THE STONE AGE OF INDONESIA

VERHANDELINGEN
VAN HET KONINKLIJK INSTITUUT
VOOR TAAL-, LAND- EN VOLKENKUNDE

61

THE STONE AGE OF INDONESIA

H. R. VAN HEEKEREN

Second, Revised Edition

with a contribution by

R. P. SOEJONO

THE HAGUE - MARTINUS NIJHOFF - 1972

I.S.B.N. 90.247.1300.5

PREFACE TO THE FIRST EDITION

Indonesian prehistoric archaeology was only a little-known and recently developed science in the days that Dr. P. V. van Stein Callenfels took the first tentative steps in this field of study, and ever since other scholars walked in his steps and helped to advance our prehistoric knowledge.

Dr. W. J. A. Willems, who was the first to introduce an entirely new scientific method of excavation, Dr. A. N. J. Thomassen à Tuessink van der Hoop, who distinguished himself by field-work in Sumatra and later as the Djakarta Museum's general oracle and Prof. Dr. G. H. R. von Koeningswald who enjoys a world-wide recognition owing to his palaeontological studies, were my predecessors whom I feel it my pleasant duty to remember here because I learned so much from them.

Among the foreign scholars who had a great part in the progress of prehistoric research I wish to mention in particular Prof. Dr. Robert Heine-Geldern, Paul and Fritz Sarasin and Prof. Dr. Hallam L. Movius Jr. They all have largely contributed to the knowledge of prehistoric Indonesia, but the results of their studies and examinations are scattered in numerous periodicals and scientific papers, which unfortunately are not always easily obtained or are written in foreign languages not always accessible to one and all.

The purpose of this study is to summarize all data concerning the knowledge of Indonesian prehistory, as derived from that which has been published by others on this subject as well as from my own experiences in this field.

The subject-matter is divided into three consecutive stages: the Palaeolithic, Mesolithic and Neolithic.

The theatre of the main cultural development has been, and still is, Java and Sumatra. Many islands, however, are situated at quite a distance from the centre of development; they are inhabited by peoples living in great isolation, who had their traditions handed down from one generation to the next. In some cases these more or less static and conservative cultures are, at least in material and economical aspects, reminiscent of prehistoric civilizations.

Special thanks are due to the Director of the Wenner Gren Foundation "The Viking Fund", New York, who provided me with grants-in-aid in 1951 and 1952. Thanks again are due to Mr. M. W. F. Tweedie, Director of the Raffles Museum & Library, Singapore and Mr. G. de G. Sieveking, Curator of Museums, Perak, who both read and criticized the entire manuscript and offered many valuable suggestions. I am also greatly indebted to Prof. Hallam L. Movius Jr., Harvard University, Cambridge, Mass., U.S.A., for his scientific help and his moral support and friendship in those post-war days when I left the prisoner-of-war camps in Siam and Japan and had to make a fresh start.

Though I cannot acknowledge all my literary debts, I do wish to express my thanks to the friends and relations who have given me their aid: the Head of the Archaeological Service of Indonesia, Mr. Soekmono and the Board of Directors of the Lembaga Kebudajaan Indonesia "Bataviaasch Genootschap van Kunsten en Wetenschappen", Djakarta, for the many photographs I needed for this manuscript and to Mr. Basoeki for the illustrations and maps.

This volume will before long be followed by a second volume dealing with the Bronze-Iron Age of Indonesia.

Djakarta, January 1957 H. R. VAN HEEKEREN

PREFACE TO THE SECOND EDITION

In the autumn of 1967 I was approached by Professor E. M. Uhlenbeck on behalf of the Koninklijk Instituut voor Taal-, Land- en Volkenkunde, Leiden, with the request to prepare a new edition of "The Stone Age of Indonesia" as well as of "The Bronze-Iron Age of Indonesia", as both volumes were out of print or nearly so.

Although I wanted very much to comply, I made one condition, namely that I felt it a pressing need to return for some months to Indonesia to study the progress made in prehistoric research since I left in 1956. Such a visit was necessary to bring the book up to date.

I am most indebted to "The Netherlands Foundation for the Advancement of Tropical Research" (WOTRO), which awarded me a subsidy for this purpose, and so I have been back in Indonesia from March 1 to July 1, 1968.

I would like to express my profound appreciation for the kind reception and generous assistance which I received from my old Indonesian friends as well as from officials, which made my stay not only very fruitful but also most pleasurable. Special thanks are due to the Head of the Archaeological Service in Indonesia, Drs. Soekmono, for his assistance, and to my successor Drs. Soejono and Professor Sartono of Bandung, for their help and for many valuable and pertinent remarks regarding the subject-matter of the books.

It has been an unforgettable time for me, to be in the field again in Java, Celebes and Bali with Soejono and some of his associates, and to find how much he has done in the realm of our common concern since my departure. He also deserves credit for forming a team of new staff members. There is, to be sure, no lack of qualified people now to continue prehistoric research. Unfortunately the difficulty in finding money for carrying out excavations under present conditions is almost insuperable. Here lies a task for foreign institutions which are interested in the subject, in providing the funds so badly needed.

I am pleased to acknowledge the help of critics who called my attention to some errors in the first edition; I have taken advantage of this second one to correct them. I had to write this book in a foreign language, but I overcame the difficulty by the help of Mr. J. H. Reiseger of Wimbledon, who checked the whole manuscript and to whom I wish to express my sincere gratitude; of course he cannot be held accountable for the imperfections that still remain.

The new edition has been extensively revised and reference is made to new discoveries, described at some length. I have also taken into account recent developments, fresh points of view, changes of emphasis, etc. of others as well as my own, and have endeavoured to integrate these. Several phenomena therefore are now looked at from a different angle, or appear in a new light.

Technical terms such as "Palaeolithic", "Mesolithic" and "Neolithic", though narrow and incomplete in many respects, are retained for want of better ones, but we are sadly in need of more apposite terminology.

Since man and his culture always belong to a particular landscape, a brief orientation as to physical environment is added in the first chapter.

The principle object of this book remains the establishment of a reliable chronological framework for the Stone Age of Indonesia.

Heemstede, February 1969 H. R. VAN HEEKEREN

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INTRODUCTION: DIVERSITY IN UNITY

The Indonesian Archipelago consists of a belt of large and small islands which connect Australia with Asia. It extends from 6° N.Lat. to 11° E.Lat., and from 95° to 140° E.Long. The entire area has an equatorial insular monsoon climate where the sun is directly overhead twice a year, with a high temperature, a high humidity and a heavy rainfall. It has two wet and two dry seasons: the sub-equatorial belt from 10° to 20° from the equator, one wet (October - January) and one dry season (May - October). The east monsoon brings dry air from Australia but Borneo and Sumatra lying close to the equator and far from Australia have no dry season. Indonesia has days of almost equal length throughout the year with short periods of dawn and dusk. The landscape is green at all seasons. The temperature on the plains averages 26°, and 20° in the highlands with a decrease of temperature of 5½ to 6° for a rise of 1,000 meters.

The natural environment shows a great variety of conditions dependent on proximity to either seas or mountains. The coastal plains receive more than 2,000 mm. of rain, and the mountainous regions 3,000 mm a year. In the Lesser Sunda chain, each more easterly island is somewhat more arid than its western neighbour.

Speaking in general terms, the mornings are sunny, also in the rainy seasons, when in the afternoon clouds gather with a subsequent tropical downpour which is short but of great intensity, after which the sky clears again.

Indonesia has the fifth largest population in the world, but the distribution is very uneven; there is a direct relationship between soil fertility and population. More than 60 million people live in Java alone; the total population is estimated at 110 million. The islands were covered with rain forests before these were destroyed by human agency, except for the eastern part of the Lesser Sunda Islands where savanna landscapes prevail due to the influence of the Australian anti-cyclones. Mangroves grow along the coastal plains, and steep mountains of volcanic origin arise on most of the islands, some reaching to

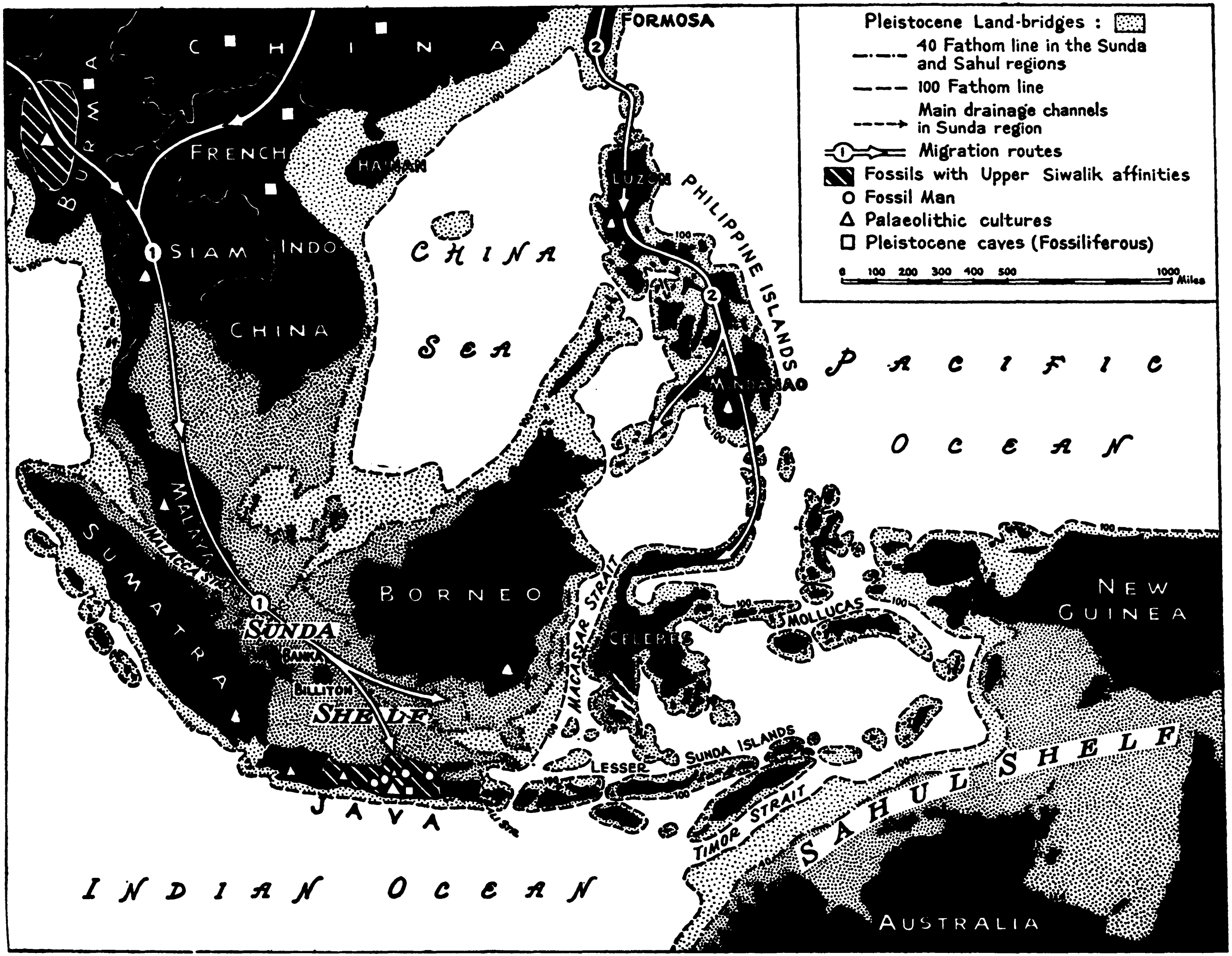

Fig. 1. Pleistocene Landbridges.

above the treeline. In New Guinea (Irian) some mountains even reach as high as the snowline.[1]

Owing to the proximity of the equator, practically no destructive tropical cyclones occur in the Archipelago, giving a high degree of security to navigation. Considering the importance of fish as a food and a source of protein, one might expect a highly developed fishing industry. However, pelagic fishing has never been intensively practised and deep-sea fishing is practically unknown. Still, coastal fishtraps exist in a large number of types, and coastal fishing is also practised with nets and hook-and-line. A large number of estuarine and fresh-water fishing methods are known. Sometimes strong plant poisons are used, temporarily stupefying the fish and causing them to come to the surface.

Indonesia has a more or less uniform culture, especially as seen at village level, although there are over three hundred different ethnic groups, and more than two hundred and fifty languages, which however show, linguistically, a basic relationship and belong to the so-called Malayan division of the Malayo-Polynesian group.

Racially the people belong to the Austronesian or Palaeo-Mongoloid stock, except for New Guinea and adjacent islands, where the Papua-Melanesians are the dominant race with small groups of Negritos in the mountainous interior. In the Moluccas, the northern part of Halmaheira and the eastern Lesser Sunda Islands, a mixture of these races is found.

The economy is still largely agrarian with advanced *sawah* agriculture, planting rice in the wet monsoon and other crops in the dry season, and gardening in land surrounding the houses with a large variety of crops and fruit trees. In parts of Eastern Indonesia sago is the staple food, supplemented by taro and yams as sources of starchy food. Sago is mainly obtained from spontaneous sprouts of the sago palm (*Metroxylon sagu*). The coconutpalm, spread all over Indonesia and beyond, is another very important source of food (oil, drinks, palm-wine and sugar).

As a general rule one might say that the native population consumes practically no milk, and that they prefer fish to any other protein food.

Especially in the past, physical and mental activity was hampered by epidemic and endemic tropical diseases such as malaria, and by intestinal maladies such as amoebic and bacillary dysentery. The limited

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[1] Sauer, '63; Gouron, '58.

possibilities of contact and stimulus in the remote islands, and the rugged interior of the larger islands have been largely responsible for the slowness of cultural growth in those areas.

On the other hand the coastal areas of Sumatra, Java and Bali have been constantly exposed to external influences and were therefore prone to radical changes in culture and religion.

The fauna of the greater Sunda Islands corresponds roughly to that of continental South-East Asia, while nearer to New Guinea a penetration of Australian elements is noticeable. In Celebes and Timor the extreme outposts of the Australian fauna are to be found besides endemic Asian forms.[2]

[2] De Beaufort, '26.

I. CENOZOIC

Geologically, Indonesia is complex. The Archipelago is a heterogeneous geosynclinal region divided into two dissimilar areas. One, the northwestern, has been stable since Pleistocene times: it has a quiet, regular submarine relief which consists of two continental shelves or extensions of the beach below sea-level caused by denudation and sedimentation. The continental shelves are the Sunda Shelf uniting Borneo, Sumatra and Java with the Malay Peninsula, and the Sahul Shelf joining Australia, New Guinea and the Aru Islands.

The second area, situated in the southeast, is unstable: it has a considerably active submarine relief and comprises Celebes, the Moluccas and the eastern string of the Lesser Sunda Islands. The small deep-sea basins and troughs east of Celebes are especially notable.[3]

Java, thus far the only island where fossil hominids have been found, is a part of the Great Sunda Shelf. Like nearly all the other islands of the Archipelago, it emerged from the sea late and contributed nothing to the origin of the mammals. From the beginning its fauna immigrated from the Asiatic Continent by way of landbridges, which were due to a combination of orogenic movements and a lowering of the sea-level during glacial stages. The former greatly overshadowed the effects of the rise and fall of the sea-level during the Pleistocene.

At the close of the Miocene the first groups of islands emerged from the sea in places where at present the Western Java Plateau and the Southern Mountains of Central Java are situated. North of these islands was a shallow strait with a few scattered small islands, the forerunners of two anticlines which later developed into the Northern Limestone Mountains and the Kendeng Hills. The latter consist of a folded ridge from 350 to 400 metres high, and stretching from Semarang in Central Java to near Surabaja in East Java. There are indications that the tectonic movements of the Kendeng Hills occurred mainly below sea-level during tertiary times. Since the end of the Pliocene these

[3] Umbgrove, '49, 1-4; Van Bemmelen, '49.

tectonic movements exerted a greater pressure and caused the enlargement of the emerged parts of Java. Finally, these parts developed into a narrow peninsula as a later extension of the Asiatic Continent. Terrestrial conditions were already well established in Western Java by the beginning of the Pleistocene as evidenced by several localities south of Cheribon (Tji Djulang) and south of Tegal (Kali Glagah). The Tji Djulang fauna includes *Archidiskodon, Merycopotamus, Stegodon* and a primitive *Hippopotamus*; the Kali Glagah fauna *Archidiskodon, Hippopotamus, Antilope* and *Sus stremmi.* There is no complete agreement yet concerning the demarcation of the Pliocene and Pleistocene on Java. It has been unanimously agreed, however, at the 18th session of the International Geological Congress of 1948 in London, that the beginning of the Pleistocene was heralded by large-scale and powerful crustal movements and by the rather abrupt appearance of new types of mammals, known as the Villafranchian, characterized by the first true elephants as *Archidiskodon,* and by *Equus* and *Leptobos.* The latter criterion holds good also for Asia. On this basis both the Tji Djulang and Kali Glagah faunas, which have a Villafranchian aspect, have to be placed at the very base of the Lower Pleistocene. Due to environmental conditions, the Javanese forms lack the horses and many of the antilopes which were animals of the open plain.[4]

In this period the eastern part of Java began to emerge from the sea, attended by a phase of powerful volcanic activity which resulted in the formation of three curved belts of volcanoes, namely a long row extending from North Sumatra via Java and the Lesser Sunda Islands to the Banda Archipelago, a second and shorter one starting in Halmaheira and the adjacent islands and a third line beginning in North Celebes via the Sangihe Islands, Mindanao, Luzon and the adjacent islands.

One third of Java is covered with the products of volcanic activity. Since then the geological formation of Java has been influenced by continued volcanic activity, foldings, uplifts and downwarps which divided it into a number of synclines and anticlines in an east-west direction. Inland seas filled the depressions. Interfering processes such as fluviatile erosion and fluctuations of the sea-level sometimes caused rapid and considerable changes in the topography of Java.

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[4] Boden Kloss, '29; Pilgrim, '44, 28-38; Smit Sibinga, '48, 97-98, '49, 1-31; King and Oakley, '49; Hooijer and Colbert, '51, 533-38; Hooijer, '52a; Von Koenigswald, '34, '37a, '39a, '49a, '56a, 56c.

In Southeast Asia the level of the ocean must have fluctuated in time with the rhythm of the various advances and retreats of the ice. Owing to the First Glaciation the greater part of the South China Sea and the Java Sea, which are mostly less than 40 m. deep, ran dry and this led to the formation of the Greater Sunda region when Sumatra, Java, Borneo and Malaya were connected, forming one land mass. Now the large mammals were able to reach Java overland and as far as possible they followed the alluvial tracts of the newly emerged surface.[5] The topography of the Archipelago allowed a second route, from South China, via Formosa and the Philippines and next to Borneo and Celebes via the Sangihe landbridge. By orohydrographic and zoo-geographic research, G. A. F. Molengraaff and M. Weber have found that the recent valleys and rivers of the Sunda area are found below sea-level, forming a drowned river-system with alluvial tin ore deposits along the submerged river-courses in Bangka and Billiton.[6] Next it became apparent that a main stream had existed formerly which received the rivers of East Sumatra and the Kapuas River of West Borneo. Biological studies in this field have shown that the actual piscine fauna of these rivers is still the same after the river-system has been dismembered in post-glacial times. The main stream had its source on a plateau where Bangka and Billiton are situated at present. This powerful stream ran in northerly direction and debouched into the southern part of the South China Sea; another stream ran southward and debouched into Macassar Strait.

According to Molengraaff and Weber, a lowering of the sea-level by 72 m took place during the Fourth Glacial Period, and H. de Terra calculated that it exceeded 100 m. during the Second Glacial, this being the most extensive retreat of the sea.[7]

The current belief that the Tropics were not subjected to important climatological fluctuations during the Pleistocene should at least be doubted, in view of present knowledge. It seems that cyclic processes have affected the whole globe and that glacial advances and retreats in the north and in the mountainous regions were accompanied in the Tropics by a succession of pluvial and interpluvial periods. Thus in the Far East, notably in Kashmir and Burma, de Terra could establish four Glacials, in the Irrawaddy Basin near Chauck three Pluvials,

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[5] Von Koenigswald, '34, 185-201; '35, 188-98, '56a, '56c; de Terra, '43, 440-41.
[6] Brouwer, '26, 1-33; Dickerson, '41; de Terra, '43, 459-62, '49.
[7] Molengraaff and Weber, '21, 395-439; de Terra, '43, 459-62.

whilst Barbour and Teilhard de Chardin reached the same conclusions concerning the Yangtze Valley in China.[8]

Along zoo-geographical lines, Stresemann[9] decided on the following working hypothesis: in the Early Pleistocene, during the first Dry Period, the Tropics were blanketed by grasslands. Immigrating grass-birds could choose between two passages, one from Tenassarim, Burma and Malaya to Sumatra and the Lesser Sunda Islands. The other from South China via Formosa (Taiwan) to the Philippines, Celebes and the Lesser Sunda Islands. The same passages are reported by C. G. van Steenis as having been used for the extension of the alpine flora.

The first Dry Period was followed by the first Pluvial. Rain forests spread to Malaya, North and West Borneo, the Philippines and North Celebes. Savanna landscapes disappeared and the grassland birds with them. This was followed by a second Dry Period milder than the previous one. The grassland birds made their appearance again. This time there was only one passage open to them, the one leading to the Lesser Sunda Islands by way of Formosa and the Philippines, since the other route was obstructed by rain forests. Hereafter, the second Pluvial set in and the rain forests spread to the extent which, but for human interference, they would now have. Stresemann assumes *at least* two Pluvials in the Tropics during the Pleistocene period.

One should remember, too, that Julius Schuster[10] found a fossil arboreal flora at Trinil on Java, just above the chief fossil bearing bone-bed. The flora comprised 54 species of which 24 still occur in Java, but at an altitude of 600 - 1,200 m. above sea-level. This would mean that Java, at that time, had a climate cooler and damper than at present with a temperature of 6 - 8° lower. This may well be the correct view but we must not neglect the possibility that the plant remains were washed down from higher regions to be deposited lower down, in which case the theory would be incorrect (Fig. 8).

The Pleistocene beds of non-glaciated Java consist of a combination of volcanic, marine and fluviatile facies but in drawing conclusions it should be kept in mind that Java with its equatorial position, and being an island relatively recently emerged from the sea, at the end of the Pliocene, differs considerably from the continent and therefore presents a complicated picture. Correlation of the sequences of this area with

[8] Barbour, '34; Teilhard, '37a.
[9] Stresemann, '39, 312-425.
[10] Schuster, '11a and b.

those of the Asiatic Continent has the best chance of being successful if based mainly on faunistic evidence.

Pleistocene deposits are dated and correlated by subdivision into Lower, Middle and Upper periods, distinguished by four or five consecutive faunas. The beds differ from place to place but a generalized stratigraphy is given on the next page.

No hominids are known from the Tji Djulang and Kali Glagah faunas at the base of the Lower Pleistocene, but both the Djetis and Trinil faunas contain remains of *Meganthropus* and *Pithecanthropus*, who may have lived side by side.

In the following pages the name of *Pithecanthropus* will be replaced by *Homo erectus*, as, according to the modern concept, the structural differences are not sufficient to justify more than a sub-specific distinction between the two. Use of the name *Pithecanthropus* would therefore be in conflict with the taxonomic rules.[11]

Meganthropus is another case of doubtful nomenclature. Its remains are fragmentary in the extreme and difficult to interpret. They consist of only two or three mandible fragments with some teeth. The jaws are considerably larger and thicker than those of any known hominid and have the size and stoutness of a male gorilla's. For the time being the name *Meganthropus* will be retained. It does not preclude the possibility that the name will have to be changed at some future date if additional findings are made which give the answer to the question of whether we are dealing with a distinct genus, another variant of the *Homo erectus* group (as supposed by Le Gros Clark[12]), or with a member of the *Australopithecinae* (as argued by Robinson).

Skull caps of *Homo erectus soloensis* have been discovered in terrace deposits related to the Solo River near the village of Ngandong. Geological and palaeontological evidence suggests that they are of Upper Pleistocene date, probably corresponding to the Third Interglacial or to the beginning of the Fourth Glacial.

Lastly, from a period which cannot yet be precisely defined, but most probably the very end of the Upper Pleistocene, two large-brained skulls of the earliest *Homo sapiens* have been discovered, named *Homo sapiens wadjakensis*.

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[11] Weiner, '65.
[12] Clark, Le Gros, '55, 131-45.

		DEPOSITS	MAMMALIAN FAUNA	FOSSIL MAN	ARCHAEOLOGY
	HOLOCENE	TROPICAL SOILS	RECENT SUB-RECENT	AUSTRONESIAN SAMPUNG MAN	Bronze-Iron Age NEOLITHIC MESOLITHIC
PLEISTOCENE	LATE UPPER	Cave deposits Appr. 40-12,000 years	SUB-RECENT	OCEANIC NEGROIDS HOMO SAPIENS WADJAKENSIS	OLDEST CAVE INDUSTRIES
PLEISTOCENE	LATE UPPER	SOLO TERRACES Appr. 100,000 years	NGANDONG	HOMO ERECTUS SOLOENSIS	NGANDONG INDUSTRY
PLEISTOCENE	EARLY UPPER	NOTOPURO BEDS conglomerates, tuff layers — o — o — o — o —	TRINIL	— o — o — o — o — o — o — o — o —	SANGIRAN FLAKE INDUSTRY
PLEISTOCENE	EARLY UPPER	BAKSOKA TERRACES	? ? ? ? ?	? ? ? ? ?	PATJITANIAN
PLEISTOCENE	LATE MIDDLE	KABUH BEDS conglomerates, tuff and sandstone o: basalt 495,000 years	TRINIL Plant-bed Bone-bed	HOMO ERECTUS ERECTUS I HOMO ERECTUS ERECTUS A HOMO ERECTUS ERECTUS II HOMO ERECTUS ERECTUS III HOMO ERECTUS ERECTUS VI HOMO ERECTUS ERECTUS VII MEGANTHROPUS PALAEOJAVANICUS B	? ? ? ? ?
PLEISTOCENE	EARLY MIDDLE	PUTJANGAN BEDS Black clays, lower volcanics o: tectite 610,000 years		HOMO ERECTUS ROBUSTUS IV HOMO ERECTUS ROBUSTUS V HOMO ERECTUS ROBUSTUS B HOMO ERECTUS ROBUSTUS C MEGANTHROPUS PALAEOJAVANICUS A MEGANTHROPUS DUBIUS C	? ? ? ? ?
PLEISTOCENE	LOWER		KALI GLAGAH TJI DJULANG (villa-franchian)		
		UPPER KALIBENG coral limestone LOWER KALIBENG globigerina marls			

GENERALIZED CHRONOLOGY OF THE PLEISTOCENE IN JAVA

o = absolute dating based on Kalium-Argon method: Max Planck Institute, Heidelberg

A. THE LOWER-PLEISTOCENE OF JAVA

1. THE TJI DJULANG AND KALI GLAGAH FAUNAS

As I have set forth on the previous pages, the Lower Pleistocene of Java starts with the Tji Djulang and Kali Glagah faunas of West Java without any living species but with the appearance of *Archidiskodon, Stegodon, Hippopotamus, Merycopotamus nanis* and *Leptobos.* Both faunas are still ill-defined and require much more study. No hominids are known from this period.

B. THE EARLY MIDDLE-PLEISTOCENE OF JAVA

1. THE PUTJANGAN BEDS

North of Modjokerto in East Java the Kendeng Hills are at their lowest and near the village of Perning they have a height of only 50 to 100 m. Near Klagenblandong lies a dissected mountain ridge running from east to west, being part of the Kedungwara anticline. The country, in particular along the road to Sumbertengah, is exposed to such a degree that the stratigraphy can be clearly distinguished. The area under discussion is situated in the eastern part of an old marine strait which once comprised a large part of the Solo Valley. In later times it was filled with fine volcanic material by fluvial and eolian agencies. Afterwards, it was temporarily flooded again by the sea.

As stated by Duyfjes,[13] the stratigraphy of the Putjangan beds in this area, starting with the upper layers, consists of a sediment of coarse and fine sandstone, 35 m. thick; a marly tuffaceous sandstone with marine molluscs, 10 m. in thickness; a 15 m. thick layer of greenish clay, and a coarse sandstone layer 100 m. thick, containing fine and coarse conglomerates and andesite boulders. The lowest stratum contains deposits of a finely stratified tuffaceous sandstone which constitutes the transition to a similar, 10 m. thick layer with clay in some places. Beneath it are marly and clayish tuffaceous sandstones, bearing conglomerates and marine molluscs, and scattered big lumps of coral and andesite rocks, 15 m. thick. Finally, a thick layer again of tuffaceous sandstone which in some localities could not be distinguished clearly from the preceding one. At the top of the ridge the fourth layer, con-

[13] Duyfjes, '36, 136-49.

sisting of a coarse sandstone, breaks the surface. Officers of the Geological Survey sank a pit at this spot to collect fossils from this layer, which led to the discovery of a fossil infant skull at a depth of only one metre (Fig. 2).

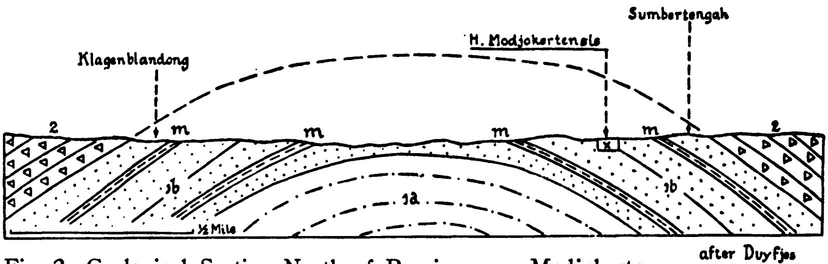

Fig. 2. Geological Section North of Perning near Modjokerto.

1. Early Middle Pleistocene Putjangan Beds containing the Djetis fauna.
   1a. Marine deposits.
   1b. Fresh-water deposits.
   m. Marine layers.
2. Late Middle-Pleistocene Kabuh Beds containing the Trinil fauna.

x. Site where the infant skull of *Homo erectus robustus* was found.

This time there could be no mistake concerning the age of the skull. The deposits had been carefully examined geologically as well as palaeontologically by Duyfjes [14] and Von Koenigswald [15] respectively. The site was investigated again in 1938 by De Terra and Movius, who both arrived at the same conclusion. Complete proof was given by de Terra [16] who, after studying the mineralogical composition of the matrix inside the skull and comparing it with samples taken from the pit, found them to be identical. The possibility of the skull's having been washed from a more recent horizon into an older layer can therefore be excluded. Guide fossils of the Djetis fauna have been found on the spot.

Deposits of the same age as those found near Modjokerto have also been recovered in other places, although of a varied composition. Near Sangiran and Trinil they have been more affected by volcanic activity. The Trinil layers consist of a mud-flow breccia (100 m. thick), overlaid by the well-known Middle Pleistocene Kabuh beds. The breccia

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[14] Duyfjes, '36.
[15] Von Koenigswald, 36, a, b.
[16] De Terra, '43, 442-43.

itself covers the Upper Pliocene Kalibeng beds of marine origin. All layers have been affected tectonically and dip to the south.

North of Solo, the dome-like uplift of Sangiran which is 6 km. long and 4 km. wide was exposed by folding and erosion to such a degree that its entire stratigraphy could likewise be clearly distinguished near the village of Krikilan and elsewhere. Here, too, the lowest deposits are of marine origin and are covered by volcanic tuff-breccia (30 m. thick) created by a mud-flow which contains andesite blocks. This layer is immediately followed by a black clay deposited in stagnant pools and marshes, with numerous fresh-water molluscs (200 m. thick) (Pl. 5). The lowest volcanic breccia yielded guide fossils of the Djetis fauna, as well as two different types of Early Man: *Meganthropus palaeojavanicus* and *Homo erectus robustus*. Bone-bearing beds consisting of black clay containing fresh-water molluscs have also been found at Trinil, Kritjak and Bandjarbangi and some other places on the banks of the Solo River; near Watualang they occur in three places.

The foot of the Butak Hill starts also with marine beds, overlaid by volcanic breccia interrupted by tuff banks. The stratigraphy shows, from top to bottom: a tuff bank, 125 m. thick, a tuffaceous sandstone layer and tuff breccias, 175 m. thick, banks of tuff, 40 m. thick, and a sandstone bearing fossils of the Djetis fauna. Tuff breccia, 200 m. thick, close the horizon. Movius [17] correlates the Putjangan beds with the Lower Sanmenian beds of North China, with the Upper Irrawaddy of Burma and with the Pinjor and Tatrot zones of Punjab.

2. THE DJETIS FAUNA

In the entire stretch of the Kendeng Hills there are Putjangan beds which yield an Early Middle Pleistocene mammalian fauna. This fauna was not recognized as a distinct element until 1927, when L. M. R. Rutten was the first to discover an isolated molar of a primitive Stegodon in the vicinity of Modjokerto. Later Cosijn described other fossils from the same area in 1931-1932; in 1934 von Koenigswald and Cosijn visited the region and collected a large quantity of important material, in particular at Sidorojol. They noticed that the collected fauna included species which did not occur in the Trinil fauna, and also *Stegodon* and *Hippopotamus* which were more primitive. Guide fossils are *Cervus zwaani*, *Duboisia santeng* and *Epileptobos groeneveldtii*. Von Koenigswald has stated that the Djetis fauna can be correlated with the Pinjor

[17] Movius, '44, table VI; '48, table 1; '55a, 521, 535; Le Gros Clark, '46b, 9-12.

fauna of Punjab, but as it has also features in common with the South Chinese fauna, i.e. presence of *Ursus, Gibbon* and *Tapirus,* he named it a Sino-Malay fauna.[18] The Djetis fauna has been found in the Putjangan beds near Sangiran with *Homo erectus robustus* and *Meganthropus palaeojavanicus,* and near Modjokerto with the skull of an immature *Homo erectus robustus.* In Western Java the fauna occurred in the Tjitarum Valley near Bandung and Subang. Human artifacts have not been found in these layers. The complete list of the Djetis fauna reads as follows:

PRIMATES
Meganthropus palaeojavanicus von K., *Homo erectus robustus* von K., *Symphalangus syndactylus, Pongo pygmaeus* Hoppins, *Hylobates moloch* Audebert, *Trachypithecus cristatus* Raffl., *Macaca irus* Cuv., *Macaca* sp.

PROBOSCIDEA
Stegodon trigonocephalus praecursor von K., *Elephas* sp., *Stegodon hypsilophus* Hooijer.

UNGULATA
Rhinoceros sondaicus Desm., *Rhinoceros kendeng indicus* Dub., *Tapirus* cf. *indicus* Desm., *Nestoritherium javanensis, Sus brachygnathus* Dub., *Sus coerti* von K., *Sus* sp., *Hippotamus koenigswaldi* Hooijer, *Cervus (Rusa) zwaani* von K., *Cervus (Rusa)* probl., *Cervus (Rusa)* cf. *hippelaphus* Cuv., *Muntiacus muntjac* Str., *Tragulus kanchil* Raffl., *Duboisia santeng modjokertensis* von K., *Antilope saatensis* von K., *Antilope* sp., *Epileptobos groeneveldtii* Dub.

CARNIVORA
Epimachairodus zwierzyckii von K., *Felis palaeojavanica* Str., *Felis tigris* L., *Paradoxurus* sp., *Arctictis binturong* Raffl., *Viverricula malaccensis* Gml., *Viverra, Hyaena* sp., *Mececyon merriami, Ursus* cf. *kokeni, Ursus malayanus* Raffl., *Lutra* cf. *palaeoleptonyx.*

PHOLIDOTA
Manis palaeojavanica Dub.

RODENTIA
Acanthion brachyrus, Hystrix sp., *Rhizomys* cf., *sumatrensis* Raffl.

3. MEGANTHROPUS PALAEOJAVANICUS Von Koenigswald

In April 1941 Von Koenigswald discovered a fragment of an enormous, massive and primitive mandible near Sangiran (mandible A).

[18] Von Koenigswald, '33a, '34, '35, '40b, '50b, '52a, '57. Hooijer ('52a, '56, '57a) has shown that these Sino-Malayan or *Stegodon-Ailuropoda* faunal elements in the Djetis fauna are incompatible with a Lower Pleistocene age,, as advocated by Von Koenigswald; a fauna can be no older than its latest components, and the *Stegodon-Ailuropoda* fauna is of Post-Villafranchian, Early Middle Pleistocene. As this view has become the consensus of opinion it is adopted in this book.

Two molars and the first premolar were still *in situ*, while the greater part of the *alveolus* of the canine was also preserved. The dimensions of this fragment, larger than any observed in a human mandible, greatly surpass even those of the Heidelberg jaw, and in fact fall within the range of the male gorilla.

At the *alveolus* of the first molar the jaw measures no less than 44 mm. in height as against 34 mm. in the Heidelberg specimen. The average thickness is 26.5 mm. as against 18.5 mm. in Heidelberg. The antero-posterior length of the molars totals 33 mm.; in Heidelberg this is 25 mm. 131 mm. is the circumference at the mental foramen level; this is unusually large surpassing even that of the male gorilla which never exceeds 121 mm., whilst that of Heidelberg measures 92 mm. The jaw is chinless and the buccal surface rounded; its shape is therefore rather simian. But the mental foramen is located exactly at the half-way level of the mandible as in *Homo erectus erectus* and in modern man. There is no simian shelf, and the premolars are not specialized; the symphysis, showing the beginning of the mental spine, is essentially human. The jaw is slightly higher but thicker than that of the gorilla. It apparently combines characteristics of both anthropoids and hominids. In spite of its enormous dimensions, it should, as its name already suggests, fall within the range of the early hominids or more probably within the Australopithecinae, first identified in South Africa but probably once widely distributed in the Old World. The dentition which is present is also considerably larger than that of any man, fossil or modern. The form and pattern of the bicuspidate unspecialized premolars resemble that of *Homo erectus pekinensis*. It is 10.0 mm. long (Heidelberg 8.1 mm.) and 12.0 mm. wide (Heidelberg 9.0 mm.). The crown is badly worn and higher than in Heidelberg and *Homo erectus erectus* but on the other hand is surpassed in size by some Krapina molars, as well as by some molars of modern man. The second premolar is also bicuspid, longer and wider than in *Homo erectus erectus*, and exceeds the maximum values of *Homo erectus pekinensis*. The cingulum (a lower collar around the base of the tooth crown) is less developed than in *Homo erectus pekinensis*. In spite of wear it was possible to establish that the first molar has six cusps arranged in a pattern almost identical to that of *Dryopithecus*. It is 15.0 mm. long (maximum length of *Homo erectus pekinensis* is 13.6 mm.; of Heidelberg 11.6 mm.; of *Homo erectus robustus* B 12.5 mm.) and 13.5 mm. wide (maximum width of *Homo erectus* *pekinensis* is 12.6 mm.; of Heidelberg 11.2 mm.; of *Homo erectus robustus* B 13 mm.) (Fig. 3).

Fig. 3. Mandible fragment of *Meganthropus.*

F. Weidenreich has reconstructed the entire mandible complete with dentition, and from this it appeared that the massive impression of the jaw is created by its reduced length. The data just given have all been obtained from casts described in Weidenreich's monograph. Another mandible (mandible B), ascribed by Von Koenigswald to *Pithecanthropus dubius,* consists of the right portion with the first and second molar in position; the root of the second premolar, of which the crown is broken off, still remains in the bone. The fragment was found near Sangiran in 1939, and according to the collector, it came from the Putjangan beds. The dimensions of the jaw fall slightly below the minimum of the gorilla but it is thicker than that of *Homo erectus robustus* B and thinner than that of *Meganthropus.* There is a gradual reduction in thickness from the torus superior where it amounts to 19.0 mm., to the torus inferior, where the thickness measures 13.5 mm. This feature is decidedly simian and the reverse of the hominids. But the large mental foramen consists of one single aperture located halfway the height of the mandible in line with the second premolar as is usual in the hominids including *Meganthropus* A and *Homo erectus erectus.* The molars show from the tips of the five cusps strong wrinkles emerging, which melt in one central point. The dentition is arranged in the shape of a parabola, another characteristic of the hominids. But the unusually large molars exhibit a decrease in size from front to back, a feature common in the anthropoids. Furthermore the pattern of the dentition points to specialization. The first molar is badly worn, exposing the dental cavity. Its crown is almost square, measuring 13.0 mm. in length and width. The second molar is less worn and measures 14.1 mm. in length and 14.3 mm. in width. The jaw shows no vestige of a mental spine. The symphysis is different from *Meganthropus*. Von Koenigswald does not rule out the possibility that the mandible is that of an anthropoid not yet known, in which a number of hominid characteristics are combined. Supplementary finds are highly desirable and may enable us to make a clearer analysis.

An additional, highly fossilized mandible fragment of *Meganthropus* was found in September 1952 by P. Marks near Sangiran, north of the hamlet of Glagahombo. It was weathered out of a hard 1½ to 2 m. thick and strongly cemented conglomerate which forms the boundary between the Kabuh and Putjangan beds. The fragment consists of the right side of the mandible, broken off at the distal end, but including the foremost portion of the ascending ramus as well as the complete tooth-row P3 - M3. The crowns of the teeth, except for M3, are broken off.[19] Together with Von Koenigswald's find, it gives a fair idea of the antiquity, the general form and the enormous size of the Meganthropus mandible. The proportions, bluntness and roundness seem to indicate that we are dealing here with a variation of the Australopithecus-group. This assumption is unavoidably vague and needs confirmation (P. 6).

[19] Marks, '53, 26-33; Weidenreich, '45b, 44-52; Le Gros Clark, '55; Garn and Lewis, '58, 874-80; Von Koenigswald, '50a, '64.

Le Gros Clark is rather sceptical about a generic separation of *Meganthropus* from *Homo erectus* on the basis of dental morphology. "It may readily be admitted that the available fossil material from Java is not yet adequate to decide finally whether there was more than one genus, or more than one species, of hominid living in Java during the Early Pleistocene. But from general considerations the probabilities seem to be against such a conclusion, and (it must be emphasized again) there is at present no really convincing morphological basis for the recognition of more than one species, *Homo erectus*." Weidenreich, who was the first to speak about Giant Man on Java, is rightly criticized by Le Gros Clark in the following way. "Some authorities have interpreted the large mandibular fragments from Sangiran as evidence for the existence in Java during the Pleistocene of "giant" hominids. This seems to be a misapplication of the term "giant", which is commonly taken to refer to stature. But a large hominid jaw does not imply a giant individual. On the contrary, so far as other paleontological evidence goes, there is some reason for assuming a negative correlation between the size of the mandible and the total stature."

4. HOMO ERECTUS ROBUSTUS

In 1936 Von Koenigswald's men found several large cranial fragments of a rugged early hominid in the Putjangan beds near Sangiran.[20] The finds include most of the posterior half of the calvarium including the hinderpart of the base, a maxilla with almost the entire palate, the floors of the nasal cavity and a rudimentary nasal spine. The teeth, except for the four incisors of which the alveoli are preserved, and the second and third left molar, are in position (Skull IV). An isolated, shovel-shaped upper incisor was also found. Weidenreich proposed the name *Pithecanthropus robustus,* but this name was discarded by Von Koenigswald, who uses *Pithecanthropus modjokertensis* instead. According to Weidenreich the skull had been crushed with great force in prehistoric times, causing a dislocation of the component parts. He examined and studied the casts and was able to reconstruct the whole skull by readjusting the fragments and taking the mandibles of *Homo erectus robustus* B, and *Homo erectus pekinensis* G1 as models. The size of the skull exceeds that of the Middle Pleistocene *Homo erectus erectus* to such an extent that it cannot be explained as a difference in sex. We may assume that the skull represents a new sub-species of the *Homo erectus* group. It is not impossible that *Homo erectus robustus* is a direct descendant of the still more rugged *Meganthropus.* The skull is not only larger, but conspicuously wider than that of *Homo erectus erectus* I and II. The upper part of the skull is narrower than the base, which is a simian feature. There is a peculiar development of the sagittal crest which consists of a series of knob-like protuberances, terminating on either side in a rather protruding supra-orbital ridge, a feature unknown in the other Homo erectus skulls. The cranial capacity has been estimated at 900 cc. Above the orbits is a massive, transverse bar of bone. The greatest cranial length is 199 mm. (*Homo erectus erectus* II: 176 mm.). The greatest width at the base is 158 mm. (*Homo erectus erectus* II: 135 mm.). The skull vault is remarkably low, especially in the occipital region and the obelion; the nuchal plane is flat. The occipital curvature exhibits an angle of 91°; in *Homo erectus erectus* II the angle is 103°; in *Homo erectus soloensis* it is also 103°. The mastoid process is large, projecting downward and sharply inward, while it is an insignificant protuberance in *Homo erectus erectus* II. The foranum magnum (the large hole in the base of the skull through which the spinal cord passes to its junction with

[20] Von Koenigswald, '37b; Weidenreich, '45b, 36-44.

the brain) is well forward on the skull base, in a modern position. The bulky palate is smooth without ridges or furrows, as in the apes. Its length amounts to 75 mm., as against 57.7 in the Rhodesia palate. It could not be compared with that of other examples of the Homo erectus group since they were all missing. It conforms very well with the Homo erectus robustus mandible B. There is a pronounced prognathism. The huge molars increase in size from the first to the third, which again is an ape-like characteristic. The point of the canine rises above the biting surface of the premolars. Between the upper canines and the lateral incisors there is a diastema or a simian gap of 5 mm. on the right side and 6.2 mm. on the left side, permitting the interlocking of the canine of the lower jaw. This again is an ape-like feature not usually seen in *Homo sapiens, Homo erectus* or *Australopithecus*. The first upper premolar has three roots, seldom seen in any hominid. The upper dental arch is comparatively long and narrow. The teeth have human characteristics, their pattern being quite similar to that of *Homo erectus pekinensis,* except that in the latter the cingulum is more strongly developed.The canines are small when compared with those of the anthropoids. Nevertheless they are considerably larger than found in any other fossil or recent man, and only the largest Homo erectus pekinensis canine equals them in size. The width exceeds the length, as is the case in all human canines, while in the anthropoids it is just the reverse. Below are given the measurements of the teeth taken by Weidenreich (1945b, p. 28) (the figures in parentheses refer to worn teeth).

The skull is the largest and most massive of any hominid, and shows a close relationship with *Homo erectus erectus* I and II of the Middle Pleistocene. But *Homo erectus robustus* is not only larger and more primitive in many respects, but also relatively flatter.

A fifth skull of which the facial portion and the teeth are missing is that of an infant and, as previously stated, it was excavated in 1936 by employees of the Geological Survey in the lacustro-volcanic Putjangan beds of Sumber Tengah north of Modjokerto. It must have belonged to a child of about 3 years of age, as the fontanels were already closed. The skull was provisionally classified by Von Koenigswald under the name *Homo modjokertensis* (Pl. 10A, B; Fig. 2).

The skull is difficult to compare with that of adult examples because it is not fully grown and during the period of growth bone is plastic and prone to important changes. The length of the skull is 138 mm.,

Teeth Upper	Height	Length	Width	Rectangles (length x width)
	mm.	mm.	mm.	
I_2r	(9.3)	10.0	10.4	104
Cr	(12.5)	9.5	11.7	111
Cl	(13.1)	9.5	11.9	113
P_1r	(8.4)	8.2	12.4	102
P_1l	(8.7)	8.5	12.4	105
P_2r	(7.5)	8.2	12.1	99
P_2l	(8.5)	8.5	12.3	104
M_1r	(6.7)	12.1	13.7	166
M_1l	(7.0)	12.3	13.6	167
M_2r	(7.7)	13.6	15.2	207
M_3r	(7.7)	10.8	14.0	151

the width 109 mm., and the length-width index is 78.9. The cranial capacity is approximately 700 cc., which means that the capacity would not have increased beyond 1,000 cc. in the adult. The vault is more receding than that of a modern child's skull of the same age. The supra-orbital ridges are already beginning to protrude in their lateral sections. The occipital bone is rounded and there is a narrowing of the forehead behind the torus supra-orbitalis.

After close examination Von Koenigswald [21] assumed that the skull belonged to an immature member of the Homo erectus group, most probably to *Homo erectus robustus,* despite the existence of great morphological differences which could be explained by the fact that distinct characteristics of the adult had not yet developed. This assumption can perhaps be better understood in the light of L. Bolk's foetalization theory,[22] based on his examination of a dead pregnant chimpanzee. He noticed that the foetus was more human than a full-grown specimen. The skin was hairless, except on the skull. The snout was less protruding and the skull clearly showed a bulge on the forehead. The foramen magnum was located as in the skull of recent man. In man the foetal shape remains the same, broadly speaking, after his birth, but in the anthropoid, after it has left the womb, a process takes place during its growth which results in the gradual recession of the forehead. Bolk wanted to show that external factors have no effect whatsoever on the development of the specifically human forehead, but that it is rooted in the organism of the creature, in the ape as in man.

[21] Von Koenigswald, '36a, b.
[22] Bolk, '26.

The progress of growth in man is comparatively more conservative, in the ape more propulsive. Man in his foetal stage is not bound to pass through a simian stage; it seems rather that the simian foetus passes through a human stage. Now, it is possible that the process of growth in the early hominid took place more or less in the same way as in the anthropoid. Hence *Homo erectus robustus* probably was born with a more or less vaulted forehead, a feature still to be seen in the first years of his life, while the recession and other peculiar features took place at a later age. This may be the correct view, but at present it is only a possibility (Pl. 10 A & B).

The *Homo erectus robustus* mandible B was also found by Von Koenigswald's collectors in 1936. It came from the black clay at Bukuran near Sangiran. The fragment represents the right side of a heavy mandible, measuring 86.5 mm. in length. The ascending ramus is missing. The second premolar and the three molars are in position; the alveolus of the incisor must have been relatively small. The size of the molars increases from front to back. The second premolar is extremely large, measuring 9.3 mm. in length, and 10.9 mm. in width. The jaw has no interior torus transversus, its place being marked by a slight protuberance. The mandible exhibits three mental foramina, two (the largest) at a higher level than the third. This is a rare feature in hominids. The first and second molars are more or less quadrangular, both having five cusps. The third molar is oval-shaped and has six cusps. The size of the first premolar exceeds the maximum in modern man as to length and width. This large and massive mandible fits very well into the maxilla described at some length on the previous pages[23] (Fig. 4).

It was in November 1960 that one of Sartono's collectors discovered a highly fossilized right half of a hominid mandible of which the ascending ramus was lacking, ascribed to an adult of *Homo erectus robustus*. The fragment had been found on a slope of a hill near the hamlet of Mandingan (Sangiran dome) which was entirely composed of Putjangan formation and together with a mandible of *Bibos palaeojavanicus*. Most probably it had been washed out from the upper black limic claystones. The left half is broken off along a fracture which runs more or less parallel with the symphysis. There is only one mental foramen at a point directly below the second premolar as against three in mandible B.

[23] Von Koenigswald, '40b, 140-65; Weidenreich, '45b, 36-44.

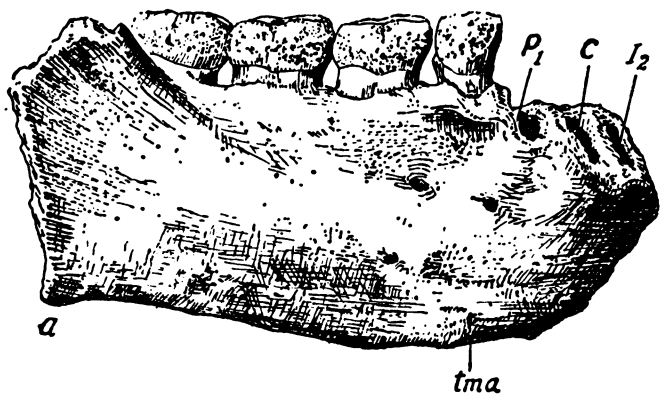


Fig. 4. Mandible fragment of *Homo erectus robustus*.

Of the dentition are left a badly damaged, relatively small canine, the two premolars, and two molars. The first molar is broken off. Of the incisors only the alveoli are visible which are filled by matrix. The alveolus of the central incisor contains part of the root. The two premolars, quadrangular in shape with rounded corners, are equal in size; the third molar is smaller than the second. This was the third mandible fragment of *Homo erectus* found since 1890.[24] The measurements of the lower teeth are the following:

	Meganthr. A	Sangiran 1939	*Homo erect. rob.* B	*Homo erect. rob.* C	*Homo erect. pekin.* Average
	mm.	mm.	mm.	mm.	mm.
Length M_1	15.0	13.0	12.5	—	12.6
Length M_2	—	14.1	13.0	13.5	12.6
Length M_3	—	—	14.5	13.5	11.6
Length P_1	10.0	—	—	9.0	8.6
Length P_2	10.2	—	9.3	9.0	9.0
Length C	—	—	—	1.6	?
Width M_1	13.5	13.0	13.0	—	11.8
Width M_2	—	14.3	13.2	12.5	12.6
Width M_3	—	—	12.5	12.7	?
Width P_1	12.0	—	—	10.7	9.9
Width P_2	12.0	—	10.9	10.7	9.8
Width C	—	—	—	8.5	?

[24] Sartono, '61.

Measurements of the various mandibles are:

Thickness at the vertical level of

	Meganthr. A	Sangiran 1939	*Homo erect. rob.* B	*Homo erect. rob.* C	*Homo erect. pekin.* Average
	mm.	mm.	mm.	mm.	mm.
Symphysis	25.5	19.0	16.4	18.3	13.6
Mental foramen	28.0	19.3	16.5	20.1	15.5
Between M_2 and M_3	26.3	20.3	17.8	24.0	16.9
Average	26.6	19.5	16.9	21.1	15.7

Height at the vertical level of:

	Meganthr. A	Sangiran 1939	*Homo erect. rob.* B	*Homo erect. rob.* C	*Homo erect. pekin.* Average
	mm.	mm.	mm.	mm.	mm.
Symphysis	47.0	(38.2)	42.2	—	33.8
Mental foramen	48.0	38.5?	35.0	38.1	27.6
Between M_2 and M_3	45.0	30.0?	31.0	30.2	27.5
Average	46.7	35.6	36.1	34.2	29.6

Circumference at the vertical level of:

	Meganthr. A	Sangiran 1939	*Homo erect. rob.* B	*Homo erect. rob.* C	*Homo erect. pekin.* Average
	mm.	mm.	mm.	mm.	mm.
Symphysis	120.0	—	103.0?	—	86.0
Mental foramen	131.0	105.0	89.0	98.1	79.0
Between M_2 and M_3	120.0?	—	85.5	89.2	78.5
Average	124.3	—	92.3	93.6	81.2

C. THE LATE MIDDLE-PLEISTOCENE OF JAVA

1. THE KABUH BEDS

Everywhere in Java the Kabuh beds are of nearly the same composition. They consist of water-deposited sediments of volcanic origin such as tuffs, sandstone and conglomerates. At the Sangiran dome, situated 12 km. north of Surakarta in Central Java, especially at the section exposed near Krikilan, the entire sequence from the Pliocene marine sediments to the Upper Pleistocene is clearly exposed (Pl. 5; Fig. 6). The Kabuh beds, 15 to 50 m. thick which overlie the Putjangan

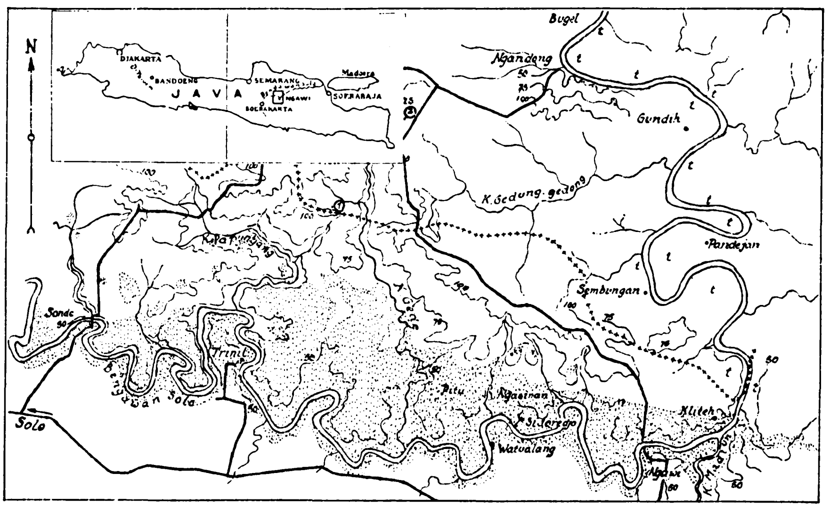
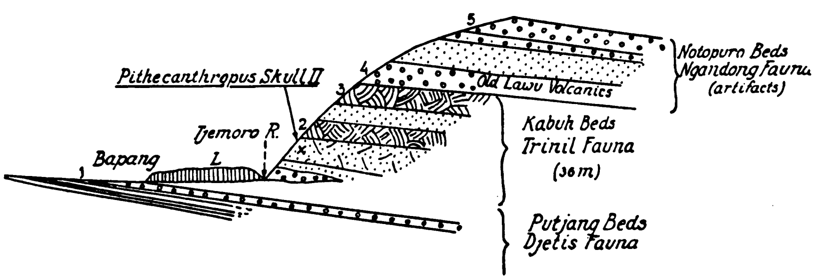


Fig. 5. Location of Trinil and Ngandong with terraces.

beds, consist at Bapang mainly of light grey-green tuffs, sandstone and conglomerates. At the base lies a strongly cemented basalt deposit, 1 m. thick, poor in fresh-water molluscs but rich in fossil vertebrates which are most numerous in the sandstones. In this layer the calvaria of *Homo erectus erectus* II was found. The Bapang formation corresponds with the Trinil mud-flow agglomerates, which are also of Middle Pleistocene age. Next follow tuffs and conglomerates with fossil plant remains, 9 m. thick. At the base of this layer, near Tandjung, the skull fragments of *Homo erectus erectus* III were found, whilst north of Ngebung it yielded a wealth of palaeolithic flake-tools of chalcedony in the upper portion of the layer. The flake-tools did not come from the same beds as those containing the hominid remains but from a layer somewhat higher in the sequence. Trinil is the village which attained fame as the result of the discovery of the much discussed skull cap of *Homo erectus erectus* I. Therefore its geology has been carefully examined by a great number of scientists including Dubois (1891-'92), Van Es, Duyfjes and De Terra.[25]

The lowest deposits of sandstone and tuffs have been discussed in the previous paragraph. They are overlain by folded Middle Pleistocene Kabuh beds which are composed of the following layers:

a. Tuffs, pumice, lapilli and large andesite blocks;
b. The main bone-bed between 40 cm. and 1 m. thick, developed under fluvial conditions. The bones are much water-worn and fell to pieces before being deposited in the layer;
c. A thin clay layer (60 - 80 cm. thick) containing fossil leaves, roots and fruits;
d. A greyish-white layer of sandstone, representing a fluviatile deposit with volcanic components, fossil bones of the Trinil fauna and fresh-water molluscs;
e. Tuffaceous sandstone and conglomerates (from 3 to 6 m. thick), bearing traces of the Trinil fauna (Fig. 6).



After Van Bemmelen and de Terra

Fig. 6. Geological section at Bapang, Sangiran.

1. Cemented base Agglomerate, 4 m.
2. Eroded material — Sand and fine gravel with basis clay bed, 27 m.
3. Sand and clay, 9 m.
4. Volcanic breccia (lahar formation) and river-sand, 7 m.
5. River-gravel and sand, 14 m.

[25] Volz, '07, 256-71; Dubois, '08, 1235-70; Martin, '08, 7-16; Elbert, '07, 125-42; '08, 648-62; '09, 513-20; '11, 736-41; Carthaus, '11, 1-35; Dietrich, '24, 134-39; Duyfjes, '36, 136-49; Van Es, '31; Van Regteren Altena, '38; Von Koenigswald, '40b, 36-46; de Terra, '43, 447-52.

Not so distinct is the formation of the Gunung Butak which is entirely covered by teak-trees. Near Kedung Brubus, 45 km. east of Trinil, a small fragment of a human mandible, as well as a femur of *Homo erectus erectus* was found. Here, too, fluvial deposits seem to overlie the Putjangan beds, consisting of sandstone, tuffs and conglomerates which apparently correspond with the mud-flow conglomerates of Trinil. The Kabuh beds are folded and dip approximately 40° to the southwest.

2. THE TRINIL FAUNA

The Kabuh beds at the Sangiran dome, especially the conglomerates, contain a rich Trinil fauna of Late Middle Pleistocene age, which includes the skull cap of *Homo erectus erectus* II (near Bapang), fragments of the skull cap of *Homo erectus erectus* III found in a slightly younger tuff near Tandjung, and also a calvaria of *Homo erectus erectus* VI, found also at Tandjung but on the opposite bank to where skull III was found. Finally another skull of *Homo erectus erectus* has recently been found, called skull VII. This skull was found on 30th January, 1965, outside the actual Dome of Sangiran in a fine cross-bedded sandstone which forms part of the Kabuh beds. Apart from these early human remains, there occur such distinct items as *Stegodon trigonocephalus* Martin, *Elephas hysudrindicus* Dubois, *Cervus* (*Axis*) *lydekkeri* Martin, *Bos* (*Bibos*) *palaeosondaicus* Dubois, and *Duboisia santeng*. The Trinil fauna [26] was also encountered in the fluvial beds of the Butak hills between Tegal and Cheribon. Von Koenigswald refers to it as a Sino-Malayan fauna based on the presence of *Simia*, the Malayan bear, tapir, rhinoceros and *Stegodon*. The Trinil fossil bones are heavily fossilized and of a dark colour. Their weight is 35% more than that of fresh material. The complete list of the Late Middle Pleistocene Trinil fauna reads as follows:

PRIMATES

Homo erectus erectus Dubois, *Pongo pygmaeus* Hoppius, *Symphalangus syndactylus* Raffl., *Hylobates* cf. *moloch* Audebert, *Trachypithecus cristatus* Raffl., *Macaca irus* Cuv.

PROBOSCIDEA

Stegodon trigonecephalus Martin, *Elephas hysudrindicus* Dubois, *Cryptomastodon martini* von K.

[26] Von Koenigswald, '40b, 56-7, '49b.

UNGULATA

Rhinoceros sondaicus Desm., *Rhinoceros kendeng indicus* Dubois, *Tapirus* cf. *indicus* Desm., *Tapirus* cf. *augustus* M. et G., *Sus macrognathus* Dub., *Sus brachygnathus* Dub., *Hippopotamus sivajavanicus* Dub., *Cervus (Axis) lydekkeri* Martin, *Cervus (Rusa) hippelaphus* Cuv., *Muntiacus muntjac kendengensis* Str., *Tragulus kanchil* Raffl., *Duboisia santeng* Dub., *Epileptobos groeneveldtii* Dub., *Bos (Bibos) palaeosondaicus* Dub., *Bos (Bubalus) palaeokerabau* Dub., *Bos (Bubalus)* sp.

CARNIVORA

Felis palaeojavanica Str., *Felis tigris* L., *Felis pardus* L., *Felis bengalensis* Kerr., *Paradoxurus hermaphroditus* Pall., *Arctictus binturong* Raffl., *Viverricula malaccensis* Gml., *Viverra* div. spec., *Mececyon trinilensis* Str., *Cuon sangiranensis*, *Ursus malayanus* Raffl., *Lutra* cf. *cinerea* Illig., *Lutra* cf. *sumatrana* Gray.

INSECTIVORA

Echinosorex sp.

RODENTIA

Lepus nigricollis Cuv., *Lepus lapis* Hooijer, *Acanthion brachyrus* L., *Hystrix* sp., *Rhizomys* cf. *sumatrensis* Raffl., *Rattus* sp.

3. HOMO ERECTUS ERECTUS Dubois

On November 24th, 1890, Eugène Dubois reported among the fossil mammalian fauna from a sandstone and andesite tuff near Kedung Brubus, a fossil locality in the Kendeng beds in Central Java, a fragment of the right corpus of a human mandible (A), contemporary with *Stegodon*, *Elephas*, *Hippopotamus* and *Hyaena*. It was the first human fossil found in Java. The fragment consists of a small triangular piece of the right lower jaw. It is only 36 mm. long. The alveolus of the canine and of both premolars were preserved with some portions of the roots. Dubois[27] drew attention to the poor chin development and the curious flattening and hollowing of the inner surface. He associated it with the Trinil hominid fossils belonging to *Homo erectus erectus*. A re-examination has been carried out lately by P. V. Tobias, leading to the unsuspected fact that it most probably belonged to a juvenile.[28] The jaw is low compared with the mandible B described previously, whilst the measurements of its alveoli indicate a smaller dentition. Its height at the interstice between the canine and the lateral premolar is 28.3 mm. (mandible B: 33.0 mm.; *Homo erectus pekinensis* A II: 14.5 mm.; *Homo erectus pekinensis* G I: 16.3 mm.). Apart from the few remarks already made, this small mandible fragment is unsuitable for comparative study.

[27] Dubois, '24a, 265-68.

[28] Tobias, '66; Weidenreich, '45b, Pl. 9, Fig. 26.

In the autumn of 1891 Dubois excavated a tooth of an anthropoid and a peculiar skull cap at Trinil along the Solo River (Fig. *7*; Pl. 1). At first he regarded the calvaria as the remains of an individual which he named *Anthropopithecus*, because of the relatively large skull, too big for an ape, and the absence of bone ridges on the skull. Exactly a year later, a left femur was collected from the same level in a waterborn deposit 15 metres upstream. He assigned this to the same individual who, he concluded, could walk erect like a man, since the thigh bone did not differ fundamentally from that of modern man.[29] The question of whether skull and leg bone were actually parts of the same creature, as argued by Dubois, was not solved until years later, when several Homo erectus pekinensis skulls with similar modern-looking thigh bones were discovered in China. Fluorine tests made by Bergman and Karsten [30] eventually showed that thigh bone and skull were of the same age and contemporary with the bones of the Trinil Fauna. Dubois considered the creature as a representative of the long sought transitional stage between Ape and Man. In 1894 Dubois changed its name to *Pithecanthropus erectus*, a name which we have now changed again, for reasons set forth above, into *Homo erectus erectus* Dubois, Skull I (Pl. 1).

Dubois devoted most of his life to the study of these highly important but incomplete discoveries. He changed his mind more than once, as is natural, on such matters as the geological age of the finds.

Since his discoveries many scientists have occupied themselves with the *Pithecanthropus* problem; seldom have finds such as those from Trinil attracted so much attention, evoked such great controversy and brought forth such emotional reactions from so many experts and religious people who did not relish the idea of descending from an apelike ancestor. Now, however, the concept of human development from a primate stock has acquired wide acceptance.

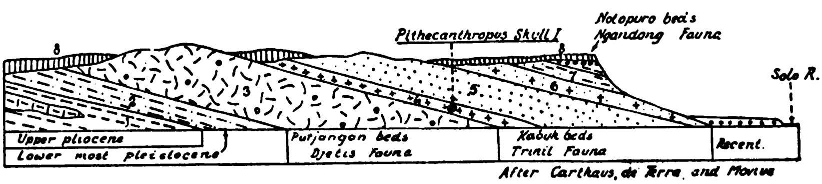


Fig. 7. Stratification near Trinil, Solo River.

[29] Dubois, 1894, 1896a, b; Von Koenigswald, '40b, 110-16.
[30] Bergman and Karsten, '52.

According to Quenstedt, the bibliography on this subject alone amounted to more than 500 scientific publications in 1936, and since then hundreds of papers have been published, including the monographs by Von Koenigswald, Weidenreich and Le Gros Clark.

In 1896 Dubois collected the opinions of 19 authorities on this skull cap. Five of them regarded the skull cap as that of an ape, seven believed it to be human, and seven others considered it as intermediate stage between ape and man. Later opinions varied from a degenerated *Homo sapiens*, a pygmy, a small Neanderthalian, to a bastard of ape and man.[31] The Trinil discovery stood alone for a long time. Expeditions were sent out; the excavations of the Selenka expedition of 1907-08 at Trinil to a depth of 40 feet, removing more than 10,000 cubic yards of earth, provided a wealth of fossil vertebrates, but no additional Homo erectus finds (Pl. 2, 3). The Sonde tooth which was assigned by some to this species is in fact one of modern man. The excavations in 1930-31 produced no important results. However, at last, by the discovery of *Homo erectus pekinensis* (called *Sinanthropus pekinensis* by Davidson Black) in North China by Zdansky, Andersson and Pei, this creature was released from its isolation. This, followed by the finds of Von Koenigswald in Java in 1936-1938 and subsequently by the Indonesian scientists Jacob and Sartono in later years, enabled us to gain a fuller knowledge of this ancient creature, anatomically as well as geologically, and its human nature could no longer be denied.

The holotype, or *Homo erectus erectus* skull I, consists of a very thick and heavy skull cap, complete above the ears and eyes. The exterior parts are smooth and possess no crest as found in gorilla and orang-utan. For the rest, its appearance, especially in side view, is rather simian, an impression caused mainly by the markedly-receding forehead and the heavy supra-orbital ridges. The skull is very low; the highest point is exactly at the bregma (the point where the transverse and longitudinal sutures meet at the top of the skull vault), as in the anthropoids. Its greatest length is 184 mm., and greatest width 134 mm., which gives a length-width index of 72.8. This makes the skull decidedly dolichocranic. The cerebral volume has been estimated at 914 cc. (*Homo sapiens* 1,200 to 1,500 cc.). Because of this feature *Homo erectus erectus* occupies an intermediate position between man and ape. The occipital region has an angular contour and a bone ridge for the attachment of what must have been powerfully developed neck-

[31] Von Koenigswald, '40b, 15-24.

muscles. Due to the position of the foramen magnum, the head was carried in a primitive, forward position. Studies of the endocranial cast made of the interior of the skull show that the frontal lobes are smaller than in modern man but larger than in the largest existent anthropoid. The left frontal lobe is slightly larger than the right, suggesting right-handedness. The parietal lobes are rather strongly developed, but are still smaller than those in recent man. The occipital lobes are intermediate between man and ape.[32] The question of whether *Homo erectus erectus* had the power of speech is still under discussion. A rudimentary swelling over that part of the frontal lobe devoted to speech suggests that at least the potentiality for speech was present.

The left femur, found in the same bone-bed about 15 m. upstream from the calvaria, is remarkably straight and does not resemble that of an anthropoid. Anatomical features prove an upright gait. From this it was deduced that in this species limbs of a human type must have developed before a human shape of skull and brain. Five more femora were found in Dubois' collection, four from Trinil and one from Kedung Brubus. The tooth which Dubois attributed to *Homo erectus erectus* later proved to be that of a fossil orang-utan. The age in geological terms can be established with reasonable certainty as Middle Pleistocene, a time corresponding to the Second Glaciation in other parts of the world. By means of the recently introduced new methods of absolute dating (by means of Potassium-Argon), a leucit basalt from the Muriah volcano in North Central Java has been dated. In the tuffs of the Muriah complex near Pati Ajam a typical Trinil fauna with *Axis* lydekkeri was also found. Dr. H. J. Lippolt of the Max Planck Institute for Nuclear Physics in Heidelberg dated the basalt as 495 (± 100—60),000 = 595,000 to 435,000 years old. A second dating by the same method was carried out for tektites found in Java in a horizon near the base of the Kabuh beds, as well as in association with the fossil bones of *Stegodon* on Flores and Luzon. The age of the tektites are estimated at 610,000 years. Therefore *Homo erectus erectus* may have lived approximately 550,000 years ago[33] (Fig. 7).

It was 46 years later that a second skull cap was found (*Homo erectus erectus* II). One of Von Koenigswald's collectors found it in 1937, but unfortunately he did not appreciate its value, as he smashed it into 30 pieces in order to be paid for each separate fragment. The

[32] Bouman, '38, 1-3; Ariëns Kappers and Bouman, '39, 30-40; Kranz, '61; Dubois, '33.
[33] Von Koenigswald, '62, '64; Kurtén, '62.

skull had been recovered from a sandstone rock-fall on the right bank of the Tjemoro River near the village of Bapang, Sangiran. A closer examination of the spot proved that the rock had fallen from a cliff 5 m. above the river. Von Koenigswald in Bandung succeeded in restoring the specimen, as the recently fractured pieces fitted together well. After the restoration it appeared that the skull was more complete than Dubois' holotype. Part of its base with the region of the condyles and the temporal bones on both sides were preserved (Fig. 6; Pl. 4 A, B).

The skull is slightly lower and wider than skull I, but apart from this they are exactly alike. The greatest length is 176.5 mm., the width 140.0 mm. and the length-width index is 79.2. The cerebral capacity is only 835 cc. The skull shows the same supra-orbital ridges, which are separated from the cap by a weak depression. The forehead slopes sharply backwards. Only the left part of the brow-ridge is present. The sutures are closed, which points to an adult individual. The smaller dimensions as compared with skull I are attributed to a difference in sex, so probably this skull is that of a female and the Trinil example that of a male. On the whole this skull looks more human than Dubois' holotype, as it is more complete [34] (Pl. 4 A & B).

In 1938 von Koenigswald's collector found some badly weathered fragments of a third skull, which no doubt belonged to the same type as skulls I and II. The fragments came from a hill behind the village of Tandjung in the southern part of the Sangiran dome. The find (*Homo erectus erectus* III) consisted of an almost completely preserved right parietal bone, the upper third of the left parietal, and the greater portion of the upper part of the occipital bone. As the cranial sutures were wide open, the skull represents that of a young individual. It was possible to calculate the position of the lambda and opisthocranion and on this basis to reconstruct the midsagittal region. There were no essential differences from the second skull. The skull length is estimated at 177 mm., and its width was probably less than that of the second skull. The bones are extremely thick for a young individual. Along the middle line of the skull where the two parietal bones meet in the sagittal suture there is an elevation like the ridge-pole of a roof.[35]

In 1963 a sixth skull cap of *Homo erectus erectus* was found by collectors of the Indonesian scientists T. Jacob and Sartono (numbers IV and V come from the Putjangan beds as described in previous

[34] Von Koenigswald, '40b, 78-101; Vallois, '46.
[35] Von Koenigswald, '40b, 102-10.

pages). Skull VI was found in cross-bedded yellowish-white tuffaceous sandstone Kabuh beds of Sangiran, in the village of Tandjung near a tributary of the Tjemoro River, on the opposite bank of which skull III was found in 1937. In association with it fossil vertebrates of a Trinil fauna were found, including *Stegodon*, *Hippopotamus* and complete skulls of *Bubalus palaeokerabau* and *Bibos palaeosondaicus*. The following parts of the skull were present: occipital, both parietals, both temporals, sphenoid fragments, the frontal and the left zygometic bone. Jacob presumes that the skull belongs to a male individual in his early twenties. He measured a cranial capacity of 975 cc., which would make it larger than the other *Homo erectus* skulls found thus far. Other peculiar characteristics are that the angle between the occipital and the nuchal planes is larger than in previous finds; the sagittal torus is higher than in *Homo erectus erectus* I and II, but lower than in IV. The supraorbital torus is extraordinarily thick; the mastoid process is fairly well developed. The cranial base, a very fragile part and most vulnerable to post-mortem natural damage, is lacking. The robustness of skull VI lies between that of IV and of I, II and III. The thickness of the zygomatic bone is in the range of recent man [36] (Pl. 7 A & B).

Homo erectus erectus skull VII was discovered in January 1965 near the hamlet of Putjung in association with a fossil proboscid maxilla. Both parietals and temporal bones and the occipital part were present. The calvaria came from the Kabuh formation of the Sangiran dome. Sartono is in charge of the study of the skull, and his manuscript is ready for the press.

4. THE LOWER PALAEOLITHIC CULTURES

a. *Java*

It is clear that Java has been inhabited by man since the early part of the Middle Pleistocene. It should be remembered, however, that the places where the fossil remains have been found were not the original living-sites of *Meganthropus* and *Homo erectus*, but that those accumulations were caused by volcanic and stream action. It is therefore not surprising that artifacts have never been found alongside with the bones of their makers, neither are such combined finds to be expected in the near future.

The oldest palaeolithic tools so far found, mostly as surface finds

[36] Jacob, '66, 67a, b; Sartono, '64a, b.

Cranial dimensions in *Homo erectus*

Homo erectus	I	II	III	IV	V	VI	Homo erectus pekinensis
Cranial length	183	176.5	177	199	138	184	193.6 mm.
Cranial width	130	135	—	156	115	139	141
Auricular height	92	89	—	90	62	102	98.4
Length-width index	68.8	74.2	—	62.8	83.4	75.5	72.2
Length-height index	50.3	50.4	—	45.2	—	55.4	50.9
Biparietal width	126	131	128	125	—	128	136.2
Minimum frontal width	85	79	—	78	—	82	—
Biauricular width	135	129	—	156	—	115	145.5
Distance between temporal lines	92	69	—	78	—	91	93.5
Biasteriac width	92	125	—	—	—	121	—
Bimastoid width	—	102	—	—	—	114	—
Bipteric width	—	(100)	—	—	—	93	—
Transverse fronto-patietal index	67.4	60.3	—	62.4	—	63.1	—
Lower parietal width index	94.3	101.5	—	80.2	—	88.5	94.5
Transverse curvature index	52.3	47.7	—	—	—	42.6	—
Transverse parieto-occipital index	72.9	95.5	—	—	—	93.1	—
Transverse arc	258	262	—	—	—	270	—
Lambda-inion arc	61	56	—	—	—	44	—
Lambda-inion chord	53	53	—	50	—	43	—
Occipital angulation	108	103	—	91	—	115	103.2°
Parietal angulation: right	—	(118)	—	—	—	120°	—
left	—	(116)	—	—	—	115°	—
Lambda angle	—	(139)	120	—	—	129°	—
Cranial capacity	900	775	—	900	700	975	1075 ccm.

After Jacob '66

exposed by erosion, can be dated in the Late Middle Pleistocene at the earliest.

In October 1935 G. H. R. von Koenigswald [37] and M. W. F. Tweedie, Curator of the Raffles Museum in Singapore, paid a visit to the Sewu Mountains, a typical Cone-karst region with numerous conical hills, 100 m. high and with rounded top and convex slopes with subterranean drainage, caves, and sinks. The region was once covered by woods, but these have been destroyed by man during the last century. This deforestation was followed by erosion. Traces of the original forests are still to be found in the dolines which are filled with *terra rossa* and in fossil form along some river banks.

[37] Von Koenigswald, '36, c, d.

The Punung formation consists of two alternating lithographical facies: tuffaceous sandstones and reef limestone, overlain unconformably by *terra rossa* with some fossil vertebrates.[38] The region as a whole is an uplifted compact massif of Upper and Lower Miocene age (Fig. 8A, B, C, D).

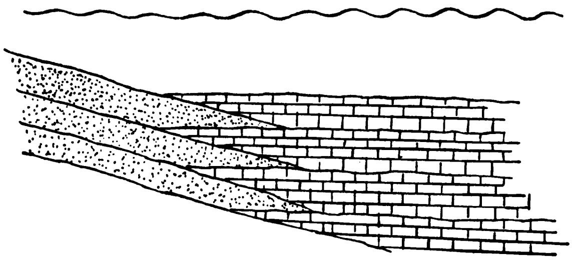


Fig. 8A. Miocene-Pliocene: Submarine topography. Coral-reefs and tuffs.

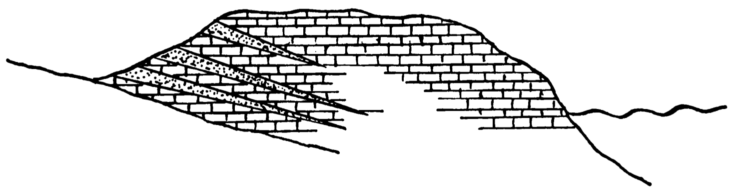


Fig. 8B. Pliocene-Early Pleistocene: Uplift and tilting.

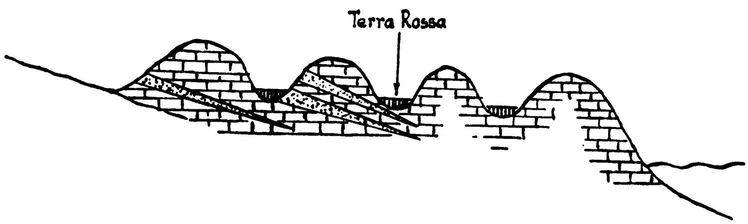


Fig. 8C. Early Middle Pleistocene: Forming of the dome-like hills.

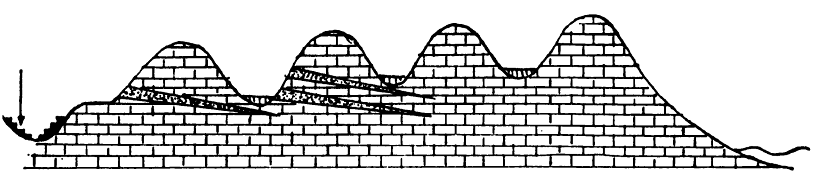


Fig. 8D. Late Middle Pleistocene: Forming of the Baksoka River and implementiferous terraces.

Formation of the Gunung Sewu, after Sartono

[38] Sartono, '64.

On 4th October Von Koenigswald and Tweedie discovered, for the first time in Java, a great number of large, massive, crudely worked stone tools, apparently of a Lower Palaeolithic character. The vast majority of the tools were manufactured of silicified tuff and were light ochreous, dark-brown to almost black; others were of silicified limestone, dirty-white in colour, and a few were made of fossil wood. The implements were picked up in a dry water-course of the bed of the Baksoka River south of Punung, but some tools were collected in a "boulder conglomerate" in the bank of the river, 3-4 m. above its bed. In some places this bank or terrace dipped under the level of the floor of the valley showing that it was gently folded. Yet he was not quite sure whether these finding places were the parent layers of all the tools; some of the tools might have been washed from higher horizons and secondarily deposited. The same author stated that typologically as well as geologically the newly discovered Palaeolithic culture represents a "complete Chellean" with hand-axes, flake-tools and a few crude blades. In total some 3,000 stone tools were collected in this very prolific locality; they were mainly stray finds, artifacts exposed through erosion. It is questionable whether judgment should have been pronounced on such insufficient evidence. Thus far no artifacts had been extracted from a datable geological horizon and palaeontological evidence was almost absent. Only one tooth of *Bos* sp. had been found in a 3-4 m. terrace (Pl. 8, 9).

Fig. 9. Chopping-tool. Gedeh River. 125 x 117 x 56 mm.

