The small and short of it: minibifaces and points from Kilombe, Kenya, and their place in the Acheulean.

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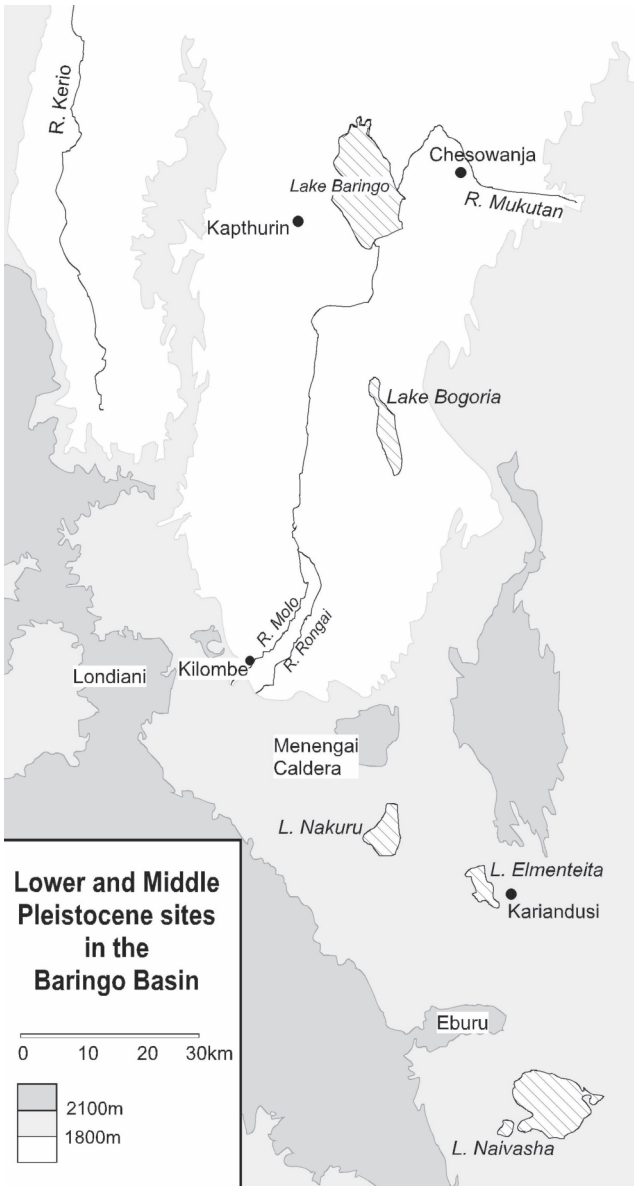

Figure 1: *The setting of Kilombe in the central Rift Valley of Kenya.*

Abstract

The earlier Acheulean is often thought of as characterized by large bifaces, but small bifaces occur in assemblages even in early phases of the tradition more than a million years ago. We discuss here the presence at Kilombe in Kenya of extremely small specimens which can be termed 'diminutive bifaces' or 'minibifaces'. The paper analyses the whole spectrum of bifaces in the site, and finds that the ultra-small specimens are the tail of the distribution, and in effect the mirror-image of the length distribution of very long bifaces. They are therefore an integral part of the assemblage, but its extreme expression. They support the idea that *Homo erectus* often made tools that morphed across categories, rather than having sharp boundaries between types, and that the species was able to focus on delicate tasks as well as heavy-duty work.

Introduction

The Acheulean tradition is the longest-lasting phenomenon of human cultural activity, enduring from about 1.75 million years to about 100,000 years ago in one form or other (Beyene *et al.* 2013; Lepre *et al.* 2011; de Lumley 2004; Haslam *et al.* 2011; Ruebens 2007; Schild and Wendorf 1977). In the last few years there has been a resurgence in Acheulean studies around the world (Goren-Inbar and Sharon 2006; Le Tensorer 2006; Lycett and Gowlett 2008; Machin 2009; Sharon 2007; de la Torre 2016). Current studies tend to divide into two kinds - those that are concerned with the nature of cultural transmission, using 'the handaxe' as example in issues such as fidelity of copying (e.g. papers in Mesoudi and Aoki 2015); and those that emphasise technology and cultural variation as shown on the ground in archaeology, often also drawing out themes of theoretical interest (Isaac 1977; Goren-Inbar *et al.* 2015; Le Tensorer 2006; Le Tensorer *et al.* 2011). These approaches are to some extent bridged by experimental studies concerned with form and function (e.g. Key and Lycett 2011; Key *et al.* 2016).

