

# BIFACE DISTRIBUTIONS AND THE MOVIOUS LINE:

## A Southeast Asian perspective

Adam Brumm<sup>1</sup> and Mark W. Moore<sup>2</sup>

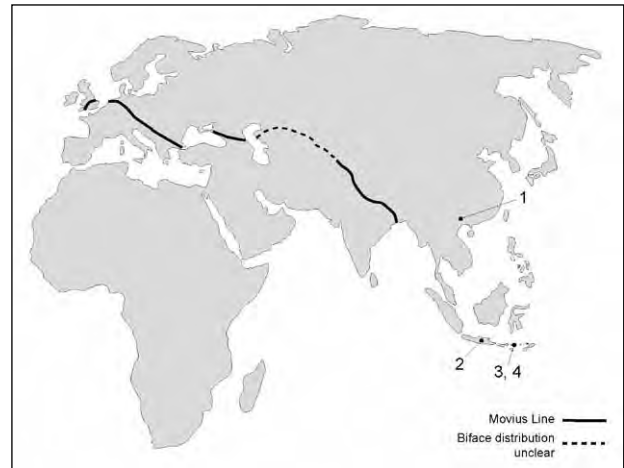
### Abstract

The 'Movius Line' is the putative technological demarcation line mapping the easternmost geographical distribution of Acheulean bifacial tools. It is traditionally argued by proponents of the Movius Line that 'true' Acheulean bifaces, especially handaxes, are only found in abundance in Africa and western Eurasia, whereas in eastern Asia, in front of the 'line', these implements are rare or absent altogether. Here we argue, however, that the Movius Line relies on classifying undated surface bifaces as Acheulean on typological grounds alone, a long-standing and widely accepted practice in Africa and western Eurasia, but one that is not seen as legitimate in eastern Asian contexts. A review of the literature shows that bifaces are relatively common as surface finds in Southeast Asia and on this basis we argue that the Movius Line is in need of reassessment.

### Introduction

... the evolution of flint technology through prehistory was a cumulative process: new tricks were added, but there were no extinctions (Johansen and Stapert 1995:1).

Acheulean biface technology emerged in East Africa ca 1.76 million years ago (Ma) (Lepre *et al.* 2011) and the extent of its subsequent distribution has important implications. It has long been argued that a technological boundary, the 'Movius Line', separates Acheulean technologies of Early and Middle Pleistocene Africa/western Eurasia from simpler, 'least-effort' core-and-flake industries of equivalent age in eastern Asia (Dennell 2009; Keates 2002; Lycett and Bae 2010; Lycett and Gowlett 2008; Lycett and Norton 2010; Mulvaney 1970; Norton and Bae 2009; Norton *et al.* 2006; Petraglia and Shipton 2008; Pope and Keates 1994; Schick 1994; Simanjuntak *et al.* 2010; Wang 2005) (Figure 1). The manufacture of Acheulean bifaces, especially handaxes, is said to require complex production routines and the ability to fashion tools into preconceived designs, implying advanced cognitive capabilities (Gowlett 2006; Wynn 1995, 2002). Core-and-flake assemblages, alternatively, are widely thought to reflect the simplest approach to stone tool manufacture (Pelegrin 2005; Roche 2005; Shea 2006; Wynn 2002). Few researchers today would support Movius' (1948) contention that the apparently uncomplicated lithic technologies of Pleistocene eastern Asia indicate 'cultural retardation'; however, it is generally agreed that early hominin tool-making in this region was technologically simpler than that in Palaeolithic Africa/western Eurasia (Clark



**Figure 1** Map showing the Movius Line and key localities mentioned in the text. The received idea is that 'true' Acheulean bifaces only occur behind the Movius Line, in Africa and western Eurasia, and are absent to the east and southeast of the demarcation boundary. Stone artefacts resembling Acheulean bifaces have been recovered *in situ* from non-modern hominin contexts in (1) the Bose Basin of southern China, (2) Ngebung 2 at Sangiran, Java, and at (3) Wolo Sege and (4) Liang Bua on the island of Flores, eastern Indonesia.

1992, 1998; Lycett and Bae 2010). This view is based on various lines of evidence (cf. Moore 2010, in press), but to many researchers the purported absence of Acheulean artefacts east of the Movius Line remains the decisive factor (Corvinus 2004; Dennell 2009; Keates 2002; Lycett and Bae 2010; Norton and Bae 2009; Pope and Keates 1994; Schick 1994).

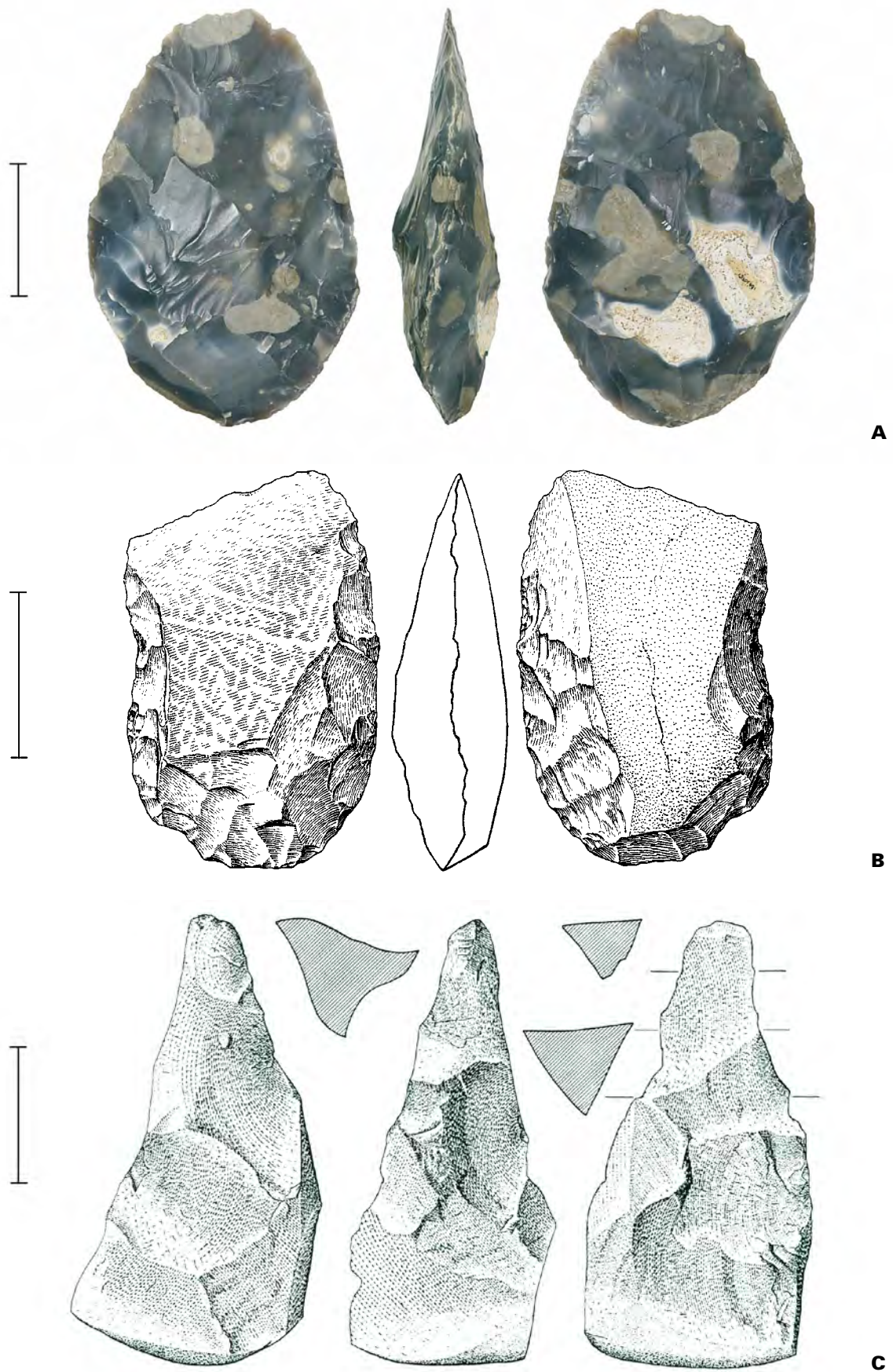
This paper critiques the Movius Line and the key evidence used to define it: the purported lack of bifaces in Southeast Asian Palaeolithic assemblages. The Movius Line is widely accepted to represent a significant pattern in the empirical data (Lycett and Bae 2010). However, we argue here that it continues to be defined largely on the basis of African and western Eurasian bifaces found outside stratigraphic contexts and ascribed to the Acheulean on typological grounds alone. This is not seen as a legitimate practice in Southeast Asia and elsewhere in the Far East, where bifaces are common as undated surface finds but, lacking a dated context, are routinely considered products of modern human cultures. Dating African and western Eurasian surface finds as Acheulean while dismissing similar Southeast Asian and Far Eastern artefacts is a case of shifting the goalposts, one that potentially distorts Acheulean evidence in the Palaeolithic Old World.

