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Atbarapur (Hoshiarpur district, Punjab), the Acheulian of the Siwalik Range within the South Asian context

Atbarapur (district de Hoshiarpur, Panjab), l'Acheuléen de la Chaîne des Siwaliks dans le contexte sud-asiatique

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ABSTRACT

The largest collection of Acheulian artefacts in the Siwalik region is from the site of Atbarapur in north-western India. The artefacts occur in reworked sediments of the Pinjore Formation, starting with the onset of the Pleistocene and continuing at places in this region till 0.6 Ma. The technical study shows two similar "*chaînes opératoires*": one based on cobbles for making small flakes and the second based on boulders for large flakes. Both are short and simple: cores are not prepared and each of them produced about seven flakes. Handaxes and cleavers, typical Acheulian tools, are made on the large flakes, often struck from the ventral face of larger flakes (Kombewa method) or from split boulders. The technology compares well with the Lower Pleistocene Acheulian of peninsular India, but with slightly more refined bifaces. It also compares with assemblages from Africa and East Asia: Atbarapur stands as a milestone on the diffusion route(s) of the Acheulian.

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RÉSUMÉ

La plus riche collection acheuléenne de la région des Siwaliks provient du site d'Atbarapour dans le Nord-Ouest de l'Inde. Les artefacts se trouvent dans un sédiment remanié de la formation du Pinjore, dont le dépôt débuta avec le Pléistocène et continua, à certains endroits de cette région, jusqu'à 0,6 Ma. L'étude technologique met en évidence deux chaînes opératoires, l'une à partir de galets moyens, l'autre à partir de gros galets produisant de grands éclats. Toutes deux sont courtes et simples : les nucléus, non préparés, ont produit chacun environ sept éclats. Bifaces et hachereaux sont aménagés sur les grands éclats, souvent obtenus à partir de plus grands éclats (méthode Kombewa) ou de galets fracturés en deux. Cette technologie est comparable à celle qui caractérise l'Acheuléen du Pléistocène inférieur dans la péninsule indienne, mais avec des outils bifaciaux un peu plus élaborés. Elle est également comparable à ce qu'on trouve en Afrique ou en Asie de l'Est : Atbarapur représente un jalon dans la diffusion de l'Acheuléen.

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1. Introduction

In the north-western region of the Indian sub-continent two Palaeolithic industries were identified in the 1930s: the Soanian (mainly composed of choppers) and the Acheulian (Teilhard de Chardin, 1936; Teilhard de Chardin, 2004; Teilhard de Chardin and de Terra, 1936; de Terra and Paterson, 1939). The Acheulian is much less common than the Soanian and it is usually represented by cleavers or handaxes, often occurring as single pieces (Mohapatra, 1975; Mohapatra, 1981; Mohapatra and Singh, 1979a; Mohapatra and Singh, 1979b; Rendell and Dennell, 1985; de Terra and Paterson, 1939).

Movius (Movius, 1944; Movius, 1948) emphasised the Soanian cobble tools in his theory of two cultural zones during the Lower Palaeolithic in the Old World, leading to the concept of a "Movius line", which is still being debated (Corvinus, 2004; Keates, 2002), although in eastern Asia there are now strong arguments against it (Petraglia and Shipton, 2008) with the presence of handaxes and/or cleavers in South China (Hou et al., 2000; Huang, 1989; Wang, 2006), in Korea (Norton et al., 2006), in Sumatra (Forestier et al., 2005) and in Java (von Koenigswald, 1936; de Lumley et al., 1993; Sémah et al., 2003). In the Siwaliks also, the number of Acheulian finds (Kumar and Rishi, 1986; Mohapatra, 1975; Mohapatra, 1981; Mohapatra and Singh, 1979a; Mohapatra and Singh, 1979b; Rishi, 1989) and the strong suggestion that the Acheulian sites pre-date the Soanian (Chauhan, 2003; Gaillard and Dambricourt Malassé, 2008; Gaillard and Mishra, 2001; Teilhard de Chardin, 1936) throw the concept of two lower Palaeolithic traditions into doubt. At Dina and Jalapur (Pakistan) on the Jhelum River, handaxes were found in sediments pre-dating the tilting estimated to have occurred before 400 ka (Rendell and Dennell, 1985). At Satpati (Nepal), tilted sediments also yielded seven handaxes (Corvinus, 1990; Corvinus, 1995; Corvinus, 2007). However, in the entire Siwalik range, from the Indus to the Brahmaputra, Atbarapur is the only site known so far, where more than 50 bifaces, typical of the Acheulian, have been found along with flakes, cobble tools and cores. They were collected in the 1980s by the three Indian authors and form the only representative assemblage of the Acheulian in the Siwaliks, providing significant technical data (Gaillard et al., 2008) for further comparisons.