Size range of tools is an aspect of the evidence sometimes overlooked. In this paper, we focus on exploring data from the site complex of Kilombe in Kenya which highlights the role that small bifaces play in the Acheulean from an early date. In general such small specimens are under-recognized and under-studied, although they are recorded here and there in the literature (e.g. Leakey 1971: 189, at Olduvai Gorge TK, where they are described as 'diminutive').

Historically, textbooks have tended to single out the large iconic handaxe of the classic Acheulean as a single phenomenon, later to be replaced by new categories of small tools in the Middle Palaeolithic, alongside some remaining smaller bifaces. Variation in size and form internal to sites is important, however, because it relates to the practicalities of using tools, and questions about task that were carried out. As tools were intended for performing functions, it is a significant consideration that a tool 5cm long has very different capabilities from one 25cm long.

Certainly, a peculiar point about the first million years at least of the Acheulean tradition is that the makers appear to have invested very little in the design form of tools other than the handaxes. Almost all their 'formal' efforts went into various forms of the bifaces themselves. The few other categories in classic Acheulean typology, discussed in detail by Isaac (1977), are often less well standardised than the bifaces, and are generally regarded as 'casual', except in having well-defined size ranges.

Larger bifaces seize attention because they are conspicuous. In this paper we redress the balance through focussing on a series of questions:

1. Are small bifaces regularly part of the early Acheulean (as well as later times)?
2. Where preent do they form a group distinct from other bifaces?
3. Are they more or less uniform in design than other parts of the biface spectrum?
4. Do they appear in particular contexts in a site complex?
5. Are they linked with the eventual appearance of hand points?
6. Do they provide us with useful information about the capabilities of and tasks undertaken by Homo erectus (much the strongest candidate to be their maker at this time)?

Acheulean context

East Africa presents the oldest evidence for the Acheulean, especially from the Rift Valley sites of Konso Gardula and West Turkana in Kenya (Beyene *et al.* 2013, 2015; Lepre *et al.* 2011), and from Olduvai Gorge and Peninj in Tanzania (Diez-Martin *et al.* 2015; de la Torre *et al.* 2008; de la Torre and Mora 2014). As these sites are distributed along a 1000 km length of the Rift Valley, it seems likely that the Acheulean became a regional phenomenon from an early date. If we add in the appearances at Wonderwerk Cave in South Africa and Ubeidiya in Israel, around 1.5 million or somewhat later, it can be suggested that handaxes had become a significant part of Early Stone Age assemblages well before 1 million years ago (Chazan *et al.* 2008; Bar-Yosef and Goren-Inbar 1993 Pickering 2015). In most cases the numbers of bifacial tools in these assemblages are relatively small, but the measurements by Mary Leakey (1971, p. 189) from sites such as TK in Upper Bed II make clear that some of them already include small specimens.

Acheulean sites in the range of 1.5-1.0 Ma remain relatively rare (Gadeb dates to ca. 1.2-1.5 Ma: Clark 1980), but at 1.0 Ma there appears a very well-dated time line represented by Kilombe, Kariandusi, Olorgesailie, Isinya and possibly Olduvai Bed IV (Gowlett 1978, 2005; Gowlett *et al.* 2015; Durkee and Brown 2014; Shipton 2011; Roche *et al.* 1988). These sites coincide with a period of high lake stands noted by Trauth *et al.* (2005), and which has been argued to coincide with a a significant phase for human evolution and climate change (Maslin *et al.* 2014).