### Acheulean Bifaces

The term 'Acheulean biface' encompasses a range of large bifacial forms, including handaxes, cleavers, picks, knives, lanceolates and unifaces (Clark and Kleindienst 2001; Kleindienst 1962; McNabb *et al.* 2004) (Figure 2). Handaxes, cleavers and picks are the classic types. Handaxes are defined by a polythetic set of

<sup>1</sup> Centre for Archaeological Science, School of Earth and Environmental Sciences, University of Wollongong, Northfields Avenue, Wollongong NSW 2522, Australia abrumm@uow.edu.au

<sup>2</sup> Archaeology and Palaeoanthropology, University of New England, Armidale NSW 2351, Australia mmoore2@une.edu.au



**Figure 2** Acheulean biface types. A: Bifacial flint handaxe from Boxgrove, southeast England (photograph by A. Brumm). B: Cleaver from unspecified locality (after Debénath and Dibble 1994 Figure 11.106). C: Quartzite trihedral pick from Casablanca, Morocco (after Inizan *et al.* 1999: Figure 17). Scales are 50 mm.

characteristics (e.g. Crompton and Gowlett 1993; Wynn 1995). They are commonly identified as bifacially flaked stones with a generally elongate or ovate plan form and approximate bilateral symmetry around the long axis (e.g. Clark and Kleindienst 2001; Gowlett 1986, 1990; Kleindienst 1962; Roe 1964, 1968, 1994; Wynn 1979, 1995). Cleavers are bifaces, often made on large flakes (Sharon 2009), with an unretouched distal edge oriented in a perpendicular or slightly oblique direction to the long axis of the blank (Gowlett 1988; Inizan *et al.* 1999; Texier and Roche 1995). Picks comprise large, thick, retouched tools with high-backed planoconvex or triangular cross-sections and robust pointed tips resulting from unifacial, bifacial or trihedral reduction of heavy cobbles or large flakes (Bar-Yosef and Goren-Inbar 1993; Isaac 1977; Kleindienst 1962; Leakey 1971). Acheulean bifaces, in particular handaxes, are widely interpreted as butchery tools (e.g. Jones 1980; Machin *et al.* 2007; Mitchell 1997; Schick and Toth 1993), although other functions have been inferred (e.g. Kohn and Mithen 1999; Whittaker and McCall 2001). Very few microwear or residue analyses have produced convincing evidence for the functions of any of these artefacts (Shea 2006; but see Binneman and Beaumont 1992; Domínguez-Rodrigo *et al.* 2001; Keeley 1980, 1993; Mitchell 1997).

The earliest known bifaces identified as Acheulean date to around 1.76 Ma in Africa (Gibbon *et al.* 2009; Lepre *et al.* 2011), and the Acheulean tool-making 'tradition' is generally thought to have disappeared by ca 100,000 years ago (Ka) (Lycett and Gowlett 2008). In spite of this vast time span, and despite frequent assumptions to the contrary, there are no attributes of Acheulean bifaces that are chronologically unique. Bifaces that are essentially typologically identical to Acheulean handaxes appear in multiple periods in the prehistoric and historical records (Johansen and Stapert 1995; Otte 2003; Stapert 1981). For example, in terms of the latter, Tindale (1949) recorded Aboriginal people in the Gulf of Carpentaria making Acheulean-like bifacial tools (known as *mariwa* on Mornington Island and *tjilangand* on Bentinck Island). Likewise, bifaces resembling handaxes are documented in archaeological and ethnographic contexts on Brunette Downs Station and near Camooweal in the Barkly Tableland of northern Australia (Barkly 1979; Moore 2003; Rainey 1997) (Figure 3). This is due in part to the constraints of stone reduction. The process of reducing a stone to the thin bifacial forms often made by modern humans requires a progression through earlier flaking stages. Products of these earlier stages can be identical to Acheulean tool types (Callahan 1979) and interruption of the process results in their discard into the archaeological record. Virtually any technology in which tools or cores were produced by bifacial flaking could result in the discard of objects resembling handaxes and, for that matter, Levallois flakes and other Palaeolithic tool forms (cf. Moore 2010).