2. Geographical, geological and chronological contexts

The Siwaliks correspond to both geological formations and geomorphological features: they are made of deposits resulting from the erosion of the Himalayas and have been uplifted into a hill range (Fig. 1) during the recent phases of Himalayan orogeny, starting in the middle of the Middle Pleistocene. The three formations of the Upper Siwalik sub-group do not have the same age everywhere (Opdyke et al., 1979); for instance the Pinjore formation continues at places till around 0.6 Ma (Ranga Rao, 1993) and this is confirmed by the fauna (Nanda, 2002).

Atbarapur is located about 25 km north of Hoshiarpur on the south-western slopes of the Siwaliks (Fig. 1). The

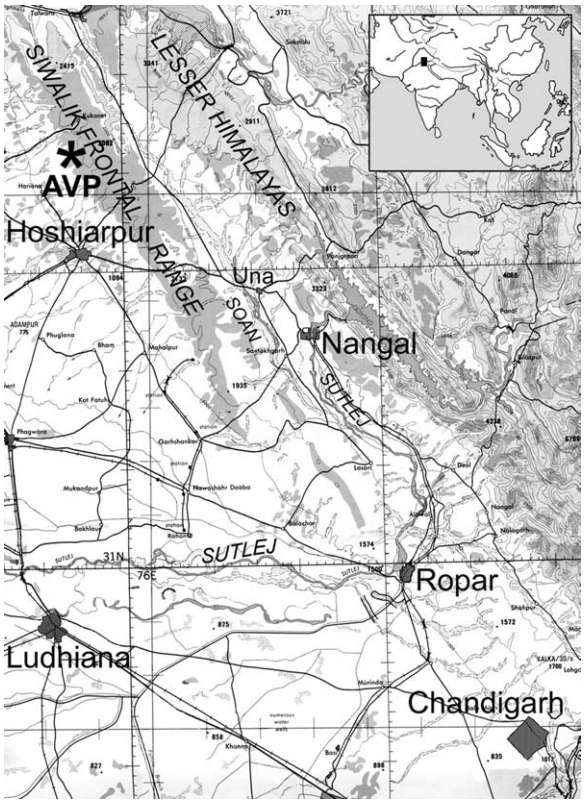

Fig. 1. Location of Atbarapur site (AVP) in the Hoshiarpur Siwalik Range.
Fig. 1. Localisation du site d'Atbarapour (AVP) dans la chaîne frontale des Siwaliks, secteur d'Hoshiarpour.

local outcrops of sandstones and loose conglomerates of mostly quartzite pebbles, cobbles and boulders belong to the Pinjore Formation (GSI, 1976), especially to its upper part, later than the Olduvai event, since tectonic activity is known to have reactivated the erosion at that time (Nanda, 2002). The artefacts have been collected from the bed of a *choe* (seasonal stream) flowing towards the Punjab plains for about 1.6 km and reworking the Pinjore formation. Interestingly, the Acheulian occurrences in this region are located along the faults bordering the Siwalik Frontal Range on both sides and enhancing the erosion of the Pinjore Formation (Gaillard et al., 2010b). Therefore the artefacts are older than 0.6 Ma and probably younger than 1 Ma (Olduvai event) otherwise the raw material, in the form of quartzite boulders, would not have been available.

