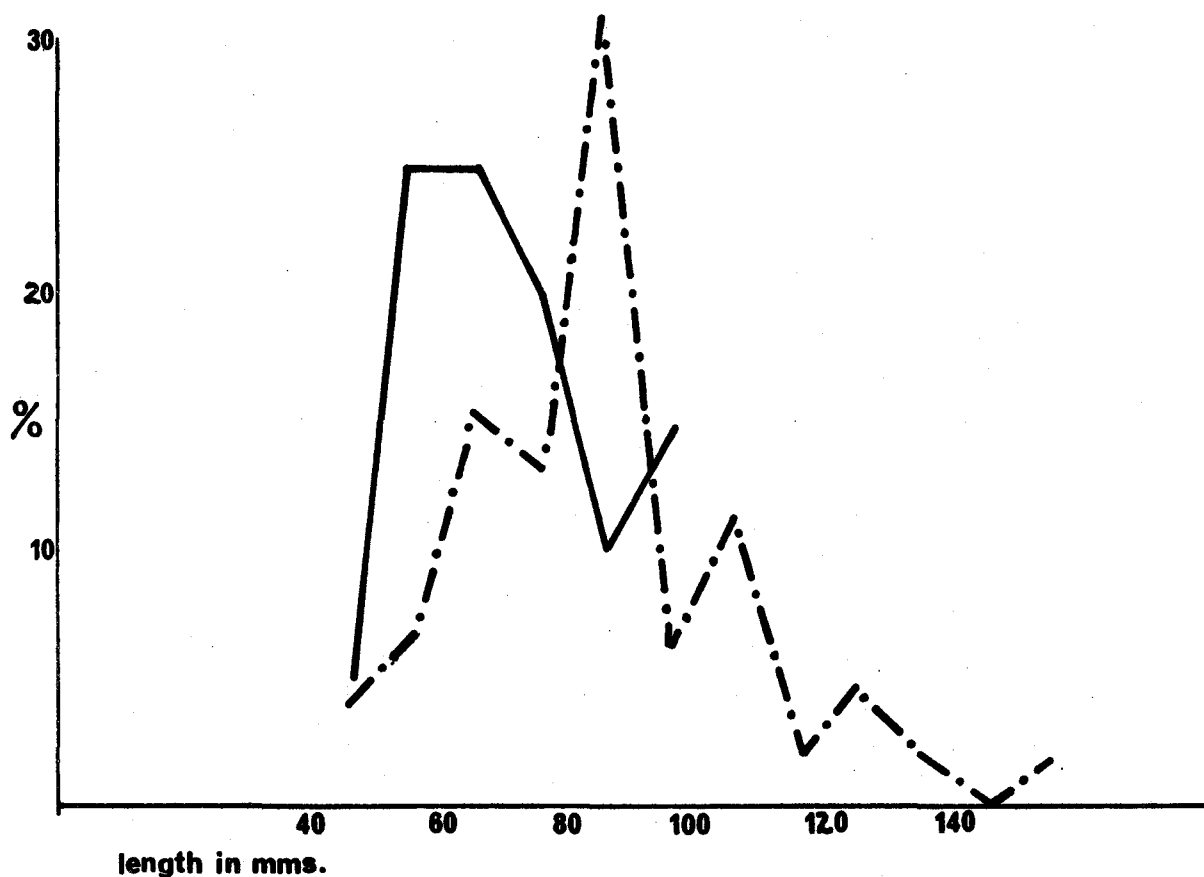


Figure 53.

JMM

Figure 54

Sai Yok. Distribution of thickness,
pebble tools, according to length/thickness
index less than 50, N=47: - . - . -
more than 50, N=20: —————
layers 1-20.

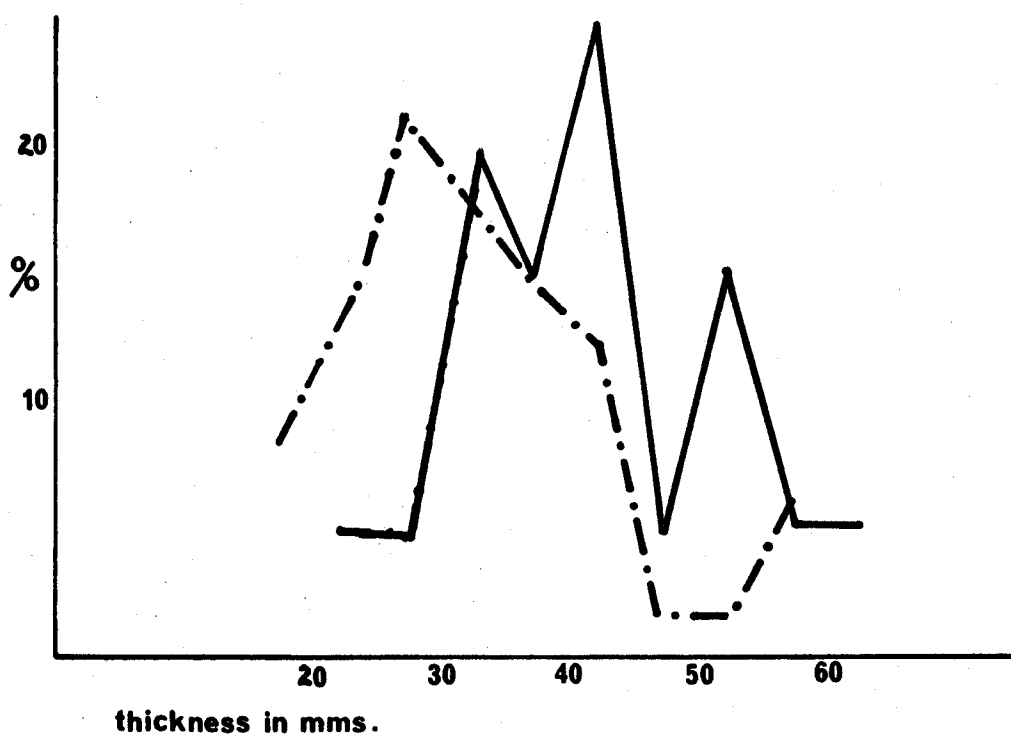


Figure 54.

JMM

Figure 55

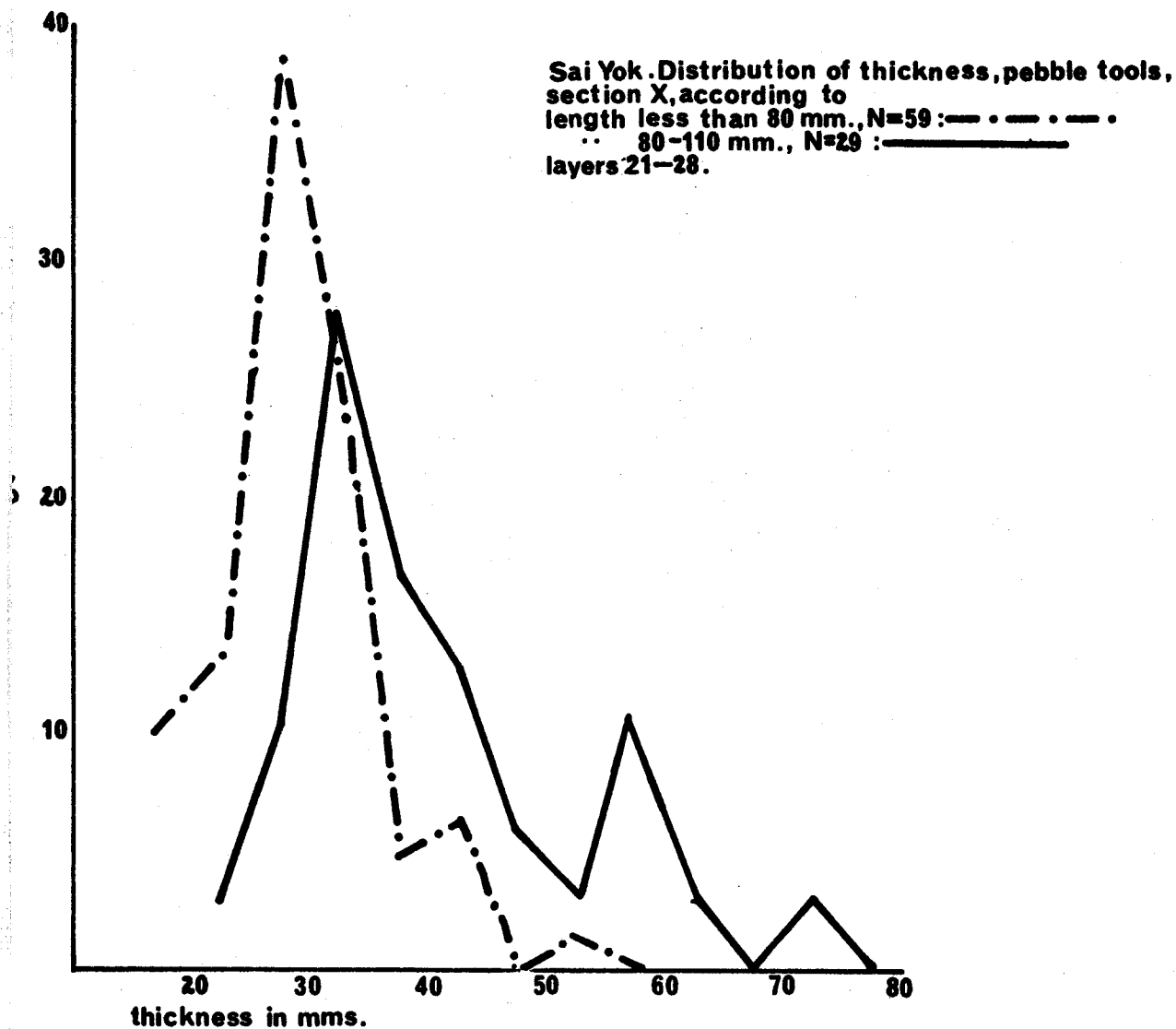


Figure 55.

JMM

Sai Yok. Distribution of B_1/B_2 index,
sample from all levels,
 $N=100$.

