

# Observations on Cabengian and Pacitanian artefacts from island Southeast Asia

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*„Let's talk again," the Student said,  
„Of terraces and stones,  
Of artefacts from riverbanks,  
Of bulbar ends and cones –  
And why the dates seem never right –  
And where we may find bones.“*

## Introduction

Geomorphological investigations and excavations in the past decades appear to indicate that the Palaeolithic stone artefact collections from localities in the Walanae valley near Cabenge (formerly: Tjabenge) in Sulawesi and from the Baksoka valley near Pacitan (formerly: Patjitan) in Java date largely to the Late Pleistocene. A core artefact from Halmaheira (northern Moluccas) may have a similar age. No radiometrically datable materials have as yet been found in these regions. In view of the technological and typological similarities of the larger stone artefacts from these localities and their supposedly penecontemporaneous age, we present an analysis of a small collection, in particular bifacially modified cobbles and pointed bifaces, in an attempt to clarify their relationship. The discussion of the artefacts is concluded by remarks on Late Pleistocene human population movement in island Southeast Asia (and greater Australia); within this latter framework attention is also given to the recent radiometric dates of the Ngandong fossil locality in Java.

## Provenance and preservation of the artefacts

The stone artefacts that we present in this paper comprise three samples with a total of 42 specimens<sup>1</sup>. These surface and sub-surface samples derive from the Walanae valley in southwestern Sulawesi, the Baksoka valley in southern Java, and from southwestern Halmaheira (Fig. 1).

The artefacts from Sulawesi, Samples 2 and 3, were collected during fieldwork in the Walanae region in the years 1990 to 1994 (for a discussion of Sample 1, see Keates and Bartstra 1994). Sample 2 has a total number of 22 artefacts and is from Paroto (n = 18), Kecce (n = 1), Bunane 1 (n = 2) and Bunane 2 (n = 1).

<sup>1</sup> Lack of space does not permit us to present photos or drawings of other than the most significant of the artefacts. Some of the specimens discussed have been illustrated elsewhere though, and where appropriate the relevant literature is referred to in the text. See also Note 5.

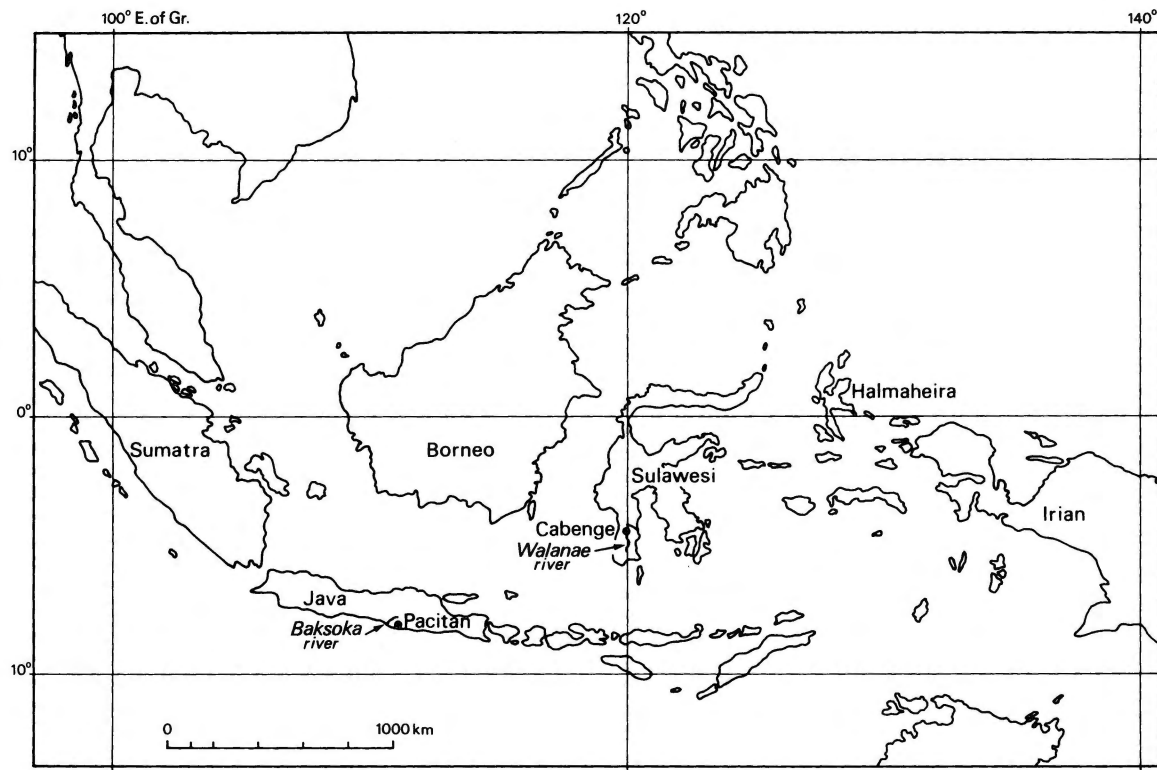


Fig. 1. Island Southeast Asia, showing the rivers Walanae (southwestern Sulawesi) and Baksoka (central Java), the find areas of the Palaeolithic Cabengian and Pacitanian industries. Drawing: J.H. Zwier, Dept. of Archaeology, Groningen.

Table 1. Frequencies and locality of lithic categories from Paroto, Kecce and Bunane (Sample 2)

Category	n	Locality with number of specimens
Flakes	5	Paroto
Cores	6	Paroto (5), Bunane 1
Unifacial point	1	Paroto
Bifacially modified cobbles	7	Paroto (4), Kecce (1), Bunane 1 and 2 (2)
Pointed bifaces	3	Paroto

These artefacts comprise flakes and cores, a unifacial point, bifacially modified cobbles and a few pointed bifaces (Tables 1 and 2; the unifacial and bifacial pebble and cobble artefacts are in fact the well-known choppers, chopping-tools and hand-adzes of Movius' terminology; the pointed bifaces correspond largely to the (proto-) handaxes (Movius 1949); we, however, have chosen to abandon the functional connotations; see Keates and Bartstra 1994; also Note 10). Sample 3 has a total number of 11 artefacts and derives from the Lenrang 2 (n = 7) and Jampu 2 (n = 4) localities. These artefacts are flakes and various cores and a bifacially modified cobble (Table 3).

The artefacts from Paroto, Kecce, Bunane, Lenrang and Jampu were collected from stream-laid, coarse, not cemented surface gravels, which lie scattered across the river-facing slopes of the low hills that border

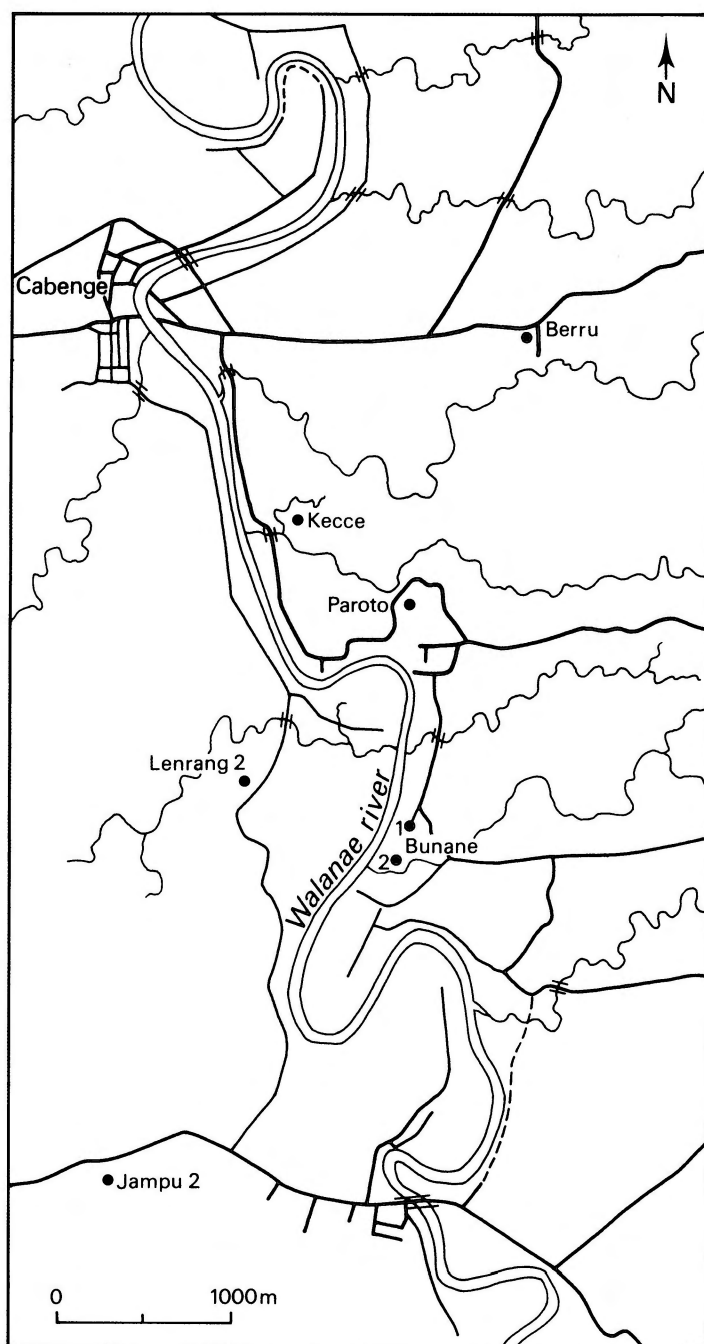


Fig. 2. Map of the area east and south of the town of Cabenge (south-western Sulawesi), where the Palaeolithic Cabengian artefacts are found. The localities mentioned in the text are indicated with a black dot. The first Cabengian (flake) tools were discovered directly north and south of the village of Beru (or Berru in the local Buginese spelling) by J.C. Olivier and H.R. van Heekeren in 1947. (Compare map/Fig. 1 in Keates and Bartstra 1994.) Drawing: J.H. Zwier, Dept. of Archaeology, Groningen.

