ISLAND MIGRATION OF EARLY MODERN *HOMO SAPIENS* IN SOUTHEAST ASIA: THE ARTIFACTS FROM THE WALANAE DEPRESSION, SULAWESI, INDONESIA.

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ABSTRACT: Surveys and excavations conducted in the northern Walanae depression[1] in South Sulawesi have resulted in the recovery of lithic artifacts from Late Pleistocene river terraces. A number of these artifacts may represent evidence of the earliest known occupation of the island, and this may be of relevance to the first occupation of Australia. The uncomplex technology of the artifacts is of special interest regarding discussions on the presumed cultural complexity of early modern *Homo sapiens*.

KEYWORDS: Southeast Asia, Sulawesi, Walanae depression, Walanae terraces, Palaeolithic Cabenge industry, lithic artifacts, cores, flakes.

1. INTRODUCTION

Java is the only island in Southeast Asia which preserves evidence of *Homo erectus* occupation with a date of about 1 million years, coincident with the earliest arrival of hominids in the Far East from the African continent (Pope, 1983; Bartstra, 1983; Bartstra & Basoeki, 1989).[2] The antiquity for the occupation of other islands in the region by (presumably) anatomically modern humans extends back to about 30 000 to 40 000 years ago (Fox, 1970; Harrisson, 1970; 1978; Glover, 1981; for an overview see Bellwood, 1985). These dates lie within the time-frame of the hitherto earliest known occupation of the Australian continent (Pearce & Barbetti, 1981), but seem at odds with the most recently determined age of about 50 000 years ago from northern Australia (Roberts et al., 1990). According to Shutler (1984) *Homo sapiens sapiens* might have entered Southeast Asia as long as 70 000 years ago. The earliest radiometrically dated occupation site in Sulawesi is Leang Burung 2, a cave located in the Maros region in the southwest peninsula (c. 30 000 BP; Glover, 1981).

The 2000 m deep Makassar Strait which separates Sulawesi from the islands of the Sunda shelf appears to have formed an effective geographical barrier to hominid migration until the Late Pleistocene. The Sunda shelf was periodically dry during the Pleistocene (Berggren & van Couvering, 1979). Thiel (1987) suggests that the Southeast Asia islands were first colonized during the Late Pleistocene as a response to high sea-levels which reduced food resources caused by a reduction in available land. She assumes that a period of rising sea-level between 53 000 and 45 000 BP (50 000 and 40 000 BP, see Chappell & Thom, 1977) based on sea-level curve calculations of Chappell and Thom provided the stimulus and opportunity to initiate sea-travel. The updated sea-level curve of Chappell & Shackleton (1986), however, suggests that a higher sea-level rise occurred between 64 000 and 59 000 years ago. Clark (1991) has recently criticized Thiel's hypothesis as too simplistic.

In this article we discuss what may represent the earliest evidence for human colonization of Sulawesi. Among artifacts collected from river terraces in the northern part of the Walanae depression in Southwest Sulawesi, many specimens probably predate the assemblages from Leang Burung 2. The Walanae sites have not yet yielded datable materials; the vertebrate fossils discovered in this region (Hooijer, 1949, 1960, 1975) bear no stratigraphical relationship to the artifacts (Sjahroel, 1970; Bartstra, 1977, 1978; Sartono, 1979; Bartstra & Hooijer, 1992; Hooijer & Bartstra, in press; Bartstra et al., this volume). Recently, we have proposed a relative chronological framework for the Walanae artifacts based on terrace morphology and comparison to radiometrically dated assemblages known from a number of caves in the Maros region (Bartstra et al., 1991).

2. ARCHAEOLOGICAL RESEARCH IN THE WALANAE DEPRESSION

Artifacts and vertebrate fossils in the northern Walanae depression were first recognized by van Heekeren (1949, 1958) mainly in the vicinity of the village of Beru (Bartstra et al., 1991; Bartstra et al., this volume; fig. 1). Subsequent, more extensive fieldwork has shown that these artifacts (which have entered the textbooks as the Palaeolithic Cabenge industry, formerly Tjabenge industry, van Heekeren, 1972) are associated with three or four river terraces (Bartstra, 1977; Sartono, 1979).