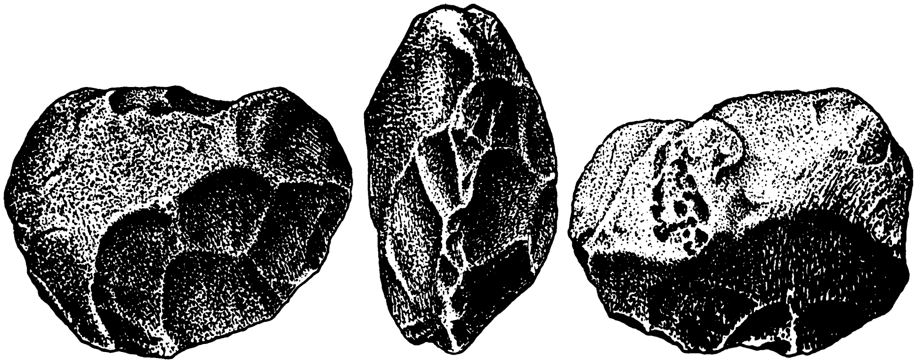


Fig. 10. Chopping-tool. Klepu, 6.9 m. terrace. 107 x 76 x 60 mm.

In the spring of 1938, after having finished a field-programme in the Irrawaddy Valley of Upper Burma resulting in the acknowledgment of a peculiar Lower Palaeolithic cultural development in southeastern Asia, Hellmut de Terra, Père Teilhard de Chardin and Hallam L. Movius Jr. accompanied Von Koenigswald to the Baksoka area to study on the spot the general situation and the geological problems connected with it.[39] Teilhard devoted a few pages to the problem;[40] he observed three

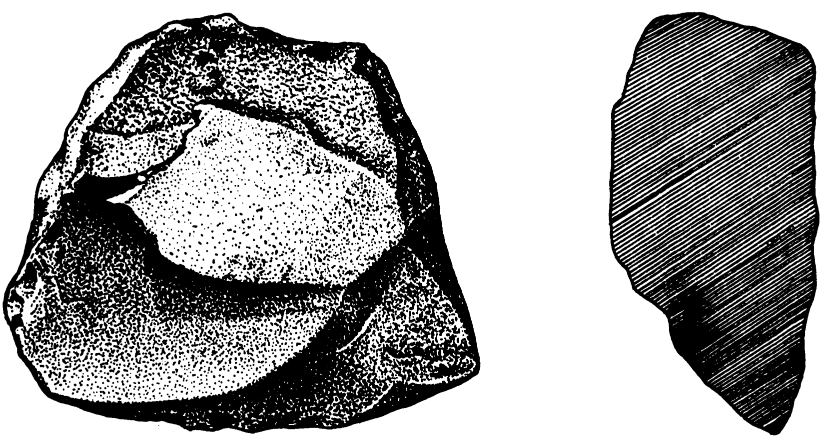


Fig. 11. Pseudo-cleaver fashioned from a massive flake. Baksoka River; 15-20 m. terrace. 118 x 126 x 54 mm.

[39] Movius, '43, '44, '48, '49a, b, '55a.
[40] Teilhard, '37b, '38.

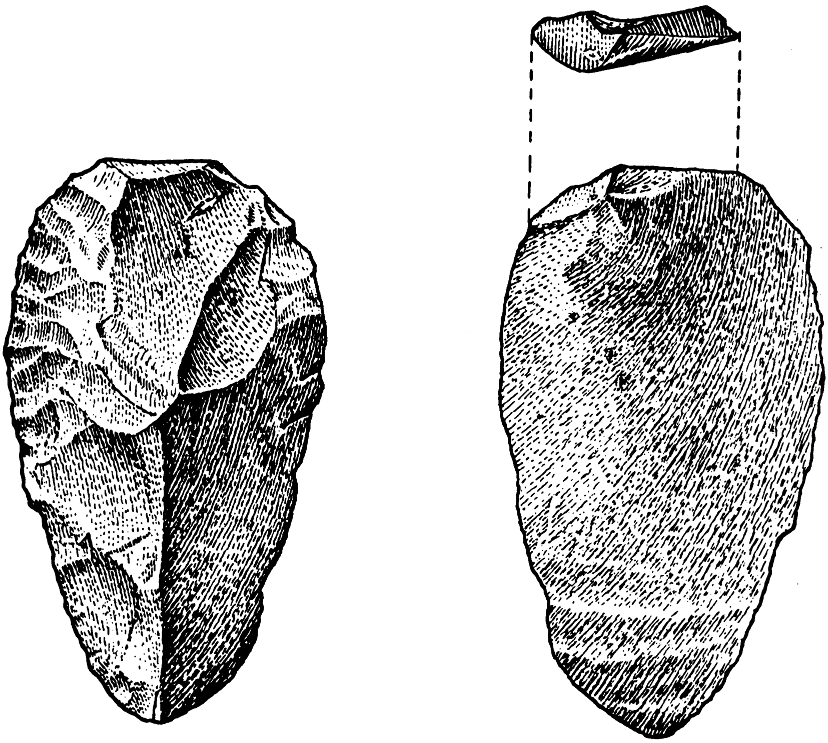


Fig. 12. Flake-tool. Baksoka River. 78 x 43 x 14 mm.

levels of implementiferous terraces on respectively 2 m. (composed mainly of silt), 10 m. (red gravel and loam with a basal layer of coarse gravel) and 25 m. (boulder-gravel with red loam). Teilhard, as Von Koenigswald before, qualifies the Palaeolithic assemblage as "Chellean" (Pl. 11 & 12).

The best study of the Patjitan tools is that of Movius. He contests rightly their Chellean character, pointing out that the number of bifaces (tools with bilateral finish) is very small, only 153 or 6.32% out of 2,419 tools classified as hand-axes, and of these only 42 completely worked around the butt-end. The working technique of the bifaces in most cases, especially the longitudinal flaking parallel to the axis of the tool, is in the chopper tradition. More than 50% of the assemblage is formed of flakes showing signs of use. The massive tools made of pebbles or of large flakes and sphere-segments derived from a shattering process consist of choppers, chopping-tools, hand-adzes and proto hand-axes. Therefore the Patjitan culture shows a striking difference from the Lower Palaeolithic Chopper/Chopping-tool Complex of the Far East. Thus far this complex has been recorded in Punjab [41] where it is named the Soanian, in Burma [42] (the Anyathian), in Thailand [43] (the Fingnoian), in Malaya [44] (the Tampanian) and also in Northern China [45] where it is termed the Choukoutienian and where it is found

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41 Movius, '48, 376-86.

42 Movius, '43, 341-493.

43 Van Heekeren, '48, 24-32; Movius, '48, 404-6.

44 Collings, '38, 575; Sieveking, '60, 91-102, '62, 103-39; Walker, '56.

45 Movius, '48, 386-402, '55a, 270-77.

In a fissure 175 x 50 m. wide, in the Ordovician limestone hills near the hamlet of Choukoutien, 31 miles southwest of Peking, large-scale excavations were carried out from 1920 tot 1939, when the Japanese invasion in North China put an end to the activities, but were reopened by the Chinese after World War II. In some places the deposits (a hard lime breccia and partly stratified sand) were more than 50 m. thick. Fossil remains of more than 40 individuals of both sexes and of various ages were found. It became clear that China Man or Peking Man was in fact not distinguishable generically from Java Man. Therefore it is justifiable to apply the name *Homo erectus pekinensis*. Compared with Java Man, Peking Man has a somewhat more refined cranial morphology: the forehead region is better developed, the cranial capacity greater, the supra-orbitals not quite so heavy, the parietal bones higher and more rounded and the foramen magnum is placed slightly further forward. Limb bones are not fundamentally different from those of *Homo erectus erectus* or for that matter from *Homo sapiens*.

There is ample evidence that he was a mixed feeder. He produced thick, heavy flake and core-tools made of pebbles of fine grained green sandstone and quartz and occasionally of quartzite, chert and flint. The core implements (Choppers) were worked on one surface only, and chopping-tools flaked on both sides of the cutting-edge. The flake implements mostly made of quartz were crude and manufactured by simple bipolar technique (hammer-and-anvil method) or by direct percussion. Furthermore there are thousands of flakes without secondary trimming. The overall picture of this industry conforms with the tool-making tradition of the general Lower Palaeolithic Chopper/Chopping-tool tradition of Southeast Asia. In post-war years, human and cultural remains of great antiquity have been found, including Choukoutienian artefacts in the Fenho Valley of Shansi; a maxilla and skull cap of a member of the Homo erectus group in western Hupei and a calvaria at Mapa in North Kwangtung.

All fossil remains of *Homo erectus pekinensis* found in the course of many years at Choukoutien were lost during the war. This is what has happened (Kwang-Chih Chang '68): "Although Peiping fell to Japanese invaders in 1937, scientists at the Cenozoic Laboratory of the Geological Survey of China were able to continue study at Chou-k'ou-tien until 1939. Then, in 1941, decision was reached between the Chungking and American authorities to transport these fossils to the United States for safekeeping, and they were crated and moved to a warehouse in Ch'in-huang-tao, a small port city northeast of Peking, into the custody of the U.S. Marines. Just at this time Pearl Harbour was attacked. In the resultant confusion the fossils disappeared either from the warehouse or together with a sunken ship and have never been heard of since."

in association with skeletal remains of *Homo erectus pekinensis*. In some instances, namely in the Soanian, Anyathian and the Choukoutienian, a Middle Pleistocene dating could be established on the basis of the fossil fauna. The Anyathian, the Fingonoian and the Choukoutienian are devoid of true hand-axes. Several authorities when referred to the Chopper/Chopping-tool complex consider the matter of race to be of prime importance, ascribing these toolmakers to the Homo erectus group or their direct descendants. Such statements are open to question. Without any doubt the Patjitanian is comparable in technical knowledge to the Chopper/Chopping-tool complex of Southeast Asia, though it is not necessarily of the same age. After all, we still do not know its place in the geological scale. New approaches and additional knowledge are necessary. In the description of our own finds in the Punung area, we accepted Movius' terminology,[46] but we redivided the choppers

[46] Movius, '55a, 261-2.

Movius discovered an unrecognized Lower Palaeolithic culture in Southeast Asia, but the classic sequence established in Western Europe cannot be applied to it. It was found necessary to invent the following new archaeological terms for the large, massive tools. The types are described in terms of shape and technique, not of function.

"*Chopping-Tools:* Core implements on pebbles or more-or-less tabular chunks of rock with a single cutting-edge produced by alternate flaking from *both sides*. The intersection of the alternating flake scars results in a sinuous outline and the formation of an edge which in many instances resembles a broad W.
Hand-Adzes: A core implement of tabular form with a cutting-edge that forms a right angle with the long axis of the tool. The flaking is restricted to the *upper surface* of one end. This results in the production of a single-beveled adze-type of cutting-edge, in contrast to the double-beveled or bifacial (V-sectioned) axe-type.
Proto Hand-Axe: In many instances these implements are made of large flakes that have been worked on the *upper surface* only into roughly pointed types of hand-adzes of plano-convex section. Normally cortex adheres to the butt-end, and only in a few instances does the flaking extend all over the upper surface. In a typological sense these tools may be considered as transitional between hand-adzes and true hand-axes or bifaces.
Choppers and/or Scrapers: The only difference between a chopper and a scraper is gross size. On this basis, large crude scrapers and massive scrapers are called choppers. Normally a chopper is manufactured on a core, whereas scrapers are usually made on flakes, but in many instances this distinction does not hold. Both are flaked on the *upper surface* along one side only so as to produce a unifacial tool with a round, semi-oval or straight cutting-edge.

The specimens typical of each of the above categories can be easily segregated. But absolutely no rigid line can be drawn between these classes as a whole in all cases where the total range of a given series is considered, and the probability of any two individuals agreeing on the classification of any of the assemblages from the several regions under consideration is extremely remote. Stated quite simply, however, the long axis of a chopper is more-or-less into four distinct types: "Flat-iron" types (long, high-backed, plano-convex in section, flat-iron shaped, with resolved longitudinal trimming; some examples are keeled), Side-choppers (massive side-scrapers, irregular in outline), End-choppers (longitudinally flaked at the end, parallel to the main axis of the tool), "Horse-hoof" choppers (high-backed, with steep and stepped retouch around all edges of the upper face producing a massive pebble-tool in the shape of a horse-hoof). "Flat-iron" and "Horse-hoof" choppers are very characteristic of the Patjitanian and may be used as type-specimens or as guide-forms for this industry[47] (Fig. 9, 10; Pl. 11, 12, 13, 14, 15, 16, 17a, b).

On 22nd October, 1952, A. Christie of the School of Oriental and African Studies, London, and the present writer made a brief trip to the Baksoka Valley. Stone tools were collected, but the soil was so moist and swampy that it was hard to move around. On 6th August 1953 the same area was visited again. This time I was accompanied by P. Marks, Soejono and Basoeki. We noticed an implementiferous boulder-bed on the right bank of the river, 3.20 m. above it. The tools were rolled and found in the upper part of the bank. Similar tools were picked up from the river gravel and were also found on low banks ½ - 1 m. above the Ngambar tributary.

On 7th August 1953, while searching for a fossil-containing fissure near Tabuhan, Soejono discovered a well-finished "Flat-iron" chopper near the Gedeh River. It was the first Patjitan tool ever to be found in this area and it led to a more careful search of the surroundings and an organized plan for further investigations. In a site under a rockfall near the Gedeh River, filled with recent black clay and silt (from torrents flooding it), more typical Patjitan tools were found. In the riverbed, too, a number of palaeoliths were collected and on the right bank we located a small boulder-bed with stone tools in the upper part, 1 m. above the river. More stone tools were collected in the dry water-course of the Serikan River, which connects the Gedeh River with the Sunglon River. A few implements were extracted from a low boulder-

parallel to the cutting-edge; in the case of hand-adzes the long axis is at right angles to the cutting-edge; proto-hand-axes differ from both of these categories in that they are pointed; while only in the case of chopping-tools has the flaking been executed from *both sides* of the cutting-edge. The essential and fundamental point to stress, however, is that regardless of definitions and classificatory procedure, choppers, chopping-tools, hand-adzes and proto-hand-axes all differ fundamentally from hand-axes, which are true bifacial implements, normally flaked all over both surfaces."

[47] Van Heekeren, '51a, '55.

bed, ½ m. above stream-level. New investigations were planned for October 1953. The present writer fell ill, but his colleagues Soejono and Basoeki carried on further research during a ten-day stay. The Tabuhan area was mapped and a trial excavation was made in the Songterus Cave, resulting in the discovery of mesolithic and neolithic tools made of stone, bone and shell and of a sub-fossil fauna including teeth of *Elephas maximus* but no Patjitan tools. Some new sites were discovered on the right bank of the Sunglon River, 1 m. above the river, and at Kiut a terrace containing Patjitan tools, 5.9 m. above the river. A few palaeoliths were collected on the left bank, 20 - 30 m. above stream-level at a site which may be the remainder of a heavily dissected terrace.

In December 1953, we spent another ten days in the Sewu Mountains, mainly making reconnoitring trips. The soil near the river was very swampy at this time of the year. Nevertheless, we collected quite a number of palaeoliths, including two beautiful hand-axes, one round in outline and one almond-shaped. They recall in general shape and in detail some standard types of the Eurafrican Acheulean. The axes are shaped out of glossy fossilized limestone; both are carefully chipped on both faces as well as on the butt-end. One of the cutting-edges of the almond-shaped specimen has a slight "S" shape twist. An implimentiferous boulder-bed was noticed on the left bank, 1½ m. above the river, exactly opposite the Ngambar tributary. The rolled tools were found in the upper portion of this bank. In May 1954 Basoeki made a ten-day stay at Punung and used the occasion to map the Baksoka Valley over a distance of 8 km. The Tabuhan area was again explored by us in June 1954 during a stay of 17 days. New implementiferous terraces were located: at Kiut, this time a red gravel-terrace with palaeoliths on the right bank of the Sunglon River at an height of 11.5 m. above the river. On the right bank of the Serikan River an implementiferous terrace was discovered 5 m. above stream-level. In the dry watercourse of the same river we collected a well-finished hand-axe and a fine "Flat-iron" chopper. A small excavation carried out in the 1 m. bank of the Sunglon River proved that tools were embedded in the upper portion only; they were waterworn. A one-day trip to the Baksoka River resulted in the discovery of an implementiferous terrace on the right bank, 4 m. above stream-level. We also recognized a dissected terrace with lateritic gravel, 15 - 20 m. above the river, by far the highest in the series. This bed had several metres of red clay on top. In total 133 unrolled stone implements of the Patjitan type were collected; among these were 27 choppers, 2 chopping-tools, 1 hand-adze, 8 proto hand-axes, 3 hand-axes, 1 pseudo cleaver, and a great number of flake-tools showing signs of use. They were made from silicified limestone and were stained red all over by the red clay in which they had been buried for an indefinite period. The site was mapped in September 1954. The last time I visited the area was in June 1968 with Soejono, Sartono and Tegu Asmar. We found that the bed of the Baksoka River, once littered with stone tools, now provided us with a few examples only. We spotted again terraces containing tools at a height of 5 - 6 m. and 10 m. on the right side of the river. Sartono had formerly found 2 fossil teeth of *Sus* sp. in a 1½ m. bank.One tooth was still in its place in a mandibular fragment. I got permission from Sartono to extract some powder from the fragment. According to a letter dated 6.3.'69 from Oakley it appeared that the level of nitrogen was 0.24%, which is higher than would be expected in bone older than the Upper Pleistocene at most, and nil eU308 (Solo Man had nil nitrogen and 25 - 30 parts per million eU308).

In brief outline we have shown that post-war discoveries by the present writer and his associates have revealed new localities, notably in the Tabuhan area, north of Punung. In this region, the Gedeh River and the Sunglon River break through the karstified hills in two places. In the Sunglon Valley 4 defined implementiferous levels were exposed, respectively 1, 6, 11 and 20 m. above stream-level, while the small Serikan River furnished proof of the existence of at least 2 different horizons; 1 low boulder-gravel at 1 m. and 1 gravel-terrace at 5 m. above the river. The tools of the low benches were found in the upper portion only, and as they were waterworn, I presume that they were brought down by erosive water action from a higher level and were secondarily deposited. It is noteworthy that similar low benches run along the Sunglon, Serikan, Gedeh and Baksoka rivers and their tributaries at an height of ½ - 2 m. above stream-level. The terrace sequences of the Baksoka and Sunglon Valleys are very similar and have many features in common; they are characterized by 4 implementiferous terraces and 4 distinct cycles of erosion. The most important terrace perhaps is the 15 - 20 m. terrace of the Baksoka Valley. It is highest and oldest in the sequence. In contrast with the tools from the lower terraces and the scattered ones of the river bed, the implements in this terrace are not waterworn and are made of silicified limestone only. Apparently the tools were fashioned during a period when the karst was nascent and before the river wore down its bed into the volcanic breccias, when the silicified tuff became available to the tool-makers. During this stage the Trinil fauna may have populated the region as their fossil remains have been found by Von Koenigswald in fissures and sinkholes near Tabuhan (Bear, tapir, *Simia, Stegodon, Elephas namadicus, Echinosorex, Symphalangus* and *Hylobates.* [48] Accordingly the tools from this terrace may be of Late Middle Pleistocene antiquity, although the Patjitanian persisted without any significant modification into the Upper Pleistocene and even beyond. These facts and others go to prove that the Patjitanian of the high terrace and the lower terraces form a single culture. It seems therefore clear that the Patjitanian shows evidence of a very slow tempo of change, in tool technique and in the creation of new forms. The technique employed in working the Patjitanian tools is essentially monofacial, as has already been stated several times by Movius.[49] The flake-tools which do not always exhibit either a bulb of percussion or a striking platform, out-number the pebble-tools by far. But the Patjitanian is characterized also by a great number of massive tools such as choppers, chopping-tools, hand-adzes, proto hand-axes and hand-axes, and the absence of true Levallois technique. The tools are made from deeply patinated silicified limestone, ochreous, dark-brown or even black. Others are made of dull-grey silicified tuff. The total finds in the Tabuhan area are:

Choppers	23	=	11.4 %
Chopping-tools	16	=	7.9 %
Hand-adzes	1	=	0.5 %
Proto Hand-Axes	8	=	4.0 %
Hand-Axes	6	=	3.0 %
Flake-tools	148	=	73.2 %
Total	202	=	100.0 %

Only a few were made of fossil wood. It is not uncommon to find that the butts are left untrimmed with a considerable part of the original crust of the pebble adhering to it. As has been presumed by Movius, the Patjitanian is fundamentally similar and closely allied to the Anyathian of Upper Burma and both form part of the great Chopper/Chopping-tool complex of Southeastern Asia. As said before the Patjitanian comprises a small proportion of bifaces many of which are flatter and much less flaked on the lower than on the upper face. Many show a technique

[48] Badoux, '59.
[49] Movius, '48.

of stone flaking, notably lengthwise trimming parallel to the axis of the object, closely resembling that of the chopper tradition. But we also found a small number of bifaces, round and almond-shaped and elongated thick-butted shapes, some of them with slightly "S" shaped sides. Movius suggested that the Patjitan bifaces are a local development, notably the pointed specimens evolved from the choppers and the ovates from the chopping-tools.

At any rate true bifaces were already well developed in the Early Patjitanian of the highest terrace in the sequence. Only a small proportion of the tools, however, may be labelled as Acheulean, and Levallois tools are completely absent.

Not much is known about the spatial distribution of the Patjitanian in Java, but sites with tools resembling this type, but not necessarily of the same age, have been found at Tasik Malaya (by Ostberger), in the Djampang area southwest of Sukabumi (by Erdbrink [50]) and at Gombong and Parigi in West Java by Houbolt.[51] All discoveries just mentioned were of surface finds without any geological or palaeontological evidence to guide us.

b. *Sumatra, Borneo, Bali and Flores*

The same absence of scientific data holds good for sites with scattered monofacial stone tools in South Sumatra where Houbolt collected tools mostly shaped out of fossil wood and volcanic rock in the valley of the Mungrup River near Tabangsawah 52 miles north of Benkulen; in 1954 Soejono picked up 19 similar tools from the riverbed of the Saling River,[52] a tributary of the Kikim River, 2 miles south of Banjumas. The tools were made of silicified coral, wood and limestone. The manufacture was carried out by coarse flaking of pebbles, large and small, or on broken pieces of rock, characterized by monofacial working. The collection included choppers, chopping-tools, hand-adzes, 1 bifacial and some flakes. Erdbrink [53] has found 2 rolled and heavily patinated specimens made of fossil wood on a boulder-gravel bed on the Kedaton Rubber Estate near Tandjung Karang, in the Lampong district.

If we turn to Borneo we see that the geologist H. Küpper has discovered 5 pebble-tools and 2 flake-implements on a gravel-terrace above

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[50] verbal message.
[51] Houbolt, '40.
[52] Soejono, '62, 219-21.
[53] verbal message.

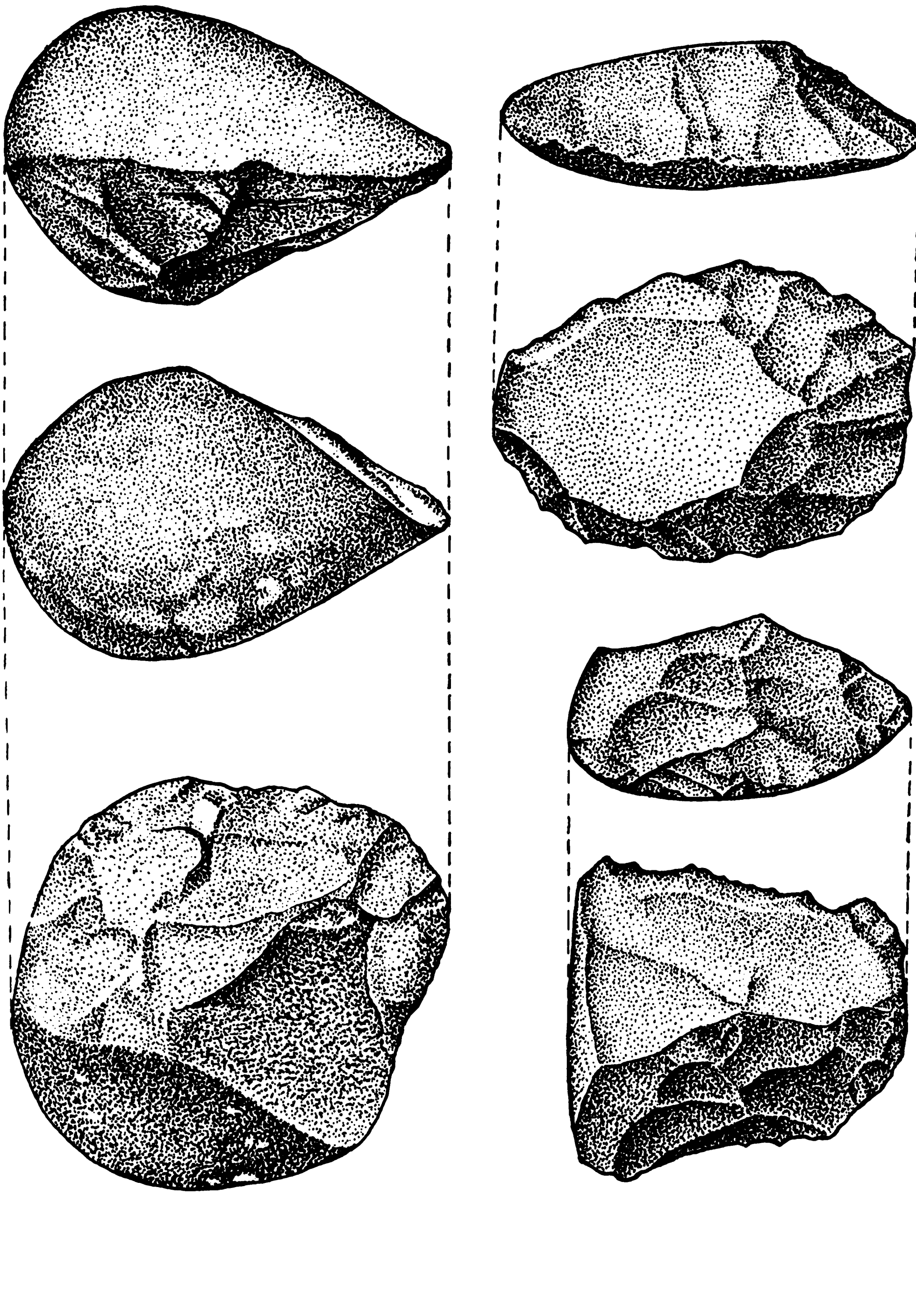

Fig. 13. Monofacial Pebble-tools. Awang Bangkal, Southeast Borneo.

the south bank of the Riam Kanan River near Awangbangkal,[54] approximately 16 km. southeast of Martapura in Southeast Borneo. It it not certain, but probable, that they are of Pleistocene age. The dressing of the pebble is always confined to one face only and the tools are worked in a manner known as that of choppers. The artifacts are made of quartzite (Fig. 13).

Scattered finds of monofacial pebble-tools have also been made in Bali. In May 1961, Soejono, prehistorian to the Indonesian Archaeological Service, picked up 40 basalt tools of this kind in the northern part of the island, north of the village of Sembiran.[55] Flaking was again executed on one face only, the cortex still adhering to parts of the flaked surface. Among the findings were "Flat-iron" types, side-choppers, proto hand-axes, hammerstones and flakes.

Flores, too, seems to belong to the same area where pebble-tools were once in use. I saw a good example of a crude side-chopper in the collection of Verhoeven, and during my last visit to Indonesia in 1968 Soejono was kind enough to show me a small collection of pebble-tools collected in the same island, found in association with Stegodon fossils.

All discoveries of assemblages of monofacially flaked pebble-tools and chunks of rock deserve full attention, but to suggest connecting these with the Patjitanian and accordingly with the great Chopper/Chopping-tool complex of Southeast Asia remains mere guesswork. It is true that typologically the general aspect of the assemblages just mentioned seems comparable with that of the Patjitanian, but there is a complete absence of geological and/or palaeontological data. Assignment to the Patjitanian would therefore be based on no more evidence than the notoriously uncertain one of typology.

Indeed, recent exploration in Thailand has proved that the exact relationship between the Lower Palaeolithic Chopper/Chopping-tool culture and the Mesolithic Hoabinhian has never been properly determined.[56] However, with the recent expansion of our knowledge of the pebble industries in Thailand, the impression is gaining ground that the post-glacial Hoabinhian is definitely in the Chopper/Chopping-tool tradition and has its roots in the Lower Palaeolithic of Southeast Asia, the one merging into the other without any significant modification. Despite differences in technical skill, the basic character of the tools is similar:

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[54] Van Heekeren, '51b.
[55] Soejono, '26, 225-31, '64.
[56] Van Heekeren and Knuth, '67, 105-11.

types sometimes differ in detail but fundamentally they belong to the same group; both palaeolithic and mesolithic implements are composed of monofacially flaked core-tools. Moreover, the crudest and simplest types of tools of the Lower Palaeolithic continue to be found in the Hoabinhian. It is therefore not possible, at present, to draw lines of demarcation on typological grounds alone. Thus these industries, or some of them, that have been classified on typological ground as palaeolithic may prove on absolute dating to be mesolithic or more precisely to be Hoabinhian. It therefore serves no useful purpose to discuss these further until far more evidence is available. All this is in sharp contrast to the situation in Africa, for instance, where prehistory also starts with pebble-tools, but where it then leads on to the development of bifacial hand-axes, the Levallois technique and subsequently to specialized flake-and-blade industries.

D. THE UPPER-PLEISTOCENE OF JAVA

1. THE NOTOPURO BEDS

The Notopuro beds have some striking features. In the first place, their composition is rather anomalous; secondly, near Sangiran there is an erosional unconformity separating the uppermost gravel series from underlying volcanic material and waterlaid deposits of the Kabuh zone. In the third place the Notopuro beds of Sangiran are characterized by a distinct resistant escarpment. Elsewhere on the central plain of Java there is a marked disconformity at the same stratigraphic horizon. In the deposits are large boulders. Between the village of Ngawi and Trinil lie similar deposits, made up of fine, grey tuffaceous layers. Beds of the same antiquity are present, with interruptions, along the slopes of the Kendeng Hills which are not so well known and have as yet not been examined in as much detail as the older layers. Often they appear to have been partly or completely washed away, or else they are overlain by recent alluvial deposits. In the gravels round Sangiran a great number of flake-implements of a glossy yellow chalcedony occur, as discussed below. As far as we know, the fauna is the same as that of the Kabuh beds.

2. THE SANGIRAN FLAKE-INDUSTRY

Palaeolithic flake-artifacts were discovered by G. H. R. von Koenigswald as early as 1934. The first site on Java to yield the tools was the dome-shaped anticline of Sangiran, north of Surakarta. Von Koenigswald assumed that the flake-implements which he collected from the surface northwest of Ngebung originated from the upper portion of the Middle Pleistocene Kabuh beds and were associated with some rolled and derived bones belonging to the Trinil fauna. On this basis he believed that the gravel-series in which the tools were found belonged to the upper part of the Middle Pleistocene, but Teilhard de Chardin, De Terra and Movius disagree with this conclusion. They inspected the Sangiran region in 1938; no tools were found in the Kabuh beds on that occasion, but in the upper gravel-series which were separated by an erosional unconformity from the underlying volcanic material and waterlaid deposits of the Kabuh zone they collected quite a number of palaeolithic flakes made of shiny yellow chalcedony and jasper. Pebbles of chalcedony and jasper were found in large quantities in the Notopuro beds, all along the Kendeng range, extending from south of Semarang to the vicinity of Surabaja.[57] In the same year Movius collected similar chert and jasper artifacts from the surface of an Upper Pleistocene river-terrace near Karsono north of Ngawi (Fig. 14; Pl. 22).

I had the opportunity of visiting Sangiran and the Solo Valley twice in 1952 and again in 1953, 1955 and 1968, when more flake-tools were collected. At Sangiran there are two factors which enable us to recognize the Notopuro beds even from great distances. The red-brown colour of these beds, perhaps caused by ferric oxides, clearly contrasts with the underlying grey-blue Kabuh beds; moreover the Notopuro beds, as said before, all show a resistant escarpment. At the base, the beds start with a volcanic conglomerate caused by a mud stream. There is no unanimity among geologists as to whether this layer was laid down during the last stage of the Middle Pleistocene or as early as the onset of the Upper Pleistocene period. All tools were exclusively found in the lower portion of the Notopuro beds. The coarse conglomerate which unconformably covers the Kabuh beds is overlain by sand and river-gravel. The total thickness of the Notopuro beds is more than 20 m. At Sangiran there is hardly any evidence of palaeontological material, but at other places these beds contain a rich Trinil fauna.

We collected more than 70 flake-tools in the gravel series northwest of Ngebung, south of Putjung, Ngrawan and at Djagan, west of Bapang. The flakes are rather small (2 - 6 cm.) and made of shiny yellow and brown chalcedony and red jasper, all coming from the gravels of the Notopuro beds and therefore indicating an Upper Pleistocene age. The workmanship of the Sangiran Industry is poor compared with the highly specialized Upper Palaeolithic flake and blade cultures of Europe, Africa and the Middle East. The industry has a Clactonian appearance and comprises scrapers, end-scrapers, ogival points, some borers, core-scrapers and crude blades. As a whole the Sangiran industry presents a poorly developed flake assortment with a small increment of crude blades. Most of the tools have a striking platform at a wide angle to the long axis of the object and display a well pronounced bulb of percussion. Secondary chipping, if found at all, is slight. Cores are irregular and flaked in all directions. Since the remains of *Homo erectus soloensis* are also of Upper Pleistocene age, the Sangiran flake industry may be the work of this kind of Early Man. Further research is necessary before we can reach a final conclusion.

[57] De Terra, '43, 457; Movius, '55, 527-39.

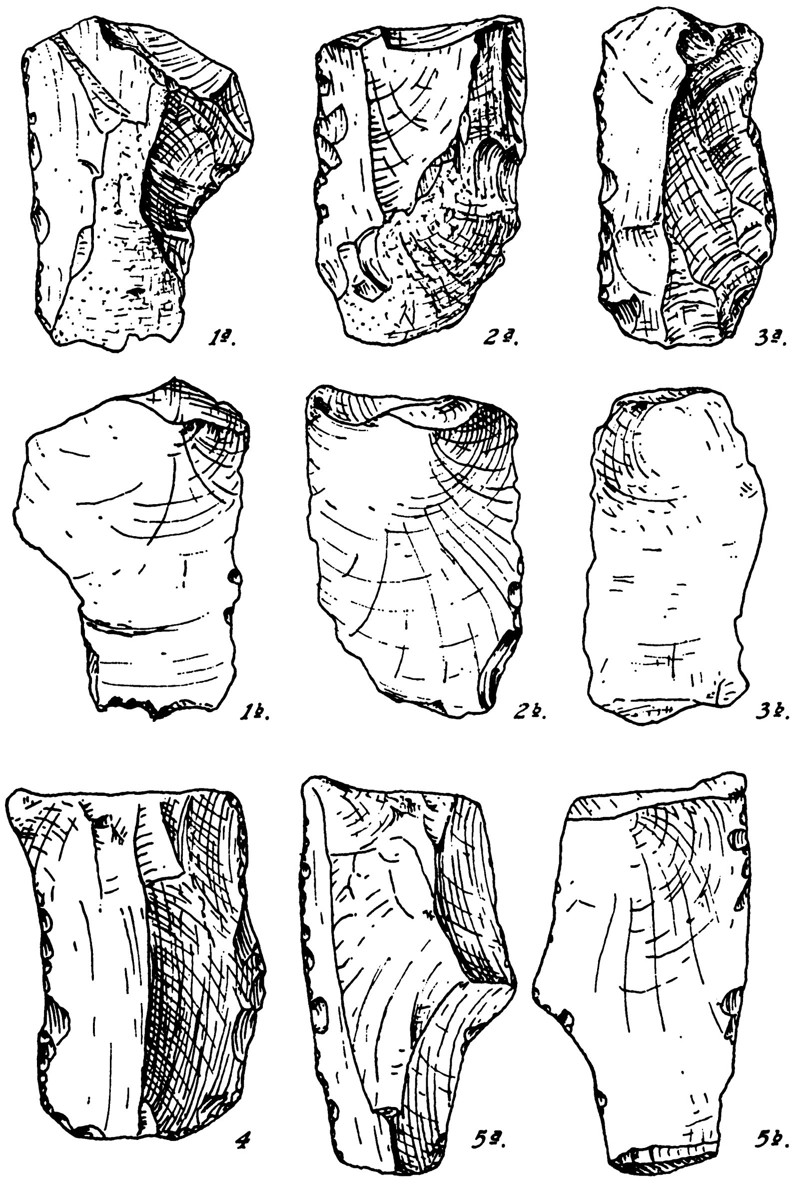

Fig. 14. Flake-tools from Sangiran.

after Von Koenigswald

Flake-industries like the Sangiran with flakes of similar rock have been discovered in Southwest Celebes, the Philippines and in Portuguese Timor.[58] Since it has become known that *Stegodon* saw fit somehow to cross the Wallace Line to Celebes, Flores and Timor,[59] the heavily patinated chalcedony flake-tools from Timor collected in great numbers and now stored in Lisbon obtain a special meaning. Too little serious work on this aspect has thus far been carried out. From the large collections available, it seems that technique, choice of raw material and patina at Sangiran (Java), and in Celebes, the Philippines and Timor are almost identical.

3. STREAM-TERRACES

Of more or less the same period are the high river-terraces bordering the Solo River, which follows the southern border of the Kendeng Hills until it reaches Ngawi. From here it turns northward. The terraces were reported as early as 1908 by J. Elbert as containing fossil remains of vertebrates. In Java, such high terraces seem to have developed exclusively in the Upper Pleistocene during the last stages of the uplift of the Kendeng Hills, which caused the river to cut down vigorously until equilibrium was regained, leaving ancient terraces at 20 m. above the present river. They unconformably overlie the ancient folded deposits and as they escaped the last folding which took place during the interval between the Middle and Upper Pleistocene, they must have developed after this folding (Fig. 5).

Long after Elbert, the Solo terraces attracted the attention of Ter Haar, who in 1931 discovered new fossiliferous terraces along the Solo River. An almost complete skull with horns of *Babulus palaeokerabau* was recovered at Kuwung. Later excavations were undertaken by members of the Geological Survey in a 20 m. terrace near Ngandong, 6 miles downstream from Trinil, situated on the western bank of the river.[60] Here the river runs through intensively folded tertiary tuffaceous marls. The excavation of the terrace, an area of 150 x 300 feet with a maximum thickness of 10 feet, yielded surprising discoveries with the greatest accumulation within the first metre from the bottom in a sand-gravel layer. As many as 20,000 fossil mammal bones were found, among them 11 fragmentary human calvarial fragments and 2 incomplete tibiae, straight and slender as in recent man. All facial parts

[58] Almeida, '53, 487-88.
[59] Hooijer, '57b; Von Koenigswald, '58; Hooijer, '69.
[60] De Terra, '43, 457; Movius, '55, 527-39.

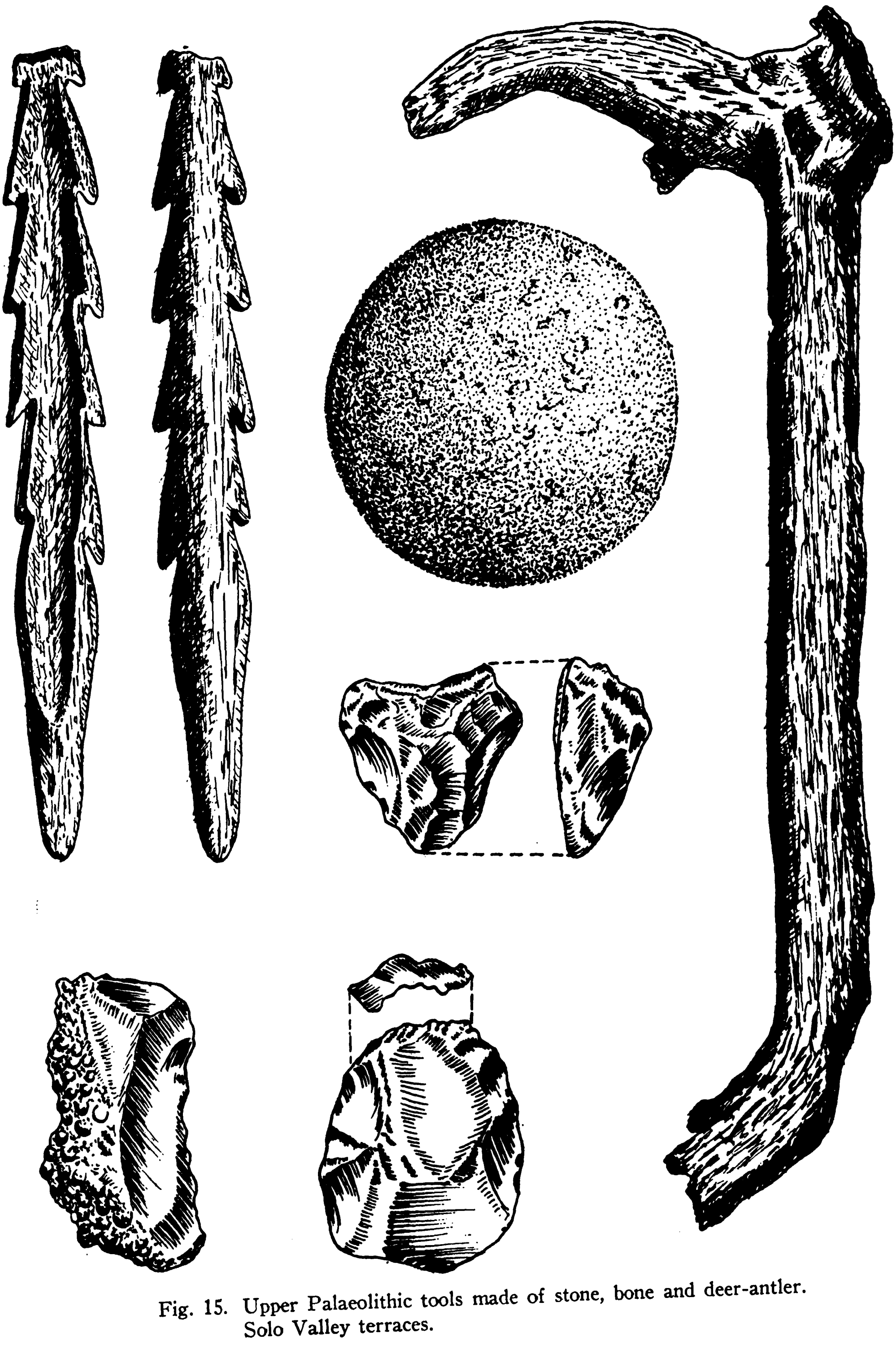

Fig. 15. Upper Palaeolithic tools made of stone, bone and deer-antler.
Solo Valley terraces.

of the skulls were missing as well as most of the bases; not even a single tooth was found. The skulls were found in varied positions, some of them resting on their vaults.

Similar terraces exist both upstream and downstream from Ngandong, the terraces of Ngandong, Ngrawoh, Pandejan, Kuwung, Sidoredjo, Sembongan and Ngasiman all contain the Upper Pleistocene Ngandong fauna. The site richest in fossils is at Watualang. At Pitu the terraces overlie directly the Kabuh beds (Pl. 18, 19, 20).

4. THE NGANDONG FAUNA

Two-thirds of the vertebrates of the Ngandong fauna which have been examined consists of remains of the prehistoric banteng: *Bos (Bibos) banteng palaeosondaicus*, of which the male and female specimens do not appear to be as differentiated as those of the recent bantengs. Next in frequency comes the fossil water-buffalo: *Bos (Bubalus) bubalis palaeokerabau*, of which an excellently preserved complete skull with the horns was found; the distance between the tips of the horns was 2.25 m.

Von Koenigswald [61] considers the Ngandong fauna as an impoverished Trinil fauna. In his last, revised list the Ngandong fauna comprises the following types:

PRIMATES
Homo erectus soloensis Oppenoorth.

CARNIVORA
Felis palaeojavanica Stremme, *Panthera tigris* Linn. var., *Panthera pardus* Linn.

PERISSODACTYLA
Rhinoceros sondaicus Desm.
ARTIODACTYLA
Hippopotamus soloensis Hooijer, *Sus macrognathus* Dub., *Sus terhaari* von K., *Sus* ex. aff. *vittatus* Müller et Schlegel, *Muntiacus muntjac* Zimmermann, *Cervus (Rusa)* cf. *hippelaphus* Cuvier, *Cervus javanicus* von K., *Bos (Bubalus) bubalis palaeokerabau* Dub., *Bos (Bibos) javanicus palaeosondaicus* Dub.

PROBODCIDEA
Stegodon trigonocephalus Martin, *Elephas* cf. *namadicus* Falconer et Cautley.

A few remains of birds from Watualang are a big black stork, a vulture and a crane which have been studied by Wetmore.[62] He writes as fol-

[61] Von Koenigswald, '49a, 91-94.
[62] Wetmore, '40, 447-50.

lows: "There are no records of occurrence of the crane in Java, and at the present time it winters south only to the Yangtse Valley, Hainan, Swatow and Northern India. Pleistocene conditions apparently carried it much farther south, and its occurrence in Central Java is of particular interest in its possible indication of climatic conditions of the period from which it comes."

5. HOMO ERECTUS SOLOENSIS

As said before, no less than 11 fossil calvarial fragments and 2 tibiae of *Homo erectus soloensis* have been found by members of the Geological Survey in a 20 m. river-terrace near Ngandong. Skull I, a calvarium lacking the greatest portion of the base, Skull II a frontal bone, and Skull III, a fragment of a calotte, have been excavated in 1931. Skull IV, a calotte; Skull V and VI, nearly complete calvaria with the bases preserved, and Skull VII, a small fragment of a right parietal bone, were found in 1932. Skull V excavated by W. F. F. Oppenoorth, and Skull VI discovered by Von Koenigswald and Ter Haar were observed *in situ* by experts. The skulls were found resting on their vaults. Skull VIII, two parietals; Skull IX and X, calvaria with the greater portion of the base missing; and Skull XI, an almost complete calvarium, were dug up in 1933. Tibia A consists only of a large fragment of a shaft, and tibia B is almost complete; they were found in 1932 and 1933 respectively. All these human fossils were recovered from a deposit consisting of sand, gravel and volcanic products of an ancient stream-terrace at the village of Ngandong, situated on the left bank of the Solo River, about 11 km. north of Ngawi. The terrace lies 20 m. above the river, and about 50 m. above sea-level. It was probably an ancient camping place of Solo Man, the numerous fossil animal remains representing the remainders of its meals. The skulls were highly mineralized; their patina is sepia-brown, in some instances with almost black spots on the top. Some skulls are extraordinarily heavy, because of their size and intensive fossilization. Skull XI weighs as much as 1,153 gr.; Skull V: 1,139 gr. The skulls, belonging to individuals of different age and sex, have so far been partly and provisionally described by Oppenoorth, Ter Haar, Von Koenigswald and Pottier.[63] Franz Weidenreich had an opportunity

[63] Oppenoorth, '32a, 49-74, '32b, 704-7, '32c, 105-15, '32d, 269-79, '37, 349-60; Ter Haar, '34, 51-57; Pottier, '44; Vallois, '35; Von Koenigswald, '33b, '58b; Washburn and Clark Howell, '52.

to study the originals after the war through the intermediary of Von Koenigswald, and some years ago his posthumous monograph, dedicated especially to Solo Man, was published,[64] although it was not finished due to his sudden death on July 11, 1948. The last to study the skulls in Utrecht was T. Jacob[65] (Pl. 21).

It is noticeable that most of the skulls lack the base which, according to Weidenreich, exhibits traces of having been broken away forcibly. This was also observed in skulls of *Homo erectus pekinensis* from North China, where in addition human bones were found split lengthwise and charred. Several authors considered this as a clear case of cannibalism, a practice apparently shared with Solo Man. The supposition is strengthened by the fact that, except for the two tibiae, no skeletal remains were found, not even a single tooth despite careful searching. Weidenreich presumes that some of the blows delivered to the skulls were ineffective. The skulls of two young individuals clearly showed that the bone had been injured by a blow with a sharp instrument, but at the same time the place of the lesion displayed a fusion of the bone, which was clear proof that the individual had survived.

Explanation of the missing base of the skulls has been that cannibals cut open the base to extract the brains for their meal. This view is contested by T. Jacob in the following way: "In Ngandong skulls the broken base does not display a structured pattern that is distinct from natural post-mortem fractures. In most cases the basal fractures are due to compression of the cranial sphere by earth pressure, as proved by the radiating lines commencing from the maximum convexity of the vault (vertex or obelion) and proceeding toward the buttress on the periphery of the base (occipital torus, supramastoid crest, infratemporal crest, supraorbital torus), and then being deflected in the direction of the fracture-prone base and viscerocranium. Some skulls were damaged during digging. Carefully excavated skulls are well preserved. The relatively intact skull XI betrays no fracture lines reaching the base from the vertex. The pattern of breakage in other skulls is comparable to brittle archaeological skulls in which fractures occur around the vertex or in the many-fissured portions of the cranial base. Information gained from our foregoing study of cranial base fractures does not, of course, absolutely rule out the possibility that Ngandong men were

[64] Weidenreich, '51, 205-90.
[65] Jacob, '67b, 5-39.

cannibals, but it does certainly reduce this cultural interpretation into a very insignificant alternative. The facts presented should be taken into account by future advocates of prehistoric encephalophagia".[66]

At any rate, the nature of the fossils proves that it was not nature but man who brought them to this place. The interpretation of some other scientists, who believe that the skulls are the trophies of head-hunters, sounds more reasonable.

The best preserved skulls were I, V, VI, IX, and XI. Their bone structure is very robust and heavy; the skulls vary in size, probably largely due to difference in sex, but apart from this they all seem to belong to the same type. The cranial bones of female examples (Skulls I, VI, IX, X), are also very thick and, even the male *Homo erectus pekinensis* does not have such a thick skull. The skulls are notable for the extraordinarily heavy bow-ridges, which protrude both forward and sideways; the tori are thickest at their lateral ends. They form a nearly straight unbroken line and continue without distinct depression into the flat, retreating frontal bone. The nuchal part is flat and forms an angle of nearly 100° with the occipital plane. At the top of this nuchal plane is a massive cross-protruding ridge or crest to which the cervical muscles are attached. Solo Man, therefore, must have had heavy neck muscles. The structure of the occipital portion of the back part of the skull closely resembles that of Rhodesia Man. The frontal view of the skull of Solo Man has an appearance specific

Cranial measurements of *Homo erectus soloensis* (in mm.)

Skull	I	II	III	IV	V	VI	VIII	IX	X	XI
cranial length	196.0	—	—	—	220.3	192.5	—	201.0	202.6	200.0
cranial breadth	148.0	—	—	—	147.0	144.0	—	150.0	155.0	144.0
basion-bregma height	—	—	—	—	131.0	124.0	—	—	—	124.0
cranial index	75.6	—	—	—	65.2	75.3	—	74.6	75.2	72.0
length-height index	—	—	—	—	59.5	64.4	—	—	—	62.0
breadth-height index	—	—	—	—	89.1	86.1	—	—	—	86.1
cranial capacity (in cc.)	1140	—	—	—	1300	1190	—	—	—	—
minimum frontal breadth	105.0	93	—	102.0	106.0	106.0	—	109.0	112.5	106.0
transv. frontopariet, ind.	70.9	—	—	—	72.1	73.6	—	72.7	72.6	73.6
maximum frontal breadth	—	110	—	—	—	—	—	—	—	124
bipteric breadth	—	—	—	—	110	114	117	—	—	122
bistephanic breadth	116	110	—	98	113	113	106	111	103	104
biasteriac breadth	148	—	128	—	127	140	125	148	148	141

[66] Jacob, '67b, 38-39.

Cranial measurements of *Homo erectus soloensis* (in mm.)

Skull	I	II	III	IV	V	VI	VIII	IX	X	XI
transv. occipitopariet. ind.	100	—	—	—	86.1	97.2	—	98.7	95.5	97.9
bimastoid breadth	—	—	—	—	—	104	—	—	117	—
interorbital breadth	29.0	—	—	—	28.0	32.0	—	—	—	—
upper facial breadth	—	101	—	115	—	—	—	—	—	123.5
basion-nasion distance	—	—	—	—	—	111	—	—	—	112
nasion-bregma chord	116.0	108	—	115	116.0	117.3	—	—	120.0	114.0
nasion-bregma arch	133.0	125	—	125	129.0	127.0	—	—	133.0	124.0
frontal sagittal index	87.2	86.4	—	92.0	89.9	92.4	—	—	90.2	91.9
bregma-lambda chord	108.5	—	95.8	92.0	111.0	97.6	100	—	94.0	115.2
bregma-lambda arch	115.0	—	101.0	97.0	119.0	102.0	105	—	98.0	111.0
parietal sagittal ind.	94.3	—	94.9	94.8	93.3	95.7	95.2	—	95.9	—
lambda-opisthion chord	81	—	—	—	89	85	—	84	85.0	87
lambda-opisthion arch	108	—	—	—	124	111.0	—	114	123.0	120
occipital sagittal index	72.3	—	—	—	71.8	74.6	—	73.8	67.3	72.4
lambda-inion chord	57	—	—	—	59	59	—	56	67	67
lambda-inion arch	55	—	—	—	60	60	—	—	64	72
inion-opisthion chord	51	—	—	—	59	52	—	54	58	50
inion-opisthion arch	53	—	—	—	—	51	—	55	59	48
nasion-opisthion chord	143	—	—	—	—	151	—	—	—	—
nasion-opisthion arch	360	—	—	—	—	342	—	—	—	—
total sagittal index	39.4	—	—	—	—	44.2	—	—	—	—
biporion chord	127	—	—	—	127	120	—	124	132	123
biporion arch	—	—	—	—	—	293	—	306	315	297
transv. curvature index	—	—	—	—	—	40.1	—	40.5	41.9	41.4
foramen magnum length	—	—	—	—	—	41.0	—	—	—	45.0
foramen magnum breadth	—	—	—	—	—	31.5	—	—	—	29.0
foramen magnum index	—	—	—	—	—	76.8	—	—	—	66.3
occipital condyle length	—	—	—	—	—	18	—	—	—	21
occipital condyle breadth	—	—	—	—	—	11	—	—	—	9
occipital condyle index	—	—	—	—	—	61.1	—	—	—	42.8
entinion-opisthion distance	21	—	—	—	—	26	—	26	24	24
hormion-basion distance	—	—	—	—	—	34.5	—	—	—	35.2
basilar portion breadth	—	—	—	—	—	24.5	—	—	—	23.2
mandibular fossa length	17	—	—	—	26	28	—	28	30	32
mandibular fossa breadth	18	—	—	—	25	20	—	17	18	19
mandibular fossa depth	14	—	—	—	15	13	—	13	17	14
tegmen pori acustici externi width	12	—	—	—	9	13	—	13	12	9
porus acusticus externus breadth	10	—	—	—	10	9	—	8.5	8.5	11.0
porus acusticus externus height	10	—	—	—	12	9.5	—	9	10	11.0
articular tubercle-mastoid	—	—	—	—	—	47	—	—	56	44
mastoid height	—	—	—	—	—	28	—	—	—	—
mastoid breadth	16	—	—	—	—	22	—	19	—	22
mastoid thickness	18	—	—	—	—	19	—	24	21	17
tympanic plate length	—	—	—	—	26	26	—	—	—	31
pyramid length	—	—	—	—	—	43	—	—	—	46

By courtesy of T. Jacob

for this type. The greatest width is at the level of the supra-mastoid process almost at the base, and it decreases upward in height. Beneath the supra-mastoid process the outside-line of the skull viewed from the front bends sharply inward; other peculiar features are the lowness of the head and the heavy mastoid process. The foramen magnum is placed well forward and occupies a position corresponding of *Homo sapiens*. The greatest length varies from 221 mm. (Skull V) to 191 mm. (Skull VI). The average length is 201.8 mm. The greatest width is from 146 mm. (Skull VI) to 159 mm. (Skull X). The average width is 152 mm. The average length-width index is 72.3 and the average length-height index 61.1. The cranial capacity ranges from 1,150 to 1,300 cc. with an average of 1,200 cc.

The best preserved Skull XI approaches the average and was chosen by Weidenreich as a model for reconstructing the skull of Solo Man. Ariëns Kappers has studied the endocranial casts of Skulls I, IV, and V. He found that the shape of the brain was more primitive than that of the Neanderthalian skull, and approached in several respects that of *Homo erectus pekinensis*. The shape of the calvarium, too, resembles an enlarged and slightly more highly developed skull of Peking Man, who has, however, an average brain capacity of 1,075 cc. Solo Man, therefore, is not a true Neanderthalian, but is more primitive and closer to the Homo erectus group. Solo Man has been estimated to have lived in the middle Upper Pleistocene, equated with the Third Interglacial. On terraces of the same Upper Pleistocene age implements of stone, bone and antler have been discovered.

6. THE NGANDONG INDUSTRY

Apart from the stone flake-tools of Sangiran type, Solo Man also used tools of bone and deer antler. In the Ngandong 20 m. terrace fossil human skulls were found in association with some flake-tools as well as with fragments of a set of deer antlers one branch of which was obliquely, the other just crudely cut off. Others possessed a sharpened point. Spines of stingray from the same deposit prove a connection with the sea, and they suggest having been used as spear-heads. At Sidoredjo near Watualang a beautiful bone spear-head with regular barbs on both sides was found on the surface. It is 95 mm. long, its greatest width being 60 mm. I cannot imagine that this fine tool was the product of Solo Man. It was not extracted from the fossil bed and came perhaps from a higher horizon. Worthy of mention is the find of a horn chopper made of the antler of the now extinct *Cervus* (Rucervus) *eldi* and that of a second stingray spine from Watualang; the latter is 136 mm. long and 6.5 mm. wide. Oppenoorth [67] also reported stone balls of andesite with a rough surface from the river-terraces at Watualang. These balls were perhaps used as pounding stones or sling stones. In direct association with the 20 m. terrace of the Solo River near Karsono, Movius collected several stone artifacts that were typologically indistinguishable from those occurring at Sangiran.[68] Geological, faunistical and archaeological considerations lead De Terra and Movius to the conclusion that the Ngandong and the Sangiran industries are both of Upper Pleistocene age (Fig. 15).

7. HOMO (SAPIENS) WADJAKENSIS

The two fossil Wadjak skulls were discovered as early as 1889 and 1890, but for no apparent reason Dubois first described them in 1920.[69] The first skull was found in the Southern Mountains of Java, south of the Wilis volcano near the village of Tjampurdarat, where there are the remains of an ancient lake which today is filled with sand and ashes from Mt. Wilis. On the limy banks of that old lake were some terraces where Van Rietschoten was searching for marble. During his explorations, mineralized mammalian bones, and a fossil human skull, now known as Wadjak I, were discovered. This find became known to Dubois, who at that time was doing research at Pajakombo in Sumatra. Once in Java, he continued the search and was fortunate in finding a second human skull, Wadjak II. The vertebrates, though fossilized, appear to belong to recent species including *Tapirus*, which no longer exists in Java and is likewise absent from the sub-fossil Sampung fauna. Dubois claimed that the deposits were of Pleistocene age. Whether or not this is right cannot be proved, since the site has been completely demolished for mercenary purposes, and hence is lost to science. No prehistoric implements were found, but these were most probably overlooked. De Terra considers that Solo Man is as ancient as the Third Interglacial, and that Wadjak Man belongs to the Fourth Glacial Stage[70] (Pl. 23, 24, 25, 26, 27, 28).

Both Wadjak skulls have a peculiar look, i.e. a combination of primitive and more progressive features. Skull I is of considerable

[67] Oppenoorth, '36; Movius, '55a, 527-29; Van Stein Callenfels, '34, '36a, '40.
[68] Letter of Movius dd. 20/10-'49.
[69] Dubois, '20.
[70] De Terra, '43, 455.

size, heavy and long (200 mm.) and has a brain capacity of 1,530 cc., which is above the average of recent man. The bone structure is strongly developed and is in some parts 10 mm. thick. The forehead slopes slightly backward. Skull II is smaller, but, as the bone structure is less thick, it still has a larger brain capacity, 1,650 cc. (modern Australian aborigines average 1,287 cc.). The back of the skull protrudes slightly, but the primitive character of Wadjak Man is seen in the powerful build and size of the palate and the great width of the dental arc. The width of the ascending ramus of the mandible of Wadjak II is as great as that of Heidelberg Man. There is a projecting chin, which is even more developed than that of recent Australian aborigines. The protuberances above the orbits do not meet. The orbits are square with rounded angles, the nose is much sunk at the root and has wide nostrils. Wadjak Man has a remarkably flat (mongoloid) face, and the cranial vault is keeled. The heavily fossilized, gable-shaped skulls are mesocranic bordering on dolichocranic.[71] The teeth are larger than in Keilor, Niah and Sampung. The skulls are most frequently compared with the Keilor skull of Australia, which they much resemble.[72] Dubois assumed that Wadjak Man was Proto-Australian, but this is refuted by Arthur Keith, Pinkley as well as by Jacob. The former points out that there is a resemblance between the great horseshoe-shaped palate of Wadjak II and that of Rhodesia Man, while the dentition shows an even greater correspondence. However, the incisors, canines and premolars are smaller. Pinkley[73] studied the jaw and dentition in detail. Although the jaw of Wadjak Man is larger than that of any living human race, the teeth are of sapiens type. Pinkley demonstrated the existence side by side of primitive features and more evolved ones. According to him, Wadjak Man is Australomorphic but by no means Proto-Australian. Weidenreich on the other hand places Wadjak Man in his phylogenic series of the Homo erectus group after *Homo erectus soloensis* and before the Australian.

Jacob was the last to study the fossils. After having partly removed the adhering matrix, he saw in Wadjak Man a mixture of Australoid and Mongoloid. He also suggested that Wadjak Man represented the type which is ancestral both to the Proto-Malayans and the Australomelanesians and that the Australoids developed in Australia and not on the Asiatic Continent.

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[71] Jacob, '67.
[72] Wunderley, '43; Adam, '43; Weidenreich, '45c; Gill, '53, '54, '66.
[73] Pinkley, '36.

Cranial measurements of Wadjak, Keilor, Talgai, Aitape and Niah (in mm.)

Skull	Wadjak I	Wadjak II	Keilor	Talgai	Niah
cranial length	200	—	197	192	180
cranial breadth	151	—	143	141	140
auricular height	118	—	120	105	—
basion-bregma height	137	—	143	—	—
cranial index	75.5	—	72.6	73.4	77.8
length-auricular height index	59.0	—	60.8	54.7	—
length-basion bregma height index	68.5	—	72.6	70.3	—
breadth-auricular height index	78.2	—	83.9	74.5	—
breadth-basion bregma height index	90.7	—	100	—	—
cranial capacity (in cc.)	1633	—	1593	1300	—
cranial module	1563	—	1533	1460	—
cranial circumference	558	—	544	—	—
minimum frontal breadth	99	99	101	99	98
transverse frontoparietal index	65.6	—	70.6	70.2	70.0
bimastoid breadth	119	—	—	141	—
bizygomatic breadth	138	—	136	128	—
orbital breadth	44	40	39.5	40	—
orbital height	35	29	30	32.5	—
orbital index	79.6	72.5	76.0	81.2	—
% of orbital height above nasion	42.4	36.7	—	—	—
interorbital breadth	26	31	32	29	—
nasal breadth	30	31	27	25	28.2
nasal height	49	—	52	43	42.5
nasal index	61.2	—	51.9	58.1	66.3
nasion-basion distance	108	—	109	—	—
nasion-bregma chord	119	126	114	—	—
nasion-bregma arch	135	140	128	—	—
frontal sagittal index	88.2	90	89.1	—	—
bregma-lambda chord	111	—	120	—	—
bregma-lambda arch	122	—	129	—	—
parietal sagittal index	91.0	—	93.0	—	—
lambda-opisthion cord	107	—	107	—	—
lambda-opisthion arch	135	—	132	—	—
occipital sagittal index	79.3	—	81.1	—	—
nasion-opisthion chord	147	—	146	—	—
nasion-opisthion arch	392	—	389	—	—
total sagittal index	37.5	—	37.8	—	—
biporion chord	127	—	135.5	—	106
biporion arch	323	—	319	—	—
transverse curvature index	39.2	—	42.5	—	—
palatal breadth	43	—	47.2	42	37.5
palatal depth	16	15	—	—	—
foramen magnum breadth	30	—	—	—	—
foramen magnum length	38	—	—	—	—
foramen magnum index	79.0	—	—	—	—
occipital condyle breadth	15	—	—	—	—

Cranial measurements of Wadjak, Keilor, Talgai, Aitape and Niah (in mm.)

Skull	Wadjak I	Wadjak II	Keilor	Talgai	Niah
occipital condyle length	31	—	—	—	—
occipital condyle index	48.4	—	—	—	—
mastoid breadth	19	24	—	—	—
mastoid height	28	33	—	—	—
mastoid thickness	8	15	—	—	—
thickness of parietal bone	7–7.5	—	—	—	4–9
thickness of frontal bone	8	—	—	7	3–6.5
thickness of zygomatic bone	8–10	—	—	—	—
frontal facial flatness index	14.0	16.0	—	—	—
simotic facial flatness index	16.7	—	—	—	—
rhinal facial flatness index	16.9	—	—	—	—
premaxillary facial flatness index	23.0	—	—	—	—

Measurements of the Wadjak mandibles in mm.

	Wadjak I	Wadjak II
corpus length. , ...	—	89
corpus width . . . . , ...	—	120
corpus index	—	74.2
ramus width	—	45
ramus height , ...	—	75
ramus index	—	60
corpus height at mental foramen	—	37
corpus thickness at mental foramen	—	14
robusticity index	—	37.8
corpus height at M1	33	—
corpus thickness at M1	18	—
robusticity index at M1	54.5	—
condyloid-coronoid distance	—	55
depth of mandibular notch	—	12
sagittal diameter of condyloid process	—	13
transverse diameter of condyloid process	—	24
index of condyloid process	—	54.2
anterior mandibular index	—	36.4

Average measurements of the mandibulat dentitions of Wadjak, Sampung and Australoids

Tooth	Diameter	Wadjak	Sampung	Australoid
		mm.	mm.	mm.
I1	MD	6.3	5.3	5.6
	BL	7.2	6.6	6.3
I2	MD	6.8	6.1	6.4
	BL	7.6	6.6	6.5
C	MD	8.4	7.4	7.1
	BL	9.5	8.5	8.2
P1	MD	8.5	8.0	7.2
	BL	9.0	9.0	8.6
P2	MD	8.3	8.1	7.4
	BL	8.5	9.2	8.9
M1	MD	13.6	12.3	11.8
	BL	12.3	11.5	11.6
M2	MD	11.8	11.9	11.4
	BL	11.3	11.4	11.2
M3	MD	12.5	11.8	11.4
	BL	11.2	10.6	11.0

MD = mesiodistal BL = buccolingual after T. Jacob

Another Wadjakoid left maxilla with the canine and molars intact was purchased by Von Koenigswald in a Chinese drugstore in Hong Kong. This specimen must have originated from one of the numerous Kwantung or Kwangsi caves in South China.

E. THE PLEISTOCENE OF CELEBES

1. INTRODUCTION

Separated from Borneo only by the relatively narrow but deep Macassar Strait, Celebes is still quite different geomorphologically and faunistically. The Macassar Strait was never less than 25 miles wide in Pleistocene times. It coincides with the so-called "Wallace Line", once supposed to be the boundary between the Oriental fauna on the one hand (Borneo, Java and Sumatra) and the Australian fauna on the other (Celebes and adjacent islands). In the south this line runs between Bali and Lombok and in the north, south of the Philippines into the open Pacific.

At first this division was unconditionally accepted by scientists. Later it appeared that more than three quarters of Celebes' neo-fauna consist of oriental species. However, the Wallace Line is geologically well-founded, and the Macassar Strait is a boundary insofar as it marks a sharp division between the rich Oriental fauna and an impoverished Oriental fauna with endemic forms and a few representatives of the Australian fauna found in Celebes and elsewhere east of the boundary line.[74]

The geology of Celebes is rather complicated. It displays a combination of uplifts, tectonic fractures, foldings and volcanic activity, features maintained well into historical times and even into the present.

During the Tertiary, Celebes was composed of a string of small islands. As a result of uplift, erosion and eruptions of the active volcanoes, the islands were joined into the shape of the peculiar four-legged spider that Celebes now exhibits. The Tertiary sediments were folded during Plio-Pleistocene times. Subsequently there began the formation of long and narrow bays, basins and coral banks which, owing to a later uplift during the Pleistocene, were elevated to heights of 1,000 m. above sea-level, as in the case of Central Celebes. The northern arm of Celebes is the oldest part to rise from the sea during the Miocene, and was shortly after submitted to a period of intense volcanic activity. The southwestern part of Celebes, the area which yielded the finds to be discussed presently, was the most stable for a considerable time. It consists of the western coastal region, the western mountain range, the Wallanae-graben, the eastern Boné mountains and the flat east coast. In the south there is a mountain complex, including

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[74] Mayr, '45, 241-50; Hooijer, '51b; Raven, '35; Rensch, '36.

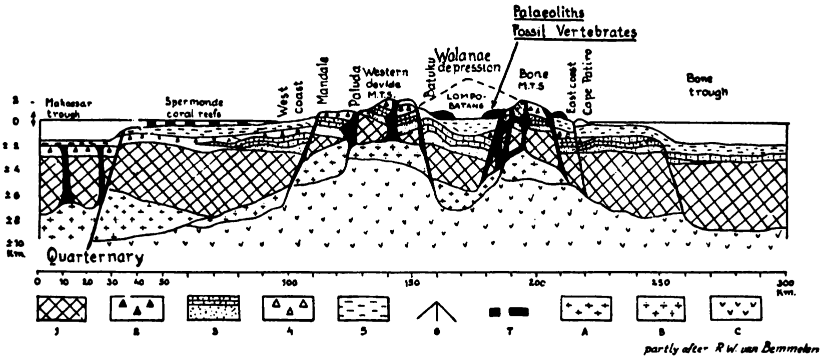

Fig. 16. Geological section through Southwest Celebes.

Legend: 1. Pre-Tertiary basement complex; 2. Volcanic rocks of Lower-Tertiary age; 3. Coal-bearing Eocene and Miocene limestone; 4. Middle-Miocene; 5. Young Neogene sediments; 6. Young Neogene volcanism; 7. Pleistocene coral reefs of the Spermonde Archipelago and raised coral reefs in the Wallanae Depression and in Boné; A. Lower-Tertiary granitic rocks; B. Upper-Tertiary granitic rocks; C. Quaternary granitic rocks.

the 2,871 m. high Lompobatang volcano which has been extinct since Tertiary times. This mountain range covers the Wallanae depression in the south and continues southward as far as the Flores Basin. East of Maros, Eocene and Miocene limestones, which cover a coal-bearing formation, rise steeply at the termination of the Pleistocene erosion surface of Macassar. This plain continues beneath the sea, where it is overlain by coral reefs and islands of the Spermonde Archipelago which developed during Pleistocene and Post-Pleistocene times.[75]

Along the foot of the limestone range, the lowest horizons of which yield *Numulites* and *Orthophragmines* and the uppermost *Lepicyclines*, there exists a series of caves and coves at a height of 30 m. above sea-level. The caves developed in early Post-Glacial times during a temporary interval of quiescence in the uplifting process. These caves and rock-shelters were occupied frequently by cave-dwellers in the Post-Glacial period to be discussed in the next chapter. In the vicinity of the village of Patanuang Asue, at an elevation of 80 m., there occurs a lagunal deposit of light-coloured, massive Miocene reefbank deposits. In these sediments occur fossil fish, crabs and leaves. The fish can be divided into two groups, one representing pelagic forms, such as *Clupeidae*, *Laranx*, *Spyraena*, and *Serranidae*, and the other, usually encountered

[75] Brouwer, '28, 153-65.

near the steep walls of the reefs, such genera as *Chaetodontidae*, *Balista* and *Scaridae*. During the formation of these sediments there must have been a lagoon which was dry at low tide. In some publications this formation has been compared with the famous fossil-bearing malm layers of Solnhofen.

2. THE PALAEOLITHIC IMPLEMENTS AND FOSSIL VERTEBRATES

My explorations of the raised coral terraces along the Boné Coastal Plain in the second half of 1946 did not produce sufficient evidence to suggest a Pleistocene occupation by man and other mammals. The search was continued in the Wallanae depression between Soppeng and Sengkang in the southwestern peninsula about 100 km. northeast of Macassar. Towards the end of 1947 I found a number of palaeolithic flake-tools associated with fossil remains of terrestrial animals on an old river-terrace behind the village of Beru (or Baru) near Tjabengè in the Soppeng District. This terrace was connected with an ancient river-course, 40 m. above the present river-system. It was bordered on both sides by cemented gravel series containing such raw material as yellow chalcedony and red jasper of which the tools were made (Fig. 16; Pl. 29, 30, 31). The presence of fossil vertebrates and palaeoliths on the same terrace, never found before in Celebes, is of special importance. All finds were surface finds, some found embedded in conglomerates and sandstone. Their Pleistocene age is established, but a more definite date cannot be set for them.

Subsequently in the following years until June 1950, similar vertebrates were found in great numbers at the same altitude at Sompoh and Tjeleko, proving that the fossiliferous beds extend over a distance of 25 km. Everywhere the same fauna was found including marine molluscs, teeth of crocodiles and numerous teeth of sharks, including *Odontaspis* cf. *cuspidata*. Almost all implements found were from Beru. At first we assumed that fossils and palaeoliths were concentrated on the terraces 50 m. above the level of the sea, but subsequently they were found at Beru on terraces at a level 25 m. higher. There was no difference in the terrestrial fauna of these terraces. The bones from the higher level, which are orange-coloured, lay on and in a hard sandstone and on the slopes connecting the lower and higher terrace-remnants, both at Beru and at Sompoh. Grey-coloured fossils were washed out from the conglomerates. The heavily dissected terraces along the Wallanae River may be segregated into four lower levels and one upper one. The third and fourth from the bottom of the valley, approximately 50 and 75 m. above sea-level respectively, are fossiliferous and contain palaeoliths. The investigations between Tjabengè and Sengkang carried out thus far were pioneer efforts, and had to be suddenly terminated when political troubles arose in 1950 in South Celebes. Therefore a large, promising scientific field was left untouched; this was unfortunate, as I was convinced that further research would bring to light fossil human remains. No further recorded work was done until the research was taken up again in 1968 by Soejono, the present writer and the geologist T. Soeradi.[76] Large-scale investigations by a number of specialists in their several fields were planned for the year 1970.

3. THE FAUNA

D. A. Hooijer, Curator at the Rijksmuseum van Natuurlijke Historie in Leiden, has examined the fossil vertebrates from Celebes and summed up his results in a number of detailed papers[77] and some summaries.[78] It is particularly striking that none of the animals the remains of which have been found, with the possible exception of the giant tortoise, are closely related to those of the Pleistocene of Java. Since they cannot have originated on an island such as Celebes, they must have entered by De Terra's second migration route. There is no insuperable barrier that could have prevented large land animals including Early Man from reaching the present Philippines overland via the Formosa (Taiwan) landbridge and subsequently via the Sangihe islands to Celebes. This theory is supported by the presence of similar stone artifacts and of fossil pygmy elephants in the Philippines.

The animal remains are just as heavily fossilized as those from the Pleistocene beds of India and Java. The fossils comprise the following:

a. *Archidiskodon celebensis.* A pygmy elephant, standing only 6 feet high, about three quarters the size of the living Asiatic elephant and half as large as *Archidiskodon planifrons* of the Lower Pleistocene of Southeastern Asia, to which it is closely related. The males have tusks in the lower jaw in the mastodont fashion.
b. *Stegodon sompoensis.* Only two last molars and a milk molar are known.
c. *Celebochoerus heekereni.* A distinct genus and species of giant pig with extremely large tusks and simply built molars. It was probably differentiated at an early date from the main stock of *Suidae,* and its relationship is not yet clear.

[76] Van Heekeren, '49a, b, c, 145-48, '53, '60, 77-81; Vaufrey, '50.
[77] Hooijer, '48a, b, c, '49a, '50, '53a, b, c, '54a, b, c, d, e, '60, '64a.
[78] Hooijer, '49b, 148-50, '51b, '55, '60, '67.

e. *Anoa depressicornis.* This dwarf buffalo differs only little from the endemic species living in Celebes.
d. *Testudo margae.* A giant land tortoise, which reached a length of 4 to 6 feet. It resembles the giant tortoises which still exist on the Galapagos Islands in the eastern part of the Pacific and on some islands of the Western Pacific. The largest living specimen of *Testudo* in Southern Celebes is less than half the size of the fossil species.

Furthermore, remains of fossil sharks (*Hemipristis, Carcharhinus, Isurus* and *Carcharias*), ray (*Dasyatis*), crocodiles (*Crocodylus* cf. *siamensis*) and a sort of soft-shelled turtle have been found and described.

As almost the entire collection consists of surface finds, it is not easy to determine whether all the remains belong to the same faunal group. As has been noted previously, the fossils were collected from three different terraces. All three terraces yielded remains of *Archidiskodon* and *Celebochoerus,* a fact which could argue in favour of the probability of their belonging to the same fauna. The fact that other fossils have been collected on the slope which joins these terraces points to the possibility that they were originally embedded in the highest terrace, whence they were washed down, coming to rest on the lower terraces.

The mineralogical examination carried out in Leiden showed that the matrix adhering to some of the fossils indicated two different geological horizons. "The matrix" wrote Hooijer,[79] "of the unworn right M^2 or M^3 from Sompoh near Tjabengè (Soppeng district), about 100 km. N.E. of Macassar was kindly studied by Mr. L. J. Fick and is a river-laid sediment with volcanic material. The rock consists of detrital grains of lateritic sandstone, the interstices partly filled with amorphous limonitic silica and opaque components. There are some pieces of quartz and veins of rhombohedral calcite. The volcanic components consist for the greater part of diopside and a few crystals of alkaline felspar". The matrix of the Anoa teeth from the same site, however, is different, consisting chiefly of calcite grains of irregular form and containing also grains of quartz and alkaline felspar. Almost identical with the latter matrix, but with less alkaline felspar and more quartz, is that of the tortoise bone from Beru. Thus it is evident that there are at least two bone-bearing beds at Sompoh, one of which may be the same as that exposed at Beru.

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[79] Hooijer, '49a, 205.

4. THE TJABENGE FLAKE-INDUSTRY

From the 50 m. terrace at Beru 67 well-preserved palaeolithic flake-tools, exposed on the surface of the ground and in combination with fossil mammal bones, were collected. Moreover, these deposits yielded more than 100 flakes which in my opinion show traces of use. At Sompoh we collected only 3 flake-tools. In 1968 more flake-tools were found by Soejono on a higher, 75 m. terrace near Beru. A common feature of the implements is their relative smallness and thickness. The flakes have been struck in all directions from irregular cores, and present on the whole a clearly defined cone of percussion and a high-angle striking platform.

The material used is mainly glossy, yellow chalcedony, red jasper and other coloured fine-grained siliceous rocks. There are thick arched points, crude concave scrapers, small core-scrapers, keeled scrapers, end-scrapers and some ogival points picks, and a few chopping-tools. The striking platform is nearly always plain, but a few are two or three-facetted, although they do not conform to the Levallois technique. In addition to man-struck flakes, there are also natural flakes that have been crudely worked on one edge; these have no bulb of percussion (Fig. 17; Pl. 32).

The typology of the collection is equally interesting, for it reveals an industrial tradition in many details similar to the Sangiran Industry on Java, which on geological evidence should be of the same age. Allied industries have been found in Portuguese Timor [80] and in the Philippines.[81] All four industries also used the same raw material, mainly yellow chalcedony and red jasper. It is probably in South China and more especially in the red clays in which the dominant artifacts are simple flakes that we must look for the point of departure of the flake industries under discussion.

The palaeolithic artifacts and the fossil vertebrates, or at least the larger part of the latter, are presumably of the same age, and the authors of this industry probably followed the same migration route as the mammals, i.e. from South China via Formosa, the Philippines and the Sangihe Islands.[82] The following difficult question concerns the geological age of the Tjabengè Industry. Palaeontologically it is

80 Almeida, '53, 487-8.

81 Beyer, '48. In a Pleistocene terrace at Rizal-Bulaka on Luzon and in a pebble quarry at Davao on Mindanao, flake-tools were found with Stegodon and pygmy elephants.

82 Van Heekeren, '60, 77-81; Movius, '55a, 538-39.

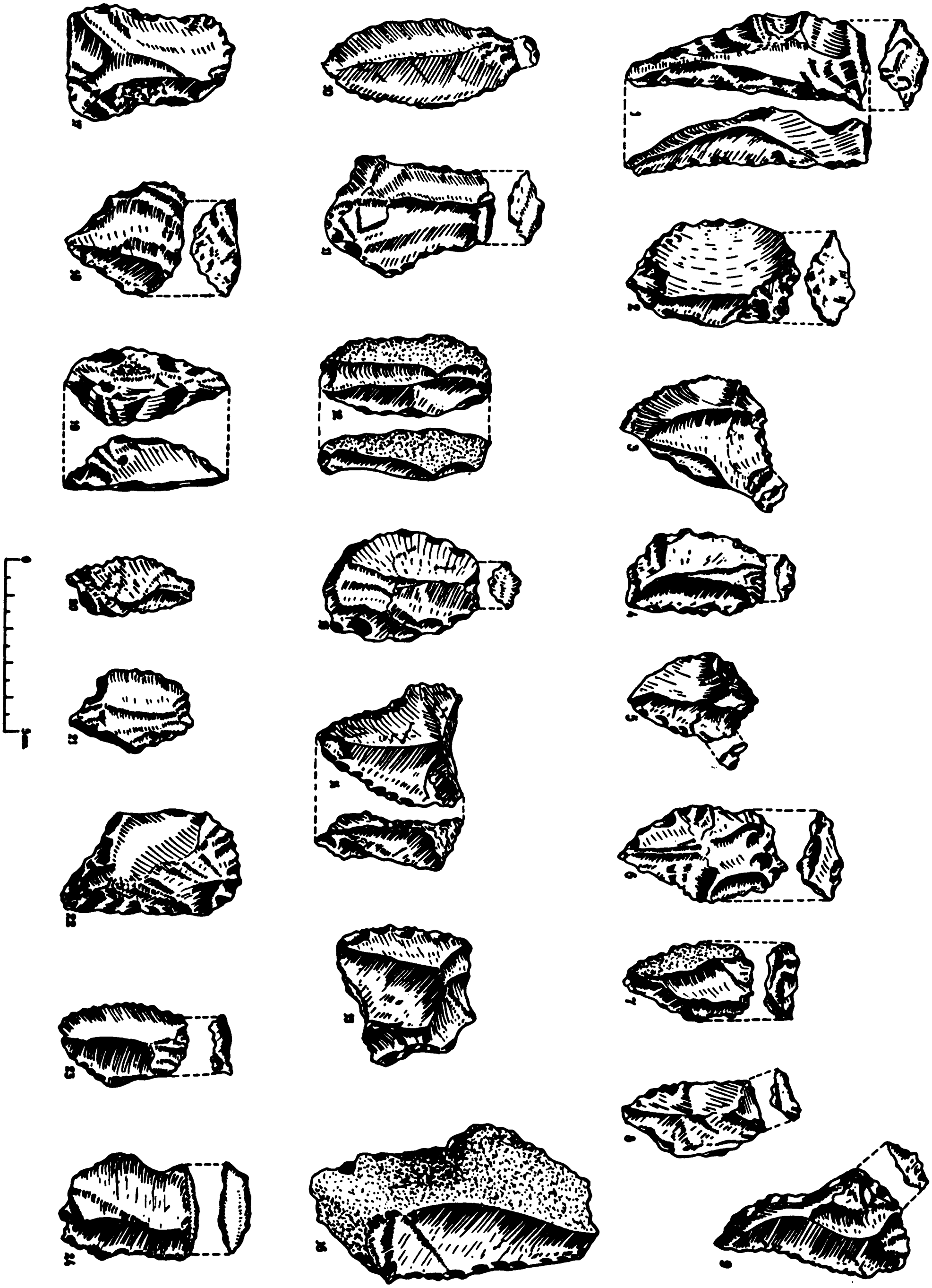

Fig. 17. Palaeolithic Tjabengè Flake-tools. Southwest Celebes.

beyond all doubt of Pleistocene age, and we are accordingly dealing with true palaeolithic tools, although a more precise dating remains uncertain. On the strength of the associated fauna, including *Archidiskodon,* one would be inclined to suggest a Lower Pleistocene age, but diagnostically one should be cautious, as they may be retarded island descendants of a more progressive mainland ancestral stock, and may have persisted through several periods of time. Even today the Celebes fauna, which includes such endemic types as *Anoa* (pygmy buffalo), *Babiroussa* (deer hog), and *Cynopithecus* (a monkey with some resemblance to the African baboon), is quite different from that of the other islands of the Archipelago. After all, therefore, it is perhaps more likely that the Tjabengè Industry can be estimated as Late Middle Pleistocene.