the right and left banks of the Walanae (Fig. 2). As this gravelsheet is situated well above the floodplain of the river and has also a clear connection to the drainage pattern, we assume that it is a Walanae river terrace deposit. It has yet to be established whether these gravels are the residue of a former far more extensive fill from which the fines have been eroded away, or whether their deposition is of a more unique and catastrophic nature associated with the erstwhile activity of the now extinct Lompobatang volcano in the south (for details of the Walanae terrace system and underlying Walanae Formation, see Bartstra 1977a, 1997; and Bartstra et al. 1994). We dismiss attempts to explain the origin of these surface gravels along the Walanae other than by river terrace formation<sup>2</sup>. Such attempts often seek to enhance the age of the artefacts. But the Walanae terrace system is in a geomorphological sense a textbook case and can directly be compared with, for instance, the Solo terraces in Central Java, as exposed in the so-called transverse valley (de Terra 1943; Sartono 1976; Bartstra 1977b).

The gravels of Bunane 2 on the right bank of the Walanae and those of Jampu 2 on the left bank appear to be the most southerly preserved terrace remnants of importance to the prehistorian. Still farther to the south the gravel diminishes rapidly in size,

<sup>2</sup> With the exception of the so-called lag gravels: the eroded residue of the conglomerates of the Walanae Formation. These lag gravels have a different composition from the terrace gravels: there is a difference in size and angularity of the components; and they are never implementiferous. See text for the relevant literature.



Fig. 3. The terrain in the Walanae valley near Cabenge (southwestern Sulawesi). Photo: H.A. van Bommel, Groningen.



Fig. 4. The terrace gravel sheet near Paroto (southwestern Sulawesi). Photo: H.A. van Bommel, Groningen.

becomes sporadic and ultimately disappears altogether. In this area a hard limestone bedrock is exposed. Accordingly, the gravels of Bunane and Jampu nicely illustrate some conditions of river terrace formation: a large incising river, debouching from a hard bedrock region with associated steep-sided valleys into a relatively soft bedrock environment with a more plain-like character, at the same time carrying a hard rock load through a relatively soft rock channel (Fig. 3). From its moment of origin a terrace fill is subjugated to erosion. This process can still be observed: due to monsoon rains and downwash, sorting has taken place on the gravelstrewn slopes of the various localities. The cobbles and thus the heavy-duty tools lie at the foot of the hills: a pattern to be reckoned with when collecting artefacts in a grid-system. Furthermore, there are the erosional influences instigated by man: most localities along the Walanae are difficult to survey nowadays because cacao plantations have been laid out and the terrace gravel is piled up in an assortment of fences, or in worse cases smashed for road construction work. The site of Kecce, well-known as a source of larger Palaeolithic implements in the 1970's, has thus almost completely been destroyed and has become useless as an area for further reaching prehistoric studies other than the collecting of the occasional artefact. Paroto, fortunately, has received some sort of protection due to measures from the archaeological offices in Makassar.

The artefacts from the Walanae valley are in various states of preservation. They exhibit surface abrasion (fluvial wear) with degrees of preservation ranging from good to moderate to poor, here defined as: a) good – no or almost no wear with clear and sharp edges and flake scars; b) moderate – edges more worn, but flake scars are still distinct; and, c) poor – pronounced rounding of edges and erosion (corrosion) of the surface, which in some cases makes it difficult to distinguish individual flake scars. The artefacts might also be described as having light to moderate to heavy abrasion. In fact, all artefacts from Samples 2 and 3 exhibit some degree of abrasion.

The terrace gravel in the Walanae valley is clearly implementiferous (Fig. 4). Yet it is difficult to ascertain which part of the total industry<sup>3</sup> is truly *in situ* and which part lies only scattered on the surface of the gravelsheet. The aforementioned disruption of the various localities make the outcome of some conducted trial excavations inconclusive. It has been said that analysing the stone artefacts of the Walanae region on the basis of rounding (abrasion, fluvial wear) and general *état physique*, suggests three distinct components (Bartstra 1978a): an oldest or first group or category of heavily abraded and patinated (primarily mixed silicified tuff and limestone) tools and waste, evenly present in all terrace gravel spurs; a later or second group of less rounded artefacts (manufactured of the same materials), which appears not to be present everywhere and which might exhibit an *atelier*-like distribution on top of the various terrace surfaces (traceable too in some variation in artefact technology between the localities; see chapter „Bifacially modified cobbles“); and, finally, a „modern“ or third group as evidenced in distinct concentrations of rather small (almost exclusively limestone) cores and flakes, neither rounded nor patinated. This latter category has a distribution beyond the terrace remnants proper. It is presumably largely „post-Pleistocene“<sup>4</sup> and is not included in Samples 2 and 3. It is the first and second group that is discussed in this paper.

A few artefacts show recent damage in the form of chipped edges, thus exposing the unpatinated raw material; from a small flake from Jampu 2 (J/6) the distal end (i.e. opposite the striking platform: the proximal end) has broken off. This is all a consequence of farmers' activities. Some flakes appear to show signs of utilisation, but the fluvial rounding tends to obscure use wear. All artefacts have patina. On some

<sup>3</sup> Van Heekeren (1960, 1972, 1975) always spoke of the „Cabenge (formerly: Tjabenge) flake industry“. Core tools in greater quantity, however, came to light during the reconnaissance surveys in the Walanae valley east and south of the town of Cabenge in the late 1970's and early 1980's.

<sup>4</sup> This third category might very well be the „open-air“ equivalent of the cave assemblages in southwestern Sulawesi (Glover 1976; Bartstra 1998; Pasqua and Bulbeck 1998; Bulbeck and Pasqua in press).

specimens it is not possible to establish whether or not they retain any cortex because of severe abrasion and prolonged patination.

For comparative purposes we have included in our analysis eight pointed bifaces from the Baksoka valley near Pacitan in southern Java and one from Halmaheira (Sample 4; Table 4). Because much has been written already about the Pacitanian (formerly: Patjitanian; e.g. Movius 1949; van Heekeren 1972) and its geographical setting (Bartstra 1976), a few remarks will suffice here. Compared to the volume of stream sediments in the valleys of the far larger Walanae and Solo rivers, the floodplain and terrace deposits in the Baksoka drainage area are rather unimpressive. Also, erosion has had a severe impact in this deforested region, and only derelict terrace remnants and spurs can now be traced on the valley slopes, often obscured by slide, slump and creep phenomena, as well as man-made terraced fields. Thus, along the Baksoka too, it is not easy to obtain an insight of the stratigraphy of the terrace fills. Older interpretations can mostly be discarded as wishful thinking or exercises to try to fit the fills in a theoretical classification of the Pleistocene (von Koenigswald 1936; Paterson 1941; de Terra 1940, 1943). The presence of a very coarse, implementiferous floodplain and terrace gravel alongside the upper course of the Baksoka has been established, however. The eight bifaces mentioned above originate from this gravel. They all show fluvial abrasion and patination.

Wear is less obvious on the enigmatic pointed biface from Halmaheira. Very little can be said about the circumstances of its discovery. This artefact was handed to us in the early 1980's, and it presumably came to light during an agronomical survey in the southwestern part of Halmaheira island<sup>5</sup>.

### Technology

All of the artefacts in the samples appear to have been manufactured by direct hard-hammer percussion on locally available river cobbles in a variety of materials, primarily silicified limestone and silicified tuff; two specimens are of an as yet unidentified very fine grained variety of crypto-crystalline material and one specimen is of chalcedony. The length, width and thickness dimensions of the artefacts are shown in Tables 2–4. The measurements were taken with a measuring board.