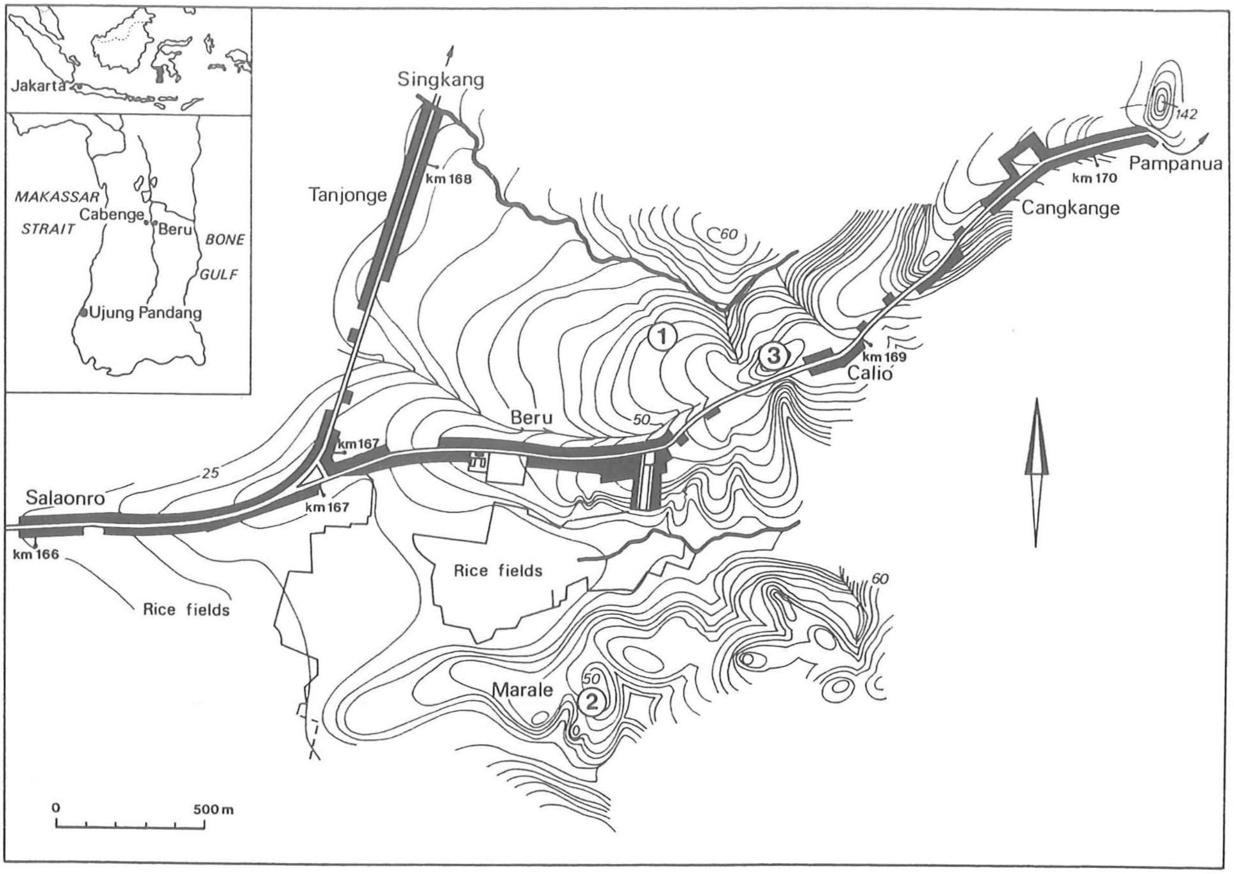

Fig. 1. Island Southeast Asia, the southwestern peninsula of Sulawesi, and the surroundings of the village of Beru in the northern Walanae depression. The ciphers 1, 2, 3 refer to the former (1970) excavations of Beru I (also known as Calio I), Beru II (Calio II or Marale), and Beru III (Calio III). These small excavations, intended to collect possible in situ artifacts, were in streamterrace deposits between 50 and 75 metres above the mean waterlevel of the Walanae river. On the above map, this river is located about one kilometre west of Beru. Lithic artifacts were collected in the very top (gravel) part of the pit profiles. They also could and still can be found on the surface in the vicinity of these excavations.

Exposed through erosion and excavation artifacts have over the years been collected from gravel and shallow unconsolidated sand-clay deposits from the right bank of the northern Walanae river (Bartstra, 1978; Bartstra et al., 1991). It is from these artifacts that the sample described in this paper derives. Surveys have shown that many lithic specimens are distributed at a height of 50 to 75 m above the river, e.g. at Beru, Calio, and Marale (fig. 1). Investigation on the left bank of the Walanae has shown similar implementiferous terrace deposits.

Very rolled and patinated core and flake artifacts occur in situ in high terrace gravel, while cores and flakes with less pronounced fluvial wear are found on the surface of the high terrace, and on lower levels. Small lithic specimens with no evidence of redeposition and no traces of abrasion are confined to elevations (terrace and non-terrace) in the proximity of the Walanae river, not only in the northern part of the drainage area but also in the southern part (Bartstra, 1978).

Analyses of the geomorphology of the Walanae terraces indicate a Late Pleistocene age for the artifacts (Sjahroel, 1970; Bartstra, 1977, 1978; Bartstra et al., 1991; Bartstra et al. this volume). On the basis of the stratigraphical context, lithic technology, and to some extent the degree of mechanical and chemical weathering, the sample of 28 lithic specimens discussed in this paper has provisionally been classified into the three indicated units. This random sample of surface and excavated specimens gives a fair insight into the variety of the lithic technology in the Beru area and for that matter in the whole northern Walanae depression. The main concern of this paper is to provide typological and technological details.

3. THE ARTIFACTS FROM THE WALANAE DEPRESSION

The sample comprises four bifacially flaked pebbles and three bifacially flaked cobbles (so-called 'chopping-tools'); two pointed partial bifaces ('proto-handaxes')

Table 1. Frequenies of lithic categories.

Category	n	%
Bifacial pebbles	4	14.3
Bifacial cobbles	3	10.7
Partial bifaces	2	7.1
Uniface	1	3.6
Cores	7	25.0
Flakes	11	39.3
Total	28	100.0

Table 2. Frequencies of raw materials.

Category	Sil. tuffaceous mat. n	Silic.tuff n	Silic.limestone n
Bifacial pebbles	3	0	1
Bifacial cobbles	1	2	0
Partial bifaces	1	1	0
Uniface	0	1	0
Cores	0	4	3
Flakes	0	11	0
Total	5	19	4

Table 3. Length, width, and thickness of the Walanae lithic sample (in cm).

Category	Specimen No.	Length	Width	Thickness
Core	M 70/2	3.65	3.5	2.65
Flake	M 70/4	3.8	2.7	0.85
Core	M 70/I	4.2	3.45	3.4
Flake	M 70/U	4.3	2.9	1.2
Core	M 70/4	4.4	4.1	3.6
Bif. pebble	M 70/3	4.65	3.9	2.6
Bif. pebble	K 87/6	4.8	4.6	3.0
Bif. pebble	B 70/I	5.2	4.7	3.35
Flake	P 87/B	5.25	3.8	1.6
Core	K 87/7	5.3	5.2	4.0
Core	M 70/A	5.9	4.25	4.2
Bif. pebble	M 70/B	6.1	5.1	4.3
Flake	P 87/A	6.6	3.1	1.6
Flake	M 70/S	7.0	4.6	2.45
Flake	M 70/Q	7.2	5.1	1.6
Core	K 87/3	7.3	7.25	5.0
Flake	K 87/5	7.5	7.0	2.9
Flake	M 70/R	7.7	4.5	2.15
Flake	M 70/T	7.85	4.4	1.9
Flake	M 70/P	8.85	6.0	2.35
Flake	K 87/4	8.9	8.0	2.75
Bif. cobble	K 70/I	9.0	8.0	6.5
Bif. cobble	K 87/2	9.5	7.7	5.1
Bif. cobble	K 70/2	9.6	8.2	6.5
Core	K 70/3	9.6	8.15	5.5
Biface	P 78/15	10.4	8.8	3.7
Biface	K 87/I	12.3	9.15	4.8
Uniface	B I 79/100	12.9	11.9	7.75

and one pointed uniface; seven cores; and eleven flakes (table 1). The specimens were mainly manufactured by direct hard-hammer percussion on locally available river-bed nodules of silicified limestone and silicified tuff varieties (table 2). Since most of these specimens exhibit fluvial wear, it is not possible to positively determine the cause of edge damage, i.e. natural abrasion or use-wear.

