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Regional Comparison of the Shapes of Later Acheulean Handaxes

This article documents an unexpected regional difference in the shapes of later Acheulean handaxes. Almost 1,200 handaxes from 17 sites located in Europe, East Africa, India, and the Near East were measured using a polar coordinate technique and compared using discriminant analysis and analysis of variance. One group of handaxes, those from Israel, clearly stood apart. The reasons for this distinction are unclear but may relate to raw material, time, or, perhaps, cultural tradition.

THIS ARTICLE ADDRESSES THE QUESTION of whether or not there were significant regional differences in the shapes of later Acheulean handaxes. Standard textbook knowledge informs us that the Acheulean was remarkably the same throughout its geographic distribution (see Tattersall, Delson, and van Couvering 1988). For example, African handaxes are supposed to be very similar to European and Indian handaxes. It is also well known that handaxes come in a variety of shapes. However, there seemed to be no clear correlation between the various shapes and the geographic regions in which they were found, giving the Acheulean a markedly monotonous flavor.

Geographic variation is a characteristic of modern material culture. Its absence in the Acheulean would constitute a dramatic contrast, the understanding of which would be important to the understanding of human cultural evolution. Unfortunately, the few rigorous studies of handaxe variation have all been on a regional level. Isaac (1977) observed that East African sites often present a considerable range of handaxe shapes but that, when several sites were compared, there was no clear directional tendency in time or space. Roe (1968), on the other hand, documented a time trend in the shapes of English handaxes. But neither addressed the larger issue of interregional differences. To our knowledge no one has undertaken a single study that measures and analyzes handaxes from the several regions of the Old World in which they are found.

We approached this study with the intention of documenting the homogeneity of handaxe shape. We expected to be unable to identify any significant geographic trend in the shapes of handaxes. As it turns out, at least one significant pattern did emerge.

Our sample includes handaxes from four regions: Europe, the Near East, East Africa, and India.

The Sample

We chose the sample of sites and artifacts in order to address the question of regional homogeneity. This required selecting a large and diverse sample from each of the regions. Of the thousands of handaxes in museum drawers, very few have been excavated from anything approaching good archeological context. Had we measured only these, we would have risked mistaking idiosyncratic or local group differences for geographic dif-

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ferences. For example, the English site of Hoxne has yielded thousands of bifaces, but if we limit ourselves to artifacts excavated from a single well-defined archeological level we would have a sample of perhaps 7 (Wymer 1983). If we then compared these 7 handaxes to the 31 handaxes from the Indian site of Hunsgi, the differences that emerged could be due to any number of factors. By selecting relatively large samples from several sites in each region, the differences that emerge, if any, should in fact reflect the differences in geography.

Very few of the sites are in excellent context. Indeed, only the Indian site of Bhimbetka is from a rock-shelter. All of the other sites have been subjected to disturbances of one sort or another. In order to maintain some standardization in site selection, we tried to select sites where sorting appears to have been minimal and which appear not to mix several aggregates. Some sites are clearly better than others in this regard. Of the 17 sites used in this study, 9 have been excavated to one degree or another. In the few cases where the excavated samples were relatively large, like Bhimbetka, we used only these. In several cases, such as Maᶜayan Barukh, we augmented the excavated sample with surface artifacts. For some of the unexcavated sites (Furze Platt is a good example) the collections included thousands of bifaces. In these cases we measured the first 100 bifaces we found. While not a random sample, this technique is no more selective than the vagaries of geological preservation to which all of the sites were subjected to one degree or another.

Chronology is probably the most serious difficulty with the sample. Only two of the sites, Olorgesailie and Isimila, have chronometric dates, and even these dates have large possible ranges. The other sites have been dated by means of geologic context or assemblage typology, a notoriously coarse and occasionally circular technique. When we originally selected the assemblages to be measured, Olorgesailie was generally considered to date to about 400,000 years ago, making it our earliest sample. Recent redating suggests that 700,000 may be more accurate (Gowlett 1987). This earlier date exacerbates the estimated age differences between the African group and the other regions, making interpretation even more difficult. Nevertheless, we are confident that all of our sample falls toward the end of the one million plus span documented for biface industries and can be considered "late" or "upper" Acheulean.

The sample consists of handaxes from 17 sites (see Table 1). We measured cleavers as well, but do not include them in the current analysis. Brief site descriptions can be found in the Appendix.