Table 2. Length, width, and thickness of the Paroto, Kecce and Bunane\* artefacts (Sample 2)

Category	Specimen	Length	Width	Thickness
Flake (whole)	P 90/T	5.10	3.65	1.60
Horsehoof core	BN 1/94/W	5.10	4.70	4.80
Horsehoof core	P 92/E	5.50	8.60	5.65
Flake (whole)	P 90/S	6.70	5.10	1.90
Bifacially modified cobble	P 90/Q	6.90	8.55	6.45
Bifacially modified cobble	BN 1/94/U	7.10	7.15	5.40
Bifacially modified cobble	P 91/P	7.20	6.50	4.60
Flake (whole)	P 90/R	7.20	6.80	1.95
Bifacially modified cobble	BN 2/94/V	7.85	8.50	5.50
Double-platform core	P 92/A	8.10	7.80	7.70

<sup>5</sup> The artefacts from Sulawesi, Java and Halmaheira presented in this paper are part of the collections of the National Research Centre of Archaeology in Indonesia, which are for the greater part stored in Jakarta, Yogyakarta and Makassar. The presented samples are so-called study collections, on extended loan to the Donald Baden-Powell Quaternary Research Centre, University of Oxford, England and the Institute of Archaeology in Groningen, the Netherlands. Each artefact has been marked with a special code, referred to in the text and tables.

Category	Specimen	Length	Width	Thickness
Bifacially modified cobble	K 90/L	8.50	12.80	7.75
Bifacially modified cobble	P 93/N	9.10	10.10	9.55
Multi-platform core	P 92/F	9.50	12.30	8.85
Unifacial point	P 90/O	10.70	8.90	4.95
Single-platform core	P 91/K	10.80	11.90	10.70
Flake (whole)	P 92/D	10.95	6.35	3.70
Flake (whole)	P 92/G	11.55	12.15	4.90
Pointed bifaces	P 93/M	12.05	10.95	5.60
Pointed bifaces	P 92/I	12.60	10.90	5.20
Pointed bifaces	P 92/H	12.90	11.10	6.30
Bifacially modified cobble	P 92/B	13.20	9.70	8.50
Double-platform core	P 92/C	17.30	11.00	9.50

\* P = Paroto; K = Kecer; BN 1 = Bunane 1; BN 2 = Bunane 2.

Table 3. Length, width, and thickness of the Lenrang 2 and Jampu 2\* artefacts (Sample 3)

Category	Specimen	Length	Width	Thickness
Flake (whole)	L/5	4.30	2.30	1.10
Multi-platform core	L/2	4.40	5.20	4.50
Single-platform core	L/7	8.80	8.20	4.40
Flake (whole)	L/4	5.30	4.30	1.50
Flake (whole)	L/3	5.35	3.40	1.80
Flake (whole)	L/2	5.70	3.90	1.25
Flake (whole)	L/1	5.95	4.20	2.00
Horsehoof core	J/2	7.50	7.80	7.00
Flake (whole)	J/7	7.95	6.10	3.15
Flake (whole)	J/6	8.00	6.20	2.40
Bifacially modified cobble	J/3	9.70	10.90	5.35

\* L = Lenrang 2; J = Jampu 2.

Table 4. Length, width, and thickness of the Pacitan and Halmaheira bifaces

Specimen	Length	Width	Thickness
JP/107*	12.60	9.10	6.60
JP/193	12.70	12.80	5.70
JP/mand 4	12.80	10.95	6.10
H/1†	13.35	11.40	6.75
JP/East P	13.45	9.60	4.95
JP/1953/510	14.15	9.90	6.60
JP/P1	14.40	8.70	5.30
JP/111	15.75	12.20	4.80
JP/217	18.05	11.60	6.50

\* JP = Java Pacitan; † H = Halmaheira.

#### Cores

The six cores from Paroto and Bunane (Sample 2) comprise one single-platform core, two double-platform cores, one multi-platform core and two horsehoof cores (Table 2). The three cores from Jampu 2 and Lenrang 2 (Sample 3) include a single-platform core, a multi-platform core and a horsehoof core (Table 3). The Paroto cores preserve between 30–50 % cortex with the exception of one double-platform core and one horsehoof core which are both non-cortical. All are of irregular morphology with low flake scar counts; the multi-platform core has the largest

number of scars (16–18). One of the double-platform cores and the single-platform core are in coarse material, and all specimens show a small number of step fractures. One edge of the multi-platform core (P 92/F) was retouched bifacially to a „point“, indicating that it may also have functioned as a tool. The single-platform core from Lenrang 2 (L/7) with its approximately flat striking platform is of irregular form with a small number of fairly regular flake scars around the periphery. The multi-platform core (L/2) was worked in what appears to be a more fine-grain stone. Flake scars are mostly large with a few small scars. Judging from its small size, amount of cortex (c. 15 %) and number of flake scars (n=13), this may represent a discarded core. Both the L/7 and L/2 cores have a few step fractures.

Three cores are so-called horsehoof cores, and these derive from three different localities. On the cores from Paroto and Bunane flakes were struck from irregularly flat striking platforms, while the Jampu 2 core has a flat-convex platform. On the Paroto core (P 92/E; Fig. 5) 6–7 flakes were removed in a concentric pattern. The Jampu 2 core (J/2) has about two-thirds of its circumference flaked (cortex is c. 30 %), but the coarse nature of the material makes it difficult to determine the total number of scars (c. 12); a few flakes were struck off the top. The Bunane core (BN 1/94/W) is more irregular in shape and less high compared to the other two horsehoof cores. To some extent this may be referable to the partly coarse grain silicified limestone in which it was made. This non-cortical specimen shows about 7 small flake scars around all or most of the periphery removed from an irregularly flat striking platform. Although the Bunane specimen seems less typical of horsehoof core morphology as presently known, further discoveries may add information about the range of variation of these cores. The horsehoof cores described here, especially the Paroto and Jampu specimens are similar to the horsehoof core described previously from Kecce (Keates and Bartstra 1994).



Fig. 5. Horsehoof core P 92/E from Paroto (southwestern Sulawesi); lateral view. Photo: R.L. Wilkins, Inst. of Archaeology, Oxford.

## Flakes

The 12 flakes are from Paroto (n = 5) and Jampu and Lenrang (n = 7; Tables 2 and 3). These are whole flakes of usually irregular shape, although some may be called flake-blades. Most preserve small areas of cortex; four flakes (three from Jampu 2 and Lenrang 2) are non-cortical, although the thick patina on one flake makes it impossible to determine if it preserves any cortex. All flakes have a small number of dorsal scars. They include seven flakes with end and five flakes with transversal striking platforms, all with clear marks of percussion. One has a cortical platform (Paroto), most a plain platform, and five flakes show simple platform preparation (faceted). Three of the Paroto flakes show possible use wear. Of these the right dorsal edge of a pointed flake (P 90/S) was modified

by secondary retouch (side utilised flake); the notches of the left dorsal edge on a second flake (P 90/T) were shaped by secondary retouch; and on a third flake (P 92/D) most of the right dorsal cortical edge was modified by partially invasive retouch resulting in an irregularly, mostly notched morphology. One flake is too abraded to determine if its notched edge was used. Five of the Jampu 2 and Lenrang 2 flakes were modified by partial and unifacial (dorsal) secondary retouch, limited to one edge, except for one specimen on which the point and right edge were worked. Natural abrasion on two flakes hinders positive





Fig. 6. Unifacial point P 90/O from Paroto (southwestern Sulawesi); left = dorsal view; right = right side view.  
Photo: R.L. Wilkins, Inst. of Archaeology, Oxford.

identification of use wear. These flakes are similar to those previously published; the present samples also include larger specimens (Keates and Bartstra 1994).

#### Unifacial point

One artefact from Paroto is a unifacially modified point which was worked on a cobble (P 90/O; Table 2; Fig. 6). The modification is bidirectional with a few, well-placed and usually medium sized flake scars, and most of the cortex preserved. This specimen may be described as „pick-like“ with a round shaped point which was further flaked at its apex, possibly to reduce the thickness.