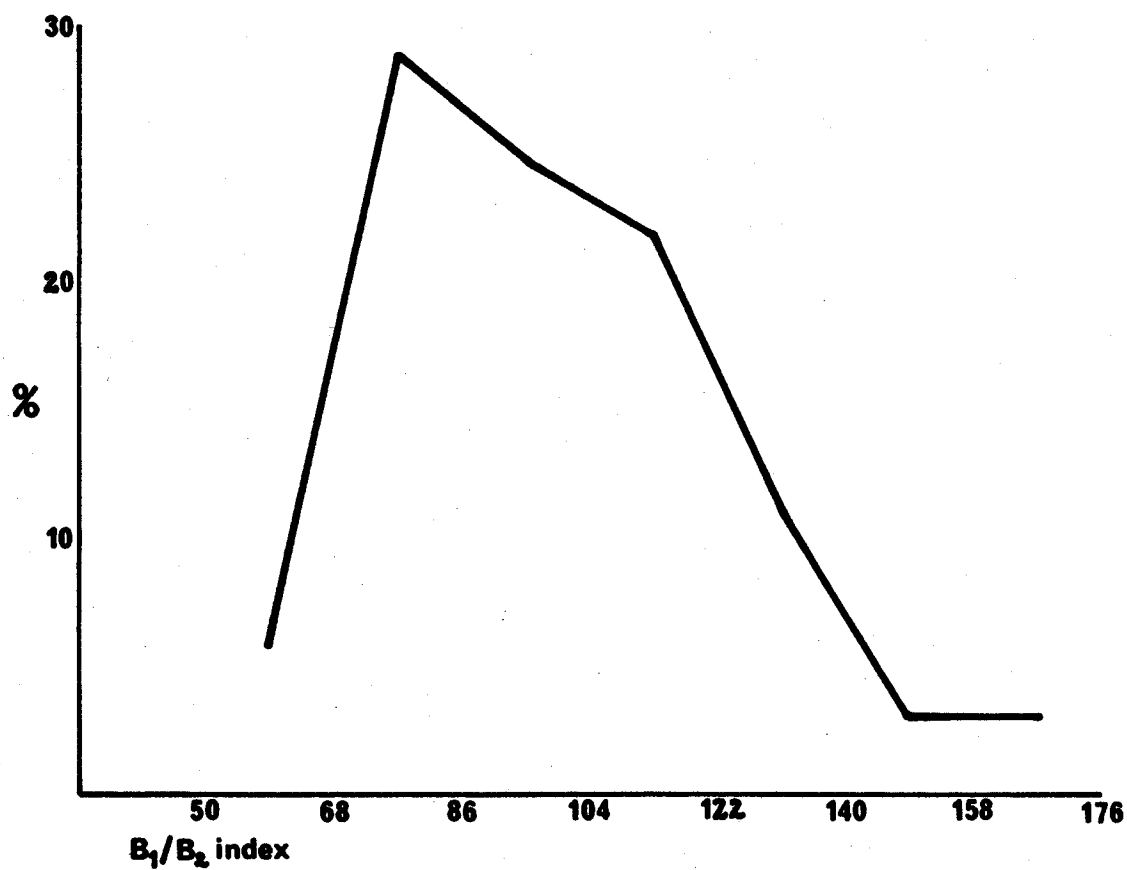


Figure 56 .

JMM

Figure 57

SaiYok. Distribution of L_1/L index,
sample from all levels, $N=100$.

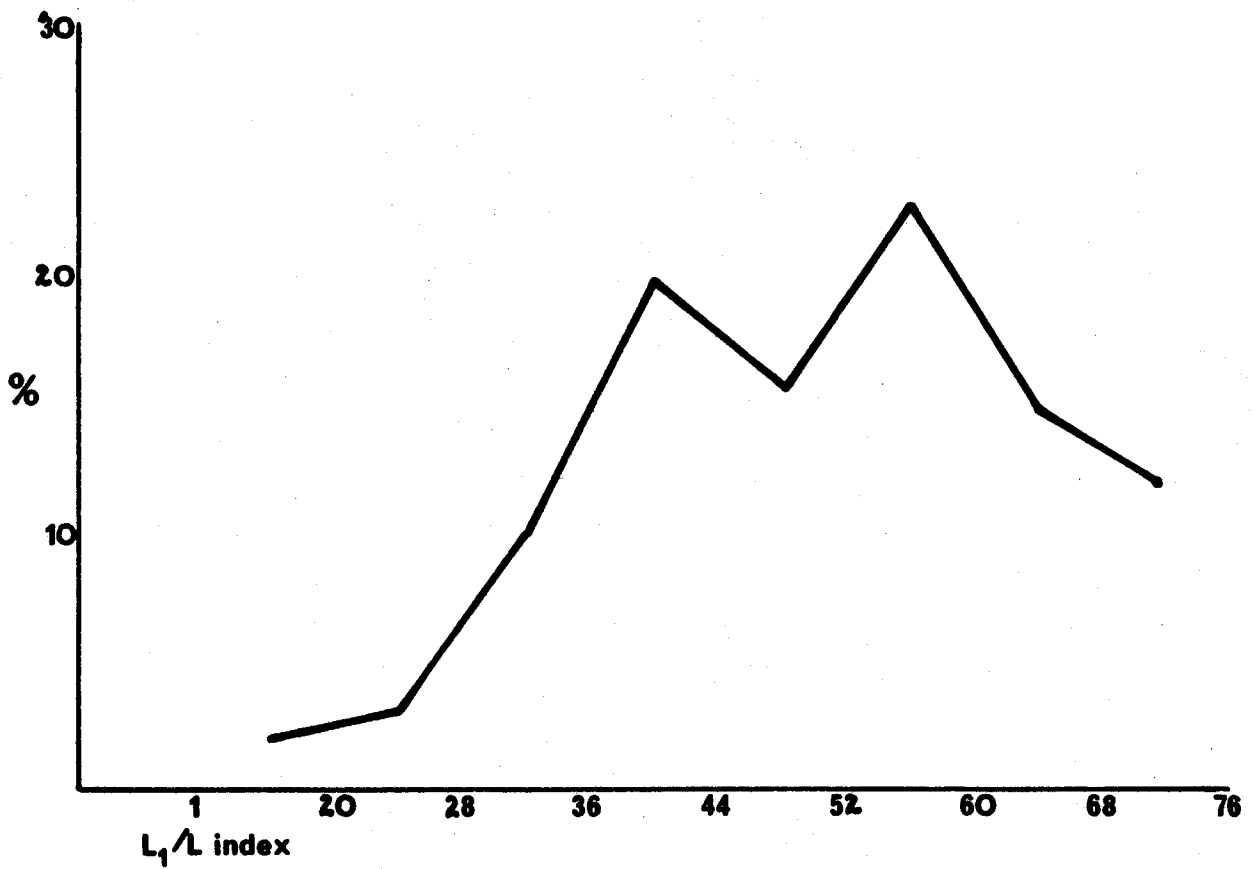


Figure 57.

JMM

Sai Yok. Sample of pebble tools,
section X, N=100; distribution of length
according to
 L_1/L index less than :43 — · — ·
more than :52 — — —

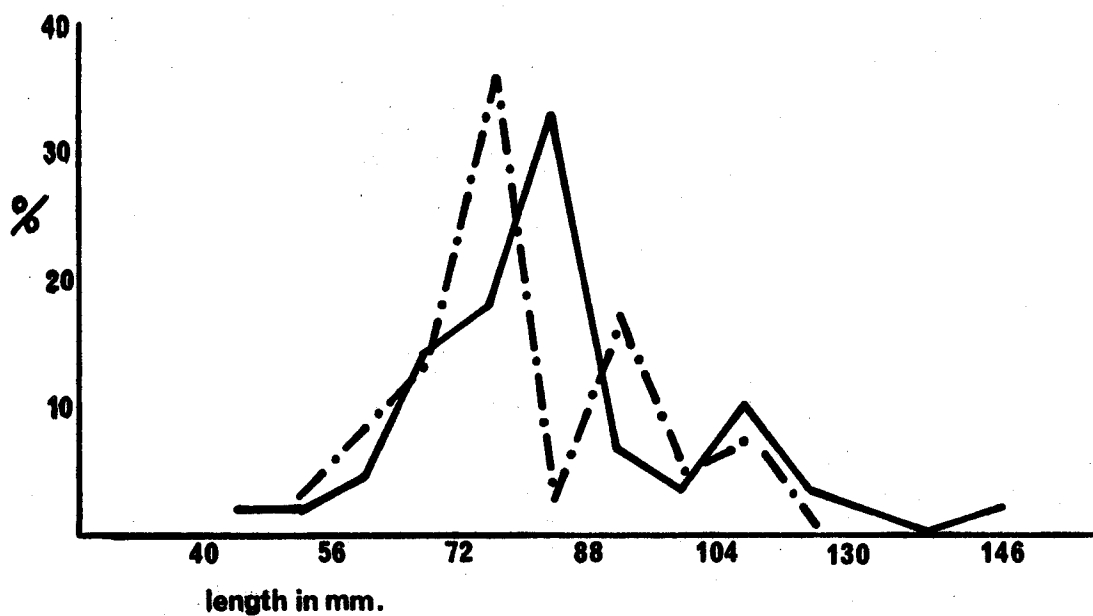


Figure 58.