Technique

We used a system of polar coordinates to measure the plan shape of the handaxes (Figure 1). We measured along each of 22 rays from the midpoint of the long axis to the periphery. Because previous work (Wynn and Staley 1979) had indicated that a system of 12 equidistant rays was insufficient to discriminate consistently between handaxes and cleavers, we used a system that concentrates measurements around the tip of the handaxes.

When measuring a biface, we first drew the outline of the artifact and then used an overlay to make the actual polar coordinate measurements. We established several conventions in order to maintain consistency. For cleavers, we defined the long axis as running from the midpoint of the bit to the furthest point on the butt. For asymmetrical artifacts (indeed, most bifaces are at least slightly asymmetrical) we always placed the narrower side to the right. On broken bifaces we estimated missing values, whenever this could be reasonably done.

The more common technique for measuring biface shape uses measurements such as length, breadth, thickness, and various indices combining measurements (see Roe 1968, for the most thorough account of this technique). The polar coordinate technique has two advantages over this "index" technique—it is quicker and it is better at measuring asymmetry. It also *appears* to make fewer assumptions about relevant variables, although this

Table 1
Sites used in this study, and number of bifaces from each site.

Site	Total handaxes		Completely trimmed handaxes
Olorgesailie	116		71
Isimila	49		—[a]
Kariandusi	84		47
Lewa	25		16
Bhimbetka	45		15
Hunsgi	31		11
Chirki	29		12
Maᶜayan Barukh	140		87
Evron Zinat	155		101
Kissufim	100		48
Furze Platt	93		26
Stoke Newington	75		25
Swanscombe	70		39
Fordwich	42		18
Corfe Mullen	46		34
Elveden	35		29
Santon Downham	43		32
Total	1,178	*Total*	611

[a]Not recorded.

is difficult to assess (for example, centering the artifact is certainly an arbitrary step). Using an overlay, one can record the coordinate values rapidly, with no need of determining "point of maximum breadth" or "breadth at one-fifth of maximum length." The index technique masks asymmetry—indeed, the technique assumes symmetry, thus eliminating a potential source of difference between assemblages. The polar coordinate technique has disadvantages as well. For example, it can miss the point of maximum breadth and it does not include information about thickness. For this study, we feel that the advantages of the polar coordinate technique outweigh the disadvantages.

All of the measurements were made by Wynn, with the exception of two of the Isimila assemblages, which were measured by P. Staley of the University of Illinois.

Statistical Methods

Because size differences can often obscure shape differences among groups, we first used SPSS-X program FACTOR (SPSS^x, release 2.1 for VAX/VMS) to perform a principal components analysis of all handaxes in the four geographic areas (Africa, England, India, and Israel) uncorrected for size. After orthogonal rotation to simple structure (using VARIMAX rotation), the contribution of size to the first component was clearly seen. We then corrected for size by using the simple technique of proportionalizing all variables—dividing each polar coordinate measurement by the length of the artifact. Another principal components analysis was then completed on the size-corrected artifacts to delineate the major components of artifact variability (in other words, to show the major areas of shape differences).

Because we had defined our four samples (geographical areas) *a priori,* we used a stepwise discriminant technique (SPSS-X, program DISCRIMINANT) to test the hypothesis that there were no differences in shape among the four groups.

Since the results of multivariate techniques like stepwise discriminant analysis are often difficult to interpret, we also used a one-way analysis of variance technique (using