The following two lithic categories, A and B, conform typologically to artifacts first described by Movius (1943: p. 351) as 'chopping-tools'. As pointed out in an earlier paper (Bartstra et al., 1991), these artifacts might deserve an alternative terminology devoid of functional connotation. Nodule size based on the Wentworth (1922) classification of clast size, where the distinction between a pebble and a cobble is a size limit of smaller or larger than 64 mm in diameter, and the extent of modification (unifacial or bifacial flake removal), are the defining attributes of pebble and cobble artifacts. The use of either pebbles or cobbles may indicate selection for size and weight by the tool makers. As both types of nodules were readily available for manufacture, this could be of functional significance.

A. The four bifacial pebble artifacts derive from Kecce[3] (n=1), Marale (n=2), and the very topsoil of the former excavation of Beru I (n=1; fig. 1). The specimens are all but one made of silicified tuffaceous materials; the exception is of silicified limestone (B 70/1).[4] These artifacts range in size from 4.65×3.9×2.6 to 6.1×5.1×4.3 cm (table 3). Dorsal modification is more extensive than on the ventral aspect and the worked edges are sinuous in shape. The one specimen from Kecce (K 87/6) is the least cortical specimen and ventral modification is limited to the upper half of this face. The shaped edge is acute and largely unworn, and exhibits very localized, minute wear in contrast to the cortical edges where this is more extensive. Modification on an almost wholly cortical specimen (M 70/3) covers one third of the dorsal face with two relatively shallow flake scars on either end of the obverse of the slightly sinuous worked edge. The small protrusion in the central part of the modified edge is only very slightly worn (also evident on K 70/1), while the neighbouring margins are comparable in degree of wear to the bifacial cobble artifacts. This pattern may indicate utilization of these edges. The edge of the most extensively flaked specimen (M 70/B) is worked to a round point with limited step-fracturing on its dorsal side and limited dorsal and ventral cortex. The dorsal aspect exhibits natural abrasion. The Marale specimen M 70/3 exhibits also slight fluvial abrasion along it's edge.

B. The three bifacially flaked cobble artifacts were all collected at Kecce and are manufactured of silicified tuff (K 70/1, K 70/2, K 87/2). The size range is 9.0×8.0×6.5 cm to 9.6×8.2×6.5 cm. The specimens K 70/1 and K 70/2 (fig. 2) were modified by the detachment of a few flakes through alternate retouch resulting in sinuous edges occupying about half of each specimens'

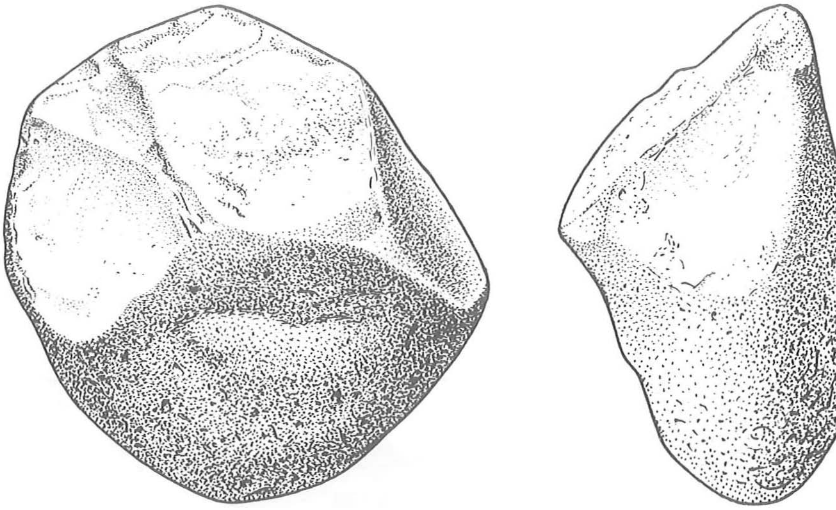

Fig. 2. Dorsal and right side views of the bifacially flaked cobble artifact K 70/2. Scale 2:3.

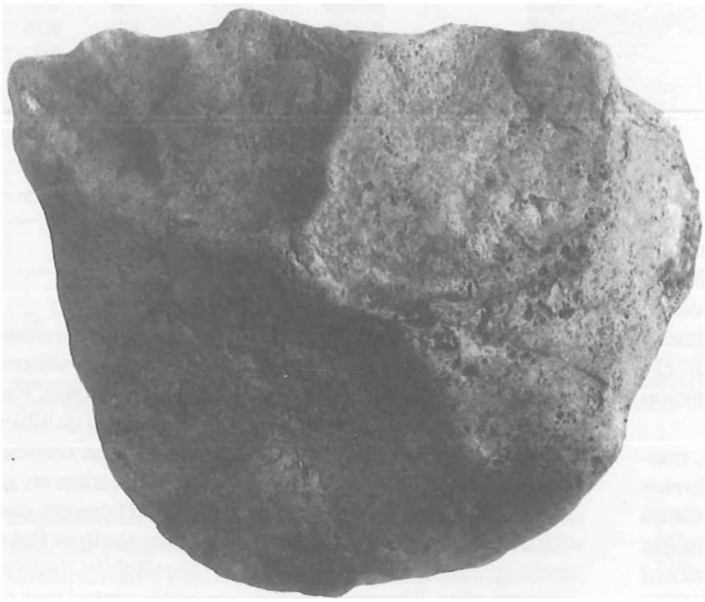

Fig. 3. Dorsal view of the bifacially flaked cobble artifact K 87/2. Scale 1:1.

periphery, and pronounced ridges at the intersection of flake scars. Size and depth of flake scars are variable with modification most extensive on the dorsal and largely limited to this face. In one case (K 70/1) two flake scars cover almost the entire dorsal surface. In contrast, the worked edge of K 87/2 (fig. 3) is relatively straight. Its non-cortical dorsal aspect shows more extensive modification than the obverse where one large flake was removed parallel to the dorsally worked edge associated with a small and shallow scar. The pattern of modification suggests that the knapper intended to produce an artifact with a straight edge by detaching one large ventral flake. The tuff variety of this specimen may have allowed more controlled flaking than the tuff of the other two artifacts.