In recent years (1956, 1960, 1963, and 1968), Th. Verhoeven, H. M. S. Hartono and J. Maringer discovered fossil bones of Stegodon, Giant Tortoise, crocodiles and rodents in tuff and sandstone beds on the left side of a dry water-course in West Central Flores. The fossil bearing deposits also contained stone artifacts, mainly flake-tools and a few small pebble-tools, 5-6 cm. long.

The flake-tools were described as scrapers, points and borers, 3-7 cm. long. Among the pebble-tools was a chopping-tool, 2 choppers and a bifacial. The tools were made of andesite, basalt, chert, quartzite and porphyry.[83]

In the same area Verhoeven also found one tectite.[84] The sites are named Olabula, Matamenge and Boaleza, and all are situated on the Soa Plateau, 500 m. above sea-level. A Late Middle Pleistocene age for the fossil-artifact bearing layer was suggested.

It was Verhoeven again who for the first time also discovered fossil bones of Stegodon in Timor, and in Portuguese Timor a great number of flake-tools were recovered on the surface. The tools were made of yellow chalcedony and red jasper. As far as typology, rock and patina are concerned, they show a close relationship with the Sangiran Industry of Java and the Tjabengè Industry of Celebes.

If one thing has become clear it is that there is no Wallace Line in the sense in which the term was used by Huxley, either at present or in the past. The discoveries mentioned in this Chapter prove that Early Man (the existence of which is hitherto indicated by stone tools only)

83 Hooijer, '57b, '64c, 49-52.
84 Von Koenigswald, '58a, 44-46.

and even Proboscideans crossed the so-called Wallace Line in one way or another. The great mammals may have reached Flores and Timor along the Sunda chain, and those of Celebes via Formosa and the Philippines.[85]

The area has great scientific possibilities and will surely yield a vast store of information. We have planned another expedition to Flores, Timor and South Celebes for the year 1970.

[85] Verhoeven, '64; Hooijer, '69; Sartono, '69.

F. IN RETROSPECT: THE PLEISTOCENE

It would be well to pause for a moment and to summarize the picture up to this point. Indonesia not only remained free of ice but had a tropical climate throughout the Pleistocene, making it attractive for continental animal and plant life and Early Man escaping from the glaciated areas of the Asiatic continent. Due to a world-wide lowering of the sea-level combined with tectonic movement during the Glacial periods, there was no insuperable barrier to large animals and Early Man's reaching the islands of the Indonesian Archipelago.

Two migration routes were available: one from the Malayan peninsula to Sumatra, Java and the Lesser Sunda Islands and the second starting in South China via the Formosa (Taiwan) landbridge to the Philippines and subsequently via the Sangihe Islands to Celebes. It has become clear that five or six phases of hominization can be distinguished on the Asiatic continent and in Java. In the first stage we had the Early Middle Pleistocene *Meganthropus palaeojavanicus*; unfortunately only two or three mandibles with some teeth have been found — robust jaw bones with hominid teeth except for the size.

We are a little better informed about the *Homo erectus* group of the second and third stages. Parts of seven skulls have been found in Java and more than fifty in China, skulls from early infancy to full maturity and of both sexes, giving a fair idea of the general shape and size of the skull and posture of the body, and showing a wide variation in a single species. But this diversity may well be equal to that of mankind today. The skulls indicate a wide variety of features, cranial capacity, relative development of the frontal region, and size of the jaw and dentition. Some of the salient features are, briefly: the skull shows a very marked degree of platycephaly with the maximum width low down in the temporal region. There is no trace of a sagittal crest as possessed by the apes. The cubic contents have been calculated at 775 to 900 cc., with an average round 860, which is approximately intermediate between *Homo sapiens* (1,350) and the male Gorilla (500). The frontal region is very narrow and receding, with a powerfully developed supra-orbital ridge, extending straight and unbroken across the frontal bone. There is a pronounced post-orbital constriction. The nose is broad and flat. The transverse crest on the flat occipital bone for the attachment of strong neck muscles is extensive and seems to be an adjustment to a forest environment. The cranial bones are extraordinarily thick. The surface features of the endocranial cast made of the interior of the skull show a conspicuous expansion of that part of the brain which is concerned with the power of speech, which probably developed at the same time as the ability to manufacture tools. The region of the frontal lobe below the middle frontal subcus is relatively small, smaller than that of *Homo sapiens* but larger than that of Gorilla. All this tells us nothing of the nerve system, which is supposed to be much more closely related to intellectual qualities than brain volume.

Apart from skulls, three mandible fragments with teeth and one upper jaw have been discovered in Java in the course of many years. The powerful jaws project forward in a more or less muzzle fashion, but are already on a reduced scale as compared with the apes. The mandibles have no mental eminence. The jaws were equipped with large teeth arranged in an evenly rounded dental arch, the canines sometimes projecting a little. There is a simian increase in size of the molars from first to third. In the only upper jaw found is a narrow but distinct diastemic interval, never found in any other hominid jaw. The pattern of the dentition indicates the consumption of both meat and vegetable food.

The femora found are similar to those of modern man in almost every detail of morphology, size, proportion and joints, and are quite different from the short and massive simian thigh bones. They show that these hominids walked erect with the hands free to manipulate objects and hold weapons and tools. Evidently *Homo erectus* developed a human posture earlier than a human skull.

The concept of human evolution from a primate stock has only recently acquired acceptance and nowadays there is no longer doubt that *Homo erectus* was a hominid; a hominid with a small-brained primitive skull but with limb bones indistinguishable from those of modern man.

Homo erectus lived in a temperate climate (North China), as well as in the sub-tropics (South China) and in the tropics (Java). More rugged and massive types occurred in the earlier periods: *Meganthropus palaeojavanicus* and *Homo erectus robustus* in the early phases of the Middle Pleistocene and *Homo erectus erectus* throughout the Middle Pleistocene, in Java and Peking Man, Mapa Man of Kwantung and Lantian Man of Shensi in China.[86] The last grade is represented

[86] Woo Ju-kang, '56, '66, 83-6, '59, 176-82.

in Java by the Upper Pleistocene *Homo erectus soloensis* and by Ch'ang-Yang Man[87] in Central China. Morphologically *Homo erectus soloensis* or Solo Man looks like a more evolved *Homo erectus erectus* or Java Man, with an average brain volume of 1,200 cc., the endocranial cast resembling that of *Homo erectus pekinensis*. Physically both Solo Man and Ch'ang-Yang Man show some Neanderthaloid features. Solo Man has a massive brain case and an extraordinarily long but still relatively low skull with a marked platycephaly and a powerful development of the supra-orbital tori and very thick cranial walls. The tibiae show no difference from those of modern man. His height is estimated at 164 cm. for the male and 161 cm. for the female. A very prominent transverse crest on the flat occipital part forms the attachment of strong neckmuscles. Geological and palaeontological evidence suggests that they belong to the beginning of the Upper Pleistocene, or are 60 - 100,000 years old.

In the last part of the Upper Pleistocene *Homo (sapiens) wadjakensis* and Niah Cave Man[88] make their appearance in Java and Borneo respectively, and in North China Upper Choukoutien Cave Man and Tze-yang and Liu-ching Man.[89] Quite unexpectedly, some skulls of this period have an extraordinarily large brain volume, well above 1,500 cc., i.e. far above the average for modern Europeans.

No signs of culture have yet been detected in the same deposits as Early Man in Indonesia. The fact that no tools were found in association with skeletal remains of *Homo erectus* is readily explained by the fact that the fossil remains were swept down by volcanic mudstreams and deposited at the foot of the volcanoes. Since the population density was low, camps moved frequently and apparently troglodytism or cave life was unknown to Early Man in Indonesia, evidence of occupation may be expected to be scanty.

We suppose that *Homo erectus* was a roving collector of food, plant and animal, over a wide area. He probably lived in small self-contained groups, widely dispersed and highly mobile. Isolation in tropical forests and lack of contact with the outside world gave little chance for the

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87 Woo-Ju-kang, '59.

88 Harrisson, '57, '58; Solheim, '60. Harrisson found in the Niah Cave, Sarawak (northwest Borneo, geographically but not politically belonging to Indonesia) a skull of Homo Sapiens (Brothwell, '60), and some pebble-tools and flakes dated by C14 as 40,000 years old. The associated fauna was recent except for the giant pangolin (Hooijer, '61).

89 Woo Ju-kang, '58.

adoption of the achievements of others. We suppose that communication took place by articulate sounds with conventional meanings.

It is plausible to assume that physical evolution of Man in Africa and Asia moved along closely parallel lines, but not so their cultural development. In Africa prehistory also starts with pebble-tools, but then leads to the development of the bifacial hand-axe and Levallois and blade techniques with an increasing number of specialized tools. On the other hand, in Southeast Asia, including Indonesia, there are complexes of crude, monofacially flaked pebble-and-chunk tools of Middle, Upper and Post Pleistocene date and assemblages of simple Clactonoid flake industries. All these facts lead us to conclude that in Pleistocene times the Far East was more or less of a backwater, a marginal area of technical retardation as compared to Europe, the Middle East and Africa. Movius [90] aptly described this phenomenon as follows: "When the sum total of the data from Southern Asia and the Far East is considered as one coherent whole, the most important single conclusion to be drawn is that this vast region cannot be considered as having been in any sense 'progressive' from a cultural point of view at the Palaeolithic level of development. Although to date comparatively little fieldwork has actually been done, and many basic problems are still virtually unanswered, the evidence summarized in this paper does not provide any support for this thesis that the region as a whole could ever have been an important centre of development for early human culture. Indeed, for the most part the tools consist of a relatively monotonous and unimaginative assemblages of choppers, chopping-tools and hand-adzes made on water-worn pebbles or roughly tabular chunks of stone. And this tradition seems to have persisted here as long as the practice of making stone tools survived. In contrast with what is known concerning cultural developments during the enormous span of time represented by the Middle- and Upper-Pleistocene subdivisions of Late Cenozoic times in such regions as Europe, the Middle East and North Africa, much of Southern Asia and the Far East, gives the impression of having acted as an isolated and self-sufficient area, closed to any major human migratory wave. Since the archaeological evidence indicates that as early as Lower Palaeolithic times, the region seems to have been a marginal area of cultural retardation, it is unlikely that it played a vital and dynamic role in Early Man evolution. It is quite apparent, however, that very primitive forms of Early Man per-

[90] Movius, 55a, 538-9.

sisted here long after types at a comparable stage of physical evolution seem to have become extinct elsewhere". This may be the correct view and is in accordance with Teilhard's interpretation as well as with my own as set forth in another essay.[91]

However, this interpretation may be too simple for what may well have been a highly complex situation, and a divergent view is worth considering. Anorganic matter only is usually found on archaeological sites, as organic objects survive only under exceptional conditions. This applies also to the sites under discussion, and the records are consequently based on stone implements only. The conclusions arrived at, of cultural simplicity and slow cultural development, may therefore be valid for the stone tools by themselves, but be quite false if applied to the overall picture. Sweeping conclusions in this case should be looked at with suspicion.

To obtain a proper insight into the Palaeolithic of the Tropics, account should be taken of climatic conditions, and of the special properties obtaining in tropical forests, which for example enabled the nomadic food-gathering tribes to develop an elaborate folk culture based on the availability of bamboo, hardwood and rattan, and surviving even to the present day. It is conceivable that such organic materials played a dominant role in the making of various equipment, and this may have contributed towards the neglect of the technique of stone flaking in palaeolithic times, and even more so in the mesolithic period, as we shall see in the next chapter.

The foregoing is based on opinion rather than indisputable fact. If true, it is contrary to what has happened in other regions, where a steady improvement in the utilization of stone occurred, with a continuous development of new types and varieties of specialized tools.

Time will give us the correct answer, especially if we should be so fortunate as to discover sites in a peat-bog or dry alkaline soils, where conditions would have been right for the preservation of organic material. The likelihood of such a find in the near future is, however, very slender indeed.

Finally we have to realize that as far as we know at present there is a wide gap between the Ngandong Industry and the cave cultures described in the next chapter. Our uncertainty is due to the fact that all cave cultures, on the slender evidence of an associated recent fauna, have been qualified as mesolithic or post-glacial, which is not acceptable

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91 Van Heekeren, '67, 110-11.

by present-day standards. For instance in adjacent western Palawan, Philippines, we have evidence of an Upper Palaeolithic flake-industry more than 30,000 years old. Data of a comparable nature were obtained in the Niah Cave in Sarawak. There an Upper Palaeolithic flake and pebble-tool industry was revealed to be 30 - 40,000 years old. Both industries were radio-carbon 14 dated and both were associated with human skeletal remains of sapiens type and a recent fauna. Only in the Niah Cave were a few remains of the extinct Giant Pangolin found.

These facts are of prime importance, and we can say now with confidence that in tropical Southeast Asia no major climatological break between terminal Pleistocene and Post-Glacial took place, necessitating faunal readjustments. All in all we are left with little doubt that at least some cave industries in Indonesia will appear to be Late Upper Pleistocene (geologically) or Late Upper Palaeolithic (archaeologically). A closer definition is not possible with the data at present available. Only radio-isotope dating may, we hope, bridge the gap.

The last 25 years have witnessed unexpected and important discoveries on the islands of Celebes, Flores and Timor, all lying east of the Wallace Line. The discoveries include the remains of fossil proboscidians and other animals, and in the same deposits palaeolithic tools, mainly flake-tools were uncovered, most probably of Late Middle Pleistocene age.

The research is still in progress and the discovery of Early Man in this vast area is to be expected.

II. POST-GLACIAL

A. MESOLITHIC OR SUB-NEOLITHIC STAGE

1. INTRODUCTION

During the post-glacial history of the Indonesian Archipelago, volcanic activity, uplift and tilting continued after the last retreat of the ice in the northern hemisphere. A general rise in sea-level occurred during this period and communication with the continent of Asia must have become less frequent; the landbridges became inundated, but it is notable that at least one of the mesolithic industries described below was directly connected with that on the continent (Fig. 18).

The climate of Indonesia appears in the main to have been similar to that of the present, and there was a recent fauna, though many individual species appear to have been larger than those extant today.

The colonization of Indonesia by a series of successive waves of races of *Homo sapiens* took place by sea and by inland waterways and *Homo erectus soloensis* was no longer present. The new races have been differentiated as Palaeo-Melanesoids, Negritos and Mongoloids, and are presumed to have spread throughout the Archipelago by means of rafts and simple dug-out canoes. Few facts about their way of life can be deduced on archaeological grounds with any certainty. However, in parts of Southeast Asia and Australia there are tribes still living at the economic level of mesolithic man, marginal to civilization, or in inaccessible and inhospitable valleys and mountains. The study of these tribes has helped us to some extent to understand and reconstruct certain aspects of mesolithic life. So it may be said that these people did not practise agriculture and animal husbandry in general, although they knew a haphazard kind of planting, and cleared the land and felled trees, mainly by fire. It is a well-known fact, for example, that the Veddahs of Ceylon, although food-gatherers and hunters, plant the tops of tubers so that new plants may grow and produce more tubers, and that Australian aborigines throw tops of wild yams in a place where the soil is black, and when they return the next season to the camp site they find a yam patch growing. Basically, however, both Veddahs

Fig. 18. Mesolithic Cultures in Indonesia.

and Australoids are true food-gatherers and hunters. At this early stage of social development, the quest for food was the prime mover, next to protection against enemies, human and sub-human, by means of a number of taboos and magical beliefs. The people moved around their tribal territory in small bands of 20-40; trespassers were driven away. The women never took part in hunting, but were, besides caring for the children, mainly responsible for food-gathering, animal and vegetable. There was no social organization beyond the family. In choosing camp sites, however, the advice of the oldest man was followed. Generally there was no surplus food; food was shared every day within the group.

Inland hunting and food-gathering must have been nomadic with only short periods of occupation, since the resources of any locality were necessarily limited. Sometimes, however, the presence of an assured food supply, such as shell banks along the coast, allowed the sites to be inhabited for longer periods, even all the year round, and so made possible the development of a semi-sedentary economy. The sea produced the greater part of the diet, and shellfish collecting and coastal fishing were the most important activities, supplemented by some hunting. The empty shells were thrown away and sometimes grew into large mounds or kitchenmiddens not far from the coast. In other cases there was a riverine orientation with the gathering of fresh-water gastropods, fishing and small game hunting. For the rest, in their daily routine, the people were dependent on wild fruits, edible roots, tubers and yams, berries, nuts, herbs, leaves of various plants, honey, the seed of the tree-fern, insects, lizards, birds, monkeys and snakes. They lived in temporary shelters (windbreaks or simple huts made of wood, bamboo, rattan and leaves), or they took to rock-shelters and cave-mouths wherever available and in easy reach of a river. They made fire by the fire-sawing technique, an art once spread all over Southeast Asia and still in use in many places. The fire-saw consists of a piece of split bamboo; on the upper, convex side is a transverse groove and some dry moss is put beneath it. The saw, a sharp splinter of bamboo, is moved to and fro in the groove with great force until the moss begins to smoulder. Then a flame is produced by continued blowing. Mesolithic people set fire to the forest, so that bamboo, which needs much light and was once confined to the river banks, extended inland. The stripping of bark was already known and was used also for killing trees in a relatively easy way. Canoes were hollowed out of tree trunks; fire was applied to them and a sharp stone or shell was used to chop off the charcoal so that the fire could attack the wood again.

Food was cooked in tubes of green bamboo which withstood the fire long enough to cook it, or the food was roasted in red-hot charcoal or in hot ashes. They used spears of bamboo and other hardwood with a fire-hardened point, or bows and arrows of which the tips were sometimes poisoned with vegetable poisons. At other times a wooden blow-pipe was used. The women carried digging sticks in search of wild yams, tubers and roots. Basketry and matting were wellknown. When considering the mesolithic industries in the Far East, we should realize that mesolithic man, living in a habitat bursting with bamboo, found this supply of his needs so rewarding that we may assume that his best efforts were spent on the perfection of equipment made from bamboo, supplemented with rattan and hardwood. As a result he largely lost interest in stone flaking, and this may have led to the steady decline of stone knapping. It was a remarkable and unorthodox development which does not fit into the traditional European scheme. In this context it is worth mentioning that in Australia, remote from mainland Asia and the centre of civilization, where wood is scarce and bamboo absent, stone industries flourished, with a great number of minutely chipped and specialized types. In adjacent New Guinea on the other hand, with thick tropical forests and abundant bamboo, the prehistoric population, before learning to domesticate plants (yams and tubers as taro) and animals (dog, pig and chicken) used only simple stone flakes without any secondary chipping.[92] Here again man's cultural efforts in this permanently humid tropical region were not centred on stone but on bamboo, and this seems to be the hall-mark of mesolithic industries in such environments.

As a preliminary classification of the mesolithic industries in Indonesia, four different categories may be distinguished. Sometimes distinction is difficult and rather arbitrary, and it is not a chronological one but based chiefly on the dominant raw material used and the technique of stone-flaking. The four categories are:

The Hoabinhian pebble-tool industries,
The Sampung bone industries,
Specialized flake-blade industries, and
Unspecialized flake-blade industries.

In the following pages we shall try to describe and analyze these industries to some extent from the knowledge acquired in our excavations.

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[92] Golson, '68.

2. BACSON-HOABINHIAN: GENERAL

The term Bacson-Hoabinhian is a combination of the names of the limestone massif of Bacson north of Tonkin, and Hoa-binh 60 km. southeast of Hanoi where the industries were first recognized: the term was adopted by the Congress of Prehistorians of the Far East in 1932.[93] It is an industry characterized by pebble-tools worked only on the upper face and with the entire ventral face of cortex; in many instances the cortex has also been left on the less essential parts of the upper face. The tools are made of conventionally shaped natural river pebbles, split pebbles and boulder flakes. There is much stoneworking wastage but only a few flakes show clear signs of intentional working and these are confined to the upper levels of the non-ceramic deposits. Very clumsy, roughly made choppers with an archaic appearance occur alongside more advanced and finely worked tools. The industry is further characterized by a variety of key types such as: crude end and side-choppers, high-domed "horse-hoof" and "iron-heater" shaped tools (by the removal of steep, wide flakes), heavy picks, ovals, discoids, "short-axes" (produced by the truncation of a pebble at right angles to the longitudinal axis of the object), and pestles and mortars. It has only a small proportion of bone and shell artifacts, and displays the use of haematite. Scattered human bones have been found in many caves and some burials have also been reported. The human skeletons in most cases were found in a flexed position and were stained with red ochre; pounding stones and mortars show traces of the same red pigment.

The stone tools were mainly woodworking tools, for felling trees, for the removal of sheets of bark and irregularities on the surface of tree-shoots and branches in the making of spears. Efficient hunting tools are lacking, but probably the most important weapons and hunting tools for attacking from a distance consisted of wooden and bamboo spears, all made of perishable organic material and therefore not expected to survive. The stone tools were also used for chopping, scraping, cutting and sawing and as a hoe for working in the soil. The Bacsonian industry [94] seems to be a local development of the Hoabinhian with a very high proportion (70%) of edge-ground pebble-tools. Edge-grinding seems to be a very old device in this part of the world as well as in Australia. The Hoabinh people lived along river-courses in open camps

[93] General reviews on the Bacson-Hoabinhian: Matthews, '64; Van Stein Callenfels, '32b, '33, '36b; Fairservis, '59, 162-66; Vallois, '53; Van Heekeren ,'67b; Dani, '60.

[94] Mansuy, '09, '20, '24, '25b, c; Mansuy et Colani, '25.

or in cave-mouths and rock-shelters when available and in easy reach of the rivers, or in other cases along the sea-coasts where sometimes large and high kitchenmiddens were formed in association with an old shore-line. The food remains point more to a food-gathering economy than to that of hunters. Still mammal remains suggest that at least some big and small game hunting was practised. Shells, however, form the bulk of most habitation deposits: fresh-water, brackish-water or marine, depending on the area occupied. Shellfish, apparently, were an important part of the diet. The Hoabinhian is definitely pre-ceramic or non-ceramic and has grown out of the Lower Palaeolithic Chopper/Chopping-tool complex of Southeast Asia, described in the former chapter. Only in the upper layers are potsherds and polished axes sometimes found mixed with Hoabinh tools.

The bearers of the Bacson-Hoabinhian throughout the Far East were not a physically homogeneous race, but Palaeo-Melanesoids were predominant.[95]

The mammal fauna consisted of species still living today in the same area. According to the old conventional conception, that would mean that the age was post-glacial. But such a conclusion is open to criticism, for we ought not to lose sight of the probability that the fauna of this tropical rain forest area was not subjected to major and decisive climatic changes at the termination of the Pleistocene and that the present fauna may date back as far as the last part of the Upper Pleistocene. At any rate there has never been found any faunal or geological evidence that climate or environment was significantly different at that time from what it is now, permanently humid and tropical. Only a few reliable radio-carbon 14 dates are available at present to give a more precise answer as to the absolute age of the consecutive horizons of the Hoabinhian: layers with end-chipped choppers from the Niah cave in Borneo [96] are 32,630 ± 250 years old; the beginning of an advanced Hoabinhian deposit in the Ongbah cave in Thailand is datable at 8,810 ± 170 B.C.[97] Furthermore one of Solheim's students has found traces of a number of domesticated vegetables associated with a late Hoabinhian, mixed with some neolithic elements such as cord-marked, incised and plain potsherds, and a few polished stone axes, from a site in North Thailand, dated 6,600 and 7,200 B.C.[98] Pollen analysis of a 12.79 m. core collected from

95 Huxley, 1863; Duckworth, '34; Huard, '38; Patte, '40; Verneau, '25; Tratman, '38; Mijsberg, '40; Wastl, '39; Duy, '66; Snell, '49; Trevor and Brothwell, '62.
96 Harrisson, '57.
97 Sörensen's information.
98 Personal communication from Solheim.

the bottom of a lake in Central Taiwan has shown that around 9,000 B.C. the local vegetational history began to exhibit evidence of forest disturbance with a steady rise of the total percentage of secondary forest, shrubs and herbs, and that from this time onwards the lake sediments continuously contain quantities of carbonized plant fragments.[99] There is growing evidence to support the suggestion that the Hoabinhians were the first to start intentional clearing of the primary forest by burning and practising an incipient form of horticulture of perennials such as root, tuber and fruit plants. That would mean that the Asian tropics had the first cultivated plants in the world and, secondly, that man learned to plant crops before he raised them by seed.

As far as we know at present, the homeland of the Hoabinhian seems to be in South China (Szechwan, Kwantung, Yunnan and Kwangsi provinces) and at fairly high altitudes on the eastern fringes of the Tibetan plateau.[100] From here influences radiated southwards into the mainland of Southeast Asia, Vietnam,[101] Annam,[102], Laos,[103] Thailand,[104] Malaya,[105] and the northeast coastal areas of Sumatra, Borneo, and subsequently into Australia and Tasmania.[106]

All industries found in these areas belong basically to the Hoabinhian, with local and chronological variations.

3. THE HOABINHIAN IN INDONESIA

The Hoabinhian of Indonesia is best preserved in Sumatra, though recent discoveries in Java, Bali, Borneo and Flores provisionally ascribed to the Lower Palaeolithic Chopper/Chopping-tool complex by the discoverers may in the future be partly or entirely classified as Hoabinhian when more data become available.

The industry in question is native to South China, Vietnam, Cambodia, Thailand and Peninsular Malaya where it is found in open sites, in numerous caves and rock-shelters in the interior, or in coastal mid-

99 Kwang-chih Chang, '68b; Solheim, '68, '69; Burkill, '53, 12-42; Spier, '51, 69-76.
100 Pei, '35; Bien and Chia Lan-po, '38; Chiu Chung-lang, '58; Chiu Chung-lang and Chia Lan-po, '60.
101 Colani, '27, '28, '29a, b, c, '32, '39.
102 Mansuy, '25c; Pajot, '27; Patte, '23a, b, '25, '32; Saurin, '57.
103 Fromaget, '40.
104 Sarasin, '33; Van Heekeren, '47, '61, '62, '67b; Heider, '51; Knuth, '62; Nielsen, '62; Matthews, '64.
105 Wray, 1897, '05; Earl, 1860; Evans, '20, '22, '28a, b, '30, '38; Van Stein Callenfels, '36a; Vaufrey, '27; Collings, '36a, b; Sieveking, '54, '54-'55; Matthews, '60, '61; Tweedie, '42, '53, 55.
106 Tindale, '37; McCarthy, '40a; Mulvaney, '66; Matthews, '61, '64.

dens such as Da-But in Vietnam and in the province of Wellesley in Malaya. The last mentioned site is believed to represent a late stage with some tool types such as necked axes not generally found in the Hoabinhian.

In Sumatra the distribution of the Hoabinhian is mainly confined to the coastal region facing the Malay Peninsula where it is represented by extensive middens along the northeast coast, being most prolific at the large open sites of Acheh, Lho' Seumaweh. The principal tool type of the mounds, 90% of the total, is an elongated oval monofacially flaked pebble-tool, known as "sumatralith" to previous investigators. This name is no longer used since later excavations have proved that this tool also plays a dominant role on the continent, and is certainly not an Indonesian speciality as was claimed in the past (Fig. 19).

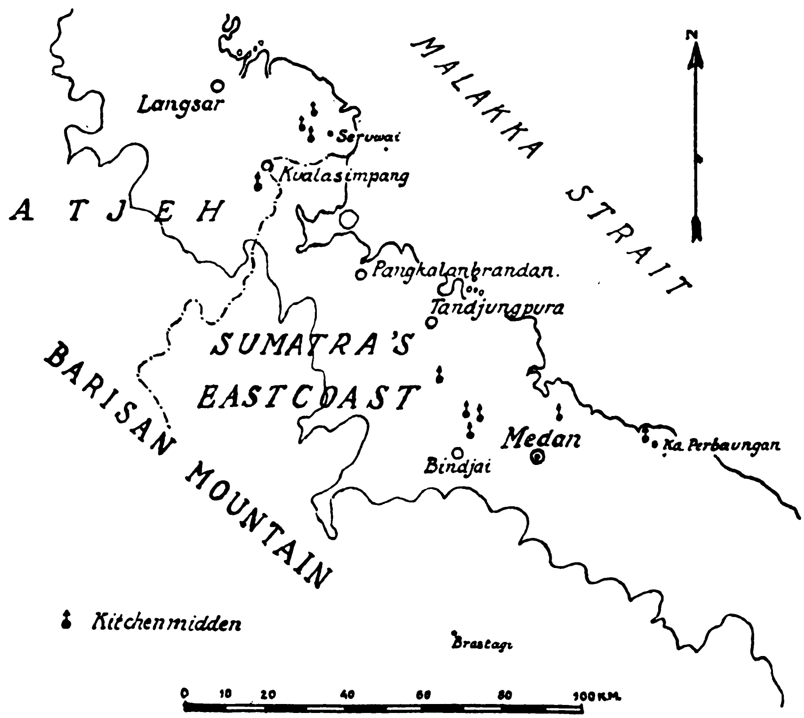

Fig. 19. Kitchenmiddens near Sumatra's east coast.

The first flaked pebble-tool was discovered in 1924 by J. H. Neumann on the surface at Batu Kenong, Deli. It is of weathered andesite and is flaked on both faces, giving it a wavy line in profile (Pl. 33). It has an almond shape, part of the point being broken off, and measures 155 mm. (long) x 95 mm. (wide) x 70 mm. (thick). An attribution to the Post-Glacial period was confirmed by the discovery of an identical tool in a shell midden near Medan.[107] In 1927 and subsequent years L. C. Heyting collected more flaked pebble-tools in the Upper Serdang region; all tools were flaked on one face only. Large shell mounds with a diameter of 30 m. and a height of 4.5 m. were reported as early as 1907 near Seruwai on the lower course of the Tamiang River. In the opinion of the discoverers (Yearbook 1917 of the Mining Department of Bandung), the middens had been formed by a plague raging among the shellfish. Witkamp, however, was later able to show that their presence was due to human activities and that the mound contained, apart from shells, also scattered animal bones and pestles and mortars.[108] The distribution has since been found to extend along the northeast coast for 130 km. Most sites are now about 10 to 15 km. inland along what was once the seashore, and some of them have been submerged more than one metre in the swamps formed behind the beach.

In 1925 and 1926, Van Stein Callenfels excavated a midden on the Saentis Tobacco Estate, but apart from a short popular article in one of the numbers of the 'Illustrated London News' no report was ever published (Pl. 34). The following information has been extracted from his field notebook and from an article by Van der Meer Mohr.[109] The shell mound in question contained 93% *Meretrix meretrix* and 6.5% *Ostrea* shells. Only a few flaked pebble-tools, all unifacially chipped and of the common oval type with the exception of one "short-axe" were recorded. Crude pestles and mortars and a large quantity of haematite were also found. The conchyliologic research was carried out by Van der Meer Mohr. He found shells of *Melo indica* with a round hole pierced in the columellar part of the last coil. These may have been used as goblets, or trumpets, or water scoops, or the whole may have been made to fit a wooden handle. In any case they were utensils or ornaments, as indicated by the constant presence of a hole in the same place. Other shells have been used as scrapers. The greatest percentage of the shells consists of *Meretrix*; when boiled, such molluscs start to "yawn" and the edible contents can be taken out. Other shells, however, such as *Melongena pugilina, Ellobium auris* and *Potamides teloscopium* had to be smashed to remove the flesh (Pl. 35, 36, 37, 38, 39).

[107] Van Stein Callenfels, '24, 127-33.
[108] Witkamp, '20, 572-74.
[109] Meer Mohr, v. d. '32, 1-9.

Two shell mounds were reported in the northern part of the Bula China and Tandem Hilir Estate, 20 km. northeast of Medan. One of the mounds was located at a distance of 17 km. from the recent beach at the edge of the mangroves. It was a mound measuring 30 x 20 x 3 m. One third of the upper part, however, had already been removed and used in lime-kilns and for road metalling. The mound lay on a blue-gray floor. Five different layers could be distinguished, namely loose shell layers 1 m. in thickness separated by layers of earth 20 cm. thick. The layers were thickest in the centre gradually decreasing in thickness towards the edges. The shells were mainly *Lamelli-chranchiata* and gastropods. There were closed as well as separated valves, large and small. The shells above the old high tide line were undamaged, and those below were weathered, broken and brittle. The shells were mixed with mammal bones of recent species, such as monkey, rhinoceros, elephant and deer, and there were a number of pebble-tools. Fourteen stone tools from this site are now in the Rijksmuseum voor Volkenkunde in Leyden, presented by Mr. H. Broekmeyer of Bussum. The tools were mainly of the oval type and flaked on one face only, but there is also a stone knife and a discoidal tool with chipping round the edges. Two stones were stained red and yellow (Pl. 40).

More information of shell mounds comes from the investigations of H. M. E. Schürmann at Bindjai Tamiang.[110] This place is situated 100 m. south of the Tamiang River and 15 km. in a straight line from the coast. Schürmann found a number of monofacially flaked pebble-tools of an oval shape and some pestles and mortars, and bones and teeth of elephant, rhinoceros, bear and deer. Furthermore there were remains of crab, tortoise and fish vertebrae 3½ cm. in diameter. Human skeletal remains were also recovered during his excavation, including a cranium with occiput and temporal bones, fragments of three other skulls, an upper jaw with six worn teeth and about 30 fragments of limb and other bones. Many long bones were split, evidently to remove the marrow, suggesting cannibalism. The cranium had slight brow-ridges. The human remains were interpreted as belonging to people of short stature, with a dolichocranic skull, belonging to the Melanesoid stock.[111]

As said before, when Schürmann visited the mound for the first time in 1927, one third of the upper part of the mound had already been removed for economic purposes. An excavation in squares was carried

[110] Schürmann, '31, 905-23.
[111] Wastl, '39, 181-85.

out in the remaining part. The stratigraphy from top to bottom reads as follows:

East Central part:

30 cm. shells mainly *Meretrix*;
30 cm. ash layers with red pigment particles, pebbles, flaked pebble-tools and scattered animals bones;
20 cm. shells mainly *Meretrix*;
20 cm. ashy layer with red ochre and bones;
20 cm. shells mainly *Meretrix*;
10 cm. ash layer with red ochre, rolled pebbles, flaked pebble-tools and bones;
60 cm. sand with pebbles and *Meretrix* shells and some bones;
50 cm. blue-grey and yellow sand mixed with some clay; no shells.

The layers were not horizontal but sloped 10° to the east.

Southwestern part:

20 cm. with much ash and red ochre, flaked pebble-tools and bones;
50 cm. *Perna* bank;
50 cm. much ash and red ochre, flaked pebble-tools and bones;
30 cm. sand with *Meretrix* shells, pebbles and some bones;
120 cm. yellow-grey sand mixed with some clay.

The layers sloped 6° to the southwest.

Central part:

70 cm. stratified shell banks (mainly *Placuna* and *Meretrix*), red ochre, ash layers, flaked pebble-tools and bones;
90 cm. yellow-grey sand with numerous *Meretrix* and pebbles, some bones;
50 cm. yellow-grey sand mixed with some clay.

It has become evident that the mound was originally formed in shallow sea; the lower layers were found in a natural depression below the ancient sea-level. Oysters and algae adhered to the flaked surface of some tools, showing that these had been submerged. Apart from pebble-tools made of quartzite, sandstone and andesite, there were 3 rubbing stones (1 with four facets), furthermore thick pieces of polished bone and many small angular pieces of red and, less frequently, yellow ochre, and finally 2 pieces of charred wood, 90 and 50 cm. long, found on the floor of the midden, considered to be remains of piles. Bivalve molluscs sometimes show signs of having been used but have not been properly described.

H. Küpper reported some sites in the Langsar region of Acheh, the most important one situated on a plateau 60 m. above sea-level northwest of Lho' Seumaweh, where flaked pebble-tools were found lying on the surface in great numbers. Similar open sites were found more to the west and near Kandang. The tools were made of finely grained sandstone with quartz and felspar particles. The flaked pebbles were oval, spheroid, discoid and bar-shaped. There were also boulder flakes which had been used as cores. The regions where the sites were discovered form a single geographical unit characterized by a range of barren limestone ridges, covered in some places by a layer of quarternary gravels which contain the raw material used for the manufacture of the stone tools [112] (Pl. 41, 42, 43, 44).

The types are:

1. Triangular, pointed tools, flaked on the upper face only; marginal chipping is lacking. Some measurements: 84 x 85 x 43 mm.; 88 x 86 x 45 mm.; 104 x 60 x 46 mm.
2. Proto hand-axes, resembling western hand-axes but flaked on the upper face only. Measurements: 84 x 85 x 45 mm.; 88 x 86 x 45 mm.; 104 x 60 x 44 mm.
3. End-choppers, made on heavy pebbles, longitudinally flaked at the end only, parallel to the main axis of the object. Measurements: 134 x 74 x 53 mm.; 138 x 70 x 33 mm.; 90 x 66 x 28 mm.
4. Side-choppers, coarsely, unilaterally flaked along one of the long sides and made on heavy, massive, suitably shaped pebbles. Measurements: 134 x 60 x 50 mm.; 86 x 50 x 41 mm.
5. Discoidal pebble-tools. The technique of manufacture is quite simple. The tools are fashioned from round, rather flat pebbles. Retouches are confined to the circumference of the upper face. Measurements: 100 x 82 x 29 mm.; 86 x 62 x 32 mm.
6. Discoidal flake scrapers, made on boulder flakes.
7. Pseudo-cleavers. Tabular scrapers, fashioned from large flakes, sometimes with steep retouches on one of the sides. Measurements: 114 x 75 x 30 mm.; 114 x 74 x 34 mm.

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[112] Küpper, '30, 985-88; Lebzelter, '35, 318-25.

8. Heavy choppers, with vertical dorsal flaking and flat unworked ventral face. The thickness of the object is about half of its length, and two-thirds of the width. Measurements: 82 x 64 x 42 mm; 84 x 47 x 44 mm.; 90 x 70 x 40 mm.; 97 x 74 x 44 mm.; 70 x 60 x 40 mm.; 80 x 47 x 27 mm.; 124 x 84 x 43 mm.
9. Ovals. Upper face flaked all over or with marginal retouches leaving the cortex of the rest of upper and entire lower face intact. Measurements: 63 x 43 x 12 mm; 66 x 37 x 18 mm.; 90 x 53 x 27 mm. There are also longer and relatively narrower specimens.
10. Chopping-tools, with alternately flaked cutting-edges.
11. Bifaces or hand-axes, flaked on both faces. One specimen has traces of polishing. Bifaces are scarce. Measurements: 95 x 25 x 20 mm.; 61 x 21 x 24 mm.; 72 x 26 x 30 mm.

From the above it will have become clear that on the northeast coast of Sumatra there once flourished a vigorous mesolithic pebble-tool industry, the remains of which have come to us from shell mounds and from open sites on the flat ridges of limestone hills. It is very striking, therefore, that this form of culture is little known in other parts of the Archipelago. Except on Flores (Leang Ped'as, Wangka) and on Java (Gua Mardjan), pebble-tools have never been found in any caves or rock-shelters, and up till now there is no report of shell mounds along the shores elsewhere.

P. V. van Stein Callenfels,[113] in view of a Palaeo-Melanesian skull which was found in association with the Hoabinhian in Eastern Sumatra and of reports from Malaya and Vietnam, went so far as to speak of a Melanesian Civilization with regard to the Hoabinhian. Collings,[114] McCarthy [115] and Evans,[116] however, definitely opposed this qualification, which they considered premature at the least.

The large accumulations of flaked pebble-tools of Hoabinhian type and food remains along an old coastline in Northeast Sumatra and numerous similar tools on a plateau in the same region suggest that the Hoabinhians led a semi-sedentary life. The economy was based mainly on food-gathering, fishing and hunting and we may safely speculate that a simple form of horticulture was also practised with domesticated root and tuber plants. Unfortunately dates based on

[113] Van Stein Callenfels, '36b.
[114] Collings, '36a, 122-23.
[115] McCarthy, '40a, 38.
[116] Evans, '38, 141-46.

the decay of the isotope carbon 14 are not available, but we hope that in the near future more excavations of shell mounds, if any are left, will be taken up again. It is a pressing need that excavations under present-day standards and palynological research should be carried out, and there is plenty of charcoal in the mounds to allow proper dating.

4. THE SAMPUNG BONE INDUSTRY

The Sampung bone industry is characterized by a great proportion of bone, antler and shell tools of various types, and further by pestles and mortars, primary flakes and blades (used but not retouched), projectile points of stone with rounded base, shell ornaments, red pigment and flexed burials, and a few cord-marked potsherds.

The type site Gua Lawa (Bat Cave) was discovered in January 1926 by L. J. C. van Es, a geologist, when visiting the Southern Mountains near Ponorogo, East Java. On this occasion he was informed by the district officer that employees of the sugar factory Patogan had obtained phosphates to be used as fertilizers from the Gua Lawa near Sampung and in the course of this had encountered animal bones. As there was a chance that these were fossil vertebrates, Van Es sent an assistant to the cave with instructions to collect fresh material. The bones then obtained were forwarded to Bandung for examination. It appeared that the bones were not fossilized, but belonged to animal species which still live in Indonesia. Several bones, however, appeared to have been worked and artificially polished. It was decided to perform a preliminary excavation in the northeastern part of the rock-shelter. This was situated about a mile south of Sampung on the southern slope of an isolated limestone outcrop which is separated from the main limestone range. The bed rock was reached at a depth of 13¾ m. below the surface, and it appeared that the cliff had once been undercut by a small river, at present running 70 m. in front of the cave which had led to the formation of the rock-shelter. The section from bottom to top reads as follows: directly covering the rock bottom, a layer of brown sand with some river pebbles, 4 m. thick; upon this came a stratum of volcanic ash and sand about 75 cm. thick. Some fossil bones were encountered at a depth of 11½ m. The ash layer was superimposed by finely stratified sandy material, 4½ m. thick and deposited in stagnant water, apparently a lake. This lake had afterwards become completely silted up. Only after this phase had the cave commenced to be inhabited by men who used the shelter as a home. These men were not yet Indonesians, as we shall see presently. The cultural layer was more than 3½ m. thick. Van Es[117] found a number of bone tools (two types of spatulas and a dagger of horn), winged stone arrow-heads, and two arrow-heads with rounded base, unspecialized flakes and blades without retouch, haematite in two shades, light and dark red, pestles and mortars, some ornaments of shell, and a human skeleton lying on its left side, the legs bent, with the head resting on the left shoulder and the right hand on the face. There were also a number of animal bones and teeth. According to Van Es there was no difference in the stratigraphy of the various cultural elements. Only in the uppermost layer were modern potsherds, some pieces of bronze and iron and a few rectangular polished stone adzes encountered. One cord-marked potsherd was found at a great depth (Fig. 20).

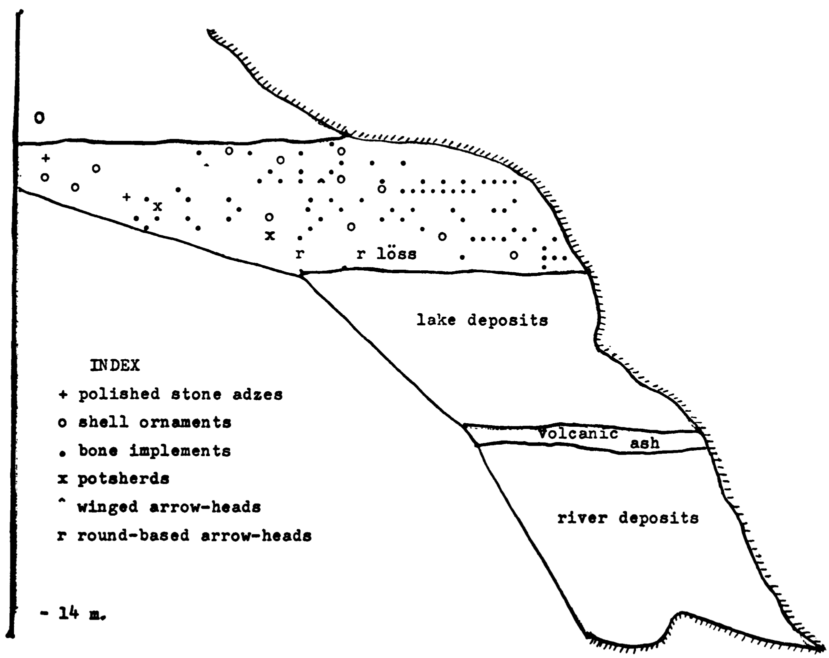

Fig. 20. Gua Lawa, Sampung, East Java.
Cross-section after van Es.

[117] Van Es, '26, 468-74, '29, 329-40.

From 1928 to 1931 systematic excavations were undertaken by Van Stein Callenfels. He published a preliminary, well-illustrated paper on his work, but it was never followed by a final one [118] (Pl. 45, 46, 47).

The artifact-bearing deposits were 3 to 4m. thick and offered a good opportunity to obtain a stratigraphical view, if there was any. Van Stein Callenfels stated that in the upper layers a few iron and bronze pieces and modern potsherds were found, intermingled with a number of neolithic adzes. The next layer contained exclusively implements fashioned of bone and antler, such as awls, a few beautifully finished fishhooks, worked horns of stags and roes like daggers, perhaps for digging up edible roots in the forest. Besides these there were 99 bone spatulas of two different kinds; 63 specimens were of the concave-convex type made of a long bone, split lenghtwise and ground into a round cutting-edge, and 36 specimens were made of a flat bone, hardened in the fire and polished — good tools for cleaning and scraping the skins of tubers such as yams and roots such as taro (wild and probably also domesticated) (Fig. 21).

The third layer down yielded neolithic, bifacially flaked stone arrow-heads; among these were 2 miniature ones, perhaps used for fowling and 1 cord-marked potsherd (Pl. 48, A, B, C). 79 pestles and mortars were found spread throughout all layers. A number of flat grinding stones, their smooth surface hollowed to greater or lesser degree by constant use, were suggestive of the preparation of wild seed food (probably of tree-fern, ground into a flour from which cakes could be baked in the way the Veddahs of Ceylon still do).

Others still bore traces of red pigment on the grinding surface, the haematite having been ground to a paste. There were also primary flakes and blades without secondary working and many retouched shell scrapers in the collection, which were overlooked by Van Stein Callenfels.[119] The stratigraphy is far from convincing; it is rather enigmatic and not confirmed by later excavation. If it were correct it would mean that a mesolithic non-ceramic bone culture was overlying a neolithic stratum with winged arrow-heads seemingly derived from an ancient Japanese neolithic.

During the excavation several badly preserved human skeletons were found, some incomplete. The skeletons were lying in a contracted or flexed position, the hands under the chin or over the face, the knees

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[118] Van Stein Callenfels, '32a, 16-32; Dammerman, '32, '34a, 229-35, '34b.
[119] Willems, '39, 181-85.

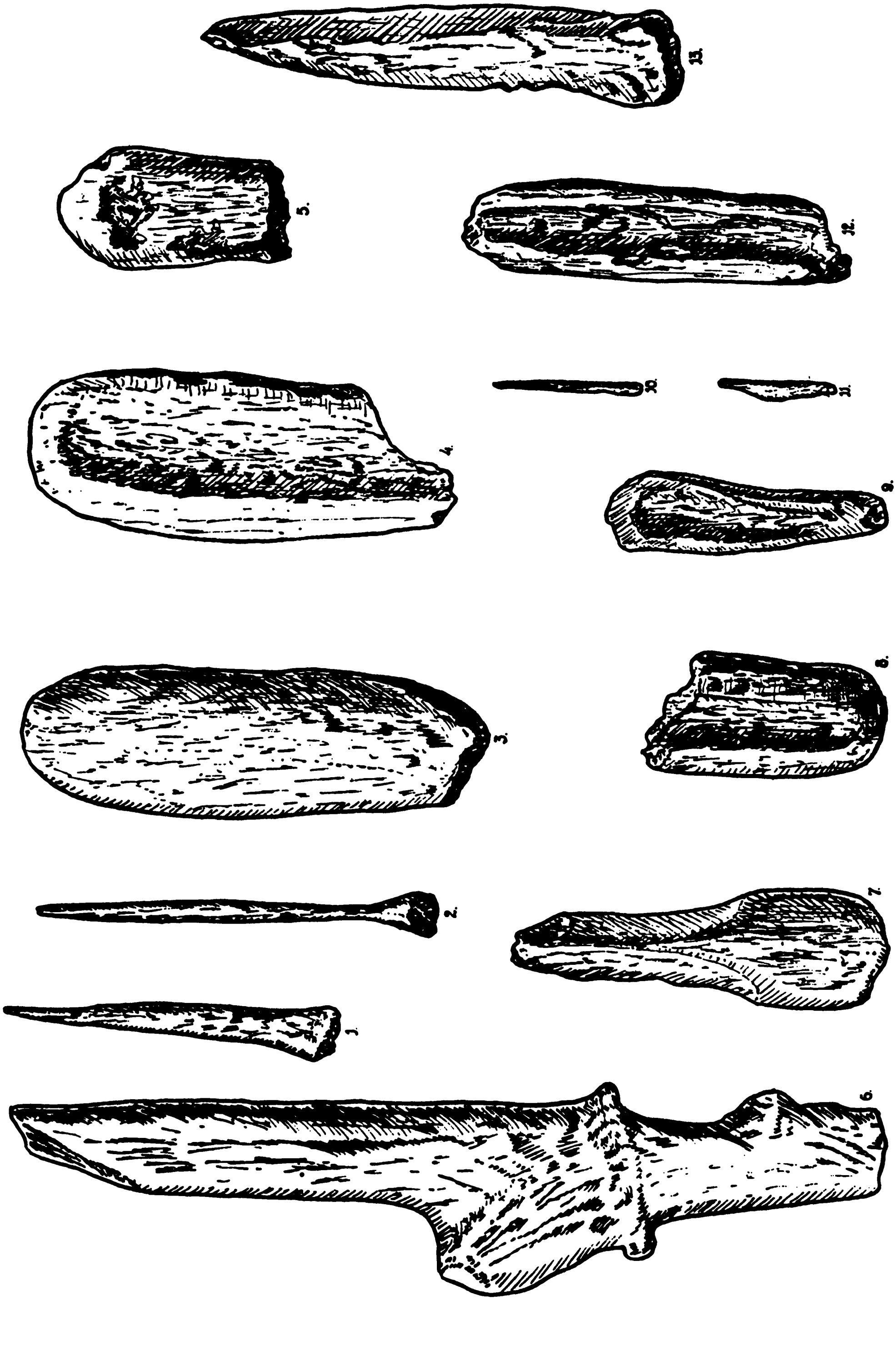

Fig. 21. Bone tools, Sampung, Java.

sometimes drawn up towards the chin, in short in the Hoanbinhian way as encountered in the Gua Chah in Malaya and in the Sai-Yok rock-shelter, Thailand. Some of the skeletons were covered by a large slab of rock apparently to keep wild animals away or to prevent the deceased's spirit from leaving the body. The skeletal material was forwarded to W. A. Mijsberg, who was able to reconstruct one skull and the greater part of another. The first one was measured accurately and described.[120] The measurements are in cm. (Pl. 51, 52, 53).

Skull F Sampung

cranial length	17.0	minimum frontal width	9.1
cranial width	13.3	transverse fronto-parietal index	68.4
auricular height	11.7	bizygomatic width	13.4
basion-bregma height	?	nasion-prosthion distance	6.1
cranial index	78.2	middle facial index	45.5
length-auricular height index	68.8	nasal index	56.7
width-auricular height index	88.0	orbital height	3.1
cranial module	1400	orbital width	4.3
cranial capacity	1325 cc.	orbital index	72.1

Skull F has also been studied by Jacob.[121] Here in short are his observations:

"The skull is not very well cleaned and reconstructed, and therefore, some alterations are made before the actual study. It is a male individual, with strong superciliary arches, and large frontal sinus. On the whole the skull is dolichocranic with poorly filled temporal fossa. The height of the skull is considerable owing to the sagittal torus. Between the parietal angulation and the sagittal suture the bone is flat, and then laterally it comes suddenly downward in an almost vertical plane. These features give a pentagonal, gable-shaped appearance in occipital view.

The nasal root is broad, amounting to 33 mm., flanked by two broad, round orbits. The cheekbone is moderately large and possesses a well-developed malar tuberosity; its base is of medium thickness. In norma lateralis we noticed a rather deep nasion, whence the contour goes up into a prominent glabella and farther on as a receding forehead. Slight occipital bulging is noted, caused by a prelambdoid depression. Then the sagittal contour goes down in an angulated fashion as it leaves the occipital plane for the nuchal plane. The temporal line is moderately marked, and the superior nuchal line is prominent.

In this specimen, the mastoid process is of moderate size. In basal view the anterior contour is convex, with a gradually curved malomaxillary angle. On the inner side of the occipital bone we noted that the right transverse groove is higher than the left one. All vault sutures are still open."

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120 Mijsberg, '32, 39-54.
121 Jacob, '67, 52-8.

Maxillary dentition of Javanese females and males compared with those of Sampung I and F and Bodjonegoro 1 and the average of Australoids. Measurements in mm.

Tooth	Diam.	Javanese ♀		Javanese ♂		Sa I		Sa F		Bo 1		Australoid
		min.	max.	min.	max.	r	l	r	l	r	l	
I¹	MD	7.2	10.0	6.8	10.8	9.0	9.0	—	—	9.2	—	8.7
	BL	6.0	7.9	5.9	8.9	8.1	8.0	—	—	8.0	—	7.9
I²	MD	5.3	8.0	5.0	8.9	—	8.0	—	—	7.8	7.2	7.2
	BL	5.0	7.4	5.0	7.8	—	7.3	—	—	7.0	7.0	7.0
C	MD	6.9	8.8	6.9	9.3	—	8.0	—	—	—	9.0	8.0
	BL	6.8	9.0	6.8	10.4	—	9.5	—	—	—	—	8.7
P¹	MD	6.8	8.3	6.4	9.0	—	—	—	—	—	—	7.4
	BL	8.1	10.1	8.3	11.6	—	—	—	—	—	—	10.0
P²	MD	6.0	8.1	5.9	8.0	—	7.0	7.0	—	—	—	6.8
	BL	8.1	10.7	8.4	11.3	—	9.9	10.2	—	—	—	10.0
M¹	MD	9.6	11.8	9.0	12.0	11.1	11.0	11.9	11.2	12.8	12.3	11.0
	BL	10.3	12.7	10.0	13.0	12.9	13.0	12.6	12.8	13.4	13.1	12.5
M²	MD	8.0	10.7	8.0	11.5	11.4	—	11.2	10.9	—	—	10.3
	BL	9.0	12.3	10.1	13.8	12.9	—	12.8	12.8	—	—	12.5
M³	MD	8.0	11.0	5.8	11.5	11.0	—	—	10.0	—	—	9.5
	BL	9.5	12.7	7.0	14.5	11.5	—	—	12.4	—	—	11.8

MD = mesiodistal BL = buccolingual

Mandibular dentition of Javanese male maxima compared with those of Sampung I and b and Bodjonegoro 1, 2 and 3. Measurements in mm.

Tooth	Diam.	Javanese ♂	Sa I		Sa b		Bo 1		Bo 2		Bo 3	
		max.	r	l	r	l	r	l	r	l	r	l
I¹	MD	6.5	—	—	—	—	6.3	6.2	6.0	5.8	—	—
	BL	7.0	—	—	—	—	6.8	6.9	6.8	6.1	—	—
I²	MD	7.5	—	—	—	—	6.8	6.7	—	—	—	—
	BL	7.4	—	—	—	—	7.0	6.9	—	—	—	—
C	MD	8.5	7.1	—	—	—	—	—	—	—	—	—
	BL	9.6	8.9	—	—	—	—	—	—	—	—	—
P¹	MD	8.5	7.6	—	—	—	—	—	—	—	—	—
	BL	9.9	8.2	—	—	—	—	—	—	—	—	—
P²	MD	9.1	7.9	—	—	—	—	—	—	—	—	—
	BL	10.1	8.8	—	—	—	—	—	—	—	—	—
M¹	MD	13.0	11.5	12.0	13.1	13.1	12.8	13.0	12.2	12.9	—	—
	BL	12.0	11.2	11.3	11.8	11.8	12.0	12.0	11.3	11.4	—	—
M²	MD	13.0	12.0	11.7	—	—	—	—	—	—	—	—
	BL	12.0	11.0	11.0	—	—	—	—	—	—	—	—
M³	MD	12.9	12.1	11.5	—	—	—	—	—	—	—	13.0
	BL	12.2	10.9	10.5	—	—	—	—	—	—	—	12.5

after Mijsberg

Jacob also made a study of skull H which has never been described before. His statements read as follows:

"Sampung H provides only a very fragmentary skull, and in general, displays similar features as Sampung F. The skull seems to be dolichocranic and has a remarkably high vault. The general characteristics correspond to the average Australian skull described by Fenner (1939). In our specimen the superciliary arches are strong and V-shaped, intervened by a supraglabellar fossa. Sampung H skull also fits in the pattern of the Puger skulls from Neolithic East Java studied by Snell (1938). In both cases the long ovoid skulls have a narrow bitemporal diameter.

The mandible of Sampung H has a rather high corpus which is in addition not extraordinarily thick. It possesses well-defined muscular impressions and it is not a rocker jaw. The minimum ramal breadth is much lower than in Wadjak, and the same is true for the robusticity and the absolute thickness. Alveolar prognathism is present. The Sampung teeth are larger than the average of Mesolithic Gua Kepah, as we will see in the next chapter, and have large roots, as are also evidenced by the low location of the mental foramen. In addition, the cheek teeth length is comparable to Gua Kepah, but smaller than in Wadjak or even than in the Australoids. In general, the teeth are larger than the average of Mesolithic Flores, as will be discussed later. Finally, no shovelling is encountered in the lower incisors."

Sampung Man is medium-statured and, according to Mijsberg and Jacob, is predominantly Melanesian with some Australoid features.

Among the human skeletons found was one of a child showing the cutting of the milk teeth; round the neck was a necklace of perforated shells, apparently used as funerary gift. One of the shells was *Nerita chameleon*, all the others *Natica*. Similar perforated shells have been found scattered throughout the various layers, among them larger ones such as *Natica mamila*. Further there were two canine teeth, bored for suspension towards the root and most likely used as ornaments, two miniature oval plates of mother-of-pearl pierced with two round holes, and four fragments of an amulet of bone, showing traces of incised concentric squares near the edge.

The animal remains were sent to K. W. Dammerman [122] for examination, and belong to the species mentioned below:

UNGULATA
Bos (Bibos) banteng Raffl., *Bos (Bubalus) bubalis* L., *Cervus hippelaphus* Cuv., *Cervus eldi, Muntiacus muntjak* Zimm., *Sus vittatus* Temm., *Elephas maximus* L, *Rhinoceros sondaicus* Desm., *Tragulus kanchil* Raffl.

PRIMATES
Macaca iris Cuv., *Pithecus pyrrhus* Horsf., *Nycticebus coucang* Bodd.

[122] Dammerman, '32, 30-31, '34a, 477-86.

CARNIVORA
Felis bengalensis Kerr., *Neofelis nebulosa, Paradoxurus hermaphrodites* Pall., *Cuon javanicus* Desm., *Lutra cinerea* Illig.

RODENTIA
Hystrix javanica Cuv., *Petaurista petaurista* Pall., *Ratufa bicolor* Sparrm.

Among this sub-recent Indo-Malayan fauna, *Elephas maximus, Bos bubalis, Neofelis* and *Cervus eldi* are extinct in Java. *Rhinoceros* still exists only in the westernmost part of Java and in Sumatra. Apart from the fauna mentioned above there was also an astonishing amount of Monitor lizard bones (*Varanus salvator*). A hitherto unknown site was discovered by G. H. R. von Koenigswald in 1936.[123] It was a rock-shelter, located on the eastern side of the Tjantelan mountain near the coast of the Indian Ocean, northwest of Patjitan. A large number of unretouched flakes, a few hammerstones of andesite and trachyte, several arrow-heads with rounded base, pierced snail shells as ornaments, bone spatulas, some grinding stones and a few large human molars were encountered during the excavation of which no report has ever been published. There were no potsherds or winged arrow-heads in the collection. A conspicuous phenomenon, unique to this cave and to a cave 25 km. to the South (the Songterus cave near Tabuhan) is the presence of many facial, masklike parts of *Macaca iris* suggestive of a magical meaning.

Van Es discovered the Sampung Bone Industry about 100 km. north of Sampung in the Northern Limestone Hills near Bodjonegoro (Pl. 49). The cultural deposits were not as thick as those in the Sampung Cave, but only two, the Kramat and the Lawang Cave near Dander have been reported on.[124] The deposits of human occupation in the two caves were too shallow to be stratified. Finds of various types were mixed and neolithic axes were lacking.

Among the bone tools were two kinds of spatulas similar to those found in the Sampung Cave; apart from these there was a number of bifacial hammer-dressed winged stone arrow-heads.

W. J. A. Willems visited the limestone hills in the Semanding district in the neighbourhood of Tuban and examined two caves; the Gedeh and the Kandang Cave in 1938. The first cave is 20 m. long and the finds occurred from the entrance up to a point deep in the interior. Furthermore, preliminary excavations have been performed

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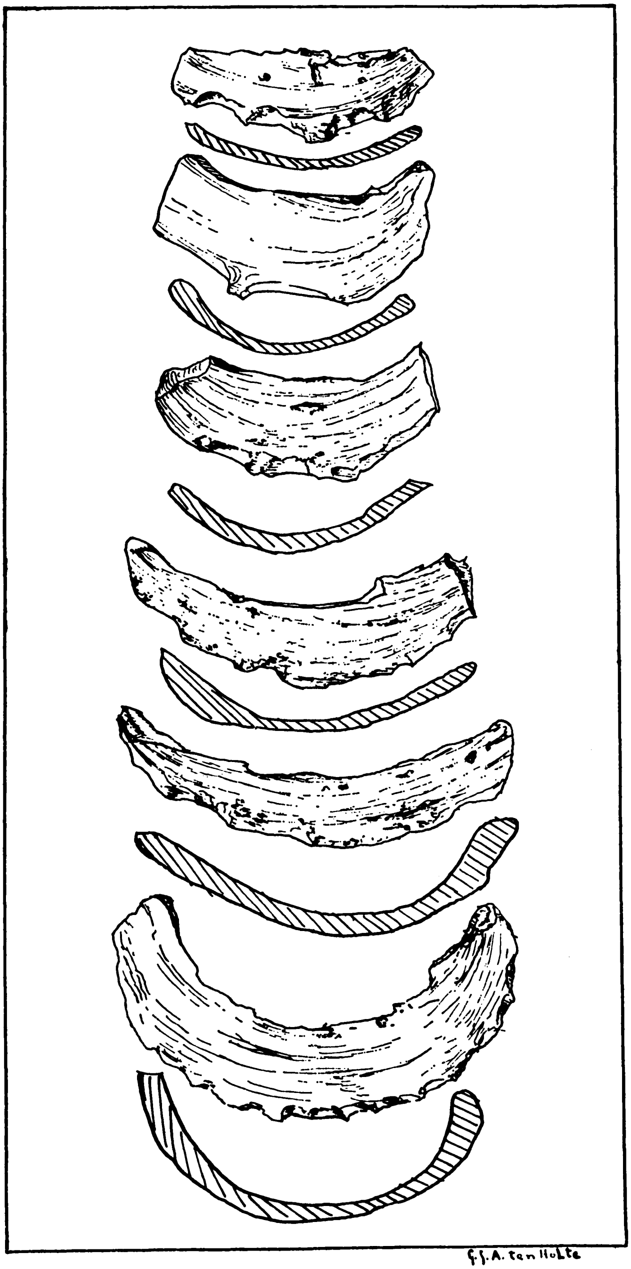
[123] Erdbrink, '54, 297-98.
[124] Van Stein Callenfels, '32b, 25-26.

in the Ketjil, Bale, Pawon, Bagong, Peturon, Butol and Pangang caves and rock-shelters, all situated in the same mountain ridge extending southwest to northeast near Tuban. They yielded the same prehistoric stone and bone objects as those at Sampung and Bodjonegoro: two kinds of bone spatulas and bifacial, winged stone arrow-heads. However, Willems also reported the presence of great numbers of shell artifacts, in particular arched scrapers with fine marginal retouches. Due to his sudden departure for Europe and the outbreak of World War II, Willems had unfortunately no opportunity to work up his notes. In the Annual Report of 1938 of the Archaeological Service in the Netherlands Indies, mention was made of his investigations.

"Unfortunately the explorations have not been wholly satisfactory in that it has not been possible to gain a true insight into the stratigraphy of these cave deposits. Variation in the soil profile showed up only in places where a kind of stratum could be established by means of a sediment of phosphate and other compounds. Since no humus formation takes place in such caves and rock-shelters, it stands to reason that methods, other than those used in Europe have to be followed. As regards the cultural stratigraphy, all artifacts of bone, stone and shell were intermingled in the upper and the lower layers. No more than in the Celebes caves were there separate horizons like those Van Stein Callenfels claimed to have discovered in the Sampung Cave. The shell artifacts were in the majority." (Fig. 22; Pl. 49, 50).

The present author recently examined the finds in the Djakarta Museum and found that not all stone arrow-heads had been chipped on both faces and that there are some unifacial arrow-heads among them. Furthermore, some bone spatulas differ from the Sampung ones in that they display the condyle. Finally I discovered many flakes and blades in the collection, but none of these had been retouched.

More than 200 km. east of the abovementioned caves, the present writer found traces of the Sampung Bone Industry in three different caves in Besuki Province. In the spring of 1933 the Betpuruh Cave and rock-shelter was discovered during exploration of an isolated limestone massif in the Beser Mountains, north of Pradjekan. The cave, only illuminated by diffuse light, was excavated, but no finds were made except near the entrance and in the adjoining small rock-shelter. The cultural deposit was very thin and nowhere exceeded one metre. Five concave-convex bone spatulas were recovered in the course of a four-month excavation. The spatulas were identical with those of Sampung. There were also small and narrower spatulas, bone awls, and a flat arrow-head of polished horn. In the same deposit were some elements of the Hoabinhian, such as pounding stones with gripmarks



Fif. 22. Shell scrapers from Gua Gedeh, Gua Pawon and Gua Bale.
Northern Limestone Massif, Tuban, East Java.

on both faces, some primary unretouched flake implements and one stone arrow-head with convex butt-end. The only ornament to be discovered was a small ring with a hole in the centre made of mother-of-pearl.[125] Potsherds were confined to the upper layers (Pl. 55).

In the westernmost part of the rock-shelter, approximately one metre from the rock-wall beneath an overhanging ledge of rock and on the bedrock, were various sub-fossil human remains. The root system of a tree growing in the vicinity had penetrated and disturbed the deposition. Among the skeletal remains was a skull from which the following parts were recovered:

1. A fragment of the frontal bone with glabella and an adjoining part of the upper rim of the right orbit. Attached to it was a small fragment of the right wall of the brain case;
2. A small fragment of the frontal bone with the lateral portion of the upper rim of the left orbit;
3. The foremost part (about half of it) of the left parietal bone;
4. A fragment of the lower border of the left orbit with the greater part of the left nasal bone attached to it;
5. A large part of the lower wall of the right orbit; the right upper jaw bone is relatively complete and shows the canine, two premolars and three molars;
6. A mandible which lacked the upper part of the right ramus and the whole left ramus, while the angle is damaged; on the right all elements from canine to the last molar were present, on the left side the second and third molar;
7. Isolated first and second incisor. On the right, in the upper jaw the alveoli are visible in which the roots of the teeth were embedded.

8–11. Four small fragments of the skull cap.

Reconstruction of the skull has not been possible. In a letter to the present writer, Mijsberg states: "In general the fragments seem to correspond with the Sampung finds. Over the eye is a ridge like that seen in the Sampung skull, but less well defined. This eminence is absent in Javanese skulls, but on the other hand it occurs frequently in Australian skulls (it is said, as much as 72 %). The Pradjekan glabella is, as a matter of fact, strongly developed; the adjoining upper rim of the right orbit to the incura orbitalis is swollen to an arcus

[125] Van Heekeren, '35, 123-29.

superciliaris. The mandible is strongly built and possesses a chin eminence. The measurements agree with those of Javanese males, but taking into account the following measurements (a) the length of the row of molars, (b) the length of the row of the molars and two premolars, and (c) the breadth of the dental arch between the outermost points of the molars, it appears that among the Javanese males which have thus far been examined, there is not one which in all measurements agrees with those of our fragments. So the fragment of this mandible possesses dental elements of a notable size which make it probable that its owner belonged to a megalodontic race. All things considered, the cranial fragments of Pradjekan are unlike those of modern Javanese, but resemble those of Sampung, and both taken together bear a resemblance to the skulls of Austroloids, Papuans and related races."

The animal remains from Pradjekan have been forwarded to G. H. R. von Koenigswald. Apart from the relics of Varanus, tortoise and numerous molluscs, he mentioned those of the following mammals:

PRIMATES

Pithecus pyrrhus Horsf.; fragments of two skulls.

UNGULATA

Bos (Bibos) banteng Raffl.; teeth, tarsus, fragment of the humerus and other remains. *Bos (Bubalus) bubalis* L.; milk teeth, a number of large incisors the condyle of a large femur and other fragments, dug up from the lower layers. *Muntiacus muntjak* Zimm.; fragments of the antlers, mandible, tarsi. *Sus vittatus* Temm.; an incisor from the mandible with transverse section typical for this pig, canines and an incisor from the maxilla. This small fauna comprises species which still live in Java, and they are mentioned in Dammerman's list of the Sampung fauna.

The second cave exploration in Besuki was started in 1931 and continued till June 1935; work was only done on Sundays, except for the months of September and October 1934 when I got assistance from Moenaf of the Archaeological Service and work could be carried on without a break. The activities took place in the Sodong Rock-Shelter situated on the northern border of the Watangan Limestone massif near the South Coast and east of the village of Puger. The excavation was hindered time and again by large blocks which had fallen from the cave-roof and had to be removed. Moreover the lower deposits were cemented into a stone-hard breccia. Excavation was carried out in three different places:

a. a sounding 4 x 4½ m. in the lower part; at a depth of 3 m. beneath the present ground-level the bedrock was reached;
b. a smaller sounding in the upper part, 2 m. higher and separated from the former by a huge stalacmite; the rock here was reached after only 1½ m.;
c. an excavation in a small niche in the rear-wall.

The stratification of the deposits in the upper part reads as follows:

Layer I, 40 cm. thick, containing modern potsherds and a few bricks and two Chinese coins (*kèpèng*) and shells. Much rock-fall.

Layer II, 30 cm. thick, a bank with marine shells, coral and sea-hedgehog's quills, devoid of cultural objects, evidently laid down during a temporary rising of the sea-level. At present 20 m. above sea-level.

Layer III, 50 cm. thick, consisting of sand with some mammal bones, a large human tooth and a few marine shells.

Layer IV, 80 cm. thick, a sandy layer with prehistoric remains but without potsherds; 67 stone flake-tools made of andesite, chalcedony, jaspar and obsidian, mainly small flakes and blades with little or no secondary work, were found. Apart from these there were 8 triangular points with a rounded or straight base, resembling the "Pirri" of Australia, flaked on one face only and having perhaps been mounted on a projectile shaft; a fine borer and 4 small Hoabinhian pebble-tools. There were also a great number of arched retouched shell scrapers; the shell used is *Cyraena,* and 18 bone implements (6 spatulas, 12 awls and short lengths of bone, pointed by grinding all around both ends, flattened in the middle, and identical with the Australian "Muduk"). In the same layer, 8 isolated, strongly-built human molars were uncovered, as large as those found in Sampung, Dander and Pradjekan caves, and an amulet of mother-of-pearl, round and with a hole in the centre. Pieces of haematite (iron oxide) were found everywhere.

Layer V, 20 cm. thick, a stone-hard red breccia with some mammal bones.

Layer VI, 40 cm. thick, stone-hard, sterile red breccia, except for some bones.

Layer VII, 40 cm. thick, stone-hard sterile breccia (Pl. 54, 56, 57).

As mentioned before, in the rear-wall of the rock-shelter was a niche where we made an excavation. Straight on the bed rock we found a human skeleton lying on its back, the legs in flexed position and the right arm across the abdomen. The skull was missing except for the mandible. We searched deliberately for parts of this skull but did not succeed in finding a single piece. It is not impossible that the cave-dwellers practiced decapitation, although nothing is known for certain about this.[126]

The small fauna comprises the following species:

UNGULATA
Cervus hippelaphus L., *Bos (Bibos) banteng* Raffl., *Bos (Bubalus) bubalis* L., *Muntiacus muntjak* Zimm., *Rhinoceros sondaicus* Desm., *Sus vittatus* Temm.

PRIMATES
Pithecus pyrrhus Horsf., *Macaca* sp.

The Mardjan Cave in the vicinity of the Sodong rock-shelter also yielded bone spatulas of the Sampung type besides a few "short-axes" and other small Hoabinhian pebble-tools. Animal remains as well archaeological material were scarce[127]; on the other hand there were many human skeletal remains, but only one individual appeared to have been buried; the skeleton was lying on its back, legs flexed, in an east-west direction, the head towards the east. It was covered by three limestone blocks. The skull was fractured and lacked parts of the facial region, but otherwise this thick-walled skull was in a relatively good condition. Its length-width index was 77.7, in agreement with that of the Sampung skull, and therefore mesocranic. The mandible was massive and had large teeth, indicating that the owner belonged to a megalodontic race. The measurements of the teeth tally with those of the Sampung and Dander caves. Apart from the burial, this small cave was littered with human skeletal remains- of ulnae, skulls, teeth, jaws and long bones. In my opinion this cave was never inhabited by man, and was only used as a ceremonial burial place for a prominent individual. Whatever else happened there can only be guessed at, most likely human sacrifice. The skeletal material of both the Sodong and Mardjan caves was lost in wartime before an expert had the opportunity to examine it.

Till now, the Sampung Bone Industry has been encountered on a large scale only in East Java, to be exact in 19 caves and rock-shelters.

126 Van Heekeren, '36, 187-93.
127 Van Heekeren, '37b, 269-77.

Apart from the tools made of stone, bone and shell, all caves displayed great quantities of red ochre used for ceremonial purposes. Though living on edible shellfish and wild vegetables, the population had become increasingly skilled in fishing and hunting small and big game, and there are indications that they already had knowledge of a simple form of horticulture mainly of perennials such as yams and tubers. The Sampungian everywhere was accompanied by a sub-fossil fauna and is of Post-Glacial age and somewhat later in the sequence than the Hoabinhian. In that period there were Melanesoids living in Java. The sites appear to be confined to the limestone massifs of the south and the north coast of East Java, and so far none have been recorded West of Surakarta, so that we seem to be dealing with a local development. Beyond Java only traces of this culture have been found in caves in Tonkin, mixed with a Bacson-Hoabinhian complex, and of a rudimentary form. Further south, in Hoabinh Province the caves yielded a fair number of bone tools, but pebble-tools were in the majority by far. A shell-mound at Da-But in North Annam,[128] however, displayed a bone industry associated with pebble-tools which resembled in many respects the Sampung Bone Industry, and furthermore produced types of bone implement not found in Tonkin but in Sampung. Van Stein Callenfels, therefore, was of the opinion that this industry originated and developed in South Vietnam and Annam and gradually superseded the use of stone, until it reached its purest form in East Java. The whole problem, however, requires a great deal more research and fieldwork, both archaeological and geochronological.

5. SPECIALIZED FLAKE-BLADE INDUSTRIES

a. *The Toalean of Southwest Celebes*

It may be said that the Toalean in general is a true microlithic industry, accompanied on occasion by rock-art (negative hand-stencils on a red background, or "mutilated" hand-stencils and animal representations in profile). The people inhabited cave-mouths and rock-shelters in which fresh-water shell concentrations occur. Secondary burial outside the caves is one of its features (Fig. 23).

The well-known Swiss naturalists Fritz and Paul Sarasin were the first to discover a blade industry with geometric microliths in Indonesia during their second expedition to Celebes from March 1902 to April 1903. Twice they visited the rather isolated mountain-range near

[128] Patte, '32.

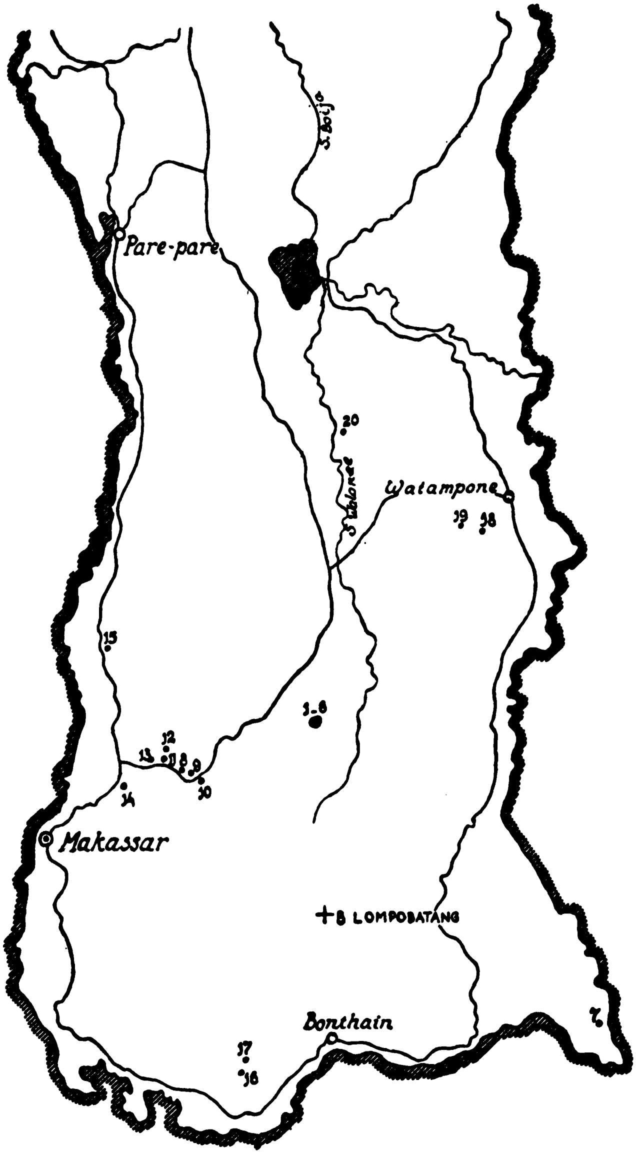


Fig. 23. Distribution of the Toalean sites in Southwest Celebes.

1. Leang Chakondo I
2. Leang Chakondo II
3. Leang Uleleba
4. Leang Balisao
5. Leang Tomatua Katjitjang
6. Leang Sebang
7. Leang Ara
8. Leang DjariE
9. Leang Saripa
10. Leang Karassa'
11. Leang Burung
12. Leang PattaE
13. Leang Lampoa
14. Mandai
15. Leang Panameanreanga
16. Batu Edjaya
17. Panganreang Tudea
18. Bola Batu
19. Panisi Ta'batu
20. Leang Tjadang

Lamonchong, east of Chamba in the southern region of what was then the principality of Boné. After many troubles and much privation they finally came into contact with the so-called Toale who still lived in the forests and partly dwelt in cave-mouths. The Sarasins excavated a mesolithic flake culture, essentially based on bladelets. The presence of barbed and winged stone arrow-heads betrayed neolithic influences of Japanese origin. The caves excavated are known as the Chakondo, Ulelebà and Balisao caves. The first one, consisting of a rock-shelter and a cave, is situated between the villages of Bakunge and Lapankanru. The rock-shelter is called the Upper Chakondo Cave. It is about 20 m. wide and lies above a dry watercourse about 430 m. above sea-level. Its deposit was not stratified and consisted merely of a greyish layer of ash mixed with limestone cinders in which a number of stone and bone implements were found. The prehistoric horizon was only 80 cm. thick and passed abruptly into a sterile, yellow stoney layer which ended right at the bedrock. At 10 cm. beneath the surface there occurred many animal bones and stone and bone artifacts; the richest level reached a depth of only 10 to 40 cm. Many of the bones were fractured and to some extent calcinated. Among the artifacts found were implements such as bladelets, knives, scrapers, points and many waste products. There were, moreover, stone arrow-heads and other flakes with serrated edges, typical for the Upper Toalean. All objects had been manufactured of andesite, chalcedony or sometimes even of limestone. Then there was a ground incisor of a boar, the point of a wooden stick and a fragment of a human skull with a round hole for suspension. Most likely this was used as a memento and worn by the relatives of the dead person, but this matter will be discussed later.[129] Potsherds were found mainly near the surface and could not be distinguished from Buginese earthenware. There were no traces of domestic animals, except for a dog's tooth.

In the second or Lower Chakondo Cave the 40 cm. thick layer of ash contained many bladelets, knives, scrapers, arrow-heads and a few animal remains. There were also the charred remains of a crudely knotted sack.