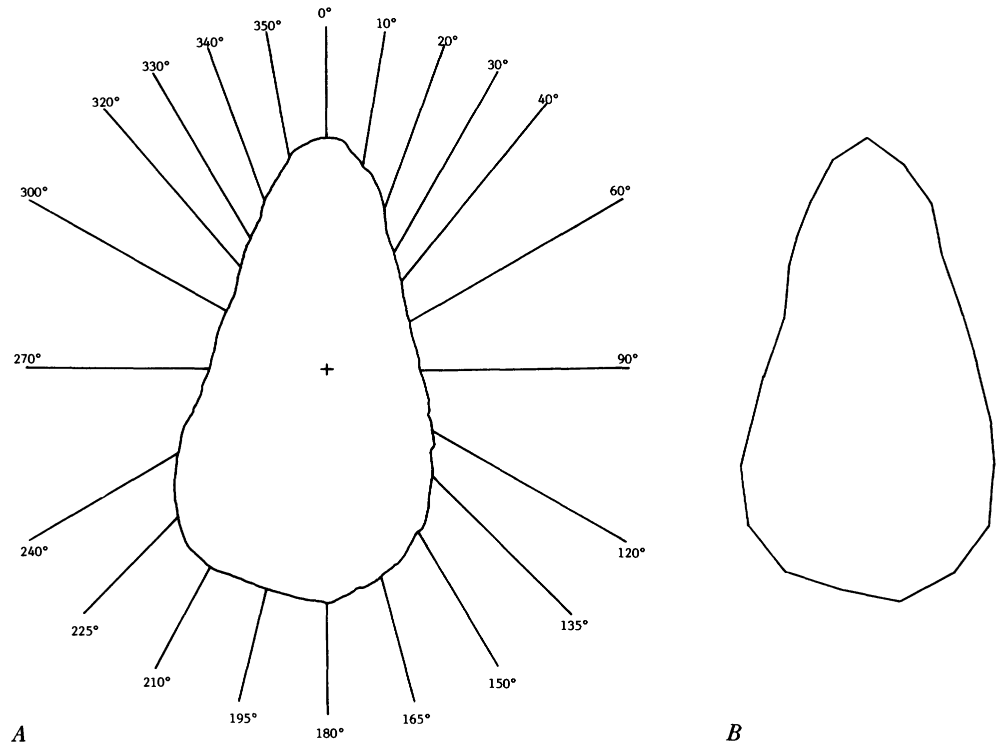

Figure 1
***A*. Outline of a handaxe showing centering (midpoint of long axis) and the arrangement of polar rays used to measure plan shape. *B*. Outline of the same handaxe generated from the measurements taken along the rays.**

SPSS-X program ONEWAY) to test for equality of group means for each polar coordinate variable separately among the four groups. While the inflation of α levels with large numbers of univariate statistical tests is well known, the results of the one-way ANOVAs do help to corroborate the results of the discriminant analyses, and also help to isolate the areas of the artifacts where most of the shape differences occur.

Results

In order to demonstrate the effect of size alone in problems dealing with among-group shape differences of lithic artifacts, we performed a principal components analysis of all handaxes (all four geographic areas grouped together), using VARIMAX rotation to simple structure. We used SPSS-X program FACTOR to perform this analysis. Two components with eigenvalues greater than 1.0 were extracted, and it was clear that both components were related to size, since the component loadings over all variables were similar (for example, the lowest loading was still greater than 0.3). Together, the two components extracted accounted for 89.6% of the variance, with the first principal component alone accounting for 83.1% of the total variance.

Having again demonstrated the problem of using raw data in the analysis of among-group variation, we next corrected for size differences among all artifacts. As previously mentioned, we accomplished this size correction by using the simple technique of dividing each polar coordinate measurement by the length of the artifact. All of the measurements produced by this technique are proportional to length.

We analyzed the size-corrected data by performing another principal components analysis with VARIMAX rotation to simple structure using SPSS-X program FACTOR. Table 2 presents the results of this analysis. Four principal components associated with eigenvalues greater than 1.0 were extracted. Together, they accounted for 84.3% of the variance in artifact measurements, with the first component alone accounting for 54.7% of the variance. From the rotated component loadings matrix reported in Table 2, we clearly see that, once the effects of size are removed, it is relatively easy to assign names to the four components that were extracted. For instance, the first component is a measure of shape differences along the left side of the artifact, while the second component (accounting for 15.6% of the variance) is related to differences at the tip. Component 3 (accounting for 9.0% of the variance) is a measure of lower right side differences, while component 4 (accounting for 5.0% of the total variance) is a measure of butt differences.

We then hypothesized that there were no differences in artifact shape among these four samples from different geographic areas. Since our criterion variable (dependent variable) was qualitative (geographic area), a discriminant analysis technique appeared to be the most appropriate approach—even recognizing the particular requirements and assumptions of the technique (for example, you should not have more independent variables than either groups or specimens within groups, and the technique assumes equality of group covariance matrices). However, the technique of discriminant analysis is known to be extremely robust both to inequality of group covariance matrices and to violations of other assumptions (Tatsuoka 1970). In addition, the technique has been used previously to process polar coordinate data—as in the use of stereoplotter-obtained polar coordinate measurements of hominoid brain endocasts to predict taxonomic assignment (Holloway 1981).