#### Bifacially modified cobbles

The bifacially modified cobbles derive from Paroto ( $n = 4$ ), Kecce ( $n = 1$ ), from Bunane 1 and 2 ( $n = 2$ ) and from Jampu 2 ( $n = 1$ ; Tables 2 and 3). The length of these artefacts ranges from 6.90 cm to 13.20 cm (Tables 2 and 3). The pattern of bifacial flake removal of the eight bifacially modified cobbles suggests that alternate flaking was conducted to produce sinuous edges. These edges vary in sinuosity (single to double S-shaped) and length. The longest modified edge is on a specimen from Paroto (P 93/N) where



Fig. 7. Bifacially modified cobble BN 2/94/V from Bunane (southwestern Sulawesi); left = ventral view; right = dorsal view. Photo: R.L. Wilkins, Inst. of Archaeology, Oxford.

the worked and mostly sinuous edge extends around half of the circumference. The specimen from Jampu 2 (J/3) has another, shorter and less sinuous edge on the right edge. Modification of the bifacial cobbles gives the impression of economical working, with a usually consistently small flake scar frequency to achieve the characteristic morphology of these artefacts. The range of the amount of cortex is about 30 % to 60 %. The dorsal aspect usually shows more extensive working than the ventral. On one specimen (P 93/N) the ventral face is more flaked, including three large scars which extend from the worked edge to the base (i.e. opposite the worked edge). To some extent the usually irregular shape of flake scars and occurrence of step fractures may be referable to the relatively poor tractability of the raw materials used. There is some variation of modification between the localities. For example, the centre of the worked edge of the Kecce specimen (K 90/L) appears to have been worked to a point. One of the Bunane specimens (BN 1/94/U) has an „arched“ (convex) central to lower dorsal, and where worked a steep edge has been produced. The manufacturers of the two Bunane artefacts, including BN 2/94/V (Fig. 7), appear to have had more skillful control over the raw material, reflected in the economical placement of and more regular shape of flake scars; ventral flaking was carried out close to the sinuous edge. On most specimens use wear in the form of edge chipping cannot be observed, which to some extent is obscured by natural abrasion. On a few the sinuous edge shows chipping that is not recent damage.

Five of the bifacial cobbles show flaking which may have been conducted to facilitate holding of the artefact during use, similar to the pattern noted on four of the pointed bifaces (see next chapter). On one of the Paroto specimens (P 93/N) the lower half of the left ventral edge and the base were flaked; on Paroto specimen P 90/Q the largest flake was detached from the lower central part of the dorsal and the base was flaked to an irregularly flat surface; on P 91/P the left dorsal edge was flaked and modification also occurs, though to a lesser extent, on the right ventral edge near the base; and on the Jampu 2 bifacial cobble (J/3) two large flake scars on the lower dorsal and ventral meet at the base of this specimen.

Pointed bifaces

The three pointed bifaces from Sulawesi were discovered at the Paroto locality. Eight pointed bifaces derive from the Baksoka valley near Pacitan in Java and one biface was found on the island of Halmahera (Tables 2 and 4). In a previous publication (Keates and Bartstra 1994) we referred to bifaces from the Walanae valley as „pointed partial bifaces“ to distinguish these from true Acheulean bifaces (handaxes). Our present samples include several pointed partial bifaces (JP/193, JP/107, P 92/H, P 92/I, P 93/M, H/1) and also some pointed bifaces (JP 1953/510, JP/P1, JP/111, JP/East P, JP/217, JP/mand 4). The

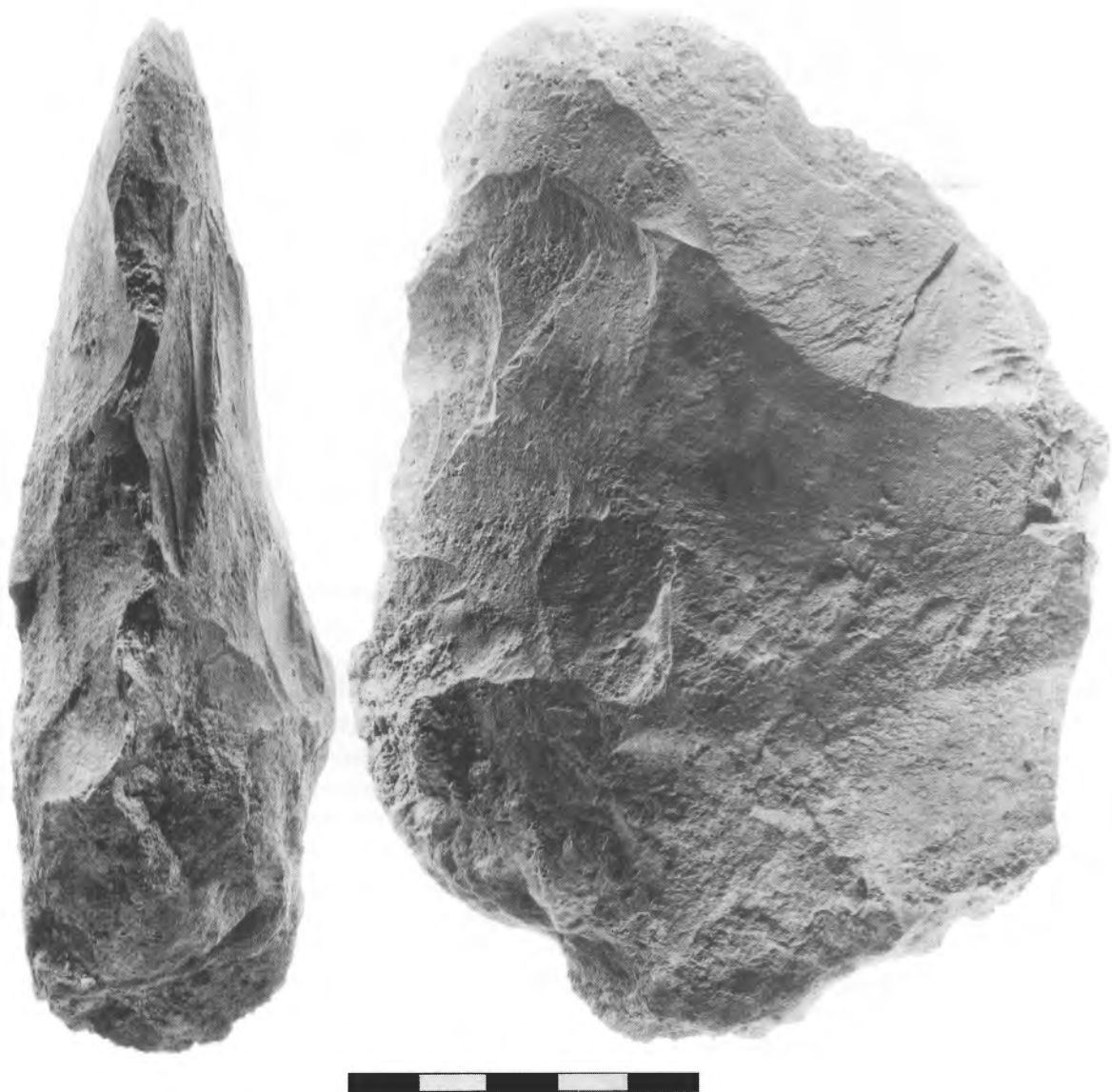


Fig. 8. Pointed biface JP/111 from the Baksoka valley (southcentral Java); left = left side view; right = dorsal view. Photo: R.L. Wilkins, Inst. of Archaeology, Oxford.



Fig. 9. Dorsal view of pointed partial biface JP/193 from the Baksoka valley (southcentral Java). Photo: R.L. Wilkins, Inst. of Archaeology, Oxford.

pointed bifaces are more extensively worked than the pointed partial bifaces, and in this respect and in their more symmetrical shapes they evince similarities to Acheulean bifaces.

Most of the six pointed bifaces retain some cortex (up to 20 %) and one biface is non-cortical. Cortex is on the base and adjacent parts (proximal dorsal, in one case proximal ventral). The number of dorsal and ventral flake scars ranges from 6–14 and 5–12, respectively. A common feature of the bifaces are step fractures, indicating some difficulty with flaking. The bifaces are of variable shape, and have symmetrical, irregular round, and asymmetrical square shaped points. One biface (JP/East P) has a round point showing abrupt and regular dorsal retouch in a concentric pattern. Compared to the other bifaces this specimen is more crudely worked (with the exception of its point). On three specimens both edges are sinuous, on one the right edge and on another the left edge only are sinuous, and one biface has straight edges (retouched from the ventral). On two of the bifaces (JP/111, Fig. 8; and JP/217, see Bartstra 1976, Fig. 50)<sup>6</sup> flaking was concentrated on the upper two thirds, perhaps to reduce the thickness of the edges; the base of each of these bifaces, especially JP/217, is thicker. JP/217 has criss-cross chipping, less longitudinal flaking and more numerous flake scars compared to the other bifaces. The more tractable raw material may ex-

<sup>6</sup> See Note 1.

plain this kind of flaking on the JP/217 specimen. On biface JP 1953/510 dorsal flaking was conducted in a horizontal manner from both edges with a ridge in the approximate centre of the specimen running from the base to the point. Its ventral face is „angled“, that is, the lower half is raised compared to the upper half at the point of a horizontal ridge. The right lateral edge of JP/mand 4 shows more extensive secondary retouch than the left edge, and retouch of the upper right ventral near the point may have been carried out to thin and/or shape the edge (both edges are sinuous).