3. Composition of the assemblage

The assemblage from Atbarapur is characterized by a majority of typical Acheulian tools, *i. e.*, handaxes and cleavers (Table 1); cleavers are twice more than handaxes.

All these artefacts are in medium to fine grained quartzite. These rocks were available in the form of cobbles and boulders, as inferred from the patches of cortex remaining on the artefacts. Nowadays, no such large rounded stones are visible in the *choe* at Atbarapur but they

Table 1
Composition of the lithic assemblage from Atbarapur.
Tableau 1
Composition de l'assemblage lithique d'Atbarapour.

	Number	Percentage (%)
Hand-axes	15	16
Cleavers	37	40
Knives	2	2
Scraper	1	1
Denticulate	1	1
Unmodified flakes	10	11
Choppers	13	14
Cores	13	14
Total	92	100

are reported in the surroundings (GSI, 1976). The Atbarapur assemblage is quite homogenous, as far as the size is concerned. Large / giant cores having produced the majority of the flakes are missing, which is expected when the source of raw material is not at the site. But the smaller flakes, produced by the cores and choppers of the assemblage are also missing. All the 13 cores still bear patches of river cortex indicating that they were cobbles (< 26 cm) rather than boulders.

4. Reconstruction of the processing sequence

The large majority of the 69 flakes are side struck but the maximal dimension of both side and end struck flakes do not vary much (141 mm and 136 mm in average). A number of these flakes with little or no cortex are Kombewa flakes (from the ventral face of a larger flake (Dauvois, 1981; Owen, 1938)) or struck from the flat surface of a split boulder (flatness of the bulbs does not help distinction).

The flakes being bigger than the cores (mean length 116 mm), the former do not result from the reduction of the latter. Nevertheless their detailed technical study (Gaillard et al., 2008) shows that the method of flaking is quite similar for both large and smaller productions. On flakes and cores the flaking directions are mostly unidirectional. The concept of core reduction recalls that of chopper trimming (but without retouch). The Kombewa method proper might have been used but actually no Kombewa cores (on flake) are clearly identifiable, while split cobbles are well represented among the cores (Fig. 2). If the same reduction method was applied, right from the beginning, for both large and small productions, splitting is expected to have been applied to the boulders too, as suggested by the large flakes, except if their bigger size makes it much more difficult than for the cobbles.

The productivity of the cores is rather low. The analysis of the flakes suggests six or seven products from each boulder or cobble core and the studied cores display an average number of seven to eight scars (minimum production). The first flakes represent 1/8 of the products. They are followed, for each core, by one or two largely cortical flakes, two or three flakes with little cortex and two or three without cortex. Such a combination fits well with the pattern of a complete short sequence of production.

The specificity of this debitage is the high proportion of side struck flakes, which may indicate that no attention was paid to the longitudinal convexity allowing long flakes. However this is a simple and convenient method for obtaining a wide cleaver cutting edge, on the lateral side of the flakes. The Kombewa method or exploitation of the split surface of a boulder (1/4 of the production) provides an even more developed cutting edge. Therefore, although simple and without management of the convexities, the core reduction sequence was well adapted to the cleaver manufacture.

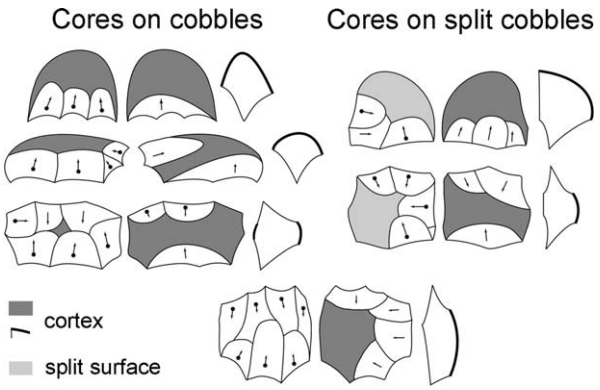

Fig. 2. Schematic representation of the core reduction sequences at Atbarapur.
Fig. 2. Représentation schématique des méthodes de production à partir des nucléus d'Atbarapour.