The Kilombe Acheulean Site Complex

The Kilombe site complex lies on the extreme south-eastern flank of the extinct Kilombe volcano, around 10 km south of the Equator (Fig. 1), and has an age of around 1 million years as judged from the palaeomagnetic record (Herries *et al.* 2011; Gowlett *et al.* 2015: a series of Argon-Argon dates is to be published). In this area there is no major rift wall, but the volcano stands on the western shoulder of the rift, on earlier grid faulting which led to the major outpourings of lava in the Plio-Pleistocene (Bishop 1978; Jones and Lippard 1979; McCall 1964). The Kilombe mountain rises to around 2400 metres, some 700m higher than the Molo river which flows around its southern margin. The sites lie in an especially favourable position, probably always at an ecotone between the plains of the Rift Valley floor, and the mountains on the western side. The main localities lie on the eastern side of a spur which juts south-east from the mountain, at around 1820 m.

Our recent research has extended to exploring other areas around the volcano, leading to discovery of further ESA and MSA sites (Gowlett *et al.* 2015). The mountain is composed of trachyte lava, but on the southern side of its cone the spur running south-east at around 1900 metres is composed of trachyphonolite; another fine-grained lava. Both rocks were used for making artefacts. In the local sequence the trachyphonolite is overlain by several metres of red and brown clays. At their top is an ancient land surface. The main site occupies a broad shallow drainageway running across this. A pause in deposition is certainly represented, but clays and weathered tuffs accumulated again to a depth of about 1.5 metres before a series of volcanic eruptions laid down the 3-banded tuff which forms a prominent marker across the area. Deposition of tuffs, clays and silts then resumed until at least half a million years ago.

The setting of the main site (GqJh1) site was a shallow depression, perhaps sometimes swampy. Small streams descended from the eastern side of the trachyphonolite spur, but around the site their flow was impeded on a small apron of underlying lava. The main site is close to the interfluve about halfway between the River Molo and the short Kibberenge stream which runs parallel with it to the north, and so always had access to water, as also suggested by hippopotamus remains from the clays. Later pyroclastic sediments obscure part of the area, but they have eroded away in places to reveal parts of the original stream courses.

The Kilombe Bifaces

The Kilombe main site surface is unusual in preserving large numbers of bifaces scattered across a surface at least 200 metres across. The numbers certainly originally ran into thousands, and excavation showed that they often occur in densities of 2-8 per sq. metre (Gowlett 1978, 2005). In some areas they can be seen to coincide with a visible interface between the brown clays and overlying sediments; elsewhere, especially near sandy runnels, they appear to occur here and there through a greater thickness of clay sediment, up to about 50 cm.

In recent investigations, two small localities have been explored at levels above the 3-banded tuff. They have ages roughly calculated of 0.9 Ma (KW) and 0.8 Ma (KNE). In any event, they demonstrably postdate the main site by the accumulation of several metres of tuffaceous sediment. The interesting point is that their bifaces resemble the main accumulations in general size and form (Tab. 1).

	Length	Breadth	Thickness	B/L	T/B	BA/BB	Mean Wt
Kilombe, all (N=670)	146 ± 31	87 ± 17	42 ± 10	0.60 ± 0.07	0.49 ± 0.11	0.79 ± 0.20	468
GqJh3 KW (N= 16)	141 ± 22	78 ± 12	39 ± 8	0.56 ± 0.06	0.50 ± 0.09	0.93 ± 0.24	344
GqJh2 KNE (N= 14)	132 ± 42	80 ± 20	44 ± 11	0.62 ± 0.08	0.55 ± 0.10	0.73 ± 0.14	422

Table 1: *Main dimensions of bifaces from the Kilombe main horizon (GqJh1), and two higher level localities, GqJh3 KW, and GqJh2 NE. B/L = Breadth/Length; T/B = Thickness/Breadth; (BA/BB is the plan pointedness ratio of Isaac (1977): BA = width 0.8 L from butt; BB = width 0.2 L from butt). L, B and T: figures are mean and standard deviation in mm.*

These similarities suggest that either a local cultural tradition was maintained over a long period; or/and local ecological needs and raw materials encouraged the production of a similar output.