The six pointed partial bifaces preserve varying amounts of cortex (range 10 %–60 %). The dorsal scar count ranges from 6–10, and ventral scars number from 4–8. The points are symmetrical, asymmetrical, of irregular round shape and one point is forked. On specimens JP/193 (Fig. 9) and H/1 (see MQR 8: frontispiece)<sup>7</sup> dorsal and ventral secondary retouch of the apex of the point are evident, and on JP/193 the point was also retouched on the left periphery. These bifaces were flaked more on one side of the dorsal face, i.e. the right dorsal on JP/193 and the left dorsal on H/1. Reduction of lateral edge thickness and/or shaping of these straight edges was noted on the P 92/I biface. Specimens with both edges sinuous are as frequent as those with one sinuous edge only, and those with both edges straight. The specimens from Pacitan (JP/193) and Halmaheira (H/1) are pick-like bifaces. In overall shape, size, more extensive dorsal modification on one side, and its „arched“ lower dorsal face, the Halmaheira biface is most similar to the pointed uniface from Beru I (Keates and Bartstra 1994). The major difference between the Halmaheira and Beru specimens is that the former shows also ventral, if limited, retouch; and there is more extensive dorsal modification on Beru I. The dorsal convexity of both specimens may have been selected for, perhaps emphasized by H/1 where flaking is least extensive in the centre, i.e. where the dorsal is most convex.

Four of the pointed bifaces from Java (JP/P1, JP/111, JP/mand 4, JP/217) and two from Sulawesi (P 92/I, P 93/M) show a particular kind of modification. On these artefacts one (JP/P1, JP/mand 4, P 92/I) or two (JP/111, P 93/M) flakes were detached from the lower lateral edge (to the base) at an oblique angle. This is somewhat similar to the lateral tranchet blow on Acheulian bifaces where this technique produces a sharp edge and an approximately symmetrical biface (see Inizan et al. 1992, p. 72, Fig. 25.2). Our initial survey has shown that this feature also occurs outside of island Southeast Asia, such as on bifaces (handaxes) from England (for example, Each Winch, Norfolk, see Wymer 1985, Fig. 12; Swanscombe, see Ovey 1964, Fig. 8; Maidenhead, see Smith 1931, p. 97, specimen 400), Germany (Kraudorf, see Jöris and Krause 1991) and a biface from India (from Singi Talav, see Gaillard 1996, Fig. 3a). On the largest biface, JP/217, two flakes were struck off from the base and the adjoining corner, similar to the pattern observed on a biface from Hoxne, Suffolk (Upper Industry, see Wymer 1985, Fig. 53.1). Another biface (P 92/I, Fig. 10), in addition to lateral edge modification (see above), was also worked on its base. This kind of modification may have allowed a more comfortable grip during tool use (perhaps providing a more „balanced“ hold; see also Marks 1982), rather than flaking conducted for the sole purpose of removing superfluous raw material. In one case (P 92/I) retouch may have been conducted to achieve a more symmetrical shape of the biface. This is noteworthy, as the bifaces from Java and Sulawesi are mostly rather asymmetrical.

The length, width and thickness dimensions of the three pointed bifaces from Paroto are within the lower range of the eight Javanese bifaces (Tables 2 and 4). Of the previously published two bifaces (of Sample 1; Keates and Bartstra 1994), the Paroto specimen is not significantly smaller than the Paroto bifaces of Sample 2, while the biface from Kecer is within the lower size range. One may conclude that the bifaces from the Walanae valley are on the average smaller than those from the Baksoka region. As the availability of raw material plays no role in this case, the dimensions indicate that the prehistoric people of Sulawesi manufactured bifaces to within a certain size limit, presumably dependent on a specific purpose.

<sup>7</sup> See Note 1; MQR = the series Modern Quaternary Research in Southeast Asia.

## Further evidence from the artefacts

Geomorphological studies and excavations at Baksoka river terrace localities in southern Java have indicated that the Pacitanian stone implements lie apparently distributed in Late Pleistocene and Holocene stream sediments (van Heekeren 1975; Bartstra 1976, 1978b, 1984). The surveys that began in the Walanae valley in southern Sulawesi in the late 1940's (van Heekeren 1949) and that were followed by more reconnaissance and excavation in the 1970's and 1980's (Sjahroel 1970; Bartstra 1977a; Sartono 1979; Bartstra et al. 1991, 1994), also point to human occupation beginning in the Late Pleistocene. One has to be aware, though, that however convincing the relative dating might appear, radiometric dates are not available. As far as Sulawesi is concerned, it is only from the Maros caves in the southwestern coastal region that a radiometrically dated stone tool assemblage is known (Glover 1981). As we have hinted at above (see Note 4), the so-called third Walanae group of artefacts might be the open-air equivalent of the Maros industries, not necessarily of Glover's (surprisingly old: see Bartstra 1998, p. 204) industry, but seemingly of one of the more „classic Toalean“ collections from the surrounding caves. Much comparative work needs to be done here and the first steps are being taken (Pasqua and Bulbeck 1998; Bulbeck and

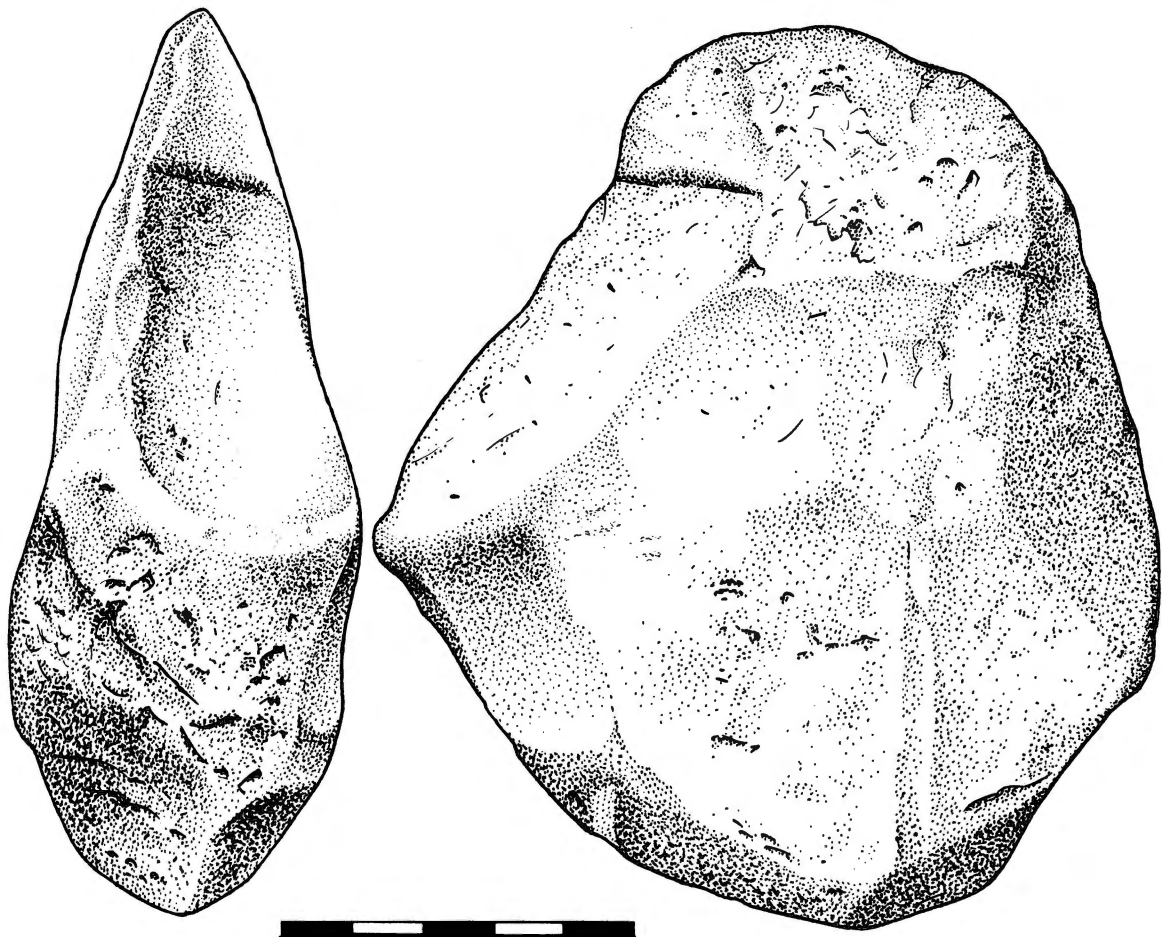


Fig. 10. Pointed partial biface P 92/I from Paroto (southwestern Sulawesi); left = left side view; right = dorsal view. Drawing: J.M. Smit, Dept. of Archaeology, Groningen.