C. The two pointed partial bifaces (K 87/1, P 78/15) and the pointed uniface (B I 79/100) were found at Kecce, Paroto[5], and in the immediate surroundings of the Beru I excavation (fig. 1). These specimens measure from 10.4×8.8×3.7 cm to 12.9×11.9×7.75 cm and are thus the largest of the sample (table 3). Flaking on these cobble nodules was carried out vertical to the long axis, although the Kecce specimen also shows limited horizontal modification. On the bifaces the dorsal face is more extensively modified, and on all specimens shaping of the points is limited to the dorsal aspect and flaking is concentrated on the left edge. The edges are usually sinuous, and the size and depth of scars is variable and frequently associated with step-flakes. One of the bifaces (K 87/1; figs 4 and 5) exhibits more

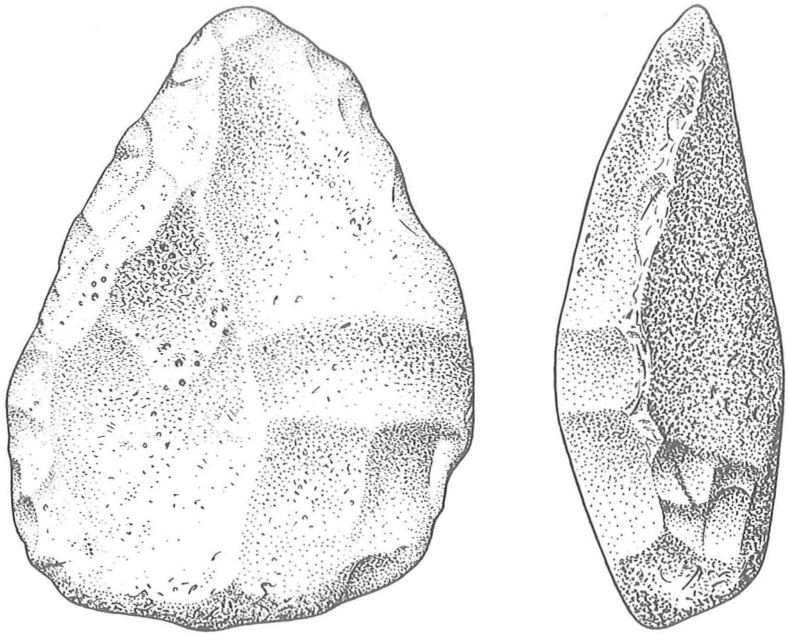

Fig. 4. Dorsal and right side views of biface K 87/1. Scale 2:3. Compare fig. 5.

regular flake scars, a smaller point, and is also more extensively modified compared to the other two specimens. Thinning of the lateral edges was conducted by invasive secondary retouch along the left dorsal edge and detachment of a single large flake from the left ventral edge placed parallel to the long axis. These features are possibly of functional significance, and the chipping along both edges may derive from utilization. Most of the ventral face is cortical. Modification of the Paroto specimen is less extensive with cortex covering the lower half of the dorsal face (P 78/15; figs 6 and 7)[6], and with a broader point than on the former specimen. The largest specimen is the uniface (B I 79/100; figs 8 and 9). The broader point compared to the bifaces is possible related to the size of this artifact. Small flake scars on the dorsal periphery of the point may be attributable to utilization. The relatively strong fluvial abrasion on the bifaces and the uniface hampers positive identification of their use as tools, but it seems that the aim of the knappers was to produce pointed artifacts with sinuous edges, attributes which are possibly of functional importance.

D. The cores were found at Kecce (n=3) and Marale (n=4) and usually exhibit slight natural abrasion. The specimens are all in silicified tuff or limestone, and include both small and large cores with a size range of 3.65×3.5×2.65 cm to 9.6×8.15×5.5 cm. The three cores from Kecce include the largest core in the sample. This specimen is a flat-based, thick, and relatively steep-edged piece (K 70/3), similar to the so-called 'horsehoof' cores. About one half of the specimen was modified. The irregular pattern of flake scars may be attributable to the vesicular limestone which also has enamel and radiolaria inclusions. Edge fracturing distributed along the base of the cortical part is possibly natural damage. The other cores (K 87/7, K 87/3) are very similar in morphology. These double-platform cores exhibit removal of mainly large flakes around the entire periphery at an acute angle. The larger core preserves more cortex compared to the smaller specimen, and on both flake scars are frequently step-flaked. The smaller striking platforms on both specimens are almost flat, in contrast to the larger irregular platforms. The larger four-sided core shows fluvial abrasion, while the smaller five-sided core is in fresh condition. The Marale cores (M 70/2, M 70/1, M 70/4) are small double-platform cores. One of these is a six-sided specimen and very similar in shape to the double-platform cores from Kecce. Step fracturing occurs on two of these cores, especially on the core which also exhibits stronger edge blunting. The third specimen (M 70/1) was more extensively worked with a limited cortical area. Flake morphology and size of this specimen are less regular compared to the two other cores from this locality. The only bipolar core (M 70/A), of heavily patinated silicified limestone, is quadrilateral in shape with small to large sized flake scars and an islet of cortex on one striking platform. Edge blunting is unevenly distributed on most of the flake scar margins.