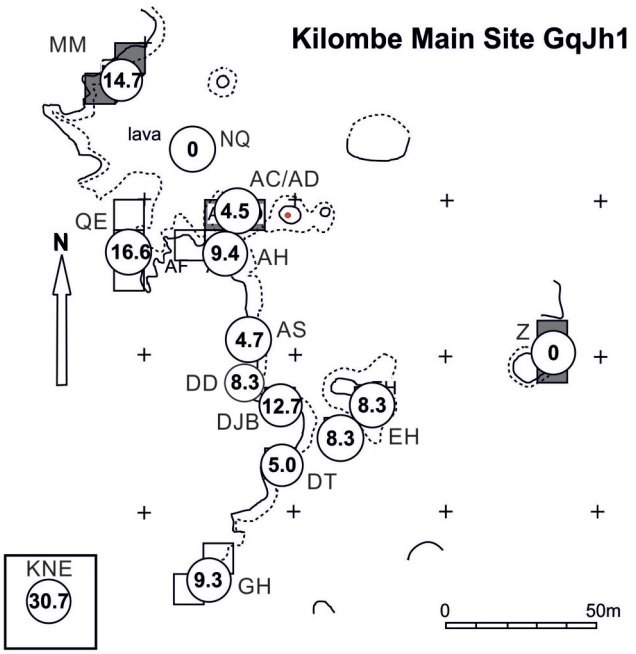

Figure 2: *Distributions of artefacts on the main horizon at Kilombe GqJh1, showing proportions of small bifaces.*

The length distribution of bifaces

The approximately 700 bifaces of Kilombe form very close to a normal distribution in length (Fig.3). The mean is slightly under 150 mm, and the standard deviation around 30 mm. New samples collected over the years have done little to affect this pattern. This size range is classic for the African Acheulean. The mean length at Olorgesailie is slightly longer at 170 mm, but the Meng, TrTr10 and H/9A sites there are all within 10 mm of the Kilombe mean (Isaac 1977). About half of 18 assemblages from Olduvai are also of closely similar length (Roe 1994, Table 8.2).

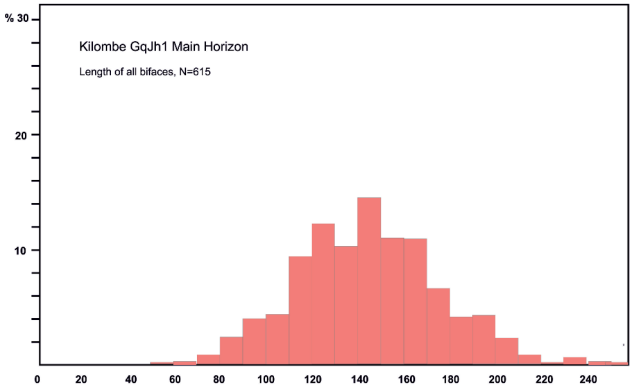

Figure 3: *The length distribution of all bifaces at Kilombe (calculated before additional specimens were found).*

From an early stage, however, it was noted that there were some very small bifaces at Kilombe (Fig. 4). A metrical study considered especially the issue of small vs large bifaces and its relationship with the Developed Oldowan problem (Gowlett 1988). A multivariate analysis using Wishart's Mode analysis picked out modes of larger and smaller bifaces on the site, with similar patterns in two areas. The larger had means of 163 and 154 mm; the smaller had means of 108 and 88 mm. The conclusion was drawn that Kilombe may include both the large Acheulean and small Developed Oldowan B modes that Mary Leakey (1971) recognized at Olduvai.

Subsequently we have made discoveries of more small - indeed even smaller bifaces - at Kilombe, and also of flake tools that can be described as points.