JMM

Figure 59

Sai Yok. Sample from all levels,
N=100; distribution of breadth,
pebble tools, section X, for
L₁/L index less than 43: — · — ·
more than 52: —

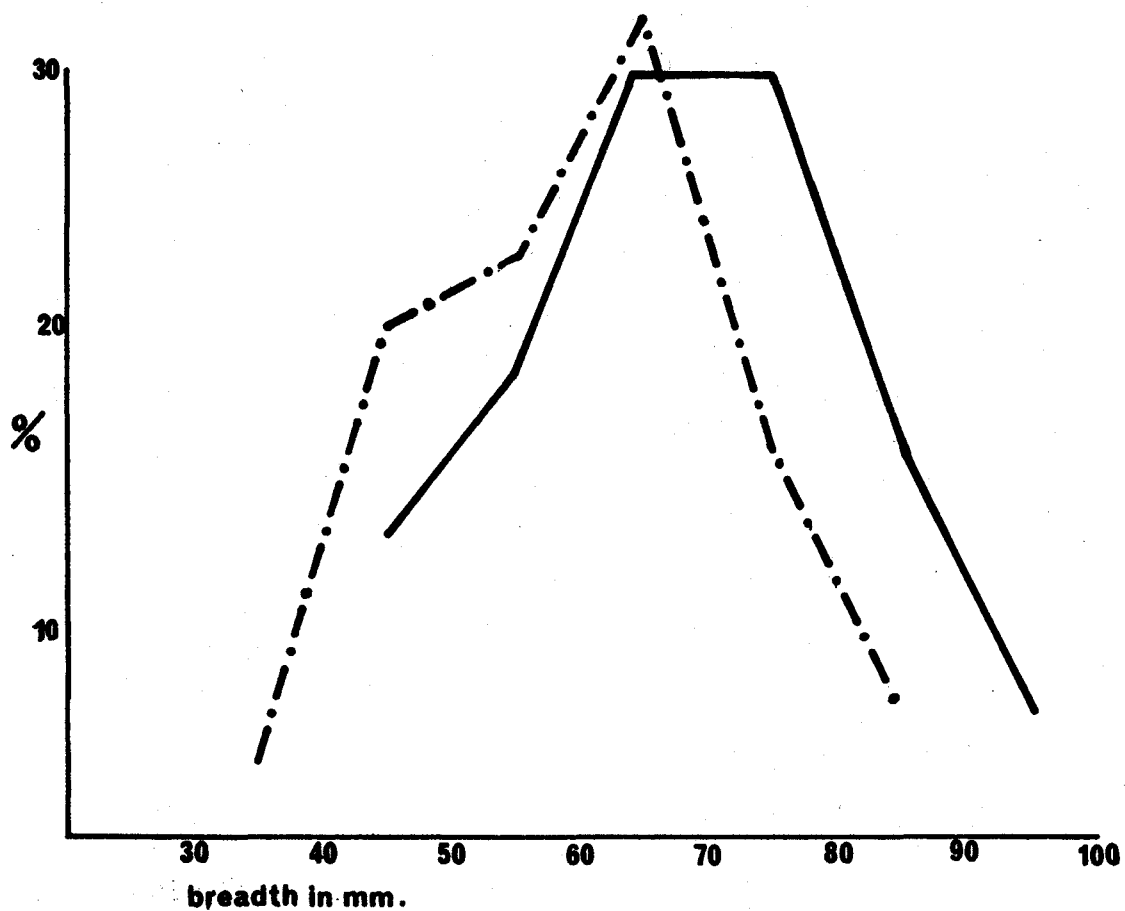


Figure 59.

JMM

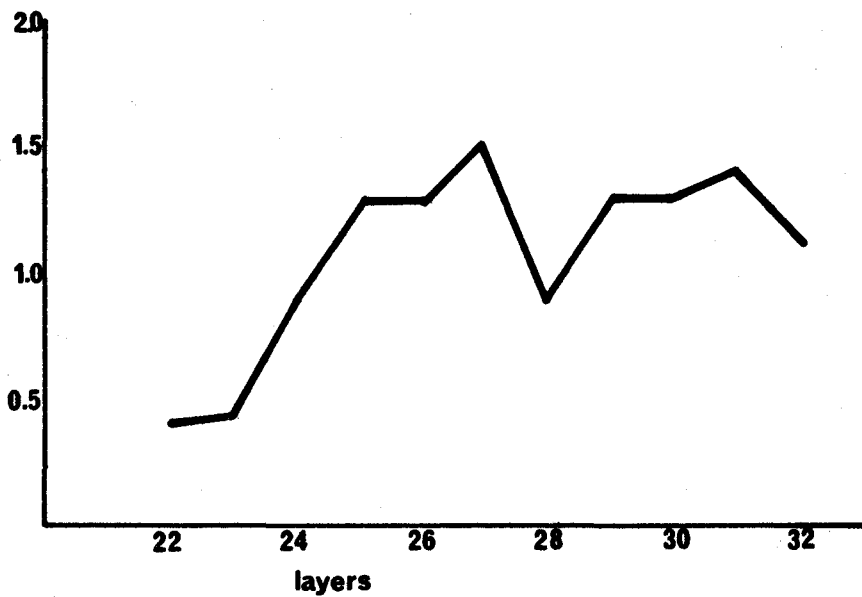


Figure 60 . Sai Yok, pebble tools. Mean scores for presence:absence of cortex.

JMM

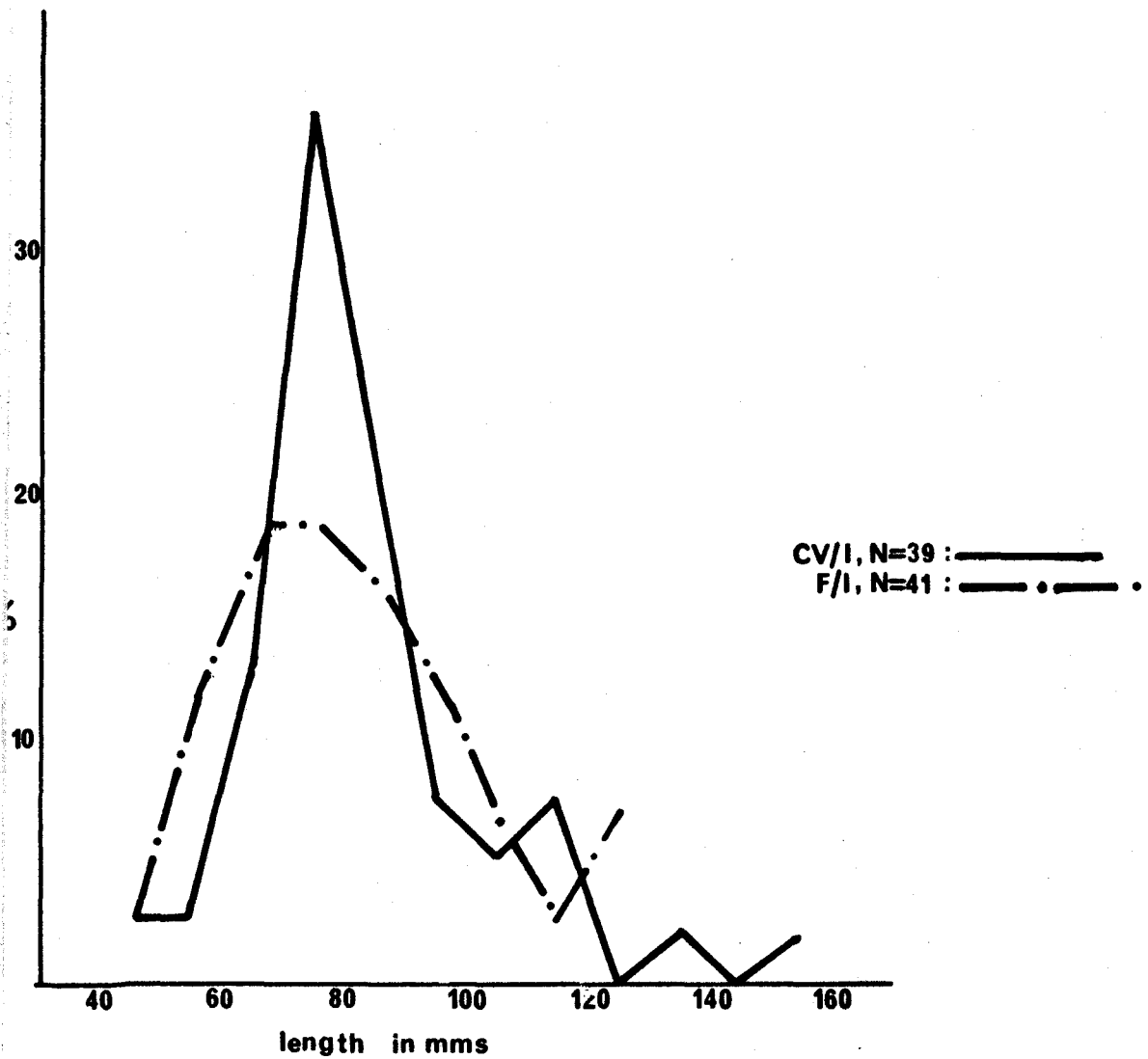


Figure 61. Sai Yok. A sample of 100 pebble tools grouped according to configurations CV/I, F/I. Length.

JMM

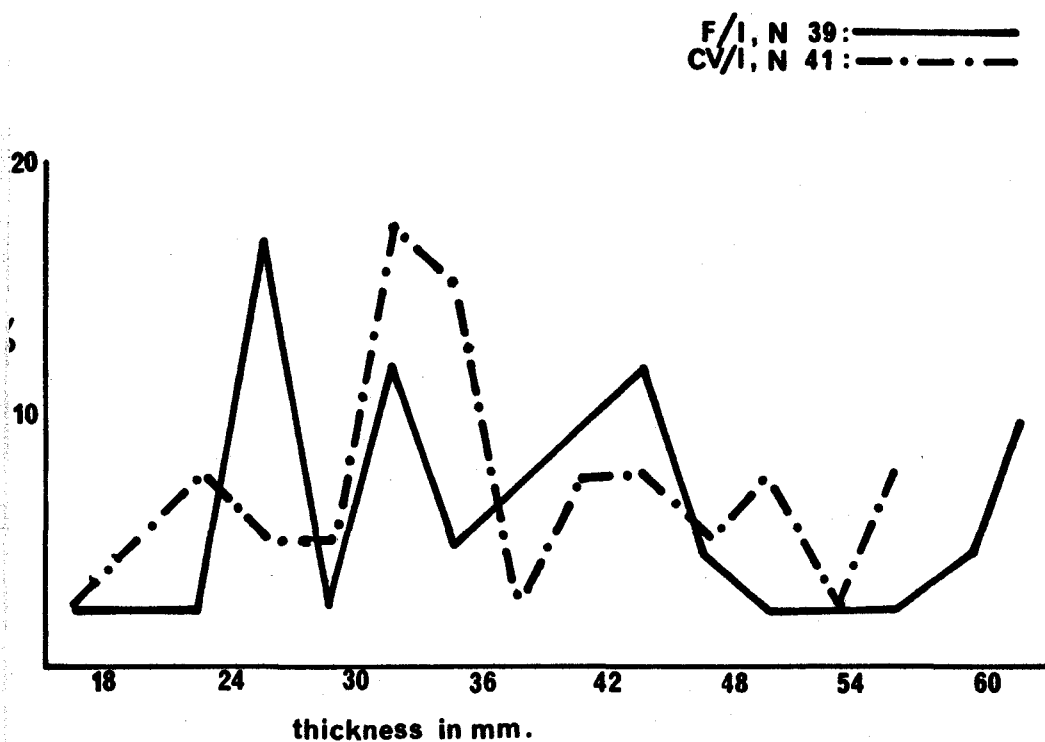


Figure 62. Thickness of pebble tools from Sai Yok grouped according to configurations F/I and CV/I.