E. The Walanae flakes finally were found at Marale (n=7), Kecce (n=2), and Paroto (n=2). All are unifacially worked specimens of usually irregular shape. The sample includes one specimen of flake-blade proportions. The specimens are mainly in silicified tuff, usually of a fine-textured variety. Cortex on these specimens is limited. The flakes were detached from transverse (n=7) and end (n=4) angles by direct hard-hammer percussion. Striking platforms are plain (n=10), cortical (n=1), and

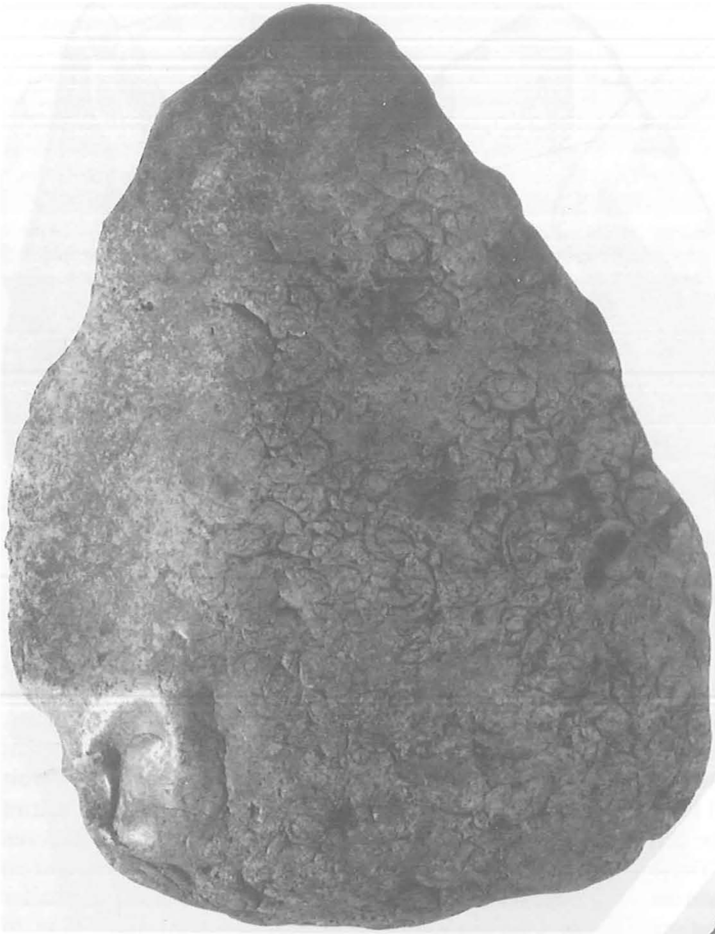

Fig. 5. Upper figure: ventral view of biface K 87/1. Compare fig. 4.
Lower figure: dorsal view. Scale 1:1.

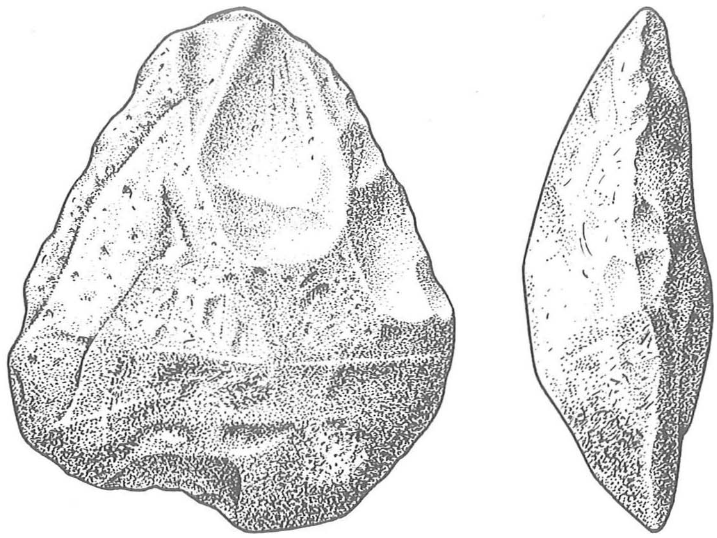

Fig. 6. Dorsal and right side views of biface P 78/15. Scale 2:3. Compare fig. 7.

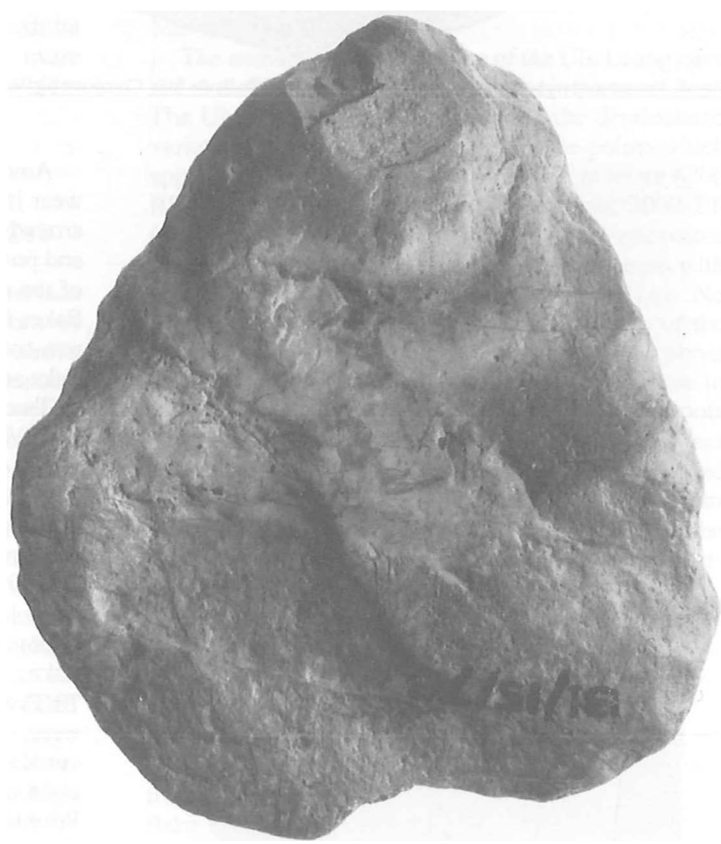

Fig. 7. Ventral view of biface P 78/15. Compare fig. 6. Scale 1:1.

faceted (n=1). The size range is 3.8×2.7×0.85 cm to 8.9×8.0×2.75 cm (table 3).