Table 2
Rotated component matrix for size-corrected polar coordinate measurements displaying component loadings on the four principal components extracted with eigenvalues greater than 1.0.[a] All handaxes are considered ($N = 1,178$).

Variable	Component 1	Component 2	Component 3	Component 4
V 10		0.8338		
V 20		0.8128		
V 30		0.7507		
V 40		0.6712	0.5591	
V 60		0.5506	0.6481	
V 90			0.7331	
V120			0.8081	
V135			0.8149	
V150			0.7386	0.5459
V165			0.5474	0.5610
V195				0.8387
V210				0.8191
V225	0.7033			0.5697
V240	0.8542			
V270	0.8714			
V300	0.8161			
V320	0.7495	0.5618		
V330	0.6888	0.6131		
V340	0.5766	0.6898		
V350		0.7477		

[a]In order to enhance interpretation, we have arbitrarily shown only loadings greater than 0.5. By far, the majority of the loadings not shown here are closer to 0.0 than to 0.5.

To test our hypothesis of homogeneity of shape across geographic area, we used a stepwise discriminant analysis, SPSS-X program DISCRIMINANT, with the group membership of each artifact established *a priori*. Actually, two analyses were completed—one for handaxes that were completely trimmed (including the butt), and one for all handaxes, including ones that were not completely trimmed.

Table 3 presents the results of the discriminant analysis for all size-corrected handaxes, including ones not completely trimmed ($N = 1{,}178$). The variables used to construct the discriminant function are largely left and right side variables, with a few tip measurements also included. The between-groups F-ratios reported in the accompanying matrix are all significant at the $p < 0.001$ level—attesting to significant shape differences among all four groups. However, the classification matrix shows that there are larger differences between some groups than others—which shows up by misclassification of artifacts. The discriminant function derived in this analysis best predicts African and Israeli artifact membership, and the overall classification rate of correctly classified artifacts is 42.4%.

When only completely trimmed artifacts are considered ($N = 611$), the classification rate increases to 46.3% correctly classified (see Table 4). Again, groups are significantly different at the $p < 0.001$ level (except as noted in Table 4), but the proportion of artifacts correctly classified is still rather low. Artifacts from Africa and Israel again have the highest rates of correct classification. The variables used to construct this discriminant function are quite similar to the previous analysis dealing with all handaxes, completely trimmed or not.

Another method for considering differences among groups is analysis of variance. Table 5 presents the results of 20 separate one-way analysis of variance analyses in an at-

Table 3

Results of discriminant analysis on size-corrected handaxes (including incompletely trimmed handaxes) by four geographic areas ($N = 1{,}178$).

Actual group (no. of cases)	Predicted group membership[a]			
	Africa	India	Israel	England
Africa (274)	159 (58.0%)	38 (13.9%)	45 (16.4%)	32 (11.7%)
India (105)	34 (32.4%)	20 (19.0%)	42 (40.0%)	9 (8.6%)
Israel (395)	48 (12.2%)	51 (12.9%)	270 (68.4%)	26 (6.6%)
England (404)	198 (49.0%)	53 (13.1%)	102 (25.2%)	51 (12.6%)

Variables used to construct classification table (in order of importance):

V270
V135
V225
V120
V340
V 30
V320
V350
V240
V 90
V 10

Matrix of F*-ratios related to differences between groups (all significant at* $p < 0.001$, $df = 11$ *&* $1{,}164$*)*

	Africa	India	Israel
India	3.56		
Israel	25.01	5.80	
England	9.08	6.59	26.34

[a]Percent of cases correctly classified = 42.4%.

Table 4
Results of discriminant analysis on size-corrected handaxes that were completely trimmed (including butts) by four geographic areas ($N = 611$).

Actual group (no. of cases)	Predicted group membership[a]			
	Africa	India	Israel	England
Africa (134)	82 (61.2%)	15 (11.2%)	24 (17.9%)	13 (9.7%)
India (38)	14 (36.8%)	11 (28.9%)	12 (31.6%)	1 (2.6%)
Israel (236)	29 (12.3%)	19 (8.1%)	172 (72.9%)	16 (6.8%)
England (203)	92 (45.3%)	26 (12.8%)	67 (33.0%)	18 (8.9%)

Variables used to construct classification table (in order of importance):

V240
V135
V 30
V120
V225
V 10
V340
V 90
V270
V320
V350
V210

Matrix of F*-ratios related to differences between groups (significance as noted, df = 12 & 596)*

	Africa	India	Israel
India	2.07[1]		
Israel	15.86	3.80	
England	6.20	2.70[2]	10.77

Note: All significant at $p < 0.001$, except 1) $p = 0.017$, and 2) $p = 0.0015$.