Here we attempt to determine how systematically the small bifaces occur, and as what proportion of the assemblage. One first test is to look at the overall length distribution: as previously observed (Gowlett 2005), this distribution of bifaces is extremely symmetrical, and remains so with the addition of new samples. For comparisons, selecting bifaces shorter or longer than 2 standard deviations from the mean yields few specimens (as would be expected), but selecting all those beyond 1.5 sd produces 52 small bifaces of less than 100 mm in length, matched by 53 long ones, above 193 mm in length (Tab. 2). This simple finding indicates that the small bifaces occur as frequently as extremely long ones, in a similar scatter along a linear scale.

Comparison of the small and long sets picks out a major shape shift, as first shown by Crompton and Gowlett (1993). The small bifaces are much broader, relatively, than longer ones; they are also considerably thicker, and rather more pointed. In both of the major form-defining ratios, B/L and T/B they are nearly twice as variable as the very long specimens. The difference in mean weight - about 150g vs 1000g - brings out the real difference between small and large in terms of the work needed to wield the tools, and the work that they can perform.

In 2015 several specimens were found which are even smaller than nearly all previous discoveries (Tab. 4; Fig. 5). The first is within the range of previous finds, but the other two are distinctly smaller. They seem to be made preferentially on trachyte, rather than the trachyphonolite which is the local bedrock, implying that their material, or the tools, has been imported from 2-3 km away.

They raise the question of whether such specimens, which are evidently rare, occur equally in all parts of the Kilombe main surface. None of the extremely small specimens was found within the excavations of EH and AH areas, although these contain 8-9 % of bifaces that are smaller than 100 mm in length. A plot of the surface, and tabulation (Table 4) suggest that moderately small bifaces are fairly evenly distributed.

Other possible insights come from the younger levels above the 3-banded tuff (the Farmhouse Cliff sediments: Gowlett *et al.* 2015). The GqJh2 NE locality, estimated to date to ~800,000, contains 4 small out of 13 specimens. Two moderately small bifaces were also found isolated above the 3-banded tuff, one in an area south of the main site, the other about 500 m west at Gq Jh3 (Fig. 6). They are ca. 90 mm and 80 mm long respectively. These finds may suggest that such handaxes in size range 80-100 mm long had particular uses for individual tasks carried out away from main site areas. One or two weathered obsidian handaxes at Kilombe, which presumably were carried for considerable distances, are of a similar size.

The extremely small 'diminutive' handaxes are much rarer at Kilombe - but there is still evidence that they came from various parts of the site. A trachyphonolite specimen from Area GH at the south of the site is probably unfinished: the maker did not complete trimming of the butt area (Fig. 6). The useful information is that, probably unlike the trachyte specimens, this one would have been made on site.

	Length	Breadth	Thickness	B/L	T/B	BA/BB	Mean Wt
Kilombe, all N=670	146 ± 31	87 ±17	42 ±10	0.60 ± 0.07	0.49 ± 0.11	0.79 ± 0.20	468
Long set N=53	207	112	52	0.54 ± 0.05	0.46 ± 0.08	0.81 ± 0.16	990
Small set N=52	89	60	30	0.68 ± 0.10	0.51 ± 0.13	0.74 ±0.15	149

Table 2: *Dimensions of Kilombe bifaces more than1.5 standard deviations from the mean in Length: the small set vs the long set.*

2015	Length	Breadth	Thickness	B/L	T/B	Wt
DD12	74	38	14	0.51	0.37	50
MM34	60	36	15	0.60	0.42	40
North of site	55	42	15	0.76	0.36	30

Table 3: *Dimensions of three very small bifaces found in 2015.*

Locality	Specimens <= 70mm L	Specimens <= 100mm L out of total bifaces	All small specimens % of total bifaces
EH/EHS	3	13/156	8.3
AC/AD	1	6/133	4.5
AH	0	5/53	9.4
AS	0	1/21	4.7
DD	0	1/12	8.3
DT	0	1/20	5.0
DJB	1	7/55	12.7
GH	2	5/54	9.3
QEJO	1	3/18	16.6
AA	0	1	(single)
AN	1	1	(single)
MM	0	5/34	14.7
NQ	0	0/20	0
Z	0	0/18	0
KNE	0	4/13	30.7