The 'waisted' shape of the largest flake (K 87/4; 8.9×8.0×2.75) was formed by multi-directional modification of it's lateral edges. The central part of this face is cortical and exhibits limited stepped flaking on the right dorsal. One flake scar is on the cortical and heavily patinated ventral face. The sinuous proximal end and lateral edges may be use-worn (less marked on the right edge). However, this is the most abraded flake and the abrasion is too pronounced to classify this specimen with any certainty as a tool.

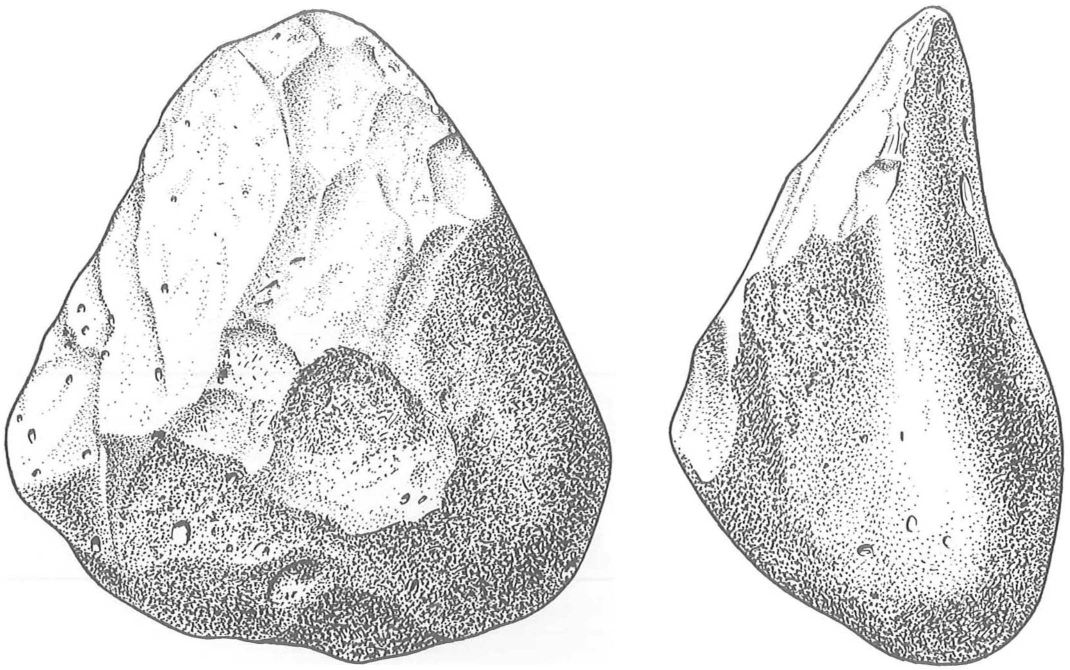

Fig. 8. Dorsal and right side views of uniface B I 79/100. Scale 2:3. Compare fig. 9.

Fig. 9. Left side view of uniface B I 79/100. Compare fig. 8. Scale 1:1.

Among the flakes with the most pronounced fluvial wear is a pointed flake with cortex extending almost around the whole periphery (K 87/5). Secondary retouch and possible use-wear is limited to the oblique margin of the point. Similar in wear and patination are three flakes from Marale. On one of these (M 70/Q) the only non-cortical edge exhibits three small and continuous flake scars which may be attributable to use-damage.

Two flakes of roughly triangular and similar shape (M 70/P; M 70/T) both retain cortical left lateral edges which are thick and positioned at a relatively steep-angle. On the cortical edge of the keeled flake (M 70/P) the invasive notch just below the retouched and blunted point may have formed through utilization including part of the associated oblique margin. The edge below the point of the sinuous right edge was modified by the removal of two long, narrow and obliquely angled flakes. Both lateral edges of the smaller specimen (M 70/T) exhibit what appears to represent invasive use-wear. This is less pronounced on the notch of the cortical edge which is located half-way below the blunt point of which the apex seems to have been removed. Prior to utilization of the non-cortical edge one narrow flake was detached from below the point, extending 3/4 down the edge. The slight denticulation on this thin edge may have formed through use-damage.

Two flakes in vesicular tuff indicate selection for cortical edge utilization. Of two roughly quadrilateral flakes one (M 70/R) may show use-wear on both denticulated lateral edges. The right margin is thin compared to the left cortical edge. The second specimen is a keeled flake (M 70/S). The concavities on the left edge and on the right cortical edge may be use-damaged. The larger of two keeled flakes from Paroto is a non-cortical flake-blade with slight distal end retouch due either to utilization or natural wear (P 87/A). The denticulated lateral edges may have formed through use-wear which is more invasive on the right edge. The second Paroto artifact is pointed and one of three small sized flakes (P 87/B). The distal point is distinctly acute and positioned at a left angle. Invasive secondary retouch on the cortical, slightly oblique left edge extends from the distal point half-way down this edge. This area and the notch on the lower right edge may be use-worn.

A small roughly quadrilateral and bilaterally notched flake (M 70/V) of limestone is in its shape and flaking pattern very similar to the large 'waisted' flake described above (K 87/4). It's left edge was formed by the removal of one flake (exposing what appear to be fossilized scales), while the right step-flaked edge exhibits two flake scars. Cortex is limited to the central part of this specimen. Both edges may be utilized. This artifact is less thick compared to a mainly non-cortical flake (M 70/U) on which both lateral oblique margins exhibit secondary retouch and possible use-wear, more pronounced on the right edge. The apex of the blunt point may have been removed.