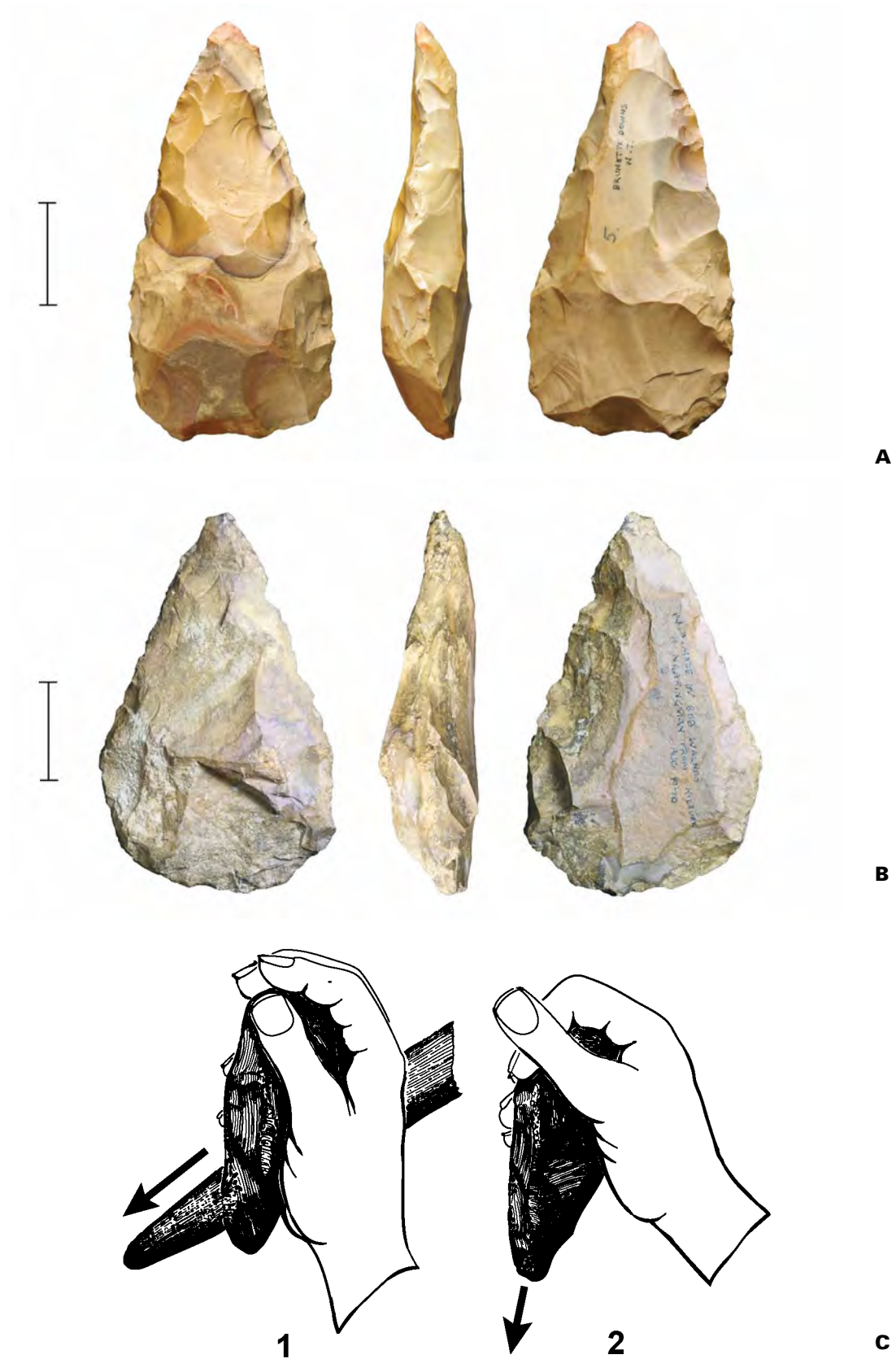
There is a long history of scholars mistakenly attributing bifaces produced by modern humans to the Acheulean. For example, artefacts from surface scatters on gravel-covered terraces in Green River Valley, Wyoming – once interpreted as Acheulean handaxes – are 'actually bifacial blanks or preforms for points or other bifacial tools' (Ebert 1992:78). In the early years of prehistoric studies in Europe it was also common for preforms of bifacial tools dating to the late Middle and Upper Palaeolithic, Mesolithic, Neolithic and Early Bronze Age to be erroneously

identified as Acheulean (Stapert 1981; see also Adams 1999; Saville 1997). As Johansen and Stapert (1995:1) remarked, for instance: 'In the Netherlands and elsewhere, rough-outs of Neolithic axes have repeatedly been interpreted as handaxes ... In Denmark, preforms of bifacial tools such as daggers, spearheads and sickles may resemble Palaeolithic handaxes'. Similarly, Otte (2003:186) noted that 'Mousterian bifacial pieces have been interpreted as evidence for an Acheulean presence in Greece [and in] Central Asia, elongated Levallois cores, which are, of necessity, "bifacial", have been confused with true Acheulean bifaces'. Johansen and Stapert (1995:26) therefore advised a cautionary approach to the classification of stray finds of implements which bear some resemblance to handaxes: 'Typology is simply not good enough for confidently cataloguing artefacts as [Acheulean], when these have been found without a stratigraphic context'.

### The Movius Line

The Movius Line is the widely adopted division between the handaxe-making hominins of Lower Palaeolithic Africa and western Eurasia and the non-handaxe-making hominins of East and Southeast Asia (Lycett and Bae 2010). It was first proposed by the Harvard archaeologist Hallam Movius (1907–1987) following his 1930s fieldwork in Burma and Java (Movius 1944, 1948, 1949). The Southeast Asian Palaeolithic assemblages, Movius argued, were characterised by crude chopper-chopping tools and contained few, if any, true Acheulean handaxes, which were inferred to be common on sites throughout Africa, Europe, the Levant and the Indian subcontinent. Movius proposed the concept of a technological demarcation line in order to delineate the easternmost distribution of handaxes. He argued that, beyond the Movius Line (see Coon 1966:47–48), early hominins in eastern Asia were biologically and culturally static due to genetic isolation from populations in Africa and western Eurasia (Movius 1944, 1948). In geographical terms, the 'line' extends from southeast to northwest from the Bay of Bengal west of the Ganges-Brahmaputra delta to the northern tip of the Himalayas (Swartz 1980) (Figure 1). Strictly speaking, however, the southern point of the Movius Line in Asia can be extended down the eastern shoreline of peninsular India, in order to separate Sri Lanka (where no handaxes are reported) from the mainland. From the Himalayas it traverses a somewhat uncertain course through Central Asia (Dennell 2009), before extending down into western Asia through the Taurus and Caucasus Mountains between the Caspian and Black Seas (Kozłowski 2003). In continental Europe a demarcation line runs along the Rhine River and the Alps, and the northern margin of the Rhodope Mountains (Adams 1999), separating the Acheulean industries of western and southwestern Europe from the non-biface industries of central and eastern Europe. This is sometimes referred to as the 'Movius Line in Europe' (Kozłowski 2003:149), although it is not often considered in models of artefact variation and hominin evolution in eastern Asia (but see Svoboda 1987).

It is now generally accepted that the Movius Line as originally conceived (i.e. Movius Line *sensu stricto*) cannot be supported (Lycett and Bae 2010). Large bifaces have been excavated from stratified Middle Pleistocene sites in China (Derevianko 2008; Hou *et al.* 2000; Huang 1987; Wang *et al.* 2008; Xiaobo 2008; Xie and Bodin 2007; Zhang *et al.* 2010) and Korea (Ayres and



**Figure 3** Acheulean-like bifaces from Australia. A: Chert biface collected by Alec Rainey in 1966 on Brunette Downs Station, Northern Territory (Barkly 1979)\*. B: Chert biface made by Njurungali man Bob Walnoo near Kununurra in 1970 (Rainey 1997). C: Schematic drawings of biface uses in an ethnographic context in the Wellesley Islands of the Gulf of Carpentaria (modified after Tindale 1949). Bifaces made from cobbles and blocks of quartzitic rock were used by both men and women as 'picks' for harvesting oysters and as general purpose cutting, chopping and digging tools: (1) sharpening the tips of digging sticks which had first been fire-hardened; and, (2) digging holes in the ground for extracting yams and tubers. Scales are 30 mm.

\*Alec Rainey's paper discussing the Brunette Downs bifaces, published in *The Artefact* in 1979 (Barkly 1979), was mistakenly attributed by the editor of that journal to 'Alex Barkly'.