Table 4: *Proportions of small bifaces found in different parts of the Kilombe main site.*

Figure 4: *Example of a small handaxe from Kilombe, seen in comparison with a small biface from Olduvai TK Upper (centre), and a flake 'awl' from the same site (right). Olduvai drawings by Mary Leakey, courtesy Cambridge University Press. Scale 5 cm.*

Figure 5: *Three small bifaces from Kilombe main horizon: top and bottom specimens are of trachyte, the centre one possibly trachyphonolite. Scale 3 cm.*

Figure 6: *Three small handaxes from Kilombe. Left, from Area AG; centre, from above the 3-banded tuff in GqJh1 south; right, seemingly unfinished specimen main site Area GH. Scale 5 cm.*

Figure 7: *Two flake points of trachyphonolite from Kilombe main horizon. The ventral face of the right hand specimen is largely unworked. Scale 5 cm.*

The presence of flake points

A particularly interesting discovery is the presence of flake points, not hitherto known at Kilombe (Fig. 7). Two of these are shown, one from Area AG in the north of the site, the other from the Area of DD close to AS, which is also unusual for having particularly elongate bifaces (Gowlett 2013). In each case, the use of a small flake blank and the working to a point; are clear. They are not, however, bifaces although there is some element of working from both faces. Neither specimen is trimmed around the butt.

Are these anomalies, or are they part of a widespread, but rare phenomenon in the early Acheulean? There are some other indications in the Acheulean that a toolform can be 'established', but occur very occasionally on our sites - for example steep sided heavy duty scrapers, found at Karari, E. Turkana, and occurring very rarely at both Kilombe and Kariandusi (Isaac *et al.* 1997; Gowlett 1978; Gowlett and Crompton 1994). The occurrence of points on other sites is discussed further below.

Discussion

This study, prompted by individual discoveries at Kilombe, as well as metrical analyses, encourages a broader reconsideration of the artefact classes involved. The early Acheulean is often regarded by textbook writers - and specialists in later archaeology or other disciplines - as being essentially unimodal in its output. The handaxes are everything. In fact this is far from the case, and the reality was recognized in the major studies of East African Acheulean site complexes such as Olorgesailie, Kalambo Falls and Olduvai Gorge (Isaac 1977; Clark 2001; Leakey 1971; Roe 1994), and is also implicit in European typologies (e.g. Debénath and Dibble 1993). Amongst the variability - of picks, cleavers, scrapers, and other tools - it is plain that small bifaces were not only present, but were sometimes dominant.

The typologies of Kleindienst (1962) and Leakey (1971) drew up a number of tool classes. Newer approaches in archaeology led to an erosion of faith in such categories, but recent studies in animal tool-use are good evidence that there can be a variety of

distinct forms and functions even in simple toolsets (Boesch *et al.* 2009; Sanz and Morgan 2009; Whiten *et al.* 1999). If this is so for chimpanzees, and also capuchin monkeys and corvids, it can be so in early hominins.

In the case of the early Acheulean, much of the complexity is embedded in earlier archaeological literature. Entire sets of small handaxes are recorded from some sites, showing that they could make effective toolkits in their own right. Olorgesailie I3 (66 bifaces, mean length 104 mm); Olduvai PDK (17 bifaces, mean length 72 mm), Olduvai BK (62 bifaces, mean length 79 mm) are good examples.

The site of TK Upper in Upper Bed 2 at Olduvai is especially helpful for making comparisons. It had 24 bifaces, of which Mary Leakey gave individual measurements for the 18 complete specimens (1971, p. 189). Compared with Kilombe in Thickness/Breadth, TKU is far more consistent. The Olduvai measurements have a correlation of 0.832, compared with far lower 0.266 for T/B among the Kilombe small specimens (Significance, P=0.001 and 0.061 respectively). The Kilombe small bifaces are more varied in form.