5. Trimming of the tools

All the 15 handaxes, except two, are made on flakes (Fig. 3). The flake scars trimming the blanks generally extend on about half of each face and never covers the entire face, except one. Usually two generations/series of retouch can be observed, the second one regularising the edge shaped by the first one. These handaxes are either amygdaloid or oval and none of them is properly pointed: all the tips are more or less rounded. The retouch of the tip is rather unifacial than bifacial. Most of the handaxes are bifacially trimmed on both sides and the angle of edges is rather open (55° to 80°).

The cleavers (Fig. 4) represent the most important component of this assemblage. Almost all of them (32/37) are made on side struck flakes. The dorsal face of the blank flakes is mostly entirely cortical (14; "type 0" of Tixier (1958)) or without cortex (13/37). Among the latter, the Kombewa flakes or flakes from split boulders are the majority (12; Tixier's type 6 defined at Ternifine (Balout et al., 1967)). Trimming is usually confined to the margins; however it can extend up to half of each face, especially on the ventral face possibly for thinning the bulb. For half of the cleavers the trimming consists of one series of retouch only, while the other ones show two series and rarely more. Therefore, the original shape of the blanks is hardly modified. All the lateral sides of the cleavers are trimmed, except four. They are either steep or at an open angle but rarely sharp. The trimming is bifacial for half of the sides but only 13 cleavers show bifacial trimming of both their sides. The cleaver's cutting edge is usually slightly convex and oblique to the longitudinal axis of the tool.

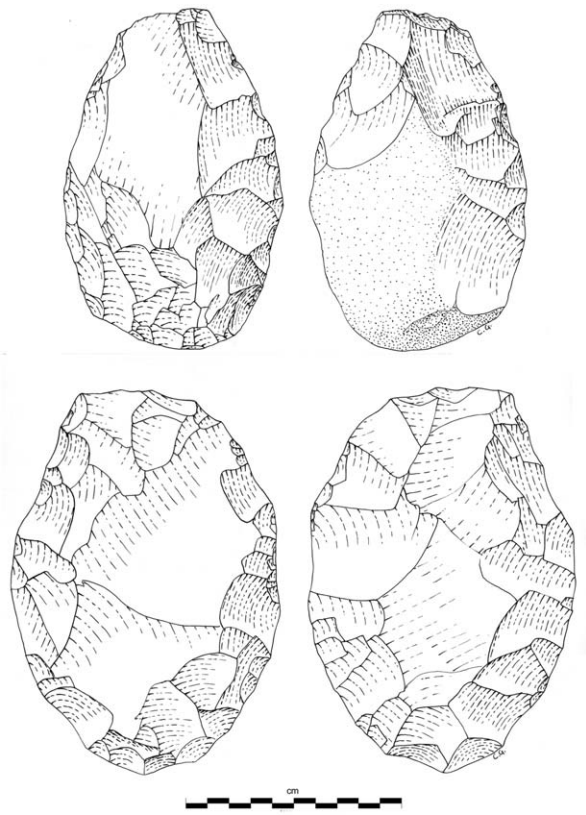

Fig. 3. Handaxes from Atbarapur
Fig. 3. Bifaces d'Atbarapour.

In the assemblage from Atbarapur, 13 choppers were identified (of which six on flakes and five on cobbles, maybe preliminary broken). Indeed half of the choppers are made on blanks that show the same technical characteristics as the cleavers. Then trimming is mostly unifacial and either made by one series of scars or two (more regular edges).