Rhee 1984; Norton and Bae 2009; Norton *et al.* 2006; Yoo 2008). A minority of scholars have argued that on the basis of this evidence, which was first brought to light in the mid-1950s (at Dingcun in China), the Movius Line should be rejected (Yi and Clark 1983). However, there has persisted a widespread agreement that the Movius Line *sensu lato* should be retained, as there still appears to be a significant disjunction between early hominin stone technology in eastern Asia and the pattern inferred for Africa and western Eurasia (Corvinus 2004; Dennell 2009; Lycett and Bae 2010; Norton and Bae 2009; Norton *et al.* 2006; Vishnyatsky 1999). As summarised by Lycett and Bae (2010), three key reasons for this have been postulated:

1. Bifaces are found at a relatively small number of sites east of the Movius Line, whereas they occur at many sites in Africa and western Eurasia;
2. The Asian bifaces are present in low densities in individual assemblages, which contrasts with the situation to the west of the Movius Line where they are said to dominate assemblages in large numbers; and,
3. The Asian bifaces are argued to be thicker and/or less refined than Acheulean bifaces and typically worked unifacially, suggesting that they are not true handaxes, but rather handaxe-like cores.

Concerning the first two points, it is important to emphasise that many bifaces to the east of the Movius Line are undated surface finds (e.g. Forestier *et al.* 2006; Pawlik 2009; Wang 2005) and are therefore rightfully challenged (Corvinus 2004; Keates 2002; Pope and Keates 1994; Schick 1994), despite the fact that the Movius Line was (and still is) defined on just such evidence. As Klein and Edgar (2002:129) argued, for example, 'The [Movius Line] does not depend on excavation, since in Europe and especially Africa, hand axes are often found on the surface'.

### 'Least-Effort' Stone Technologies in Southeast Asia

Only a very small number of early hominin stone assemblages have been excavated from securely dated archaeological contexts in Southeast Asia and, of these, few have been described in detail (for recent reviews see Brumm 2010; Dennell 2009; Dizon and Pawlik 2010; Marwick 2009; Moore and Brumm 2007, 2009; Reynolds 1993, 2007; Simanjuntak *et al.* 2010). Across the entire Indonesian archipelago there are only two lithic assemblages excavated from stratified deposits linked by chronological and/or contextual associations to non-modern hominins and that contain more than 500 stone artefacts, both from Flores (Mata Menge and Liang Bua) in the Lesser Sunda Islands (Brumm *et al.* 2006, 2010a; Moore and Brumm 2007, 2009; Moore *et al.* 2009). Despite this – and with some exceptions (see below) – the available data generally confirm the long-standing view that early hominin lithic assemblages in Southeast Asia are characterised by technologically simple stone reduction methods (Brumm 2010; Brumm *et al.* 2006, 2010a; Moore *in press*; Moore and Brumm 2007, 2009; Moore *et al.* 2009). Moore and Brumm (2009) argued that early Southeast Asian assemblages are largely indistinguishable from those reflecting least-effort approaches to tool manufacture elsewhere in the world (Isaac 1981:184; Shea 2006, 2010).

Least-effort stone technology, also known as 'core-and-flake technology', 'instant technology' (Shea 2006), 'smash-and-grab technology' (Dizon and Pawlik 2010) and more generally 'Mode 1' (Clark 1977), is widely argued to reflect the simplest and most versatile approach to stone reduction devised by members of the genus *Homo* (Shea 2006). It is based on the hard-hammer production of multipurpose implements from almost any locally available raw materials, regardless of quality, with little need for advance planning or significant investments of time and energy (Shea 2006). The resultant lithic assemblages typically contain few if any standardised artefact forms and are dominated by unretouched flakes and a limited range of relatively amorphous core types (i.e. choppers, discoids, core scrapers and polyhedrons).

Least-effort technologies exhibit an extremely wide geographical range and an almost continuous temporal distribution from the Late Pliocene to the recent past (Otte 2003). The earliest known manifestations are the Oldowan industries of Plio-Pleistocene Africa (ca 2.6-1.5 Ma) (Isaac 1981; Kimura 1999). However, essentially the same knapping methods appear in almost any context where expedient production of usable sharp-edged flakes is required, such as Upper Palaeolithic Spain (Davidson 1986), Late Bronze and earliest Iron Age Britain (McLaren 2011) and early- to mid-twentieth century Australia and New Guinea (Brumm and Moore 2005; Moore *in press*). It has often been argued that least-effort technologies, such as the African Oldowan, reflect relatively simple hominin cognitive capacities. But as Shea (2006:214) pointed out, 'Any set of circumstances that encourages this mode of stone-tool production (i.e. expedience, local raw material supplies, limited toolmaker skills) will create an Oldowan-like core assemblage, irrespective of age' (cf. Shea 2010). Indeed, debris from an early form of gunflint manufacture was misinterpreted by some British scholars as least-effort 'Clactonian' tools (McNabb and Ashton 1990).

Least-effort stone flaking methods frequently occur in the same assemblages as more 'complex' forms of lithic reduction (cf. Conard 2005:299; Jones 1977:192-193; Shea 2010:53). For example, it has long been recognised that Acheulean assemblages of Africa generally differ from preceding Oldowan (and Developed Oldowan) technologies in one important respect: the manufacture, in the former, of large bifaces (Clark 1994; Schick and Clark 2003). As Gowlett (1986:249-251) pointed out, 'All the major Oldowan tool characters are maintained in the Acheulian, although occurring less frequently'. Leakey (1971), following Kleindienst (1961), classed as Acheulean only those Olduvai sites in which bifaces comprised more than 40% of the total assemblage. This criterion was revised in later publications (Leakey 1975, 1994), such that any Developed Oldowan sites with bifaces (i.e. MNK and TK Lower Floor) were classified as Acheulean. Accordingly, the discovery in an assemblage previously defined as Oldowan of a *single* handaxe, cleaver, pick or other large bifacial artefact was seen as sufficient grounds to change the designation of the assemblage to that of the Acheulean. For instance, Kuman (1998:175-177) argued that 'with the discovery of such a sophisticated type, the industry must be considered ... Acheulian'. Gaillard *et al.* (2010:223) also stated that, in attributing assemblages to hominin industries, 'An isolated specimen alone may be significant only if it is a very "typical" tool. This may be the case of a well characterised cleaver or handaxe'.

### Assigning Bifaces to Industries in Southeast Asia

It is often assumed that handaxe-like bifaces are absent from surface archaeological sites in Southeast Asia; however, this is not the case (Simanjuntak *et al.* 2010). Table 1 was compiled from a selective sample of published sources and is not comprehensive. For example, it does not include articles written in languages other than English and it was not possible to consult the immense 'grey literature' of student theses, conference presentations and unpublished reports of government heritage bodies in Indonesia and neighbouring countries. In Indonesia, in particular, most professional archaeologists work either permanently or on a contract basis for national and local branches of government departments. The results of the fieldwork programmes undertaken by these local researchers (e.g. see references in Jatmiko 2001) are most often published in internal reports and other 'in-house' media, rather than international scientific journals. It was also not possible to include the many studies in which the discovery of bifaces in specific Southeast Asian localities is described, but actual numbers of artefacts recovered are not provided (e.g. Forestier *et al.* 2006).

As Table 1 shows, a relatively large number of bifaces have been reported in surface contexts across the Southeast Asian region. In particular, bifaces are abundant in various river channels and tributaries in the Baksoka drainage basin and adjacent valleys of the Punung region on the southern coast of central Java. Von Koenigswald (1936) was the first to describe artefacts from this area, reporting high densities of bifaces in a dry watercourse of the Baksoka River near the town of Pacitan (earlier Indonesian spelling, Patjitan). A number of artefact collecting expeditions were undertaken by researchers in the Punung region in the post-war period (e.g. see Bartstra 1976; van Heekeren 1972), and it is difficult to gain a reliable estimate of the total number of bifaces recovered (Simanjuntak 2004). However, von Koenigswald's remarks offer some insight into the sheer quantity of bifaces found in the region:

Patjitan has in the space of a few years produced an enormous amount of material in the shape of handaxes. We ourselves had more than fifty chestfuls in Bandung, most of which, deposited later in [Jakarta] Museum, have also unfortunately been lost. At times we found so many worked stone axes that every stone of larger proportions appeared to be an implement (von Koenigswald 1956:122).