The Ulelebà Cave yielded artifacts and the remains of two human individuals which were rather fragmentary and certainly not from a burial. They comprised 12 cranial fragments, a fragment of the right part of a maxilla with 2 premolars, 5 isolated molars, 4 milk teeth and

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129 Sarasin, '05a, b, '35, 127-33.

1 incisor. The fragments were partly of an old male and partly of a young individual. There was also an almost intact humerus, indicating a race of small stature.

The Balisao Cave contained a layer of ash 40 - 50 cm. thick, which yielded some stone artifacts, animal bones and few potsherds.

Sarasin supposed that the present-day Toale he met were the physical descendants of the makers of the prehistoric stone and bone implements, and that the same Toale were relics of the Veddah stock of mankind, encountered by them for the first time in Ceylon. According to the Sarasins the Toale — being impure Veddah descendants — differed somatically from the Buginese of the same area. This was contested by several anthropologists, and in 1933 the late P. V. van Stein Callenfels made fresh investigations in the same area. After having checked whether the Toale were really autochthonous, and had no Buginese ancestors in their family, he measured 23 male Toale. For comparison 53 male Buginese, all originating from South Boné, were also measured. The results have been analyzed by W. A. Mijsberg. It became evident that contrary to the view of the Sarasins no differences worth speaking of between Toale and Buginese could be established.[130]

Mijsberg's results clearly proved that there is no reason to regard the Toale as impure Veddah relics, because the Toale exhibit no more Veddah characteristics, if any, than other mountain people of the Greater Sunda Islands, nor do they differ significantly from those people.

The same area was visited by Van Stein Callenfels in 1933 accompanied by H. D. Noone and A. A. Cense. In November and December of that year they performed successful excavations in the Leang Tomatua Katjitjang (cave of the Lonesome Old Man), north of Chani. Apart from flakes, bladelets and barbed arrow-heads, they found 2 bone points with serrated edges, a stone bark beater, a bone spatula of the Sampung type, a few double-pointed pieces of bone, oval or flattened oval in section, identical with the Australian Muduk point, and 2 fragments of green glass bracelets. Basing himself on the lastmentioned intrusive elements, Van Stein Callenfels determined the absolute age of the Toalean as 300 - 100 B.C. No report of this excavation was ever published, nor of that in the Sebang Cave in the same area.[131]

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[130] Mijsberg, '41.
[131] Van Stein Callenfels, '38a, 138-44; McCarthy, '40b.

In 1933 Cense discovered on one of his official tours a new Toalean site at Ara; the site is situated on the southernmost point of Southwest Celebes opposite Salayer Island. Its geological formation consists of coral reefs which have been uplifted in Quaternary times and which partly cover the effusa of the Lompobatang volcano near Kadjang. Several ancient beaches are visible; some geologists think that there are seven; beach III lies 30 m., beach IV 50 m. and beach V 100 m. above sea-level. The prehistoric Ara site is on terrace III. When I was visiting Celebes in 1936, Cense kindly invited me to visit Ara; we were accompanied by the septuagenarian Nurudin Magassing who, as early as 1902, had escorted the Sarasins to Lamontjong. During our visit to the Ara cave it became apparent that a district officer had already made an investigation, so that there was not much left in this small cave for closer examination. What had been left was excavated and yielded the following objects: 29 micro stone arrow-heads and other small implements with serrated edges, among which were a single arrow-head with winged base, 2 scrapers, 1 large triangular stone point, a peculiar spatula-shaped bone object, 7 bone points of the Muduk type and a fragment of a stingray. The only ornament was a light blue glass bead; the deposit was only 40 cm. thick. Barbed objects were dominant, in contrast to similar finds in other Toalean caves. The implements were small, even by Toalean standards. The teeth of the serrated tools were strongly developed, relatively blunt and cut perpendicular to the axis of the object instead of backwards. In my opinion, such projectile points could only have been used for spearing fish. The bone spatula was made from an ulna which had not been split and only worked at the distal end. Potsherds were concentrated near the surface. There were no human remains except for a small but strongly-built mandible with the molars in place. I suppose that the Ara site represents a late development of the Toalean.[132]

After finishing Ara, this was followed at once by the excavation of the Leang Karassa' (Ghost Cave) on the Chamba Road in the limestone mountains east of Maros, near the village of Patanuang AsuE. The Karassa' Cave is a spacious rock-shelter which partly inclines over the road.[133] Its deposits consisted mainly of river-sand, freshwater molluscs and ash. The shells formed a definite layer, 100 cm. thick and containing many prehistoric implements, and the layer was

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[132] Van Heekeren, '37a, 30-33.
[133] Van Heekeren, '37-'38, 262-67, 281-85.

cemented to the rear wall. The stone tools were made of volcanic rock, chalcedony and jasper; bone tools were scarce. The raw chalcedony was acquired from the riverbed which runs 25 m. in front of the rock-shelter and where lumps of chalcedony were found embedded in the limestone. The shell bank which contained the implements was not stratified. Numerous primary bladelets, scrapers, knives and points, as well as 23 stone implements with serrated edges were found, but not one arrow-head with winged base. Potsherds occurred only in the uppermost layers. Although the Karassa' Cave should be considered as one of the oldest Toalean sites, the accompanying fauna did not appear to comprise fossil animal remains, which means that the site is of Post-Glacial date.[134] The cave also yielded a short, heavy human mandible; the teeth were missing.

In 1937 I continued the investigations in Southwest Celebes, the main purpose being to gain more data concerning the structure of the Toalean complex and its geographical dispersal. This time I made a trial sounding in the Panameanga Cave in the Matampa Mountains near Pankadjene, which is a continuation of the Maros Limestone mountain range. In this cave, the Toalean did not appear until 1 m. beneath the surface, under a bank of marine shells. This trial excavation was followed by one in the Saripa Cave at the Chamba Road on the right bank of a small river which cuts through the limestone. On the opposite bank, a few km. further, lies the abovementioned Leang Karassa'. The Saripa Cave proved to be a prolific Toalean site, and yielded a great quantity of primary flakes and blades which were found throughout the whole stratum which started directly below ground-level and reached only as deep as 40 to 50 cm. Beneath this layer was sandy deposit containing some shells and a few stone implements; at a depth of 1.10 m. the bedrock was struck.[135] The implements are conspicuous by their fine workmanship and the variety of types. They were mostly made of chalcedony and jasper and there were a great number of beautiful, small arrow-heads, about 80 % of which had a concave butt-end. Nearly half of these were neatly serrated along the edges. In some instances the points had been made with painstaking care and had been skilfully retouched, and other pieces had the sharpest of points. There were 2 small saws of stone and 2 peculiar borers of the "perçoir sur lame" type, which, if found in Europe, might well be taken for Aurignacian-Solutrean implements. Other types encountered

[134] Van Heekeren, '41, 229-38.
[135] Van Heekeren, '39b, 112-18.

were bladelets without secondary working, double-sided knives, borers, awls, tanged points, gravers, some core-scrapers and some geometric microliths. All these implements were made of flakes and blades and worked on one face only. Some bone points had been hardened by fire and polished all over afterwards. Finally, there were a number of small, round, dark-brown pellets with a smooth and shiny surface. We do not know the purpose of these stones. Human skeletal remains were absent.

In the same year Van Stein Callenfels resumed his investigations into the Toalean culture in Southwest Celebes. This time he was assisted by W. J. A. Willems and F. D. McCarthy.[136] It appears that four caves and rock-shelters were examined. They began with the excavation of a rock-shelter known as Panisi Ta'buttu, situated at the Salo Parusi about 11 km. southwest of Palakka in Boné. Here, as in most caves in southwestern Celebes, the deposit proved to be too shallow for stratification. For the first time mention was made of the presence of tanged tools; the cave produced 16 serrated artifacts, a number of stone and bone points (single and double pointed), blades, shell scrapers and some bone spatulas.

Next followed the excavation of the Chadang Cave near Chita on the Wallanae River in the Soppeng District by Willems and McCarthy. This steep-sloping cave was not suitable for systematic excavation and all finds were found mixed. There were potsherds, a few metal objects, shell scrapers and 12 barbed arrow-heads. In addition 3 fragments of human mandibles, one with two, another with three molars, and an extraordinarily large number of loose teeth and some long human bones were recovered.

In the meantime, Resident Ter Laag had drawn attention to two caves near the south coast in the vicinity of Bonthain. Both caves were examined by Van Stein Callenfels. No report was ever made on these important excavations.[137]

The first cave, Batu Edjaya (Red Stone Cave), still receives worship from the local population in the form of rites which include the setting free of a chicken. The upper layer contained objects of comaparatively recent date, including old Dutch coins. Next followed a compact layer of potsherds between 18 and 40 cm. below ground-level; the sherds were decorated with comb designs, scrolls, spirals, leaf motifs and rosettes, most of them derived from the Early Metal Age. In this layer were also a few polished stone axes. Van Stein Callenfels has

[136] Van Stein Callenfels, '38b, 136-44.
[137] Van Stein Callenfels, '38a, 579-84.

dated this layer to 300 B.C., based mainly on the presence of bronze bracelets. He found, too, that bone points of the Muduk type were abundant but confined to the upper layer. Among the stone implements were 53 serrated implements, 52 scrapers, 140 blade-knives, 2 stone borers, 1 pounding stone, 1 stone bracelet and 11 cores; 10 single and double points and 1 spatula were made of bone.

The excavation of the second cave, Panganreang Tudea, produced not only the typical Toalean with its barbed stone tools but also geometric microliths in abundance (triangular points chipped along one of the long sides, and minutely chipped trapezes and battered-back crescents). In the lower layer tanged tools were found. Potsherds, 13 pieces, were found in the upper layers together with 1 bronze fish hook and 1 stone bead. There were 55 bone tools, mostly single and double points, 21 shell points, 143 serrated stone tools, 70 scrapers of stone and 88 blade knives. It seems incredible that Van Stein Callenfels should have overlooked the great number of classic geometric microliths, but I did not find a word about it in his record book or in his description of the tool types. For the manufacture of the stone tools chalcedony was used (Pl. 63a, b).

In a lecture held at the Djakarta Museum, Van Stein Callenfels divided the Toalean in an Upper Toalean with winged and serrated stone arrow-heads and Muduk bone points and a Lower Toalean with tanged tools.[138]

After the war I had the opportunity to re-examine the finds which were stored in the Djakarta Museum. I was also lucky enough to find Van Stein Callenfels' field note-book and the maps, all dealing with his most important excavation, namely that of the Panganreang Tudeja. It was then that I found geometric microliths in his collection in plenty. At the same time I made an attempt to study the cultural stratigraphy. To this end I projected all finds on an imaginary vertical plane. My preliminary drawing made it possible to recognize three different cultural layers. From top to bottom these were: (Fig. 24)

Toalean I — or Upper Toalean: characterized by barbed stone arrow-heads, many of them winged at the base, by Muduk bone points, shell scrapers and some potsherds.

Toalean II — or Middle Toalean: comprising beautifully struck blades and bladelets with, or, more often, without marginal re-

[138] Van Stein Callenfels, '38a, 579-84.

touches, arrow-heads with rounded base and numerous geometric microliths.

Toalean III or Lower Toalean: containing larger and cruder flakes, flake-tools with notches and penduloulated or tanged blade implements noticed in the upper level of the third layer only.

In May 1939 Willems tried several times to discover the Toalean north of Sengkang, but he did not succeed.

It was just after World War II that I continued my excavations. The first one lasted from 11 March to 8 July 1947 and was undertaken in the Bola Batu Cave (Stone House Cave), a cave situated on the upper part of a dome-shaped limestone hill about 191 m. above sea-level, near the village of Badjo in the Barebo district of Boné and about 20 km. southwest of the capital Watampone. The cave is illuminated by diffuse light coming through the entrance and a large hole in the ceiling. The deposits never exceeded a depth of 1.50 m. and no distinct soil or cultural stratification was found. Apart from 240 stone implements representing 73.6 % of the total finds, 43 bone artifacts (points and spatula-like tools) and 141 shell tools (arched Cyraena scrapers and points) were recovered. Among the stone tools were types of a geometric-microlithic character, 58 Pirri points, 7 serrated tools, 13 blade-knives, and 15 tanged tools. In the upper layer a number of glazed Chinese potsherds were encountered, all dating from the 16th century. A.D. Some of these sherds had infiltrated the lower layers. During the excavation several human bones were found, among these a short but heavy mandible with molars and some cranial parts which did not show typically Veddah-like characteristics. The frontal bone was larger then the average in Buginese and Macassarese.

Relics of game and a great number of molluscs were found throughout the excavation. They all belong to species still living in Celebes. Pieces of red ochre were found scattered in the soil.

The last excavation of the PattaE Cave by my team took place from 17th February till 5th April 1950. Riots forced us to stop the excavation and to postpone it indefinitely. Only a preliminary paper was published[139] (Pl. 58).

The Leang-Leang valley was visited by the Sarasins in June 1895 and again in May 1902. They drew attention to the coves, which are at

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[139] Van Heekeren, '52, 22-35; Heyning, '50.

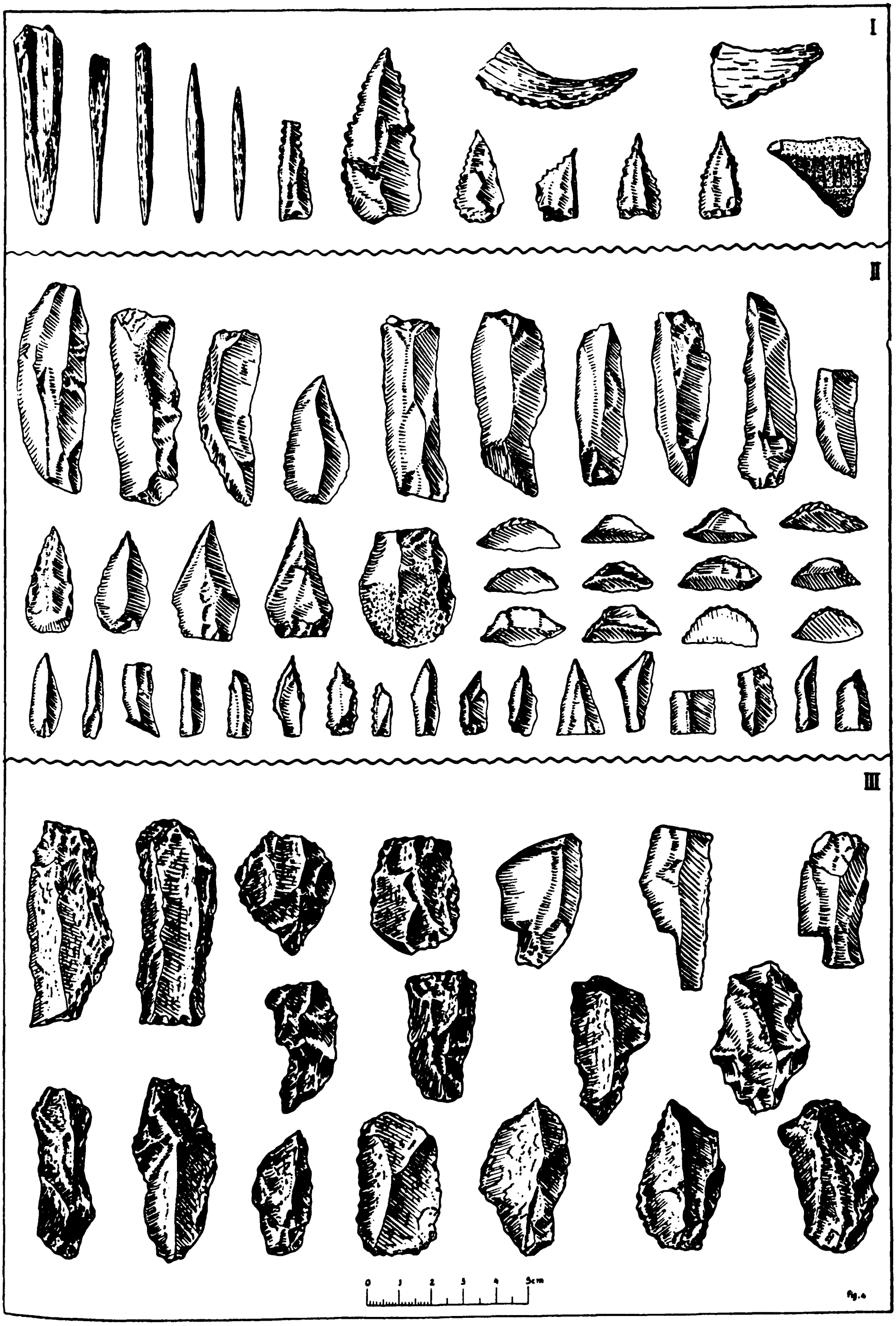

Fig. 24. Panganreang Tudea Cave, Southwest Celebes.
I. Upper Toalean; II. Middle Toalean;
III. Lower Toalean.

present at an altitude of 30 m. above the level of the sea and lie along the floor of the limestone mountains.

The PattaE cave is situated in the desa Lealleang or Leang-Leang in the Turikale district, Maros, Southwest Celebes, and can be reached by car if the wooden bridges are intact. At the foot of this cave, at a distance of 100 m., flows a small nameless brook. After leaving Maros, one drives in the direction of the well-known waterfall of Bantimurung. Halfway, at Pasar Pakalu, one turns to the left along a country road. After 2 km. one passes the Burung cave and 4 to 5 km. further lies Leang-Leang. The PattaE Cave consists of a large, rather dark cave and a small rock-shelter. On February 17th 1950 we started with a ground plan of the rock-shelter and had the surface levelled, after which the excavation of the first sector was undertaken. We followed the well-known coordination system with three dimensional measuring of all finds. Since the excavation was never finished and the deposits never exceeded 1 m. in thickness, the stratigraphy will not be discussed any further except for the fact that potsherds were found exclusively immediately below the surface, whereas serrated and concave based arrow-heads were extracted only from the upper layer. Sector I was dug off entirely; of sectors II and III only the upper layers were excavated. Due to the riots which broke out on April 5th, we were not able to continue the excavation.

The excavation provided a great number of gastropods, especially *Thiara crenulata* and *Brotatia perfecta.* The points of more than 90 % had been cut off, in order to suck out the molluscs. Remains of game were scarce: we found loose teeth, some jawbone fragments, vertebrates and others bones of *Macaca maura, Phalanger ursinus, Sus celebensis* and *Babyrousa babyrussa.* Traces of hearths were found in several places and at various depths. Pieces of red and red-brown ochre were present.

Most artifacts (92 %) were made of chalcedony and silicified chalk and were based on blades. The smallest blade measured 25 x 7 mm., the largest (detached from crude cores) 66 x 33 mm. Among the blades we noticed knives, scrapers and some gravers. They had a plain striking platform and a bulbar surface which usually presented a bulb or cone of percussion. Among the finds were a number of geometric microliths comprising battered-back blade-points, triangular in outline, crescents and trapezes. In a low horizon some tanged tools were encountered. The serrated and winged arrow-heads from the upper layer were manufactured from small and thin stone sheets with unworked faces,

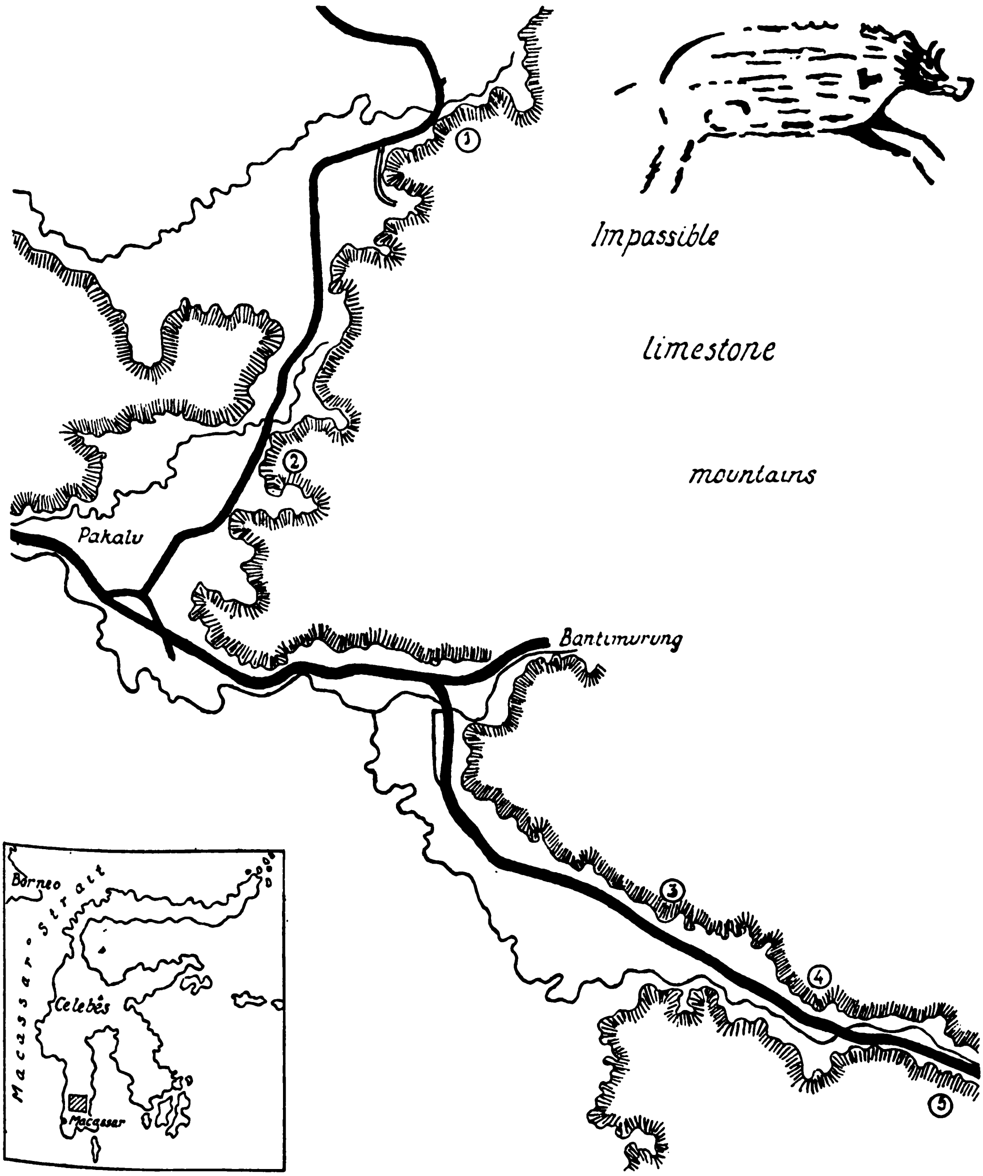

Fig. 25. Toalean sites east of Maros, Southwest Celebes.
1. Leang PattaE; 2. Leang Burung; 3. Leang DjariE; 4. Leang Saripa; 5. Leang Karassa'.

but minutely chipped all around the edges. Shell scrapers and points did not occur frequently in this rock-shelter. A few pebbles, bruised at the ends, may have served as hammer or rubbing stones, since one of these displayed traces of red pigment. The following tools were listed: 17 winged and serrated stone arrow-heads, 5 serrated stone arrow-heads straight or rounded at the base, 1 serrated and tanged stone projectile point, 1 stone showing traces of sawing, 1 stone showing hole boring, 16 tanged stone tools, 19 convex-based points, 6 scalene triangles, 5 battered-back blade-points, 6 gravers, 118 primary flakes, blades and bladelets without secondary work, 19 crude blades, 12 cores, 4 pounding stones, 4 shell scrapers, 14 shell points, and 1 bone assegai point.

On February 26th, when the first sector was being excavated, Mrs. C. H. M. Heeren-Palm was inspecting the interior of the cave when suddenly she discovered, at the end of the cave on the ceiling, several negative hand-stencils on a red background. In total 7 hand-stencils were spotted. Against one of these a crescent-like shape in red was observed, a little further a figure with five oblong stains, perhaps representing another hand-stencil. It became evident that in prehistoric days left hands had been spread with the palm against the ceiling and a red pigment splashed or spat all around them. Splashes of red paint on nearly all hands proved that the stencils were made one after another. In many places the red pigment had blistered so badly that many details were lost. All were stencils of left hands, with slender fingers probably belonging to women. Next day I found in the same tunnel, a little further inwards and on a lower part, a fine contour drawing in red striped-line technique of a charging boar with 5 or 6 tufts of hair on its neck and back. On the head were 2 horn-like objects. D. A. Hooijer, palaeontologist and zoologist, to whom I sent a reproduction, observed that the horns were bent with the crooked part forwards instead of backwards. As a matter of fact they were portrayed in the same way as the tufts on the back and neck. This is all the more remarkable as Babyrousa, of which the slender legs and clumsy body remind us, has no hair at all. In the cardiac region an object was pictured, evidently a spear-head. Is it possible that we are here dealing with a symbol of sympathetic magic, expressing the wish to strike the game in its most vulnerable spot (Pl. 59, 60)?

After the discovery of the rock-art in the PattaE Cave, we set out to search for rock-paintings in other caves in the same valley. On March 5th we found a steep rock wall with a small niche bearing 3 hand-stencils more than 8 m. above ground-level which made inspection rather difficult. All stencils were again of left hands. In the same rock wall is a fissure which after 10 m. turns to the right and opens into the outside again. On March 19th we noticed on the ceiling near the entrance several faded hand-stencils; it was impossible to fix the

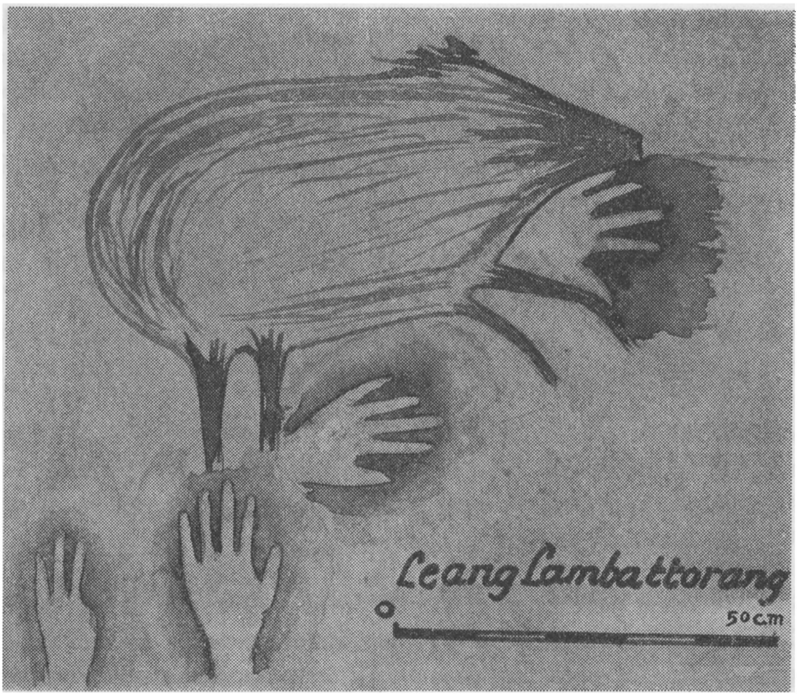

Fig. 26. Painting in red of Babyrousa and three negative hand-stencils. Leang Lambattorang, Southwest Celebes.

number. Near the exit was a distinct hand-stencil, this time of a right hand and against the side wall were traces of a second one. We have called this site the Burung Cave (Pl. 61).

In the meantime C. H. J. Franssen reported the discovery of hand-stencils in a cave near the Chamba Road, situated near the hamlet Semangi and close to the Saripa Cave. On March 26th I visited this cave for the first time in the company of Franssen. It was a large complex of caves, galleries, tunnels and large and small halls. Immediately near the entrance were two groups of hand-stencils of respectively 7 and 5 hands, but here too the pigment was severely weathered and blistered. Further inward on the right wall were 4 hand-stencils, one of them showing only four fingers, another three. Of the third hand-print the fingers were tapering like those in the PattaE Cave. Higher up in a small cave in the wall which can be reached only by using a ladder, we found 2 groups of hand-stencils, the first group consisting of 4, the second of 5 examples. From the last group the thumbs were missing. Finally in a fissure we counted 4 damaged hand-stencils, making a total of 29 in this cave complex, which we have named the DjariE Cave. On our last visit to the cave in April 1968 we also spotted a faded lower arm and hand printed on the outer wall. Till then we had noticed that all hands were rather small and slender, but this was the print of a large hand.

We also revisited the Leang-Leang Valley and found all rock-paintings except one. Tropical thunderstorms in the afternoon put an end to our investigations. When we took shelter at the village-officer's house near the PattaE Cave, we learned of a new rock-painting found in the neighbourhood, in a cave called Leang Lambattorang. Although we were all possessed by the same desire to visit this cave, it was not possible. Soejono, Mulvaney and others later paid a visit to the cave and made a drawing of the painting; it was that of a Babyrousa and three hand-stencils. More hand-stencils, forty in all, were found on other parts of the rock-wall (Fig. 26).

There exist various conceptions of the meaning of hand-stencils. Some say they were signs to ward off evil or were prohibition signs. Others consider them attributes of ceremonial mourning customs which required the widows to amputate a digit, by preference the little finger. As a matter of fact, many hand-stencils on rocks in Australia (but also in Western Europe) demonstrate mutilation of one or more fingers. In the Gargas cave in France there are more than 200 hand-stencils of which many show the same mutilation. After serious study, however, it became apparent that mutilation could be simulated by bending the finger inwards thus causing the effect in a less painful way. In this context it is worth noticing that of the hand-stencils in the Maros caves the thumbs in particular are missing, and thumbs can easily be hidden under the palm. It stands to reason that we do not possess convincing evidence as to whether the four and three-fingered hand-stencils are prints of mutilated hands or not.

The associated fauna of the Toale Industry is, geologically speaking, not very old, as all species were found to belong to a recent fauna. This has become known recently through Hooijer's outstanding monograph.[140] Even a mineralized lower jaw found in a cemented bank of the Burung Cave proved to be of *Sus celebensis* which still lives on the island. Hooijer described the fauna excavated from the Bola Batu, Tomatua Katjitjang, Sebang, Panisi Ta'buttu, Pangreang Tudea and Batu Edjaya caves.

MARSUPIALIA

Phalanger ursinus Temminck. Rare, represented only by some mandibles and teeth. In some caves larger than the present-day species.
Phalanger celebensis Gray. Found in various caves.
Phalanger celebensis callenfelsi. A large, new form, discovered in the basal layer of the Panganreang Tudea Cave.

INSECTIVORA

Suncus murinus L. Only a calvarium, excavated from the Bola Batu.

PRIMATES

Homo sapiens L. Skull fragments and mandibles in various caves.
Macaca maura Geoffr. et F. Cuv. of frequent occurrence in several caves.

RODENTIA

Lenomys meyeri Jentink.
Rattus dominator Thomas.
Rattus sp. cf. *xanthurus* Gray.
Rattus sp. cf. *rattus* L.
Rattus sp. cf. *coelestis* Thomas.

CARNIVORA

Macrogalidia musschenbroekii meridionalis. Discovered for the first time in this area, still living in the Minahassa.

ARTIODACTYLA

Sus celebensis Müller et Schlegel. Oldest remains in caves belong to a species smaller than the present-day Celebes wild pig; the increase in size has been gradual.
Sus celebensis sarasinorum. Found in the Bola Batu.
Babyrousa babyrussa L. Now vanished from the southwestern part of Celebes. Oldest examples in caves larger than the Babyrousa still living in Central Celebes.
Babyrousa babyrussa bolabatuensis. A new subspecies from the Bola Batu.
Anoa quarlesi Ouwens. Oldest remains in caves are slightly larger than the present-day species.
Anoa depressicornis Smith, rare in the Toalean caves.

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[140] Hooijer, '50a.

During his investigations Hooijer noticed that the present fauna had smaller dimensions than that of the cave remains. *Sus celebensis* alone is a notable exception: the pig, which still exists in Celebes, is larger than its prehistoric ancestor.

DISTRIBUTION OF THE SPECIES OVER THE TOALEAN SITES
ACCORDING TO DR. D. A. HOOIJER

	Sarasin 1905	Tjiani	Panisi Tabuttu	Panganreang I	Panganreang II	Batu Edjaya	Tjadang	Lampoa	Bola Batu	Karassa'	Saripa	PattaE
Phalanger ursinus	×		×	×	×	×			×	×	×	×
Phalanger celebensis	×			×	×	×			×	×	×	
Suncus murinus									×			
Macaca maura	×	×	×	×	×	×	×		×	×	×	×
Homo sapiens	×			×	×	×	×	×	×	×		
Lenomys meyeri	×			×	×	×			×			
Rattus dominator				×	×	×			×			
Rattus cf. xanthurus			×	×					×			
Rattus cf. rattus			×			×			×			
Rattus cf. coelestis									×			
Macrogalidia musschenbroekii							×		×			
Sus celebensis	×	×	×	×	×	×	×	×	×	×	×	×
Babyrousa babyrussa	×		×	×	×	×		×	×	×		×
Anoa quarlesi	×	×	×	×	×	×	×		×	?		
Anoa depressicornis		×		?	?							

In 1948 Franssen performed a small excavation in the Lampoa Cave, situated on the Chamba Road, east of Maros.[141] He exposed a culture related to the Toalean, but without barbed or winged stone arrowheads. Hooijer stated that the mammalian remains from this cave belonged exclusively to Babyrousa. A human skull which was assembled inexpertly by the finder was sent to Surabaya for study. There were numerous gastropods, which have been examined by W. S. S. van der Feen Jutting in Amsterdam. The most frequent were *Brotia perfecta* Mousson, *Neritina pulligera* and *Neritina iris Mousson,* and then *Thiara crenulata* Deshayes. All these species together were formerly called *Melania.* Oysterlike molluscs are *Batissa violacea* Lamarck and *Polyme-*

[141] Franssen, '49, 331-39.

soda suborbicularis. The latter was formerly named *Cyraena*. The shells, of these molluscs in particular, were used by the cave-dwellers for the manufacture of scrapers. Finally there were a few examples of two kinds of land snails: *Hemiplecta rugata* and *Cyclotus fasciatus* Martens.

In the foregoing pages we have summarized the investigations of the Toalean for a period from 1902 to 1968. During all these years excavations were concentrated on cave-mouths and rock-shelters. In total 19 cave excavations were undertaken and in 5 caves rock-art was encountered. The caves were situated 30 to 481 m. above sea-level. The great majority had only shallow occupational deposits ranging from 40 to 150 cm. Only one cave had a depth of more than 300 cm.

On the walls of the caves we sometimes saw cemented shell banks 50 to 100 cm. above the present surface. This was caused by water containing lime from the cave-roof and dripping along the wall where it evaporated leaving a hard layer of calcite. This layer contained mineralized shells, bones and sometimes stone artifacts. The best example of this phenomenon was observed in the Burung Cave (Pl. 62), and traces of it in the Leang Karassa'. To judge from the finds, the Toalean is a real microlithic industry with a remarkably large number of geometric microliths, thus far the only one found in Indonesia. Tanged or stemmed tools have mostly been found in the basal strata, and winged and denticulated points and Muduk fusiform bone fish gorges in the upper layers mixed with some potsherds.

In view of Mijsberg's studies on the present-day Toale from Lamontjong and Hooijer's on sub-fossil human remains from the Bola Batu, Sarasin's concept of the Toale and their ancestors as being impure Veddahs must be rejected.

In many Toale caves human remains have been encountered, such as mandibles, parts of skulls, one artificially perforated, and fragments of other bones, but a complete skeleton, or even skull, has never been dug op. It is evident that the cave-dwellers of Southwest Celebes did not bury their dead in caves. There is reason for thinking that they buried them outside the caves or exposed them in trees; then after long exposure had removed the flesh, the bones were assembled and distributed among the relatives, who wore them as mementoes. This is still the custom among the Negritos of the Andaman Islands and among some Melanesian and Australian tribes. The Kurnai in southwest Australia carry on their chests the mandible stringed together with shell ornaments. A. R. Radcliffe Brown [142] reported of the Andaman

[142] Brown, Radcliffe-, '33, 112-113; see also Man, '32.

islanders: "The bones are generally dug up by the men who performed the burial. They ... proceed to the grave or tree and dig up or take down the bones and weep over them. These are then washed in the sea or a creek and are taken to camp. Here they are received by the women who weep over them in their turn ... The skulls and jawbones of deceased relatives are preserved for a long time, and are worn round the neck either in front or behind ... The other bones are also preserved [but] ... are not treasured as much as the skull and jaw, and are often mislaid." Thus whereas every camp is sure to contain a number of skulls and jawbones, it is comparatively rare that limb bones are to be found.

The Toalean is geographically so isolated, its character so esoteric, that it is difficult to imagine the nature of any link with Asian continental microlithic industries such as have been well-known over long periods in India or in the Ordos Desert of North China. More than once I have stated that the Toalean contains peculiar Australian elements such as the stone Pirri point, the Muduk bone point, the serrated projectile point and geometric microliths, all well known from Southeastern Australia Bondi Industry which has a rich development of geometric microliths and is also observed in association with rock-paintings in red and negative hand-stencils. The serrated stone projectile points, however, stem from the Kimberleys of northwestern Australia or more probably from Japan. It is clear therefore that in prehistoric times there must have been some connection between Australia and South Celebes. An attempt should be made to find a line of communication, such as links through the intervening islands where watergaps are relatively short and suitable for crossing by simple, mobile sea-faring groups of people. The paucity of archaeological data makes it difficult to decide upon the centre of origin and patterns of movement. In this context it is interesting to note that negative hand-stencils and rock-paintings of corresponding style have been found over a vast territory, namely in Southwest Celebes, Ceram, Portuguese Timor, Kei Islands, New Guinea around the MacCluer Gulf and Southeast Australia, which suggests a single large cultural area. But of course the existence of a culture cannot be established on the basis of rock-paintings alone. The main objection to the above suggestion is that the flake-blade industries found in Flores, Timor and New Guinea, are, contrary to expectation, not strictly comparable with either Bondi Industry or the Toalean of South Celebes, although there are certain resemblances in some cases. Excavations so far have failed to yield geometric microliths which are the key types of both the Bondi Industry and the Toalean. Therefore further conclusions cannot be confidently drawn before all links in the chain are available.

All my investigations on the Toalean took place before the year 1950, i.e. before the advent of radio-isotope dating. My dating, therefore, could be established on a relative basis only. The Australian Expedition in 1969 has concentrated on the Toalean and will perhaps succeed in obtaining some absolute dating by means of radio-carbon 14 which at present is the most appropriate method, covering the last sixty millennia.

I am inclined to believe that Australia is the homeland of the geometric microliths and the rock-paintings, and that both reached Celebes through cultural diffusion and not by migration of people.

b. *The Stemmed Blade Industry of Timor*

Timor and the islands of Roti and Savu belong to the outer arc of the Sunda mountain system and are without recent volcanic formations. Timor is built up of Permian and Tertiary igneous rocks with mountains 2000 - 1500 m. high. Marine sediments were intensely folded in the Tertiary period. Following a plio-pleistocene sedimentation, there was a vigorous uplift; in the central part of Timor reefs were elevated to 1250 m. above sea-level, and in the Nikiniki district to 750 m. The island is populated mainly by Melanesoids. The Atoni in the mountains depended for their livelihood upon food-gathering and root-crop growing before their contact with Indonesian-Malay immigrants. When crops fail, they return once more to a food-gathering economy. Timor has a savanna landscape with no undergrowth in the dry season and open grasslands with white-trunked *Eucalyptus*. Some archaeological work was undertaken in 1935 by W. Meyer and A. Bühler, and later by Willems, in caves. The artifacts excavated can be classed among the specialized flake-blade industries, and partly among the evolved Hoabinhian (Pl. 71). Fine tanged or stemmed blade knives and points, strangulated or waisted blade tools in combination with small monofacial choppers constitute remarkable elements in these caves.[143] Stone tools were intermingled with potsherds. The main excavations were carried out at Nikiniki 22 km. from the south coast and 750 m. above sea-level. There was a 20 m. high and 200 m. long limestone wall with 7 rock-shelters near the Noi Fa'tu River. The westernmost cave, 12 m. high and 8 m. deep, was chosen for excavation; an artificial arrangement of rocks, 1 m. thick formed a barrier across the entrance. From the

[143] Sarasin, '36.

upper level some painted potsherds, an iron knife and a Chinese dish were discovered. Then came a stratum of brown soil with broken stones, snail shells, 1 m. thick and containing 2 potsherds with incised ornaments and 22 tanged points and knives of yellow, brown and red jasper, triangular in section, some core tools, reddish potsherds some of which with incised ornaments, a *Dentalium* shell probably used as a signal flute, and further a great number of primary flakes and blades, some leaf-shaped. There were no retouches except for the stem and on the middle part of the waisted tools. The blades had a distinct cone of percussion. Among the primary flakes were some borers and scrapers. Apart from the abovementioned finds, some rubbing stones were recovered bearing traces of red ochre, and an *Ovula* shell with parallel horizontal lines, and some nuts (*Aleuritus moluccana*). Core tools made of grey-blue chalcedony and brown jasper were monofacially flaked, occasionally with alternative retouched sides. At a depth of 135 cm. the bedrock was reached.

The explorations were extended into Portuguese Timor at the floor of the Fatu Matobia massif, south of the harbour of La'ga. A rock-shelter, 7 x 5 m., was excavated at Baagnia, 420 m. above sea-level. The occupational deposits consisted of green loam with chalk cinders. A wall of piled-up stones stood across the entrance of the shelter. In a shallow upper layer only potsherds and a scraper of bone were recovered. This was followed by a 45 cm. thick layer with potsherds, some bones and silex primary flakes. At a level of 80 cm, a single pebble was found; from 100 to 120 cm. much ash and potsherds came to light and from 180 to 190 cm. silex flakes and potsherds were encountered. At a depth of approximately 200 cm. the bedrock was struck. There were no specialized stone tools and the potsherds were not ornamented.

Before finishing with Timor, we have to mention that Ruy Cinatty[144] reported interesting rock-paintings on steep cliffs and in caves in the Tutuala region on the north coast of Portuguese Timor. Most of these were of great vitality. There were frescoes with war-dancers, running human figures and abstract geometric totemistic signs, "spirit-boats", and a negative stencil of a left hand on a red background. The human figure was predominant. In style and technique these red paintings resemble the rock-art of New Guinea and the New England Tableland in northern New South Wales, Australia (Pl. 64, 65, 66, 67, 68, 69, 70).

[144] Cinatty, '63.

c. *Cliff-Paintings on Ceram*

So far no archaeological excavations have been carried out on Ceram, the largest island of the Moluccas. In the year 1937, however, Röder was making a reconnaissance on the island when he was lucky enough to discover a series of cliff-paintings along Seleman Bay in the north-central part. The paintings were found on a smooth vertical rockface near the village of Rumasokat. Although the paintings, found at five different places, belonged to an age not yet defined, two different groups could be distinguished, one with rather weathered and faded red figures, the other with well-preserved white figures. Röder regarded the red paintings as the oldest and the white ones as belonging to a later period.

The variety of symbols portrayed is great — no two are alike except for a number of well-defined hand-stencils where the hand was placed on the rock and red pigment was sprayed all around it. Furthermore there were lizards, a man with a shield, and a squatting human figure with raised arms, all in red. Most of the designs were in outline only, others were filled in with red ochre. Among the white figures was a picture of a bird and of a canoe.

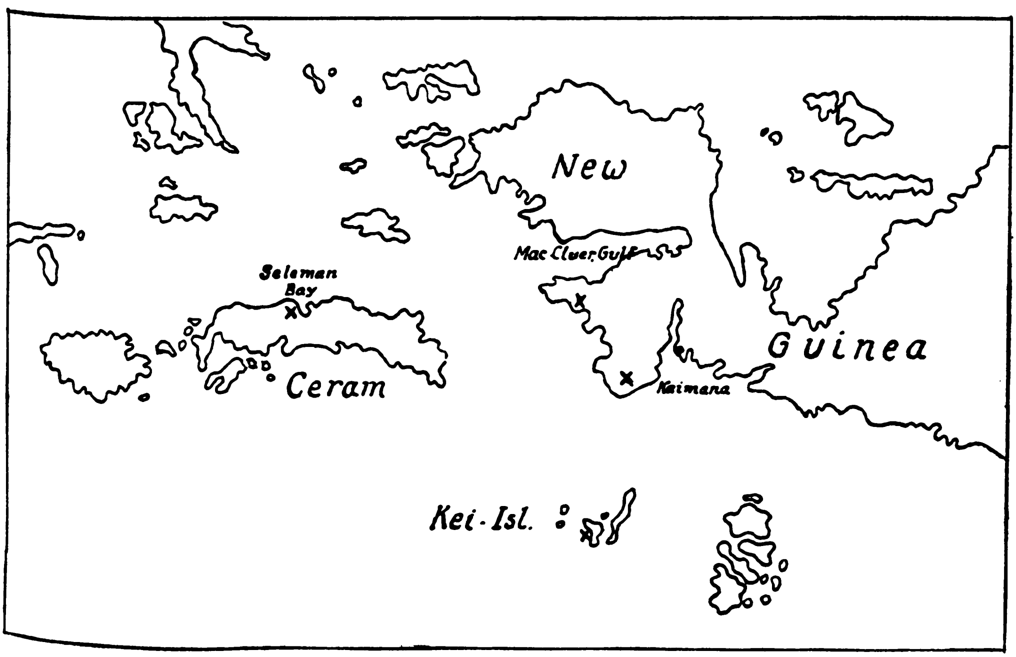

Fig. 27. x Rock-paintings in New Guinea, Kei Islands and Ceram.

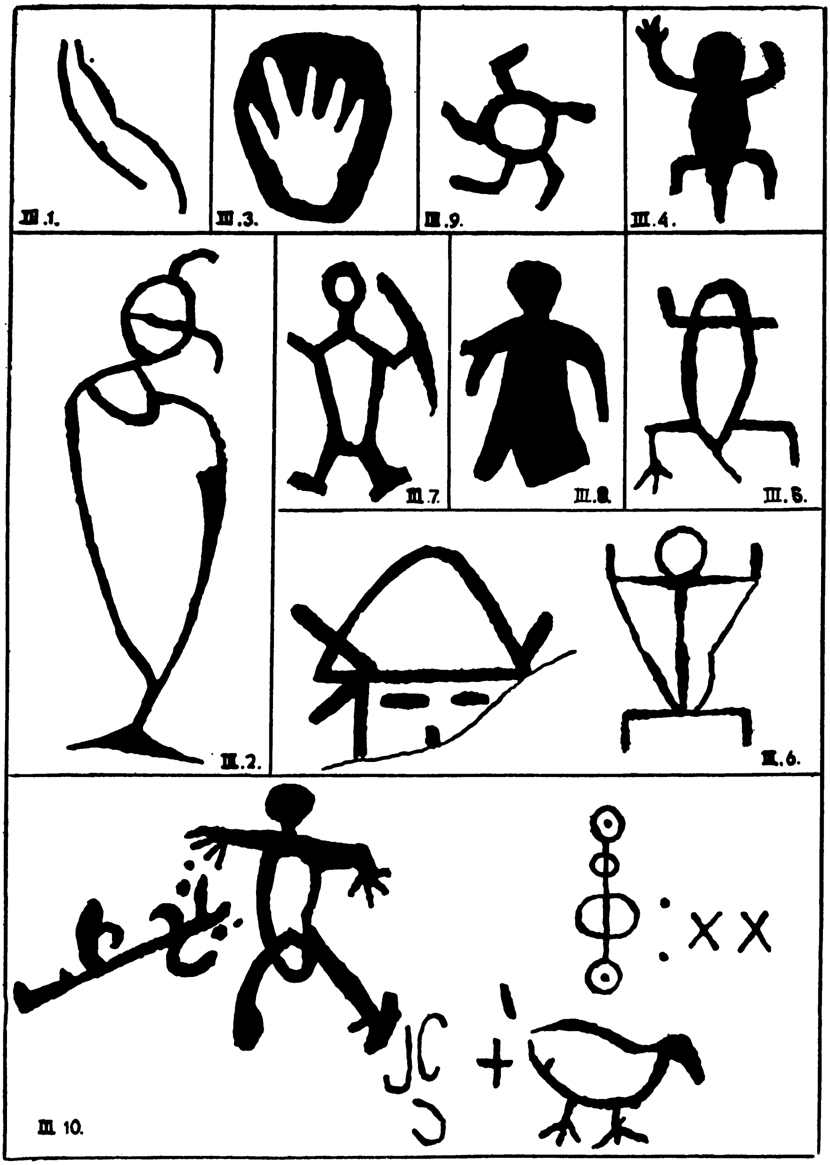

Fig. 28. Cliff-paintings on the north-central part of Ceram.
1—9 in red; 10 in white.

after Röder and Hahn

We have no certain knowledge of the use or purpose of the paintings. They may have had a mythological meaning or may be symbols of heroes and spirits, or perhaps they expressed a totemic relationship between man and the depicted animals, associated with unknown ceremonies. Without further information about old local myths, no true interpretation is possible (Fig. 28).

In the southwestern part of the same island, Röder also found more than a hundred rock-engravings, all in outline only, in the upper course of the Tola river and at other places in the same area. The figures displayed on steep rock-faces were executed by means of grooving and by conjoined punctures, but there were also figures of deer, bird, human, boat, sun-symbols and eye-motifs. Similar figures have been reported from the southern and northwestern parts of the island but these were not visited by Röder.[145]

d. *Rock-Paintings on the Kei Islands*

Jacobson was the first to report on the occurrence of a great number of rock-paintings and negative hand-stencils on a red background on one of the Kei islands called Little Kei, located south of the western part of New Guinea.[146]

The paintings were executed on the rock-face of galleries and coves, 10-12 feet and 8-10 feet respectively above the present sea-level. Many figures are in outline only, others are filled in with red pigment. To the last category belong all humanoid figures. Besides numerous negative hand-stencils there are mask-like figures, sun-symbols, squatting human figures with legs widely spread and raised arms, men with a shield, dancing and fighting people, people in a canoe, a bird and some geometric figures, all done in the style with which we are familiar from Ceram, Timor, New Guinea and southern Australia (Fig. 29).

e. *Cave and Cliff-Paintings in New Guinea*

In 1937 Röder of the Frobenius Expedition made a study of the rock-paintings of the coastal area of the westernmost part of New Guinea (now called Irian). The paintings were found to extend over a distance of roughly 30 km. along the south coast of MacCluer Bay between the hamlets of Rokas and Goras and on some islands off the coast, named Pulau Ogar and Pulau Arguni. They occur in shallow

[145] Röder, '38a.
[146] Roland, 1896, 178-79.

Fig. 29. Rock-paintings on Little Kei.

caves, coves and galleries created by sea action before the uplift of the land, and are at present mainly located at 2-4 m. above sea-level. Some paintings, however, were discovered in steep, inaccessible places, high up, 10-15 m. above the sea (Fig. 30, 31, 32, 33, 34, 35).

In general the paintings are comparable with those of Little Kei, save for a few details. Röder grouped the rock-paintings according to colour and style. Black figures were found to overlie red ones, with white figures, in their turn overlying the black ones. Therefore the red figures are the oldest, followed by the black ones, and the white paintings are the most recent. The great majority belong to the oldest, red group. There are rock walls with frescoes extending over entire galleries and cave walls. Some figures are as large as 1 m., but generally they are much smaller. There are semi-human and semi-animal figures, human figures with pointed cap (Fig. 34), squatting humans with raised arms, and lizard-ancestor pictures with the skeleton bones painted in (Pl. 72, 73, 74, 75, 76, 77). The latter are called *matutuo* by the local population and are supposed to be ancestral heroes. The population still hold festivities and offerings and ceremonial dances in honour of these figures. Apparently this type of picture suggests equality of man and animal and clan totemism.

Most characteristic once more are dozens of negative hand-stencils on a red background. According to an ancient myth the ancestors came from the east, from a land where the sun rises. These ancestors were blind and groped their way along the rock walls, leaving imprints of

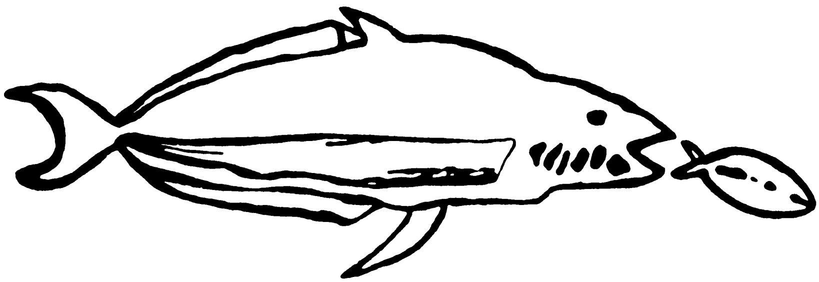

Fig. 30. Fish. Arguni Island. New Guinea.

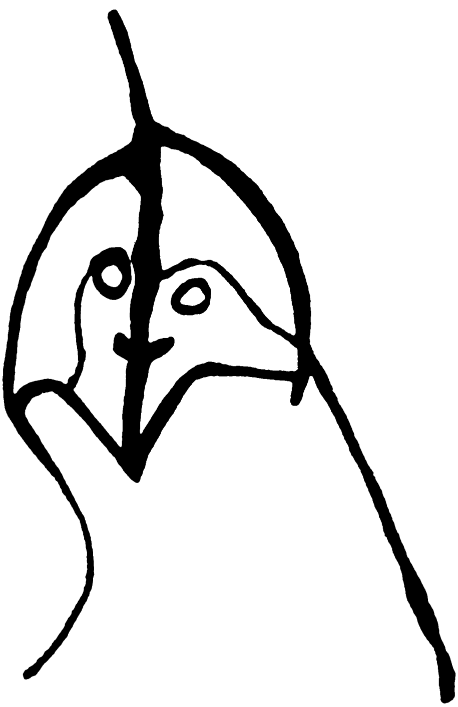

Fig. 31. Masked human figure.
Arguni Island.

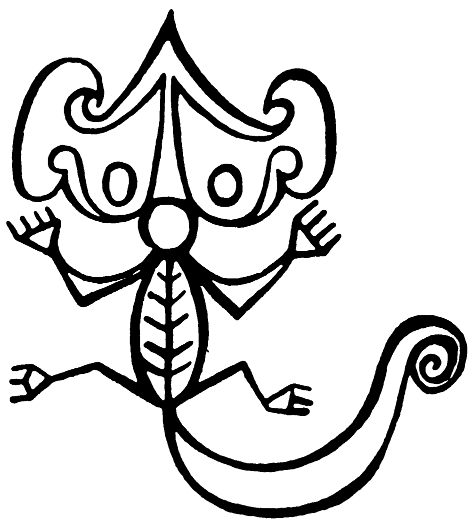

Fig. 32. Lizard with internal organs
and human masked head.
Arguni Island.

after Röder and Hahn

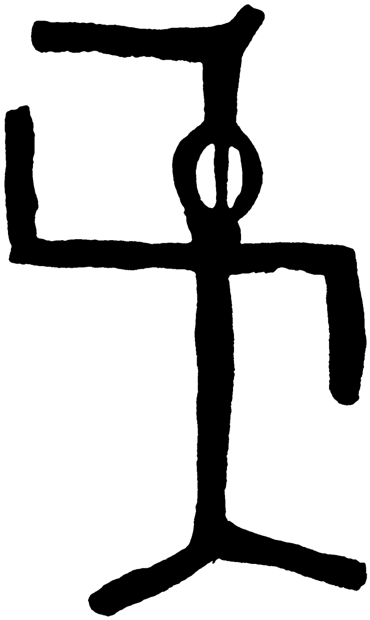

Fig. 33. Human figure. Ota Island; simple stick-figure.

Fig. 34. Male ancestor picture. Arguni Island.

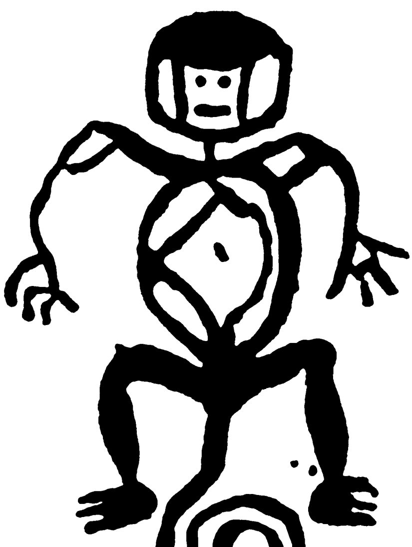

Fig. 35. Male ancestor picture. Arguni Island.

after Röder and Hahn

their hands, and less often of their feet, on the walls. They went further westwards where their eyes opened and where they became the ancestors of the lighter coloured people of the area. The hand-stencils are said to have protective powers and were made to ward off evil. Women are forbidden to look at them. Apart from hand-stencils and composite figures of man and animal, zoomorphic and anthropomorphic, there were conventional symbols and magic ones, such as tectiforms, spirals, grotesque masks representing ghosts, and a wide range of sun-symbols including the swastika. Furthermore there were men with shields and boomerangs, birds and canoes.[147] The use of these symbols must have been a very long tradition. Similar figures have turned up as *tapa* ornaments, at burial rites, connected with head-hunting festivals and as tattoo signs, on wooden walls, on shields and bead work.[148] A trial excavation carried out in the Dudumir Cave which has a great number of paintings on its walls, yielded three cultural layers. From bottom to top these are:

1. Trimmed flakes, some bladelets with alternative retouches along the edges and no potsherds.
2. Red potsherds and some flakes and blades among them with facetted striking platform.
3. A great number of potsherds with relief ornaments, but no stone flakes and blades.

Finally Röder found remains of ancient burials: decayed wooden coffins placed on wooden supports in which the deceased were supposed to travel to the beyond.

f. *Java*

During the years 1930 - 1935 A. C. de Jong and G. H. R. von Koenigswald made a great collection of obsidian flakes, all surface finds, found in abundance on the Bandung Plateau in West Java. The flakes were found lying at 23 different sites, situated about 723 m. above sea-level and mainly centred on ridges and hill tops around a lake which has since vanished. At the same sites, potsherds and pieces of red ochre were picked up. We still do not know whether the potsherds and the flakes are contemporaneous. In particular east of Dago are

[147] Röder, '38b, '40, '56, '59.
[148] Kooijman, '63.

four rich sites which together yielded more than 10,000 primary and some chipped obsidian flakes (Fig. 36a). The raw material was supplied from the neighbourhood of Nagrek, a small village where numerous obsidian bombs lie on the surface.

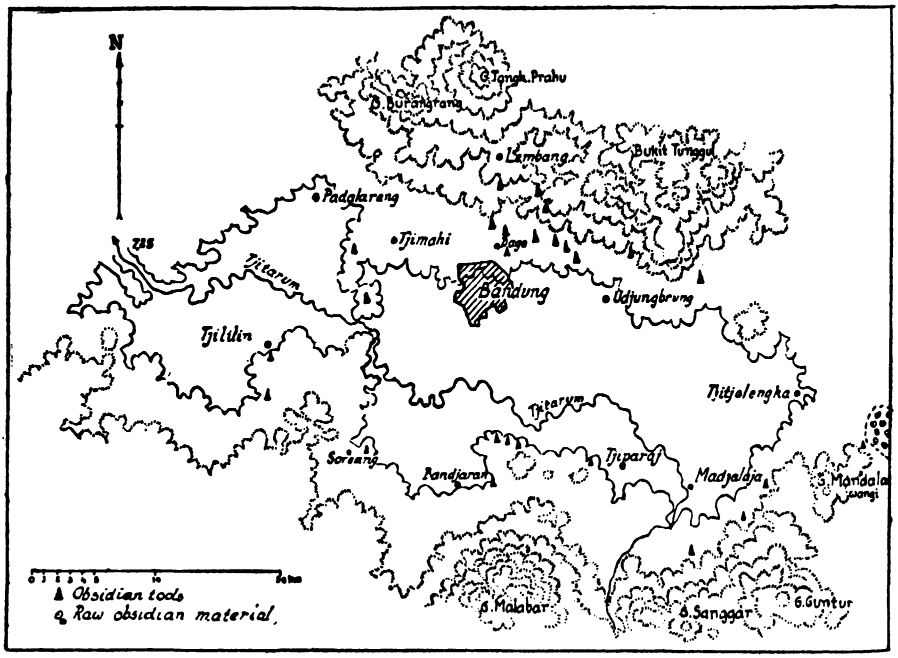

Fig. 36a. Prehistoric sites with obsidian flakes and blades round a vanished lake near Bandung.

The implements are rather small, but are certainly not microlithic as claimed by some authors,[149] as geometric forms are lacking. 95 % of the flakes are made of obsidian, the remainder of chert.

From a more recent paper of Bandi [150] it appears that in the years 1932 and 1933 J. Krebs also made a collection, principally near Dago. He donated his collection to the Basel Museum in 1936. This museum received collections from the same area from W. Mohler and W. Rothpletz. Both began their collections during the Japanese occupation in the years 1942 - 1945. Von Koenigswald's assumption that the sites

[149] Von Koenigswald, '35.
[150] Bandi, '51.

were strictly limited to places around the old Bandung lake is not tenable, as Rothpletz proved that there are sites with similar obsidian flakes up to more than 1300 m. above sea-level, and D. A. Erdbrink [151] found these on the Lembang Plateau south of Bandung, 1000-1500 m. above sea-level. It would be interesting to find out by statistical analysis the percentage of specialized tools in the bulk. That would mean that one has to do more than just pick up good pieces from the surface, as was done by the collectors. Special mention must be made of the first attempt in this direction by members of the Archaeological Service of Indonesia. The trial excavation of a newly discovered site near the Lake of Leles is a recent affair (1968). Unfortunately the flakes together with some potsherds were found on the surface only, and digging deeper down remained without results and did not yield a representative cross section.

The nature of the soil was responsible for the disappearance of all perishable material, and even zoological data were lacking. The age of this industry is uncertain as there is no stratigraphical evidence for building up a relative chronology. Our limited knowledge is based on Bandi's paper. Bandi states that the assemblage shows a lack of uniformity. The main part of the collections consists of primary flakes and waste products. True blades are scarce. Among the well-worked and retouched flakes are 291 with edge-chipping as a result of use, and 159 with marginal chipping. There are 239 typical implements such as slender projectile points of the Pirri type, side and core scrapers, gravers and naturally backed knives (Fig. 36b). Marginal retouches are almost always confined to the upper face. The projectile points usually have a chipped butt-end to facilitate hafting and are retouched along one long margin. There are a few irregular trapezes. The collection worked on by Bandi comprises 889 flakes which have been divided as follows: 49 projectile points, 46 shouldered scrapers, 25 core scrapers, 62 scrapers, 21 gravers, 11 borers, 5 knives, 10 special forms, 159 retouched flakes, 291 flakes with retouches as a result of use, 201 primary flakes, 9 shouldered core scrapers. This kind of typology, however, is an uncertain procedure as it cannot give a true picture of the composition of the total assemblage because only the better looking specimens were collected. The tool-kit as a whole is not suited to big game hunting or butchering large animals. Perhaps it is designed for a fishing-and-collecting economy supplemented by an incipient horticulture and em-

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[151] Erdbrink, '42.

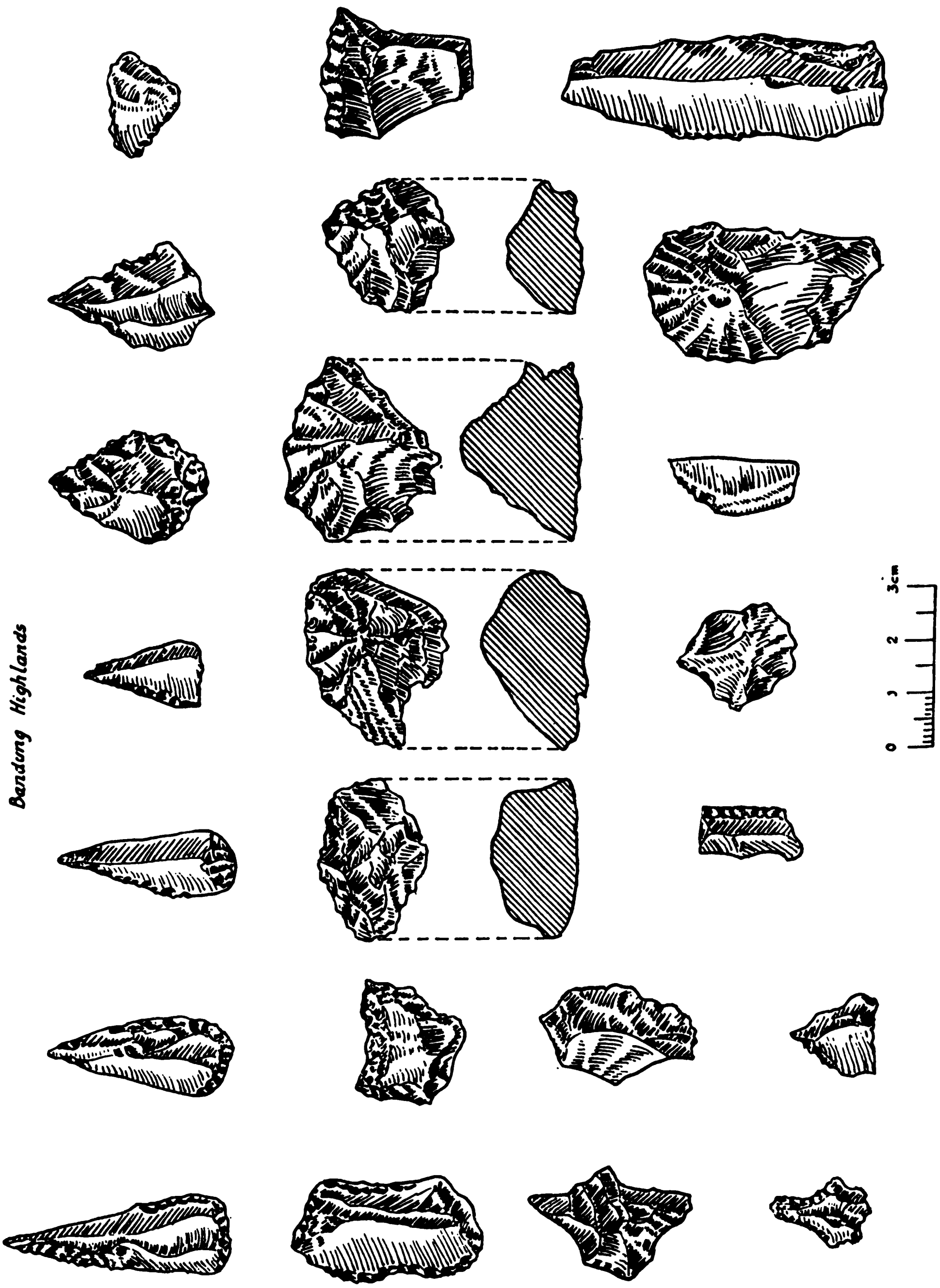

Fig. 36b. Obsidian implements from the Bandung Highlands.

ployed in the processing of plant material. This supposition is based on admittedly slight evidence and should receive further study. The flake industry which has been preserved is but a pale reflection of the original culture.

In many caves in East and Central Java, flake industries were known and have been found side by side with Sampung spatulas, antler daggers, bone points of the Muduk type, shell scrapers, shell ornaments and haematite. Especially in the Tuban caves in the Northern Limestone mountains, excavated by Willems in 1938, there are many primary flakes and well-struck blades. These flake industries have never been properly studied, and Van Stein Callenfels did not even mention them. It is a difficult question, therefore, to determine exactly whether or not these are specialized flake industries. If I understand rightly, on the slender basis of the occurrence of specific types such as Pirri points, borers, knives and scrapers, they should be classified as specialized flake industries. Any further study of this subject might well probe in that direction.

Finally Franssen [152] collected a series of waste products and small flakes of obsidian, jasper and silicified limestone in the eroded valleys of a reddish brown lateritic soil on the edge of a recent volcano mantle of the Salak Mountain of Leuwiliang, Bogor, West Java.

g. *Sumatra*

In 1913 August Tobler from Switzerland made an exploratory excavation in the Ulu Chanko Cave in Djambi, upstream between the Maringin and Batang Tabir Rivers. The cave is situated in the limestone range which in some places is interserted by volcanic intrusions.[153]

In addition to 12 cores, the finds comprised 3 arrow-heads, 4 core-scrapers, 13 scrapers, 4 gravers, 2 borers, 14 retouched flakes, 123 flakes with edge-chipping as a result of use and 118 flakes with marginal retouches. Tobler's finds, all made of obsidian, show a remarkable likeness to the obsidian items of the Bandung Plateau, West Java. The very few human skeletal remains from the cave were cranial fragments, small teeth, a fragment of the lower jaw with chin eminence, fragments of humerus, tibia and femur, showing a human race of rather small stature. The fossa olecrani of the humerus was artificially perforated. The finds are now in the Ethnological Museum in Basel, Switzerland.

[152] Franssen, '41, 531-45.
[153] Sarasin, '14.

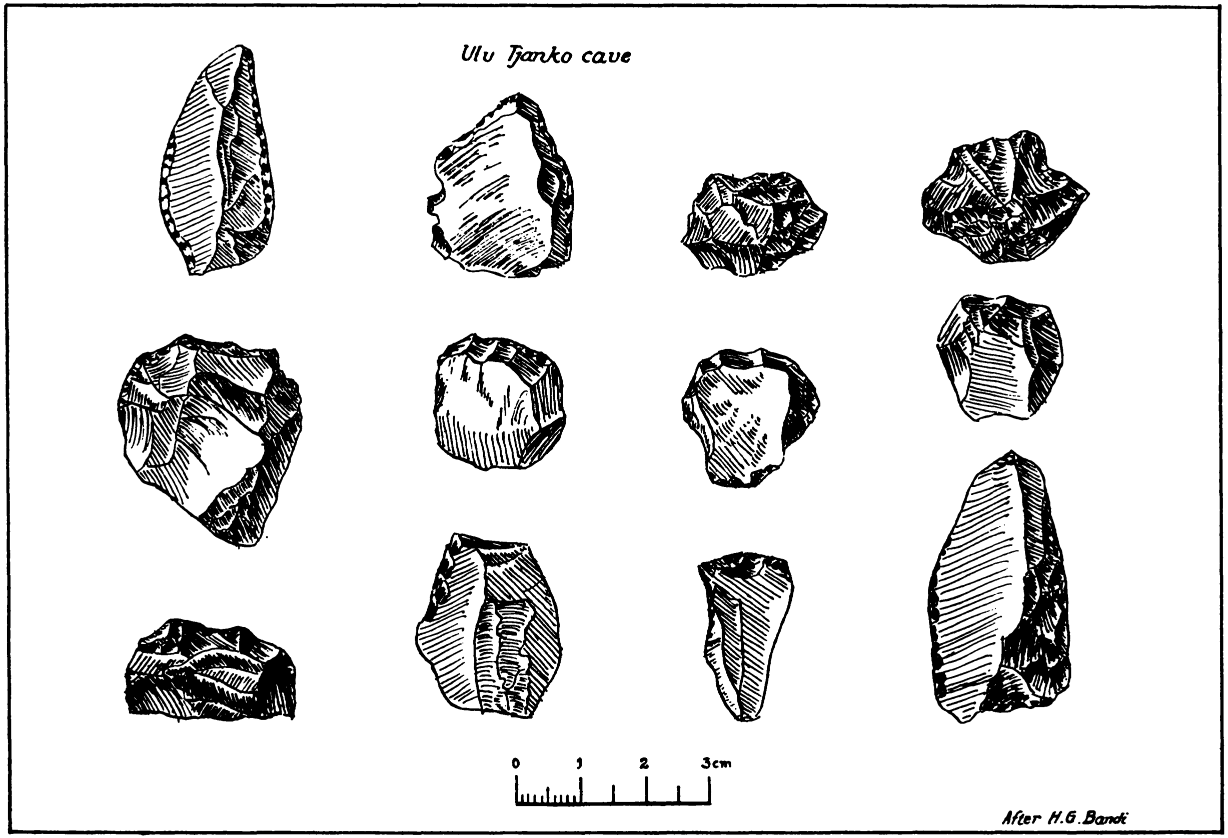

Fig. 37. Obsidian implements from the Ulu Chanko Cave, Djambi, Sumatra.

Some years later, J. Zwierzycki [154] dug up a similar industry in a cave near Ngalan in the same area during the Palaeobotanic Djambi Expedition. The artifacts were made of obsidian and other stone. These finds are kept in the Geological Museum of Bandung (Fig. 37).

In July 1939 Van der Hoop [155] collected surface finds, i.e. obsidian flakes, in the Danau Gadang Estate near Lake Kerinchi, East Sumatra. The flakes were found lying near the lake, 783 metres above sea-level. Generally the flakes were much larger than those found in the caves.

6. UNSPECIALIZED FLAKE-BLADE INDUSTRIES

a. *Diagnostic*

The distinguishing characteristic of what is called an unspecialized flake industry is an extremely low percentage, less than 1 %, of intentionally shaped and retouched artifacts in the total quantity.

When examining a representative collection of flakes, it sometimes becomes clear that, on the whole, no attempt has been made to obtain flakes of definite, predetermined shape. No specific core preparation is detectable, and flat sided cores are flaked in all directions. Although most flakes may show a bulb of percussion, indicating the spot of detachment from the parent mass, their shapes are arbitrary, haphazard, and irregular in outline. Such poor results are usually caused by poor flaking technique, and not by the use of less suitable raw material. For instance, we have found unspecialized industries based on obsidian, a material which is easily flaked and worked into shape.

Unspecialized flakes with a primitive, archaic appearance do not necessarily imply great antiquity. In the 19th century the more distant tribes of the Andaman Islands, who were negritic Mincopies, were still using stone flakes. These flakes were struck at random from pieces of quartz, and suitable ones were used only once and then thrown on a refuse heap. Primary bladelets were reserved for tattooing, scarifying and shaving. Later when the Mincopies came into contact with Europeans the thick glass from the bottom of beer bottles was selected for striking flakes of glass instead of stone, as glass flakes were sharper and more effective than stone ones. The same occurred among Australian tribes.

Haddon and Layard reported on chipped pieces of chert found

[154] Zwierzycki, '26, 63-67.
[155] Van der Hoop, '40, 200-204.

among the Tapiro of New Guinea. The unworked flakes were used for sharpening and carving arrows and knives. The same custom was observed among the Utakwa, also of New Guinea. Both the Tapiro and Utakwa are of small stature. The same holds good for the Grasslanders (inhabitants of the Augu, Wage and Wela rivers of New Guinea), who strike off flakes at random without an attempt at secondary flaking.

b. *Flores*

In the fifties Father Th. Verhoeven discovered a primitive flake industry in a great number of caves and rock-shelters in West Flores.[156] In 1952 I had the opportunity of having a look at Verhoeven's vast collection and I was struck by the primitive character of the flakes. The greatest part were waste products, next came primary flakes and crude bladelets with little or no secondary work. The most important site is the Liang Toge, a cave near Warukia in western Flores excavated in 1954, where the flakes were found in unstratified layers, 80 - 90 cm. thick. The uppermost flakes in the profile were found 10 - 25 cm. beneath the surface. Since there is no evidence of a chronological sequence, the collection will be described as one assemblage. It contains the following elements:

a. 282 shapeless flakes without bulb of percussion and without sign of secondary trimming. Many flakes are covered with cortex in some places; therefore they were struck from the outer side of the nodule.
b. 6 crude flakes with a cone of percussion on the plain lower face and use-marks; they may have been used for cutting purposes.
c. 6 small bladelets varying in length from 34.8 to 29.3 mm. in width from 14.9 to 11.3 cm., and in thickness from 3.4 to 6 mm. The triangular items may have been hafted, fitted into wood or bamboo and used as projectile points, and the long slender points as borers or awls. On the butt-end of the upper face a piece of stone was sometimes removed in such a way that the bladelet could be inserted in wood or bamboo, or to facilitate keeping it between the fingers. The specimens of this category and the former ones sometimes show a striking platform, but the bulb of percussion was in most cases removed. The upper face sometimes shows transverse flaking, while the lower face is smooth and unworked.

[156] Verhoeven, '52, 95-98, '53, 597-612.

d. 2 asymmetrical scrapers 37.2 x 28.6 x 8.6 mm. and 24.7 x 29.4 x 9.1 mm. respectively with marginal retouch along the sharp sides.
e. 2 curved scrapers of Cyraena shell, measuring 57.3 x 13.2 x 2.2 mm. and 50.7 x 12.2 x 1.8 mm. respectively with distinct marginal retouch along part of the sharp edges. A great number of similar shell artifacts were found in caves in East Java, South Celebes and along the coast of West Flores.[157]
f. 4 small ornaments made of mother-of-pearl, pierced by one, sometimes two round holes; they formed part of necklaces.
g. 28 small cores displaying some preliminary knapping and the chopping off of a part leaving a plain platform, after which the flakes were detached. The flake scars on the cores and the resulting products show that the flakes were detached at random and in various directions. The cores are usually slightly wider than high; only a few show greater height than width.

Special mention must be made of the absence of obsidian as used in other caves on Flores. The collection does not contain bone tools or potsherds.

The foregoing facts suggest that the archaeological collection of the Toge Cave represents a very backward development of a non-ceramic flake industry with some crude bladelets. Geometric forms are absent. It also includes shell scrapers and pierced ornaments of mother-of-pearl. It is obvious that the community which made the rock-shelter its home consisted of poor stone-workers. The inferior quality of the product cannot be explained by the character of the raw material. On the contrary, it appears that nodules were selected carefully for their flaking quality. Finegrained quartzite, chalcedony, chert, jasper and other siliceous stones, varying in colour from dirty white to black, and from lightbrown to red, were selected for the purpose. But in spite of such good flaking material and some preparation of the core before flakes were detached, the flakes and bladelets are crude and secondary chipping is absent or incomplete. The archaic character of the Toge industry does not imply great antiquity.[158] Actually the age has been determined by radiocarbon 14 dating (Geochron, Laboratories, Inc., Cambridge, Mass., GXO209) giving an absolute date of 3550 ± 525 years or ± 1600 B.C. The Nitrogen content of the bones as assessed by K. P. Oakley, London, is 2.5 %.[159]

[157] Willems, '39, 181-185.
[158] Van Heekeren, '67a, 157-9.
[159] Jacob, '67, 79.

The mammalian remains have been analyzed by D. A. Hooijer.[160] It appears that there are only five species of mammals associated with three extinct forms of giant rats. The full list is given below:

Dobsonia cf. *peroni* (E. Geoffroy), the bare-backed bat of the Lesser Sunda Islands.
Macaca fascicularis (Raffles) subsp. The common long-tailed macaque.
Rattus rattus. A species carried from island to island by human agency.
Papagomys armandvillei besar Hooijer. Larger than the living *Papagomys armandvillei* (Jentink) of Flores.
Papagomys verhoeveni Hooijer. A smaller, extinct species of *Papagomys.*
Spelaeomys florensis Hooijer. The most abundantly represented species in the Liang Toge.
Acanthion brachyurus (L.) subsp. The living porcupine of Flores.
Sus scrofa L. subsp. The living Sus of Flores and a descendant of a pig imported by man.

In the same rock-shelter a human skeleton was also found.[161] Although the bones were not fossilized and rather fragile, the skeleton was reasonably well preserved, but most of the right side of the skull was missing. The small skull with receding forehead shows in lateral view an alveolar angle of 61° and is hyperprognathous (Pl. 78, 79, 80). The mandible with its teeth is complete except for the right ramus. The left ramus is broad and extremely short. In view of the rounded frontal bone, the small size of the mastoid and faint muscular markings, the skull is most probably of a female 30 - 40 years old. Jacob, who made a profound study of the entire skeleton, comes to the following conclusions:

"A gracile skeleton with small body height of an adult female was excavated ..... associated with Mesolithic non-ceramic, semi-microlithic industry, and bones and teeth of a macaque, bat, porcupine, pig and extinct giant rats. Radio-carbon dating of the human bone discloses an antiquity of 3000 to 4000 years before present. The skeleton consists of the left side of the skull with mandible, upper and lower limb bones, and vertebrae. Later on fragments of a male skeleton were found in the same cave. The female skull is hyperdolichocranic, leptoprosopic, and has mesoconch orbits, leptorrhine nose, deep, narrow palate, and hyperprognathous alveolar region. Its mandible is rather robust, and possesses rather large lower premolars and molars. A gracile body build is reflected in the limb bones which also show platybrachy, supratrochlear foramen, deep olecranon, and low platymeric index. Although it is extremely difficult to assign a single incomplete skeleton to a certain subrace, the balance of available evidence suggests that Liang Toge is more closely related to the Austromelanesian race. The group it represents might be short but not dwarf as proved by the male stature." [162]

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[160] Hooijer, '57, '67.
[161] Verhoeven, '58.
[162] Jacob, '67, 79-96.

MEASUREMENTS OF THE LIANG TOGE SKULL (in cm.)

Absolute Measurements		Index	
cranial length	17.7	cranial index	67.8
cranial width	12.0	length-auricular height	64.4
auricular height	11.4	width-auricular height	95.0
basion-bregma height	12.8	length-basion/bregma height	72.3
cranial capacity (in cc.)	1204.4	width-basion/bregma height	106.1
maximum frontal width	10.8	cranial nodule	1370.0
minimum frontal width	9.3	transverse frontoparietal	90.0
biasteriac width	11.7	transverse occipitoparietal	97.5
basion-prosthion distance	10.3	Flower index	41.8
upper facial width	10.2	upper facial	58.3
bizygomatic width	12.0	jugomalar	83.3
mid-facial width	10.0	jugomandibular	87.5
maxillofrontal width	1.7	frontal	86.2
ectoconchion-porion distance	6.2		
nasion-gnathion distance	11.1	total facial	92.5
nasion-prosthion distance	7.0		
ectoconchal width	9.5		
orbital width	4.2		
orbital height	3.4	orbital	81.0
nasal width	2.2		
nasal height	4.9	nasal	44.9
palatal height	5.4	palatal	59.3
palatal width	3.2	palatal width-depth	46.9
palatal depth	1.5		
foramen magnum length	4.1	foramen magnum	82.9
foramen magnum width	3.4		
mastoid height	2.4		
mastoid width	1.4		
mastoid thickness	1.2		
thickness of zygomatic bone	0.7		
nasion-bregma chord	10.4	frontal sagittal	86.7
nasion-bregma arch	12.0		
bregma-lambda chord	11.9	parietal sagittal	86.2
bregma-lambda arch	13.8		
lambda-opisthion chord	8.8	occipital sagittal	88.0
lambda-opisthion arch	10.0		
nasion-opisthion chord	13.5	total sagittal	37.5
nasion-opisthion arch	36.0		
nasion-nasospinale FH angle*	88°		
nasion-prosthion FH angle	80°		
nasion-bregma FH angle	51°		
glabella-bregma FH angle	48°		
mid-orbital plane FH angle	86°		

* FH = Frankfort horizontal plane

MEASUREMENTS OF THE LIANG TOGE DENTITION (in mm.)