JMM

Figure 63

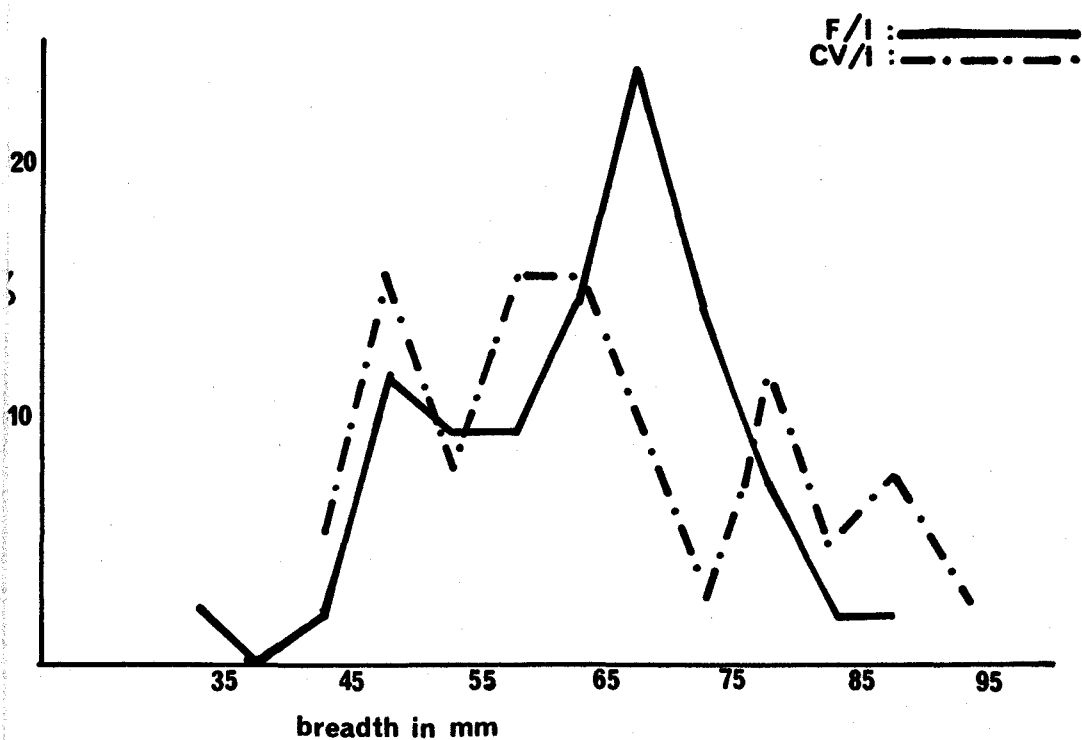


Figure 63. Pebble tools from Sai Yok grouped according to configurations CV/I and F/I.

JMM

Figure 64

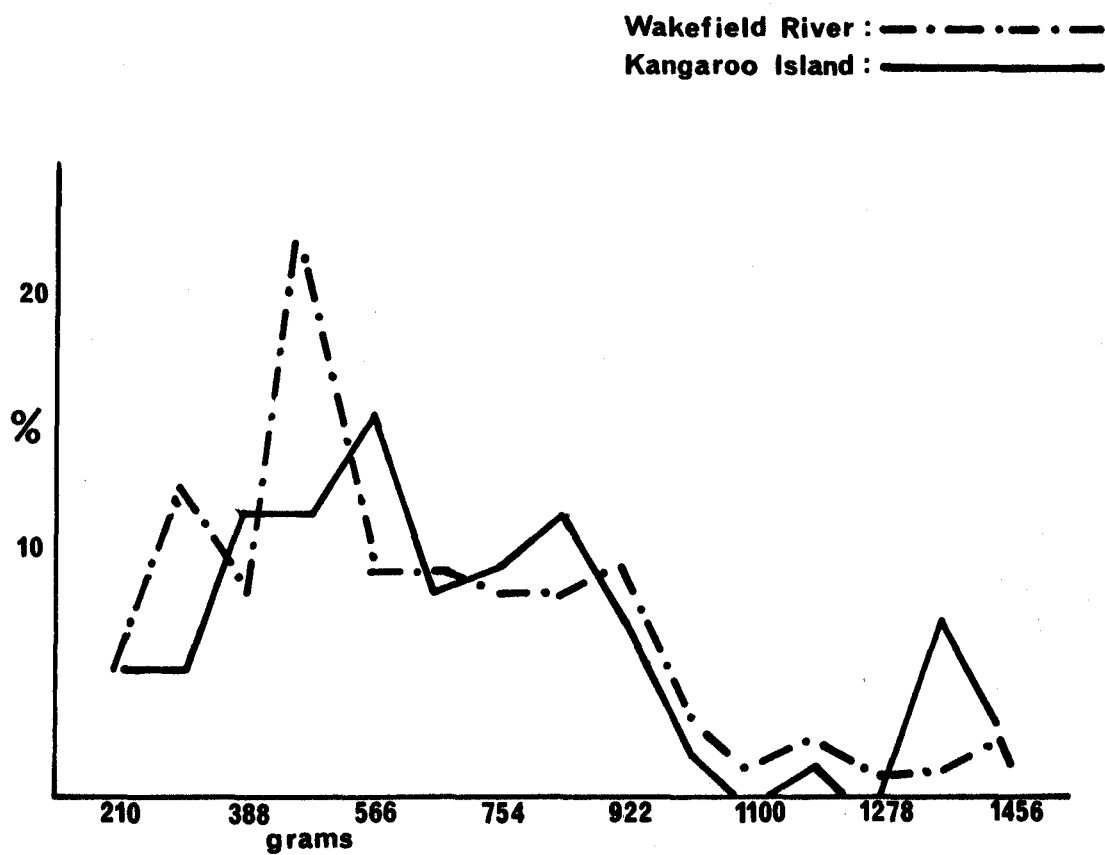


Figure 64 .Distribution of weight for the Wakefield River and Kangaroo Island.

JMM

Figure 65

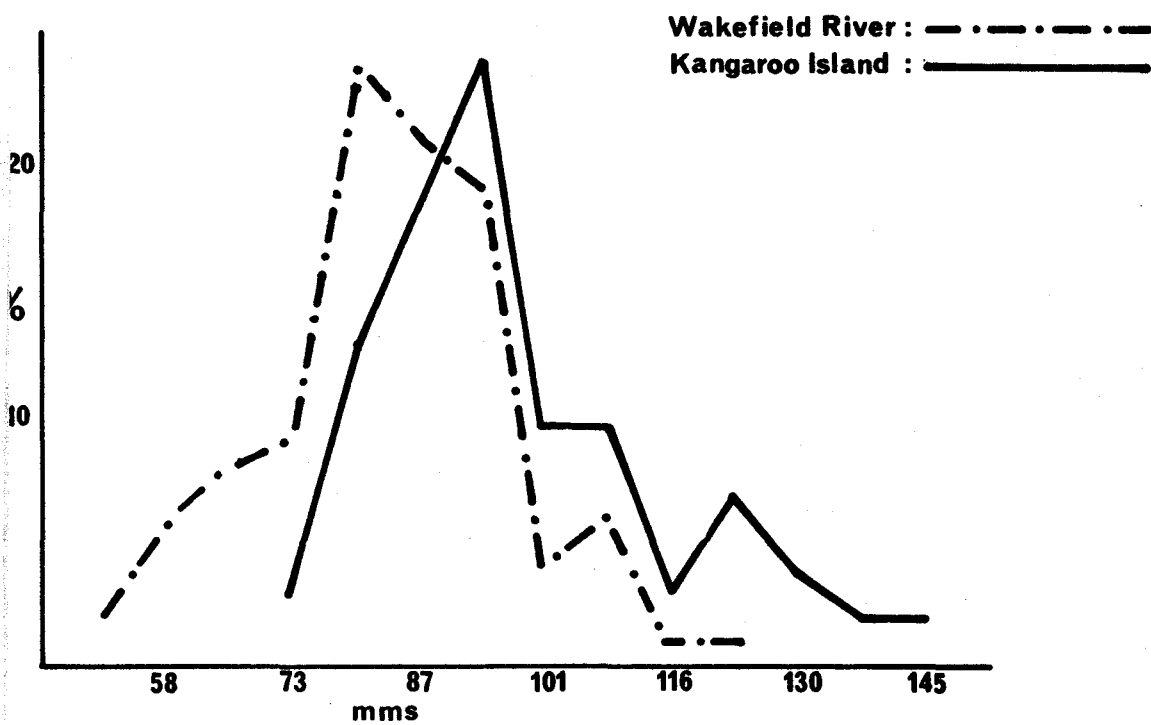


Figure 65 . Distributions of breadth for Kangaroo Island and the Wakefield River.

JMM

Figure 66

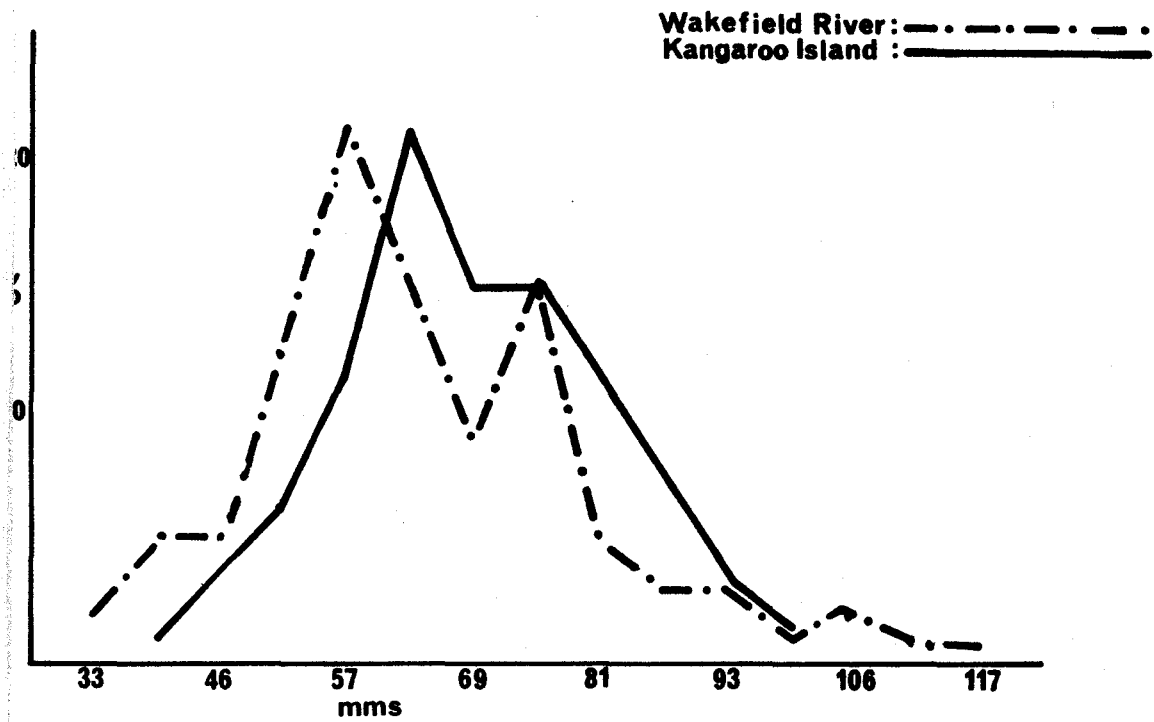


Figure 66. Distribution of thickness for Kangaroo Island and the Wakefield River.