Pasqua in press). Unfortunately, the third Walanae group has no bearing to the Walanae terrace gravel and thus to the second and first Walanae groups of artefacts. These latter constitute the true Palaeolithic component (reflected in Samples 2 and 3) and the oldest evidence of human settlement in Sulawesi.

The composition of the Walanae river terrace artefact samples with, for example, their lack of such debitage as primary flakes, and the various degrees of abrasion of the artefacts, appear to demonstrate that over the years natural and man-made disturbances have played a significant role at the localities. Apart from the above related observation of larger cobbles (and thus larger core tools) coming to rest at the foot of the hills, one could also state that small and very small Cabengian artefacts have apparently been „filtered out“ by the disturbances. However, a „collector’s bias“ is rather important in this respect. In composing small „study collections“ of lithic artefacts by random gathering (often by students) on a large surface area in the field, often within a limited time span, the eye is set on identifying interesting and remarkable specimens, whilst overlooking the tiny and insignificant flake nearby. We mean to say that the thus far presented samples (Samples 1, 2, 3) may not be quite representative of the total Cabengian assemblage that could still lie hidden at the great „core“ sites of Kecce, Paroto and Bunane.

Although there is (as yet) no direct evidence that these latter localities were erstwhile places of tool manufacture (*ateliers*), we assume that this was indeed done in the general area where the artefacts are now found. The terrace level on which the implementiferous gravel sheet along the Walanae extends, was the active floodplain area at the time of prehistoric occupation, with an abundance of lithic raw material to work on. Whether people actually also lived that close to the river or whether they carried their finished instruments farther inland to higher habitation spots, remains as yet unclear. Technologically, the artefacts can possibly be accommodated within and understood as a simple *chaîne opératoire* as far as raw material procurement and the production process are concerned, but for a complete replication we would need representative samples of artefacts (where possible „stratified“) from a primary context manufacturing site.

The foregoing also holds true for the artefacts from the Baksoka valley in southern Java. There are strong indications that the Pacitanian too consists of various diachronous lithic assemblages. In technological and typological terms these Baksoka artefacts, in particular the bifacially modified cobbles and pointed bifaces, are strikingly similar to those of the Walanae. The biface from Halmaheira fits this pattern too: we have seen specimens from the Baksoka valley which are almost identical to the Halmaheira biface. One could object that this observation is not significant in view of the „baseness“ of these core artefacts: all „choppers“ look alike, etc. But there is more to it than this. It was earlier noted that the Pacitanian is not „primitive“ or „crude“ at all, as it displays a rather high level of technological and typological sophistication (Movius 1944, 1949; Mulvaney 1970). This is also the case with the Cabengian. At first sight these latter artefacts might in their secondary working appear „a shade cruder“ than those from the Baksoka (as Movius also observed of the so-called Anyathian); but we very much doubt, taking into account the availability of only small biased samples and the severe abrasion of some of the artefacts (Fig. 11), if this impression can be upheld in the course of further study. Both the Pacitanian and the Cabengian can be described as rather advanced industries: a not too remarkable observation, as on geomorphological grounds one could already have deduced that the artefacts were manufactured in the Late Pleistocene, thus by early modern humans, who must have been able to handle lithic material rather well. The similarities between both industries thus reflect either a distinct cultural affinity or an equal adaptive response to an in our opinion formerly quite similar environment: an open, hilly country, not too far from the sea<sup>8</sup>, and close to a limestone region. We believe that the first option is definitely worth investigating, as the Pacitanian and the Cabengian are probably of one „tradition“.

<sup>8</sup> As far as southern Sulawesi is concerned: the so-called Tempe depression or Singkang embayment (with the present lakes Tempe and Sidenreng) was open sea several times during the Late Pleistocene and Early Holocene (e.g. Bartstra et al. 1994).

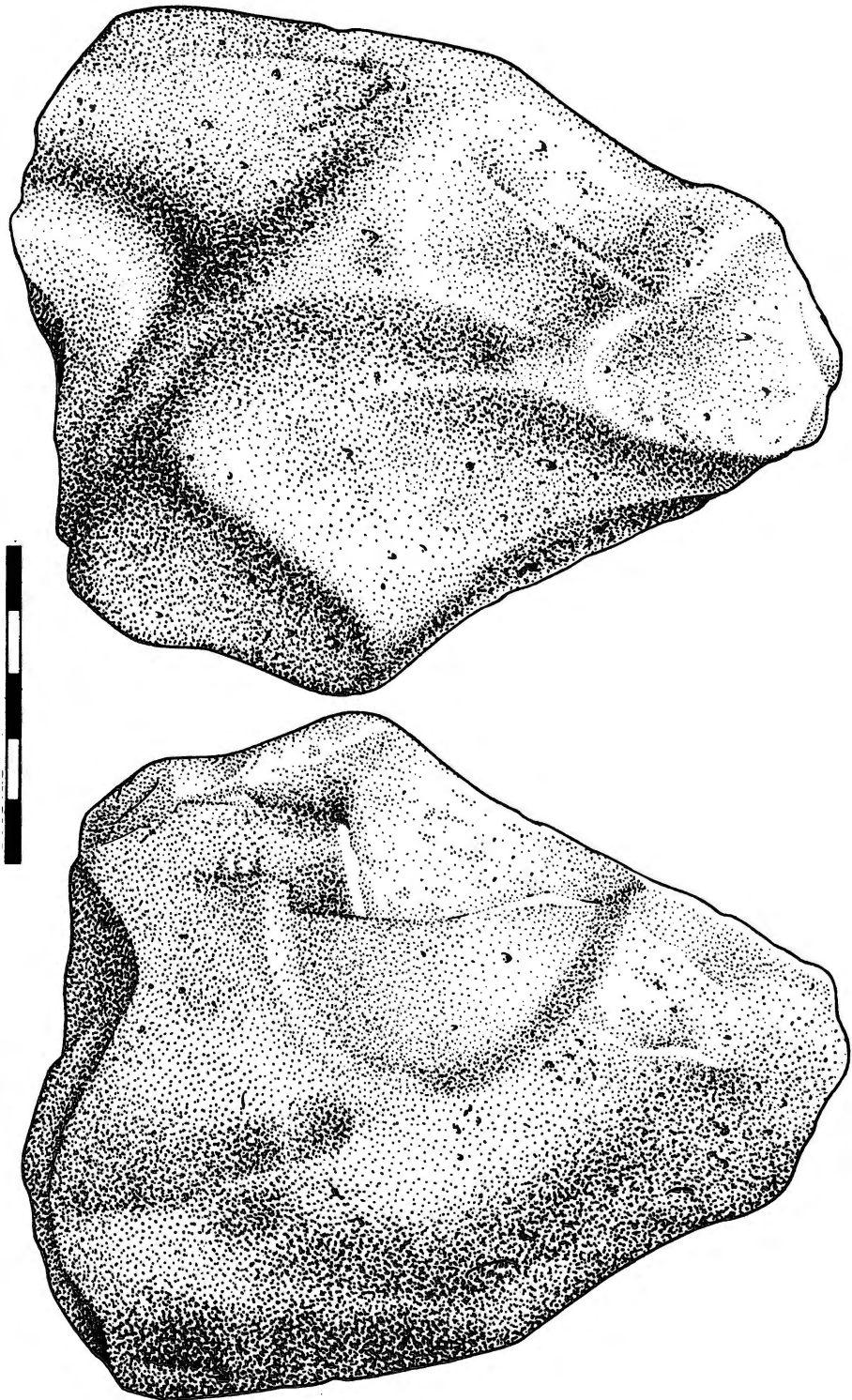


Fig. 11. Severely weathered pointed partial biface P 92/H from Paroto (southwestern Sulawesi); left = dorsal view; right = ventral view. Drawing: J.M. Smit, Dept. of Archaeology, Groningen.



To some extent one would expect differences in the available raw material to result in differences in artefact morphology, accentuated by the individual skills of the knappers. The majority of the artefacts presented in this paper were manufactured and moderately modified (limited retouch and sometimes simple core striking platform preparation) in a small variety of raw materials most of which were selected as large clasts (river cobbles). These materials are of sometimes uneven and coarse quality, resulting in varying degrees of tractability. The frequency of step fractures attests to the difficulties in manufacturing. Sometimes, the quality of the raw material has obviously placed a limit on the final product (for example, the BN 1/94/W horsehoof core). At the same time the morphology of the individual lithic categories from the Walanae and Baksoka regions and Halmaheira indicates an homogeneous technological pattern of modification. In this context it is worthwhile to recall an elder Movius (1978, p. 352) who still believed that raw material „limitations and influences“ on tool morphology in the „Far East“ were substantial (see also von Koenigswald 1939, p. 42). The young Movius (1949, p. 364) did indeed explain the variety of core and flake tools in the Pacitanian collection as possibly influenced by the tractable nature of the raw materials used. However, it also has been demonstrated that complex artefacts such as pointed bifaces can be made from lithic materials that are far less tractable, than flint, for example (Jones 1979, 1994; L. Leahey in Inskeep 1988).