Mandibular Teeth	Diameter	Left	Right	Maxillary Teeth	Diameter	Left	Right
I_1	MD	5.5		I_1	MD		
	BL	6.0			BL	7.1	
I_2	MD	6.5		I_2	MD		
	BL	6.4			BL	7.0	
C	MD	7.1	7.0	C	MD	8.3	7.9
	BL	8.2	7.3		BL	8.5	8.6
P_1	MD	7.4	7.2	P_1	MD	7.2	7.0
	BL	8.6			BL	9.9	9.8
P_2	MD	7.8	7.4	P_2	MD	7.0	6.4
	BL	9.3	9.1		BL	10.3	10.0
M_1	MD			M_1	MD	10.0	10.4
	BL	11.5	11.4		BL	11.6	11.7
M_2	MD	11.3	11.2	M_2	MD	9.8	10.0
	BL	11.4	11.5		BL	11.9	12.0
M_3	MD	10.4	10.5	M_3	MD	8.7	8.3
	BL	10.7	10.9		BL	11.6	12.1

The teeth are comparable in size to other teeth from Flores. P_2 is not reduced, and the incisors do not display shovel-shaped characteristics.

MEASUREMENTS OF THE LIANG TOGE MANDIBLE (in mm.)

corpus length	89
bigonial width	± 105
corpus index	± 84.8
bicondyloid width	± 122
width index	± 86.1
minimum ramus width	36
ramus height	54
ramus index	66.7
coronoid height	44
bicoronoid width	90
intermental width	45
dental arch length	51
corpus height at mental foramen	30
corpus height at M_2	25
corpus thickness at mental foramen	11
corpus thickness at M_2	16
robusticity index	48.3
mandibular thickness index	59.0
height of mental foramen from mandibular base	15
symphyseal height	33
height index	75.8
length of mandibular notch	38

depth of mandibular notch	9
index of mandibular notch	23.7
sagittal diameter of condyloid process	8
transverse diameter of condyloid process	23
index of condyloid process	34.8
inter-C distance	26.5
inter-M_1 distance	31
inter-M_3 distance	40.4
anterior mandibular index	44.4
gonial angle	118°
infradentale-pogonion/alveolar tangent	86°
ramus tangent/coronion-condyloid tangent	43°
gonion-gnathion-gonion angle	± 72°
infradentale-gnathion/basal tangent	85°
infradentale-pogonion/basal tangent	78°

after Jacob

Apart from particulars of the skull, Jacob has given details and measurements of the scapula, the humerus, radius, ulnae, sacrum, femur, patella, tibia, thoracolumbar vertebrae and many other bones. It is the most complete and best studied pygmoid skeleton from the Mesolithic of Indonesia.

More human skeletal remains were found by Verhoeven in the Liang Momer, 5 km. north-east of Labuhanbadjo, West Flores (five burials), Liang Panas at Longgo Dalang, Manggarai, 20 km. east of Labuhanbadjo, West Flores (cranial bones, isolated teeth, costae, vertebrae, clavicle, humerus, ulna, radius and metacarpals, os coxae, femur, patella, tibia, tarsals and metatarsals); Gua Alo south of the Liang Momer (two skeletons found in extended position); Aimere open site on the south coast of West Flores (skull consisting of the parietal, frontal, temporal, occipital bones, maxilla, mandible and teeth); Liang X 8 km. from Reo in the northern part of West Flores (skull, teeth and infracranial bones; Liang Badjo, Liang Boto, Liang Bua and Liang Rundung (a few fragmentary skeletal remains). In all the abovementioned caves and rock-shelters an unspecialized flake industry was unearthed together with the skeletal remains. All caves had shallow deposits and unstratified layers. The best preserved skull was Momer E with a cranial length of 18.2 cm., a cranial width of 13.1 cm. and a cranial index of 72.0 (Pl. 81). For further details and measurements I refer to Jacob.[163]

[163] Jacob, '67, 96-114.

My own explorations on a small scale on Flores from March to May 1952 were concerned with the excavation of two small rock-shelters. The first one was called the Rundung Cave, situated near Wangka on a coral reef bank elevated 400 to 500 m. above the sea, Riung district in north-central Flores. The debris, again, was not thick enough to disclose any stratigraphical data: from top to bottom it was composed of brown earth which made it impossible to distinguish cultural phases, if there were any. Immediately below the surface flakes were found and they appeared throughout the deposits. The raw material used for the manufacture of the flakes ranged from coloured and fine-grained silicified stones like chalcedony, chert and jasper to obsidian — in fact, materials good enough to produce good tools. Nonetheless most flakes were mere chips or poorly finished with little or no secondary working. They were probably used in the condition in which they were struck from the core. Some had been subjected to secondary transverse flaking on the upper face. Marginal retouches were absent. The flakes were probably used to cut and sharpen arrow shafts or to scarify, shave, incise or to make grooves on wooden implements. The flat-based cores were irregular and flaked in all directions, making it obvious that the flakes had been detached rather at random. Many flakes displayed a distinct bulb of percussion on the unworked lower face, others had a striking platform at a high angle (more than 90 degrees) to the longitudinal axis, whereas an equal number had a striking platform perpendicular to the longitudinal axis. The paucity of bladelets proves that the industry is one essentially founded on flakes. Points and awls betrayed the existence of a poorly developed bone culture. The cave also yielded a few scrapers and points of shell. Concave stone scrapers and notched bladelets were perhaps used to sharpen round-shafted weapons of wood. At an average depth of 29.5 cm. we recovered a number of stone projectile points used for stone-tipped arrows. The butt-end shows stepped fractures, evidently made to insert the implement into a wooden or bamboo split stick; the striking platforms of these implements are either entirely or partly removed. The flakes and bladelets are small to very small. But the industry cannot be termed microlithic as crescents, trapezes or points with one edge artificially blunted are lacking. Ornaments consisted of small perforated pendants of shell and of mother-of-pearl. We found a lozenge-shaped pendant of mother-of-pearl and another of shell in the shape of a fish. 42 cm. below the surface we unearthed 15 *kemiri* nuts covered by a flat stone of 32 x 25 cm., suggesting a kind of offering, but there is no further evidence to confirm my assumption. Near the surface some potsherds were found. Remains of hearths occurred in three different places. Remains of animals were few: there were some mandibles of rats, teeth of porcupines, fishbones and shells. Scattered human skeletal remains comprised a few small-sized molars, and premolars and two fragments of a long bone.

A second trial excavation was undertaken in the Soki cave, half-way between Ruteng and Reo. This cave was a small rock-shelter in an agglomerate. The debris at its thickest was 146 cm. deep; its upper layer consisted of yellow-brown clay which contained loose stones from the agglomerate above, products of weathering and iron oxides; this layer covered a yellow, humid clay deposit. Immediately below the surface were some crudely chipped stones and a Chinese coin (*kèpèng*) and a battered-back microlith of yellow-brown glass. We cannot exclude the possibility that the cave-dwellers occupied the site until European settlement. Further down were many flakes of hard and brittle rocks. A large number of flakes showed a minimum amount of dressing. Three flakes had two facets on the striking platform. The few bladelets found showed very poor workmanship. A shapeless piece of bronze was found at a depth of 49 cm. amid some stone flakes. A single potsherd came from a depth of 20 cm. another from 33 cm. Like the Rundung Cave, the Soki Cave yielded a number of base-stepped stone projectile points at an average depth of 55.0 cm. Flat-based cores and crude blades are irregularly shaped and flaked in all directions. In general the flakes from the lower horizons are a little larger than those from the upper ones. The character of the soil is responsible for the disappearance of all perishable material. Even zoological evidence is lacking.

Only one day was spent in visiting the Mbikong Cliff near Wangka, a discovery of Father Mommersteeg. It is situated about 500 m. above sea-level. The exposed rock-face which is 30 m. high presents a series of primitive paintings in black, such as squares with dots, concentric ovals, starfish and a primitive tortoise. The paint had been mixed with a fatty substance and was therefore indelible. It is not yet possible to say anything definite about the age of these paintings. The presence of some flake-tools at the foot of the cliff makes us believe that the cave dwellers were responsible for the paintings, which are quite different in style from those of South Celebes, Ceram, Kei Islands, Timor and New Guinea.

Life for prehistoric man in Flores must have been precarious and it must have been difficult to sustain a gathering and hunting economy. The country was inhospitable and mountainous, only a few mammals had crossed the Wallace Line and there was little wild life to provide daily food. He must have lived mainly on tubers, leaves, shoots and shellfish, fish, rats and porcupines.

The most obvious characteristics of the cave industries in Flores were poor flaking technique in the manufacture of stone tools and absence of retouching on working edges.[164]

c. *Roti*

A. Bühler undertook excavations in seven caves on Roti and scored success in two of them. Roti is a small island southwest of Timor, mainly consisting of raised limestone reefs. Caves are rare, but in western Roti, in Déngka, there is an area with caves one of which, the Lua Neoal, yielded flints at a depth of 20 cm. to 100 cm. below the surface of the ground. These have to be classified as unspecialized flake-tools. The flakes are primitive in appearance with little or no secondary working. Among them are good knives and points of yellow jasper and borers of red-brown and yellow jasper and an 11 cm. long and 6 cm. wide scraper. Among the finds is a small tanged scraper of tortoise shell. Vertebrates are absent, but there are many shells of molluscs.[165]

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164 Van Heekeren, '58a.
165 Sarasin, '36, 42-7.

B. IN RETROSPECT: THE MESOLITHIC OR SUB-NEOLITHIC STAGE

In an attempt to get a better understanding of the mesolithic (or sub-neolithic) in Indonesia, we have to take into account recent important discoveries made on the adjacent islands and the continent — in Thailand, Formosa, the New Guinea Highlands and Australia — which are likely to affect our concept. That such discoveries have been made is caused in the first place by more elaborately conducted excavations and pertinent investigations which brought an increasing number of unforeseen data to our notice. Secondly modern methods of inquiry, such as palynological examination and radio-isotope dating were introduced recently and have provided information now available by using current means. The additional data so far obtained necessitates drastic modification of formerly widely accepted views.

For instance, at one time it had been generally accepted, not unreasonably so, that the cradle of agricultural activities and of civilization was to be found in the so-called "Fertile Crescent" of the Middle East. Now however, this does not stand up to closer examination. It appears that more than a thousand years before, in the tropical, humid rainforests of Southeast Asia, man invented a simple form of horticulture of the "slash-and-burn" type, and that incipient horticulture based on peas, beans, cucumbers, Chinese waterchestnuts and most probably tuberous perennial food crops like taro and yam outdates the cultivation of cereals such as millet and rice (Chester Gorman's excavation of the Spirit Cave, Northeast Thailand, in 1965). Indeed, forest clearing and shifting cultivation took place here earlier than anywhere in the world, i.e. at the onset of the Post-Glacial approximately 9000 B.C. This may be surprising to western archaeologists, but it is an idea expressed a long time ago by Vavilov, Barrau, Sauer, Pelzer and other botanists [166] and now proved by archaeology. Technological inventions were also made at this early time, the discovery of which overthrows all former ideas. Pottery, mostly bearing cord impressions and associated with crude Hoabinh tools, uncovered recently in Southwest China and Taiwan made its appearance as early as 10,000 B.C., the oldest pottery yet discovered anywhere in the world with the possible exception of Japan.

Also impressive in the light of technological progress is the fact that grinding of the cutting-edge of pebble-tools in North Australia dates

[166] Kwang and Stuiver, '66; Burkill, '53; Vavilov, '51; Solheim, '69; Sauer, '52.

back to 10,000 B.C., while former investigators in Vietnam were prone to interpret this device as the logical outcome of contact of Hoabinhians with neolithic people.

With all these factors taken into account, the term "mesolithic" has lost much of its meaning and doubt has been expressed as to whether we can still speak of a mesolithic. Obviously this is a matter of definition. As long as we have not found a better term in tropical Southeast Asia, we now understand by mesolithic the following: an economy based on fishing and occasionally on small and big game hunting. Shellfish formed an important part of the diet. A primitive horticulture was practised and there were no settled villages. Natural conditions favoured the collecting of wild tubers in the forests which subsequently led to the clearing of patches of primeval forest and a shifting horticulture. During this phase neolithic transition took place gradually and independently. It was a natural response to environmental conditions. The people had a preference for caves and rock-shelters if adjacent to fresh water. These were frequently chosen for living space and protection from the elements. Sometimes they buried their important dead in the caves in a flexed position and sprinkled the body with red ochre. The first pots were made at this period and ground-edge pebble-tools made their appearance. The most important mesolithic culture on mainland Southeast Asia was the Hoabinhian embracing South China, Vietnam, Cambodia, Annam, Thailand and Malaya, where flake industries were scarce, underdeveloped or absent. With the above as an orientation we now turn to summarize the mesolithic cultures of Indonesia proper.

The Hoabinhian was certainly introduced from the mainland via Malaya but does not seem to have spread into the greater part of Indonesia, although it was well known in northeast Sumatra. There, however, it was not found in caves but in shell mounds extending over a length of 130 km. and today at a distance of 10-15 km. from the coast. It is clear that the people were mainly oriented to a marine environment and that the sea provided them with a rather stable food supply of fish and shellfish. Scattered bones of animals uncovered in the middens suggest that they occasionally hunted, but we are quite in the dark as to whether they already practised a kind of horticulture. There is some evidence that they lived in huts on piles erected on the middens. Some human skeletal remains with Papua-Melanesian characteristics were uncovered in one of the middens. There were a number of monofacially flaked pebble-tools, mostly of the oval type, and some utilized shells with artificially bored holes belonged to the tool kit of these people.

A much greater variety of pebble-tool types of the same period or somewhat earlier were found on a plateau northwest of Lho' Seumaweh and 60 m. above sealevel. The majority of the tools were monofacially flaked but there were also tools with alternately flaked cutting-edges and some bifaces or hand-axes.

The Sampung Bone Culture is restricted to East Java where it was uncovered in a great number of caves and rock-shelters on the north as well as on the south coast, stretching from Madiun and Bodjonegoro to Puger and Pradjekan.

The type site is the Gua Lawa near Ponorogo with artifact bearing deposits 3-4 meters thick. Bone is used to a great extent; the high proportion of bone tools, mainly two sorts of spatulas and awls, is really striking. But the finds also include bifacially trimmed, hollow and round-based arrow-heads, large and small. Shell scrapers and primary flakes and blades are numerically the most important elements. Some cord-marked potsherds were uncovered at a very great depth together with bone spatulas. Pestles-and-mortars were probably used in preparing wild seed food (of the tree fern?), and the bone spatulas for peeling wild or domesticated yams and tubers. Characteristics of Sampung burial customs are similar to those of the Hoabinhians. They included flexed burials but the Gua Sodong, Puger, was different from the others: a complete skeleton was found but without cranium, although with mandible. The head might have been removed before burial but this is by no means certain. Post-burial removal of the skull is a wide-spread Oceanic custom. The sole burial offering noticed among a number of rather ill-preserved human skeletons in the Gua Lawa was that of a necklace of drilled shells around a child's neck. There were also scattered drilled canines of a small carnivore, pendants of shell and a number of drilled shells. The fauna was recent. The Sampung Bone Culture seems to have had a local development in East Java. It is found only in rudimentary form in caves near Tonkin and in a shell mound at Da But, Annam. The Sampung skulls are predominantly Melanesian.

Although flake industries are scarce or absent on mainland Southeast Asia, they have been found in great numbers in caves and around lakes in the Philippines and all over Indonesia. In general the craftsmanship displayed in the flaking is very poor. Most flakes are random flakes with irregular outline showing no traces of secondary working. However, as mentioned before, an archaeological record sometimes gives but a pale reflection of the original, complete culture and may produce a false image of cultural simplicity. There is every reason to suppose that the inventory of perishable and now unknown artifacts of bamboo, made with cutting flakes of stone, was much larger than was the variety of stone tools, and that bamboo in the tropical rain forest furnished mesolithic man with much of his essential raw material, leading to a decline in stone flaking technique.

There is basic similarity throughout Indonesia, excluding Celebes and some other places.

The Toalean of Celebes is a true microlithic culture with delicately flaked pieces of chalcedony in the shape of crescents, trapezoids and triangles. Denticulates (flakes with one or two toothed edges) and stemmed tools (also found in Timor) are also represented in the assemblage; small bones were worked into awls and "Muduk" fishing harpoons. Fresh-water shellfish were an important part of the diet. The Toaleans depended much more on food gathering than on hunting, and they showed a preference for cave dwelling. They did not bury their dead in caves; burials have not been discovered. Rock-paintings left behind by the Toaleans demonstrate a predominance of negative hand-stencils on a red background, and secondly there are on the rock-wall realistic paintings in red of leaping boars, all shown in profile. Further to the east of the Archipelago, on the island of Ceram, Kei, Timor, New Guinea and also in Southeast Australia, the paintings refer more to mythological conceptions and are inspired by magical ideas. Again negative hand-stencils occur frequently. There is no other record of such a microlithic culture in Indonesia and rock-paintings are completely absent from Java and Sumatra.

One might entertain the idea of independent development of the Toalean on Celebes, but this is very improbable. The time does not seem to have arrived when a satisfactory answer can be given concerning the origin and the lines of diffusion of the Toalean.

Human skeletons found in caves in Flores associated with an unspecialized flake industry show a great variability. One gracile skeleton of small stature (Liang Toge) had a hyperdolichocranic skull, a hyperprognathic alveolar region and a rather robust mandible with large molars. It belonged to the Austromelanesian race. Another skull (Mommer cave) is long and oval from above, and gable-shaped in occipital view. It has a remarkably wide ramus of the mandible. The complete skull does not show much difference from those of the present Sumbawa and Lomblen populations and the cranial measurements are almost the same as those of the urnfield of Melolo, Sumba.

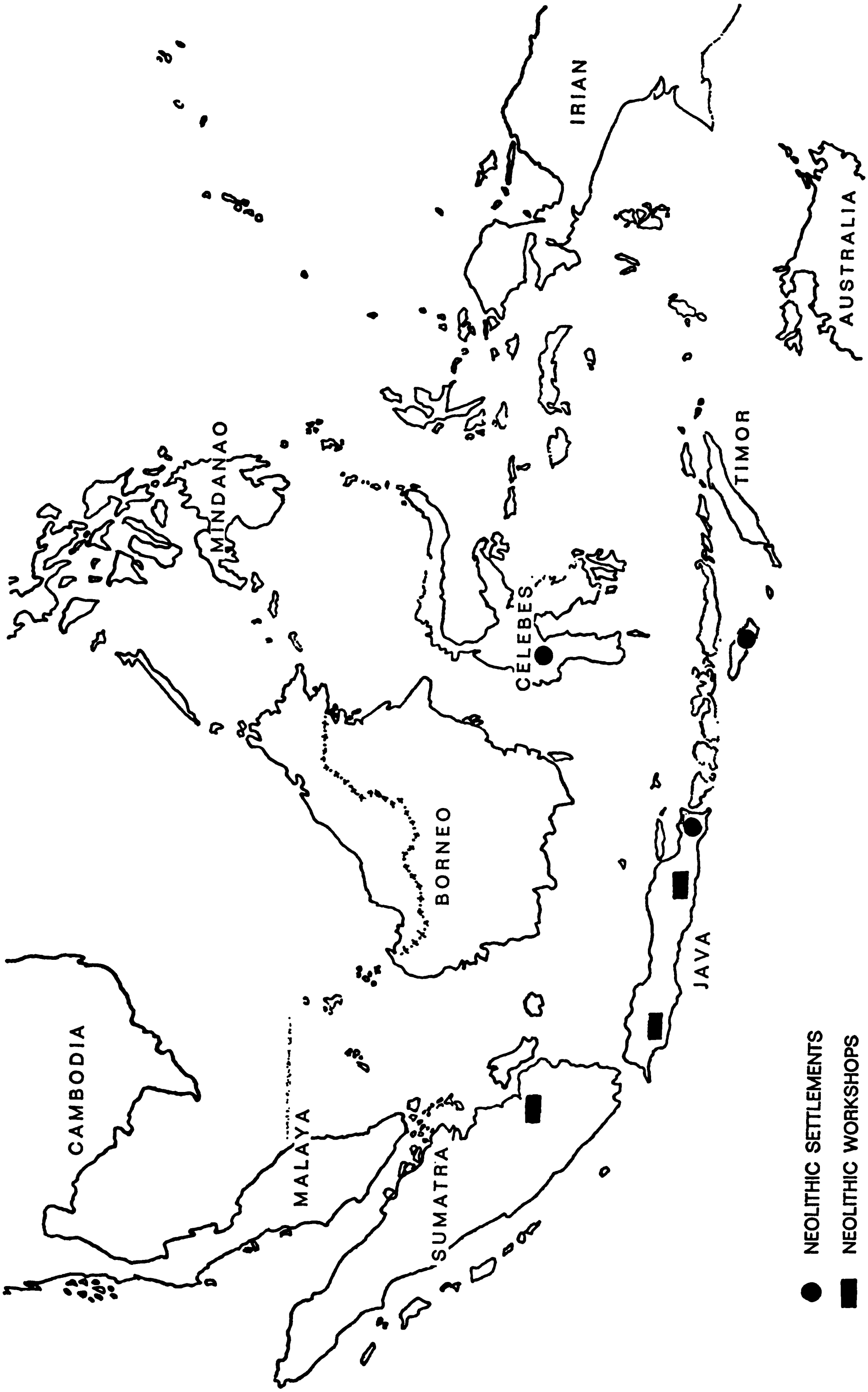

Fig. 38. Neolithic sites and workshops.

C. THE NEOLITHIC STAGE

1. SOUTHEAST ASIA: IN GENERAL

It has been assumed in the preceding chapter that the earliest, incipient agriculture in Southeast Asia started as early as terminal Pleistocene or Early Post-Glacial, 10,000 years or more ago. This assumption was suggested by botanical evidence and by subsequent archaeological research. The cultivation was of the slash-and-burn type, making the land arable, and of field rotation, adapted to a humid tropical rain-forest area. It also became obvious that the neolithic transformation took place gradually. At the same time the new techniques of edge-grinding on pebble-tools and pottery bearing cord-impressions made their first appearance and since then corded pottery has remained a prominent feature. This kind of simple agriculture preceding the growing of millet and rice was part of a coastal and riverine culture, utilizing the food resources available in stream and sea such as fish and shellfish. We assume that fishing lines and nets were already made of fibre.

It is against this background that we now pass on to the neolithic proper which started 3500—2500 B.C. with intensified destruction of virgin forest and intensified agricultural activity, practised in a village context. Shifting cultivation did not have the concept of private ownership; the land was common property of the village. There was still a strong riverine orientation in the hinterland with mixed gardening on the silt banks of the river in the dry season and the growing of domesticated plants on shifting fields in the forest clearings in the wet season. Fish and shellfish were still important items of food in the diet of neolithic man. Open patches were made in the forest: trees were ringed, burnt and felled but the stumps were not removed and this gave the field a rugged appearance. Guano from bat caves, if there were any, and ash of burnt trees were the only fertilizers. Root crops still formed an important part of the diet. Yam, a large tuber (not to be mistaken for sweet potatoes, which belong to another family), needs little care and also grows in poor soils and ripens after 4-5 months. It is a food high in bulk but poor in nourishment. Taro grows throughout the year but could not be used as staple; generally it needs irrigation and drainage. We assume that irrigation of terrace fields, not for rice but for taro, dates back to this period, and persisted for a long time, and survived even till today around the fringes of the Indo-Pacific area and in regions of comparative isolation.

Next to taro (*Colocasia antiquorum*) and yam (*Dioscorea alata* and *Dioscorea esculentum*) there were bananas (*Musa sapientum*) and breadfruit (*Artocarpus communis*) which provide a heavy starchy food which can be carried on sea voyages. At the same time hill tribes started to domesticate wild millet (*Setaria italica*) and upland glutinous rice on unirrigated fields (*Oryza perennis* and *Oryza sativa*), all basically products of Southeast Asian origin and still growing wild in that area. *Dioscorea esculentum,* however, is rare at present as a wild plant, due to the intensive exploitation by food-collecting tribes. The coconut (*Cocos nucifera*) afforded supplementary food, especially along the coasts. Along the coasts of eastern Indonesia and West Guinea (Irian), the inhabitants depended chiefly on the starch of the sago palm (*Metroxylon sagus*), which they either planted or collected in the wild state. The sago palm has in its stem a large quantity of starchy food. The tree is felled before it flowers, when it is 8-10 years old. The stem is split open and the sago is taken out and washed from the fibres.

Products such as root crops and breadfruit and bananas spread all over the Indo-Pacific area where rice and millet were unknown until recently. Another strong point in favour of the assumption that root crops predated millet and rice is the fact that the Polynesians did not know rice and millet at the time when they came into contact with the first Europeans, but they raised taro, bira (*Alocasia*), bananas, breadfruit and yams. This suggests that the Polynesians migrated from South China before cereals had replaced root crops as dominant plants. The Polynesians paid far more attention to taro and breadfruit than to yams.

Pelzer [167] gives an interesting example of sedentary cultivation of root crops as staple in the remote Balim Valley in the highlands of New Guinea. He writes that on the valley of the Balim and its tributaries, neolithic people practise intensive cultivation including such techniques as the use of green and animal manure, deep tillage with stone adzes, the digging of ditches to improve the run-off and drainage of swampy land and the construction of terraces; on the slopes they practise shifting cultivation. Here may be seen in actual operation a practice that has survived, perhaps barely changed, since prehistoric times.

We cannot say with any precision when rice entered Southeast Asia in domesticated form, but attention has recently been focussed on the

[167] Pelzer, '45.

fact that in Northeast Thailand neolithic sherds, dated 3500 B.C., imprinted with rice husk marking have been found by Chester Gorman. Neolithic man became more and more sedentary and developed an increasingly effective food-producing technology resulting in a more assured food supply, and in consequence he enjoyed a more varied and better balanced diet, millet and rice gradually replacing root crops. The shifting, slash-and-burn system worked perfectly as long as the population density was low, but could not keep pace with a population increase, leading inevitably to a shortening of fallow periods and ruin of the soil. The settled villages along the rivers and coast were small, self-supporting communities ruled by family heads, having little friendly contact with one another.[168]

Not much is known as yet about the achievement of domestication of animals, but without any doubt they domesticated pig, fowl and dog but not cattle. The said animals were not reared for economic purposes or for food, but for offering and divination. They were slaughtered at funeral feasts or at other important ceremonies, and the number and size of the animals sacrificed were of prime importance. Entrails and liver of the slaughtered animals were inspected and from this one could foretell good or bad days for future enterprises. Chickens were used to frighten away evil spirits and for cock-fighting. The ceremonies frequently included human sacrifice, head-hunting, head cult and the preservation of the heads of both enemies and ancestors. Basketry, matting and woodworking already known in mesolithic times were further developed, as well as fishing and navigation. Poled bamboo rafts were used for going down the rivers and for crossing rapids; raised platforms or small huts were built on the raft for the protection of cargo and passengers against the elements. Shallow dugout canoes were also used for river and coastal transport and fishing. To make these a large tree was felled and split in half with wooden wedges. The selected half was hollowed out by fire and with a stone adze. The double outrigger most probably was also a neolithic device, originally used on the river to cross the dangerous rapids, later for sea faring. They improved skill in sea travel and were capable of ocean voyages in seaworthy vessels. It is for instance well known that Polynesians navigated their craft over great distances, employing charts of rattan which indicated prevailing winds and currents.[169] The outrigger canoe

[168] Conklin, '59, '61, '67; Forde, '23; Merill, '45; Sauer, '52; Vavilov, '51; Spier, '51; Barrau, '63, '66; Burkill, '53, '60.

[169] Linton, '58; Hornell, '20.

enabled them, intentionally or otherwise, to spread out as far as Madagascar in the west and Easter Island in the east. Division of labour between the sexes in food production was well defined; men were clearing the field and hunted, women harvested and prepared the food. Clothing was made of bark. Barkcloth was made of the inner part of mulberry saplings, by scraping off the coarse outer bark and soaking the inner part for a few days. The strips of bark, usually half a meter long by ten centimeters wide, were laid upon each other in such a way that the edges overlapped. They were then felted together and beaten thin with a short bat or club of wood or stone and in this way a sheet of any length could be produced.[170] Towards the close of the neolithic stage, the art of weaving became known. This is attested by the finding of stone or baked-clay spindle whorls in late neolithic sites. Polished stone adzes are regarded by the present population as thunderbolts, a belief widespread in the Far East, and for that matter in many other parts of the world.[171] It is obvious from the perfect finish of the highly polished specimens and the semi-precious stone which was preferred, that craftsmen took artistic pride in their work and went beyond the needs of pure utility. We assume that weapons consisted of wooden spears and the bow-and-arrow. The houses were made of wood and bamboo with thatched roofs, rectangular or elongate-oval in shape and built on piles to protect the people against invaders and floods. Adolescent sex experiences were not only tolerated but encouraged and were held in special houses of which we still have instances on Luzon, Philippines. Marriage followed when the girl became pregnant. Neolithic man practised ancestor worship and had a totemistic cosmological system in which the bird was an upper-world figure, whereas the snake was of the under-world. Small offerings were made to numerous spirits who were supposed to live in streams, trees, rocks and caves. Pottery of greatly varied shape was generally made by women by the paddle-and-anvil technique, occasionally on a slow wheel or turn-table. The dead were buried in an extended supine position with arms along the body, not in any special direction. They were buried either in the midst of the settlement or also frequently in caves, together with pottery, stone adzes and sometimes with stone rings or bracelets encircling a forearm. Less frequently found at this

[170] Kennedy, '34; Forde, '23; Kruyt, '01; Sieveking, '56b; Shun-Sheng, '62.

[171] We met a farmer in the village of Wang Dong along the Kwae Yai (Northwest Thailand) who kept two polished stone adzes in a jar with water to protect the house against lightning.

stage were urn burials. Chalcedony and other semi-precious rocks seem to have replaced jade outside China and the Philippines.

After a sub-neolithic or mesolithic Late Bacson-Hoabinhian corded-ware horizon with flaked pebble-tools, edge-ground stone tools and sometimes a few polished adzes and crude shouldered axes, in association with the first domesticated plants (it is in the records of Chester Gordon (1964) that starting in 9200 B.C., in the Spirit Cave in North-east Thailand near the Burmese frontier, there were peas, two kinds of beans, almonds, Chinese chestnuts, cucumber, bettlenut, candle nut and black pepper) at least three successive neolithic traditions, sometimes overlapping each other, have been discernible in mainland Southeast Asia. The main features briefly are as follows:

a. A newly discovered Non Tok Tha culture (1968) with a great number of burials, dated 2500—2000 B.C., including a burial in the lowest level with a bronze socketed axe and moulds. Pottery with painted scroll and triangle pattern, and pottery with incised and impressed designs.

b. Lungshanoid with elaborate pottery with angular profile, sometimes suggesting metal prototypes, thin black pottery, tripods, fruitstands on high pedestals, a wide and varied range of polished rectangular stone adzes, bone barbed arrowheads, stone rings of the "pi" type, shell implements; extended supine burials with funeral gifts in the village and in caves. This culture was brought around 2000 B.C. from the north by brown-skinned Southern Mongoloids.

c. Geometric-stamped pottery (checker, double-checker, herring-bone motifs); hard yellowish-white ware; 1500—700 B.C. persisting into the Su-Huynh stage; cultural contact with the Yin-Shang civilization. Stepped adzes, rectangular adzes.

Several ways of diffusion were open to the Indo-Pacific area by sea. One of these runs via the Malay Peninsula to Western Indonesia, a second one from South China to Formosa and the Philippines as stepping stones to the eastern part of Indonesia and to Eastern Polynesia. A third route leads from Japan and the Philippines to Eastern Indonesia and perhaps a fourth from Vietnam directly to Indonesia.

Occasionally it has been possible to trace a movement by the distribution patterns of some typical tools, e.g. the stone adze. However, our present knowledge would not justify us in admitting theories which were based on surface or chance finds only, or on so-called evolutionary series of stone tools because of the complete absence of stratigraphical evidence and thus of relative chronology. This applies to former theories such as those of Heine-Geldern,[172] Otley Beyer[173] and Van Stein Callenfels.[174] Further systematic excavations using radio-isotope dating would be required to arrive at a reliable chronology and might enable us to either confirm or reject those theories.

2. INDONESIA

a. *Introduction*

During the period 1800-1850 neolithic tools began to be collected in the Museum of the Royal Batavia Society,[175] but the first note on such tools in 1705 was from G. E. Rumphius who shared the popular belief that they were thunderbolts, or teeth spat out by thunder demons. Subsequently authors of short papers include E. Swaving and W. Vrolik[176] in 1850, C. Leemans[177] in 1852, A. W. Kinder de Kamerq in 1868, J. J. van Limborg Brouwer[178] in 1872 and C. H. Pleyte[179] in 1887. All specimens had been surface or stray finds; some of the papers include descriptions and illustrations. In 1902 a longer paper on stone tools from Celebes was published by A. B. Meyer and O. Richter,[180] and in 1932 a paper on neolithic adzes from Besuki, Java, by Van Heekeren.[181]

Excavations were later undertaken by P. V. van Stein Callenfels at Kalumpang, Central Celebes, in 1933,[182] by Willems at Melolo,[183] Sumba, in 1939, and by Van Heekeren at Kendeng Lembu, East Java, in 1941. Fresh excavations at Kalumpang, Celebes, were carried out by Van Heekeren in 1949[184] and by Soejono at Kendeng Lembu, Java, in 1968.[185] Harrisson's work in the Niah Cave, Serawak,[186] and Glover's

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172 Heine-Geldern, '26, 51-53, '28, 809-43, '32, 543-619, '36, 32-36, '45, 136-42.
173 Otley Beyer, '48.
174 Van Stein Callenfels, '26; Menghin, '28.
175 Van der Hoop, '41, 20-165.
176 Vrolik, 1850, 99-102.
177 Leemans, 1852, 106-18.
178 Limborg Brouwer, 1872, 67-88.
179 Pleyte, 1887, 586-604.
180 Meyer und Richter, 02, 72-91.
181 Van Heekeren, '32.
182 Van Stein Callenfels, '52.
183 Van Heekeren, '56, 1-24; Willems, '40.
184 Van Heekeren, '50, 26-48.
185 Publication in progress.
186 Harrisson, '57, '59.

investigations in Portuguese Timor [187] were welcome additions to the knowledge of this area. R. Heine-Geldern, in spite of a very limited knowledge of the Neolithic in Indonesia and the absence of all stratigraphical data, made several premature attempts at a general survey of the structures of various neolithic civilizations and their distributions, and of the epochs in which migrations and diffusions took place. He based his studies mainly on the geographical distribution of various types of polished stone axes and adzes and on their comparison with neolithic tools from continental Asia, aided by deductive ethnological data and comparative linguistics.[188] His main conclusion was that the "Rectangular Adze Culture" had been the culture of the Austronesian people when they invaded Indonesia with South China as the point of departure. As was to be expected, things now appear to be far more complicated than when he wrote his papers in 1932 and 1945. Indeed, the last two decades have seen a considerably increased activity in the field of neolithic archaeology especially in South China, Thailand, Malaya, Serawak and Highland New Guinea. Accordingly our knowledge has greatly improved, for instance by absolute dating. During that time, Indonesia suffered from serious political and economic difficulties, and it was not possible to expand archaeological activity at the rate the situation demanded. Further, for one reason or another it is very difficult to locate neolithic settlements in this vast area, and neolithic burials in caves, well known from Malaya, Thailand, Vietnam and South China, are non-existent in Indonesia. Although polished stone axes and adzes have been found by the thousand as surface or chance finds, now stored in museums in Djakarta, the Netherlands and Germany, only a few neolithic settlements are known. In the absence of pottery, one of the most useful group of objects by which culture areas can be defined, much attention has been given to the typology of the stone adzes and axes. These can broadly be divided into two large categories, namely Rectangular Adzes and petaloid Round Axes and into many sub-types.

b. *The Rectangular Adze*

Basically this is a four-cornered, plain-backed adze-blade, rectangular or trapezoid in outline and rectangular in cross-section, with the width of the bit exceeding that of the butt-end. There is a wide variation in

[187] Glover, '69.
[188] Heine-Geldern, '28, '32, '45.

this class. There are large/wide or long/narrow specimens. The adze-blades must have been mounted with the bit at right angles to knee- or elbow-shaped wooden shafts. Specimens were shaped from rectangular blocks of hard stone, roughly flaked and retouched and subsequently ground and polished all over both faces and parallel sides. Other specimens made of softer stone suggest that a stone saw and coarse-grained sand were used to cut out the block from the parent mass. Sometimes the upper face of the tool is narrower than the lower face, giving a trapezoid cross-section. We have noticed two different ways of forming a cutting-edge. In one both faces approach each other gradually by grinding and polishing. The second way is by grinding a single facet at one face at an angle (single-bevelled) to the plane of the tool. Miniature adzes were most probably carpenter's tools. The Rectangular Adze has a wide geographical distribution, extending throughout Southeast Asia and beyond (all over Indonesia as far as western New Guinea, where it is scarce, Malaya, Thailand, Vietnam, Cambodia, Laos, South and North China, where it is associated with the Lung-Shan as well as the Yang-Shao cultures, Japan (in the Kantō region associated with Yomon Pottery), Philippines and Eastern Polynesia (Pl. 82).

More especially in Western Java and Eastern Sumatra, semi-precious stones were frequently used, such as nephrite, jasper, chalcedony, agate and serpentine. The resulting products can match the finest neolithic artistic achievements in the world. Various sub-types, sometimes highly specialized, have derived from the Rectangular Adze, the best known being the "Stepped" and the "Shouldered" Adze.

c. *Pick-Adze*

This is a large and highly polished adze with two symmetrical facets and a central longitudinal ridge or keel on the back of the tool which extends along the whole of its length. The cross-section is triangular or pentagonal; the lower face is flat. The cutting-edge with the apex downwards is beak-like and this type of tool is related to the Malayan "Beaked Adze".[189] The distribution is confined to Java, Bali and Sumatra, where they are mostly made of semi-precious stone (translucent serpentine, agate and chalcedony). The uncommon size of some specimens, which mostly show no traces of use, suggests that they may not have been intended for use as tools but perhaps for ceremonial

[189] Tweedie, '55, fig. 7; Evans, '31a.

purposes. A somewhat divergent type was found in the easternmost part of Java and on Bali. These are made from a lustrous black, fine-grained volcanic rock, are characterized by a semi-circular cross-section, and have a bit formed by two facets on the upper face (Pl. 83), on which the keel is lacking. In the Surakarta and Madiun Residencies of Java the Pick-Adze is non-existent. The silicified limestone of this area, though frequently used for making simple rectangular adzes and concave-based arrow-heads, may have been found unsuitable for this specialized tool.

d. *Shouldered or Stemmed Adze*

Two varieties of this tool are now recognized: a crude shouldered axe with Hoabinhian affinities, trimmed at the butt-end into a stem meant for hafting and with a curved bit, and the highly polished shouldered adze so well known from mainland Southeast Asia and Malaya. The sides of the butt of a rectangular adze were laterally reduced to provide a spade-like grip.[190] The latter type seems to have a more distinctly southern distribution, reaching as far as Assam and Burma and also found in South China, Formosa and in East Polynesia. The stemmed adze, either chipped or polished, is typical of all sites in Central Kwangtung. North of the Bay of Canton the shouldered adze gives way to the stepped adze. The first variety (the crude one) only is found in Indonesian collections. It is worked on the upper surface only and no polishing is done in the process of manufacture. This type is known in Szechwan, Kwangtung, Taiwan, Botel Tobago, the Philippines, Japan and Celebes.

e. *Stepped Adze*

Tweedie[191] describes this tool as a tool in which the thickness of the tool is abruptly diminished along a line near (or parallel) to the butt, forming a butt which presumably facilitated hafting. The step is made by sawing or by grinding on a short rectangular adze. This type is well known from South China south of the Huai River of the Yangtze delta and to the south between Hongkong and the Vietnamese border and extending to Formosa, Philippines, North-Central and South Celebes and East Polynesia (Fig. 39a).

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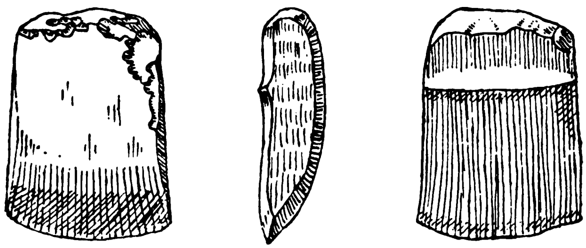
[190] Duff, '59, 125.
[191] Tweedie, '53.

b.



39a. Neolithic Stepped Adze, Minahassa, North Celebes.

f. *Shield-shaped Adze*

This tool is mostly long and has a longitudinal convex upper face and a longitudinal concave lower face looking more or less like a narrow shield. This type is scarce on the mainland but rather frequently found in Java, Sumatra, Bali and East Polynesia. It is called by Heine-Geldern "Krummendechsel". It has a rectangular cross-section.

g. *Ridged Adze*

Duff's description of this tool reads as follows [192]: "the upper front surface of the adze was reduced by hammer dressing to leave a transverse stop ridge at the demarcation of butt and blade". This tool is peculiar to Luzon, with allied forms at Hoifung (Hong Kong), Formosa and Celebes, and a variant in the Lower Cook Islands and New Zealand. It seems that they are also found in Manchuria.

h. *Roof-shaped Adze*

These relatively thick tools have sharply sloping sides which approach each other so as to leave only a narrow ridge on the upper face instead of a broad face. This kind of tool is found in East Java, Bali, Ceram, Moluccas, Tanimbar and East Polynesia (Pl. 86). Some have a narrow neck.

i. *Violin-shaped Axe*

This is a roughly shaped stone axe with little or no polish, found in Japan, Formosa, Botel Tobago and in Central Celebes (Pl. 100). The sides are waisted.

[192] Duff, '59, 125.

j. *Elongated Gouges*

These large tools have an oval to circular cross-section and have the bit distinctly concave. So far they have been found in Indonesia only in the easternmost part of Java and on the isle of Bali, and they have also been found in East Polynesia. Some smaller cigar-shaped varieties are equipped with narrow and shallow cutting-edges to which the sides converge. The apex is downwards and they have a cylindrical section. Apart from the Philippines, East Java and Bali they also occur in the South Island of New Zealand (Pl. 85).

k. *Bracelets of stone and shell*

Bracelets of stone or quoits are found frequently in Central and West Java. Mostly they are made of shiny chalcedony or red jasper. Large workshops of such rings occur near Tasik Malaja in Western Java; these will be treated later.[193]

Stone rings, a little different in shape, have been found during excavations in Malaya and Thailand, encircling a fore-arm or held in the hand. In Malaya half-finished specimens were also recovered, affording a clue to the method of manufacture. Tweedie [194] tells us the following: "It appears that a lenticular disc was made by flaking, and ground smooth on one side. It was then fixed, probably by embedding in some medium such as clay, with the smooth side upward for drilling. The circular groove in the specimen is of just the kind that might be expected from drilling with bamboo and sand as an abrasive, and is so very eccentrically placed as to suggest that embedding was deep enough to conceal the edge of the disc. It is obvious too that this eccentricity led to its being abandoned in an unfinished condition. A fragment of a similar unfinished specimen is figured by Linehan."

The bracelets or stone rings resemble the flat Chinese stone rings called *pi*.

At Krai (Surakarta, Java) shell bracelets were recovered by G. H. R. von Koenigswald in association with stone rectangular adzes and shell beads (Pl. 88). Shell bracelets are still made by the Igorot of Northern Luzon. Beyer has recorded the process of manufacture as follows: "... holes being bored through the very hard tridacna shell with drills made of a rather soft wood the actual cutting of the shell being done

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193 Franssen, '41, 132-39.
194 Tweedie, '53, 43; Linehan, '51, pl. 11, fig. 7.

by the fine sand which was constantly poured around the point of the drill. These wooden drills were of the common 'pump-drill' type in which the drill is operated by a cross-bar with cords and has a fly-wheel in the centre, turning first one way and then the other as the cross-bar is pulled down... Among the Moros and other peoples in Mindanao and Sulu, drill-points of wood, bone, and metal have been also seen in use.[195]" Distribution of stone rings is: Szechwan, Siberia, Japan, Korea, Fengtien, Jehol, Chahor, Vietnam, Cambodia, Thailand, Malaya, Java, Honan, Lamma Island, and Formosa.

l. *Stone Spear-Heads*

Flat spear-heads made of slate or schist have been found on Batangas, Luzon, North China and the Hong Kong-Hoifung area. At Batangas, Luzon, they were made of nephrite (70-80 %) and the rest of schist. In Indonesia they have so far been found only in Central Celebes (the Kalumpang site). There are specimens with a flat or convex and tanged butt (Pl. 97).

m. *Bark cloth Beater*

Wooden and stone bark cloth beaters were used during early neolithic times in Southeast Asia for the manufacture of bark cloth; only the stone specimens have occasionally survived. The most common type is a rectangular block of stone, grooved with fine parallel lines on one or on both faces. Some specimens are cross-hatched. The body of the implement is usually surrounded by a deep horizontal groove to facilate its being bound in a rattan handle.

Another type of bark cloth beater, the "horned" type, is widely spread in the Philippines, but is also known from the Minanga Sipakko site in Central Celebes and from Borneo. It has a stout handle and an upturned proximal end or horn [196] (Fig. 39b).

n. *Round Axe*

The round Axe is thicker than the Rectangular Adze and is characterized by an oval or circular cross-section, an axe-like bit and a pointed

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[195] Beyer, '48, 88.
[196] v. d. Hoop, '35, 468-70.

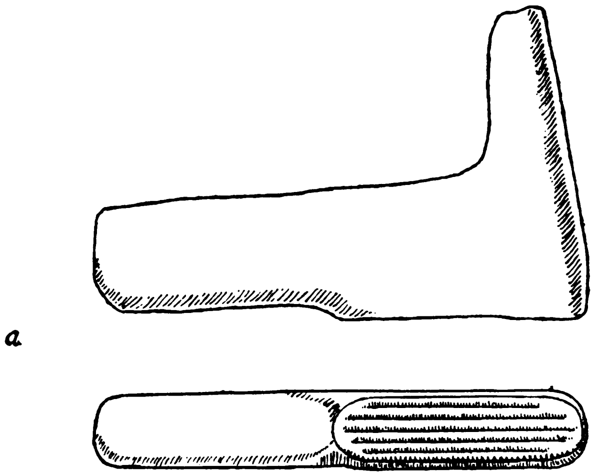

Fig. 39b. Neolithic "horned" Barkcloth Beater, West Borneo.

or rounded neck. First roughly flaked into shape, this tool is generally smoothed down by hammer-dressing and then polished. At other times, a pebble of suitable shape was looked for which was hammer-dressed and subsequently polished. Lastly there are also specimens which are simply finished by hammer-dressing. Generally speaking, the round axe predates the rectangular adze. T. Harrisson [197] has excavated round axes in the Niah Cave in Serawak which were overlain by rectangular adzes. Fully ground round axes of oval and lenticular cross-section found at the base of the Kafiavana rock-shelter in the New Guinea Highlands date back up to 10,000 years.

The first petaloid round axe in Indonesia was recorded from North Celebes at Sonder by the late Major Wawuruntu. In the northern part of Borneo, too, several round axes have been recovered. Furthermore, round axes occur throughout Celebes. Museums in Djakarta and in foreign countries display round axes from the Moluccas, Leti, Tanimbar and Flores, and also some examples from the east coast of Sumatra. Not one specimen has ever been found in Java. Recently Dr. D. M. Blankhart reported three round axes from Sangir Island and two specimens from Talaud Island, two of which were made from Tridacna shell. Dr. Blankhart's discoveries took place in an area as yet unexplored and are, therefore, of prime importance. The round axes from Menado,

[197] Harrisson, '57, '59.

Talaud and Sangir are indistinguishable from those of New Guinea, where round axes are still manufactured and used today.

The widespread occurrence of round axes in Japan is well known,[198] further in India, Burma, Manchuria, Korea, Formosa, North Vietnam, Philippines (rare), Melanesia and Western Micronesia. Judging by the nature of their distribution, it has been assumed that the round axe did not enter Indonesia from India and Malaya, but probably from Japan. F. Speiser[199] states that the representatives of the "round-axe culture" were Neo-Melanesians and in this connection the Buka are mentioned, who also introduced coiled pottery. For the time being we are not at all certain about the round-axe culture, which remains hypothetical (Pl. 89).

o. *Winged Arrow-Heads*

The occurrence of neolithic winged arrow-heads of stone in Central Java and South Celebes is rather enigmatic. They are triangular projectile points with concave or more seldom convex base (Pl. 90).

Nearly all arrow-heads from Java are made of silicified limestone and betray a very advanced technique. They are flaked on both faces. Their measurements vary considerably, but the most common ones are about six centimeters in length. Small specimens of one and a half centimeter or less are rare; it is supposed that they were employed for hunting birds. Stone arrow-heads have been found in Java at great depth in the Sampung Cave near Ponorogo and in caves near Bodjonegoro and Tuban, and numerous pieces were collected in the neolithic workshops round Punung in Central Java. They are entirely absent, however, from the western and easternmost parts of Java. The upper layers of Toala caves in Southwestern Celebes yielded many winged stone arrow-heads; in the same stratum potsherds were found. In shape and workmanship they differ in several aspects considerably from those found in Java. Usually they were made of very small sheets of chalcedony and other stone. They are smaller and flat and minutely retouched all around the edges and not on the faces. Moreover, the sides are frequently denticulated (Pl. 91). Since no such implements have been encountered on the Asiatic continent, whereas they are frequent in Japan, the tradition was most probably imported from that area.

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198 Groot, '51.
199 Speiser, '38, 463-80.

3. SPREAD OF STONE TOOLS IN INDONESIA

Sumatra:

Westcoast: A few large and small Rectangular Adzes; Pick-Adzes of agate and black fine-grained volcanic rock.

Bencoolen (Bengkulu): A few Rectangular Adzes and Pick-Adzes; among them one long narrow type. The tools are made of agate and fine-grained basalt (Pl. 84).

Palembang: A fair number of Rectangular Adzes and Pick-Adzes. A neolithic workshop near Bungamas between Lahat and Tebing-tinggi. The implements are made of red-brown, grey or brown rock and lustrous chalcedony.

Lampongs: Numerous well-shaped Rectangular Adzes, many of which made of semi-precious stone such as chalcedony, jasper and silicified limestone. Mainly collected by E. H. S. Schlegtendahl and now on display at the Djakarta Museum.

Assam: Two Round Axes with oval cross-section and more or less rounded neck.

Java:

Bantam: Numerous Rectangular Adzes made of agate, jasper, and chalcedony. Pick-Adzes and armrings of chalcedony.

Djakarta and Tangerang: Numerous Rectangular Adzes and Pick-Adzes, made of chalcedony, agate, jasper, nephrite; a fair number of bracelets of chalcedony.

Bogor: Many Rectangular Adzes, Pick-Adzes and unfinished adzes. Armrings and polishing stones from neolithic workshops at Pasir Guda Estate.

Chibadak: A stone bark cloth beater made of light-grey stone: 127 x 46 x 63 cm. Rectangular adzes made of silicified limestone and chalcedony.

Cheribon: Numerous Rectangular Adzes, Pick-Adzes and half-finished adzes, stone bracelets, a cylindrical grinding stone with facets, 159 mm. in length. The greater part of the tools made of chalcedony and jasper.

Priangan: Numerous Rectangular Adzes and Pick-Adzes, one of these measuring 430 x 91 x 30 mm.; rings of chalcedony and jasper and unfinished ones from workshops near Tasikmalaja [200] (Pl. 87).

Pekalongan: A few Rectangular Adzes and Pick-Adzes; stone rings made of chalcedony.

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[200] Franssen, '41, 132-39.

Banjumas: A few Rectangular Adzes and Pick-Adzes and grinding stones. Workshops in the Karangbolang mountains near Karanganjar.

Semarang: Rectangular Adzes and a few Pick-Adzes.

Jogjakarta: Numerous Rectangular Adzes, a few Pick-Adzes, rings made of stone. Grinding stone, 130 mm. in length.

Surakarta: Numerous finished and unfinished Rectangular Adzes, concave-based (winged), bifacially chipped arrow-heads, generally made of silicified limestone. Most of the tools are from Wonogiri and Punung where there are more than one hundred workshops. No Pick-Adzes found in this area.

Madiun: Many Rectangular Adzes and stone arrow-heads. One armring of chalcedony. No Pick-Adzes.

Surabaja: A few Rectangular Adzes made of volcanic rock and chalcedony. A few Pick-Adzes.

Madura: A few Rectangular Adzes made of fine-grained volcanic rock.

Malang: A fair number of Rectangular Adzes and Pick-Adzes and three pebble-tools with ground cutting-edge. The tools are made of chalcedony and black fine-grained basalt.

Besuki: Numerous (I bought here more than two thousand polished adzes in two years) Rectangular Adzes and Pick-Adzes of the East Java type and some unfinished adzes. Long Gouges with oval cross-section. Small and slender gouges with tapering sides from the butt to the distal end; small chisels; roof-shaped adzes. Most tools are made of black or grey or green rock. Workshops and dwelling sites at Kendeng Lembu and Pager Gunung Estate, Glenmore.

Bali: Numerous Rectangular Adzes and Pick-Adzes of the East Java type, some adzes with lenticular cross-section. Large and small gouges with semi-circular cross-section. Grinding stone with facets, measuring 104 x 36 x 17 mm.

Lombok: None.

Sumbawa: None.

Flores: A few Rectangular Adzes and a few Round Axes with oval cross-section.

Adonare: A few Rectangular Adzes.

Leti: A few Round Axes.

Tanimbar: A few Round Axes.

Moluccas: Some Rectangular Adzes; small chisels; roof-shaped adzes and a few Round Axes.

Solor: A few Rectangular Axes.

Borneo: A few Rectangular Adzes, 1 Pick-Adze in the western part; Round Axes with oval cross-section and pointed butt, 189 x 52 x 30 mm. from Pontianak; a few roof-shaped adzes; one horned bark cloth beater (Fig. 39a) of the Philippine type, found at Ampah, South and Eastern district.[201] Rectangular Adzes found overlying Round Axes in the Niah Cave, Serawak.[202]

Celebes: In the southern part of the island Rectangular Adzes are scarce; three Stepped Adzes from Tondano and one from the south-western part and one from the Minahassa; one Round Axe from the Minahassa, one highly polished Round Axe made of glossy, black volcanic rock with blunt-pointed butt and oval cross-section from the Sario River, Menado, 154 x 57 x 23 mm.; one Round Axe from Bulukumba; neolithic sites at Sempaga, Kalumpang and Minanga Sipakko along the Karama River with stone tools and grinding stones, associated with pottery and a horned bark cloth beater. Excavations made at Kalumpang by P. V. van Stein Callenfels and H. R. van Heekeren.

Sangir Island: One Rectangular Adze made of black volcanic rock (83 x 41 x 14 mm.). Found in the southern part of the island by Dr. Blankhart, one highly polished Round Axe made of dark-green rock (75 x 45 x 22 mm.), with traces of hammer-dressing. Found by Dr. Blankhart at Dumahang.

Talaud Island: One Round Axe with pointed butt and bi-levelled cutting-edge, made of Tridacna shell (105 x 54 x 29 mm.), oval cross-section. Found by Dr. Blankhart at Ennawira, south part of the island. One Round Axe with pointed butt, bi-bevelled cutting-edge and oval cross-section; made of Tridacna shell (84 x 40 x 20 mm.). Found by Dr. Blankhart at Rainis. One Rectangular Adze made of poor volcanic rock; dull-grey (111 x 45 x 21 mm.). Found by Dr. Blankhart at Rainis. One fragment of a Pick-Adze with semi-circular cross-section, made of dark-brown volcanic rock (73 x 56 x 33 mm.) and found by Dr. Blankhart at Rainis. One Rectangular Adze, made of glossy black volcanic rock (64 x 41 x 19 mm.), found by Dr. Blankhart at Rainis. One oval Adze with sharp sides, made of light-brown volcanic rock (102 x 48 x 24 mm.), found by Dr. Blankhart at Essang.

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[201] Van der Hoop, '35.
[202] Harrisson, '57, '59.

4. SOME NEOLITHIC TRADITIONS

In many places in the Indonesian Archipelago pottery is still handmade by the "paddle-and-anvil" technique. A. C. Kruyt [203] relates that among the Western Toraja in Central Celebes the technique of shaping pottery is very little known, and only in a few villages that we know of. The raw clay is fetched and planted in the ground where it is supposed to grow of its own accord. There exist several regulations and prohibitions pertaining to the making of pots. For instance, in some villages in South Celebes it is not permitted to praise the women who are exclusively in charge of the work, because it is believed that the pots will then break during the baking. The clay is kept in a cool place and covered with fresh banana leaves. The next day, small portions of clay are pounded on a flat stone with a round stone, sprinkled with water every now and then, and cleaned and kneaded into balls. The ball of clay is then moulded into the form of a pot or bowl with the thumb and other fingers, the thumb pressing the wall outward from within, the fingers modelling the pot into shape on the outside. The pot is then finished by keeping a round stone against the inside, which serves to back up the blows of a wooden beater or bat from the outside until the clay has gained the same thickness everywhere. During the process the pot is turned over and over. Finally the rim of the mouth is curved outwards with the fingers. The newly formed pot is then wind dried and baked. H. C. Conklin [204] gives a detailed description of such work done by the Buhid people of Mindoro, Philippines, where "paddle-and-anvil" manufacture of earthenware vessels can still be seen in action.

Of course not all clay is suitable for pottery making. On Mindoro there are only a few carefully chosen places in the interior near a river where clay good in plasticity and workability is to be found. The clay is greyish to reddish in colour. Just as in Celebes the people think that the clay will grow when planted in the ground for some time. The dug-out clay which is gathered by men, women or children is then cleaned. In the manufacture of a pot, work done exclusively by women, a few tools only are used, namely a wooden paddle, 40 cm. in length, 8 cm. across the middle of the blade and 1 cm. thick, a round river pebble used as an anvil placed in the interior of the pot, a few leaves to be used in forming the rim, and finally half a coconut shell filled with water for cleaning and dampening purposes. It takes some 45 minutes to fashion a small pot. The following activities take place:

[203] Kruyt, '38.
[204] Conklin, '53.

1. A lump of clay for one pot is taken and placed on a mat of banana leaves. The potter kneads, pinches and squeezes the clay for 10-15 minutes with her hands, keeping it constantly moist with water and cleansing the clay of pellets, leaves and other impurities.
2. The potter kneads and moulds the lump of clay into a squat cylinder, one and a half times as long as it is thick. Subsequently the cylinder is lengthened and then modified into a cone, the base-diameter one third of its height. Next the paddle comes into action to smooth out by tapping the upside-down cone which is slowly rotated during the process.
3. The apex of the cone is now flattened by light vertical strokes, tapping with the paddle which is constantly moistened to prevent the clay from sticking to the paddle. The sides start to bulge.
4. Next the interior of the vessel-to-be is hollowed out by light vertical pressure tapping with the stone into the flattened top, keeping the stone wet. The result is a cupped-out hollow some centimeters in depth.
5. Neck and rim are formed with the aid of a hand-clamped leaf guard and by steady pressure and by bending the rim outward with the thumb on the inside and by pushing in with the tip of the forefinger on the outside while the pot is constantly turned.
6. Now the rim is smoothed by very light tapping with a wet pebble.
7. The vessel is placed in the sun in order to dry the rim, the base staying soft enough for further hollowing out.
8. Expanding the hollow interior.
9. Using the paddle and anvil, the potter meticulously thins the walls below the rim in which the stone anvil is held in the left hand and held against the inner side of the vessel, while the paddle in the right hand taps the outside.
10. When all these activities are finished, the pot is shadow hardened and subsequently fired.

Evidence shows that the neolithic peoples of Indonesia made their clothes from beaten bark (stone bark cloth beaters have been found in neolithic sites in Southeast Asia).[205] This procedure still flourishes in Central Celebes. A. C. Kruyt [206] has gathered important information concerning this industry among Toraja tribes. It appears that not all kinds of trees produce the proper bark, but only some wild species (*Trema amboinense, Artocarpus blumei, Antiaris toxicaria, Sloetia minahassae, Ficus mulberry, Ficus sp., Urostigma sp.*), whilst one

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[205] Van der Hoop, '35, 468-70; Kennedy, '34; Shun-Sheng, '62.
[206] Kruyt, '01, 139-191.

species, the paper-mulberry *Broussonetia papyrifera,* is especially cultivated because it produces a suitable white bark. The tree is ringed and the bark stripped off. The hard outer surface is removed and the inner bark then folded and sometimes cooked, wrapped up in palm leaves and fermented for one to three days till the fibres are soft enough to be easily beaten.

The strips are usually half a meter long by ten centimeters wide and are laid on each other to be felted together. The beating is done with wooden or stone beaters on a wooden board. The stone beater is a rectangular piece of stone, especially of serpentine, provided with grooves on both faces. Encircling the object is a wide groove to fit the springy rattan string with which the tool is hafted to a rattan grip. When the bark has been crushed sufficiently, the pieces (*fuya* = *tapa*) are wind dried on slats and afterwards treated with the juice of the *ula* fruit (*Strychnos ligustrina*). The dried *fuya* is hard, but after having been folded it is beaten to flexibility.

5. EXCAVATIONS

a. *Java: Kendeng Lembu*

A number of neolithic dwelling settlements, the first to be found in Java, were discovered at the Kendeng Lembu Rubber Estate by W. van Wijland and J. Buurman in 1936. Agricultural activities on the estates of Kendeng Lembu and also of Pager Gunung, lying south of Glenmore half-way between Djember and Banjuwangi, had revealed traces of neolithic occupation. At the request of W. van Wijland, I started systematic excavations at Kendeng Lembu, but after a few days I had to stop the work indefinitely when World War II broke out in the Pacific: the finds and fieldnotes were destroyed during the Japanese occupation of Java. The stratigraphy of this site was clearly discernible. An upper layer half a metre thick contained historical sherds and some Chinese coins of the *kèpèng* type, while a lower layer 30 cm. thick revealed a neolithic habitation deposit with polished stone rectangular adzes and a great number of plain potsherds. All stone tools were made of grey-blue shale. They were found in all stages of manufacture showing that they were made on the spot. Other tools in this layer included a cylindrical grinding stone with eight facets, two stone saws, unfinished adzes, and heavy flakes probably to be classified as knives. The unornamented sherds appeared to be of simply made globular pots with flaring rims.

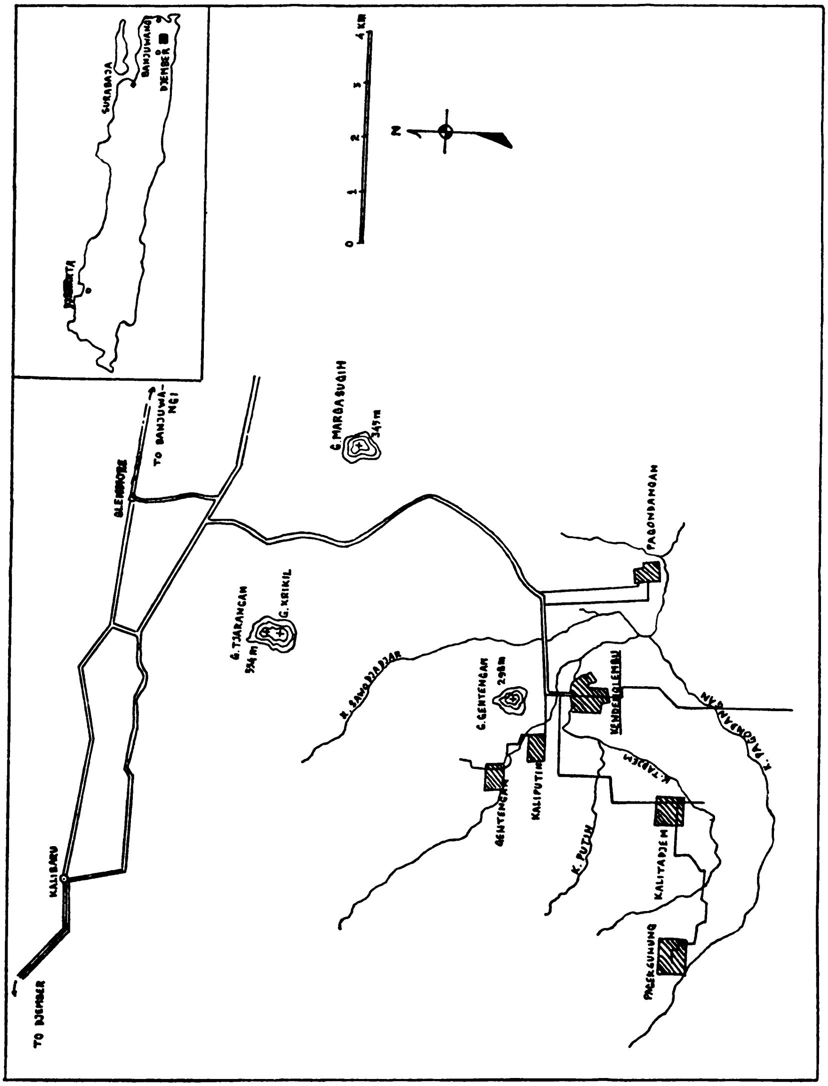

Fig. 40. Situation Map of Kendenglembu Estate. by courtesy of Soejono

On May 24, 1968, the site was revisited by H. R. van Heekeren, Soejono, Teguh Asmar and Wibowo, and with the approval of the present manager of the Estate it was decided that excavation would be resumed under the leadership of Soejono, and supported by a grant from the Koninklijk Instituut voor Taal-, Land- en Volkenkunde, Leiden. After the trial excavation was completed, I received a detailed report. I think it is worthwhile quoting in full Soejono who generously put the records at my disposal, although at present the results are not yet fully worked out.

Site Location:

"In the course of his visit to Indonesia from March to June 1968, Dr. H. R. van Heekeren, with R. P. Soejono and Teguh Asmar of the Prehistory Department of the National Archaeological Institute of Indonesia, and A. S. Wibowo, Head of the Archaeological Branch Office at Modjokerto, made an orientation trip to Kendeng Lembu, a State Rubber Estate, on May 24, 1968. Kendeng Lembu lies at an altitude of 190 metres above sea-level in the hilly region 8 km. south of the mainroad which connects Glenmore with Kalibaru (Fig. 40). This area yielded evidence of a neolithic settlement which is situated on an elevated section of the rubber plantation and had been excavated by Van Heekeren in 1941. During this short visit Van Heekeren was able to point out the spot which he explored.

Based on Van Heekeren's indication, an excavation plan was decided on for the near future in this area. The main purpose of this plan was to record data on this neolithic site through systematic excavation and to collect samples for a C-14 dating test. As is known, Van Heekeren lost all his material and records during the Second World War.

Preparatory Stages:

The working programme of the Kendeng Lembu exploration was settled as follows:

First Stage: surveying and mapping of the site to be excavated (Fig. 41).

Second Stage: Excavating sufficient sectors near pre-war excavated parts of the site. The box-system is considered the most effective to be applied.

Third Stage: Publishing the results of the excavation.

Fourth Stage: Future excavation based on the results of this excavation.

A. S. Wibowo in his capacity as Head of the Modjokerto Branch Office gave full co-operation during the periods of mapping and excavation. The technical staff of this Branch Office was brought into the activities as well as the jeep to transport the members of the exploration team from Modjokerto to Kendeng Lembu and back and the material excavated from Kendeng Lembu to Djakarta.

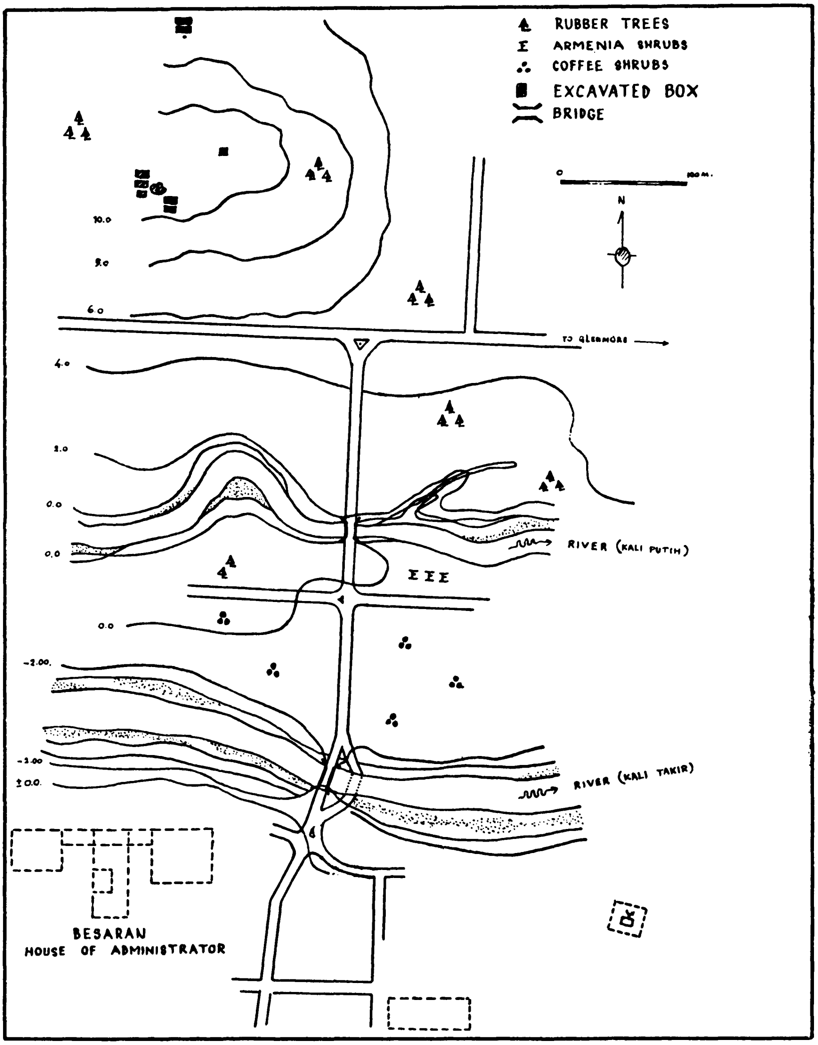

Fig. 41. Map of Kendenglembu Site.

by courtesy of Soejono

Surveying and mapping of the Kendeng Lembu site was executed by Teguh Asmar assisted by Sudardjadji and Sutiknjo of the technical staff of the Modjokerto Branch Office, from October 28 to November 7, 1968. An area of 625 x 225 m. was surveyed and mapped (Fig. 41).

The excavation was performed from January 15, 1969 to February 4, 1969. The excavation team included members of the Prehistory Department, namely R. P. Soejono, Teguh Asmar, Hendari Sofion, D. D. Bintarti and Made Suta Jasa, and Sutiknjo from the Modjokerto Branch Office. The Board of the Kendeng Lembu Estate put 6 labourers at the disposal of the team. The working hours during the excavation effective on working days had been fixed from 7 a.m.—12 a.m., to be continued from 2 p.m.—4 p.m.

Excavation:

It was decided that the excavation should take place close to the spot which, according to information from elderly inhabitants, had been excavated before the outbreak of the Second World War by the Dutch Administrator of the Kendeng Lembu Estate, W. van Wijland. The name of Van Heekeren was not known in these circles in connection with this pre-war excavation. The spot concerned still shows the results of having been excavated, having a hollow which is bordered here and there by low heaps of removed soil. A lay-out of 5 boxes was made, but before the digging started, a trial pit of 1.5 x 1.5 m. was dug to a depth of 1.5 m. to check the stratigraphical situation of the site (Fig. 42).

The excavated boxes, here indicated as Sectors I—V, measured 3 x 3 m. each, except Sector V, which measured 3 x 2.5 m. The maximum depth of the sectors reaching virgin level are respectively 1.065 m. (S. I), 1.115 m. (S. II), 1.26 m. (S. III), 0.91 m. (S. IV) and 0.96 m. (S. V) (Pl. 94a, b, c; Pl. 95a, b, c).

Over the whole site two main layers were observable in the course of the excavation, namely an upper layer consisting of loose brown soil and a lower layer consisting of compact dark brown soil (Fig. 42). An intermediate layer of greyish-black ash which is mostly not clearly distinguishable ran between the two main layers. At some points, as in S. II, another kind of layer, light brown coloured and semi-compact, was found between the main layers. This layer seemed to be a proof that this part of the site had been disturbed in former times. It can be accepted that beside some irregularities in general two principal cultural strata existed which are in accordance with the two main soil layers. The first or upper layer of ± 0.44 m. average thickness contained remains of the historic period: sherds of wheel-made pottery, bronze coins (*kèpèng*), terracotta fragments among which were many fragments of brick, some porcelain fragments and several other minor items. The second or lower layer, of which the average thickness to virgin level was ± 0.70 m., yielded neolithic material including several polished adzes, a fair amount of neolithic 'planks', pounding stones,

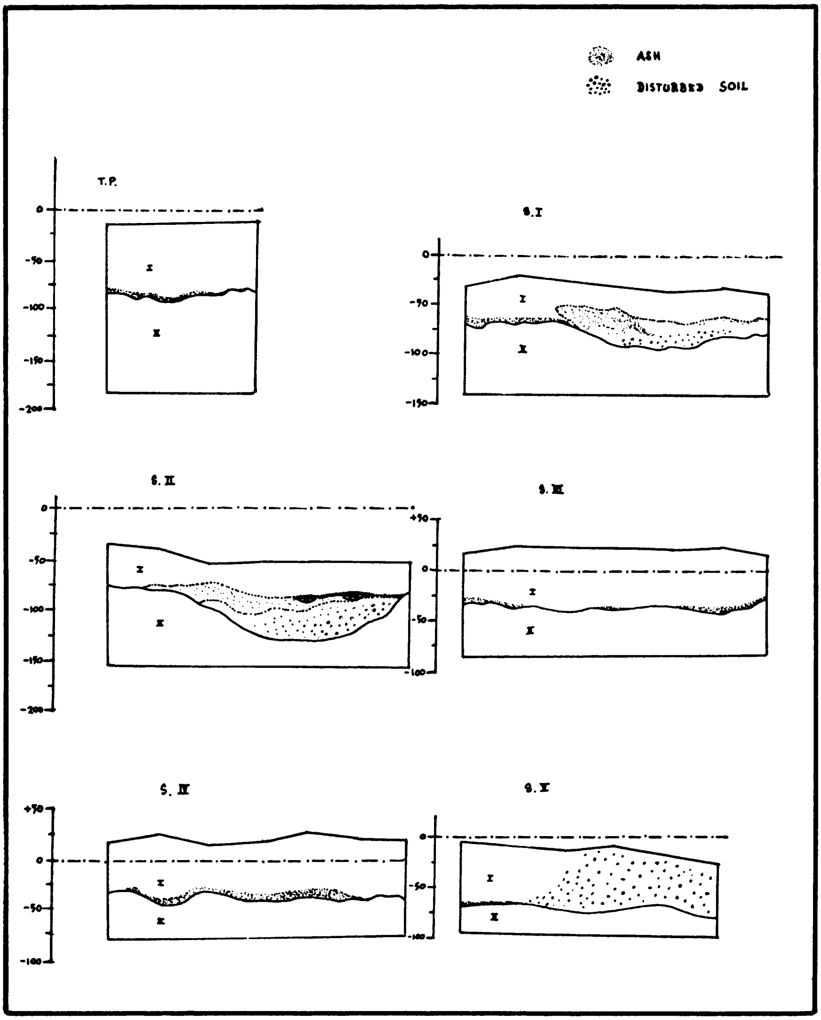

Fig. 42. Diagram of Layers on East Wall of Trial Pit and Sectors, Kendenglembu.

by courtesy of Soejono

grinding and polishing stones, some anvils, a large number of chips and flakes, some peculiar shaped flake and blade implements, and sherds of coarse red burnished pottery.

Rains hampered the excavation and objects were not easy to detect because of the muddy condition of the soil. It occurred many times that finds had to be picked up from earth removed from the excavated sectors.

59 m. north of the 0-point-1, two sondages each measuring 5 x 2 m. with a maximum depth of 1.20 m. were made. These sondages were situated on a sloping section of the site, 1.52 m. below 0-point-1. No archaeological remains were found in the sondages except that fragments of brick were revealed in the upper layer of Sondage II. Earth layers in both sondages showed the same main composition as those in the excavated layers.

Some small pieces of charcoal were detected in removed soil. Being thrown away and swathed in blackish muddy soil their proper positions were not known.

Finds:

All kinds of finds were recorded and are classified in items, as shown on the table. Additional notes on some items will be given as follows: Pre-planks are fat lumps or pebbles showing the first stage of working to obtain a rough-out of a plank.

Split stones are pebbles, either small or big, showing traces of splitting. These items would have been prepared for grinding or to obtain planks.

Chips consist of crude flakes and a small number of blades of which about 60 % show a bulb of percussion. The thickness of large and small sized chips ranged from several mm. to less than 1 mm. Only some detached parts of stone were used as tools, showing use retouches, among which could be selected types of knifeblades, sickles and points.

Grinding stones are irregularly shaped stones bearing facets as a result of grinding. Only two samples of polishing stones were unearthed, showing grooves and polished edges. Potsherds can be clearly divided into two main types (Fig. 44), namely those originating from the historic period, which are dark brown and reddish in colour and wheel-made, and a second type originating from the neolithic stratum, which are red and light brown in colour and show marks made by hand. The first type was found in the first, upper layer and the second type in the underlying layer and mixed with chips and planks. The sherds bear no pattern or ornamentation, except that grooves occur on rims of historic pottery, but in most cases both types show traces of red burnish. Sherds from both levels have an average thickness of 0.5—1 cm. Some prehistoric sherds are only 1 mm. thick. The prehistoric sherds are for a great part eroded, coarsely manufactured and round-bottomed, while historic sherds are well-preserved and show remains of pots with flattened base.

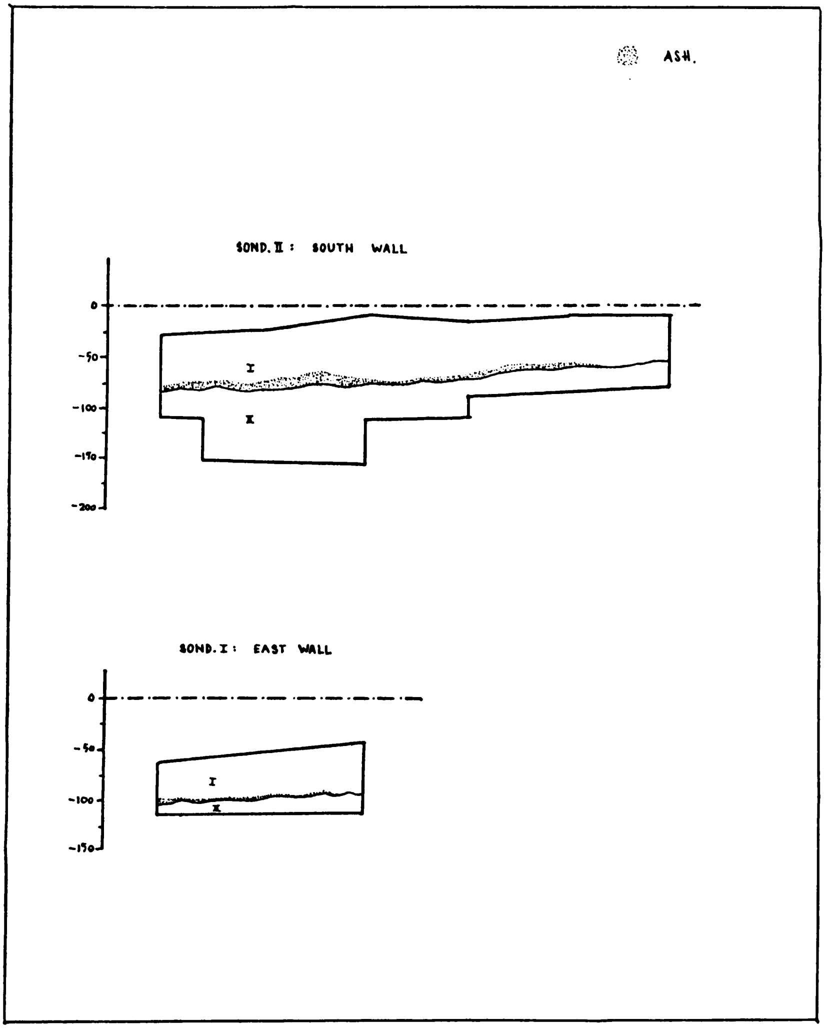

Fig. 43. Diagram of Layers of Sondages.

by courtesy of Soejono

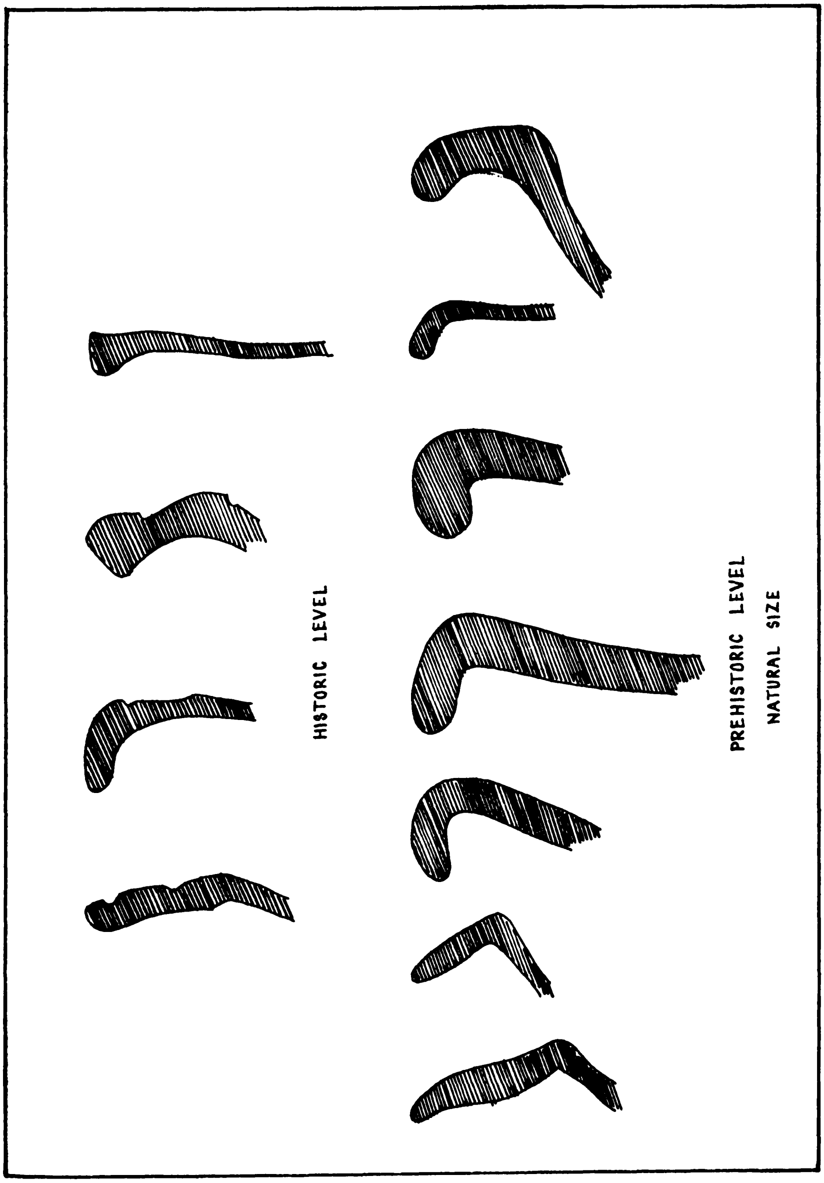

Fig. 44. Cross-sections of Rims, Kendenglembu. by courtesy of Soejono

TEMPORARY TABLE OF FINDS

CLASSIFICATION OF FINDS			SECTORS AND			
			S I	DEPTH	S II	DEPTH
ADZE	Polished	complete	1	85.5	—	—
		fragment	1	—	—	—
	Plank	complete	12		3	
		fragment	4	88.5	2	108.5
	Pre-plank		2		3	
ATELIER	Split-stone		56		55	
	Pounding-stone		6		6	
	Polishing					
	——— -stone		4	84.5	10	108.5
EQUIPMENT	Grinding					
	Anvil		—			
	Pebble		14		30	
CHIPS	Bulbus : flake/blade		276		92	
	Non-Bulbus: flake/blade		103		17	
				88.5		108.5
KNIFE-BLADE			7		3	
SICKLE			—		1	
POINT			2		—	
POTSHERDS	Rim	prehistoric	17	88.5	29	106
		historic	2	18	4	97.5
	Body	prehistoric	190	88.5	184	106
		historic	13	18	36	55
	Basis	prehistoric	—	—	—	—
		historic	1	18	6	87
TERRACOTTA	Brick		—	—	5	40
	Non-Brick		9	87	13	
MISCELLANEOUS:						
	Porcelain fragment		—	—	1	—
	Coin/Kepeng		—	—	—	—
	Iron ring		—	—	—	—
	Ring-smoother/Perforator		—	—	—	—
MAXIMUM THICKNESS	LAYER I		45.5 cM.		34 cM.	
	LAYER II		79.5 cM.		82.5 cM.	
	(to deepest excavated point)					

OF KENDENGLEMBU SITE

AVERAGE DEPTH IN cM.								AMOUNT
S III	DEPTH	S IV	DEPTH	S V	DEPTH	V.D.	DEPTH	
2	117.7	—	—	—	—	—	—	3
—	—	1	78	—	—	—	—	2
—	—	8		5		1	70	29
5	57.5	5	79.5	2	86.7	—	—	18
—		6		4		—	—	15
90		43		39		8	75	291
2		—		2		—	—	16
1	90	3	60.2	4	88	—	—	22
5		1		—		—	—	1
81		14		17		2	—	82
15		191		111		152		903
1		83		20		83		321
	90		80		82.7		70-78	
—		2		1		1		15
—		2		—		—		3
—		—		—		—		2
1	122.5	23	83.5	17	82	—	—	87
52	35.5	—	—	12	70.5	—	—	70
10	92.5	125	78.5	212	82	9	70	730
227	35.5	31	55	71	63.2	3	—	381
—	—	—	—	—	—	—	—	—
2	27.5	1	78	5	59.5	—	—	15
80	35.5	10	54.2	1	—	1	—	97
7		11		40	54	6	—	91
2	32.5	—	—	1	—	—	—	4
1	33.5	1	—	—	—	—	—	2
1	32.5	—	—	—	—	—	—	1
—	—	—	—	1	84.5	—	—	1
70 cM. 90 cM.		58 cM. 56 cM.		61 cM. 41 cM.				