JMM

Figure 67

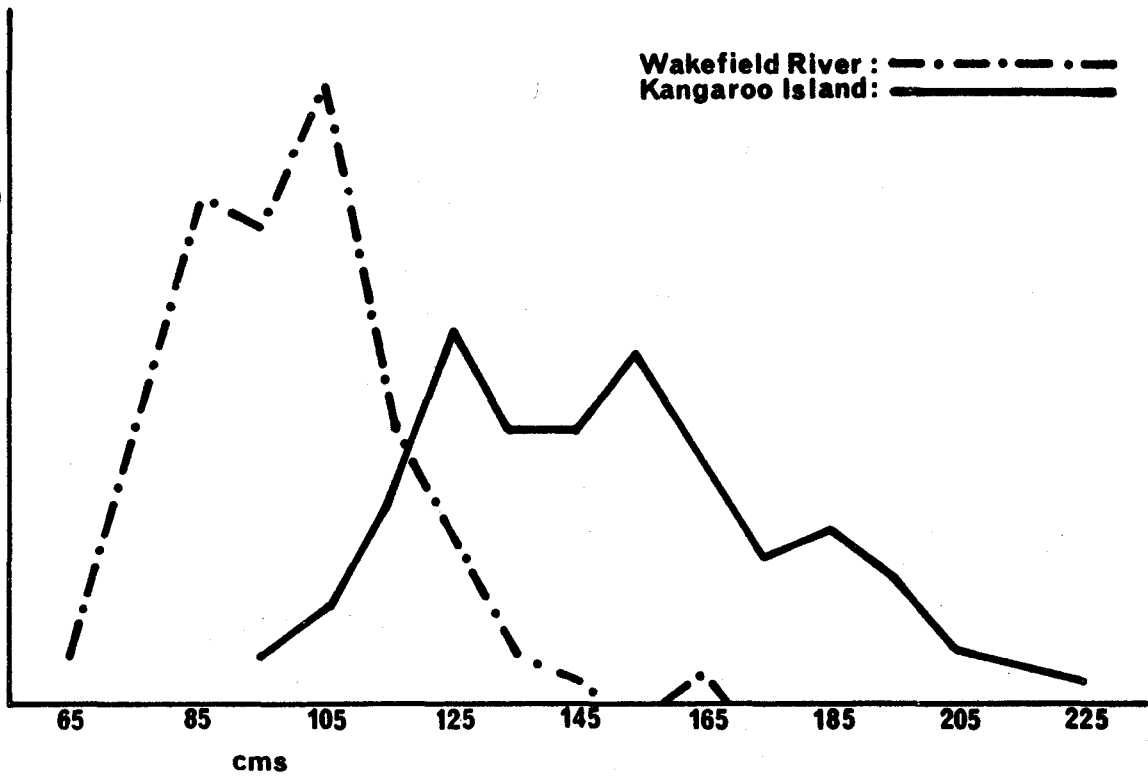


Figure 67 .Distributions of length for Kangaroo Island and the Wakefield River.

JMM

Figure 68

Wakefield River : - . - . - . - .
Kangaroo Island : —————



Figure 68 . Distribution of cutting angle for Kangaroo Island and the Wakefield River .

TABLE 1

Sao Dong	Cave and cave mouth	Colani, 1927; 7 - 18
Lang Neo	Cave and cave mouth	" 1927; 37 - 44
Lang Bay	Cave and cave mouth	" 1927; 51 - 52
X-Kham	Cave	" 1927; 19 - 23
M-Khang	Cave	" 1927; 31 - 36
Som Jo	Cave	" 1927; 45 - 47
Lang Vo	Cave	" 1927; 48 - 50
Trieng-Xen	Cave mouth	" 1927; 25 - 30
Ha Bi	Cave mouth	" 1927; 53

TABLE 1. Sites excavated in Hoa Binh Province by Colani in 1926.

TABLE 2

Site	Maximum depth of deposit
Sao Dong mouth cave	No information 2 metres
Xuan Kham	2 - 3 metres
Trieng-Xen	More than 2 metres
M-Khang	Hardly more than 1 metre
Lang Neo mouth cave	Not more than 1 metre 1.5 metres
Som-Jo	1.2 metres
Lang-Vo	10 centimetres
Lang-Bay mouth cave	No information No information
Ha-Bi	No information

TABLE 2. Maximum depths of deposits excavated by
Colani in Hoa Binh Province, 1926.

TABLE 3

	Number of artefacts	Mean in millimetres
<u>Length</u>		
Late period	50	63.7
Middle period	63	100.2
Early period	45	96.1
<u>Breadth</u>		
Late period	31	57.6
Middle period	59	67.8
Early period	45	72.3
<u>Thickness</u>		
Late period	27	27.9
Middle period	24	28.5
Early period	15	42.3

TABLE 3. Mean values of length, breadth and thickness of artefacts in Colani's three divisions.

TABLE 4

Site	Number found	Depth
Lang Neo	1	40 centimetres
Ha Bi	1	40 centimetres
Lang Bay	20	40 centimetres (mean)
Lang Vo	1	-
Sao Dong	5	3 at surface, 2 at about 1.40 metres

TABLE 4. Sites containing shells of Auricula Auris Judae, with numbers found and depths at which they were found in the deposits.

Lang Vanh	Shelter	Colani, 1929; 263
Da Phuc	Shelter	" 1929; 264
Pan Ve	Shelter	" 1929; 266
Phuc Luong	Cave	" 1929; 266
Hang Hao	Cave	" 1929; 267
Hang Oc	Cave	" 1929; 267
Dong Noi	Cave	" 1929; 267

TABLE 5. Sites excavated by Colani in Hoa Binh Province,
1929.

<u>Qui Dat region</u>		
Yen Lac	Cave	Colani, 1930; 325
Kim Bang	Cave	" 1930; 337
Xom Thom	Cave	" 1930; 341
Duc Thi	Cave	" 1930; 349
<u>Thanh Hoa region</u>		
Lang Bon	Shelter	Colani, 1930; 362
Dien Ha	Cave	" 1930; 375
Chom Dong	Shelter	" 1930; 378
Chom Van	Cave	" 1930; 382
Thach Son	Shelter	" 1930; 383
Bat Mot	Shelter	" 1930; 385
Loc Thinh	Cave	" 1930; 386
Moc Trach	Cave	" 1930; 390
My Te	Cave	" 1930; 392
Thach Lung	Shelter	" 1930; 396
Hang Da Bac	Cave	" 1930; 397
Hang To	Cave	" 1930; 397
Dong Giao	Cave	" 1930; 400

TABLE 6. Sites excavated by Colani in 1929 and 1930.

At the following sites, caves were excavated:-

Pho Binh Gia	Mansuy, 1924; 11-13
Keo Phay	" 1924; 8-11
Dong Thuoc	" 1924; 13-15
Na Che	" 1925A; 11-12
Binh Long	" 1925A; 12-14
Lang Van	" 1925A; 14-16
Bo Ky	" 1925A; 17
Hang Oc	" 1925A; 20
Lang Trang	" 1925A; 22-23
Giouc Giao	" 1925A; 23
Khac Kiem	" 1925A; 26
Bang Mac	" 1925B; 12
Han Moen	Mansuy and Colani, 1925; 28
Dong Lay	" 1925; 28
Chuc Quan	" 1925; 33
Lang Loi	" 1925; 34
Na Con	" 1925; 36
Ba Xa	" 1925; 37

At the following sites, rock shelters were excavated:-

Vo Muong	Mansuy, 1925A; 14-16
Co Kho	" 1925A; 18-20
San Xa	" 1925A; 27-28
Suam Son	" 1925A; 28-29
Lang Cuom	Mansuy and Colani, 1925; 7-27
Lang Rang	" 1925; 27
Na Moun	" 1925; 36

At the following sites, both caves and shelters were excavated:

Minh Le	Mansuy, 1925A; 20-22
Con Ke	" 1925A; 28-29

TABLE 7. Sites excavated in Bac Son.

TABLE 8

Name of site	Date excavated	Reference
Guak Kepah	1860	Earl, 1860
"	1934	Callenfels, 1936
Gunong Cheroh	1891	Wray, 1905
Gua Kajang	1917	Evans, 1918
Gua 'To 'Long	1917	Evans, 1920
Kota Tongkat	1917	" 1920
Gua Kerbau	1926	Callenfels and Evans, 1928
"	1927	Evans, 1928
Gua Debu	1935	Collings, 1936
Gua Kelawar	1935	" 1936
Gol Ba'it	1935	Callenfels and Noone, 1940
Bukit Chintamani	1935	Tweedie, 1936
Gua Cha	1935	Noone, 1939
Bukit Chuping	1936	Collings, 1937
Gua Madu	1939	Tweedie, 1940
Gua Cha	1954	Sieveking, 1954

TABLE 8. Sites excavated in Malaya.