One researcher, after revisiting von Koenigswald's (1936) collection site in 1952, commented that 'the number and quality of stone tools lying about in the Baksoka River surpassed my wildest imagination' (Marks 1982:195).

Few, if any, of the large bifaces from Southeast Asia have been recovered from stratigraphically secure contexts and so chronometric dates are not available (Simanjuntak 2004). The bifaces are typically ascribed in Indonesian chronological schemes to the pan-regional 'Pacitanian' industry (Jatmiko 2001; Simanjuntak 2004; Simanjuntak *et al.* 2010; Soejono 1961; van Heekeren 1955; von Koenigswald 1936). This industry is argued by scholars – usually those from outside the region – to be terminal Pleistocene or early Holocene in age based on Bartstra's geomorphological investigations in the Baksoka region, and thus assumed to represent a regional manifestation of the Hoabinhian

(Bartstra 1984; Keates and Bartstra 2001). The Baksoka River is an antecedent stream which appears to have existed in rudimentary form in the Early Pleistocene (Bartstra 1992). Bartstra (1976, 1978, 1984) identified the remnants of a system of fluvial terraces at heights of up to 30 m above the streambed in the upper course of the Baksoka. Subsequent excavation of six of the terraces produced *in situ* artefacts but failed to recover fossils in the uppermost terraces or chronometrically datable materials (Bartstra 1976, 1984). Following a geomorphological analysis of the surrounding landscape, Bartstra argued that the present course of the river and its current depositional pattern are probably relatively recent phenomena, dating to no older than ca 50 ka. Based on assumed rates of uplift and erosion he proposed that the elevated river terraces and the artefacts eroding from them are most likely terminal Pleistocene to early Holocene in age. Furthermore, following careful survey of the surrounding (300 km<sup>2</sup>) region, he noted that 'What is even more important is that so-called Palaeolithic types of artifacts occur in surface assemblages away from rivers' (Bartstra 1982:319). In particular, the discovery of Pacitanian artefacts in association with Neolithic materials (e.g. axe/adzes, cf. Morwood *et al.* 2008) on surface sites underlined – in Bartstra's estimation – the apparent young age of the tools (but see Simanjuntak 2004).

Importantly, many of these undated Southeast Asian bifaces are said by scholars to closely resemble Acheulean bifaces (Figure 4). Movius (1944, 1948, 1949) concluded that the specimens von Koenigswald (1936) collected near Pacitan were not true handaxes. However, Bordes (1968:81-82) argued that 'on the contrary ... [the Pacitanian industry] does contain entirely characteristic handaxes, and if they had been found in India they would unhesitatingly have been classed as Acheulean'. More recently, Simanjuntak *et al.* (2010:421) suggested that 'the Pacitan (and other Indonesian) handaxes ought to be classified as "normal" handaxes'. Keates and Bartstra (2001:26) also observed that 'most of the bifaces from Java and Sulawesi show less modification ... and symmetry [than Acheulean handaxes] ... However, one of the pointed bifaces from Java ... cannot be described other than as an Acheulean biface'. They noted that 'Some of the [Indonesian] bifaces with less elaborately worked surfaces are comparable to some [Acheulean handaxes] from ... Olduvai (East Africa) and Stellenbosch and Mossel Bay' (Keates and Bartstra 2001:27). Similarly, Bartstra (1978:33) affirmed that the Baksoka handaxes 'are very beautiful specimens. Sometimes they hardly differ from the West European bifaces'.

### Assigning Bifaces to Hominins West of the Movius Line

The above review shows that bifaces of unknown age and association are found on surface archaeological sites in Southeast Asia and many fit the classic definition of handaxes. In support of the Movius Line *sensu lato* concept, Norton and Bae (2009:333) contended that 'Only when Paleolithic archaeologists working in East Asia begin to find hundreds of sites with bifaces, and each of these sites have hundreds of typical Acheulean bifaces, will we feel a strong argument can be made to fully reject or reconfigure the Movius Line'. This assumes that the large numbers of 'typical Acheulean bifaces' from sites in Africa and western Eurasia, contrary to the situation in Southeast Asia, can be reliably linked to early hominins. This assumption may be unwarranted.

For instance, it is instructive to consider a recent edited volume devoted to Acheulean studies, *Axe Age: Acheulian Toolmaking from Quarry to Discard* (Goren-Inbar and Sharon 2006), as a general reflection of the nature and context of handaxe discoveries west of the Movius Line. There are 20 separate contributions to the volume. Of these, approximately half concern theoretical aspects of handaxe studies or regional literature reviews, while the rest are primary analyses of Acheulean assemblages. The latter describe the discovery of hundreds of Acheulean sites in Israel, India and Africa containing, in some instances, large

numbers of bifaces. However, in at least half of the cases reviewed the handaxes come from undated surface sites – sometimes containing bifaces from demonstrably younger periods – or subsurface sediments with questionable contextual integrity. We briefly examine these studies here, considering evidence from South Africa, the Near East and India, three major geographical regions in the Acheulean distribution.

Barkai *et al.* (2006), for example, described a series of Acheulean quarry complexes at limestone outcrops in northern Israel. A single handaxe and some bifacial roughouts were

**Table 1** Surface finds of large bifaces in Southeast Asia.

Region	Site	Context	Artefact Type	N	Source
Java, Indonesia	Baksoka River, Pacitan <sup>1</sup>	Surface	Handaxe Proto-handaxe <sup>2</sup>	153 195	Movius (1948:355, 1949:71)
	Baksoka River, unspecified locality	Surface	Handaxe Proto-handaxe	3 8	van Heekeren (1955:8)
	Baksoka River, unspecified locality	Surface	Handaxe Proto-handaxe	7 13	van Heekeren (1955:9)
	Tabuhan area, Sewu, Punung	Surface	Handaxe Proto-handaxe	6 8	van Heekeren (1955:10)
	Punung or Gombong	Unknown	Handaxe Proto-handaxe	16 15	Hooijer (1969:26-27)
Sumatra, Indonesia	Tambangawah, unspecified locality	Unknown	Handaxe	1	Hooijer (1969:26)
Sulawesi, Indonesia	Paroto, Walanae River	Surface	Proto-handaxe	3	Keates and Bartstra (2001)
	Walanae River	Surface	Proto-handaxe	2	Keates and Bartstra (1994)
	Talepu, Walanae Basin	Surface	Large biface	2	AB, pers. obs. 2010
Halmahera, Indonesia	Unspecified locality	Surface	Proto-handaxe	1	Keates and Bartstra (2001)
Peninsular Malaysia	Kota Tampan, Lenggong	<i>In situ</i> (?)	Handaxe <sup>3</sup>	>2	Collings (1938)
	Bukit Bunuh, Lenggong	<i>In situ</i> (indeterminate age)	Handaxe <sup>4</sup>	19	Saidin (2006)
	Kuantan, Pahang	Unknown (reputedly <i>in situ</i> )	Handaxe	~211	Collings (1937)
Burma	Irrawaddy Valley (T <sub>3</sub> gravels)	Surface	Proto-handaxe	1	Movius (1948:366)
Philippines	Cagayan Valley, Luzon	Surface	Proto-handaxe(?)	4-5	von Koenigswald (1958:69)
	Arubo 1, Luzon	Sub-surface	Proto-handaxe (bifacial) Cleaver	1 1	Pawlik (2004); Pawlik and Ronquillo (2003)
	Ille Cave, Palawan	Surface	Handaxe	1	Dizon and Pawlik (2010)
	Huluga, Mindanao Island	Surface	Handaxe-like uniface	2	Dizon and Pawlik (2010)
Vietnam	Nui Do (Mount Do), Thanh Hoa	Surface	Handaxe/biface Cleaver	7 37	Olsen and Ciochon (1990:768); Boriskovsky (1966)
	Nhan Gia, Dong Nai	Surface	Handaxe	>1	Olsen and Ciochon (1990:777)
	Dau Giay, Dong Nai	Surface	Handaxe/biface	1	Olsen and Ciochon (1990:777)
	Gia Tan, Dong Nai	Surface	Handaxe/biface	1	Olsen and Ciochon (1990:777)
	Binh Loc, Dong Nai	Surface	Handaxe/biface	1	Olsen and Ciochon (1990:777)