Some remarks:

It is proved that except for irregularities caused by disturbance of the soil two different successive layers occurred, namely a neolithic and a historic compound. It is not possible to decide from which level the historic remains originate. So whether the historic pottery is from a Madjapahit level is still the question, because comparative material from the Madjapahit period did not show identical types of pottery.

Because of the neolithic items it can be considered that the Kendeng Lembu site was a neolithic workshop. No evidence of activities of village life were found.[207]

The ash-layer on top of the neolithic stratum indicates volcanic activities of Gunung Raung, which is situated north of the Kendeng Lembu area.

Spots containing an almost identical neolithic compound were discovered approximately 1 km. south of the excavated area. Finds made at the end of 1968 during the digging of drainage trenches between rubber trees gave evidence that excavations at these spots should yield sufficient results.

To collect charcoal samples is only possible during excavations in the dry season, so that further explorations should be carried out in order to obtain absolute dates for the site."

So far the report of Soejono.

The stone adzes were all of the four-cornered, rectangular type; the pottery was simple and utilitarian. The results are not yet fully worked out.

b. *Celebes: The Karama River*

The Karama is a large river with dangerous rapids in the country of the West Toraja in Central Celebes. It rises in the central mountain ranges and debouches into the Strait of Macassar at the village of Sempaga. A few miles upstream, on the right bank of the river, there lies the hamlet of Sikendeng where previously an Amaravati bronze statue was found. In May 1933 a trial excavation was carried out by A. A. Cense; not a single trace of a Buddhist settlement was found, but only some polished stone axes and a fair quantity of potsherds, most of them undecorated. When the inhabitants noticed that Cense was interested in such implements, he was informed that some years ago, during the construction of a road near the village of Kalumpang,

[207] On this point I have a somewhat different view. The fact that such a great number of potsherds were found points to a neolithic settlement where stone artifacts were made. Organic material such as wooden structure could not be expected to survive in the lateritic soil at the site.

93 km. upstream from Sempaga, quite a number of stone tools and potsherds had been recovered[208] (Fig. 45).

Kalumpang:

After receiving this information the Governor of Celebes and A. A. Cense paid a visit to Kamassi Hill, less than one km. southwest from Kalumpang, on the left bank of the Karama River, where the district officer had made a collection of prehistoric tools and sherds. Subsequently P. V. van Stein Callenfels was invited to undertake an excavation on Kamassi Hill, which in former days had served as a ricefield. The excavation on the east side of the hill, measuring 4 x 5 m., and a narrow trench perpendicular to it were started on 25 September and finished on 17 October 1933. All organic material had decayed and no traces of wooden piles of an old dwelling or other signs of habitation were detected. Concealed in the earth of the shallow upper layer he found a great number of ornamented and unornamented potsherds, highly polished rectangular adzes, small chisels of slate, axes with knob-like handles, fragments of stone rings, unfinished axes, knives with oblique cutting-edge resembling the Tembeling knives of Malaya, polished stone arrowheads, a crude shouldered axe and some pebble-tools. A paper on the results of his excavation, originally read before the Prehistoric Congress in Manila in 1935, was finally published 16 years later after much delay.[209]

From August 23 to September 1949, the present author made a fresh excavation in the southern part of the flat top of the hill, 13 m. above the river.[210] Most probably neolithic man had chosen this site as a look-out and for protection against hostile invaders and against floods (Pl. 96).

The shallow upper layer, in which archaeological finds were made, was a hard dark-brown cloddy tuff-marl clay, 11—63 cm. thick, overlaying an archaeologically sterile yellow-white marl with chalk concretions. We collected on the surface, prior to the excavation, 32 pieces of unworked obsidian flakes and some porcelain sherds. Concealed in the upper layer 840 objects were revealed. These were marked in on a horizontal plan on milligraph paper, and the depth of each object was

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208 When we wanted to examine the Sikendeng site in 1949, it appeared that the site had vanished during a disastrous flood.
209 Van Stein Callenfels, '52.
210 Van Heekeren, '50.

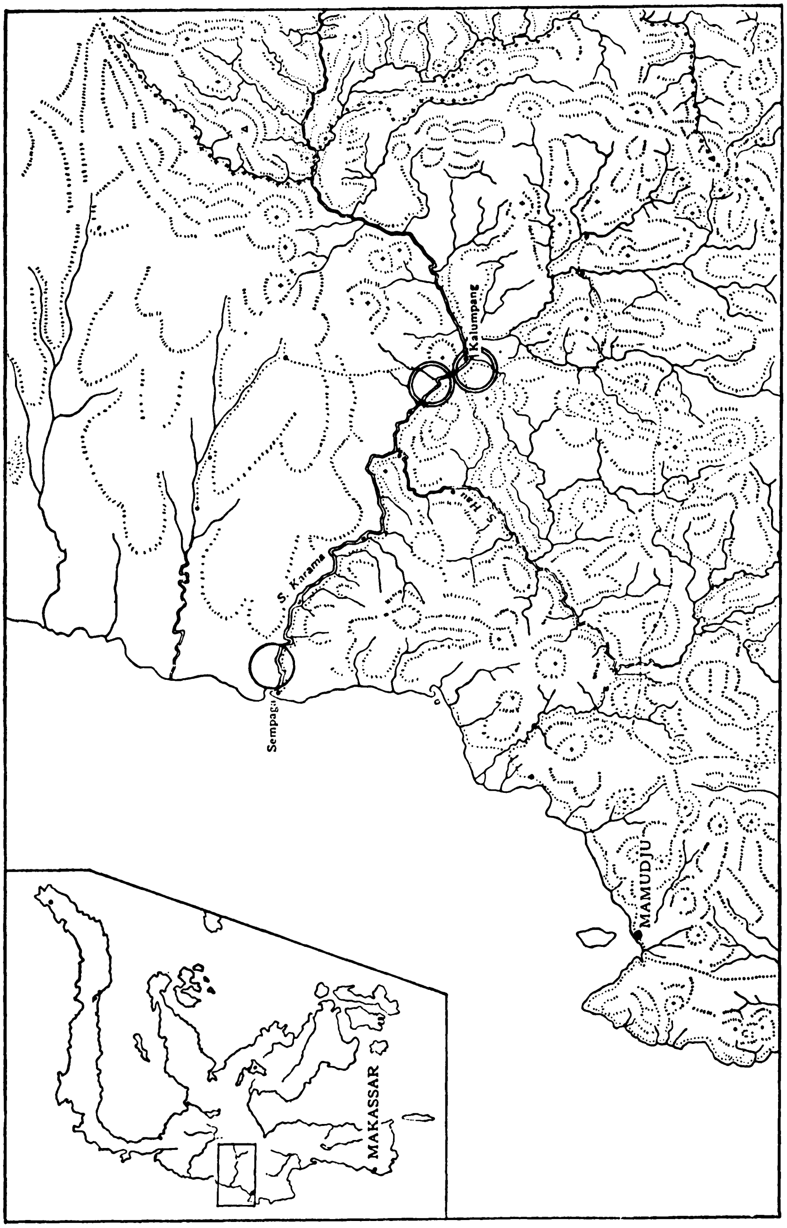


Fig. 45. Location of the neolithic sites on the Karama River.
From east to west: Kamassi (Kalumpang), Minanga Sipakko, Sikendeng.

registered. Due to the shallowness of the cultural layer, no clear stratification could be established. The following finds were recorded:

22 highly polished, four-cornered rectangular adzes made of a hard green chert. The largest specimen measured 85 x 50 mm.; the smallest only 22 x 9 mm. The upper face of the larger examples was more or less vaulted (Pl. 98).

11 ground oval axes made on river pebbles with a lenticular cross-section. Among them are some violin-shaped axes with little or no polish. Objects of this class are known from Botel Tobago, Formosa and Japan but not from western Indonesia (Pl. 99, 100).

5 polished, flat spearheads made of slate, also known from Manchuria, Mongolia, Luzon and neolithic Hong Kong. One example is stemmed (Pl. 97).

22 tanged, knobbed or winged polished arrow-heads and knives made of slate and schist showing a resemblance with such missiles in Manchuria and Japan.

27 unfinished stone adzes and axes or "planks". One group consists of large and small pieces struck off pebbles; the second group are made of river pebbles split lengthwise, destined for the manufacture of axes with polishing of the cutting-edge only.

1 stone slab with concave upper side.

1 stone bark cloth beater of a type still used in this area today.

1 phallic symbol made of baked clay. Similar pieces were found in neolithic sites in South China and one during the Ban-Kao excavation in Northwest Thailand.

706 plain, badly baked brown potsherds.

44 (or 5.9 % of the total sherds) elaborately ornamented potsherds, mostly red.

The sherds were incised and impressed with hatched triangles, squares, angular scrolls, circlets, meanders and the more or less linear adaptation of the human figure to a rather geometrical pattern (Fig. 46), related to and derived from Sa-huynh designs. There were also fragments of earthenware lamps on stands with triangles cut out of the foot. Similar examples are known from the Lung-Shan, Shang and Chou periods of China. Also found on Luzon, the classical Dongson site in Vietnam and at Pradjekan, East Java. Finally there were some crude pebble-tools in the collection. The occurrence side by side of grinding and polishing stones and unfinished tools suggests that the tools were made on the spot.

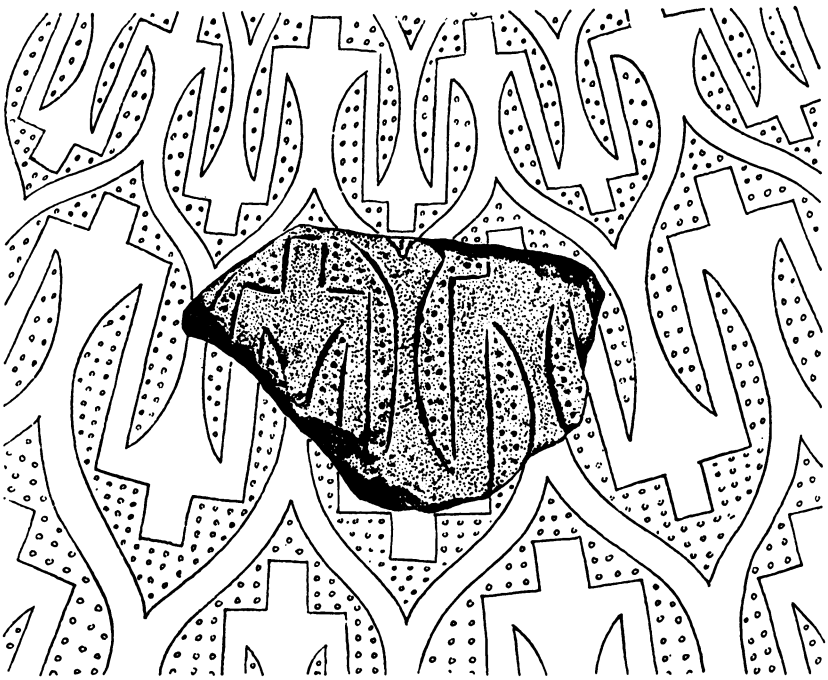


Fig. 46. Incised stylized human figures on sherd of Kalumpang (reconstruction by Carl Schuster).

The layer in which all finds were made contained augite in various conditions of weathering. Soil samples were examined by the soil-scientist Dr. W. F. van Beers who came to the conclusion that this soil formation could not be older than a thousand years. This would mean that we may speak of a serious retardation in this area, probably mainly due to its isolation.

On the basis of studies already made on the Kalumpang culture which seems to be a late neolithic single culture of mixed character, we may conclude that this culture wave penetrated Celebes from the north, i.e. the Philippines. There is evidence that the people used bark cloth. Further we may assume that there was a vigorous head cult and head-hunting, a practice which continued until the twenties of this century. In the absense of radio-carbon corroboration, any further attempt to assign an absolute date seems futile.

Apart from artifacts we have also found some human and animal bones which in some cases were charred. D. A. Hooijer has analyzed the scanty remains:

Homo sapiens L.: an incisor (Il dext.) and four bone fragments of an ulna dext., of a fibula dext., and the proximal pieces of a metarsal IV dext., and of a metarsal V dext.

Anoa sp.: a part of a right horn.

Sus celebensis (a small form): some incisors, canine and molars and bone fragments.

Sus vittatus: two canines of the lower jaw. An important domesticated form.

Finally there were some fish remains.

Minanga Sipakko:

On 1 September 1949, on one of the last nights of our stay at Kalumpang, a native informant came to sell us some prehistoric objects including 1 ground oval axe, some ornamented potsherds and 1 stone bark cloth beater of which the front part was missing. The material came from a place called Minanga Sipakko on the right bank of the Karama River, 1 km. downstream Kalumpang. During the last flood in January 1949, when several houses at Sempaga village were destroyed, a part of the riverbank at Minanga Sipakko had collapsed and the objects had tumbled down (Pl. 102).

On our journey back by canoe on 5th September, we paid a short visit to this place where we still found 10 oval axes, some unfinished axes, many large pieces of decorated and undecorated potsherds, mandible fragments of a pig, and a fragment of a stone bark cloth beater. The latter appeared to be just that part which was missing from the piece we had bought at Kalumpang. It was a so-called "horned" bark cloth beater, well-known from Luzon and also from an example from Southeast Borneo.[211]

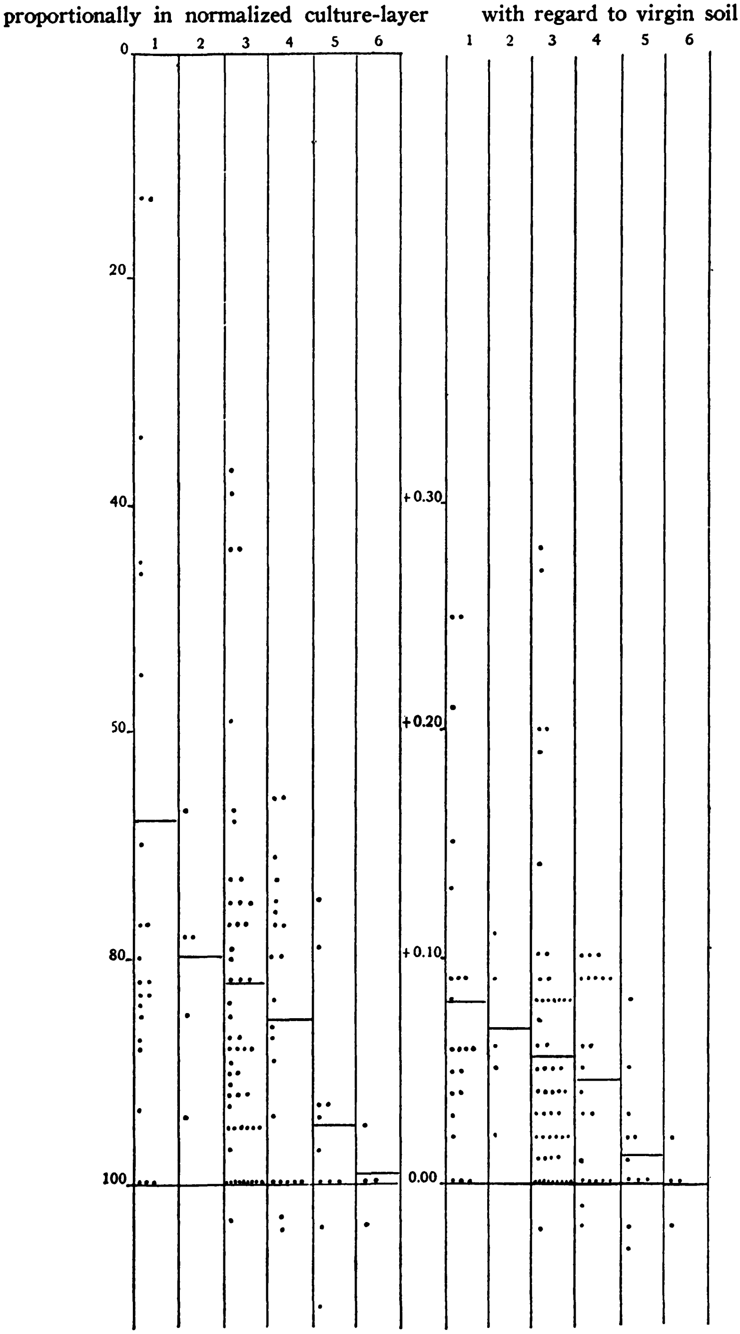
We were struck by the absence of four-cornered rectangular adzes.

A layer 2 m. thick covers the neolithic site. Sufficient evidence had now accumulated to establish that doubtless there was here a new locality with great scientific possibilities which would provide a vast store of valuable information when at some future time it could be made the subject of special study and an expedition sent to undertake large-scale excavation.

This site is bound to be much older than the Kalumpang site.

[211] Van der Hoop, '35.

SCHEMATICAL INDICATION OF THE DEPTH DISPERSION OF SOME CULTURE-ELEMENTS AT KAMASI - KALUMPANG SITE



1.	four-cornered polished adzes	22	4.	stemmed arrow-heads	22
2.	polished spear-heads	5	5.	ground oval axes	11
3.	ornamented potsherds	44	6.	pebble-tools	4

c. *Sumba: Melolo Urnfield*

At first I ascribed the Melolo Urnfield to the Bronze Age, basing my opinion mainly on the presence of elaborate pottery. But as there has been no evidence up to the present of a single piece of metal, the viewpoint now taken, justifiably or not, is that this site should be included in the Neolithic.

From an early date the necropolis of Melolo, an extensive urnfield in the eastern part of the island of Sumba, has drawn the attention of the curious, and part of it was pillaged by marauders of Savunese origin and by unqualified and incompetent explorers. Only the diggings of E. R. K. Rodenwaldt and L. Onvlee respectively have been to some purpose, and an excellent excavation was carried out by W. J. A. Willems.

The first person to devote a few lines to this hoard was A. C. Kruyt who wrote in connection with some digging by D. K. Wielenga. In 1923 excavations were carried out by L. Dannenberger and Rodenwaldt. Rodenwaldt divided his finds between the Museum at Djakarta and the Tropical Museum at Amsterdam. He also sent 34 human skulls found in urns to J. P. Kleiweg de Zwaan, who made a detailed study of them.[212]

In 1926 K. W. Dammerman did some excavation in this graveyard. After that date all unauthorized digging was forbidden.

In 1936 permission was given to Onvlee for renewed research of the terrain. This learned scholar, although not an archaeologist, sent an extensive report to the Head of the Archeological Service in Batavia (Djakarta), presented the funeral furniture and other finds to the Museum in Djakarta, and sent the human remains for examination by the physical anthropologist C. A. R. D. Snell in Surabaja. The anthropometric study on this material is the subject of a special publication.[213]

P. J. Lambooy also published a short article on Melolo in which he mentions, among other discoveries, the lower jaw of a pig found in an urn, the only indication of animal sacrifice at Melolo.

In the months of August and September, 1939, Willems, then prehistorian to the Archaeological Service, carried out an excellent and systematic excavation on the same terrain. Unfortunately he left for Europe shortly after, never to come back. However, I was able to find

[212] Kleiweg de Zwaan, '41.
[213] Snell, '48.

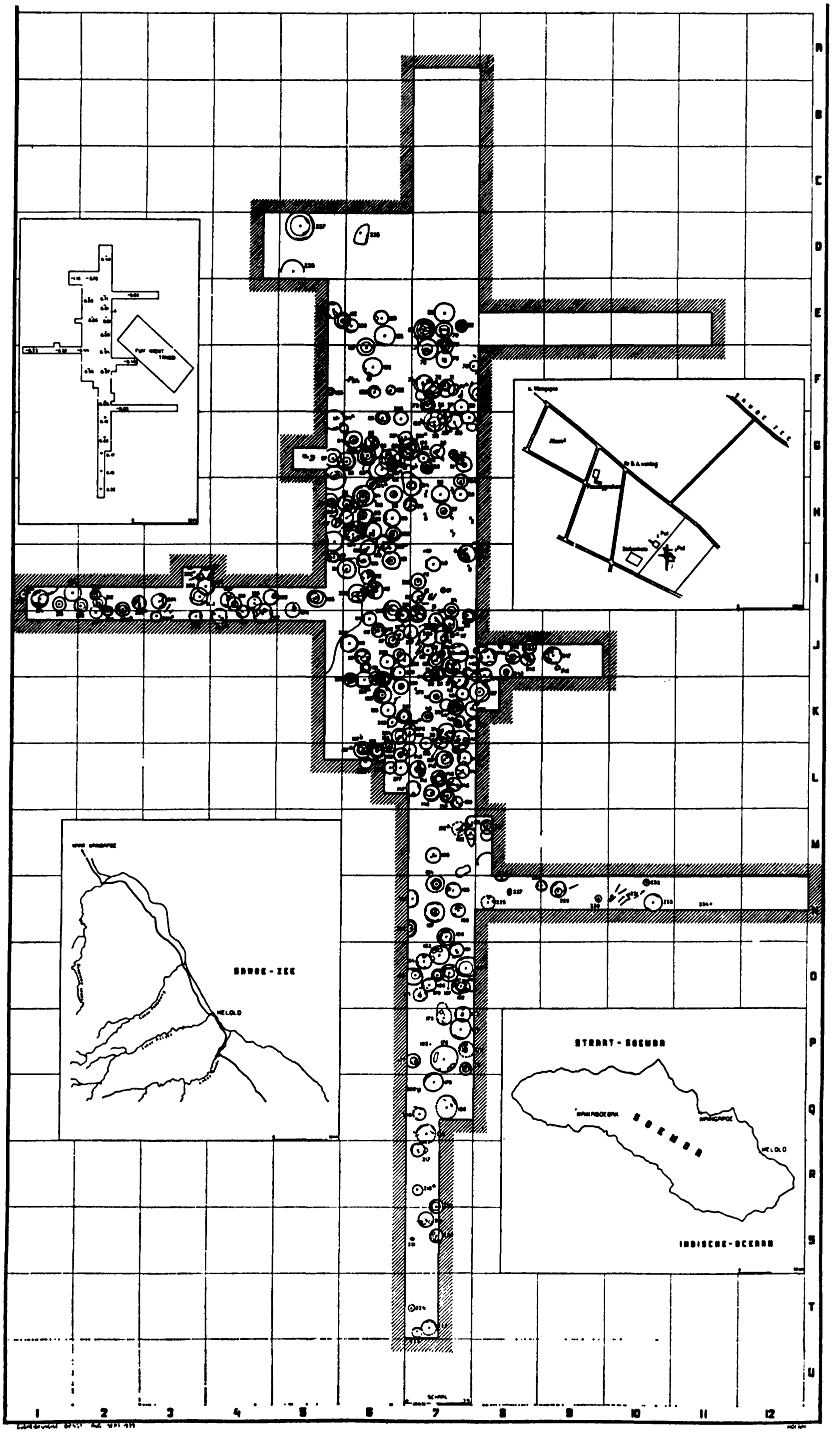


Fig. 47. Map of the excavation of the Melolo Urn Field, East Sumba.

and use his diary, photographs, and drawings for a treatise on Melolo after I had taken his place after the War as a prehistorian to the Archaeological Service.[214] My conclusions were as follows:

Melolo is an extensive urn cemetery. Only a part of it has been explored so far and its boundaries on the south and west have not yet been clearly defined. The area is about 20-25 m. in length. Numerous

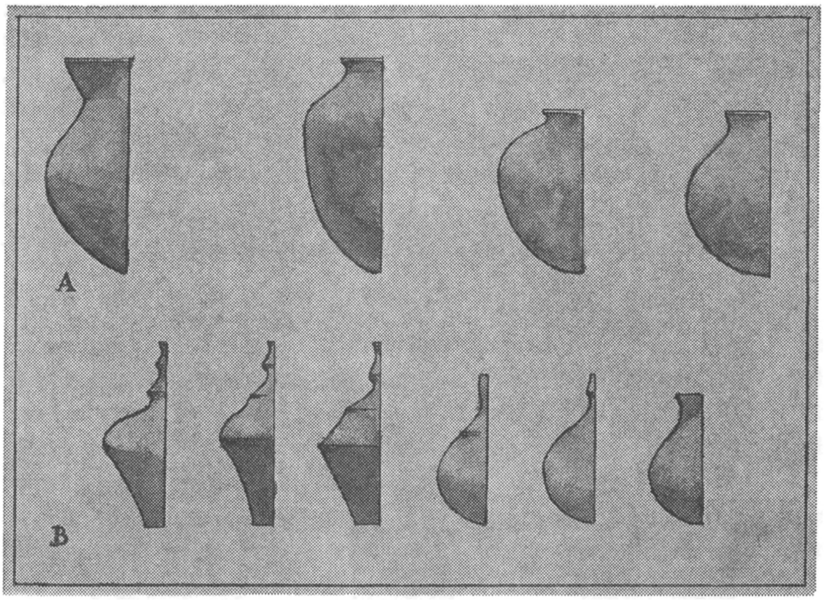


Fig. 49a. Urn profiles, Melolo, East Sumba.
49b. Burnished flask profiles, Melolo, East-Sumba.

urns were recovered some 2 to 50 cm. below ground level with no apparent scheme of distribution. They were found singly, and sometimes in groups. The urns were of a low standard of workmanship and poorly fired. They were large round-bottomed pots, simple and utilitarian: none had a flat base. The colours were red, grey and dark-brown. Many had collapsed and were crushed and sometimes mixed together in a confused mass. Comparatively few specimens were unearthed intact. A large proportion of the broken urns could be restored. They were all globular jars, some with straight necks, and mouths of varying width, others with necks curving outwards to a lesser or greater degree (Fig. 49a). Only a few were adorned, simple

[214] Van Heekeren, '56.

incised line patterns being used, mostly meanders, wavy lines, and fingernail imprints. The height varied from 20 to 70 cm. The urns were found covered in various ways: by large sherds, by broken pots, and sometimes by peculiar earthenware flasks placed inverted into the mouth of the urn.

The urns contained human skeletal remains but never a complete skeleton, which points to the custom of secondary burial, the skull only, with or without mandible, sometimes with a few limb bones, being finally buried in an urn. Although the majority of urns contained one skull only, there were examples of two or three skulls in one urn, skulls of adults as well as of children. In this kind of multiple interment all the dead were probably buried simultaneously (Pl. 103, 104, 105).

Funeral gifts found consisted of shell beads drilled on both sides, stone beads, shell bracelets and rings, polished four-cornered rectangular stone adzes and a unique pendant, skillfully carved out of shell, representing a pig's head (Fig. 50).

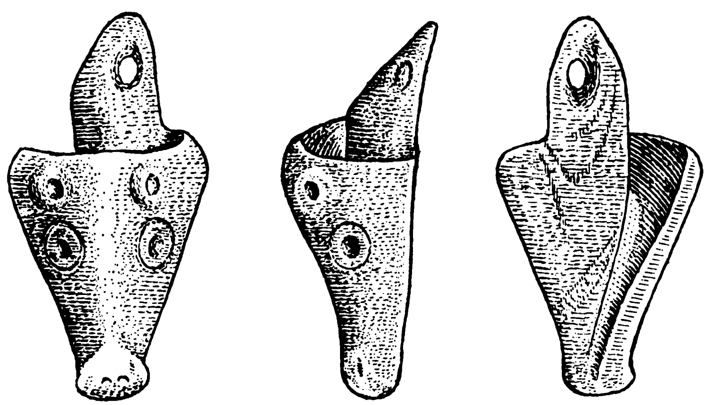


Fig. 50. Pendant made of shell: a carved pig's head.

Outstanding among the grave-goods were the earthenware flasks, red or dark-brown with long and slender necks (Fig. 49b). A wash of thin clay was applied to the surface and subsequently burnished. The craft of this ceremonial pottery is of a high standard. They were decorated with incised and punctuated line patterns, the lines filled in with a white substance or paste (Fig. 48). A fair number of the vessels had human face designs, incised with great skill between rim and shoulder, faces usually with round eyes, sometimes with oval and

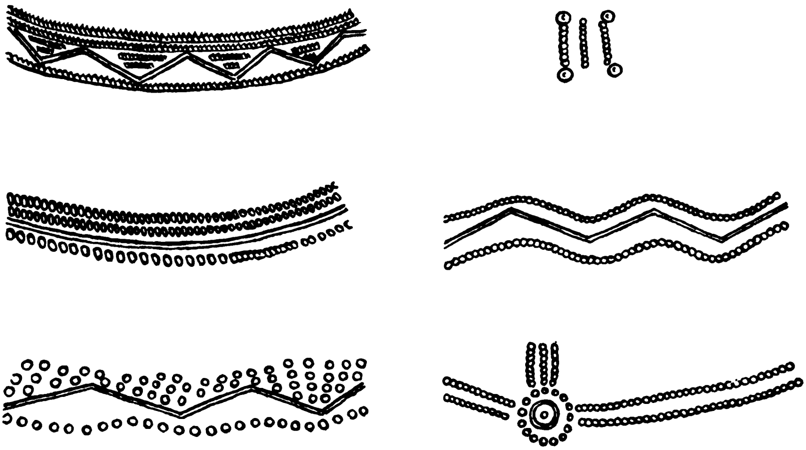


Fig. 48. Geometric incised and impressed ornaments on burnished flasks found as burial gifts in urns, Melolo, East Sumba.

in one instance with slit eyes. One jar had three faces (Fig. 51). Another jar was quite outstanding and different from all others. It is of a dark brown earthenware and the neck is shaped like a human effigy with flattened torso and short outstretched arms. The head is covered with what seems to be a kind of helmet (Pl. 105).

The funeral goods were buried and were found intact in many cases and others were easily reconstructed, either entirely or in part from the fragmentary remains.

A record was made of a considerable number of skulls found, from which it appeared that these urn-burial people were a meso-dolichocranic group, apparently a mixture of Palaeo-Melanesian and Malayan races. Similar groups still live further to the east in the Indonesian Archipelago.

When we enter into the problem of the origin of the Melolo culture, we find that it is conceivable that we are dealing with a local development, although this is doubtful. Probably we should look elsewhere for the roots of this culture, but the dilemma is, as we should reveal at once, that nothing of the sort has ever been found in Southeast Asia, and therefore the matter remains a subject of speculation. Let us admit that in the present situation it seems better to postpone discussion of the matter.

Nothing is known about an absolute date. We are not even sure whether it all belongs to the Bronze or to the Neolithic age. The situation is comparable in a way to that of Kalumpang, with the

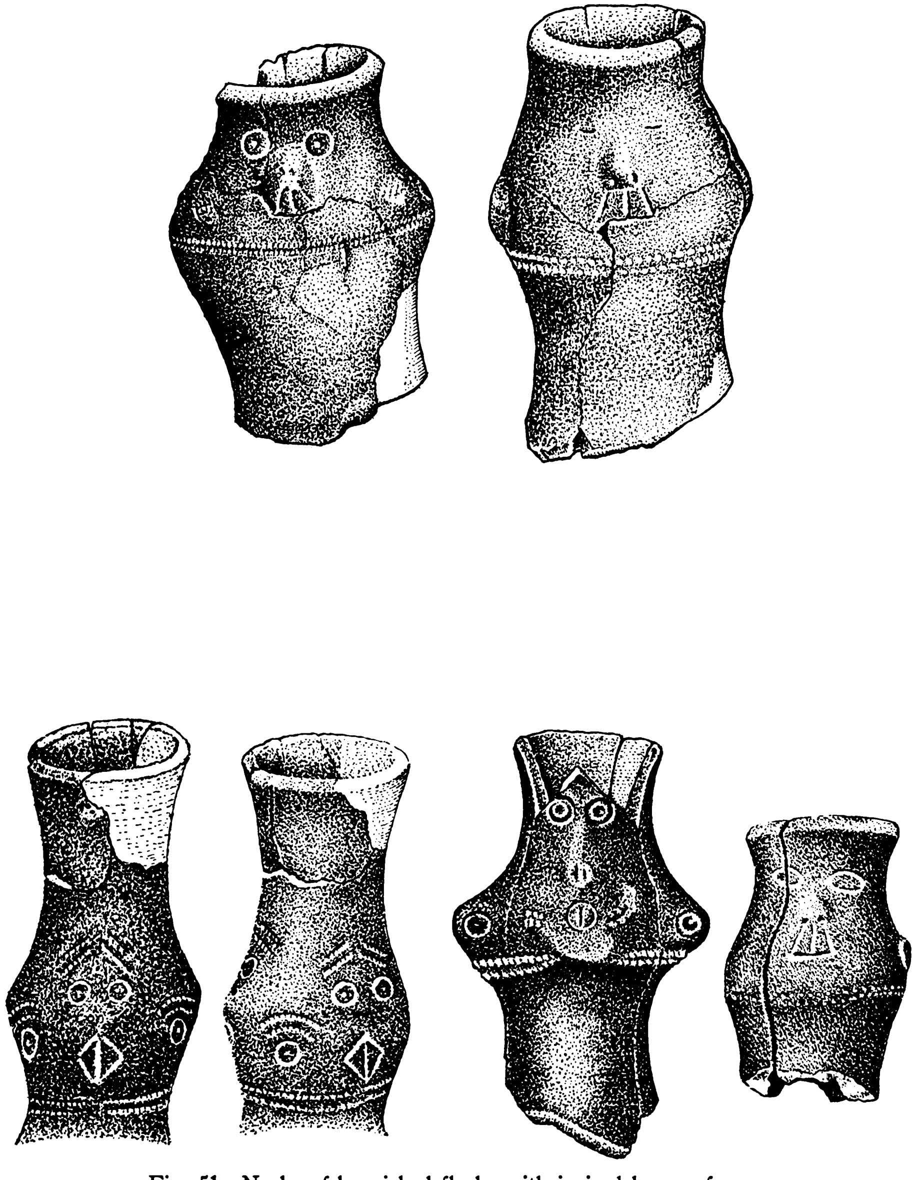


Fig. 51. Necks of burnished flasks with incised human faces.

PRINCIPAL ANTHROPOLOGICAL DATA OF THE SKULLS FROM MELOLO

(after Snell and Kleiweg de Zwaan)

	Max. Length	Glabello Inion L	Max. Width	Min. Frontal Width	Max. Occip. Width	Height Calv.	Index Cranialis
A.	177	168	131	85	101	100	74.0
B.	188	181	130	101	110	110	69.4
C.	183	171	131	88	99	111	71.6
D.	166	157	133	83	100	98	80.1
E.	184	172	139	96	—	108	75.5
F.	183	175	—	90	105	106	—
G.	175	153	128	85	99	102	73.1
H.	181	164	133	91	103	111	73.5
I.	173	163	136	—	—	101	78.6
J.	170	149	136	—	101	113	80.0
K.	182	173	—	89	101	101	—
I.	181	164	133	—	106	107	73.5
II.	160	156	126	85	97	88	78.8
III.	190	184	137	95	112	107	72.1
IV.	178	173	140	87	105	98	78.7
V.	183	171	138	93	—	102	75.4
VI.	187	180	136	—	112	101	72.7
1.	178	163	133	94	102	109	74.72
2.	186	183	133	96	106	101	71.51
3.	185	181	140	—	114	108	75.68
4.	176	171	136	98	105	103	77.27
5.	175	174	125	—	101	97	71.43
6.	186	179	137	—	103	96	73.66
7.	182	182	140	95	113	106	76.92
8.	185	175	144	90	108	105	77.84
9.	180	179	133	92	100	96	73.89
10.	168	164	138	—	—	78	82.14
11.	188	189	136	96	109	97	72.34
12.	178	177	141	—	105	96	79.21
13.	175	169	145	97	107	100	82.86
14.	181	179	134	—	95	105	74.03
15.	180	178	138	—	106	87	76.67
16.	180	172	133	—	109	99	73.89
17.	180	—	141	—	—	—	78.33
18.	178	169	132	96	111	104	74.16
19.	177	178	130	90	101	95	73.45
20.	181	170	138	89	104	106	76.24
21.	171	166	132	90	97	98	77.19
22.	173	—	130	82	104	100	75.14
23.	183	181	136	98	107	99	74.32
24.	169	159	133	84	—	95	78.70
25.	175	166	138	89	104	102	78.86
26.	174	166	133	90	103	96	76.44

	Max. Length	Glabello Inion L	Max. Width	Min. Frontal Width	Max. Occip. Width	Height Calv.	Index Cranialis
27.	173	164	139	90	105	102	80.35
28.	177	165	133	—	105	96	75.14
29.	181	173	135	100	116	105	74.59
30.	183	181	139	—	107	104	75.96
31.	174	—	125	86	—	—	71.84
32.	179	172	137	—	106	105	76.54
33.	167	157	131	87	—	93	78.44
34.	182	178	137	95	107	103	75.27
average	178	171	135	91	105	101	75,7

difference that the Melolo people knew already the art of weaving as is attested by the finds of spindle whorls.

The site is not yet exhausted and requires further research.

6. NEOLITHIC FACTORY SITES

We have seen in the previous paragraphs that in neolithic settlements stone tools were sometimes made in the village, as was attested by the finds of partly finished ("planks") and completely finished and polished rectangular adzes in association with pottery at Kendeng Lembu, East Java, and Kalumpang and Minanga Sipakko in West Central-Celebes.

Apart from this, there were open sites in those areas in Java where there was plenty of raw material for the manufacture of stone tools, which leave little doubt that they were once neolithic workshops. They contain not a single potsherd.

One of the best known areas is that of the Sewu mountains south of Solo in Central Java where in the course of many years more than a hundred workshops became known. The mountains here were built up of limestone alternating with deposits of marl and volcanic tuff. The silica of the tuffs has been dissolved and deposited locally into the underlying limestone, partially replacing the lime. Silicified limestone is found in larger and smaller lumps [215] and provides the raw material from which neolithic man fashioned his tools, namely bifacially flaked arrow-heads and rectangular adzes. Here the ground is littered with great masses of chips and partly finished rectangular adzes but there are no finished or polished specimens. Probably the "planks" were made for trading, and polishing was done later in the village. Apart from

[215] Sartono, '64b, Chapter I.

adzes there were in some sites also flexed arrow-heads similar to those of the Marosso Culture of Early Yomon, Japan. Mostly they were found mixed with "planks" of rectangular adzes, but in one place they were found lying under the adzes, suggesting that they are of an older date than the adzes [216] (Pl. 92).

More open neolithic factory sites have been reported from Krawang, Bogor, south of Sukabumi, south of Malang and from Benaran, Solo.

In Sumatra there is only one site known, near Palembang.

Without any doubt there must be many more workshops in Java and elsewhere but they have still to be discovered.

In a very limited area south of Tasik Malaya in West Java, another kind of workshop has been discovered where the local population provided a large number of stone rings, finished and partly finished. The rings were made of semi-precious stone such as agate, chalcedony and jasper, white, brown and red in colour (Pl. 87). From the remains and debris it was possible to reconstruct on rough lines how the procedure of modelling stone rings took place.

Various sizes of river pebble of semi-precious stone were collected on river banks and then flaked into a rough disc, 1-6 cm. thick and with a diameter of 4-8 cm. The disc was subsequently hollowed out by flaking off small bits of stone from both sides. Then the disc was perforated and at the same time the base was ground into facets. So a coarse ring was obtained with some traces of grinding. The hole was enlarged by grinding to the desired size. The ring was finished by polishing with wood or bamboo. The end product is a shiny, transparent, perfectly shaped ring.[217] Measurements of the outside diameter run from 24 to 54 mm.; the height is 6-17 mm.

Finished rings are known only from West Java, east of Cheribon and west of Bandung. We do not know for certain which purpose the stone rings served as most of them are too small and narrow to be bracelets. More likely they were used as ear rings.

7. FORMER WORKING-HYPOTHESES

Polished stone adzes and axes from surface exposures and purchased from local people have enriched private collections and the museums with thousands of specimens. Notwithstanding the fact that such material is necessarily of limited scientific value because all strati-

[216] Van Stein Callenfels, '32, 25-27.
[217] Franssen, '41, 132-9.

graphical data are missing, it has received a good deal of attention from prehistorians such as Heine-Geldern, Duff, Otley Beyer, Van Stein Callenfels and the present writer. Next to nothing was known about neolithic pottery in those early days of investigation, the twenties and the thirties.

One of the merits of P.V. van Stein Callenfels, who died in 1938, was the foundation of a prehistoric section in the Djakarta Museum and the organization of congresses for Far Eastern prehistorians.

We need not deal at any length with his hypothesis, however, which was meant to subdivide chronologically the neolithic stage in Indonesia, but which was based on prejudice and ill founded imagination.[218] He classified the stone adzes in evolutionary series but failed to take account of the fact that the difference in types or sub-types could adequately be explained on the basis of the rock used and the purpose for which tools had been manufactured. For example small chisels were made for wood carving, large and broad examples for felling trees and breaking the ground, and gouges for hollowing out canoes. Environmental conditions also should be taken into account. It is here well to remember that a large proportion of the polished stone adzes must have belonged to the Bronze Age, as bronze was very costly and beyond the reach of the simple peasants and in consequence stone continued to play an important role during the whole of this period.

For the convenience of the reader it will be as well to recapitulate briefly Heine-Geldern's working-hypothesis which has been a stimulus for other prehistorians working in the Far East for many years; some of these ideas are still valid today. In spite of the unreliability of Oceanic and Chinese archaeology in the thirties, and the absence of stratigraphic data, Heine-Geldern published as early as 1932 a bold and impressive manuscript [219] in an effort to survey on broad lines the neolithic structures, developments and distribution as well the epochs in which migrations took place in the Far East. In 1945, however, he followed this up by a second paper [220] in which he modified his views. His concept was mainly based on the geographical distribution of the various stone axe types and on comparative linguistics. We can do no better than quote Heine-Geldern: .... "that what I called the 'Quadrangular Adze Culture', had been the culture of the Austronesian peoples when they invaded Indonesia ..... as far as western Indonesia

[218] Van Stein Callenfels, '26.
[219] Heine-Geldern, '32.
[220] Heine-Geldern, '45, 139-40.

is concerned, also by pick-adzes with a longitudinal ridge on the upper side and with pentangular or triangular cross-section. At the same time, it appeared that the last common home-land of the Austronesian peoples before their dispersal must have been the Malay Peninsula. However, this "Austronesian" Quadrangular Adze Culture, if we may so call it, could be traced even further back and it became clear that it had come from China by way of the central regions of Further India. The development of the highly specialized pick-adzes of western Indonesia from a simple adze type with quadrangular cross-section and semi-circular edge, found in Laos, through an intermediate type frequent in the Malay Peninsula is particularly striking and indicated clearly the direction and way of the ancient migration". And Roger Duff [221] underlines as follows: "While both adze form and hafting technique would appear unimportant, they are scarcely known beyond the Pacific Basin notably Indonesia - South-East Asia and Polynesia, with a tenuous extension reaching north along the Asiatic littoral to Bering Strait and North-West America".

According to Heine-Geldern, characteristics of the Quadrangular Adze Culture (still prevalent among the peoples of Indonesia) are: planting rice and millet; the special shape of the reaping knife used for harvesting rice; the brewing of beer from rice or millet; the raising of pigs or buffaloes for sacrificial purposes; bark cloth; the custom of head-hunting; megalithic monuments as memorials of sacrificial feasts or as memorials to the dead; and the outrigger canoe which enabled the Austronesians to spread out over the whole of Indonesia and beyond, as far as Madagascar in the west and Easter Island in the east. Support of his views might be afforded by Kern's philological studies: the distribution of the "Quadrangular Adze Culture" seems, broadly speaking, to correspond to that of the Austronesian (Malayo-Polynesian) languages.

Heine-Geldern's views were, in those early days of investigation, based on too little evidence and remained very hypothetical. He grossly oversimplified the problems and he was the first to acknowledge it. He died in 1968. In his last letter to me on January 30, 1968 he wrote the following: "On the basis of your and Sörensen's finds in Siam I am inclined to think that the Lungshanoid culture of Siam was not that of the Austronesians, or at least not the main original Austronesian Neolithic. It lacks those very characteristic types of stone axes and adzes which are known from Laos and the Malay Peninsula. As was

[221] Duff, '59, 121.

to be expected, things now appear far more complicated than when I wrote my paper of 1932". Indeed, the Lunshanoid which was discovered in Siam and in Malaya, does not seem to link up with western Indonesia.

If there was such a thing as a "Quadrangular Adze Culture", we really do not know what is to be understood by it, and the precise relationship between the various neolithic groups in Southeast Asia cannot yet be determined. There is, for example, in China little or no difference between rectangular adzes and axes or for that matter between the bone tools of the Lungshan (with Black Pottery) and the Yang-Shao (with Painted Pottery) phases. And in Indonesia, rectangular adzes have been found in observed association with Sa-huynh pottery, oval adzes and stone bark cloth beaters in Celebes; in urnfields with elaborate anthropomorphic vessels in Sumba, and in Java with simple and plain potsherds. It would be easy to multiply examples, but the above should suffice to prove that there were many "Quadrangular (= Rectangular) Adze" Cultures!

The neolithic complexes probably entered Indonesia at different places and at different times. Also worthy of consideration is the possibility that a population migration from one area to another would presumably assimilate or be assimilated by the culture of the area into which it moved. Whether or not there was already an underlying unity of culture remains a matter of speculation.

Probably there is some validity in Heine-Geldern's assumption that the centre of neolithic civilization was in China, a centre from which influences radiated outward. How such influences were transmitted, however, and in which direction, are questions that cannot be answered yet, except that at least one neolithic wave reached Celebes from the north by way of the Philippines, as our excavations at Kalumpang proved.

D. IN RETROSPECT: THE NEOLITHIC STAGE

In the history of civilization, the neolithic stage is a very important one. It is therefore the more regrettable that we have to admit that our knowledge of neolithic Indonesia is vague and rudimentary. At present it raises more problems than it solves. This is due to various reasons. In the first place we have to realize that there have been only a limited number of archaeologists. Further neolithic settlements are difficult to track down in this immense area, and neolithic cave burials, frequently found in Vietnam, Thailand and Malaya, are, for some unknown reason, lacking in Indonesia. Then there is yet another reason as set forth in the foreword: economic difficulties in the last decades have greatly hampered the progress of archaeological research.

As archaeological evidence is insufficient, we have to content ourselves with an inevitably short and inconclusive summary, based upon a few excavations and on comparison with surviving neolithic social systems. The neolithic in this vast area had a long duration and survived around the margins and in regions of comparative isolation. Thus, in the Polynesian islands it survived till the advent of the Europeans; in the mountains of New Guinea it still exists today. The folk culture in the interior of some Indonesian islands, especially at village level, still retains many elements of old neolithic social traditions.

Drastic increase of population and overuse of the available land on the mainland perhaps forced the South Mongoloids to move to other areas. The expansion throughout Indonesia and beyond was an event intimately related to the diffusion of intensive agruculture, the spread of the four-concerned polished rectangular adze and its variants, the paddle-and-anvil pottery manufacture and the out-rigger canoe. The Mongoloids expanded by way of the sea, and replaced and/or interbred with the former Melanesoids. Conversion to agriculture led to movements inland, particularly along the rivers.

In East Indonesia, more precisely New Guinea and Melanesia, Melanesoid people were responsible for the introduction of the Round Axe and coiled and ring-built pottery complexes and agriculture with two tuberous foods, yam and taro, and fruit trees and the domesticated pig, dog and chicken, all basically of Southeast Asian origin. Rice and millet never reached New Guinea and Oceania in pre-European times. On the coral islands off the shore of New Guinea and the Sangihe islands north of Celebes, where no stone is available, shell served as a substitute.

The term neolithic is here applied to effective village-farming communities with intensive agriculture of taro, yam, breadfruit and bananas and in late neolithic times, millet and rice.

The domestication of animals such as the pig and chicken was a minor affair as the animals were killed only at sacrificial feasts. Beer from rice in Western Indonesia and from sago in Eastern Indonesia were integral parts of ritual festivities. So were head-hunting and the head cult, ancestor worship, feasts of merit, and the use of bark cloth, all social customs still practized on some remote islands and in the interior of some larger islands where they may be regarded as residual elements which have survived with little alternation since neolithic times.

Only a few excavations have been undertaken in Indonesia so far, providing important information about four sites situated at great distance from each other. All sites contained polished rectangular adzes, but otherwise the compounds showed great discrepancies. The excavations provided for the first time large quantities of pottery, one of the most instructive type of object by which cultural areas can be defined.

Recent excavations at the rubber estate Kendeng Lembu in East Java yielded a great number of rectangular adzes, finished and unfinished ones, and a large quantity of plain sherds of simple utilitarian pots, red and dark brown in colour. The presence of stone sickles betrays perhaps that the authors of this culture already knew how to grow cereal crops, millet and/or rice. As the sherds did not show any ornaments, it is not possible as yet to see any relation with other neolithic cultures. When excavation is continued in the dry season, it will probably be possible to collect charcoal samples for radio-carbon 14 dating.

From various elements revealed in the course of the Kalumpang excavation in West-Central Celebes, it became aparent that an important late-neolithic wave had invaded Celebes from the north, by way of the Philippines. Apart from a number of four-cornered rectangular adzes, there were violin-shaped ground axes, knobbed stone knives, ground spear-heads, oval axes, crude shouldered axes, and a 'horned' bark cloth beater of the Philippine type, all occurring with pottery related to the Sa-huynh-Kalanay tradition which was widely scattered over Southeast Asia. The sherds show incised and punctuated ornaments such as rectangular scrolls or meanders, zigzags, chevrons, circlets, impressed punctuations, triangles and geometrical human figures.

The results of the urnfield, located and excavated at Melolo, East Sumba, present an awkward puzzle. The urns were simple, utilitarian, globular pots containing one or more human skulls and infrequently some long bones. The urns were covered with inverted burnished flasks or large sherds. The funerary gifts inside the urns were: elaborately burnished flasks with long necks, red or brown in colour and ornamented with incised lined human faces, polished four-cornered rectangular adzes, spindle whorls, shell bangles, beads and a beautiful carved shell pendant in the shape of a pig's head. Empty spaces were sometimes filled in with geometric ornaments. In some instances the incised lines were filled in with a white paste. There are a few characteristics which show some correspondence with the Sa-huynh tradition: the geometrical designs, the practice of secondary burial, the presence of spindle whorls and beads and the white-inlaid incised lines, but apart from these there are no data of a comparative nature. Concerning the origin of the anthropomorphic designs we are quite in the dark. I do not wish to eliminate the possibility of independent invention, although this is not very likely. We have much more to learn before a final judgment can be made.

In the adjacent countries of Indonesia, South China, Thailand, Malaya, Formosa, Serawak, Australian New Guinea, the last decades have brought an increasing interest in neolithic research and with accompanying expansion of knowledge, a number of surprising data have become known.

It has become apparent from the investigations and from evidence brought forward, based on modern techniques such as radio isotope dating and pollen analyses that:

1. edge-grinding on stone tools in North Australia, New Guinea Highlands, Southwest China, and Further India goes back as far as Late Pleistocene times, about 13000 years B.C. At the same time we may observe already some hafting devices for stone tools such as crude waisted pebble- and flake-tools, crude shouldered and necked implements.

2. Agricultural developments of a primitive character started as early as terminal Pleistocene, 10,000 B.C. in the same tropical rain-forest area.

3. A finding worthy of separate consideration is that the beginning of pottery manufacture dates 6000 B.C. on mainland Southeast Asia as well as New Guinea. The oldest Round Axes from Borneo and New Guinea are of the same age.

4. Horticulture in New Guinea as attested by pig bones has been radio-carbon 14 dated as approximately 3000 B.C.

5. The highly polished four-cornered rectangular adzes have never been found in layers older than 3000 B.C.

The items mentioned under 1-3 are definitely pre-neolithic in the sense in which we have qualified the neolithic proper.

In how far all this is valid also for Indonesia will become apparent by future research. Anyway the time when virtually all information concerning the neolithic stage was based on surface finds of polished stone adzes and axes, and bold hypotheses on slender evidence, seems to be over.

I

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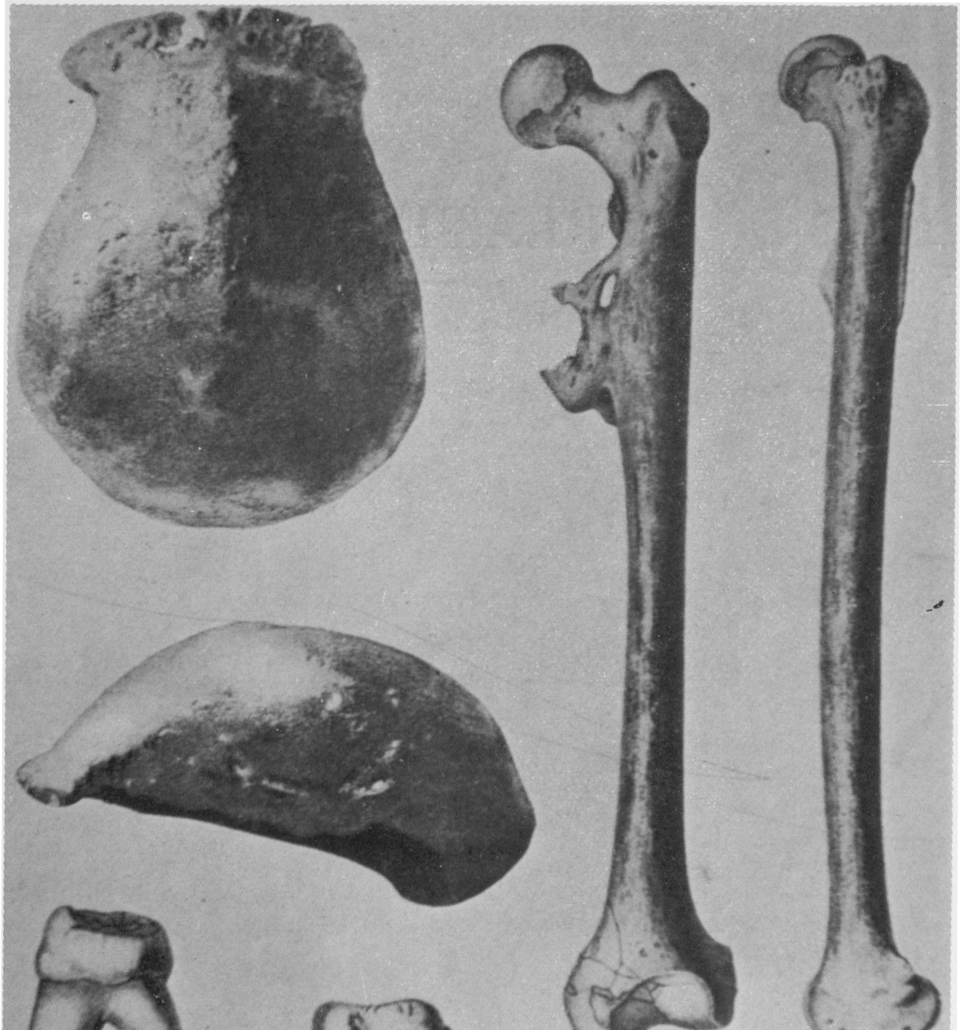
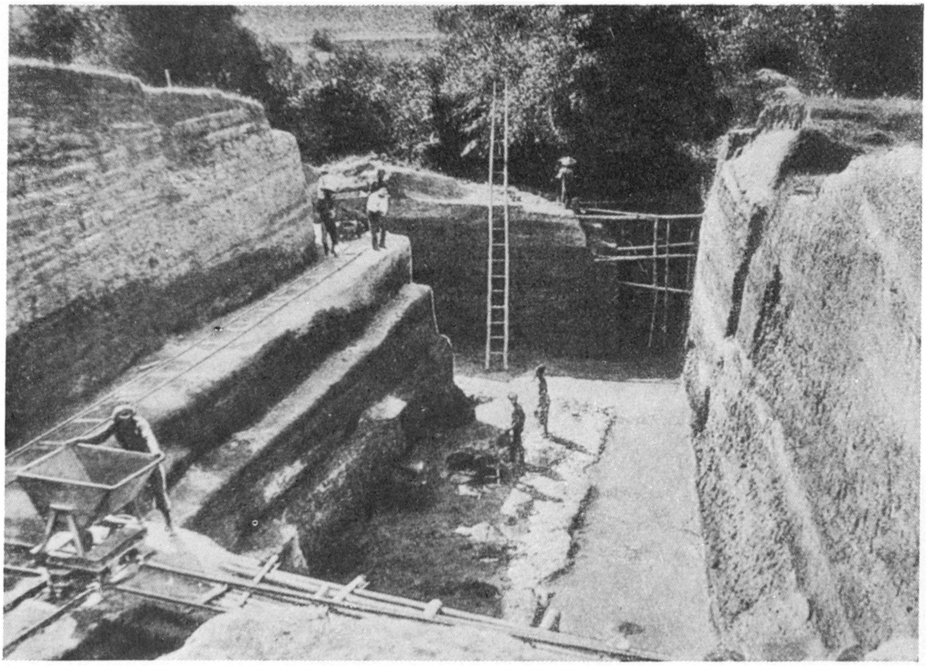
PLATES

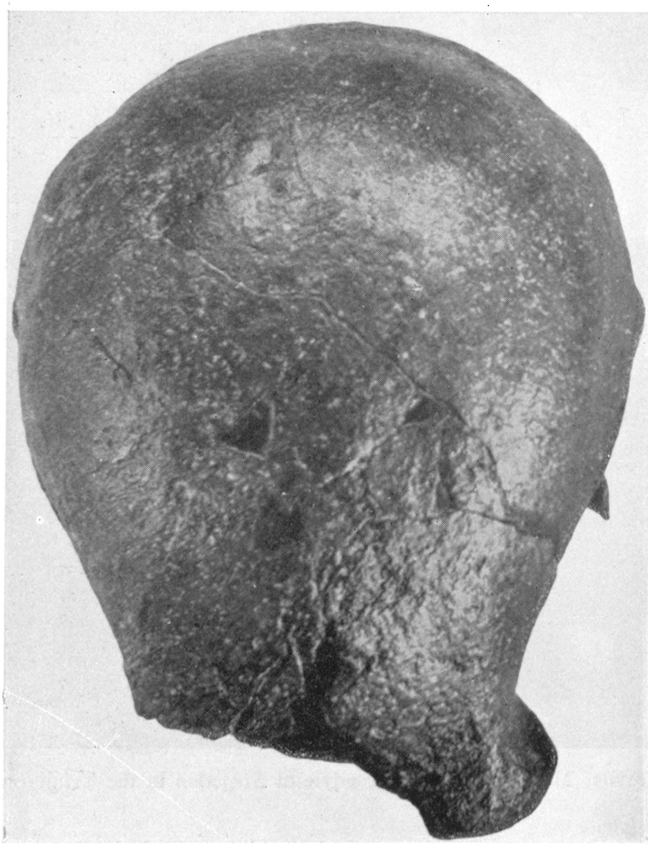


Pl. 1. Cranium and femur of *homo erectus erectus* I.
The molar is not human but belongs to Orang Utan.

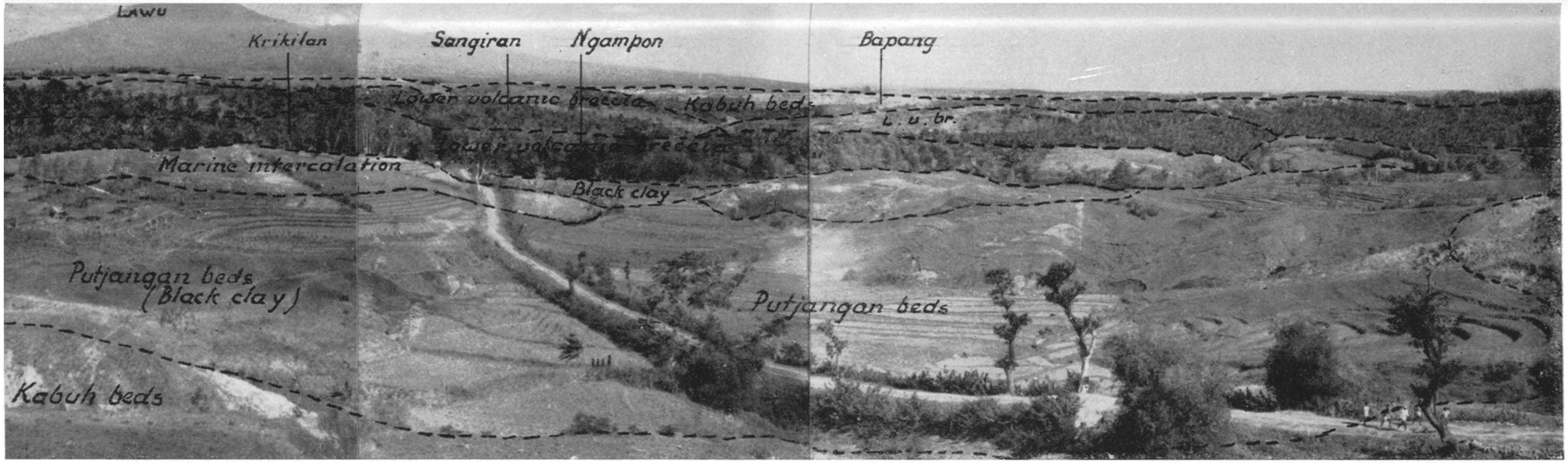


Pl. 2. Trinil Excavation, June 1907. (Selenka Expedition)

Pl. 3. Fossils: Mandible, ribs and condyle of *Stegodon* in the Trinil Bone-Bed.

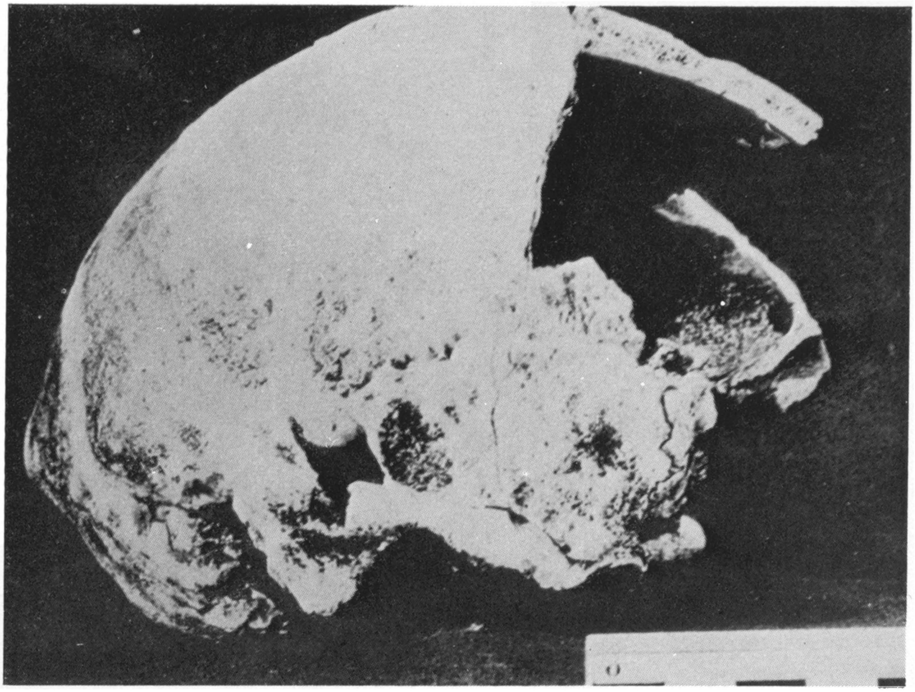


Pl. 4A and 4B. *Homo erectus erectus* II.
Above, lateral view. Below, vertical view.

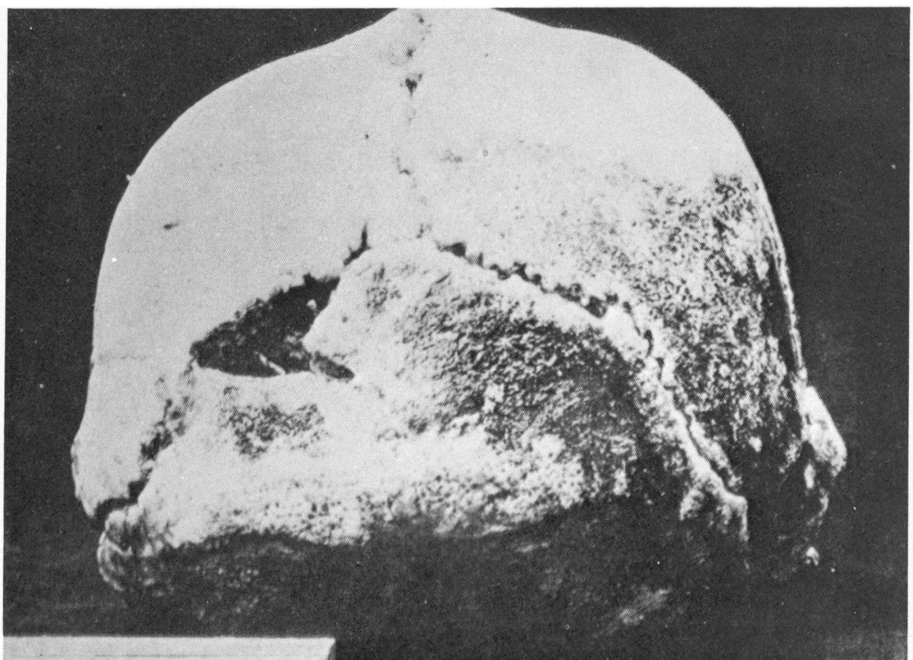


Pl. 5. Stratigraphy of the Sangiran Dome.

Pl. 6. View of the Kabuh Beds overlain by Notopuro Beds, North of Ngebung, Sangiran; in the foreground the basal conglomerate layer where the second mandible of *Meganthropus* was found.

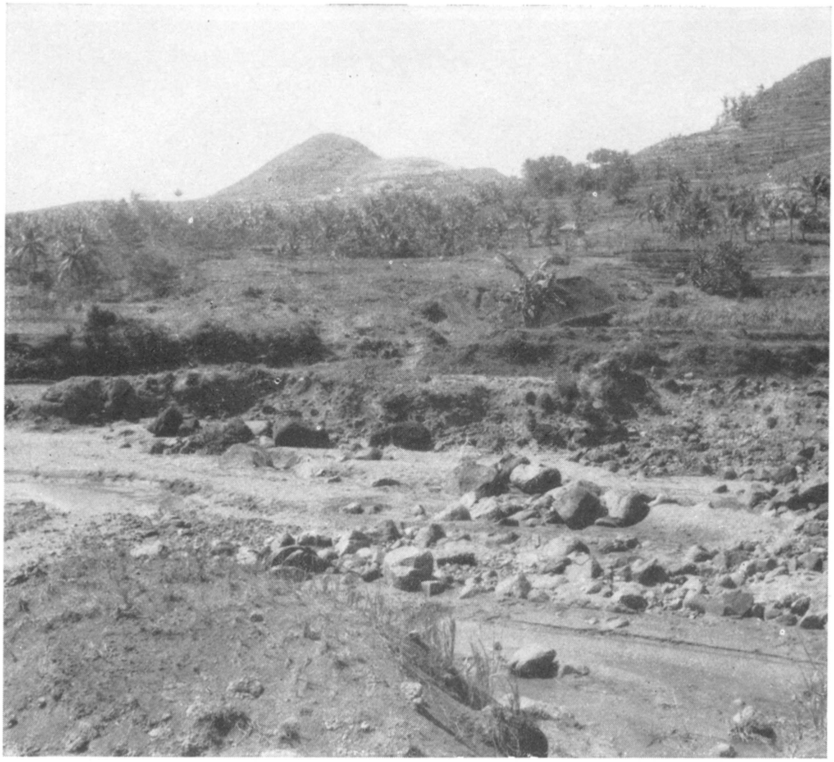


Pl. 7a. Right lateral view of *Homo erectus erectus* skull VI.



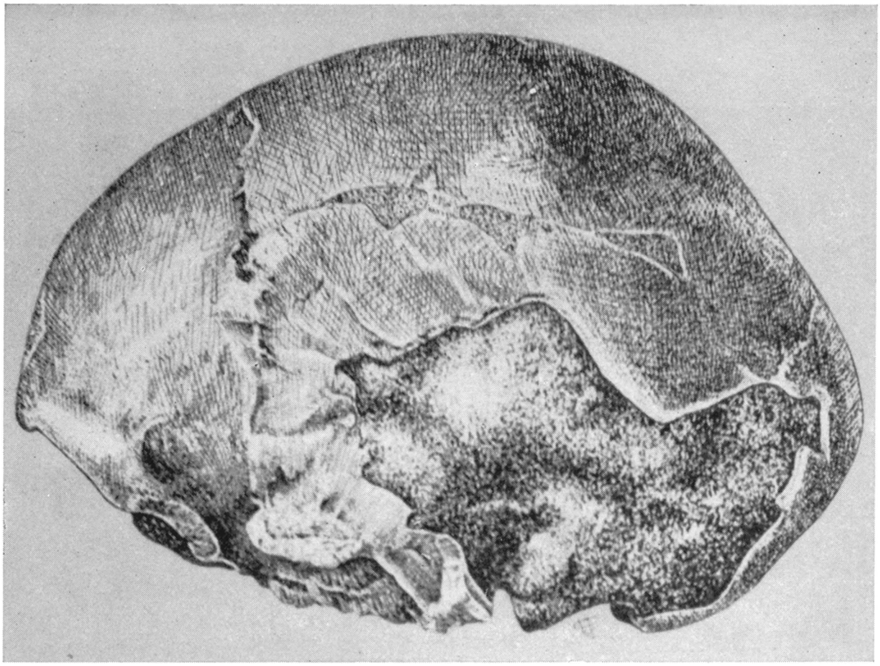
Pl. 7b. Occipital view of *Homo erectus erectus* skull VI.

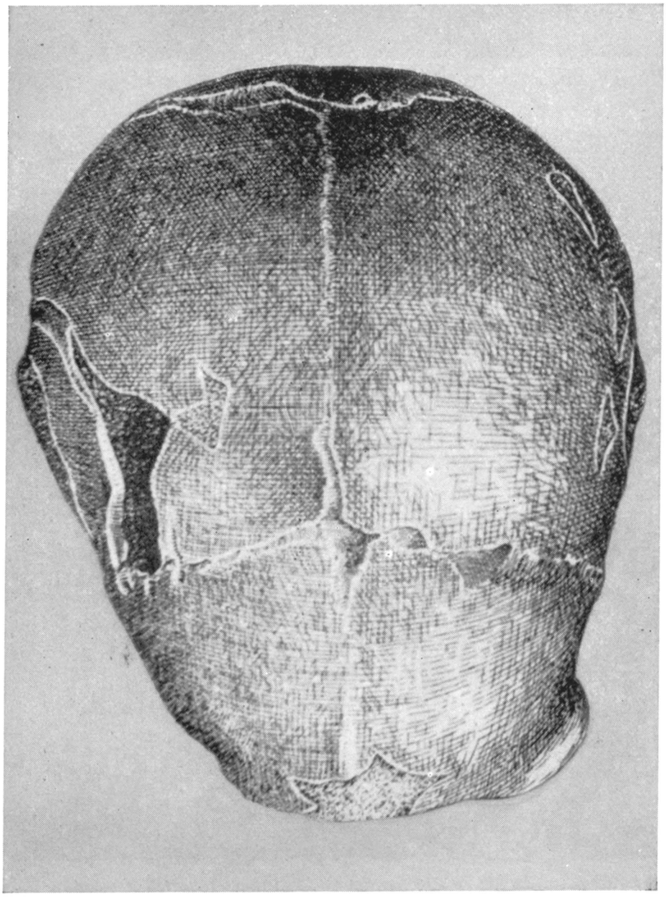
(after Jacob)



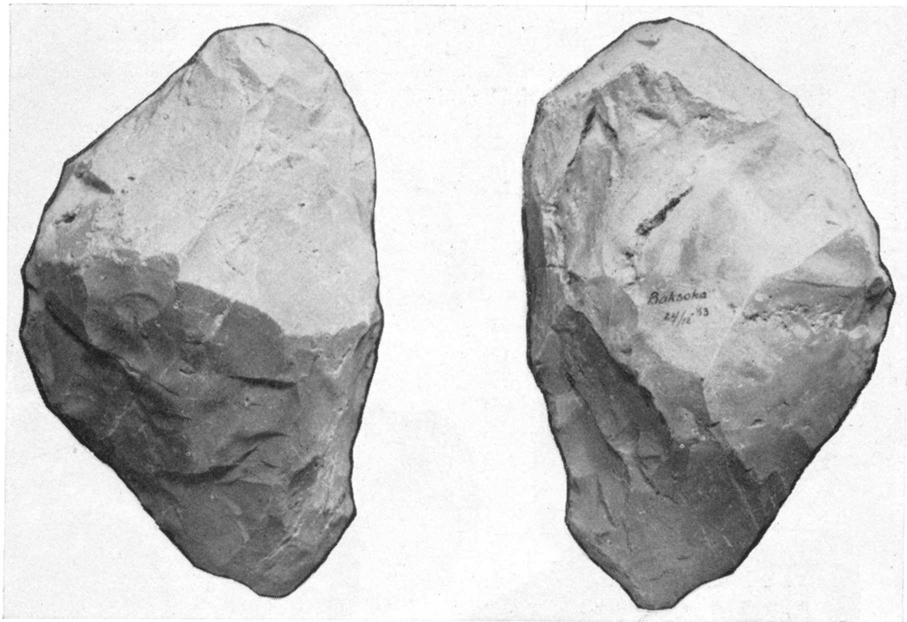
Pl. 8. Baksoka River; boulder-gravel $1\frac{1}{2}$ m above the level of the river containing palaeoliths.

Pl. 9. Implementiferous red gravel 7 m above river-level resting on tuff.

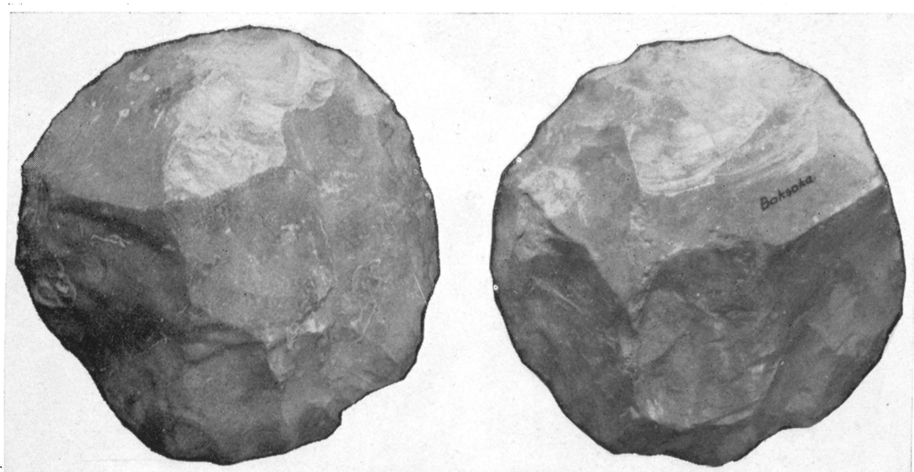




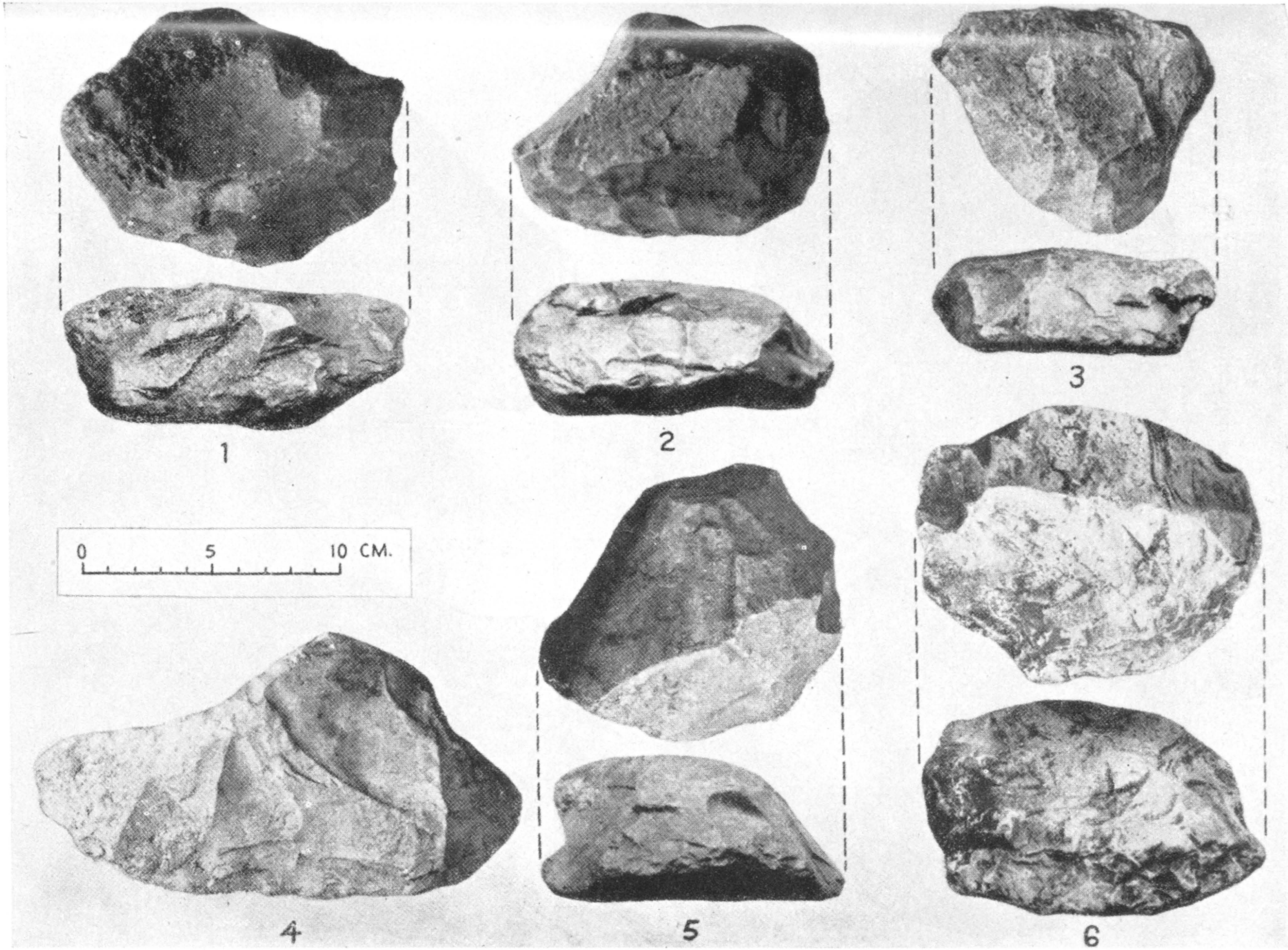
Pl. 10A and 10B. *Homo erectus robustus* infant skull. Above, lateral view, left side. Below, vertical view.