TABLE 9

Site	Maximum depth
Gua Kajang	Over four feet
Gua'To 'Long	Three to four feet
Kota Tongkat	Four feet
Gua Kerbau	Four metres
Gua Debu	Twenty-six feet, of which only first two and a half feet were habitation deposit
Gol Ba'it	Two and a half metres
Bukit Chintamani	One and a half metres
Bukit Chuping	Three feet six inches
Gua Cha	Eleven feet

TABLE 9. Maximum reported depths of sites in Malaya.

Bos sp. - wild ox
Capricornis sumatrensis - goat antelope
Muntiacus muntjak - barking deer
Cervus unicolor - sambur deer
Sus cristatus - wild pig
Sus barbatus - wild pig
Macaca nemestrina - pig tailed macaque
Pithecus sp. - langur
Rhizomys sp. - bamboo rat
Helarctos malayanus - Malay bear
Rusa sp. - large deer
Turtle
Tortoise
Porcupine

TABLE 10. Vertebrate species identified from
Malayan sites.

Fresh water species

1. Fam. Melaniidae. Common.
2. Fam. Viviparidae. Not common.
3. Fam. Unionidae. Not common.
4. Fam. Ampullariidae. Very common.

Fresh and brackish water species

5. Fam. Cyrenidae. Very common.

Mangrove species

6. Telescopium telescopium. Common.
7. Verithidea obtusa. Common.

Marine species

8. Mytilus sp. Not common.
9. Hemitapes marmorata. Common.
10. Arca granosa. Very common.
11. Nerita lineata. Very common.
12. Ostrea sp. Not common.
13. Cyprea miliaris. Not common.

TABLE 11. Molluscan species reported from Bukit
Chuping.

TABLE 12

Site	Total reported	Uniface	Biface
Gua Kajang	5	1	?
Gua 'To 'Long	6	-	6
Kota Tongkat	2	?	1
Gua Kerbau	?	some	some
Gua Debu	32	?	some
Gol Ba'it	?	some	some
Bukit Chintamani	?	?	?
Bukit Chuping	6	6	-
Gua Madu	500	?	some
Gua Cha	-	-	some

TABLE 12. Flaked pebble tools from Malayan sites.

TABLE 13

Site	Total	No. of pebble tools edge- ground but not flaked	No. of pebble tools edge- ground and flaked
Gunong Cheroh	1	-	-
Gua 'To 'Long	3	2	1
Gua Kerbau	?	?	?
Gol Ba'it	1	1	-
Bukit Chintamani	1	1	-
Gua Madu	2	1	1

TABLE 13. Edge-ground tools from Malayan sites.

TABLE 14

Catalogue no.	Provenance	Remarks
<u>Musee de l'Homme,</u> <u>Paris</u>		
32.94.18	Lang Vanh	Unifacially flaked pebble tool
34.39	Lang Vanh	"
32.94.81	Lang Bon	"
32.94.109	Lang Bon	"
32.94.76	Lang Bon	"
32.94.92	Lang Bon	"
32.94.106	Lang Bon	"
32.94.99	Lang Bon	Bifacially flaked pebble tool
32.94.8	Chom Dong	Unifacially flaked pebble tool
34.39	Da But	Edge ground pebble tool
32.94.128	Yen Lac	"
33.39.10	Vo Muong	"
33.39.12	Len Dat	"
33.39.18	Lang Rang	"
34.39	Xuen Kham	"
33.39.23	Minh Le	"
<u>Pitt Rivers Museum,</u> <u>Oxford</u>		
	Gunong Pondok, Perak, Malaya	Five bifacially worked pebble tools
	Medan district, NE coast of Sumatra	Three unifacially worked pebble tools
<u>Museum of Ethnography</u> <u>and Archaeology,</u> <u>Cambridge</u>		
27. 1995 A	Gunong Pondok, Perak, Malaya	Unifacially flaked pebble tool
27. 1995 B	"	"
27. 1997 A	"	Bifacially flaked pebble tool
27. 1997 B	"	"
27. 1997 C	"	"
37. 547 C	Gol Ba'it, Perak, Malaya	Unifacially worked pebble tool
27. 1998	?	Bifacially flaked pebble tool
32. 573	Sumatra	Unifacially flaked pebble tool

TABLE 14

TABLE 15

Description	Number	Percentage	Description	Number	Percentage
Flaked tools	707	52.9	Uniface pebble tools	528	39.5
			Truncated pebble tools	120	8.9
			Bifacials	40	2.9
			Split pebbles	19	1.4
Hammer stones	1	0.07			
?? cores	29	2.2			
?? tools	596	44.6			
?? artefacts	3	0.2			
Total	1336				

TABLE 15. Section X, numbers and percentages of various classes of artefacts.

TABLE 16

Description	Number	Percentage	Description	Number	Percentage
Flaked tools	113	97.4	Uniface pebble tools	85	73.3
			Truncated pebble tools	12	10.4
			Bifacials	4	3.5
			Split pebbles	12	10.4
Hammer stones	0				
?? cores	0				
?? artefacts	3	2.6			
Total	116				

TABLE 16. Section C, numbers and percentages of various classes of artefacts.

TABLE 17

Source	D.F.	Sum of squares	Variance	F
<u>Maximum breadth</u>				
Between groups	2	5072	2536.1	14.61
Within groups	513	89010	173.5	
Total	515	94082		
<u>Position of maximum breadth</u>				
Between groups	2	7549	3774.8	15.71
Within groups	513	123243	240.2	
Total	515	130793		
<u>Maximum length</u>				
Between groups	2	16344	8172.3	18.95
Within groups	513	221133	431.1	
Total	515	237478		
<u>Breadth at 1/5 length</u>				
Between groups	2	1003	501.8	3.61
Within groups	513	71136	138.7	
Total	515	72139		
<u>Breadth at 4/5 length</u>				
Between groups	2	3336	1668.0	9.57
Within groups	513	89348	174.2	
Total	515	92684		
<u>Maximum thickness</u>				
Between groups	2	7500	3750.1	27.63
Within groups	513	69618	135.7	
Total	515	77118		
<u>Weight</u>				
Between groups	2	1233876	616938.0	22.27
Within groups	513	14208999	27697.8	
Total	515	15442875		

TABLE 17. Analysis of variance on a sample of 516 uniface pebble tools from section X, the section being divided horizontally to give three divisions containing approximately equal numbers of artefacts.

TABLE 18

Source	D.F.	Sum of squares	Variance	F
<u>Maximum breadth</u>				
Between groups	2	706	352.8	1.93
Within groups	513	93377	182.0	
Total	515	94082		
<u>Position of maximum breadth</u>				
Between groups	2	579	289.7	1.14
Within groups	513	130214	253.8	
Total	515	130793		
<u>Maximum length</u>				
Between groups	2	691	345.4	.74
Within groups	513	236788	461.6	
Total	515	237478		
<u>Breadth at 1/5 of length</u>				
Between groups	2	643	321.6	2.30
Within groups	513	71497	139.4	
Total	515	72139		
<u>Breadth at 4/5 of length</u>				
Between groups	2	339	166.9	.92
Within groups	513	92350	180.0	
Total	515	92684		
<u>Maximum thickness</u>				
Between groups	2	347	123.5	1.15
Within groups	513	77071	150.0	
Total	515	77118		
<u>Weight</u>				
Between groups	2	29725	14862.5	.98
Within groups	513	15413150	30045.1	
Total	515	15442875		

TABLE 18. Analysis of variance on a sample of 516 uniface pebble tools from section X, the section being divided vertically along the Y coordinate to give three divisions containing

TABLE 19

Source	D.F.	Sum of squares	Variance	F
<u>Maximum breadth</u>				
Between groups	2	885	443.9	2.43
Within groups	513	93197	181.6	
Total	515	94082		
<u>Position of maximum breadth</u>				
Between groups	2	443	221.9	.87
Within groups	513	130349	254.0	
Total	515	130793		
<u>Maximum length</u>				
Between groups	2	1808	904.4	1.96
Within groups	513	235669	459.3	
Total	515	237478		
<u>Breadth at 1/5 length</u>				
Between groups	2	961	480.7	3.46
Within groups	513	71178	138.7	
Total	515	72139		
<u>Breadth at 4/5 length</u>				
Between groups	2	222	111.1	.61
Within groups	513	92461	180.2	
Total	515	92684		
<u>Maximum thickness</u>				
Between groups	2	345	172.6	1.15
Within groups	513	76773	149.6	
Total	515	77118		
<u>Weight</u>				
Between groups	2	58854	2942.7	.98
Within groups	513	15384021	29988.3	
Total	515	15442875		

TABLE 19. Analysis of variance on a sample of 516 uniface pebble tools from section X, the section being divided vertically along the Z coordinate to give three divisions containing approximately equal numbers of artefacts.

TABLE 20

Coordinate	Division 1	Division 2	Division 3	Total
X	169	191	156	516
Y	168	175	173	516
Z	166	168	180	516

TABLE 20. Numbers of unifacially flaked pebble tools falling into three arbitrary divisions made along the X, Y and Z coordinates of section X.

TABLE 21

Variable	Layer	N	Mean	Standard deviation	Coefficient of variation
1	1	161	5.9	1.2	20.3
	2	198	6.0	1.3	21.7
	3	154	6.6	1.0	15.1
2	1	161	3.8	1.4	36.8
	2	198	3.9	1.4	35.8
	3	154	4.7	1.7	36.1
3	1	161	7.7	2.0	25.9
	2	198	7.8	1.9	24.3
	3	154	9.3	2.4	25.8
4	1	161	4.4	1.0	22.7
	2	198	4.5	1.1	24.4
	3	154	4.8	1.3	27.1
5	1	161	4.5	1.2	26.1
	2	198	4.6	1.2	26.1
	3	154	5.2	1.7	32.7
6	1	161	3.2	0.9	28.1
	2	198	3.1	1.1	35.4
	3	154	3.9	1.4	35.8
7	1	161	163.4	95.9	58.6
	2	198	156.2	88.8	56.8
	3	154	209.5	124.2	59.2

TABLE 21. Sai Yok. Section X. Means of seven variables for three arbitrary divisions.

TABLE 22

Variable	Divisions 1-2	Divisions 1-3	Divisions 2-3
Maximum breadth	0.5	5.2	5.1
Position maximum breadth	1.2	5.2	3.9
Maximum length	0.5	6.6	6.7
Breadth 1/5 length	0.5	2.9	2.4
Breadth 4/5 length	0.9	3.8	2.4
Maximum thickness	1.2	4.8	5.7
Weight	0.7	3.6	4.5

TABLE 22. Values of difference between means of
s.e. difference
seven variables for unifacially flaked pebble
tools from three arbitrary divisions along the
X coordinate, section X.