[a]Percent of cases correctly classified = 46.3%.

tempt both to corroborate the results obtained by the use of discriminant analysis, and to display exactly where the differences occur. Table 5 shows which variables were significantly different at the $\alpha = 0.05$ level between the groups shown. We see here that most of the variables are significantly different between Africa and Israel, and between England and Israel.

Conclusion

Our analysis suggests that handaxe shape did, in fact, vary according to geography, at least during the later Acheulean. There do appear to have been differences in the modal shapes produced in different regions.

The ANOVA results consistently yielded three groupings of sites: a "narrow" group consisting of English and one African site (Lewa, which is a very selected sample); a "wide" group consisting of the Israeli sites along with one English and one Indian site; and a "normal" group consisting of the remainder—mostly African. While these groups do not show exclusive geographic membership, there is a very clear tendency for Israeli, African, and English sites to differ from one another.

The most striking evidence comes from the Israeli handaxes. Even when our entire four-region sample of completely trimmed handaxes is included in a discriminant function analysis, 73% of the Israeli handaxes are classified correctly. When only Israeli and African handaxes are considered together, 78% are correctly classified. In the ANOVA results, the three Israeli sites consistently fall together at the "wide" end of the range of

Table 5
Summary table of multiple one-way analysis of variance analyses showing which variables were significantly different ($\alpha = 0.05$, using Student-Newman-Keuls *a posteriori* test) between groups.[a]

	Africa	India	Israel	England
Africa		V10, V20, V30, V40, V60, V90, V120, V135, V150, V165, V210, V225, V240, V270, V300, V320, V330, V340, V350	V10, V20, V30, V40, V60, V90, V120, V135, V150, V165, V195, V210, V225, V240, V270, V300, V320, V330, V340, V350	V120, V135, V150, V165, V195, V210, V225, V270, V350
India	V20, V30, V40, V60, V120, V135, V150, V240, V270, V330, V340		V60, V90, V120, V135, V150, V165, V195, V210, V225, V240, V270, V300, V320, V330, V350	V10, V20, V30, V40, V60, V90, V120, V240, V270, V300, V320, V330, V340
Israel	V10, V20, V30, V40, V60, V90, V120, V135, V150, V165, V195, V210, V225, V240, V270, V300, V320, V330, V340, V350	V90, V120, V135, V150, V195, V210, V225, V240, V270, V300		V10, V20, V30, V40, V60, V90, V120, V135, V150, V165, V195, V210, V225, V240, V270, V300, V320, V330, V340, V350
England	V120, V135, V150, V165, V195, V210, V225, V350	V20, V30, V40, V60, V270, V300, V330	V10, V20, V30, V40, V60, V90, V120, V135, V150, V165, V195, V210, V225, V240, V270, V300, V320, V330, V340, V350	

[a]Values above diagonal are for all handaxes ($N = 1{,}178$), while values below diagonal are for completely trimmed handaxes only ($N = 611$).

variability for each variable and show a consistent significant difference compared to other regions. The Israeli handaxes clearly stand apart.

The other regions are not as clearly distinct. In the four-region discriminant function analysis, 61% of the African handaxes are correctly classified—a respectable success rate, although not as impressive as for Israel. India and England do "poorly," with only 29% and 9% of the trimmed handaxes classified correctly. Almost half of the English handaxes are classified as African. The results from analysis of variance may give us a clue here. One group of English sites falls consistently in the "narrow" range of the variables, indicating a predominance of narrow shapes. The other group of English sites is less consistent, but includes sites that often have "wide" values. A discriminant function analysis run on just English sites corroborates the existence of these groups, which, not surprisingly, are the same as those identified by Roe 20 years ago. It may be that lumping both into one "English" sample creates a completely artificial English mode that does not discriminate well. India, unfortunately, succumbs to no such special pleading. For whatever reason, the Indian handaxes do not stand apart.