There is one kind of raw material that definitely determines the shape of the final artefact and that is silicified (mineralised) or fossil wood. As Movius (1944, p. 41) indicated, fossil wood makes nice „hand-adzes“, but never true „choppers“, because it „breaks in a rectangular shape“. Along the Baksoka and the Walanae, the prehistoric knappers occasionally made use of river cobbles of silicified wood. We have seen several „hand-adzes“ in museum collections (we would classify them as bifacially modified cobbles), and one or two curious attempts (in the Pacitanian) to produce „hand-axes“ (bifaces) from fossil wood<sup>9</sup>.

The occurrence of horsehoof cores in Sulawesi (in the Walanae area and at Leang Burung 2) is of much interest, as these artefacts have been identified in the Pacitanian (van Heekeren 1955, 1972, p. 40; Bartstra 1976, p. 90), but also at Australian sites (Bowler et al. 1970). One might ponder whether the horsehoof core is part of a technological complex associated with a distinct phase of (early modern) human settlement in the region. More analysis and research is needed on this topic, especially sieving through already existing artefact collections from the interim region: from Sumbawa (Batutring), Flores (Warloka, Lewolere) and Timor (Motahoar; see Soejono 1985a and b for a synopsis [in English]).

In the Walanae valley, small size river clasts (i.e. pebbles, less than 64 mm in diameter) seem not to have been favoured in manufacturing core artefacts. Furthermore, the emphasis seems to have been on bifacially rather than unifacially modified material (see also Keates and Bartstra 1994). For the moment we merely register these observations: there might be different views after future quantitative sampling. We have already hinted at a collector's bias concerning the Walanae samples. It should be noted that to a certain degree this bias is also present in the tables and frequencies relating to the Pacitanian. Von Koenigswald, Movius and van Heekeren all collected at random on the valley slopes and floodplain areas near the Baksoka. Thus, Movius' (1949, p. 355) frequencies of Pacitanian lithic categories recognise „choppers“ (unifacially modified) as more numerous than „chopping-tools“ (bifacially modified). But in van Heekeren's (1955, p. 10; 1972, p. 43) much smaller sample from the Tabuhan area, these frequencies are less apparent.

<sup>9</sup> In view of Movius' (and later authors') detailed division within the „chopper/chopping-tool complex“ of the category „choppers“ into various (sub)types, we have always been of the opinion that a separate category of „hand-adzes“ is rather superfluous. The term „adze“ was originally adopted by Movius to discern the fossil wood artefacts of the Anyathian of Burma. Later, the „hand-adze“ in the Pacitanian is represented by massive, steep-ended scrapers, with a straight to slightly convex working edge, but worked on one side only. The raw material might be silicified wood, but also silicified tuff or limestone. In any case, in Movius' terminology a „hand-adze“ is very different from a „hand-axe“, but unfortunately one finds both types often mixed up in the literature (e.g. Hooijer 1969, p. 7 etc.).

Even more significant, when comparing tool totals and frequencies from the Walanae and Baksoka areas, is the observation that our typology is not in all cases congruent with von Koenigswald's, van Heekeren's or Movius'. The latter's well-known „choppers“, for example, are in many cases not the same instruments as our „unifacially modified cobbles“ (see Keates and Bartstra 1994), since Movius (1943, pp. 354, 359; and see Bartstra 1976, p. 82), when he started outlining his typology, confusingly also recognised „bifacial choppers“, which are different from his „chopping-tools“. Placing Palaeolithic core tools in categories is a rather subjective endeavour, as the gradation between the various tool types is often almost imperceptible. In our opinion a reliable comparison between Pacitanian and Cabengian tool totals and relative frequencies is only possible when larger samples from both industries are analysed in the framework of one distinct typology by one researcher<sup>10</sup>. Incidentally, these larger artefact samples do not have to come from the field, but could be „excavated“ in the institutes and museums where Pacitanian and Cabengian artefacts are stored (Ujung Pandang, Beru, Yogyakarta, Punung, Bandung, Jakarta, Frankfurt am Main, Groningen, Leiden, Oxford, Cambridge/Mass., etc.).

The „bifacial“ preference that we have noted in the Cabengian core assemblage might indicate a preference for a sinuous distal edge. Such an edge may be stronger than a straight and thin edge and able to withstand greater pressure during use. On the bifacially modified cobbles (which also may have functioned as cores) the flaking of the worked edge (the functional area) also usually resulted in a relatively horizontal surface. The exception to this pattern are two bifacial cobbles from Kece (K 90/L; also K 70/2 in Keates and Bartstra 1994, p. 22) on which the flaked edge was shaped to a point. These different morphologies imply different functions.

The issue of a „hand-axe culture“ in Java became prominent with von Koenigswald's seminal publication on the Early Palaeolithic of Java in 1936<sup>11</sup>. Most of his illustrated „hand-axes (*coups-de-poing*)“ do not, however, bear comparison to even crudely manufactured handaxes as these are known from Europe or Africa (see Figure 1 and Plates XLVI to LIII in von Koenigswald 1936; and see Plates 11 and 13 in van Heekeren 1972), reflecting a definition of handaxes that is too broad. Von Koenigswald's handaxes would certainly more convincingly be accommodated in other tool categories, and von Koenigswald's successor in the Baksoka river region, Movius, did exactly that. There remained, however, a category which even Movius (1949) persisted in calling handaxes: albeit a rather small category, and in Movius' view technologically different from Western-made specimens. In the Walanae river region handaxes (pointed bifaces as we term them) also appear to be very limited in number. The site of Paroto has yielded some, and one biface is known from Kece. The Walanae biface sample is too small to use for significant observations, but the much larger Baksoka sample shows some interesting morphological variations. It appears that some bifaces were indeed handheld (with flake removal typically intended for a better grip; see Marks 1982), whereas others could have been hafted (see e.g. Bartstra 1976, p. 93, Fig. 49).

In comparison to Western Acheulean handaxes, most of the bifaces from Java and Sulawesi show less modification (especially the pointed partial bifaces, e.g. JP/193; Table 4) and symmetry (see above chapter „Pointed bifaces“). However, one of the pointed bifaces from Java, specimen JP/217, cannot be described other than as an Acheulean biface (illustrated in Bartstra 1976, p. 94, Fig. 50), very similar to bifaces

<sup>10</sup> Which could tempt some readers to wonder why we ourselves did not adopt the Movius typology in the first place in analysing the Pacitanian and Cabengian, instead of introducing new artefact categories. But precisely the arbitrariness of the Movius nomenclature did shy us away from it, augmented by misgivings concerning the functional connotations.

<sup>11</sup> The broader question of whether or not an Acheulean technology is present in East and Southeast Asia, as well as the current status of the so-called Movius Line, has seen a sort of revival in the last decennium. The issue is specifically relevant to China and Indonesia and will be discussed in a forthcoming paper (Keates in prep. a). One of us has posed the possibility that Movius' well-known „chopper/chopping-tool complex“ might very well exist, but that it has to be moved upward on the time-scale of the Pleistocene and has to be correlated with the first arrival and subsequent settlement of *Homo sapiens* (e.g., Bartstra 1989, 1992, 1994). The large core tools might reflect an adaptation to the tropical forests, which *Homo erectus* avoided.

from England and France (Roe pers. comm.; Bartstra 1978b, p. 33)<sup>12</sup>. Some of the partial bifaces with their less elaborately worked surfaces are comparable to some specimens from China and from Olduvai (East Africa) and Stellenbosch and Mossel Bay (South Africa)<sup>13</sup>. With reference to illustrations of „Prae-Stellenbosch“ and Stellenbosch artefacts, von Koenigswald (1939, p. 45) had observed similarities between these and Pacitanian artefacts. Three of von Koenigswald's (1936, Plate LI. 2, 3 and 6) handaxes evince similarities to bifaces from the late Middle Pleistocene/early Late Pleistocene river terrace locality complex of Dingcun in central China (cf., illustrations in Wang et al. 1994; Keates in prep. a).

The Halmaheira biface (H/1 in Table 4, and illustrated as frontispiece in MQR 8, 1984<sup>14</sup>) is thus far still the first of its kind to be reported from this island. On the basis of comparative pointed biface technology and typology to bifaces from the Baksoka and the Walanae regions and their estimated age range, as well as comparison to stone tool assemblages excavated in various parts of Halmaheira (Bellwood et al. 1993, 1998), we suggest a Late Pleistocene age for this biface. As indicated (see above), the similarities between the Halmaheira, Sulawesi and Java bifaces and the tools in other tool categories, leads us to consider the possibility of Late Pleistocene cultural contact between these islands, or alternatively, that Halmaheira and Sulawesi were settled by early modern *Homo sapiens* from Java. It is also worthwhile noting that pointed bifaces have been documented in Australia (Rainey 1991).