<sup>1</sup> von Koenigswald (1936) collection site/assemblage.

<sup>2</sup> Proto-handaxes are defined by Movius (1949:36) as large, unifacially retouched blanks (often flake blanks) with a 'crude and roughly oval or pointed' plan form and a planoconvex cross-section. They may be akin to unifacially flaked handaxes, handaxe roughouts or non-classic bifaces in European terminology.

<sup>3</sup> Harrison (1978) argued that many of the Kota Tampan artefacts recovered by Collings (1938) and, later, Walker and de Sieveking (1962), are not humanly modified (see also Majid 1990). However, Movius (1948:403) examined up to 208 artefacts collected by Collings (1938) and identified 'several' handaxes; two of these are illustrated in Collings' (1938) report, but the exact number recovered is unclear.

<sup>4</sup> Saidin (2011) recently claimed that 15 'handaxes' embedded in 1.83 Ma suevite boulders (i.e. rocks formed during meteorite impacts) were recovered from Bukit Bunuh; however, at present, no further information about this claim is available.

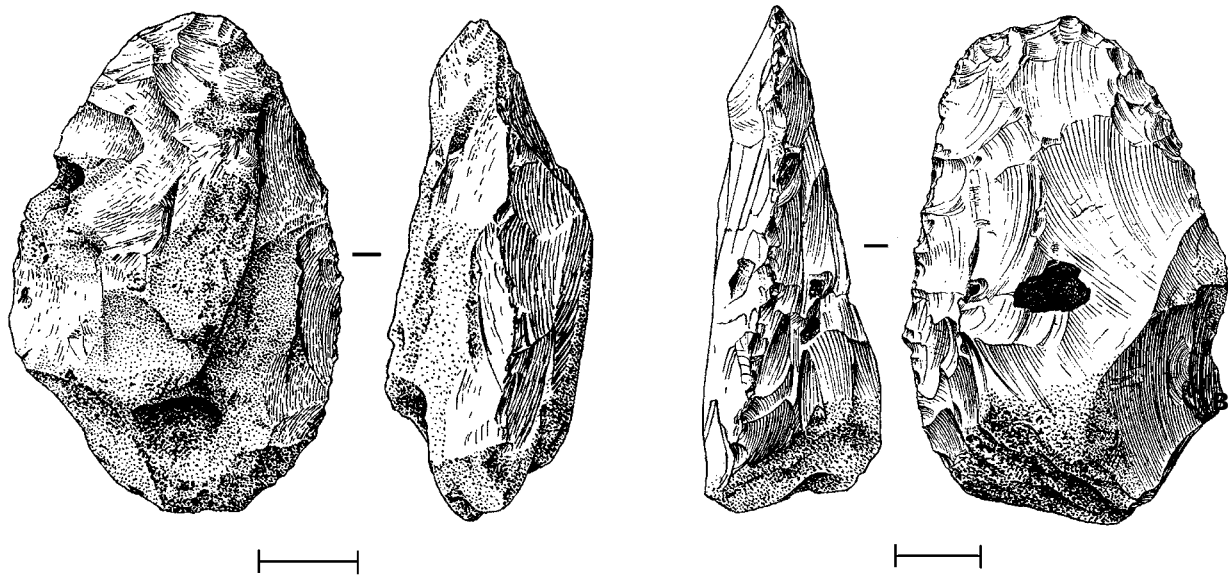


Figure 4 Pacitanian bifaces from the Baksoka River valley (after Bartstra 1976). Scales are 30 mm.

collected from exposed bedrock formations, but no handaxes were found in dated sediments (Barkai *et al.* 2006:38). The researchers affirmed that there is evidence for recent stoneworking at the sites, including, disconcertingly, 'a Neolithic bifacial tool workshop' (Barkai *et al.* 2006:25). They also noted that one of the early stage handaxes 'may be a Neolithic axe roughout' (Barkai *et al.* 2006:27). Nonetheless, they confidently stated that they can discriminate between Acheulean bifaces and modern bifaces on the basis of typology. They posited that 'The chronology [of the Acheulean quarries] derives from the lithic finds' (Barkai *et al.* 2006:38).

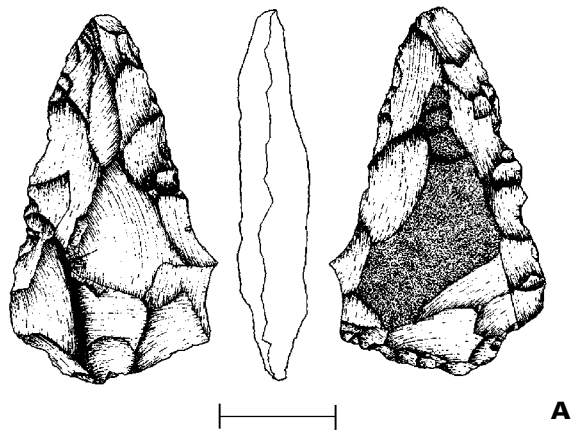
In central India, Paddayya *et al.* (2006) reported an apparent handaxe quarry at Isampur in the Hunsgi Valley and assigned more than 200 sites from the surrounding valleys to the Acheulean (Paddayya *et al.* 2006; Petraglia 2006). But as they conceded, 'At many of the sites the cultural material was found on or close to present surfaces, thereby creating a degree of uncertainty about the integrity of the sites' (Paddayya *et al.* 2006:47). Elsewhere in India, Pappu and Akhilesh's (2006:177) excavation of handaxes at Attirampakkam, Tamil Nadu, suggested that many bifaces found in surface contexts may have eroded from much younger (i.e. modern human) levels, 'and thus these [surface handaxes] must be regarded with caution'.