Discussion

There are several possible explanations for the regional distinctions that we have identified. We will briefly discuss just three: raw material, time, and cultural tradition.

At the outset we would like to discuss activity as a possible cause of the differences. Given what little archeologists know about the function of bifaces (see Keeley 1980, for example) it seems unlikely that the mechanical tasks performed in Israel differed significantly from those performed in Africa. No one has ever made a convincing argument that mechanical function is responsible for the general shape of the biface, let alone the differences in shape.

Jones (1981) has demonstrated, persuasively we think, that raw material does constrain the form of bifaces. Our results corroborate his conclusion. When we ran a discriminant function analysis on the Kariandusi handaxes, it was able to classify 75% of the cases correctly according to raw material (lava or obsidian). The flaking properties and the general properties of the blank apparently affected the outcome. Alternatively, perhaps the knappers selected specific raw materials for specific shapes—a possibility we find less likely. But raw material alone cannot account for all the variation that we see, and it certainly does not account for the regional trends. The Israeli sample is a case in point. Wide forms predominate in all three sites, yet the raw materials are different—a fine tabular flint at Maʿayan Barukh, and flint pebbles at Evron and Kissufim. In the analysis of variance, all three sets of handaxes cluster at the "wide" end of the variable values. A mirror argument can be made for England, where nodular flint was the norm, but where handaxes fall into two distinct groups. In sum, raw material is a confounding factor, but not a determining factor.

It may be impossible to eliminate time as a possible explanatory factor. Even if we could place all of the sites with certainty within 10,000 years of each other—a clear impossibility—we could not eliminate the possibility of change over time. Indeed, Roe (1981) has identified relative age as the most reasonable explanation for the two English groups—"narrow" assemblages were earlier than "wide." Unfortunately, the relative dating of all 17 sites is impossible. They have all been described as "late" Acheulean, but could still span a period of several hundred thousand years. The best dated are the East African sites (which are between 700,000 and 200,000 years old) and the English sites (which are probably between 300,000 and 200,000 years old, based on correlations to sea core chronology). The position in time of the Israeli and Indian sites is even less certain. Indeed, typology of assemblages is the major chronological consideration! It is possible that all of the Israeli sites are very late and all of the African sites very early, and that this accounts for the distinctive difference.

The third possibility is that there was a cultural difference in the sense of a difference in the learned standards of acceptable shapes. The Israeli Acheulean hominids used a model shape that they learned every generation by observation or instruction. English hominids learned a slightly different standard, and so on. This is not the place to discuss the knotty problem of style and its implications for culture. However, the presence of geographically distinct styles is characteristic of modern culture and its absence has occasionally been used to argue for the primitiveness of Acheulean culture. The existence of regional traditions at the end of the Acheulean, however subtle these differences seem, is therefore of relevance to any discussion of cultural evolution.

The information that we have about the sites in the sample does not allow us to choose between the latter two interpretations. Given the large time range, conservatism might well argue for the chronological explanation. Nevertheless, the result was not what we had anticipated. A regional pattern did emerge, and even if it turns out to reflect a chronological change, this pattern suggests that the Acheulean was not as homogeneous as some have argued.

Appendix

The African Sites

Kariandusi (Leakey 1931) is located in the Rift Valley in Kenya between lakes Naivasha and Nakuru. The site was excavated by Louis Leakey in the 1920s and consists of an "upper site"and a "lower site." Leakey excavated two series of bifaces from the upper site, an obsidian series and a lava series. The upper site is in secondary context, but the artifacts appear not to have been much moved. The age of the site is unknown.

Olorgesailie (Isaac 1977; Gowlett 1987) is located in the Rift Valley in southern Kenya. It consists of a number of occupation horizons, most of which were associated with streambed deposits. Most of the artifacts had been disturbed by stream action but their condition and variety of size suggest that movement was minimal. The bifaces were all made on lava. For this analysis we used bifaces from the main site at DE/89 (horizon C) and also H/6. Recent potassium argon determinations indicate that these horizons date to about 700,000 years.