Small flake tools are also represented at TK Upper: Mary Leakey described 15 'awls' on flakes. Awls appear in her typology, but points do not. The awls are made of quartz or quartzite, and the pointed tip was commonly made by notching on each side of it, giving a bi-concave outline. Most specimens could, however, be described as points (see Fig 3., right), and Leakey suggests that sometimes the points were broken off in the performance of tasks.

Points appear commonly in the later Acheulean, and their appearance in early Levallois forms as long ago as 400,000-500,000 years ago is of topical interest in Africa (Johnson & McBrearty 2010; Sisk and Shea 2011; Tryon 2006; Wilkins and Chazan 2012). The evidence from Kilombe, tantalising on its own, combined with Olduvai is strongly suggestive that hand points had a long history within the early Acheulean, even a million or more years ago.

When Glynn Isaac first studied bifaces from Olorgesailie, he came to the conclusion that previous workers, in Europe and Africa, had used many subcategories which could not be strictly justified - typologists used them for defining forms, but there was little evidence that they were separate categories in the eyes of the makers. Apart from the obvious distinction of cleavers, he resorted to metrical analysis, abandoning terms such as 'ovate' and 'pointed' (Isaac 1977). It is possible that we have gone too far in deconstructing classic typologies, but in this there may be an aspect of the emic and etic in anthropology. It is not good to impose untested archaeological categories from the outside: rather, we should search for those used by the early humans themselves (an emic classification) - but as long as used pragmatically some of the subdivisions can be useful. If they appeared on European sites, some of the early African forms might well be described as leaf-points or handpoints (cf Bosinksi 1967; Debénath and Dibble 1993). A provisional category of points, as a subject for testing, would be useful throughout the African Acheulean, not least because of their possible relevance to the eventual emergence of hafting (Barham 2013).

Conclusions

Although Acheulean toolmakers invested most of their formal design efforts into handaxes and allied forms for a very long period, their output was not unimodal. The questions posed initially in this paper can be answered as follows:

Are small bifaces regularly part of the early Acheulean? Yes, they are: both within the same series of bifaces that have a longer mean length, and in some cases as complete assemblages with means less than 100 mm.

Where present, do they form a group distinct from other bifaces? This tends not to be the case. Small bifaces do not include cleavers, but otherwise they appear to be part of a graded series of bifaces. For example, at Kilombe, in length, there are just 4 specimens less than 70 mm long, 7 in the 70-80 mm range, 15 in the 80-90 mm range, and 22 specimens in the 90 mm.

Are they more or less uniform in design than other parts of the biface spectrum? In general these bifaces appear to be 'stubby': that is they are relatively broader and thicker than most of the longer bifaces. But in these characters they fit within the expected profile of allometry studies at Kilombe (Crompton & Gowlett 1993).

Do they appear in particular contexts in a site complex? At Kilombe they appear to occur in most areas and assemblages. The very smallest specimens are so rare that they only occur here and there, but nevertheless in at least three zones of the site.

Are they linked with the eventual appearance of handpoints? This is a question for further study, but the present of point-like objects which are not bifaces is incontestable both at Kilombe and Olduvai.

Do they provide us with useful information about the capabilities of Homo erectus? Homo erectus is

by far the strongest candidate to be the toolmaker. There is a wide interest in the practical and cognitive abilities of this hominin (Le Tensorer 2006; Gowlett 2011; Wynn 1995, 2002). The small bifaces and 'minibifaces' at Kilombe confirm that hominins were able to pay special attention to very small objects, and hence to focus on delicate tasks. This indicates that they could switch from their most common output to making unusually small (or sometimes large) variants when the task demanded it. Yet this adjustment resembles more the moving of a modern dimmer switch than the throwing of a classic light switch. This is an idea for further testing: perhaps *Homo erectus* worked with somewhat more adjustable and less sharply defined categories than modern humans, but it is also the case that some rules in biface production, such as the proportion of breadth/length were quite sharply defined.

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