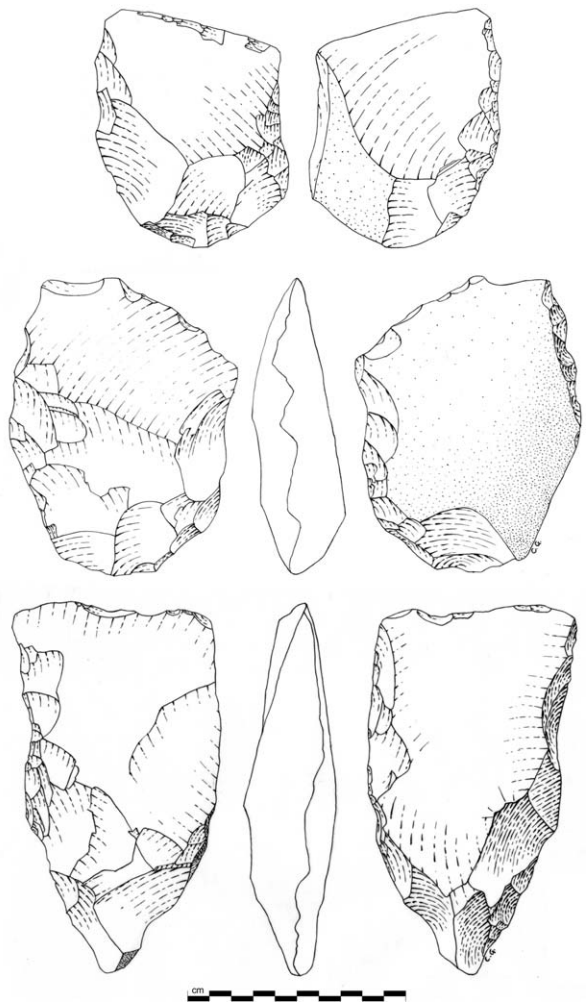

Fig. 4. Cleavers from Atbarapur
Fig. 4. Hachereaux d'Atbarapour.

6. Discussion

Atbarapur is the richest Acheulian site of the entire Siwaliks and although it may not be in a primary situation, the assemblage is very informative regarding the technical behaviour of the people having made and used it. It is composed of large flakes on one hand, and cores and choppers on the other hand. Both groups having almost the same size, they correspond to two parallel reduction sequences, following the same modalities, but one uses boulders as cores (absent at the site) and the other one uses cobbles (from which the flake products are missing). Apart from the cores and half of the choppers, the whole assemblage is made on flakes, the majority of them being trimmed into cleavers and handaxes, the former twice more than the latter.

The lithic industry from Atbarapur definitely belongs to the "Large Flake Based Acheulian" well represented in South, East and North Africa, Near East and South Asia (Gaillard et al., 2010a; Gaillard et al., 2008; Mishra et al., 2010; Sharon, 2007). This technological trend of making large flakes may be independent from the raw material (Sharon, 2007; Sharon, 2008) or may not (Leng and Shannon, 2000; Noll and Petraglia, 2003; Santonja and Villa, 2006). However, in any case, the boulders used as raw material at Atbarapur were definitely favourable to the production of large flakes. Moreover this technological trait is common in the Indian sub-continent. Tools from Atbarapur compare well with the other Acheulian occurrences from the Siwalik Frontal Range between Ghaggar and Beas Rivers, where cleavers are more frequent than handaxes (Mohapatra, 1981; Singh, 2007). However it is to be noted that in central Nepal, on the southern slopes of the Siwaliks, only handaxes have been found, mostly made on cobbles (Corvinus, 1990; Corvinus, 1995; Corvinus, 2007). Further east in the sub-Himalayas, no Acheulian is known so far.