Isimila is an extensive Acheulean site located in the Central Highlands of Tanzania, near Iringa (Cole and Kleindienst 1974; Hansen and Keller 1971; Howell, Cole, and Kleindienst 1962; McBrearty 1978). It consists of several occupation surfaces stratified in fluvial deposits that fill a shallow basin. Howell, Cole, and Kleindienst excavated at the site in 1957–59, and Keller and Hansen excavated in 1969–71. The excavated samples appear to have been in good context. We used only bifaces from excavated components in our analysis. The bifaces are of quartz, quartzite, and a fine-grained granite. Radiometric dates on bone fragments have yielded a date of between 330,000 and 170,000 years.

The *Lewa* bifaces are a selected, surface sample. We included them because of their extreme "refinement." Lewa is a surface locality, so far undescribed, that lies to the north of Mount Kenya.

The English Sites

We measured bifaces from seven of the sites used by Roe in his studies of the English Acheulean (1968, 1981). Rather than review the arguments for internal chronology, which are rather involved and on too fine a level of analysis for our purposes, we refer readers to Roe's fine summary (1981). Suffice it to say that all of the sites are in fluvial or lake deposits, most of the artifacts had been moved by water action to one degree or another, and few are from controlled excavations. Roe considers six of the sites to be Middle Acheulean and to date from Hoxnian interglacial times through, perhaps, Ipswichian times. One site, Fordwich, appears to be earlier and Roe considers it to be early Acheulean. We chose at least one site from each of Roe's biface groups (1981) except group III, which had only one site. All of the bifaces in our sample were made on flint nodules. The sites are: *Corfe Mullen, Elveden, Fordwich, Furze Platt, Santon Downham, Stoke Newington,* and *Swanscombe Middle Gravels.*

The Indian Sites

Chirki (Corvinus 1970; Misra 1978) is the most problematic of the Indian sites; indeed it may be the most problematic of our entire sample. The collection consists of artifacts excavated from a colluvial "rubble boulder horizon." There is a relatively low percentage of small flakes and, even though many of the tools appear unrolled, there seems to have been considerable sorting. The bifaces were made on pebbles of fine-grained dolerite, which has suffered considerably from the ravages of time. Many are disintegrating. The site is of unknown age.

The *Bhimbetka* bifaces were excavated from one of a series of rock-shelters. The Acheulean layers of the shelter yielded a rich collection of artifacts that included a wide range of tool types. Sidescrapers are the most numerous type. Most of the bifaces were made on quartzite flakes. The site is not securely dated, but based on typological grounds—the sidescrapers in particular—Misra (1978) assigns it to the "terminal phase" of the Acheulean.

The *Hunsgi* collection was excavated from trial trenches in two adjacent localities. The context is little disturbed and, indeed, one locality appears to include a living floor with a possible structure. The bifaces were made on flakes of silicious limestone. The site is undated, but, based on typology, Paddayya (1977, 1982) considered it to be earlier than Bhimbetka.

The Israeli Sites

There are three localities at *Evron* (Gilead and Ronen 1977), but we used only the collection from one of these, Evron Zinat. The prehistoric occupation appears to have been along the margins of a shallow lake or swamp. Most of the artifacts are unabraded; certainly all that we measured are unabraded. The collection consists of bifaces and flake tools. About one-third of the latter are Levallois flakes. Flint pebbles are the most common raw material. There is no firm independent dating for the Zinat aggregate. Based on typology, it appears to be Upper Acheulean.

The *Kissufim* aggregate (Ronen et al. 1972) is a surface collection. The artifacts have been collected from very consistent contexts along the banks of a wadi in Kibbutz Kissufim. All appear to derive from a single reddish-brown loam that is stratified below a calcareous sandstone and a loess. The collection includes both bifaces and flake tools, all of which show the same degree of patination and few signs of abrasion. Flint pebbles are the prevailing raw material. There is no firm independent indication of age. Based on typology and a relatively high Levallois index, Ronen attributes the Kissufim collection to the Upper Acheulean.

Maʿayan Barukh (Stekelis and Gilead 1966; Ronen et al. 1980) is an open site that has yielded an impressive collection of artifacts. Ronen et al. excavated some of the artifacts from two trenches but the majority have been collected and stored by Amnon Assaf, who is curator of the Regional Prehistoric Museum of the Huleh Valley. All of the artifacts derive from the same *terra rossa* soil. Assaf's collection consists of over 8,000 artifacts, two-thirds of which are completely unabraded. A fine eocene flint is the raw material. Sometimes the blanks are tabular, other times pebbles. Levallois is common among the flake tools.

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