In the Vaal River region of South Africa, Sharon and Beaumont's (2006) analysis of the Victoria West Acheulean core technology was based on assemblages recovered from mine tailings, gravel bars and other unstratified surface contexts. Sampson (2006:75) claimed that some 300 Acheulean quarry sites have been identified at hornfels outcrops in the central plateau region of South Africa; however, all were surface finds and none have been chronometrically dated. Late Stone Age artefacts also occur at the sites. Despite this, Sampson (2006:103-104) argued that 'Acheulian quarry debris ... is readily distinguished from younger material (often mixed with it) by two simple criteria. Acheulian flakes and cores are larger and carry a very thick ... [weathering] rind'. At the type site, Smaldeel 3, bifacial handaxes or cleavers were not present, leading Sampson (2006:95

his italics) to speculate that 'it nonetheless must be Acheulian because *all* younger assemblages bear even less resemblance to Smaldeel, and they have thinner weathering rinds. Smaldeel is ... Acheulian by default'.

The *Axe Age* studies do not inspire confidence in unreflexive claims that, contrary to the situation in Southeast Asia, handaxes occur in prolific numbers at innumerable well-dated sites to the west of the Movius Line (e.g. Lycett and Bae 2010; Norton and Bae 2009; Petraglia 2006; Pope and Keates 1994). Nor are the studies published in this volume exceptional. It is our general impression that many scholars working west of the Movius Line tend to classify bifaces recovered as stray finds as Acheulean based on perceived morphological affinities alone. For example, hundreds of Acheulean sites have been reported from India, as noted by Petraglia (2006), but 'approximately two dozen have been excavated and even fewer have been dated' (Chauhan 2009:62; but see Haslam *et al.* 2011; Pappu *et al.* 2011). Dennell (2009:339) noted that 'Because current dating of the Indian Acheulean is so limited ... relative ages of Acheulean sites are often proposed on typological grounds'. Fieldwork in the Deccan region of southern India also suggests that Neolithic bifacial axe blanks are prolific as surface finds (Brumm *et al.* 2007) and are often difficult to distinguish typologically from objects classified as handaxes (Figure 5). Handaxes are differentiated from Upper Palaeolithic and Harrapan artefacts on terrace surfaces in the Sind Province of Pakistan by typology and degree of patination (Biagi and Cremaschi 1988). Similarly, handaxes have been collected in large numbers from sites in South Africa and the eastern Sahara (Egypt and Sudan), Syria, Jordan and other parts of the Arabian Peninsula, but most are from surface contexts of unknown age and association (Dennell 2009; Hill 2001; Klein 2000; Kuman *et al.* 2005; Rollefson 1984).

The same pattern occurs in other regions of the western Old World. For example, a total of nine Acheulean bifaces have been recovered from the only stratified Acheulean site in Turkey (Slimak *et al.* 2008), despite a significant number of surface finds from the region. A handful of *in situ* handaxes are known from



**Figure 5** Acheulean-like bifaces of Neolithic age, south India. The illustrated biface (A) is an early stage blank for an edge-ground axe, and the photograph (B) shows a large bifacial axe roughout (see Brumm *et al.* 2007). Both items are manufactured from dolerite and were found in the Sanganakallu-Kupgal region in the Deccan Plateau, Karnataka. Scale is 50 mm.

Greece (Gowlett 1994; Lycett and Gowlett 2008), the Balkans (Darlas and Mihailović 2006) and the Caucasus (Doronichev and Golovanova 2003). In marked contrast to the situation in Southeast Asia, Gowlett (1994:43) noted that in Greece ‘The rare finds are just enough to be useful’. In other countries, such as Iran (Biglari and Shidrang 2006), Turkmenistan (Vishnyatsky 1989), Afghanistan (Davis and Dupree 1977) and elsewhere in central Asia (Vishnyatsky 1999), Acheulean sequences are defined almost entirely from surface collections or subsurface deposits with questionable chronological integrity (see Dennell 2009 for review). Despite the paucity of well-dated bifaces, however, there is little doubt among scholars that Acheulean hominins were present in these parts of the western Old World.

## Discussion

Our brief review suggests that many (possibly most) ‘Acheulean’ bifaces in western Old World regions are found in surface contexts and so cannot be unambiguously linked to early hominins. In light of this, the assessments of some archaeologists of surface collected handaxe-like implements east of the Movius Line appear inequitable. We note, for example, that while Barkai *et al.* (2006) uncontroversially identified Acheulean bifaces among Neolithic quarrying debris at surface outcrops in Israel, the Nui Do ‘handaxes’ from Vietnam – also found in a surface context in association with Neolithic quarrying residues (Boriskovsky 1966) – are dismissed by most authorities as unground adze blanks (Olsen and Ciochon 1990:768). Clark (1998:444) also argued that the handaxe-like bifaces reported from Dingcun in northern China may be misidentified roughouts from Neolithic quarry sites. Whilst we do not challenge these interpretations, we suggest that the tacit acceptance of undated surface bifaces to the west as Acheulean and the rejection of similar bifaces to the east are at the root of the Movius Line. If the many large bifaces found in surface contexts in Southeast Asia were uncritically accepted as Acheulean handaxes, including ‘Pacitanian’ bifaces, Neolithic and early Metal phase axe/adze preforms, and Hoabinhian artefacts, then the Movius Line would disappear. The preferable course of action, however, is to omit all undated surface finds from the definition of the Movius Line.

So, are the dated Early or Middle Pleistocene sites in East and Southeast Asia ‘Acheulean’ in character? As noted, a key

criterion used by researchers in Africa and western Eurasia to identify an assemblage as Acheulean is the presence of at least one implement that fits the typological definition of an Acheulean biface. This requirement is fulfilled at multiple sites in East Asia, the best known of which occur in the Bose Basin in the Guangxi Province of southern China (Figure 1). Over 80 localities with flaked stone artefacts are recorded in the 800 km<sup>2</sup> basin along the banks of the Youjiang River, of which 20 have been excavated (Hou *et al.* 2000; Xie and Bodin 2007; Zhang *et al.* 2010). At least 15,000 artefacts have been recovered in association with a system of seven terraces of laterised fluvial deposits dissected by the east-west flowing Youjiang River. In the fourth terrace (T4), excavations into a 20–100 cm thick zone in an upper sedimentary unit of poorly developed latosols (7–10 m thick) have produced *in situ* flaked stone artefacts, including large bifaces which closely resemble handaxes (Hou *et al.* 2000; Xie and Bodin 2007). Three tektites found in the artefact bearing deposits yielded a <sup>40</sup>Ar/<sup>39</sup>Ar isochron age of 803±3 Ka (Hou *et al.* 2000). Hou *et al.* (2000) reported a total of 991 stone artefacts from their investigations, the most comprehensively described so far, of which 84% were recovered *in situ* from three excavation localities in T4, and 16% surface collected. Some 172 of these artefacts were classified as Acheulean bifaces, of which 65% are primarily reduced on one face. While Hou *et al.* (2000) plainly stated that bifaces were recovered *in situ*, it is not clear from their published data how many came from the actual excavations, an oversight recent overviews (e.g. Xie and Bodin 2007) do not help to clarify. Despite this, two bifaces classified as handaxes, and nine as picks, were recently excavated from stratified T4 deposits in association with 155 tektites at Nanbanshan in the Bose Basin (Wang *et al.* 2008). In addition, six bifaces were recovered *in situ* from a 40 m<sup>2</sup> area (Lycett and Norton 2010) in the T4 unit at Fengshudao on the northwestern edge of the Bose Basin (Xie and Bodin 2007; Zhang *et al.* 2010). Outside China, excavations at four localities in the Imjin/Hantan River Basins in the central Korean Peninsula have yielded at least one handaxe and one cleaver (and up to 56 additional bifaces) from stratified deposits with a proposed minimum age of 300–350 Ka (Norton *et al.* 2006).