In peninsular India the Acheulian tools made on large flakes are very common, especially in regions where the bedrock is quartzitic or basaltic. From Atbarapur, the closest Acheulian sites are near Didwana in Rajasthan. However, in this sector the cleavers are almost absent, in the early and in the later phases as well. At Singi Talav, dated to 800 ky (Kailath et al., 2000), the handaxes and

rare cleavers are mostly made on quartzite slabs collected 3 km away from the site (Gaillard et al., 1990; Gaillard et al., 1985; Gaillard et al., 1983; Gaillard et al., 1986). Then the more refined assemblages from Koliya and Jankipura are devoid of cleavers (Misra et al., 1982).

The central Narmada valley is rich in large flake tools made in Vindhyan quartzite (see, for instance, Patnaik et al., 2009). At Bhimbetka (40 km north of the Narmada) the lower levels of the rockshelter III-F-23 have yielded a large Acheulian assemblage including at least one giant core. The cleavers more than double the handaxes and all are made on large flakes. The entire assemblage is considered as an evolved Acheulian (Misra, 1985). To the west, in the lower Narmada and its tributaries (Orsang, Karjan), Acheulian tools on large flakes are also reported (Ajithprasad, 2005; Sankalia, 1974), as well as in the eastward prolongation of the Narmada, in the Son valley, where the Acheulian assemblages include equal proportions of handaxes (in chert) and cleavers (in quartzit; Sharma and Clark, 1983). In the neighbouring Belan valley, some assemblages also comprise large components and more cleavers than handaxes but the flake production seems to be more advanced (Victoria West and Levallois methods; Pant, 1985) than at Atbarapur. In the Betwa valley, the very rich Acheulian industry from Lalitpur, made from a local micro-granite, is largely dominated by cleavers (Singh, 1965; Jayaswal, 1978) and seems to be more comparable to Atbarapur.

In the Deccan, where the basalt is mainly used for making the large tools, Chirki on the Pravara is a very significant excavated site (Corvinus, 1983), in river deposits having recorded a negative polarity (Sangode et al., 2007) and therefore belonging to the Lower Pleistocene. The assemblage comprises more than 700 large cutting tools, mostly handaxes and cleavers (slightly more). They are made in two varieties of basalt, one local and one more compact from several kilometres away. Almost all the cleavers and half of the handaxes are made on flakes (otherwise on cobbles or split cobbles). Among the cleaver blanks, some Kombewa flakes have to be noted, but most interesting are the large flakes detached from prepared cores (Corvinus, 1983). They may appear technically more advanced than those from Atbarapur, but their lateral sides are unifacially trimmed in most of the cases, while at Atbarapur they are bifacially trimmed, at least on one side.

Further south in the western Deccan, the site of Bori (670 ka (Mishra et al., 1995)) mostly provides handaxes and picks made on basalt cobbles, but below the tephra one large flake has been found (Deo et al., 2007). At Morgaon (Lower Pleistocene (Sangode et al., 2007)) assemblages include large flakes and cores indicating the Kombewa method. The raw material is available at the site in the form of big basalt core-stones. A few flakes are trimmed with minimum flaking into cleavers and rare handaxes (Deo et al., 2007; Mishra et al., 2009). In the Hunsgi and Baichbal valleys (Karnataka), about 200 Acheulian sites have been identified (Paddayya, 2007a; Paddayya, 2007b) among which Isampur is the earliest (1.2 Ma; Paddayya et al., 2002). The main raw material is available at the site itself as slabs of silicified limestone. The assemblage is mainly composed of small and large flakes, the latter being sometimes retouched into handaxes and cleavers (48 and 15 in trench 1). They are associated to knives, scrapers, chopping tools, etc. (Paddayya et al., 2002; Paddayya et al., 2006). At some other sites as Kolihal, the flaking methods are more advanced (preparation of the flaking surfaces) and the large cutting tools more standardised: they belong to the Middle Acheulian (Paddayya, 2007b).