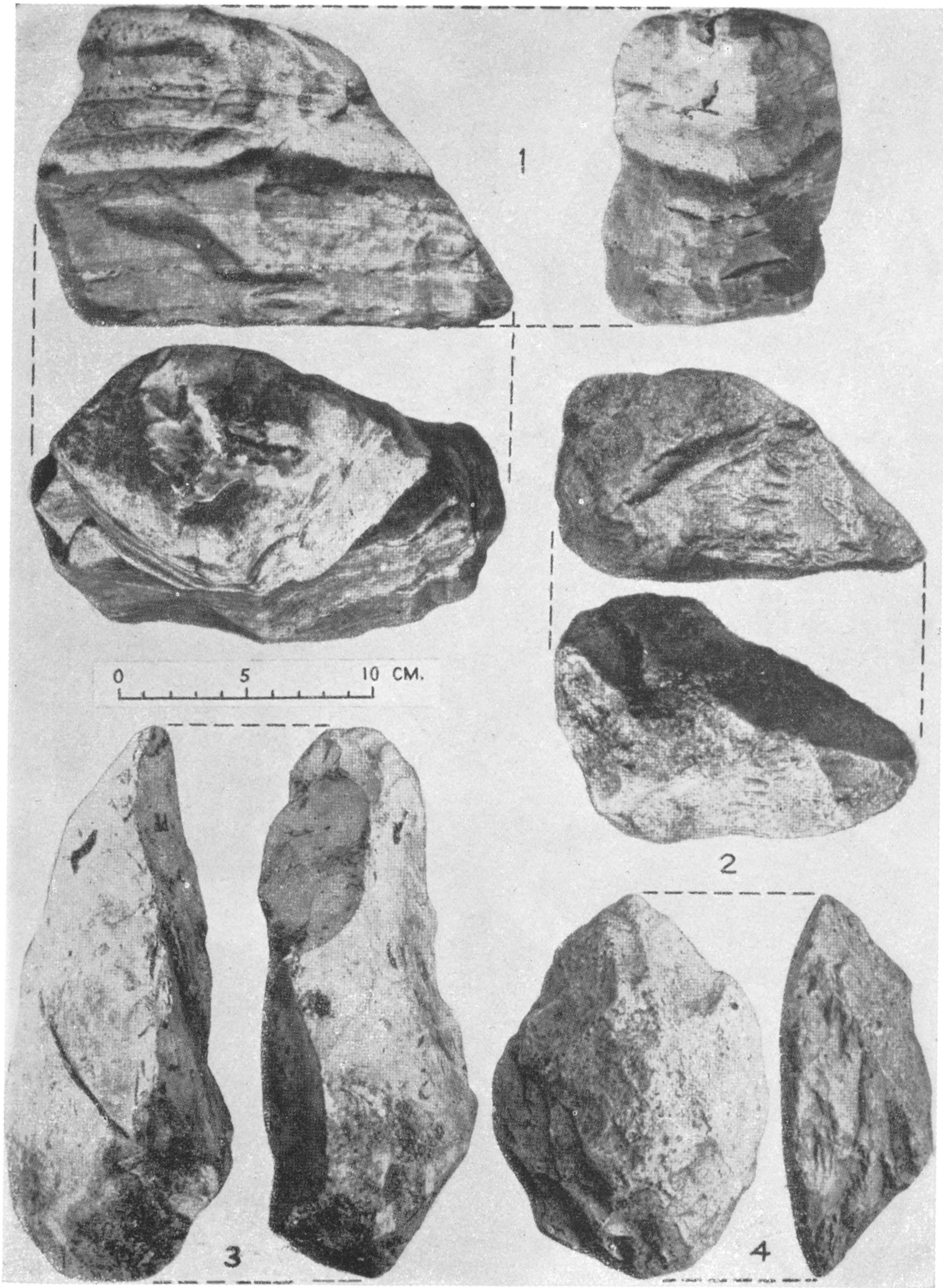
Pl. 11. Long bifacial Hand-Axe. 189 x 118 x 72 mm. Baksoka River.



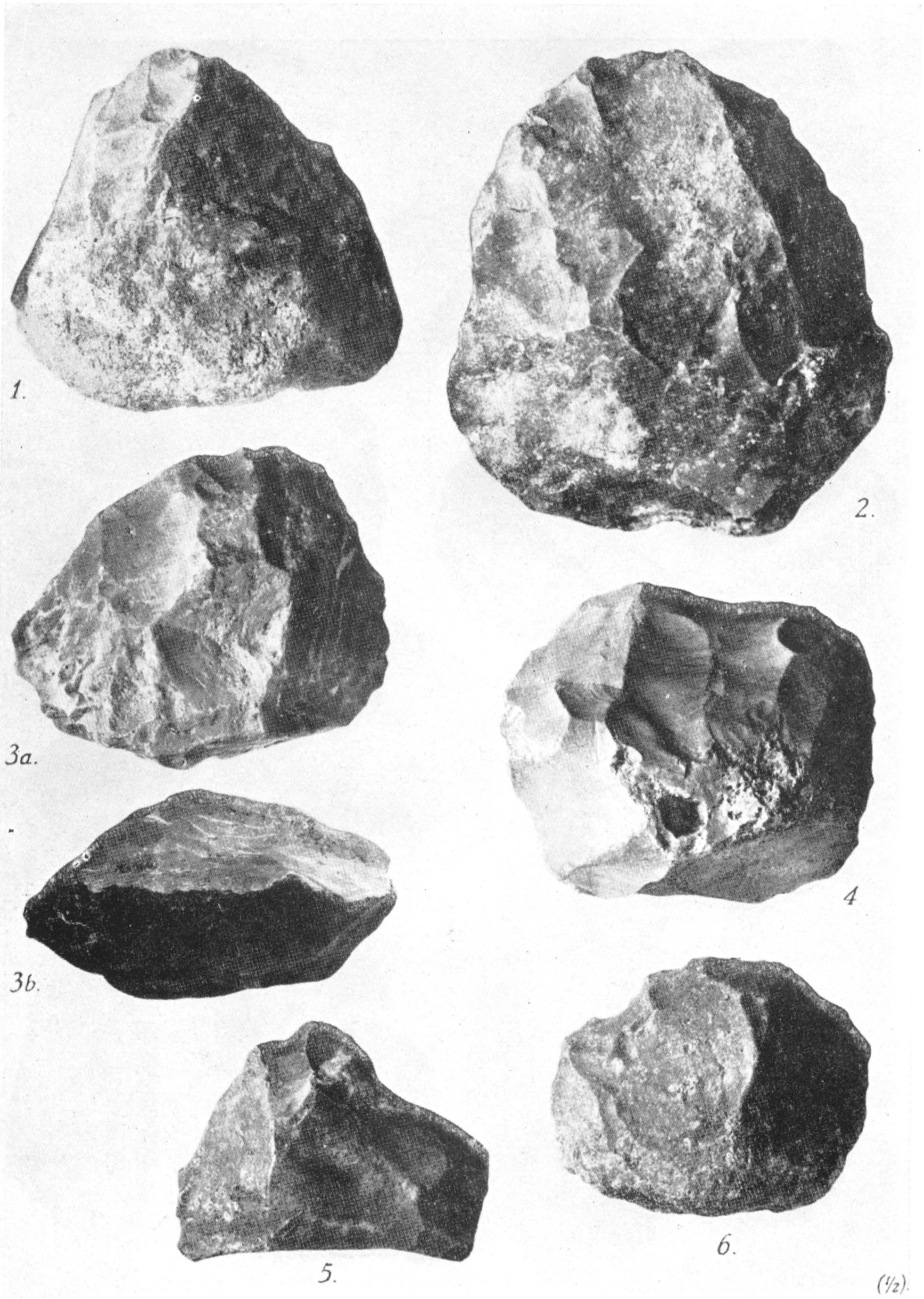
Pl. 12. Round bifacial tool 120 x 114 x 65 mm. Baksoka River.



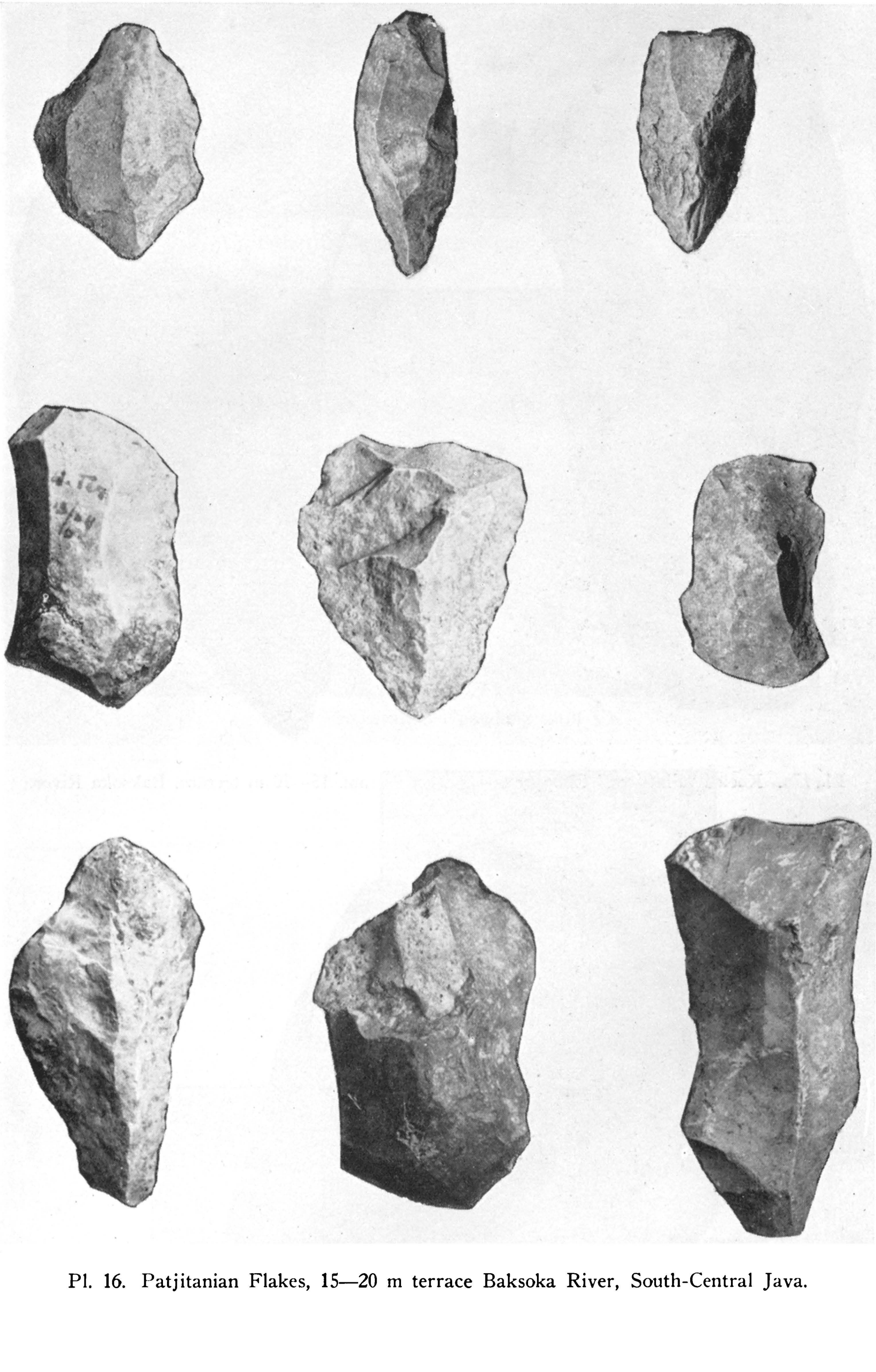
Pl. 13. Patjitanian implements from South-Central Java.
1—3 Choppers. 5—6 Hand-Axes. 4. "Flat-iron" Chopper.



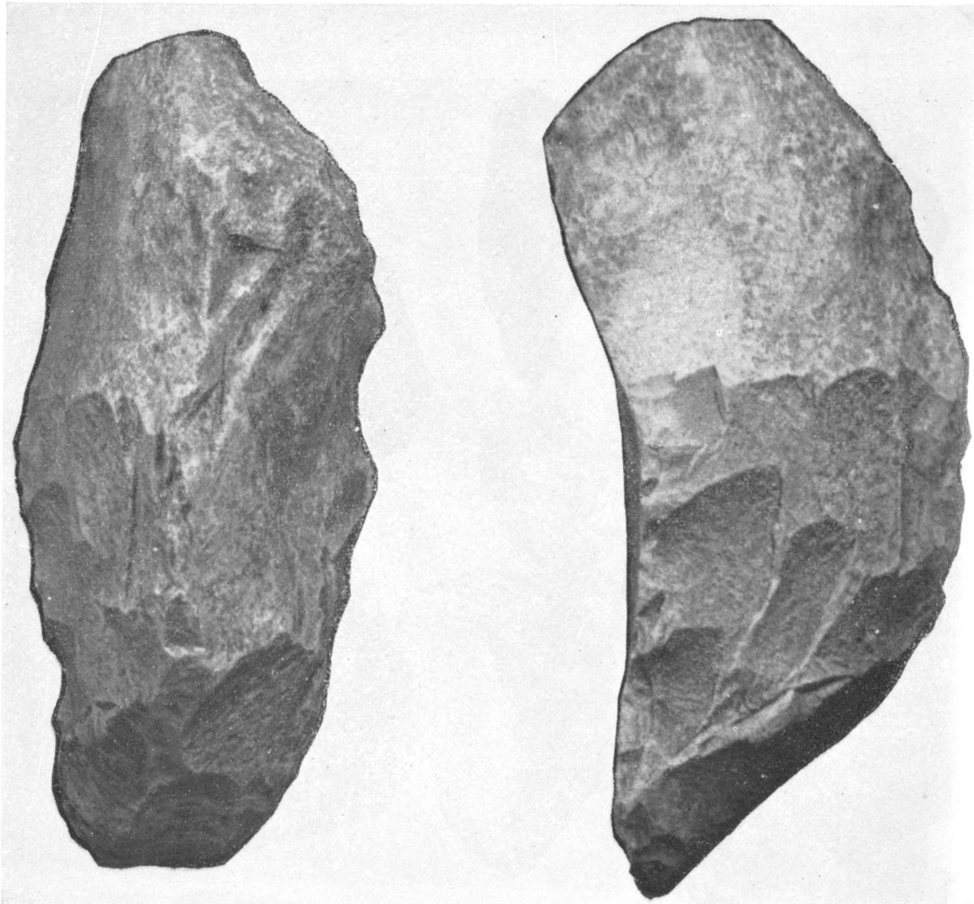
Pl. 14. Patjitanian implements from South-Central Java. 1—4 Proto-Hand-Axes.



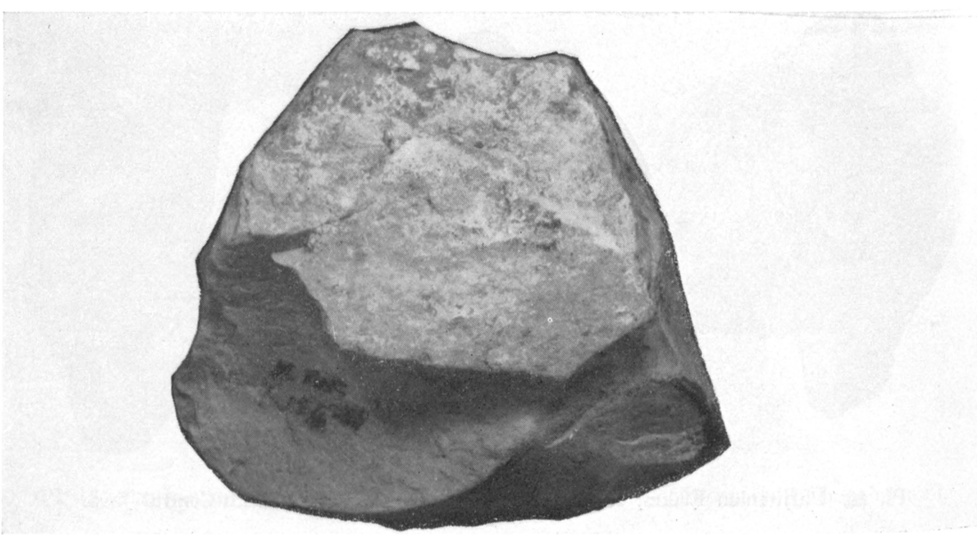
Pl. 15. Patjitanian implements South-Central Java. 1—2, 4—6 Choppers. 3 Chopping-tool.



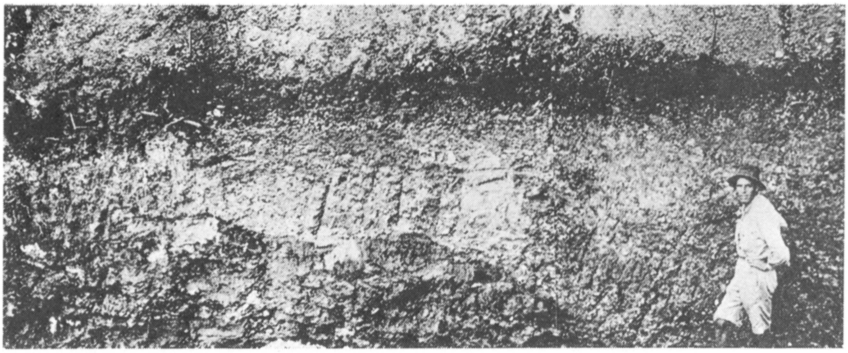
Pl. 16. Patjitanian Flakes, 15—20 m terrace Baksoka River, South-Central Java.



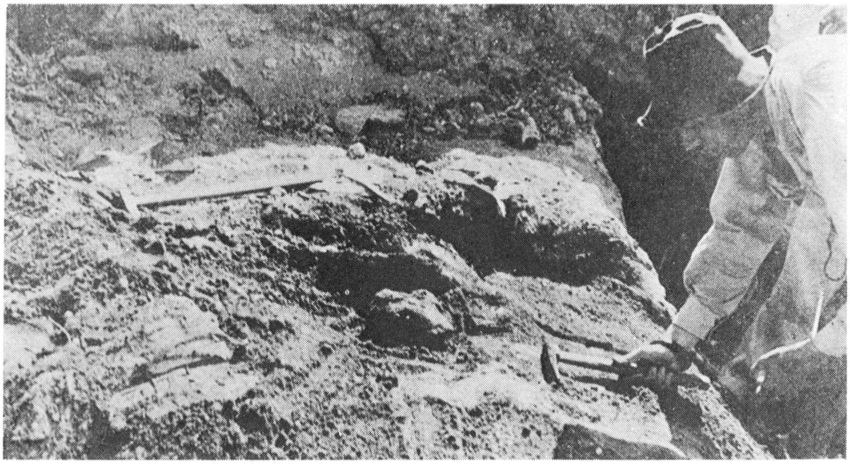
Pl. 17a. Keeled "Flat-iron" Chopper 204 x 94 x 94 mm. 15—20 m terrace. Baksoka River.



Pl. 17b. Pseudo-Cleaver on flake, 108 x 125 x 58 mm. 15—20 m terrace. Baksoka River.

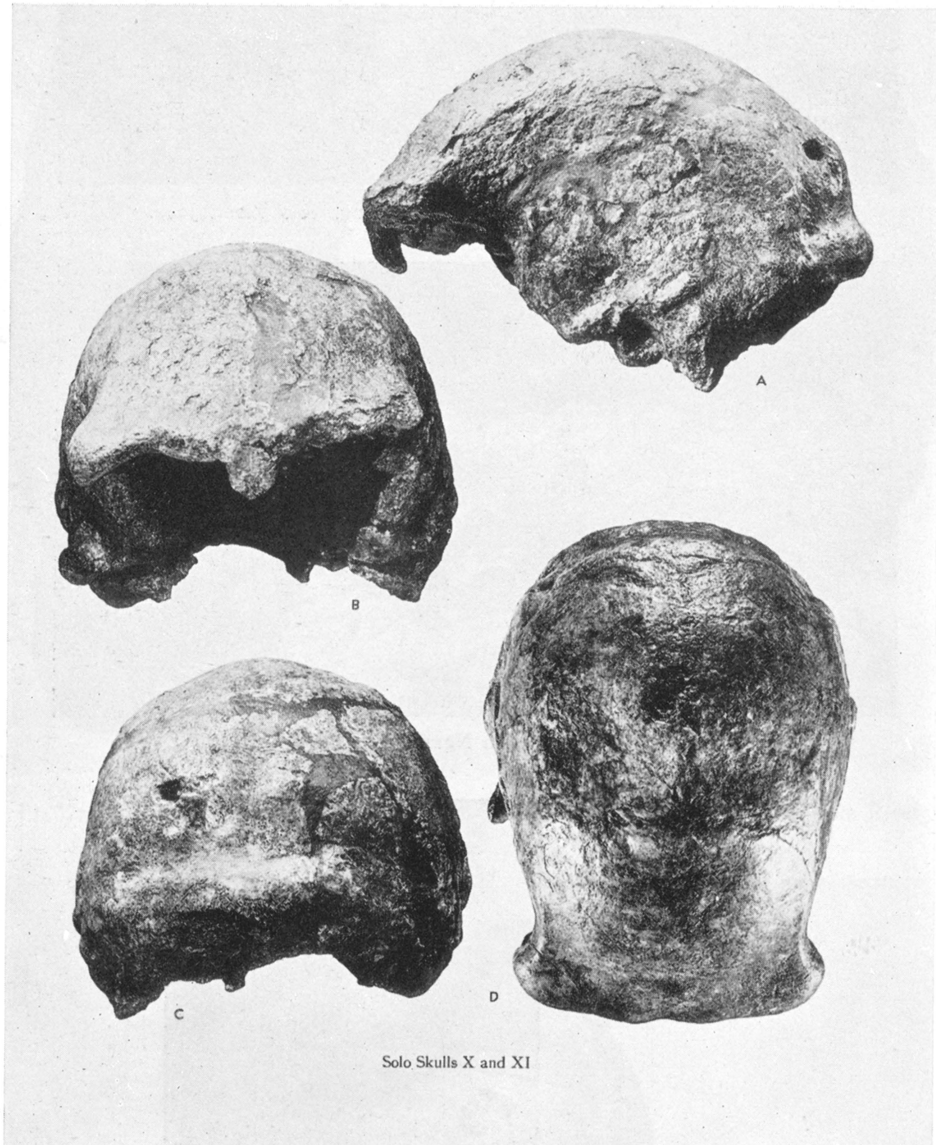


Pl. 18. Cross-section 20 m terrace. Ngandong, Solo River, Java.



Pl. 19. Excavation Ngandong skull VI.

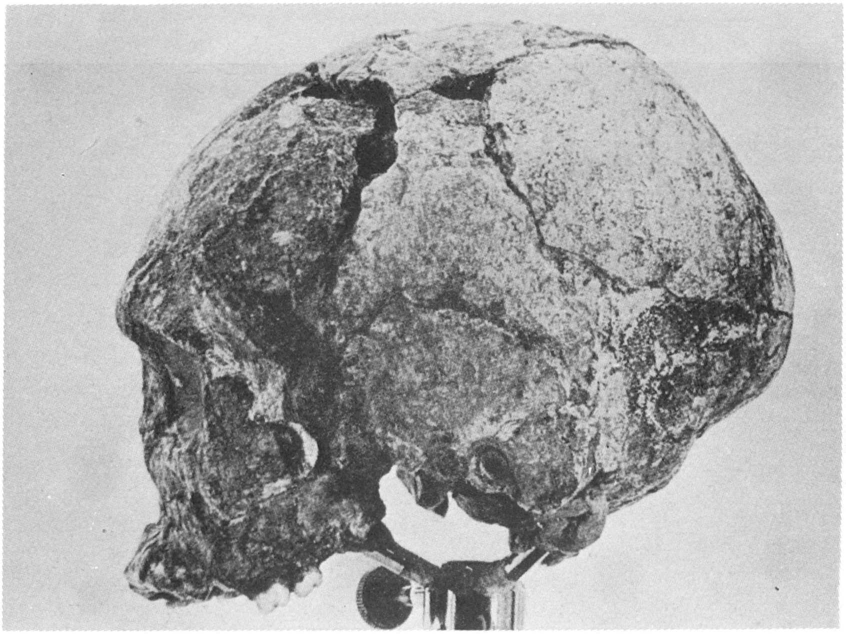
Pl. 20. a. Ngandong skull V 'in situ'; b. Excavation 20 m terrace.



Pl. 21. *Homo erectus soloensis.*

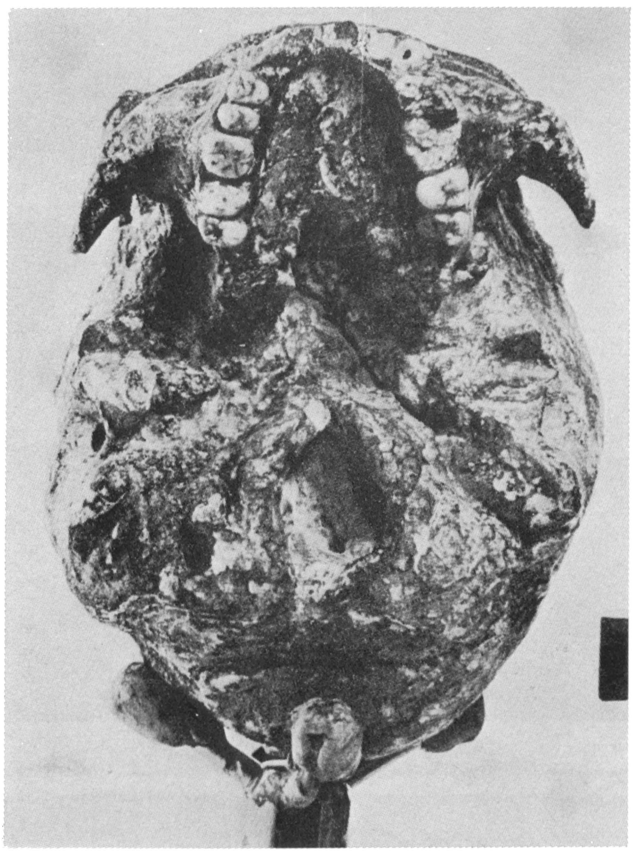
Skull X A. lateral view, left side. B. frontal view.
Skull XI C. occipital view. D. vertical view.

Pl. 22. Palaeolithic Flake-tools. Sangiran, Java.



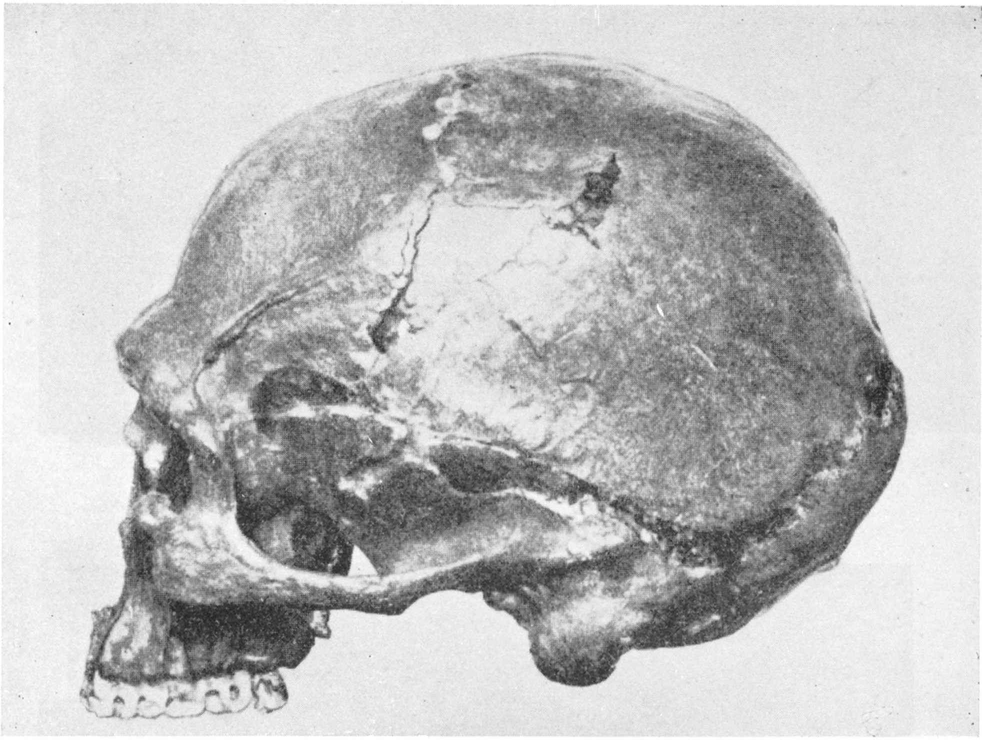
Pl. 23. Left lateral view of Wadjak skull I.

(after Jacob)

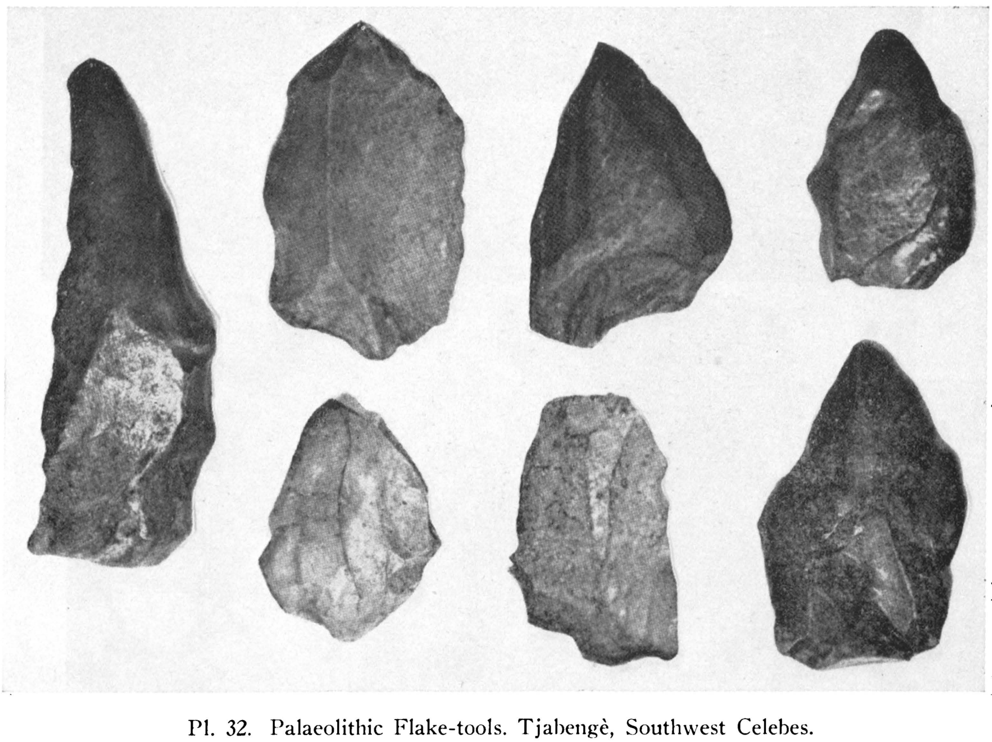


Pl. 24. Basal view of Wadjak skull I.

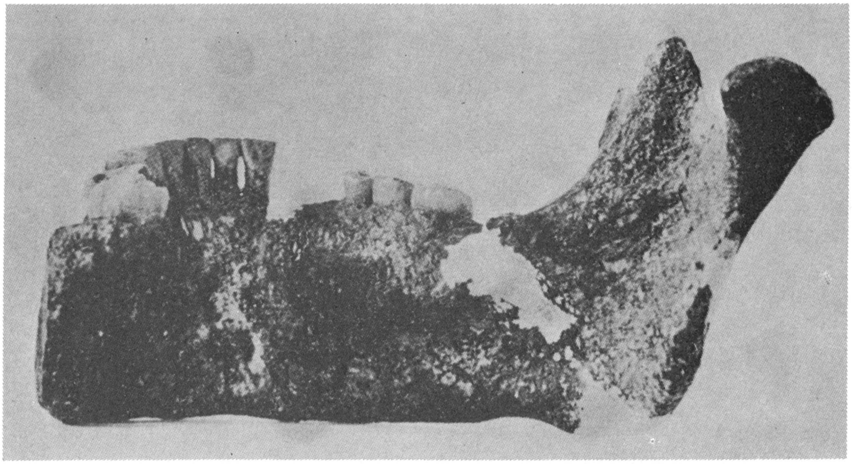
(after Jacob)



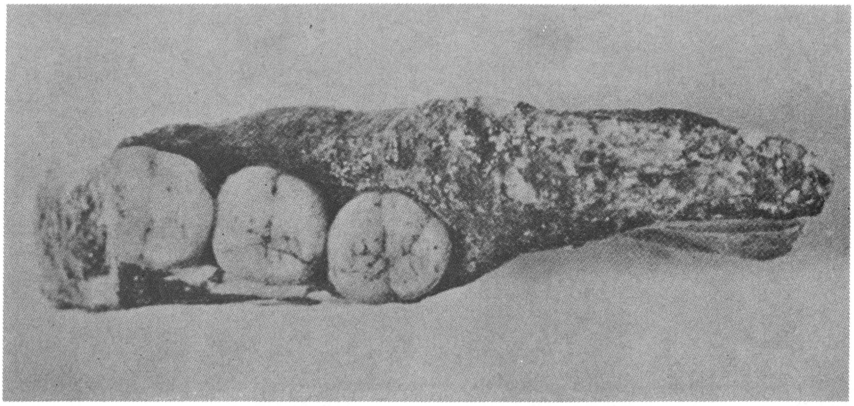
Pl. 25. Skull of *Homo wadjakensis* II. Java.



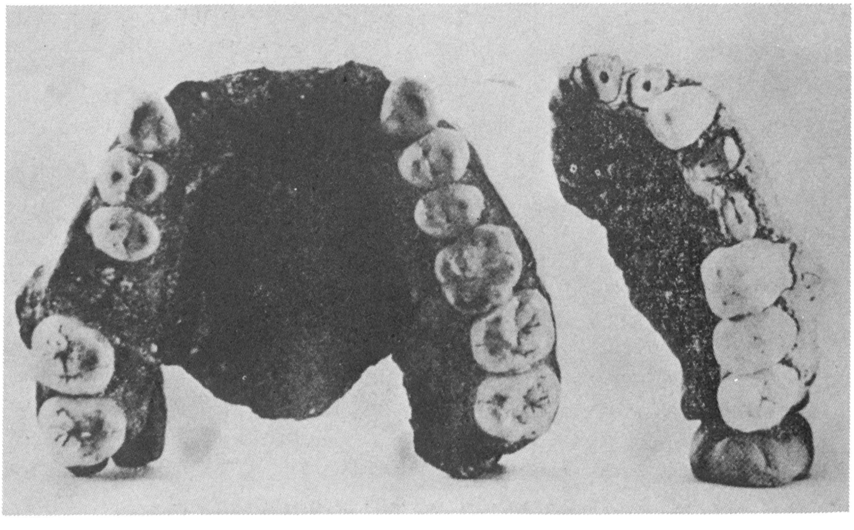
Pl. 32. Palaeolithic Flake-tools. Tjabengè, Southwest Celebes.



Pl. 26. Wadjak mandible II (after restoration).
(after Jacob)



Pl. 27. Occlusal view of Wadjak mandible I.
(after Jacob)

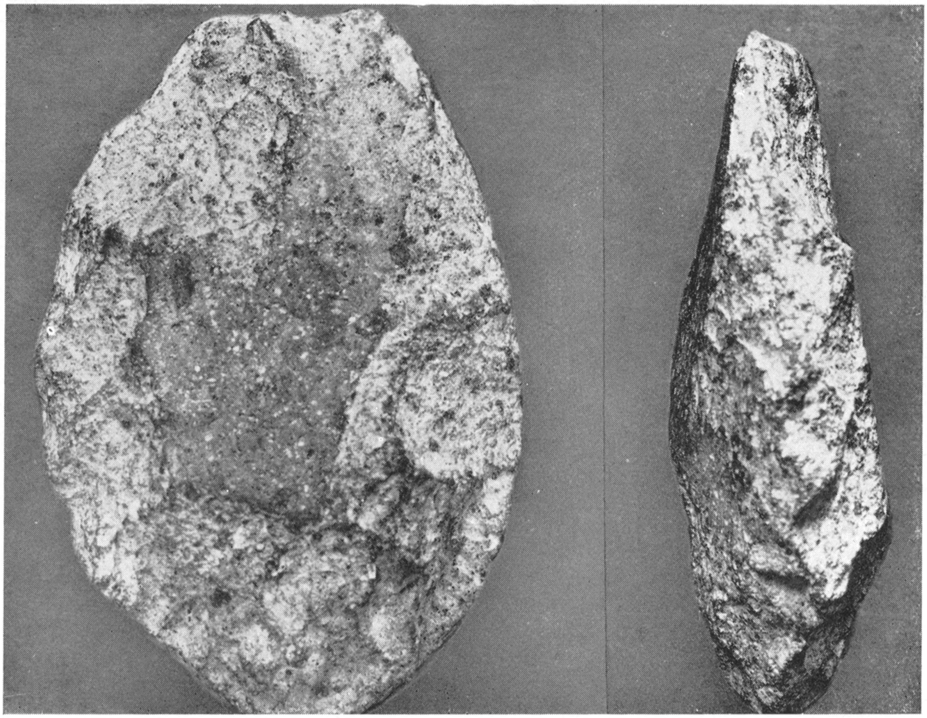


Pl. 28. Occlusal view of Wadjak I and Hongkong maxilae.

Pl. 29. Dissected terraces between Soppeng and Sengkang with fossil vertebrates and palaeolithic tools. In the background the Wallanae River.

Pl. 30. Old water-course 43 m above present river-level with conglomerates containing jasper and chalcedony. Beru village near Tjabengé.

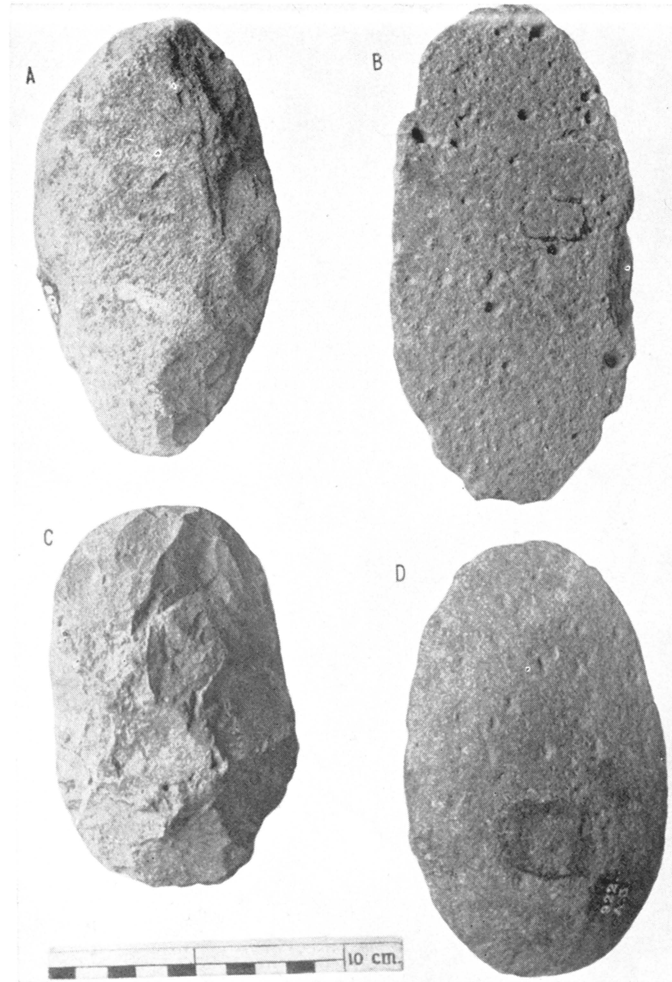
Pl. 31. Sompoh: in the background the hill-ridge with dissected terraces.



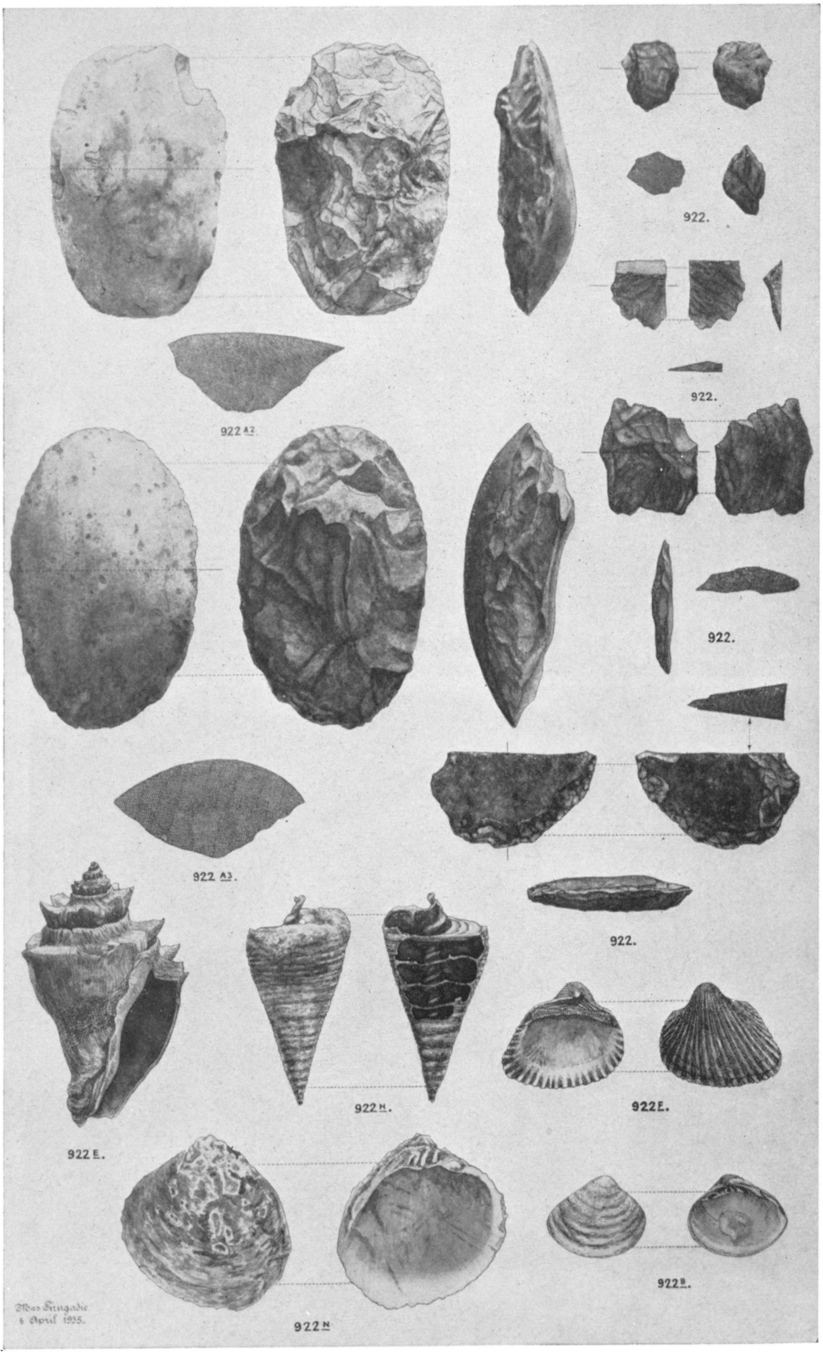
Pl. 33. Bifacial Hand-Axe. Northeast Coast of Sumatra.

Pl. 34. Saentis kitchenmidden. Northeast Coast Sumatra.

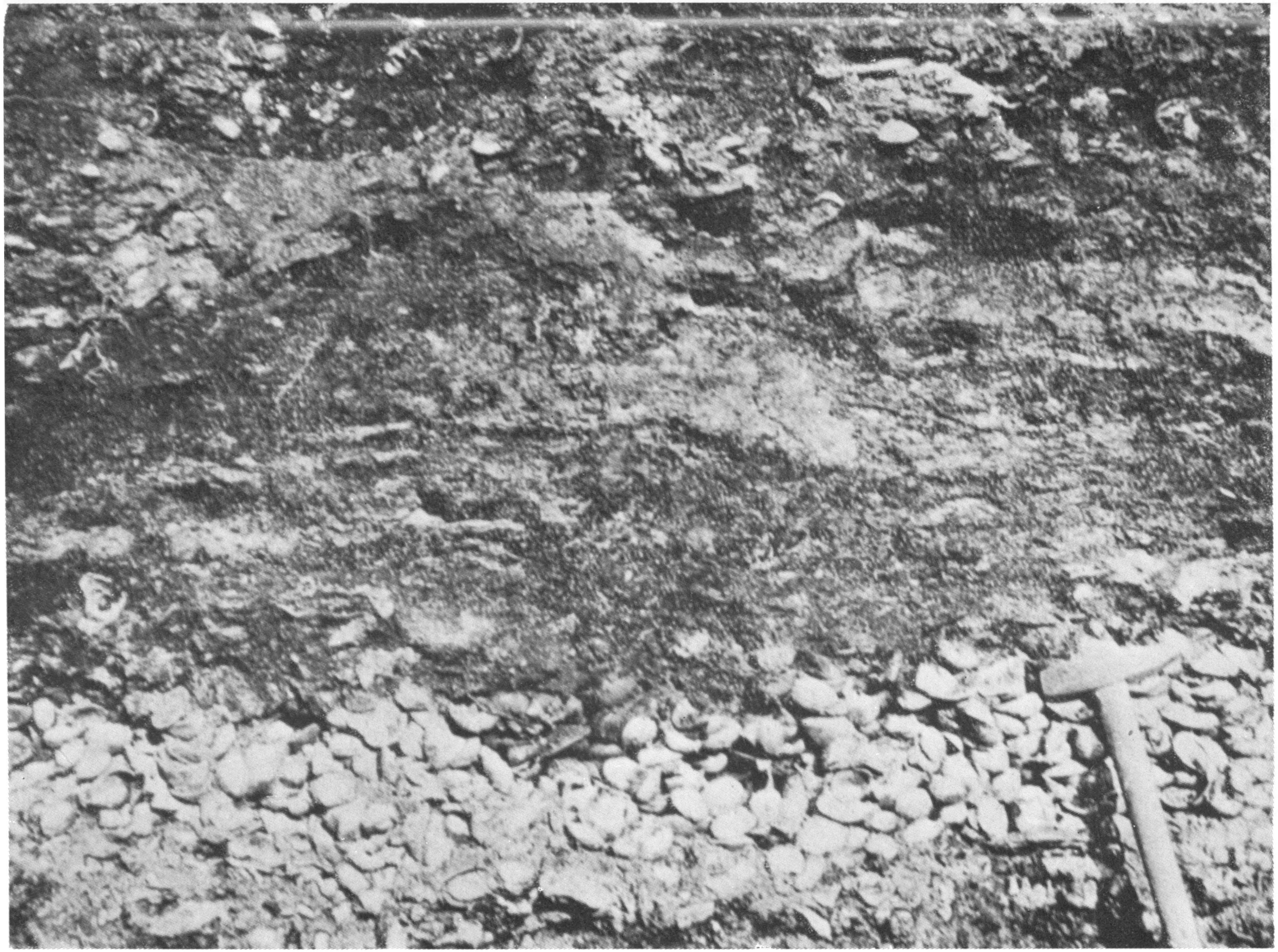
Pl. 35. Debris and discarded material. Saentis kitchenmidden, Northeast Coast of Sumatra.



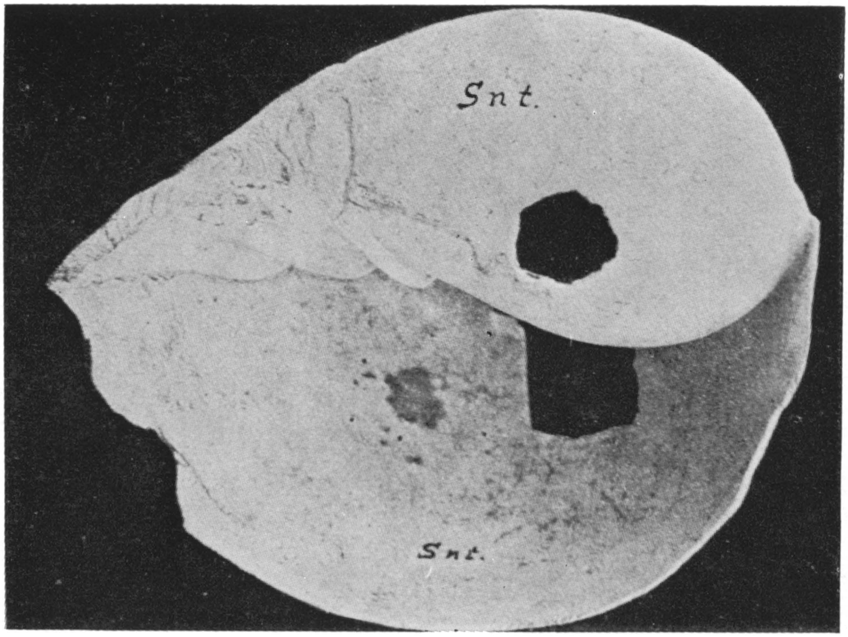
Pl. 37. Oval, monofacial pebble-tools.
A. flaked surface; B. smooth, unworked face;
C. flaked surface; D. smooth, unworked face.



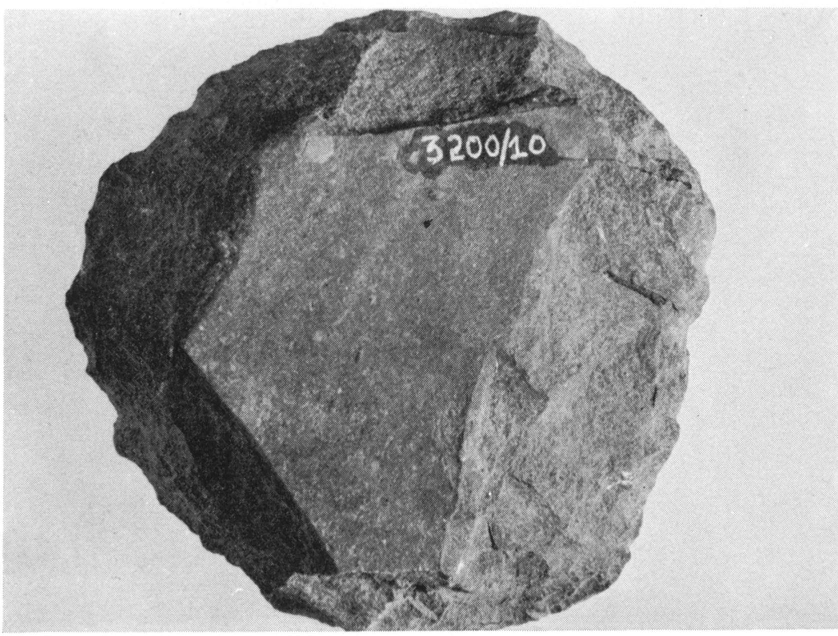
Pl. 36. Oval monofacial pebble-tools, 'short-axe' and shells.
Saentis Shell mound, Northeast Sumatra.



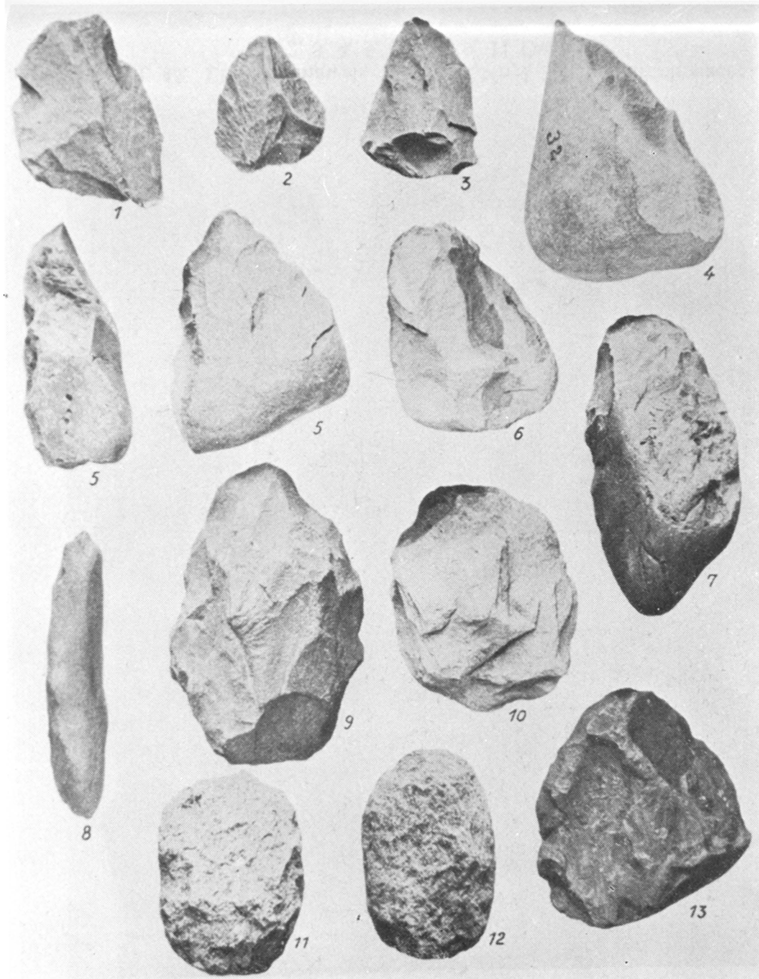
Pl. 33. Saentis kitchenmidden, Sumatra.
Layer with artifacts, ash and bone fragments. Lower part with *Meretrix* shells.



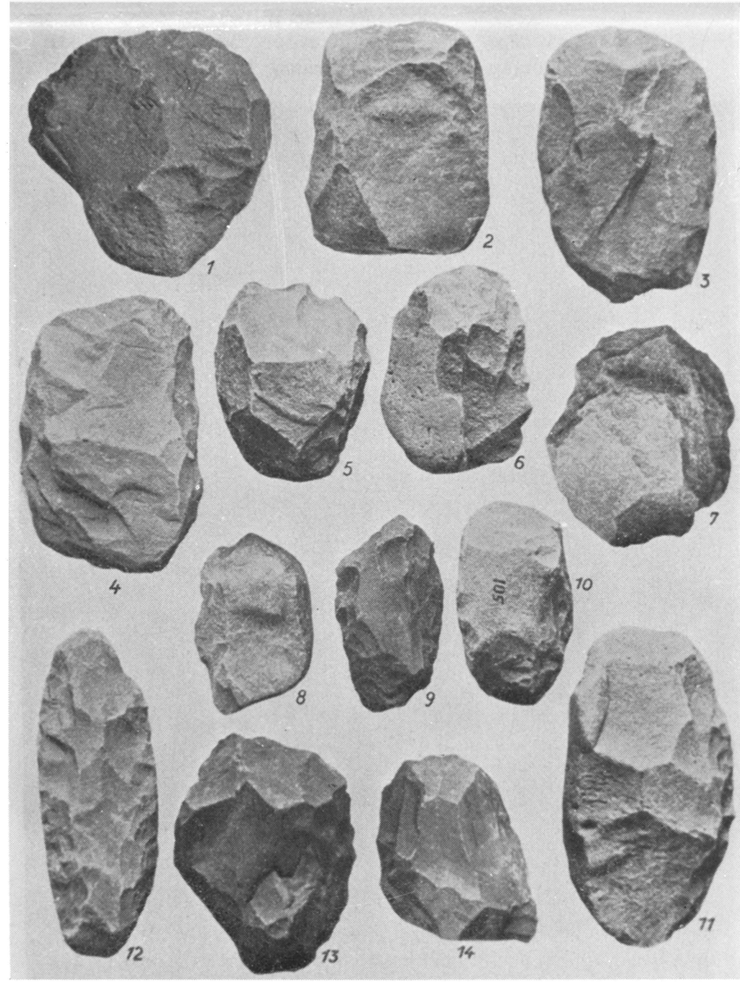
Pl. 39. Saentis kitchenmidden:
Melo indica shell with a round hole.



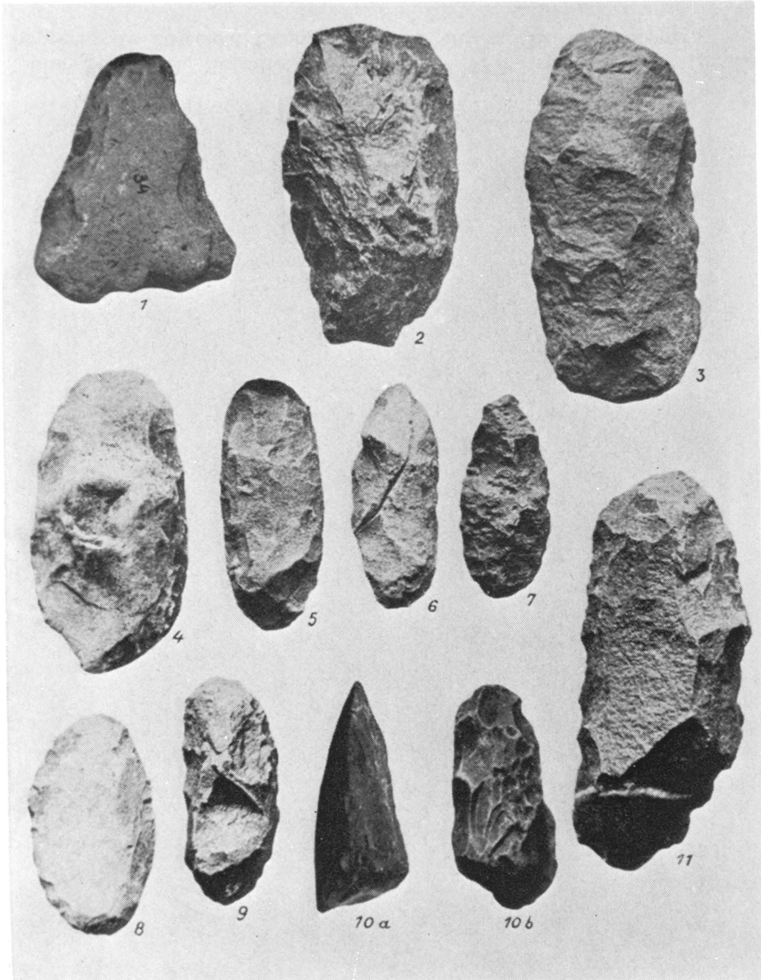
Pl. 40. Discoidal monofacial pebble-tool. Kitchenmidden Bulu China, Sumatra.



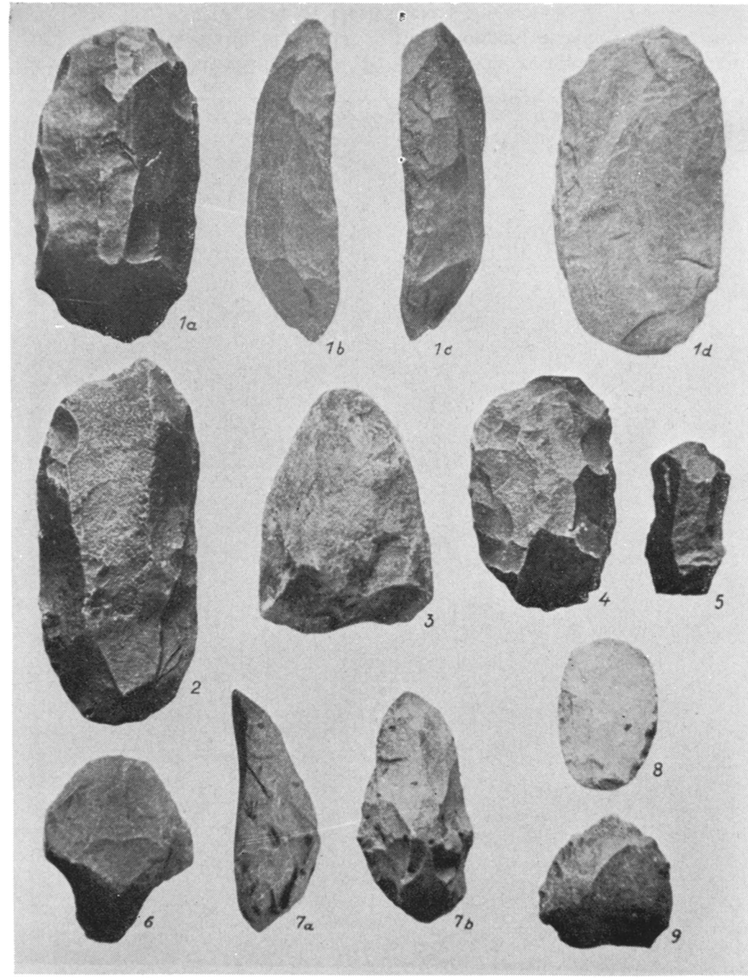
Pl. 41. Lho' Seumaweh, Sumatra. Nos. 1, 2, 3, 4, 5, 6 Proto hand-axes; 7, 9 Choppers; 10 Discoidal Chopper; 11, 12 Ovals; 13. End-chopper.



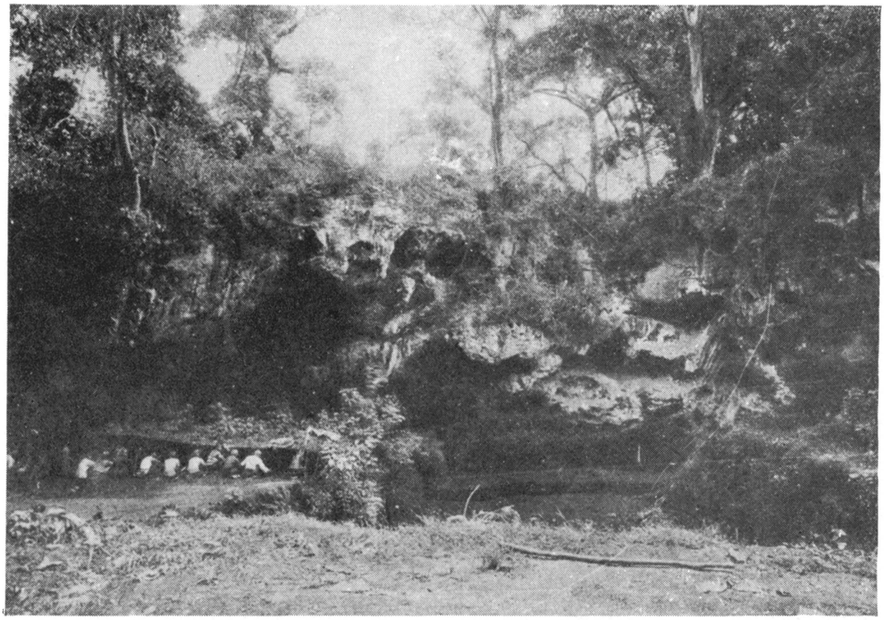
Pl. 42. Lho' Seumaweh, Sumatra. No 1 Discoidal scraper; 2 Quadrangular scraper; 3, 4, 10, 11 Ovals; 5 End-chopper; 6 Side-chopper; 7, 8, 9, 14 High-backed choppers.



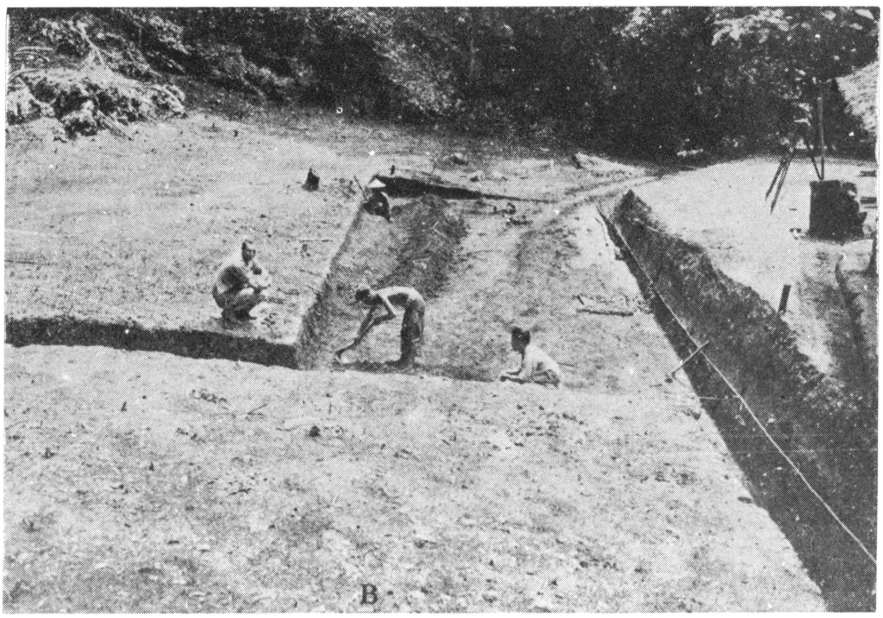
Pl. 43. Lho' Seumaweh, Sumatra. No 1 Triangular chopper; 2, 3, 4, 5, 6, 7, 8, 9, 11 Ovals.



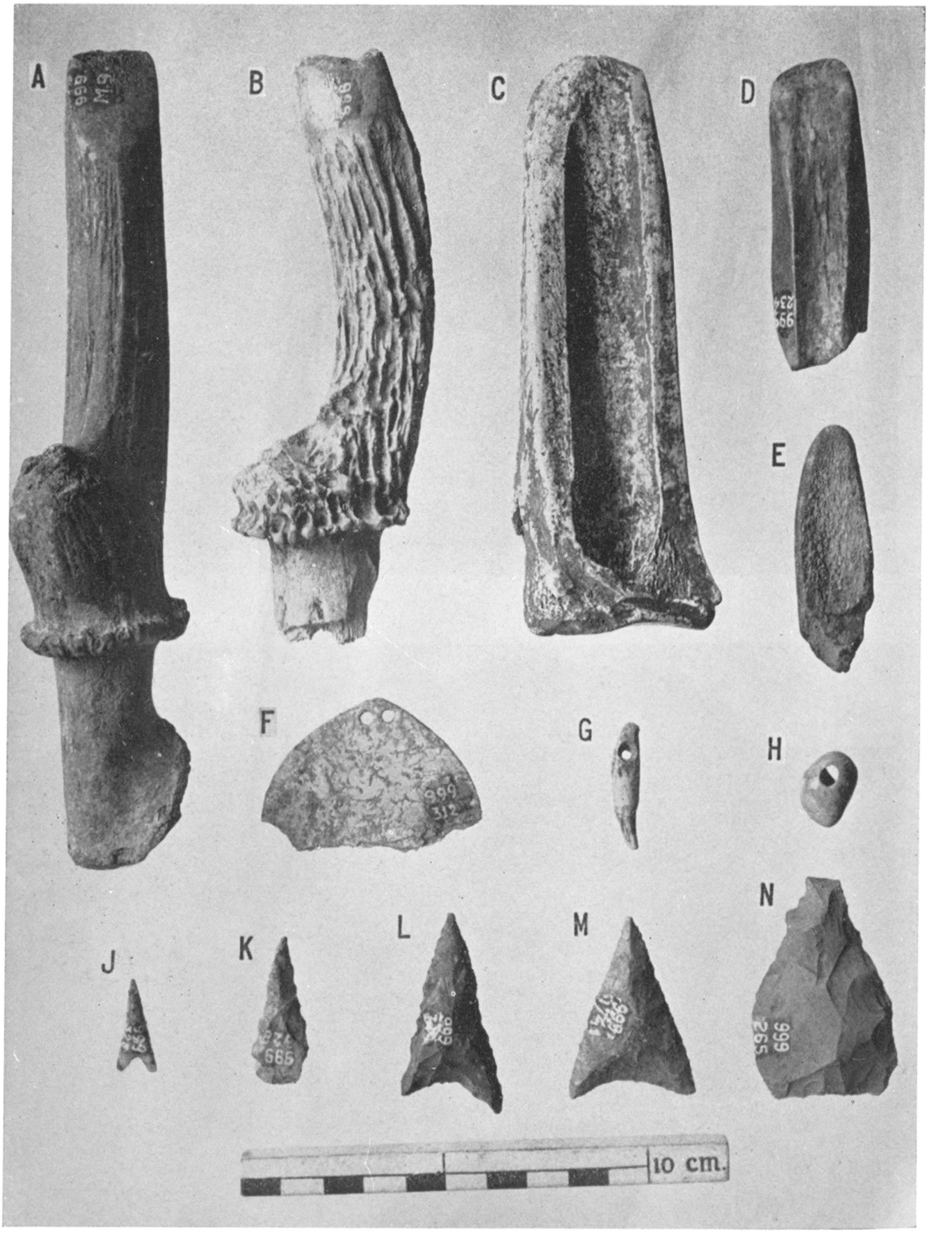
Pl. 44. Lho' Seumaweh, Sumatra. No 1 Facet flaking; 2—4 Ovals; 7 'Iron-heater' chopper; 8 small Oval with edge chipping only; 9 small Chopper.



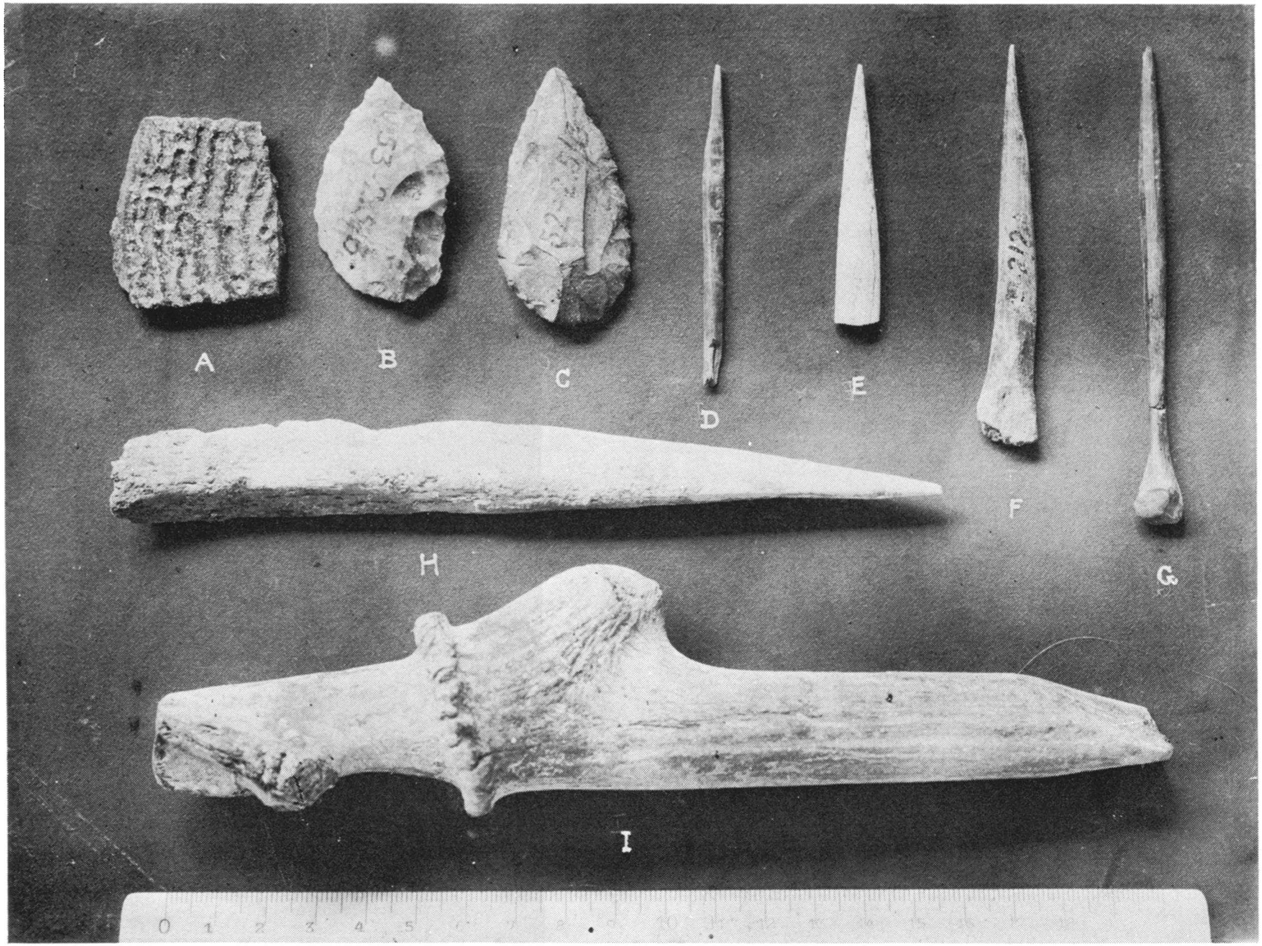
Pl. 45. Excavation Gua Lawa, Sampung, Java.



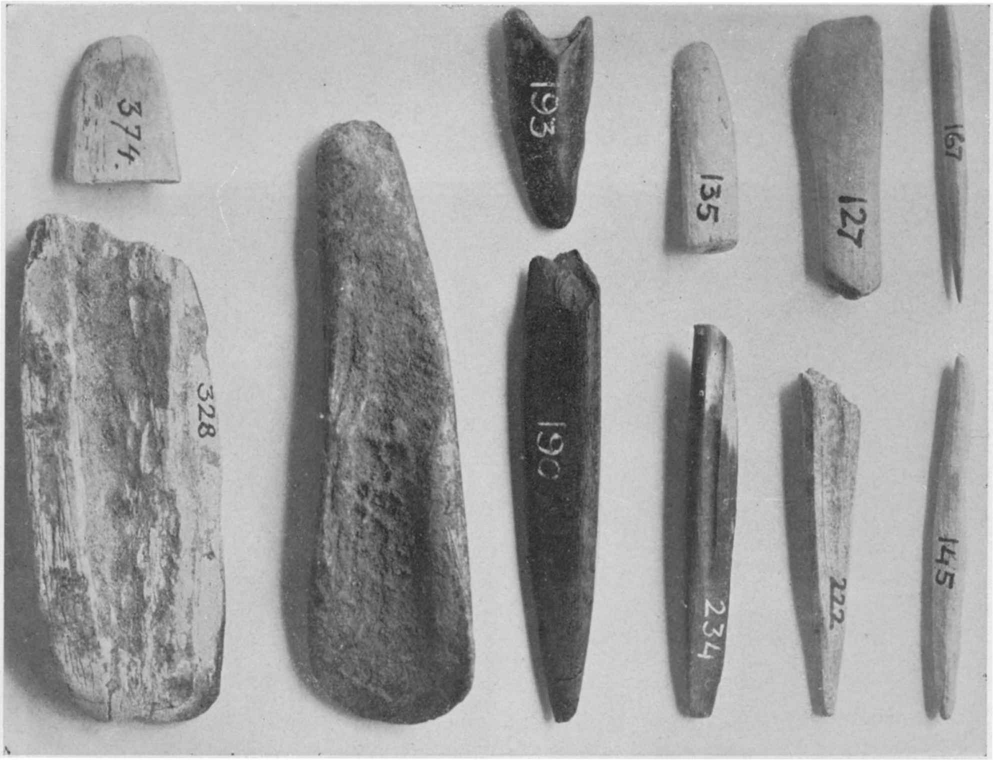
Pl. 46. Excavation Gua Lawa, Sampung, Java.



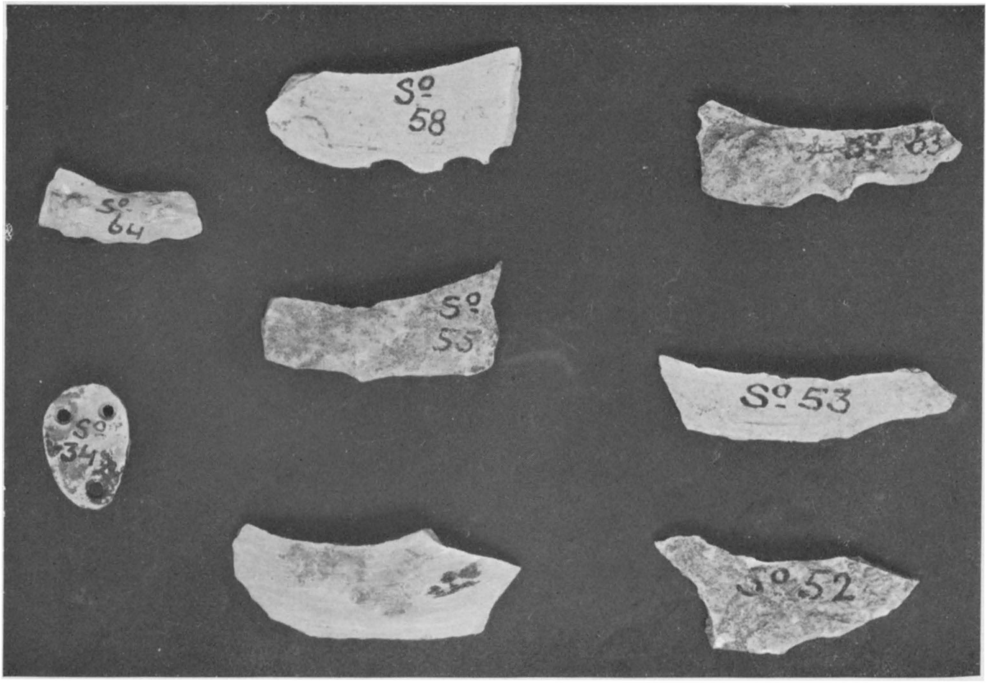
Pl. 47. Stone, bone and antler implements, Lawa Cave, Sampung, East Java.



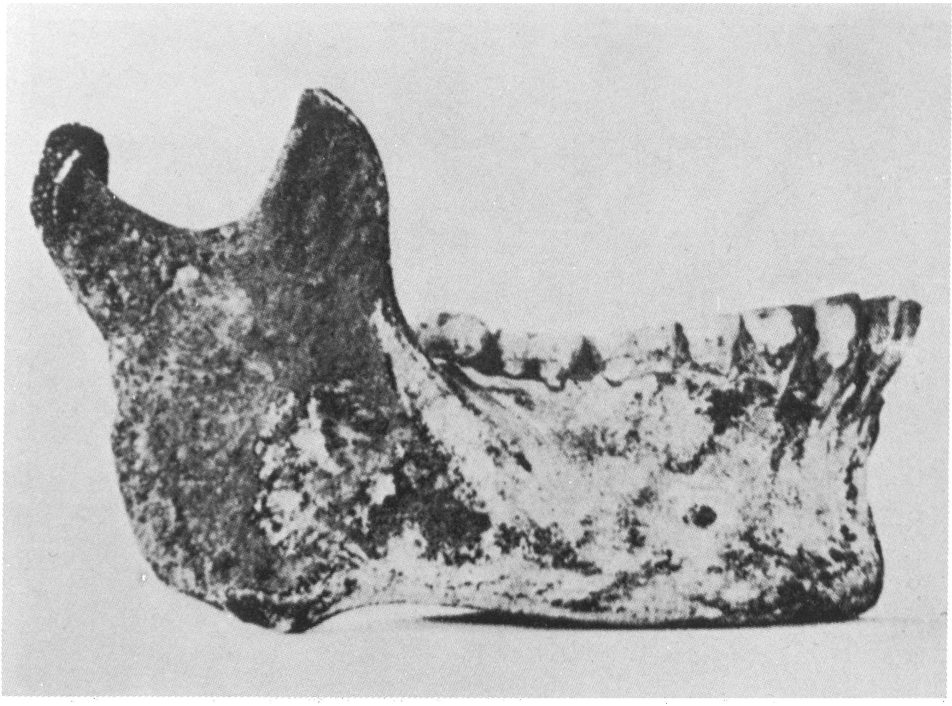
Pl. 48. Cord-marked potsherd, round based arrow-heads, bone awls, bone and artler daggers. Gua Lawa, Sampung Java.



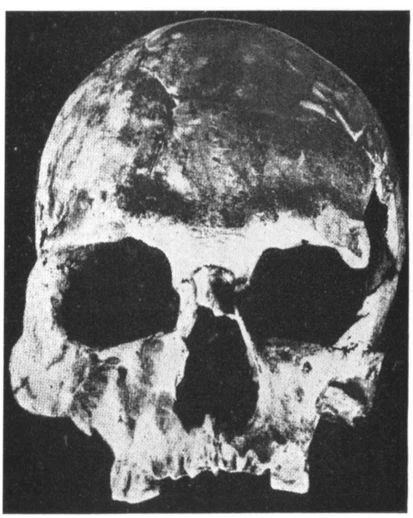
Pl. 49. Bone implements, Gedeh Cave, Tuban, Java.

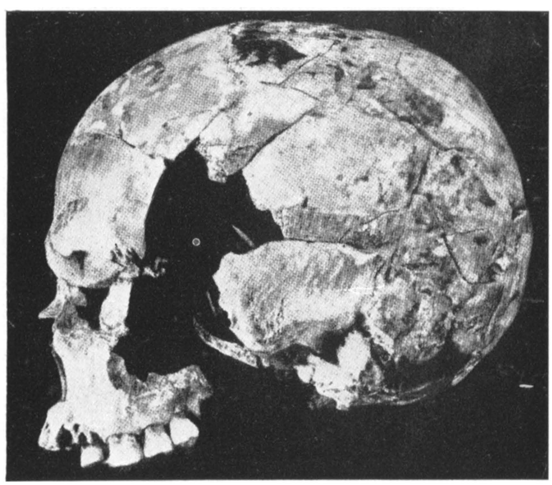


Pl. 50. Shell implements, Sodong Cave, Puger, Java.

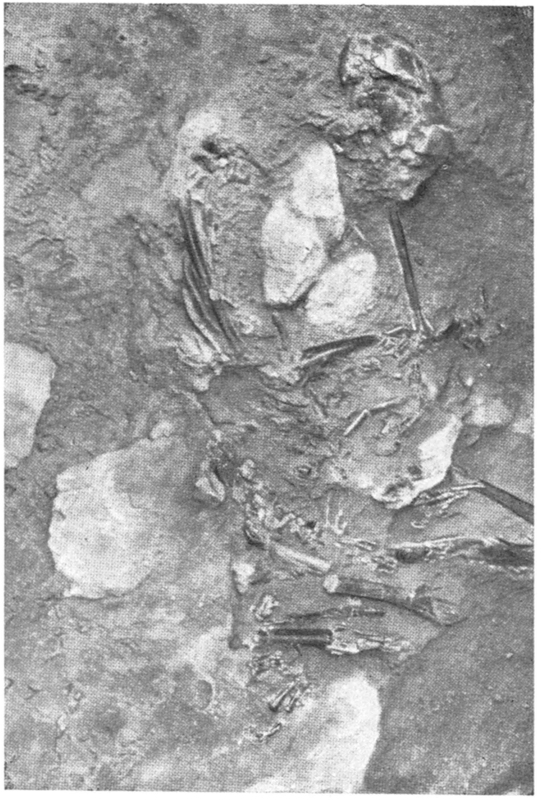


Pl. 51. Right lateral view of Sampung H mandible.