Further, tools that are typologically Acheulean have been recovered from two Early or Middle Pleistocene island Southeast

Asian sites and one site associated with a non-modern hominin (Figure 1). A large fine-grained andesitic artefact identified as a cleaver was excavated from an ancient riverbank surface within the volcanic-sedimentary Kabuh series (ca 800 Ka) at Ngebung 2, Sangiran, central Java (Sémah *et al.* 1992; Simanjuntak *et al.* 2010). Excavations at Wolo Sege, an open site situated within the basal deposits of the Ola Bula Formation in the So'a Basin of central Flores, yielded three *in situ* picks dating to before 1 Ma (Brumm *et al.* 2010a, 2010b) (Figure 6A). A radial core that is typologically a handaxe was recovered in association with *Homo floresiensis* remains at Liang Bua Cave, western Flores (Moore and Brumm 2009) (Figure 6B).

## Conclusion

There is a long-standing practice in lithic studies of identifying artefacts of a particular form and technology as handaxes in certain contexts but not in others. Bifaces that occur in excavated Holocene assemblages are not classified as handaxes, even though they may fit the definition of the type, whereas typologically identical artefacts from a Pleistocene context are classified as handaxes. Further, the same artefacts might be uncontroversially classified as handaxes if recovered from the surface west of the Movius Line, but not east of the line. In practice, classifying an object as a handaxe is not based exclusively on morphological attributes inherent to the artefact, but includes the contextual attributes of age and geographical location (cf. Adams and Adams 1991). These approaches perpetuate, rather than test, the notion of a Movius Line.

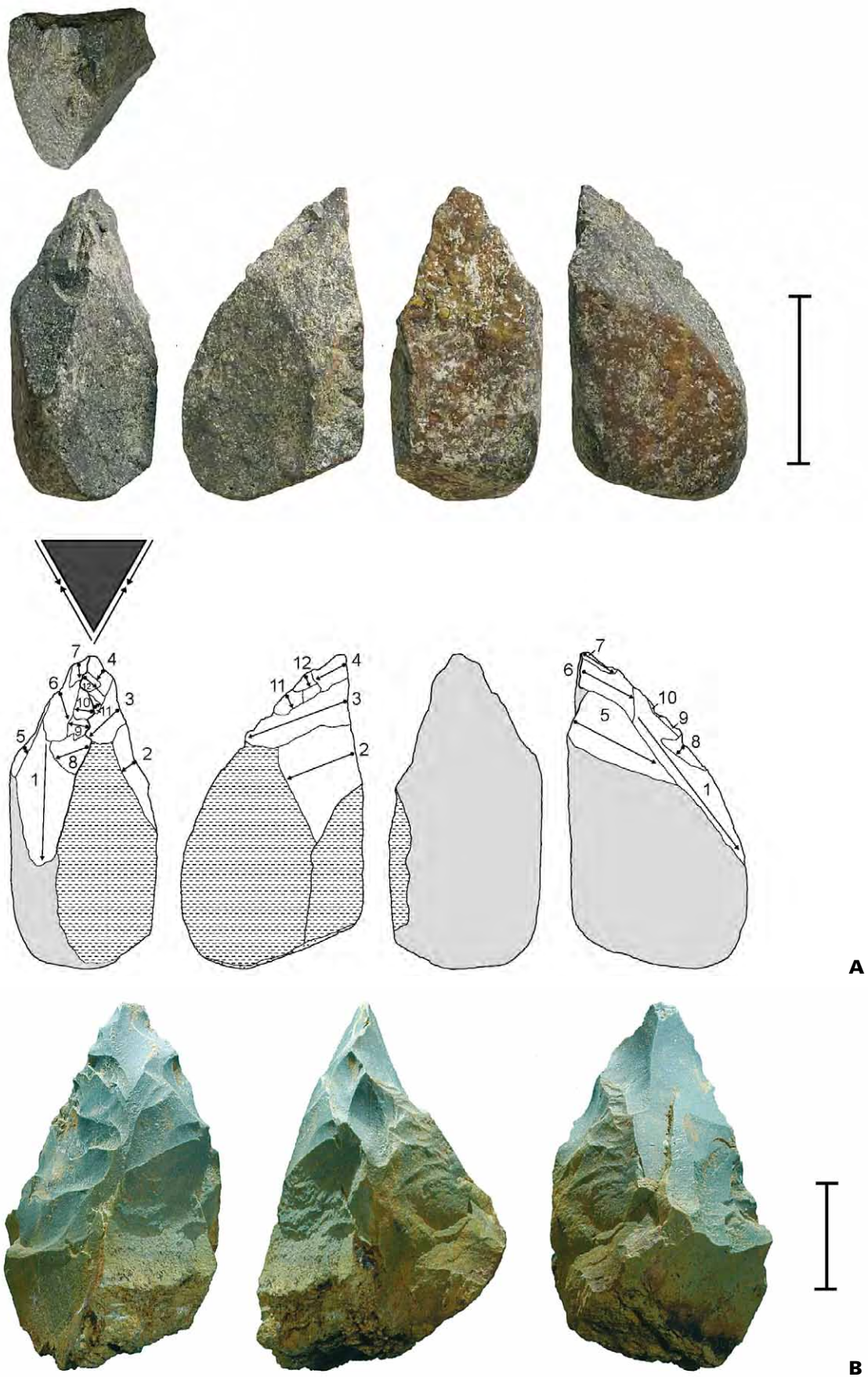
It is clear that we need new ways of analysing and interpreting variability in Palaeolithic stone assemblages on both sides of the putative Movius Line. The malleable definition of handaxes when applied to eastern Asian assemblages is especially problematic. The discovery of *H. floresiensis* on Flores (Morwood *et al.* 2004) and models that reconsider the Asian contribution to human evolution (e.g. Dennell and Roebroeks 2005; Martínón-Torres *et al.* 2007) highlight the need for a new phase of intensive archaeological and palaeoanthropological research in Southeast Asia. What is needed, in particular, is a long-term commitment to extensive systematic excavations of remnant palaeolandscapes in key areas like the Sangiran Dome and the So'a Basin, an approach that has yielded significant behavioural data in East Africa (e.g. at Olgorgesailie and Koobi Fora). These investigations will provide the opportunity to move beyond stifling paradigms based on questionable premises, to recover early hominin stone assemblages from stratified, securely dated contexts in Southeast Asia, and to approach the analysis of stone tool assemblages from a more inclusive perspective.

## Acknowledgments

Mike Morwood, Gert van den Bergh, Fachroel Aziz and Iwan Kurniawan are thanked for facilitating our research in Indonesia. Alec Rainey provided access to the Brunette Downs bifaces and information about their provenience. We are also grateful to Thomas Sutikna for fielding our queries about Indonesian bifaces. Brumm's research was supported by a postdoctoral fellowship from the Australian Research Council (ARC), and Moore's research was supported by an Australian Research Fellowship from the ARC.

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**Figure 6** Archeulean-like artefacts from hominin sites on Flores, Indonesia. A: Trihedral 'pick' from Wolo Sege in the So'a Basin, dated to before 1 Ma (scale is 100 mm). B: Bifacial radial core excavated from Late Pleistocene deposits of Liang Bua Cave in association with *Homo floresiensis* remains (see Moore *et al.* 2009) (scale is 30 mm). The schematic drawing in A shows the direction and order of flake removals on the trifacially reduced 'pick'.

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