South India also provides similar Acheulian assemblages. Nagarjunakonda-1 (Andhra Pradesh) stands apart with more cleavers than handaxes, which are trimmed on large flakes struck from unprepared boulder-cores (Jayaswal, 1978). The other Acheulian assemblages are characterised by outnumbering handaxes, mostly made on nodular blanks rather than on flakes, as for instance at Renigunta (Andhra Pradesh; Gaillard et al., 1990; Gaillard and Murty, 1988). However, in the trench 8 of Attirampakkam (Tamil Nadu), the lower layers (6, 7, 8) have yielded 8000 artefacts including 21 cleavers, 53 handaxes and six picks mostly made on large flakes of coarse quartzite collected a few kilometres away (Pappu and Akhilesh, 2006).

The nature and availability of the raw material and the modalities of collection (excavation/surface) make it difficult to compare the assemblages to each other. The large cutting tools appear more elaborated at Atbarapur than in the Early Acheulian as from Morgaon or Isampur, but the absence of core preparation prevents their assignation to the Middle Acheulian.

Considering the geographical situation of Atbarapur, on the southern fringes of the Himalayan barrier and in the midway between both extremities of Asia, it would be very interesting to find in this site indication of possible route of diffusion for the Acheulian, if at all it is a matter of diffusion and not of polycentric invention (as suggested by Boëda (2005)). The simplistic model recently proposed on the basis of the sole morphometric data (Lycett and von Cramon-Taubadel, 2008) is far from satisfactory. Technology rather than shape may indicate cultural links, hence possible diffusion routes. And routes are probably not one-way only. The Acheulian assemblages are highly diversified due to many factors including availability, nature and shape of raw materials, function of sites, etc. However this diversity does not go beyond a certain limit even when using various rocks (Sharon, 2008). Similarities between Indian and African Acheulian are obvious (Noll and Petraglia, 2003; Sharon, 2007) and it has been suggested that it originated from India (Mishra, 2007-2008). Atbarapur compares well for instance with the assemblages from eastern Middle Awash (Schick and Clark, 2003). From Africa, the coastal plains might have been the easiest way, either through the Arabic peninsula, by crossing the Bab el Mandab and Ormuz straits (Petraglia, 2003; Petraglia, 2005), or through the Levantine corridor, where Acheulian sites are well represented at early dates, especially at Ubeidiya (Bar-Yosef and Goren-Inbar, 1993) or, more significantly, at Gesher Benot Ya'aqov yielding assemblages based on large flake production (Goren-Inbar et al., 2000; Sharon, 2007). But then towards East Asia, where more similar assemblages also occur as in Luonan (Wang, 2006), the coastal route is much longer than the one following the sub-Himalayan slopes. This might have been a good alternative, since further east the upland environment seems to be quite favourable to human occupations (Schepartz et al., 2000).

It should be borne in mind that at the time when Acheulian people were living in this region the local landscape was very different: the Siwalik Hills did not exist and this region was the continuation of the vast Indo-gangetic plain. From the Jhelum valley to the Nepal, Acheulian people have circulated and abandoned artefacts, now found along the Siwaliks of north-western India (Corvinus, 1990; Corvinus, 1995; Corvinus, 2007; Rendell and Dennell, 1985; Singh, 2007). Lack of evidence further east does not necessarily imply a break in the cultural/technical continuity. The Mainland South-east Asia has undergone drastic geographical changes and the coastal land that could have been occupied around 0.8 Ma is now under the sea. But Acheulian assemblages based on large flake production do occur in East and South-East Asia, up to Java where the well-stratified site of Ngebung at Sangiran, dated to 0.8 Ma (Sémah et al., 2003; Simanjuntak et al., 2010), has yielded a few large flakes and a cleaver (de Lumley et al., 1993) recalling those from Chirki in India. However the assemblages from Bose basin are different due to the use of cobbles for making handaxes (Hou et al., 2000; Xie and Bodin, 2007) yet sharing many features with any Acheulian industry based on cobbles.

The site of Atbarapur, probably older than 0.6 Ma, is one of the milestones, midway between Africa and the Far East, in the early diffusion of the Acheulian tradition.

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