Artefact	Calculated value of χ^2	Significant value of χ^2 at 5 per cent level
Reworked flakes	2.00	11.1
Bifacials	7.34	11.1
Truncated tools	11.1	12.6
Uniface tools	62.6	12.6
?? tools	greatly in excess of 67.7	12.6

TABLE 23. Calculated values and significant values of χ^2 for the distribution of artefacts in section X below layer 20.

TABLE 24

	Surface A	Surface B	Surface C	Surface D
Group 1	24	11	-	-
Group 2	1	2	1	20
Group 3	-	-	5	1

TABLE 24. Numbers of valves of Chione stutchburyi in three groups with surface forms A, B, C, and D.

TABLE 25

	Percentage of sample
<u>Group 1</u>	
Length less than 20.4 millimetres	
Width less than 26.5 millimetres	
Weight less than 14 grams	
Surface A or B	
35 valves	49.3
<u>Group 2</u>	
Length 20.5 - 27.4 millimetres	
Width 26.6 - 32.5 millimetres	
Weight 15 - 37 grams	
Surface D	
20 valves	28.2
<u>Group 3</u>	
Length more than 27.4 millimetres	
Width more than 32.5 millimetres	
Weight more than 37 grams	
Surface C	
5 valves	7.0
Unclassified	
11 valves	15.5

TABLE 25. Definitions of three groups of Chione stutchburyi valves from a midden deposit at Kauri Point.

Variable	Calculated value of χ^2	Significant value of χ^2 at 5 per cent level
Length	25.87	22.36
Breadth	24.90	21.03
Thickness	24.85	24.99
Length/breadth index	23.60	18.30

TABLE 26. Calculated values of χ^2 and significant values of χ^2 for fitting the distributions of length, breadth, thickness and length/breadth index to the appropriate normal curve for a sample of 100 unifacially flaked pebble tools from section X.

TABLE 27

Cortex configuration	Percentage
NNNN	67
SSSS	11
SSAA	5
NAAN	1
NNSN	5
NNAN	1
NNSS	2
NNNS	1
SNNN	2
SSNA	1
NNAS	1
NSAS	1
SAAA	1
SSSA	1

TABLE 27. Percentages of unifacially flaked pebble tools with various configurations of cortex remaining on the worked face in a sample of 100 artefacts from all levels, section X.

Observation	Configuration	Percentage
9	SSSS	82
11	SSSS	
9	NNNN	4
11	SSSS	
9	SSNS	3
11	SSNS	
9	NNNN	2
11	SSNN	
9	SSSN	2
11	SSSN	
9	NSSS	1
11	SSSS	
9	SNNS	1
11	SNNS	
9	NNNN	1
11	AAAA	
9	SSNN	1
11	NNNN	
9	SNNN	1
11	NNNN	
9	NNNN	1
11	AANN	
9	NNSN	1
11	SSSS	

TABLE 28. Configurations of observations 9 and 11 for a sample of 100 unifacially flaked pebble tools from section X.

TABLE 29

Observation	Configuration	Percentage
16	F/I	42
17	F/I	
16	Cv/I	40
17	Cv/I	
16	Cv/I	5
17	F/I	
16	F/Cv	1
17	F/Cv	
16	I/I	4
17	I/I	
16	F/F	6
17	F/F	
16	Cv/F	2
17	Cv/F	

TABLE 29. Configurations for observations 16 and 17
on a sample of 100 unifacially flaked
pebble tools from section X.

Number in tray	Number taken	Designation of tray
19	2	Conventional semi-uniface
25	2	"
22	2	"
9	1	"
32	3	i. Made from a corner ii. Work blunted examples
26	2	Also used as hammer stones
26	2	Worn and battered upper edge
25	2	Upper edge trimmed down
29	3	Patinated, concretions, and weathering
7	1	Fully uniface
26	2	Conventional semi-uniface
27	2	"
40	4	"
12	1	"
11	1	Miscellaneous large

TABLE 30. 'Firsts' from Kangaroo Island.

TABLE 31

Configuration	Kangaroo Island	Yamba	Seelands	Sai Yok
	Percentage	Percentage	Percentage	Percentage
CC CF CF CC	89	56	4	5
CF CF CF CF	7	32	88	77
CF CF CF CC	1	3	5	8
CF CF CC CC	2	8	3	10

TABLE 31. Proportions for observation 13 in the coded record.

Wakefield RiverCutting angle 65° - 75°

Mean breadth : 85.08 millimetres N = 26

Cutting angle 90°

Mean breadth : 82.90 millimetres N = 44

Kangaroo IslandCutting angle 65° - 75°

Mean breadth : 100.01 millimetres N = 48

Cutting angle 90°

Mean breadth : 95.60 millimetres N = 13

TABLE 32.

TABLE 33

Variable	Mean Group CF CF CF CF	Mean Group CC CF CF CC	t
Length	129 mm.	125 mm.	0.43
Breadth	107 mm.	96 mm.	0.27
Thickness	43 mm.	41 mm.	0.54
Weight	49.0 gms.	48.7 gms.	0.05

TABLE 33. Pebble tools from Yamba.

TABLE 34

Pebble tools	26
Pebble tools made on	
split pebbles	18
Truncated pebble tools	11
Truncated pebble tools	
made on split pebbles	4
Bifacially worked tools	<u>1</u>
Total number of tools examined	60

TABLE 34. Proportions of kinds of pebble tools
from Seelands.

TABLE 35

Layer	N	Length cms.	Breadth cms.	Thickness cms.	Weight gms.	Cutting angle
II	6	12.7	8.0	4.3	442	53°
III	4	7.0	6.5	3.0	450	51°
IV	2	10.5	7.5	2.5	350	45°
IIIA	18	9.6	7.2	3.2	306	57°
IVA	10	8.6	6.2	2.3	180	45°
VA	2	8.5	7.5	5.0	350	50°

TABLE 35. Means for various layers at Seelands.

Variance ratio at 1 per cent level of probability for

$$n_1 = 5, n_2 = 36 : 3.70$$

Calculated variance ratio for

length	=	2.88
breadth	=	1.26
thickness	=	3.43
weight	=	1.79
cutting angle	=	1.05

TABLE 36. Calculated variance ratios for Seelands.

TABLE 37

Site	Number in Sample	Mean (cms.)	Coefficient of variation
Wakefield River	100	99.8 ⁺ 2.70	18.14
Kangaroo Island	100	148.8 ⁺ 1.98	19.83
Yamba	71	123.9 ⁺ 4.00	27.12
Seelands	42	99.2 ⁺ 4.24	28.22
Sai Yok	100	83.7 ⁺ 1.92	22.93

Sites	Difference between means	<u>Difference</u> s.e. difference
Wakefield River Kangaroo Island	49.0	4.62
Kangaroo Island Yamba	24.9	3.36
Yamba Seelands	24.7	4.23
Seelands Sai Yok	15.5	3.29

TABLE 37. Means of length, and the significance of the difference between means.

TABLE 38

Site	Number in sample	Mean (cms.)	Coefficient of variation
Wakefield River	100	84.3 [±] 1.60	18.98
Kangaroo Island	100	100.4 [±] 2.08	20.72
Yamba	71	81.1 [±] 3.10	22.19
Seelands	42	75.1 [±] 2.61	22.64
Sai Yok	100	63.8 [±] 1.30	20.38

Sites	Difference between means	<u>Difference</u> s.e. difference
Kangaroo Island Wakefield River	16.1	6.19
Kangaroo Island Yamba	19.3	6.67
Yamba Seelands	6.0	1.76
Seelands Sai Yok	11.3	3.89

TABLE 38. Means of breadth, and the significance of the difference between means.

TABLE 39

Site	Number in sample	Mean (cms.)	Coefficient of variation
Wakefield River	100	64.4 [±] 1.40	21.7
Kangaroo Island	100	71.6 [±] 2.03	28.3
Yamba	71	40.2 [±] 1.41	16.6
Seelands	42	33.5 [±] 1.62	31.9
Sai Yok	100	37.5 [±] 1.20	32.0

Sites	Difference between means	<u>Difference</u> s.e. difference
Wakefield River	7.2	2.88
Kangaroo Island		
Kangaroo Island	31.4	12.56
Yamba		
Yamba	2.7	1.17
Sai Yok		
Sai Yok	4.0	2.10
Seelands		
Yamba	6.7	3.72
Seelands		

TABLE 39. Means of thickness, and the significance of the difference between means.

TABLE 40

Site	Number in sample	Mean (gms.)	Coefficient of variation
Wakefield River	100	612 [±] 29	47.6
Kangaroo Island	100	663 [±] 31	46.8
Yamba	71	478 [±] 28	51.1
Seelands	42	300 [±] 29	63.0
Sai Yok	100	201 [±] 13	65.6

Sites	Difference between means	<u>Difference</u> s.e. difference
Wakefield River	51	0.7
Kangaroo Island		
Kangaroo Island	185	5.5
Yamba		
Yamba	178	4.3
Seelands		
Seelands	99	3.1
Sai Yok		

TABLE 40. Means of weight, and the significance of the difference between means.

TABLE 41

Site	Number in sample	Mean (degrees)	Coefficient of variation
Wakefield River	100	83.2 $\pm$ 1.85	2.23
Kangaroo Island	100	75.8 $\pm$ 1.20	1.58
Yamba	71	60.8 $\pm$ 1.26	1.81
Seelands	42	57.3 $\pm$ 1.10	2.71

Sites	Difference between means	<u>Difference</u> s.e. difference
Wakefield River	7.4	3.08
Kangaroo Island		
Kangaroo Island	15.0	8.34
Yamba		
Yamba	3.4	1.30
Seelands		

TABLE 41. Means of cutting angle, and the significance of the difference between means.

TABLE 42

Site	Number in sample	Mean	Coefficient of variation
Yamba	71	155.1 ⁺ 4.28	29.63
Seelands	42	141.2 ⁺ 6.36	25.49
Sai Yok	100	132.2 ⁺ 2.90	21.93

Sites	Difference between means	<u>Difference</u> s.e. difference
Yamba Seelands	14.0	1.79
Seelands Sai Yok	9.0	1.40
Yamba Sai Yok	22.9	3.69

TABLE 42. Means of length x 100, and the significance of
breadth
the difference between means.