4. CHRONOLOGICAL AND TYPOLOGICAL CONTEXT OF THE WALANAE ARTIFACTS

The Walanae artifacts have on considerations of terrace association, findspot, typology, and observations of fluvial wear and patination, confirmed in the above described sample, been divided into three temporal groups (Bartstra, 1978; Bartstra et al., 1991). Comparison to assemblages from three Late Pleistocene and Holocene cave sites in the Maros region near the southwestern coast of Southwest Sulawesi provides a provisional chronological framework for the artifacts (Bartstra et al., 1991). These limestone caves document a temporal, though possibly interrupted record of human occupation from c. 30 000 years BP to c. 2000 years BP (Mulvaney & Soejono, 1970, 1971; Glover, 1981; Bellwood, 1985).

The described bifacial cobble artifacts, partial pointed bifaces, the pointed uniface, large cores, and the large waisted flake, are the most abraded and patinated artifacts from the Walanae area. These artifacts derive from high terrace gravel, which has a sheet-like distribution on the river-facing slopes of the hills bordering the Walanae. The artifacts lie possibly not too far from the place(s) where they were manufactured and utilized (Bartstra, 1978; Bartstra et al., 1991). The described categories have not been found anywhere else in Sulawesi, including the oldest, radiometrically dated site in Sulawesi, the partially excavated Leang Burung 2 cave (Glover, 1981, and pers. comm.; Bartstra et al., 1991). The described artifacts may therefore represent the earliest evidence of human occupation in Sulawesi and may indicate that the initial adaptation to this island environment was based on a flake and core tool technology.

Cores and flakes with better preservation of flake scars are found on the surface (tread) of the high terrace of the Walanae river and in those deposits which may constitute lower terrace levels (Bartstra, 1978). Some of the above described bifacial pebble artifacts and flakes can be included in this second group (e.g. K 87/6, M 70/B, and M 70/U). The small sized flakes with their slight fluvial wear and patination might also be included in this category. According to Glover (1981, and pers. comm.) these artifacts are comparable to the Late Pleistocene Leang Burung 2 industry.

Only two specimens in the sample might belong to the third recognized group of small cores and flakes with no evidence at all of fluvial transport and found on hilltops and other high territory throughout the entire drainage system of the Walanae river (B 70/1 and M 70/1). We consider this third group as definitely Holocene and synchroneous with the later cave artifacts of the Maros region ('Toalian').

The archaeological sequence of the Ulu Leang cave site in the Maros region is of particular importance here. The Ulu Leang assemblage includes the denticulated variety of the so-called Maros projectile-points which appear for the first time at Ulu Leang from about 6200 BP until the site was abandoned at about 3000 BP (Glover, 1976). These points have also been excavated at the later site of Leang Burung 1 in association with pottery (Mulvaney & Soejono, 1970; 1971). No substantial change in stone artifact technology of the Maros assemblages has been recognized until about 7000 years ago with the appearance of an increase in flake tools and a trend toward smaller sized tools (Presland, 1980). The diminution in relative artifact size in the Maros sites may indicate that the unrolled bifacial pebble artifacts, cores, and small flakes from the northern Walanae depression are younger than the abraded specimens, reflecting an evolution towards smaller size in that area too.

The Walanae artifacts were originally attributed to the Cabenge 'flake' industry of South Sulawesi by van Heekeren (1958). The smaller flake specimens bear out van Heekeren's (1958; 1972) observation of the technological and morphological similarities he recognized between the artifacts from Cabenge and from the site of Sangiran in Java, in particular the keeled flake-blades. However, although commonalities between these flakes to a number of the Walanae artifacts are apparent, this cannot in any way indicate a cultural or proximate temporal relationship. This is an important point, since the frequent similarity of temporally separate assemblages constitutes a major feature of Far Eastern Palaeolithic technology (e.g. see Ikawa-Smith, 1978; Aigner, 1981; Pope, 1988). If one has to look for similarities or resemblances it is more adequate to compare the Walanae artifacts with the so-called

Pacitanian (formerly Patjitanian) of the south coast of Java. Especially the core artifacts make a comparison on typological and technological grounds worthwhile, setting aside for the moment any notions of cultural affinity.

The Walanae technology is characterized by the generally consistent use of hard-hammer percussion, preferential selection of fine-textured raw materials, and uncomplex modification. The faceted striking platform of one flake exhibits evidence of rough core preparation (but not Levallois technology). Faceted striking platforms have also been noted at Leang Burung 2 (Glover, 1981). The mainly vertical flaking on the bifaces and the uniface is comparable to that observed on the pebble and cobble artifacts. However, it is the total morphological pattern of the bifaces and the uniface that makes these artifacts characteristic in the selection of larger nodules, more extensive flaking of one face compared to the obverse, their pointed shape with modification of the points limited to the dorsal aspect and mainly to the left side, and the 'arched' form of the dorsal. The Kecce biface (K 87/1; figs 4 and 5) is the most extensively worked specimen and also shows more secondary retouch along it's left dorsal edge. The morphology and size of these artifacts is very similar to an artifact collected by H.G.A. van Panhuys in southwestern Halmaheira, Indonesia.[7] This specimen is in silicified limestone and described as an 'hand-axe on a river pebble' (cobble, 13×11 cm). In their shape and in the technique of mainly vertical flake removal, the pointed partial bifaces and the pointed uniface from Sulawesi and the specimen from Halmaheira are very similar to the Pacitanian artifacts classified as 'hand-axes' or 'proto-hand-axes' (von Koenigswald, 1939; Movius, 1948: pp. 358, 361; van Heekeren, 1972: pp. 37,41). However, these so-called handaxes are not to be confused with those known from the Acheulean of Africa and Europe, since they are in most cases not of Acheulean technique. We prefer to classify these proto-handaxes and handaxes as cores, unifacial or bifacial pebble and cobble artifacts, picks, or pointed unifaces and bifaces.

The similarities between the pebble and cobble artifacts and the bifaces and the uniface suggests that the latter technique may have developed from the former one. Movius (1944: p. 101; 1948: p. 361) thought that the proto-handaxes and handaxes of the Far East were a local development. The probably earliest dated artifacts in Southeast Asia are unifacial cobble artifacts ('choppers') from early Middle Pleistocene contexts in northern Thailand (Pope et al., 1981; 1986; see also Jacob et al., 1978). This may indicate that bifacially modified artifacts are a later temporal phenomenon, but at present we have too few sites in Southeast Asia to support this interpretation.