Although Veth et al. (1998, p. 166) state, as others still do, that the earliest Late Pleistocene stone tool industries in island and mainland Southeast Asia largely consist of flake assemblages, we do not agree. The statement simplifies the issue of early modern human behaviour in the region. The Pacitanian and the Cabengian include numerous core tools, as do other assemblages, including those in mainland Southeast Asia, for example, from the Lang Rongrien rockshelter in Thailand (to which Veth et al. 1998 make reference). At Lang Rongrien the small sample of 44 or 45 stone artefacts from the earliest layers 8–10, include not only flake tools ( $n = 22$ ), but also core tools ( $n = 9$  or  $10$ ), the latter mostly found in the lowest unit, layer 10, and the utilised flakes more common in layers 9 and 8 (see Anderson 1990, pp. 12, 21, 54, 57, Table 5; incidentally, could the small size of chalcedony clasts, usually less than „fist-sized“, exploited for the Lang Rongrien artefacts, and which Anderson (1990, p. 38) deems as perhaps unsatisfactory for tool manufacture, also be of relevance to the frequency of core tools?).

### Concluding remarks

If we assume that the oldest specimens of the Cabengian and the Pacitanian artefacts are of early Late Pleistocene age, then what can be said about the taxonomic status of the prehistoric manufacturers, considering the archaeological (and genetic) evidence now available on the human occupation of the islands in the Southeast Asian, New Guinean and Australian region?

The established chronometric dates from this region, from Borneo (Niah; Harrisson 1970), the Philippines (Tabon Caves; Fox 1970) and Sulawesi (Leang Burung 2; Glover 1981), at c. 30,000–40,000 years ago, as well as (more recently) from Gebe island (between Halmaheira and New Guinea [Irian]) at 32,500 B.P. (Bellwood et al. 1998) and the Talaud Islands (northwest of Halmaheira) at c. 30,000 B.P. (Tanudirjo 1998), all indicate a rapid expansion of prehistoric people in island Southeast Asia. This expansion is probably connected with the first modern humans in island Southeast Asia and the initial human settlement of Greater Australia. However, dates from northern Australia of c. 50,000–60,000 years (Roberts et

<sup>12</sup> Thus, as Hugo Obermaier already remarked in 1925: *Es muy grande la variación de las hachas de mano...* He referred to the oldest handaxes in Europe; we refer to the oldest handaxes in island Southeast Asia.

<sup>13</sup> Stellenbosch and Mossel Bay artefacts can be studied in several museums and institutes in Europe, amongst others at the Pitt-Rivers Museum in Oxford and at the Institut de Paléontologie Humaine in Paris.

<sup>14</sup> See Note 1; MQR = the series Modern Quaternary Research in Southeast Asia.

al. 1990; but see O'Connell and Allen 1998) and most recently from south-east Australia of  $62,000 \pm 6,000$  years for the Lake Mungo 3 skeleton, a fossil which now represents the oldest evidence of human occupation in Australia (Thorne et al. 1999; see also Lilley 1998) might indicate that the earliest chronology for island Southeast Asia does not record the earliest modern human occupation of the region. More than 30,000 years ago, sites in Sahul already had a wide distribution (Smith and Sharp 1993), a fact which seems to indicate that we can expect to find older (chronometrically dated) sites in island Southeast Asia in the future.

Thus, in view of these chronometric dates and our opinion (for geomorphological and stratigraphical reasons) that the Cabengian and Pacitanian assemblages in their oldest phase are early Late Pleistocene, might we then infer that their makers were also modern humans, spreading as a first wave of settlers from west to east?

In this respect the Uranium-series and ESR dating of the Ngandong (Solo) hominid locality in Java by Swisher et al. (1996) deserves attention. In the literature the Ngandong hominid fossils are usually considered to date to the early Late Pleistocene, but the Swisher team has reported surprisingly young dates for the fossil faunal bone material that is associated with the hominids, of c. 27,000 and 53,000 years B.P. (Swisher et al. 1996). This is far younger than the dates from Lake Mungo, and as the Ngandong fossils are often called *Homo erectus*, something seems to be amiss here.

The Ngandong fossils are usually referred to as late *Homo erectus* (e.g., Santa Luca 1980; Pope and Cronin 1984; and see Weidenreich 1951, pp. 226, 227), but some authors are more cautionary. Stringer (1984, p. 139) refers to the hominid fossils as „some individuals certainly differ from the typical *H. erectus* s.s. morphology in ways approximating that of *H. sapiens* s.l.“ (see also Campbell 1974, p. 112; Day 1986, p. 361; Bräuer 1989). Grimaud-Hervé's (1994) comparative study of Pleistocene hominid endocasts from Java (including the Ngandong crania 5, 7 and 12) and of recent endocasts, concludes that the Ngandong *Homo erectus* brain occupies an intermediate evolutionary position between the earlier Javanese *Homo erectus* and the modern human patterns. The greater cranial capacity (1,013–1,251 cc; Holloway 1980), more developed reliefs of the third frontal and second parietal convolutions (related to articulate language acquisition), and the position of the cerebral lobes associated with the anterior movement of the occipital lobes, all indicate an evolutionary change from the „classic“ Javanese *Homo erectus* (Grimaud-Hervé 1997; pers. comm. 1999), and thus point to a possible transitional evolutionary stage of the Ngandong fossil population. This certainly revives the decennia old dispute whether *Homo erectus* evolved into *Homo sapiens* in the region, or whether the latter came in from mainland Asia, pushing aside (in the old diffusionistic way) the *Homo erectus* groups to backwater regions, implying that *Homo erectus* and *Homo sapiens* were contemporaries for a time. Unfortunately, there are no unquestionable Palaeolithic artefacts known from the village of Ngandong or its surroundings, which means that archaeologically we can contribute little to the dispute, at least as far as the fossil hominids of Ngandong are concerned (but see Note 11).

We might, however, urge caution in relation to the new chronometric dates produced by the Swisher team (see also Grün and Thorne 1997). If the procedure in the laboratory was correct, we might question the reliability of the samples used. Again we point to the years of geomorphological field research conducted in the Solo river basin, where the complicated terrace stratigraphy has always been focused upon (Volz 1907; ter Haar 1934; Lehmann 1936; de Terra 1943; Sartono 1976; Bartstra 1977b), and where no one has ever doubted that the highest lying terrace sediments (from which the Ngandong crania derive) have to be placed somewhere in the first part of the Late Pleistocene. It is hardly possible that the Solo high terrace sediments could lie at the present height above the river, when they came into existence at the date Swisher et al. (1996) suggest. Furthermore, on palaeontological grounds there seems also no reason to accept the new Ngandong dates (de Vos 1998, pers. comm.). Therefore, we eagerly await the results of the radiometric dating of two of the Ngandong crania (Falguères 1999, pers. comm.); although new questions will arise in connection with *post situ* Uranium loss (see Bartstra 1988, Bartstra et al. 1988, and

van der Plicht et al. 1989) and the influence of various cleaning and preservation procedures which have taken place since the hominid material was unearthed in the 1930's.

The Ngandong controversy gives us no reason yet to abandon our idea that the Cabengian and the Pacitanian have to be associated with early modern *Homo sapiens* in the „Far East“. Revised sea level data show that between c. 60,000 to 70,000 years ago, sea levels dropped by a maximum of about 87 m and at c. 74,000 years ago by about 74 m (see Chappell et al. 1996, Fig. 4). If there is truth in the reasoning that the incentive to travel was induced during stands of low sea level (but the opposite could be endorsed too: high sea level reduces the available land area and forces people away as the result of population pressure), the initial sea migration in Southeast Asia may have started at least 74,000 years ago<sup>15</sup>.

Based on their investigations in the northern Moluccas, Bellwood et al. (1993, 1998) suggest that the earliest human occupation of this region was initiated from western New Guinea (Irian). However, the Halmaheira biface and its likeness to the artefacts from the Cabenge and Pacitan regions might equally indicate a first colonisation of this island from the west (and see Birdsell 1977). This seems to be underscored by human genetic and morphological evidence (Bhatia et al. 1995; Ishige 1980:4–5)<sup>16</sup>.

Thus, were we asked to place the Palaeolithic artefacts from Pacitan, Cabenge and Halmaheira in chronological order, we would endorse the „classical“ view: the Pacitanian first, then the Cabengian, and finally the biface from Halmaheira.

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<sup>15</sup> We are extremely sceptical about recent claims that *Homo erectus* was capable of prolonged sea voyages (Sondaar et al. 1994; van den Bergh et al. 1996; Keates 1998).

<sup>16</sup> The fossil hominid and genetic evidence relating to island South East Asian Late Pleistocene populations will be discussed further in a forthcoming paper (Keates in prep. b).

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