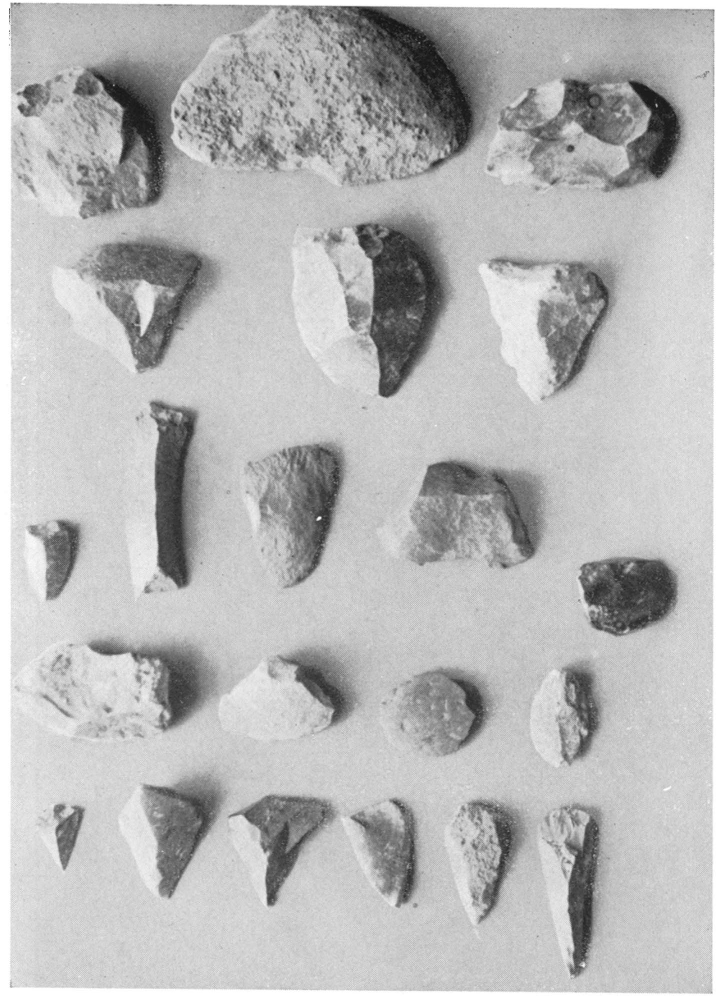




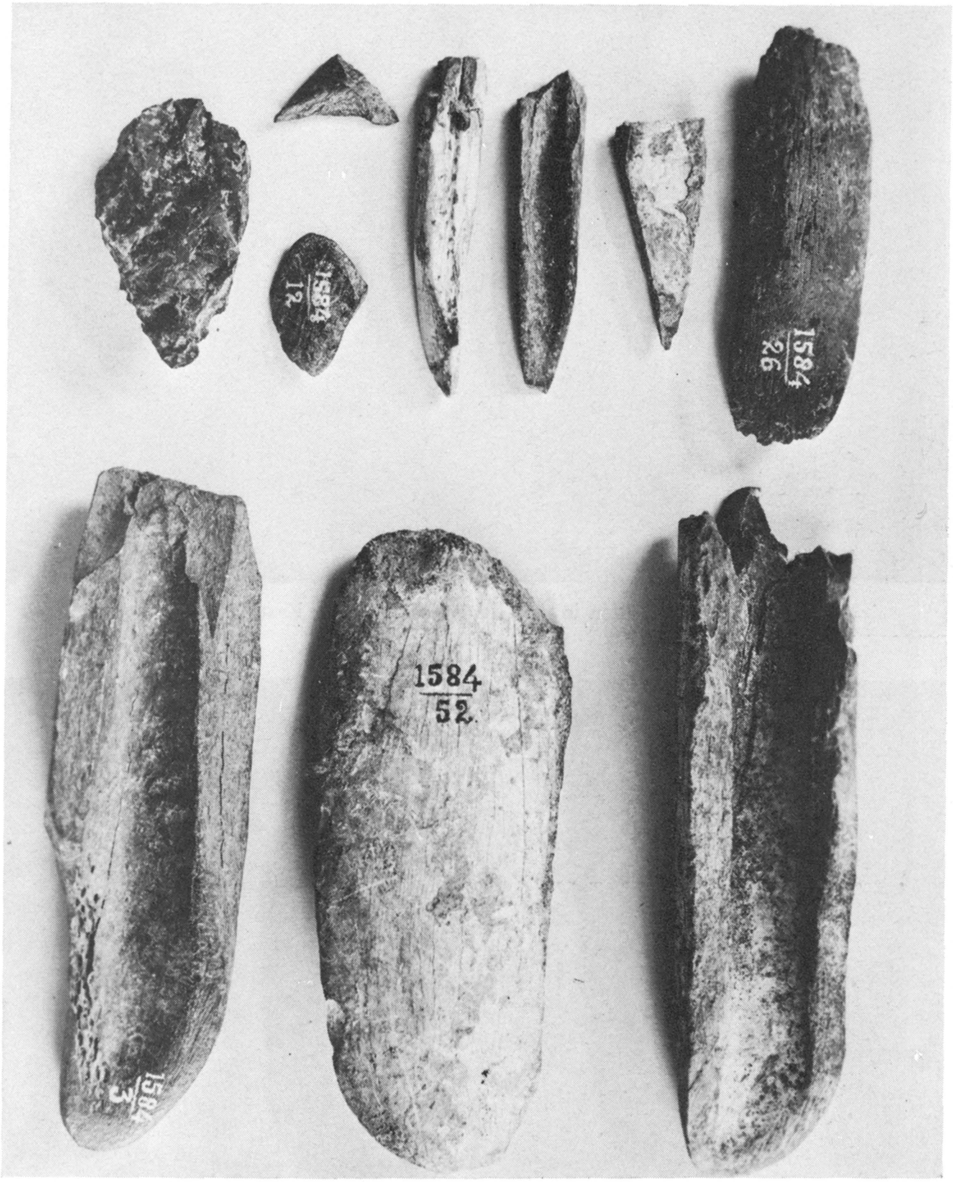
Pl. 52. Sampung F skull, Java.



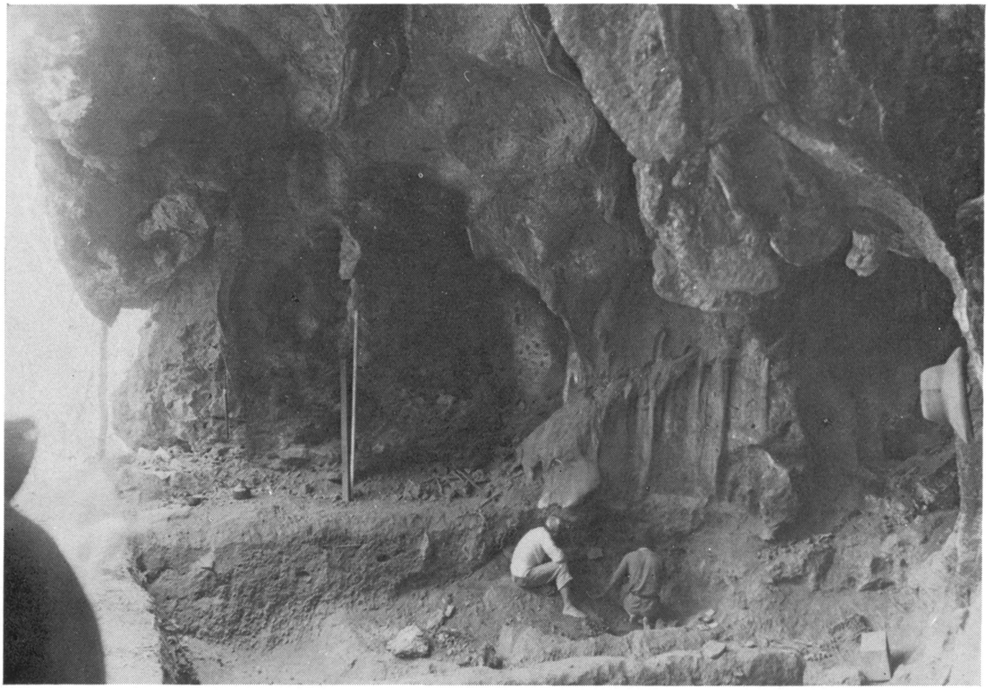
Pl. 53. Human skeleton (flexed burial), Gua Lawa, Java.



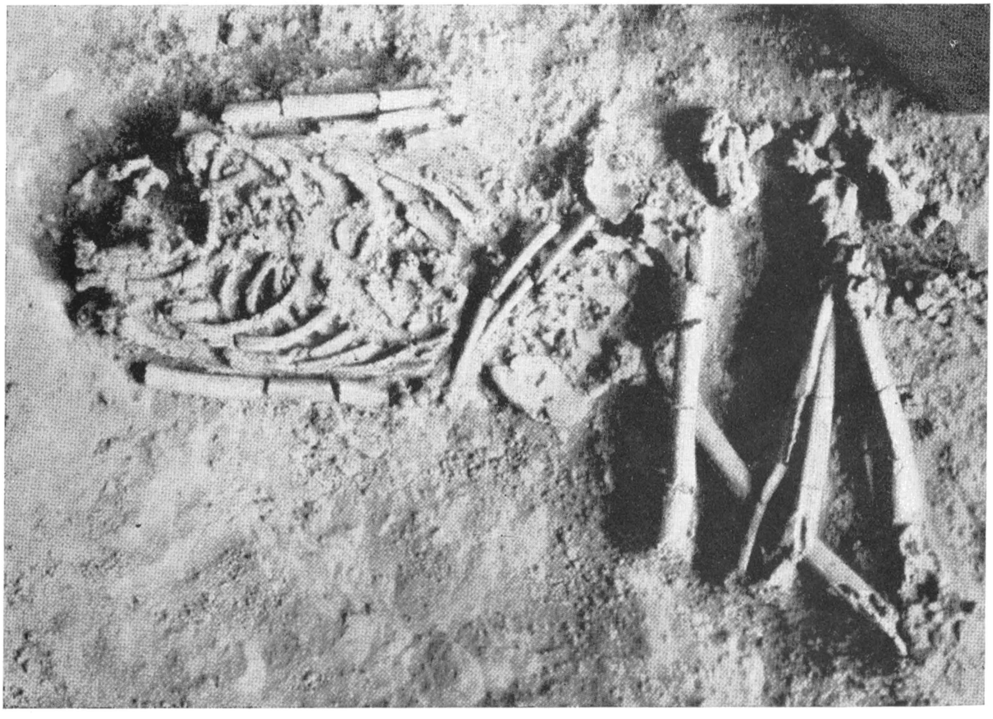
Pl. 54. Stone implements, Sodong Cave, Puger, East Java.



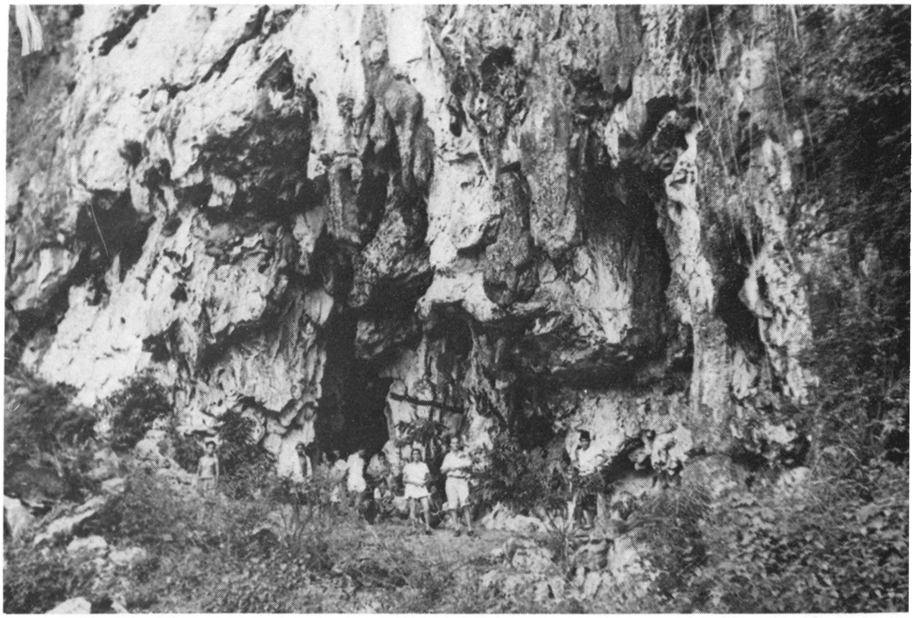
Pl. 55. Bone and stone implements. Gua Betpuruh, Pradjekan, East Java.



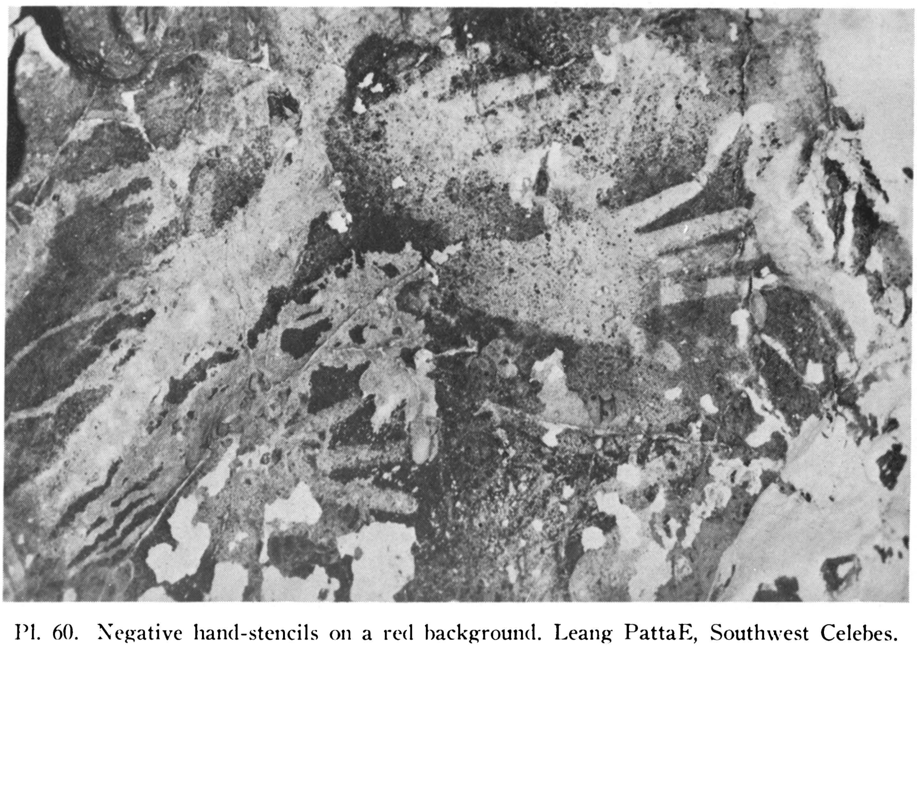
Pl. 56. Excavation in the Gua Sodong, Puger, East Java.



Pl. 57. Human skeleton in flexed burial. Head is missing.
Gua Sodong, Puger, Java.



Pl. 58. Leang PattaE, Turikale, Southwest Celebes.

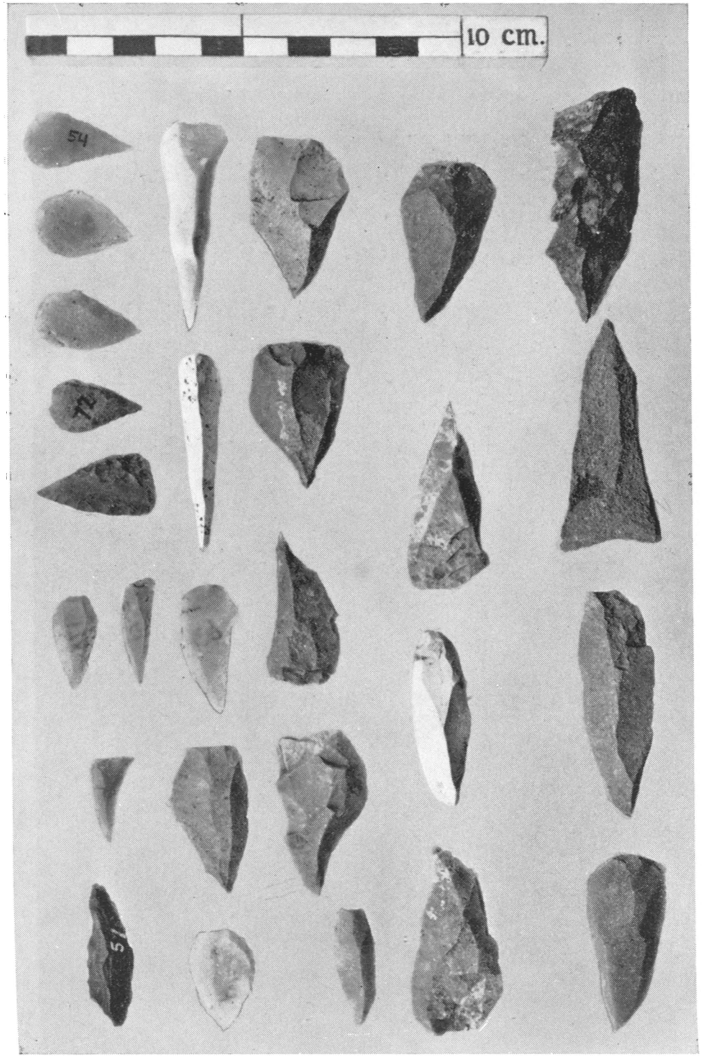


Pl. 60. Negative hand-stencils on a red background. Leang PattaE, Southwest Celebes.

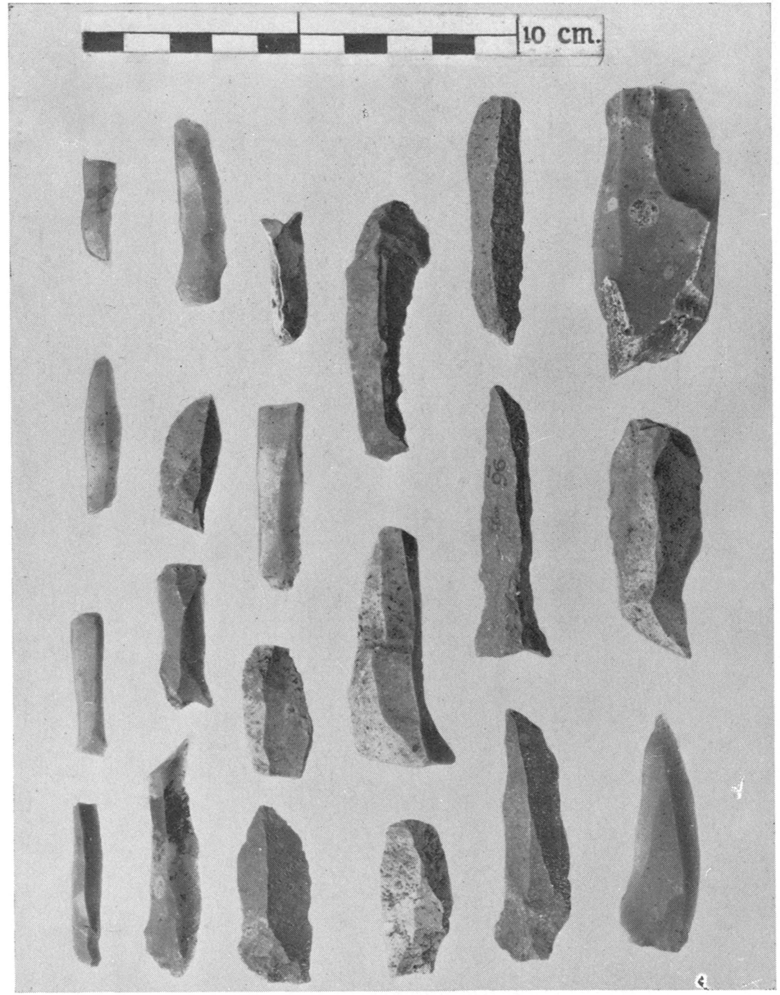
Pl. 59. Rock-painting in red striped-line technique of a charging boar.
PattaE Cave, East of Maros, Southwest Celebes.

Pl. 61. Negative hand-stencil on a red background. Burung Cave, East of Maros, Southwest Celebes.

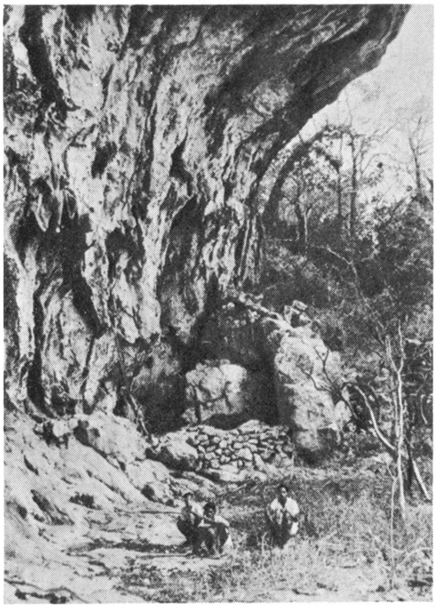
Pl. 62. Leang Burung: cemented bank of shells and fossil bones. On the right side a mandible of *Sus celebensis*.



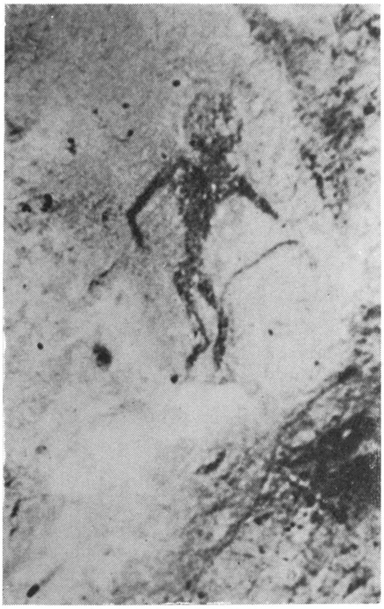
Pl. 63a. Flake- and Blade-Implements. Panganreang Tudea, Bonthain, Southwest Celebes.



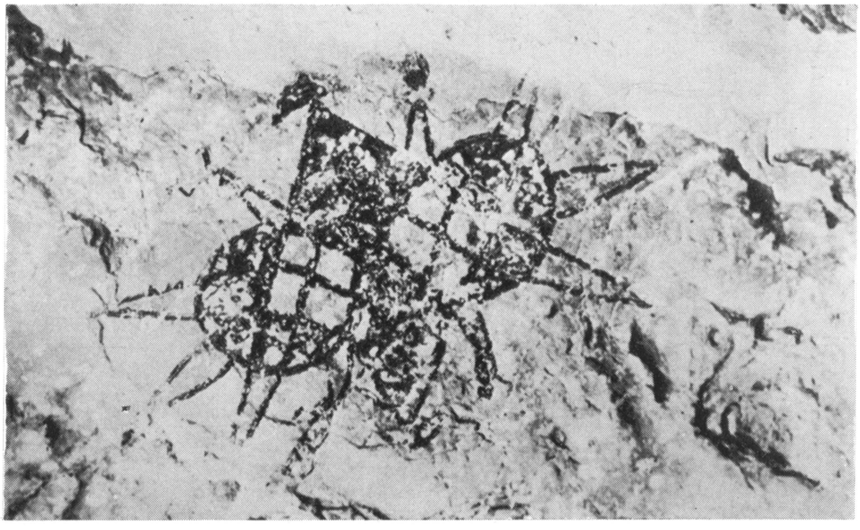
Pl. 63b. Flake- and Blade-Implements. Panganreang Tudea, Bonthain, Southwest Celebes.



Pl. 64. Ilikerekere Rock-shelter Portug. Timor. after Ruy Cinatti



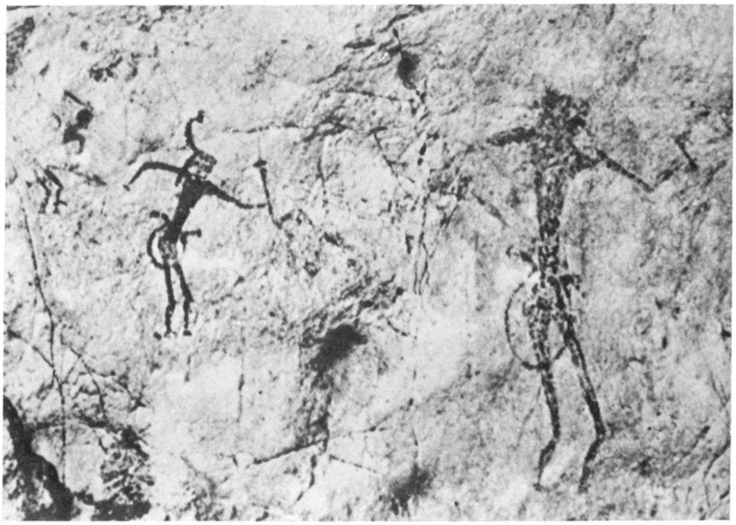
Pl. 65. Dancer Ilikerekere. after Ruy Cinatti



Pl. 66. Abstract rock-painting Ilikerekere.

after Ruy Cinatti

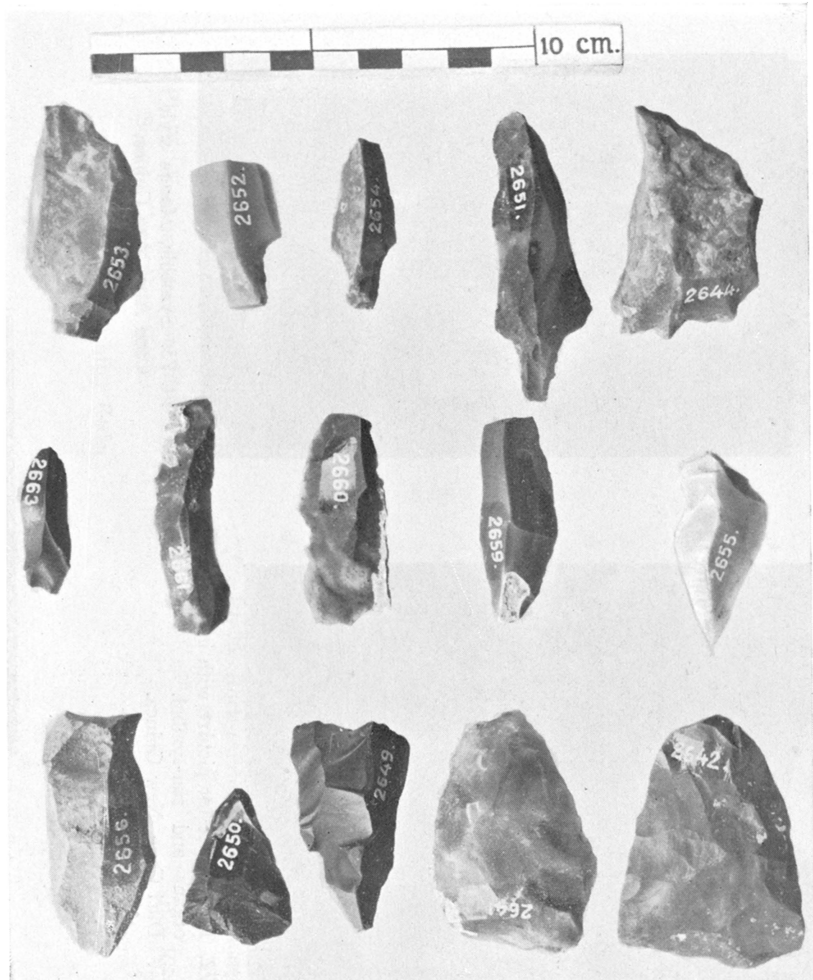
Pl. 67. Rock-paintings, Ilikerekere, Portuguese Timor. Ceremonial dancers.
after Ruy Cinatti



Pl. 68. Rock-paintings, Ilikerekere, Portuguese Timor. Ceremonial dancers.
after Ruy Cinatti

Pl. 69. Rock-paintings, Ilikerekere, Portuguese Timor. Simple stick-figures.
after Ruy Cinatti

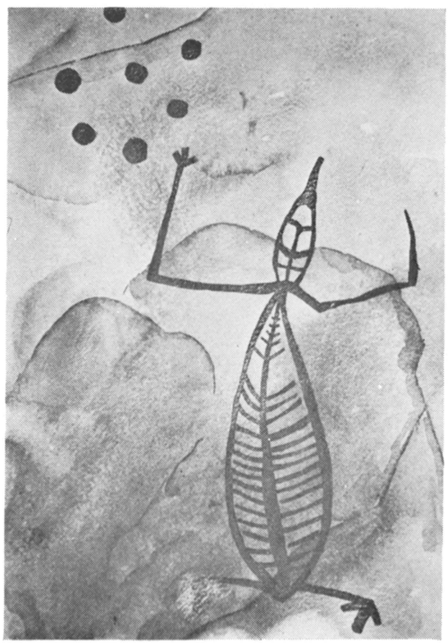
Pl. 70. Negative hand-stencil. Ilikerekere, Portuguese Timor.
after Ruy Cinatti



Pl. 71. Stone implements, Ulnam Cave, Bonle'u, Timor, including tanged blades and core tools.

Pl. 72. Lizard-ancestor picture with internal organs and sun-symbol. Duri Cave, New Guinea.

Pl. 73. Symbols, Manga style. Cape Abe, New Guinea.

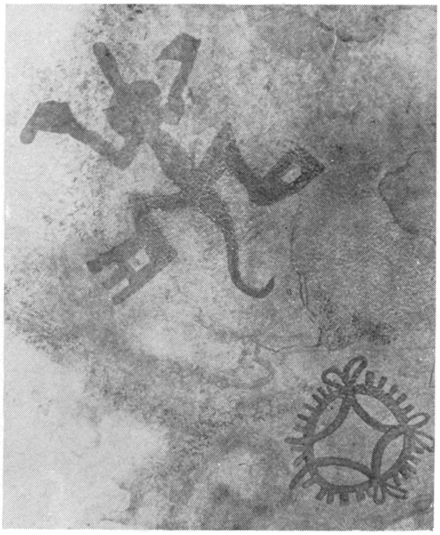


Pl. 74. Lizard-ancestor picture and red dots. Duri Cave, New Guinea.

after Röder

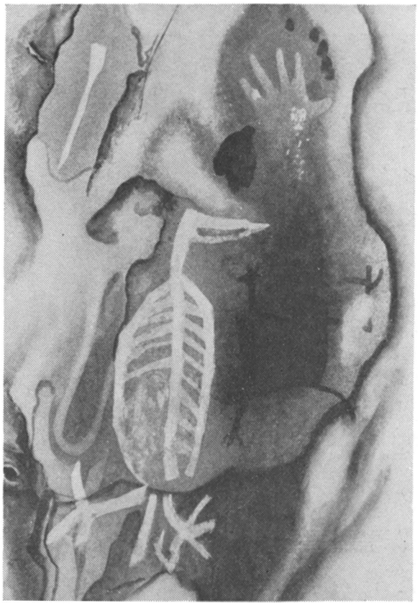
Pl. 75. Rock-paintings in black. Sossora Cave, New Guinea.

after Röder



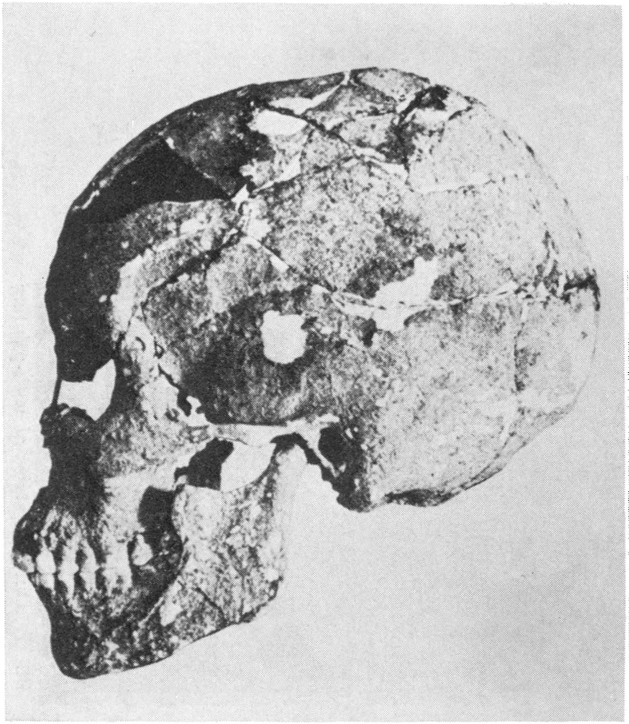
Pl. 76. Rock-paintings in red Tabulinetin style, New Guinea.

after Röder



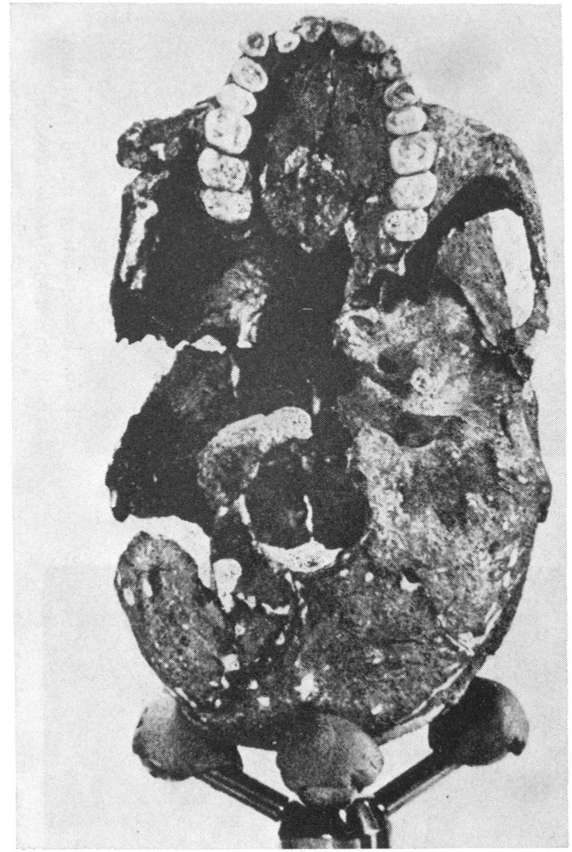
Pl. 77. Different styles of rock-painting superimposed on each other, New Guinea.

after Röder



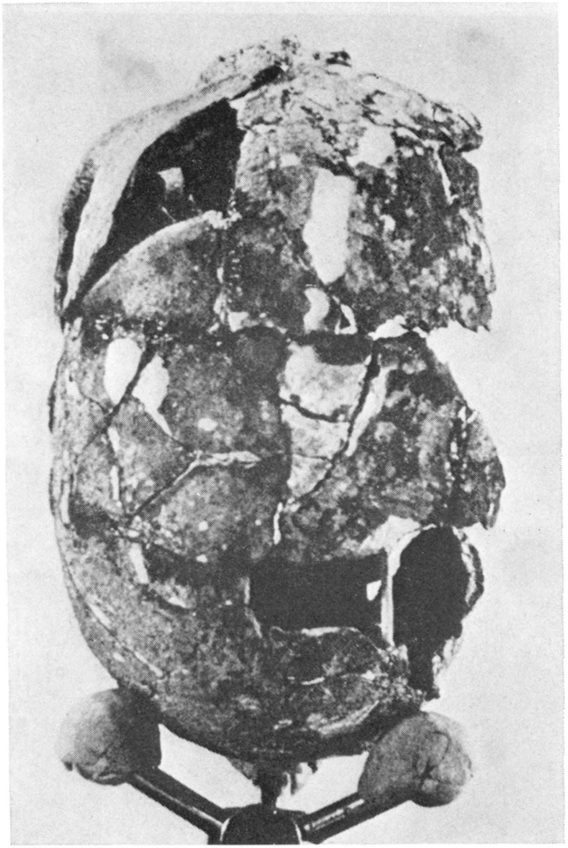
Pl. 78. Left lateral view of the Liang Toge skull. Note receding forehead, and the alveolar prognathism. Flores.

after Jacob

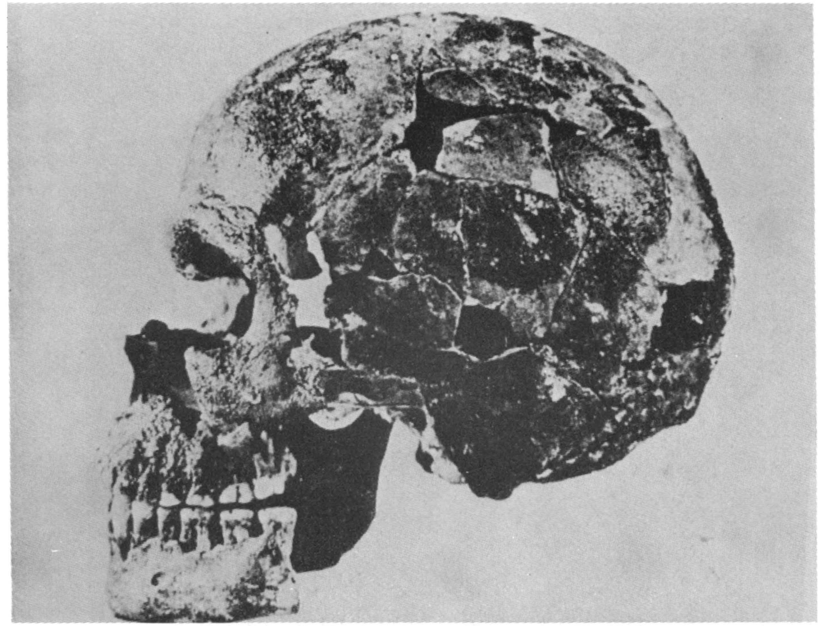


Pl. 79. Basal view Liang Toge skull, Flores.

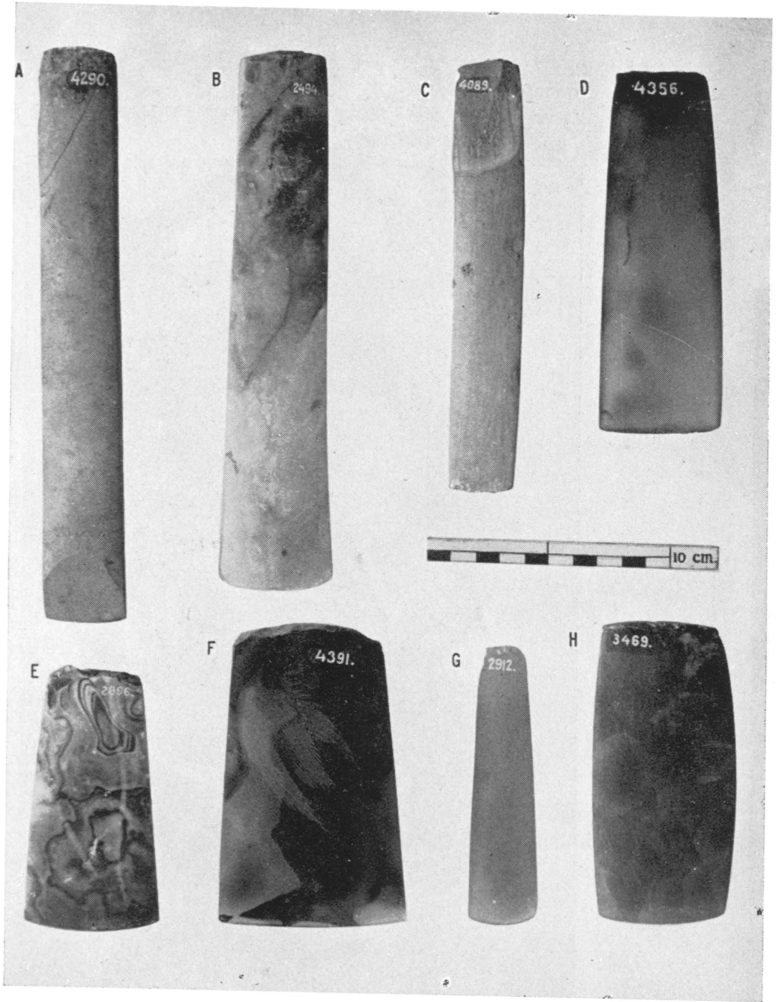
after Jacob



Pl. 80. Vertical view of the Liang Toge skull, Flores.
after Jacob

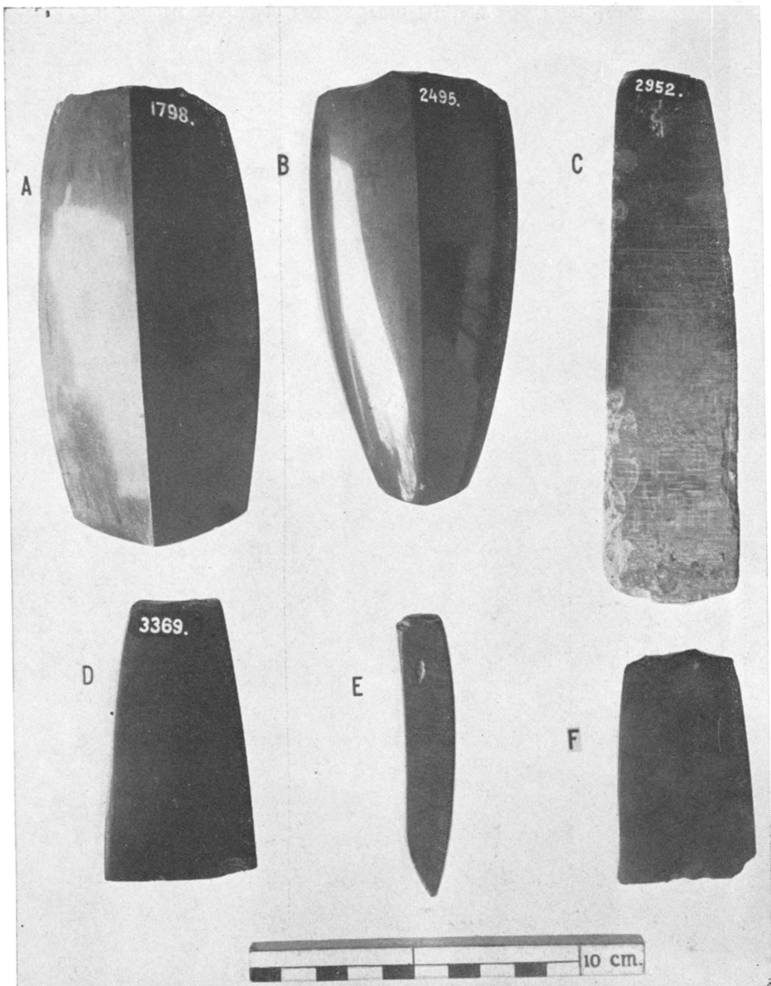


Pl. 81. Left lateral view of the Liang Momer skull with occipital bulging, Flores.



Pl. 82. Rectangular Adzes from Java.

Pl. 83. Pick Adzes from Java.

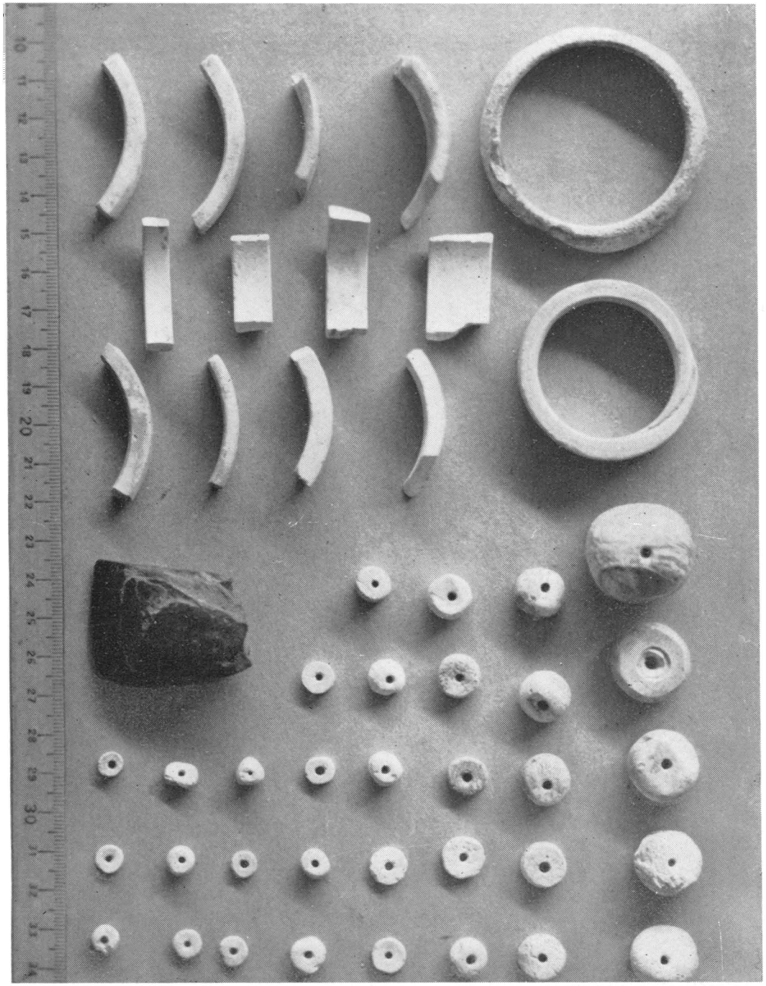


Pl. 84. Pick Adzes and Rectangular Adzes from Benkulen, Sumatra.

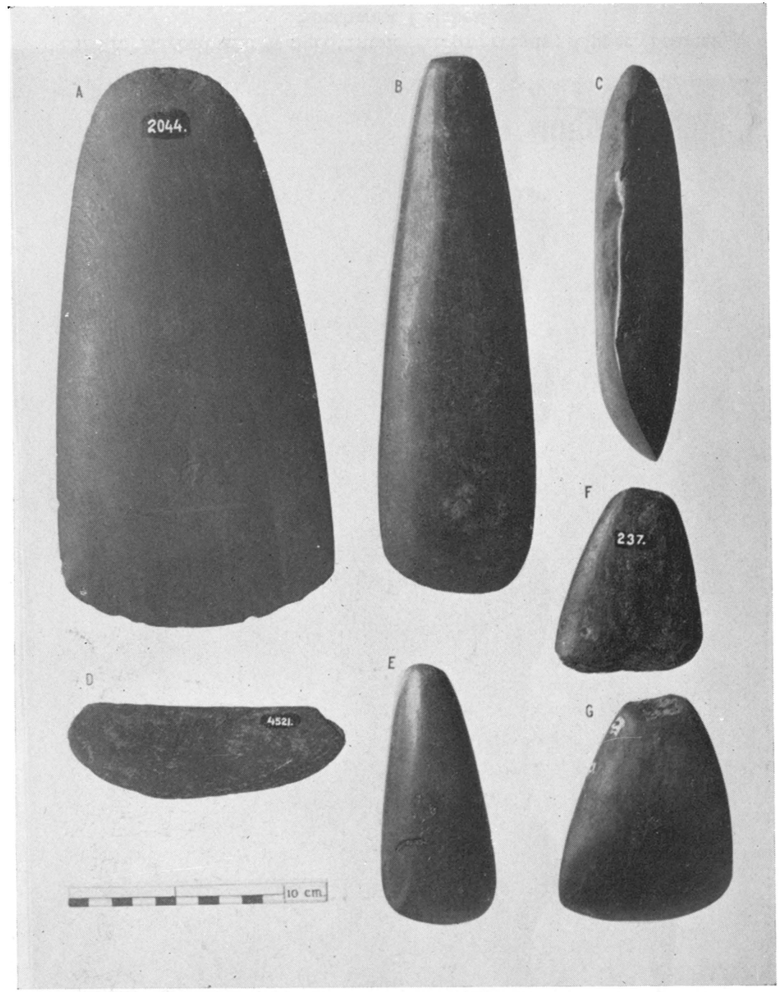
Pl. 85. Large Gouges with circular cross-section, Pradjekan, East Java.

Pl. 86. Roof-shaped Adzes from Ambon and East Java.

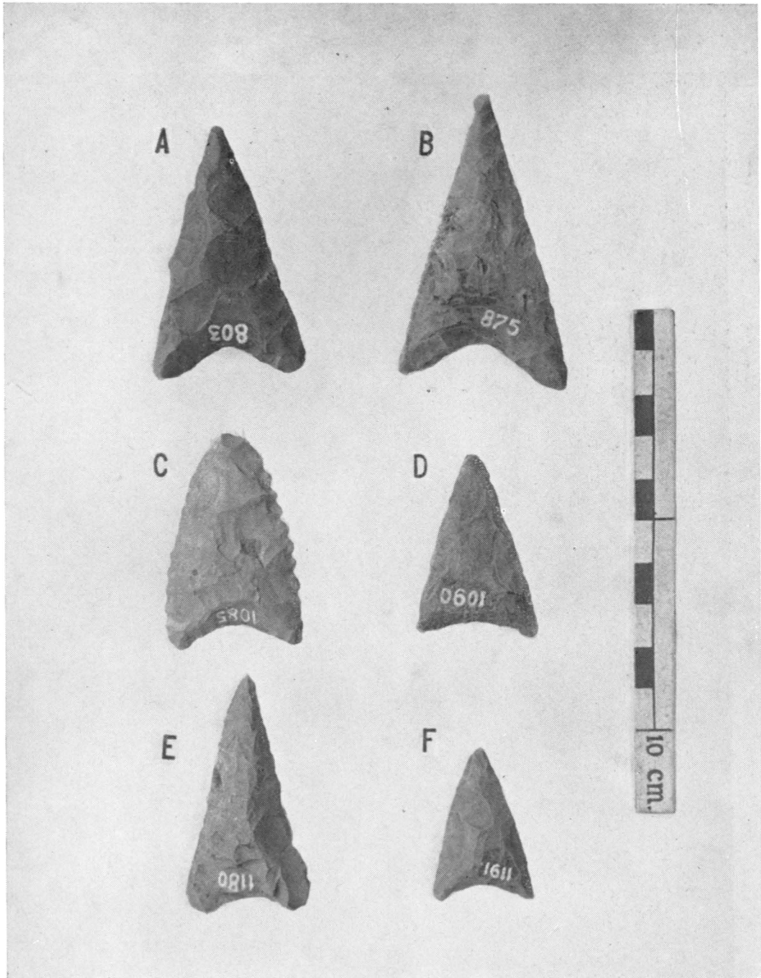
Pl. 87. Four phases of stone ring making; West Java.



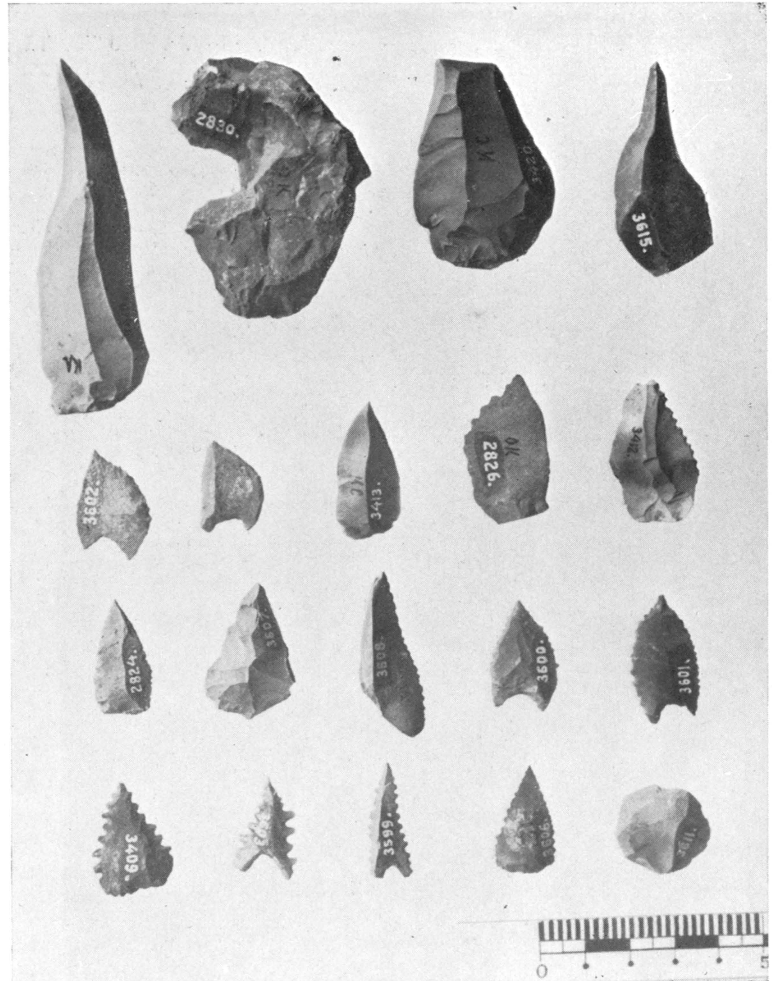
Pl. 88. Bracelets and beads, made of shell, and a small Rectangular Adze. Krai, Gundih, Central Java.



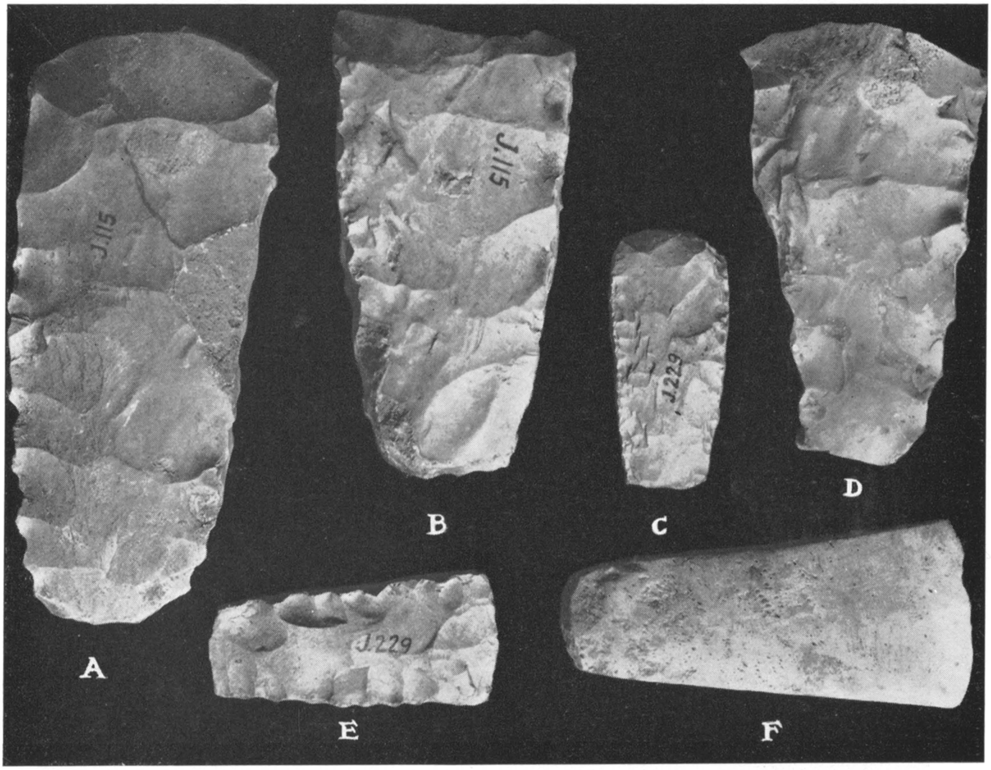
Pl. 89. Round Axes: A, C, D, from New Guinea; B, E, from Celebes; F, G, from East Sumatra.



Pl. 90. Winged Stone Arrow-Heads, Punung, Central Java.

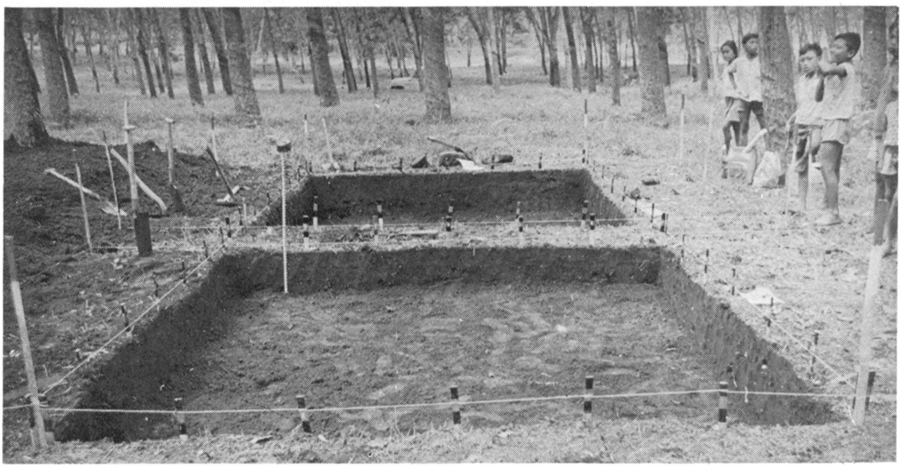


Pl. 91. Barbed and winged Stone Arrow-Heads; Upper Toalean, Southwest Celebes.

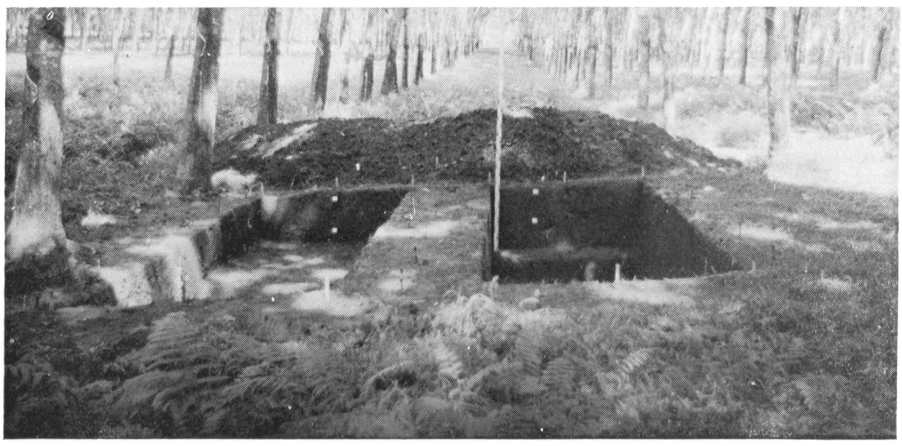


Pl. 92. Unfinished and finished Rectangular Adzes, Punung, Central Java.

Pl. 93a. Kendeng Lembu. Trial pit (east wall) with layers indicated.



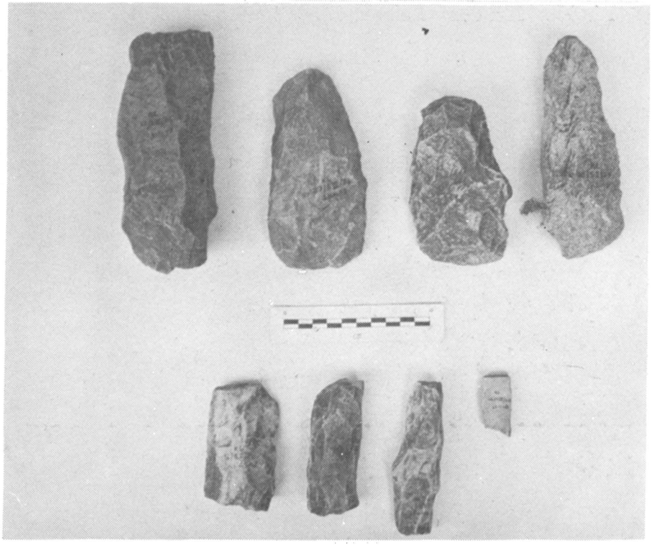
Pl. 93b. Kendeng Lembu. View of sectors I and II.



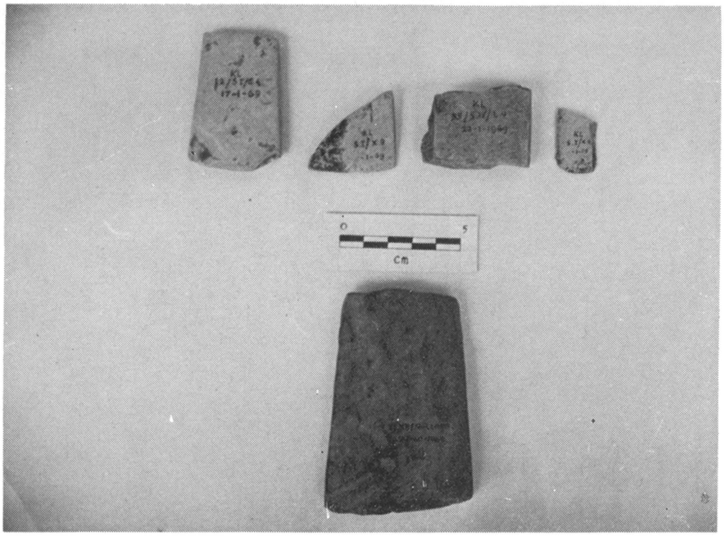
Pl. 93c. Kendeng Lembu. Sondage I and II, viewed from the west.
by courtesy of Soejono

Pl. 94a. Kendeng Lembu. Stratigraphy in Sector IV.

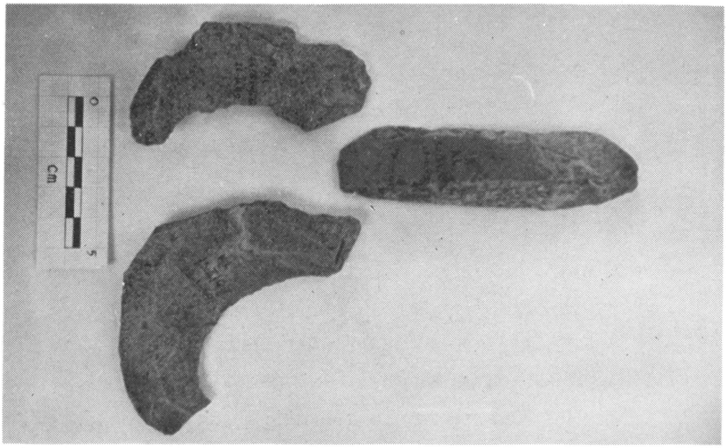
Pl. 94b. Kendeng Lembu. Neolithic 'plank' uncovered.



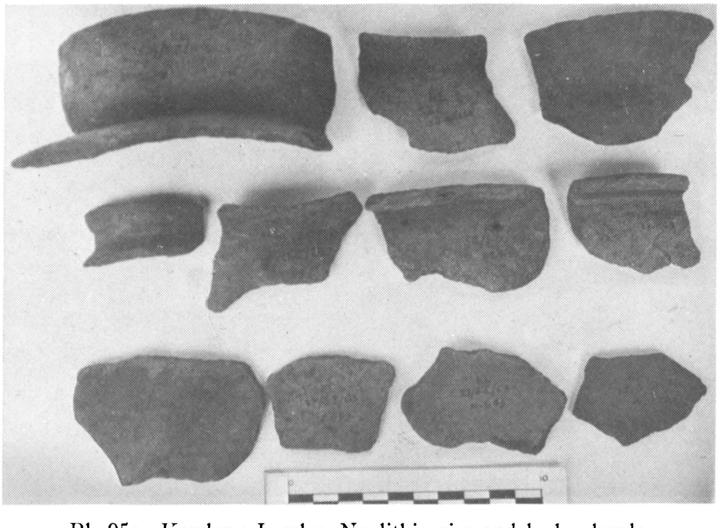
Pl. 94c. Kendeng Lembu. 'Planks' of various sizes.
by courtesy of Soejono



Pl. 95a. Kendeng Lembu. Polished neolithic adzes, complete and fragments. The specimen below was found in a drainage trench near the excavation site.

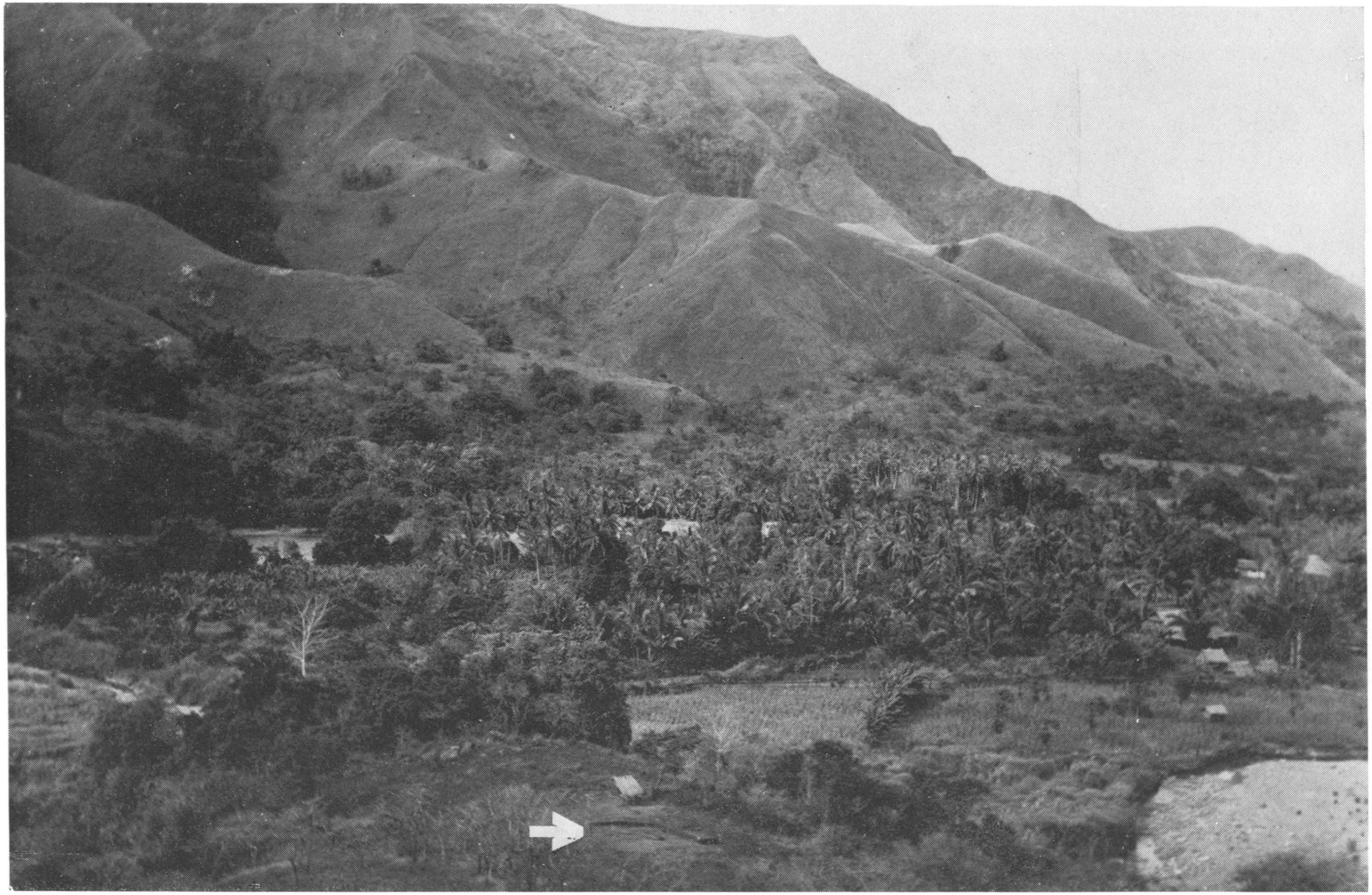


Pl. 95b. Kendeng Lembu. Blade knife and sickles of stone.

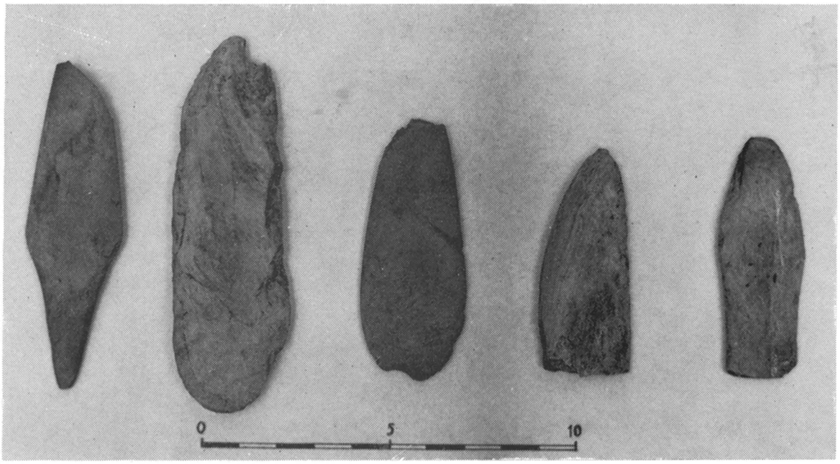


Pl. 95c. Kendeng Lembu. Neolithic rim and body sherds.

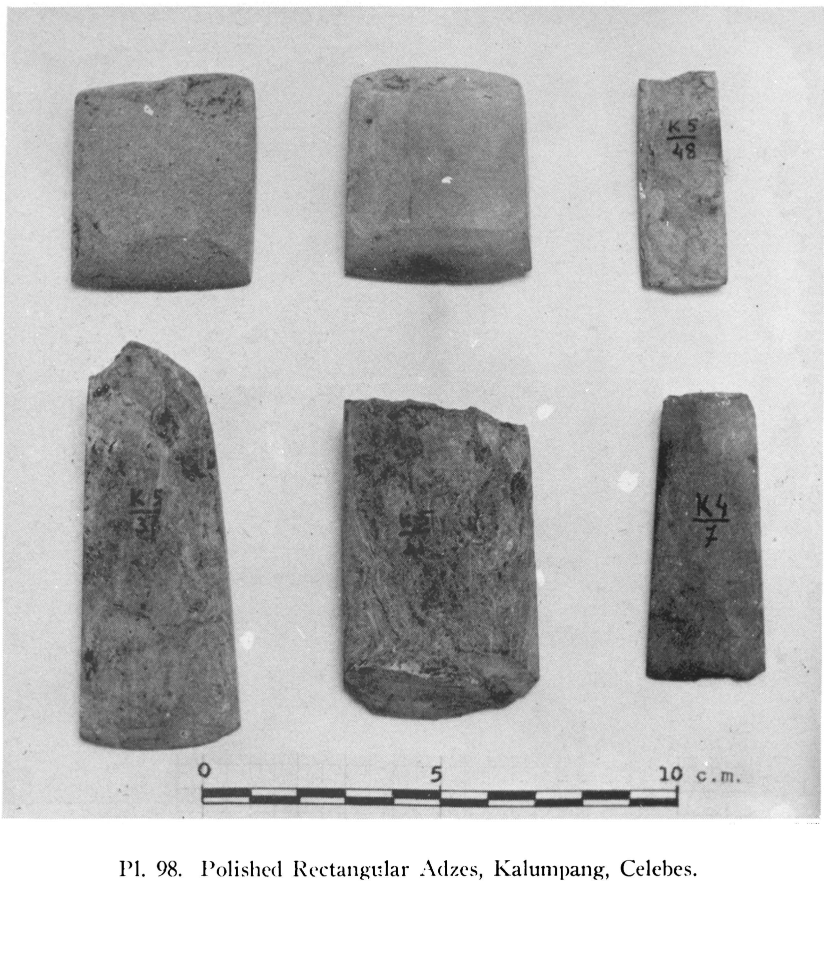
by courtesey of Soejono



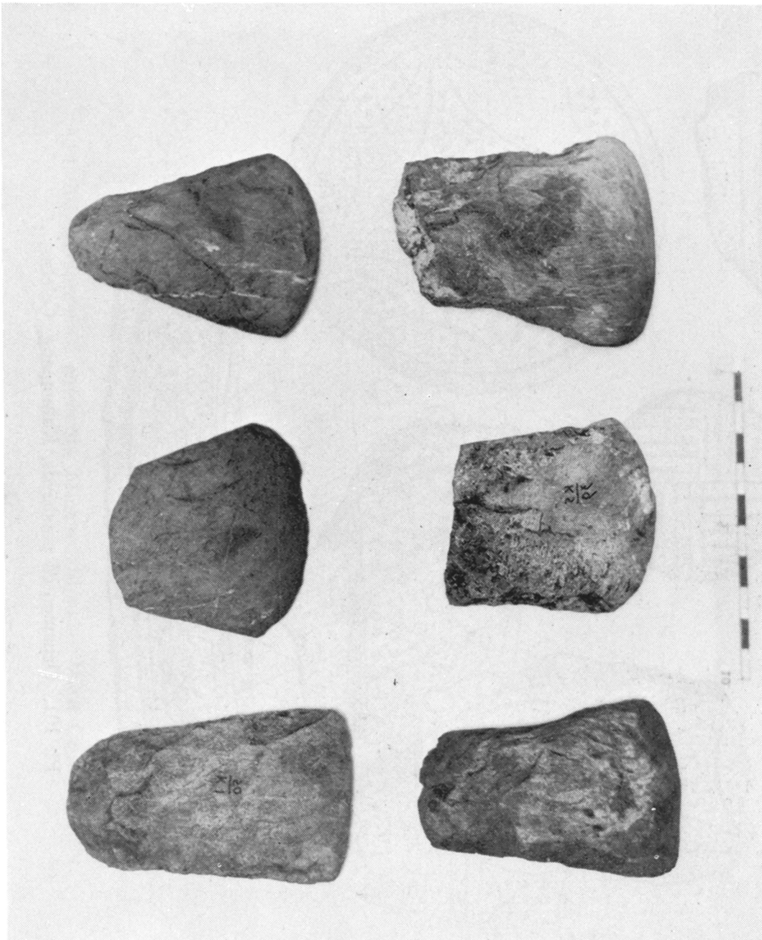
Pl. 96. Situation of the Kamassi site, Kalumpang, Celebes.



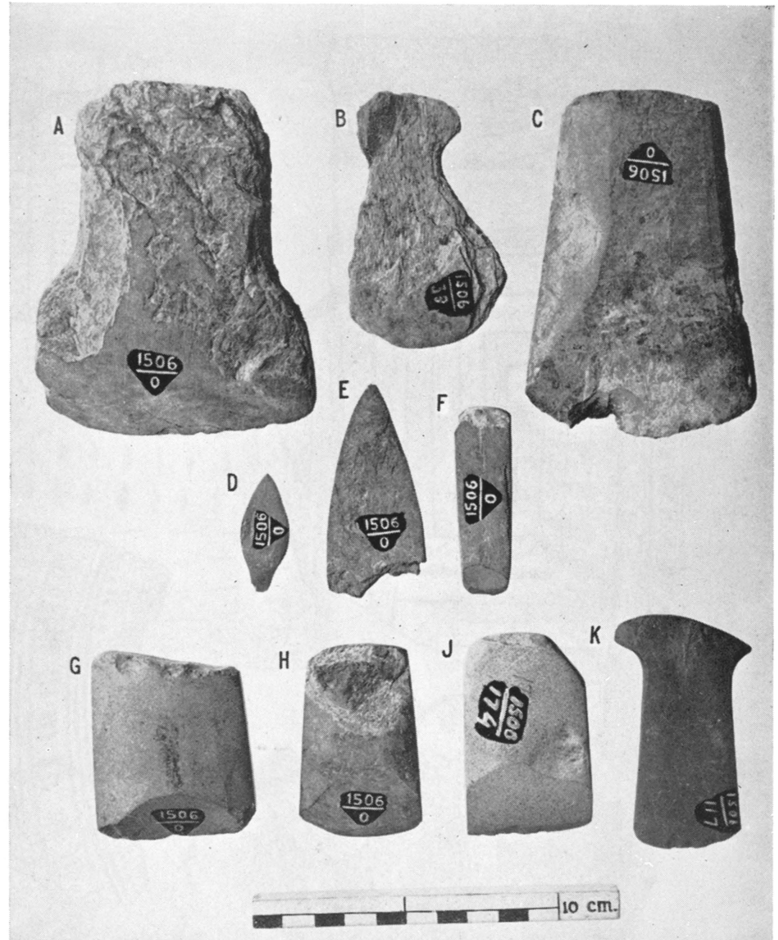
Pl. 97. Ground Stone Spear-Heads, Kalumpang, Celebes.



Pl. 98. Polished Rectangular Adzes, Kalumpang, Celebes.

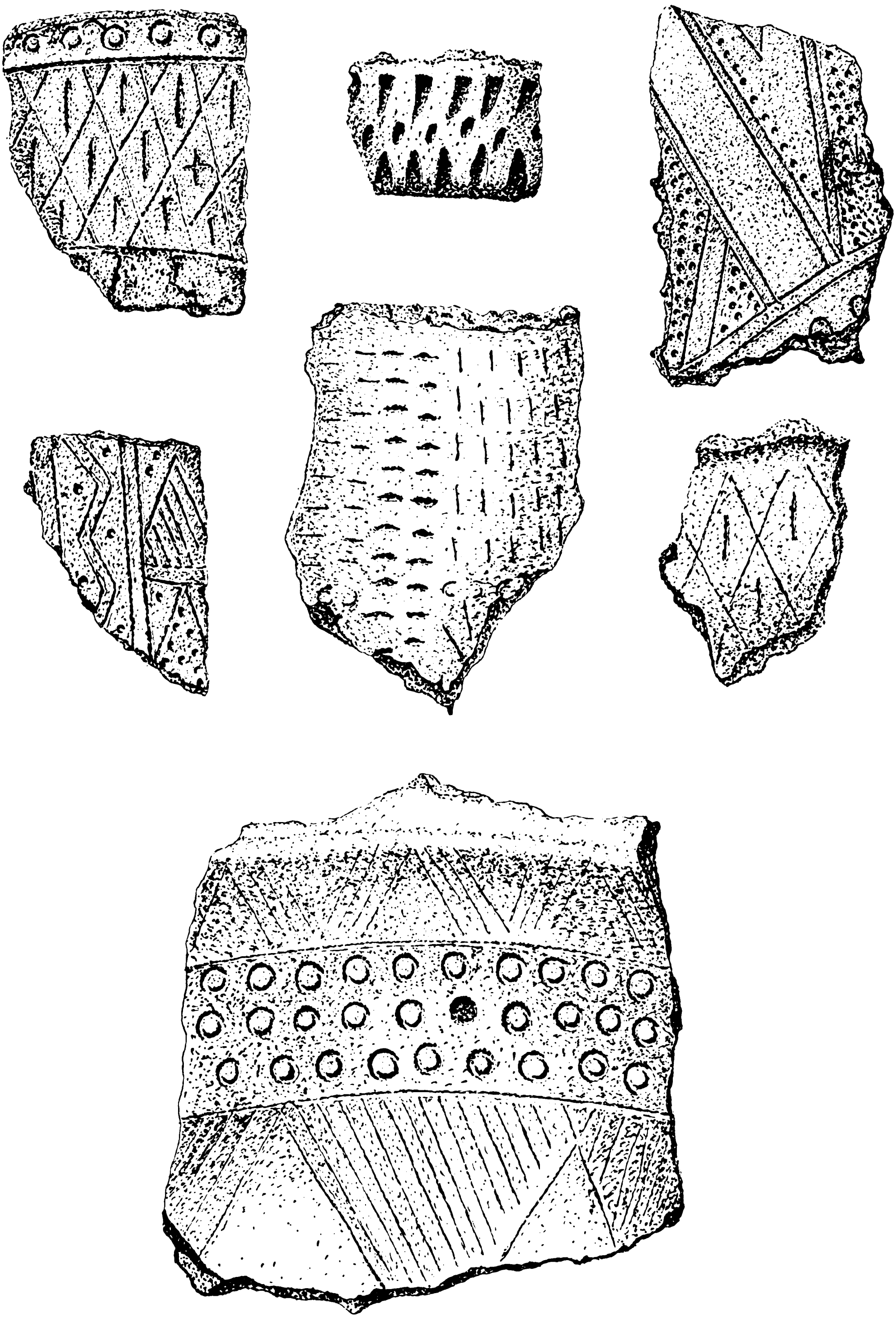


Pl. 99. Ground Oval Axes. Kalumpang, Celebes.



Pl. 100. Violin-shaped and Rectangular Adzes and polished Stone Arrow-Heads from Kalumpang, West Central Celebes.

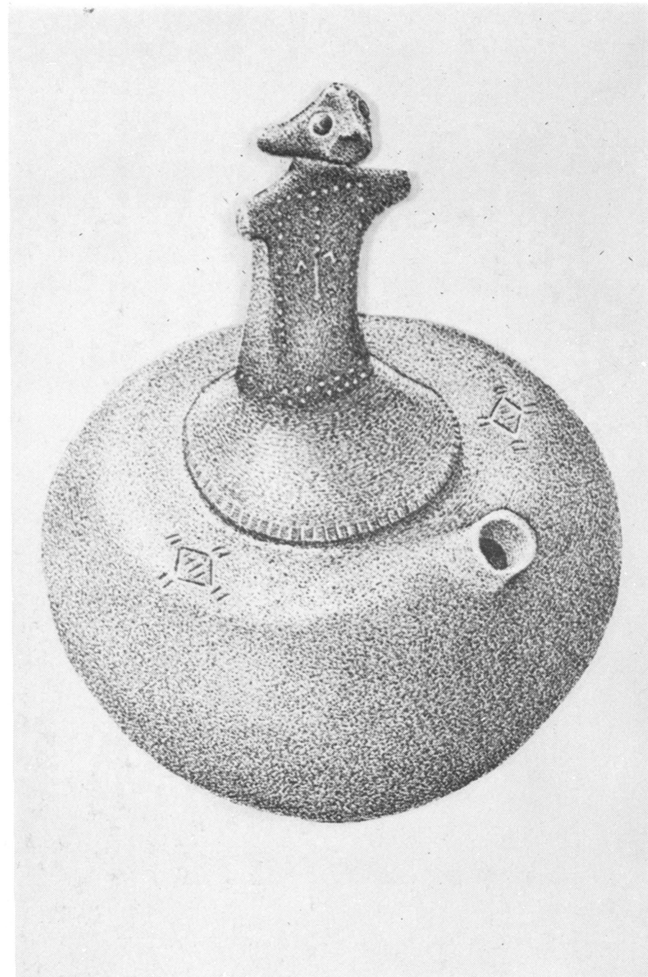
Pl. 101. Ornamented potsherds, Kalumpang, Celebes.



Pl. 102. Ornamented potsherds, Minanga Sipakko, West Central Celebes.

Pl. 103. Urn with bracelet made of shell. Melolo, East Sumba.

Pl. 104. Earthenware flask with incised human face and geometric ornamentation: Urn Cemetery, Melolo, East Sumba.



Pl. 105. Earthenware Flask with figurine and spout: Urn Cemetery, Melolo, East Sumba.