It is of interest that the two pointed partial bifaces and the pointed uniface were not more extensively modified (e.g. into handaxes) despite the tractable raw materials in which they were made. This indicates that the material was not a limiting factor, and that other explanations must be sought to understand the technology (see below). These artifacts were manufactured by modern *H. sapiens*, but lack the complexity which researchers familiar with European and Near Eastern assemblages cite as a characteristic component of the cultural character of this species (e.g. Binford, 1985; Mellars, 1989; Klein, 1989).

5. FUNCTIONAL ASPECTS

At this stage of research it is indeterminable whether the specimens reflect different activity facies. Secondary retouch is usually not extensive and occurs on the partial bifaces, the uniface, and on four flakes. The pattern of flake removal and the usually sinuous edges on the bifacial pebble and cobble artifacts suggests that these specimens were made for use as tools and may indicate thinning of edges for functional purposes. The variable degrees of edge damage on some or all of these artifacts may represent use-wear, but this cannot be ascertained with specimens found in a fluvial depositionary context, as is the case with the Walanae implements.

Some of these artifacts, including the not recovered flakes detached from the pebble and cobble artifacts may have been used for the manufacture of non-lithic tools. The notched flakes and indications for selection of cortical edge utilization may be reflective of wood-working processes. One notched flake from Leang Burung 2 on which the cortical edge was utilized is illustrated by Glover (1981: fig. 7c). A number of authors familiar with the Pleistocene record of Far Eastern lithic technology have argued that the use of non-lithic technology could explain the conservative and generally amorphous character of the local industries (Gorman, 1970; van Heekeren, 1972; Hutterer, 1977 contra 1985; Harrisson, 1978; Ikawa-Smith, 1978; Pope, 1983; 1989). It has also been suggested (Pope, 1988; 1989) that the distribution of bamboo may coincide with the distribution of chopper-chopping tools as defined by Movius (1944; 1948). The ubiquitous availability of bamboo and other suitable plant materials for tool production in the forested environments of the Far East may have presented the triggering mechanism in the evolution of an evolved non-lithic technology of which the Walanae stone artifacts may form a part. Thus, modelling hominid behaviour in the Far East solely by means of lithic technology, disregards consideration of the palaeoenvironmental context. The informality of the Walanae artifacts, although manufactured by modern *H. sapiens* in tractable materials may be more suitably explained in terms of an emphasis on non-lithic tool production. The use of a limited variety of raw materials, i.e. silicified tuff and silicified limestone may be referable to the ubiquitous availability of these rocks compared to other materials. However, it cannot be excluded that they were preferentially selected, because of their effectiveness in processing such plants as bamboo and wood. While these considerations may contribute to a better understanding of hominid behaviour in this region, it should also be noted that some standardization of manufacture is indicated with regard to the pointed bifaces and the uniface. These artifacts may represent a lithic facies restricted to the Walanae, and recent discoveries of further specimens in the area seems to promise the possibility of identifying a regionally characteristic technology for Sulawesi.

6. CONCLUSION

The geomorphological, typological, and sea-level change evidence may indicate that some of the Walanae artifacts (the large flake, large cores, bifacially worked cobbles, and the partial bifaces and uniface) may be representative of the earliest phase of hominid occupation of Sulawesi. These artifacts and the earliest dates for hominid occupation of the Australian continent (Roberts et al., 1990), suggest that sea-travel in island Southeast Asia was initiated before 50 000 years ago. We therefore suggest that the chronometric evidences from the Niah and Leang Burung 2 localities should be interpreted as the minimum age for sea migration within island Southeast Asia. Although further research is necessary to detail the stratigraphic context of the Walanae artifacts, we believe that they nevertheless represent important evidence for Late Pleistocene and Early Holocene behaviour of early modern *H. sapiens*. The Walanae artifacts as a whole reinforce the conservative and uncomplex quality of Southeast Asian stone tool technology which does not seem to have changed significantly with the emergence of modern humans.

Further surveys and possible excavations with the aim to recover secure primary context evidence of human occupation is planned in the Walanae depression. This may lead to a better understanding not only of the process and pattern of early human colonization of island Southeast Asia, Australia and New Guinea, but also of the regional behavioural characteristics where early modern human occupation in the world has been documented.

7. ACKNOWLEDGEMENTS

It was not possible to depict all the artifacts of the described sample. We have therefore concentrated on a few distinct core implements. Other artifacts will be illustrated in forthcoming papers. They are all available for study at the Biologisch-Archaeologisch Instituut in Groningen.

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8. NOTES

1. The drainage area of the Walanae river is here referred to as the Walanae depression (see Bartstra et al. this volume).
2. Recently it has been suggested that *Homo erectus* could have used boats or rafts to reach the islands east of Java (J. de Vos & R. van Zelst, Infusis (Intern informatieblad van het Nationaal Natuurhistorisch Museum te Leiden) 49, p. 5).
3. The site of Kecce is not shown in figure 1. It is situated about 3 km southeast of Marale and consists of some low hills (local outcrop of the Walanae Formation; see Bartstra et al., this volume) with a gravel sheet on the river facing slope. This streamgravel is implementiferous, and is part of the Walanae riverterrace system.
4. The codes refer to the numbers on the artifacts: the letter gives the site, the first two numbers the year of the find.
5. The site of Paroto also lies outside the area depicted in figure 1. Paroto lies approximately one kilometre south of Kecce and consists of gravel-strewn hills. For more locational details of these sites on the right bank of the River Walanae, see caption of figure 2 in Bartstra et al., this volume.
6. Figure 7 depicts the number BI/15/78 on the ventral side of the artifact. This number is obsolete and even wrong, and should be read as: P 78/15. The biface is definitely from Paroto.
7. See frontispiece of volume 8 of the series *Modern Quaternary Research in Southeast Asia*, Balkema, Rotterdam.

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