TABLE 43

	Kangaroo Island	Yamba	Seelands	Sai Yok
Kangaroo Island				
Yamba	None			
Seelands	None	Breadth Cutting angle $\frac{\text{Length} \times 100}{\text{Breadth}}$		
Sai Yok	None	Thickness	$\frac{\text{Thickness} \times \text{Length}}{\text{Breadth}} \times 100$	

TABLE 43. Relationships between samples revealed by the difference between means.

HOA BINH

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			P					
Sao-Dong	2 metres	Mainly <u>Melania</u> midden	72	11	-	1000	One grinding stone	-	-	-	<u>Unio</u> , <u>Auric-ula</u> <u>auris</u> <u>Judae</u>	Sherds	Rare	Present
X-Kham	2-3 metres	Mainly <u>Melania</u> midden	21	3	-	170	-	-	1	-	<u>Unio</u>	-	Rare, include rhinoceros	-
Trieng-Xen	More than 2 metres	Mainly <u>Melania</u> midden	21	3	-	170	Polishing stone, pestle	4	3	-	<u>Unio</u>	-	Numerous, include rhinoceros	Present, some burnt
M.-Khang	1 metre	Mainly <u>Melania</u> midden	25	2	-	190	3 large stones with depressions	-	1	-	-	-	-	4 lower mandibles
Lang Neo	2 metres	Mainly <u>Melania</u> midden	43	10	-	600	Pestle, polishing stones	6	-	-	<u>Unio</u> <u>AAJ</u>	Intact recent pots. Also bronze objects	Carnivore canine pierced at root	2 skulls: 1 fragmentary 1 recent
Som-Jo	1.2 metres	Mainly <u>Melania</u> midden	13	2	-	-	-	-	-	-	-	Some	-	1 lower mandible
Lang Vo	10 centimetres	Mainly <u>Melania</u> midden	8	1	-	-	-	-	-	-	<u>AAJ</u>	Sherds	Rare	-

HOA BINH

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			P					
Lang-Bay	-	Mainly <u>Melania</u> midden	7	1	-	-	-	-	-	-	<u>Auricula auris Judae</u>	-	-	1 lower mandible
Ha-bi	-	Mainly <u>Melania</u> midden	4	-	-	-	-	-	-	-	AAJ	-	-	-
Lang-vanh	3 metres 70 centimetres	<u>Melania</u> midden	-	54	5	600	One polishing stone	18	-	-	<u>Unio</u> <u>AAJ</u>	Some sherds	A few teeth	Fragments of about 8 skulls
Da-phuc	3 metres	<u>Melania</u> midden	-	38	-	1200	Two polishing stones. Pestles	150	-	<u>Unio</u>	-	Some sherds	Rhinoceros Elephant Carnivores Deer	Numerous fragments of skulls
Phu-ve	2 metres	<u>Melania</u> midden	-	-	-	-	-	6	-	<u>Unio</u>	-	Some sherds	-	Remains of several skulls
Phuc-luong	1 metre	<u>Melania</u> midden	-	-	-	-	-	7	-	-	-	Some sherds	Mammalian	-
Hang-hao	70 centimetres	<u>Melania</u> midden	-	-	-	-	-	-	-	-	-	-	Mammalian	-
Hang-oc	1 metre 45 centimetres	<u>Melania</u> midden	-	-	-	-	-	-	-	<u>Unio</u>	-	Some sherds	Mammalian	Fragments
Dong-noi	-	<u>Melania</u> midden	-	-	-	-	-	8	-	<u>Unio</u>	-	Some sherds	Mammal	Fragments

HOA BINH

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			p					
Lang bon	3 metres 70 centimetres	Calcareous clay and <u>Melania</u> midden	34	4	1	-	6 hammer stones 2 pestles	2	6	<u>Unio</u>	-	Some sherds	Crustacea <u>Trionyx</u> Carnivore Rhinosceros Deer	About 14 individuals
Dien ha	3 metres 80 centimetres	<u>Melania</u> midden	-	-	-	-	Pestles Hammer stones Iron tools	-	-	-	-	Some sherds	-	2 long bones
Chom dong	-	<u>Melania</u> midden	-	8	-	-	Hammer stones	-	-	-	<u>Helix</u>	Some recent sherds	Pig Deer Turtle	Fragments of skulls of 5 individuals
Dong Giao	2 metres 10 centimetres	<u>Melania</u> midden	-	1	-	-	Pestles	1	1	-	<u>Helix</u>	-	Mammals	Fragments of 2 recent skulls
Chom van	-	Disturbed	-	-	-	-	Some hammer stones, pestles	-	-	-	<u>Helix</u>	Sherds, not ancient	Rare	-
Thach-son	2 metres	Calcareous clay with <u>Melania</u> shells	-	-	1	-	-	-	-	-	AAJ <u>Unio</u>	Recent	Crustacea Turtles Rhinosceros Deer Carnivores	Fragments of 2 mandibles
Bat moi	-	Disturbed	-	-	-	-	Pestles	-	-	-	<u>Unio</u>	-	-	-
Loc-thinh	1 metre 30 centimetres	Disturbed	-	-	-	-	Hammer stones	-	1	-	AAJ	Some sherds	Crustacea <u>Trionyx</u> Deer	Some

HOA BINH

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			p					
Moch-trach	-	Calcareous clay	-	-	-	-	Hammer stones	1	-	<u>Unio</u>	-	A few sherds	Deer Carnivores Some burnt	Fragmentary
My-te	-	Calcareous clay	-	1	1	2	Hammer stones Iron knife	-	-	-	<u>Melania</u> <u>Unio</u> <u>Helix</u>	Some sherds	Mammals	Part of a mandible
Thac-lung	-	Calcareous clay with <u>Melania</u>	-	3	-	-	Hammer stones	-	-	-	-	-	-	-
Hang da-bac	-	Disturbed	-	-	1	-	Hammer stones	-	-	-	-	-	-	-
Hang to	-	Calcareous clay with <u>Melania</u>	-	-	1	-	Hammer stones	-	-	-	<u>Unio</u>	-	Deer	-
Yen-luong	-	-	8	-	-	-	Grinding stones	-	-	-	<u>Melania</u>	-	Mammals	-
Tchong-doi	-	-	6	-	-	-	-	-	-	-	-	-	Mammals	-
Nhan	-	-	6	2	-	-	-	-	-	-	-	Some sherds	-	-

BAC SON

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			p					
Binh-Long	1 metre 80 centimetres	Shells and loose earth	9	9	-	-	One pounding stone	1	-	-	-	Some sherds	-	-
Vo-muong	1 metre 60 centimetres	-	15	5	-	-	One grinding stone Pestles	2	-	-	-	Some sherds	-	-
Lang-Va	2 metres	Fine earth with shells	12	1	-	-	Pestles	-	-	-	-	Some sherds	-	-
Bo-Ky	-	Disturbed by guano diggers	3	-	-	-	-	-	-	-	-	-	-	-
Lang-luc	-	-	4	-	1	-	1 pestle 1 perforated schist pendant	-	-	-	-	-	-	-
Co-kho	1 metre 85 centimetres	Calcareous clay with shells	6	6	-	-	-	-	-	-	-	-	-	-
Hang-oc	1 metre	With shells (concretions)	1	1	-	-	-	-	-	-	-	-	Bos sp. Deer	-
Minh-le cave	50 centimetres	Disturbed	-	2	1	-	1 pestle	-	-	-	-	-	-	-
Minh-le shelter	-	-	2	8	-	-	Fragments of pounding stones	-	-	-	-	-	-	Fragments of 2 skulls

BAC SON

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			P					
Keo-Phay	1 metre	-	25	2	-	-	4 pestles, hammer stones	-	-	-	-	-	-	Present
Pho-binh-gia	2 metres	Soft, with ash layers	1	2	4	-	1 polishing stone Pestles Grinding stones	2	-	Fragment of a shell ring	<u>Unio</u> <u>Melania</u> <u>Cyprea</u> sp.	Some sherds	Horse Turtle other mammals	5 adults 2 infants
Dong-thuoc	1 metre 20 centimetres	Calcareous clay with shells	4	5	5	-	-	-	-	-	<u>Melania</u> <u>Unio</u>	Some sherds	<u>Bos</u> sp. Deer Tortoise	Remains of 2 individuals
Lang-trang	60 centimetres	-	3	4	-	-	-	-	-	-	-	Some sherds	-	-
Giouc-giao	60 centimetres	Calcareous clay with shells	11	10	-	-	Flakes, some large, more or less reworked. Stones with depressions	-	-	-	-	-	-	-
Khac-Kiem	-	-	1	1	1	-	-	-	-	-	-	Some sherds	-	Fragments of 2 skulls
San-xa	-	-	-	8	1	-	-	-	-	-	-	One sherd	-	Fragments of 2 individuals
Suam-son	50 centimetres	-	-	-	1	-	-	-	-	-	-	-	-	-
Lai-ta	-	Calcareous clay	1	4	-	-	Grinding stone. 2 polishing stones. 3 hammer stones	-	-	-	<u>Cyprea</u> <u>Arca</u>	-	-	-

BAC SON

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			P					
Bang-mac	70 centimetres	-	2	-	-	-	One polishing stone	-	-	-	<u>Cyprea</u>	-	-	-
Na-che	-	-	3	7	-	-	One grinding stone	-	1	-	-	-	-	-
Con-ke shelter	2 metres	-	4	3	1	-	Two pestles	-	-	-	-	Clay beads	-	-
Con-ke cave	65 centimetres	Disturbed	2	2	3	-	-	-	-	-	-	-	-	-

QUANG BINH

Site	Depth of deposit	Nature of deposit	Stone tools				Other implements	Bone Artefacts		Shell artefacts	Other shell	Pottery	Faunal remains	Human remains
			F	EG	P	T			P					
Yen lac	2 metres 50 centimetres	Calcareous clay	10	3	1	-	1 mortar 1 grinding stone	4	-	<u>Unio</u>	-	Some sherds some recent	Mostly deer	1 mandible
Kim bang	-	Calcareous clay	4	-	-	-	1 hammer stone	1	-	-	<u>Melania</u>	Some sherds some recent	Mostly deer	-
Xom Tham	1 metre 40 centimetres	Calcareous clay	-	-	1	-	Pestles Beads	3	1	Shell disks	-	Numerous sherds some recent	Some	-