HANDAXE ASSEMBLAGES FROM THE GUNJANA VALLEY, ANDHRA PRADESH: A METRICAL ANALYSIS

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Prehistoric research in India over the last hundred years has produced rich evidence of Stone Age human occupation in varied topographical and ecological settings. Notable regions with Lower Palaeolithic sites include the Thar Desert (Misra et al. 1982; Gaillard et al. 1983, 1985, n.d.), Central India (Misra et al. 1977; Joshi 1978), Saurashtra (Marathe 1981), Maharashtra (Corvinus 1973), Karnataka (Paddayya 1982), and Andhra Pradesh (Murty 1966; Rao 1966; Rao 1979; Reddy 1968; Raju 1981, 1983, n.d.). However, although scores of Acheulian sites have so far been documented (Sankalia 1974; Misra and Bellwood 1985), objective quantitative comparisons of lithic assemblages have been few (Joshi and Marathe 1985; Semans 1981; Raju 1981; Rao 1979; Reddy 1976; Gaillard et al. n.d.). In this paper, I present a study of handaxe assemblages from four surface Acheulian occupation sites in the Gunjana valley, Andhra Pradesh.

THE GUNJANA VALLEY AND ITS ACHEULIAN SITES

The Gunjana River, a tributary of the Cheyyeru, originates in the Seshachalam reserved forest at an altitude of 1052 m. The region has a tropical dry deciduous vegetation cover which includes woodland and savanna in the higher ranges, and savanna, degraded savanna, and thorny scrub thickets on the plains. It is a semi-arid region, with both southwest and northeast monsoons contributing to a mean annual rainfall of about 700 mm, and it is also a favoured habitat of fisher-hunter-gatherers who exploit a variety of riverine resources, small game, avifauna, and many plant foods.

The Gunjana valley is also rich in Stone Age cultural remains (Raju 1981, 1983, n.d.). I have discovered 9 Acheulian sites so far (see Fig. 1), and have collected artefacts from seven of them. Handaxes are the predominant tools throughout, followed by scrapers, flakes and cleavers.

In qualitative terms the majority of the artefacts are characterised by small and shallow flake scars, symmetrical outlines, thin cross-sections and even surfaces, all suggesting use of the cylindrical hammer technique. Most of the handaxes are made on fine grained quartzite and have shallow and tiny trimming scars, sharp and straight profiles, and biconvex or lenticular cross-sections (Fig. 2). The assemblages are broadly homogenous in the physical conditions of the artefacts, their sizes, raw materials, techniques of manufacture, and typology. These similarities suggest that all belong to a single cultural tradition.

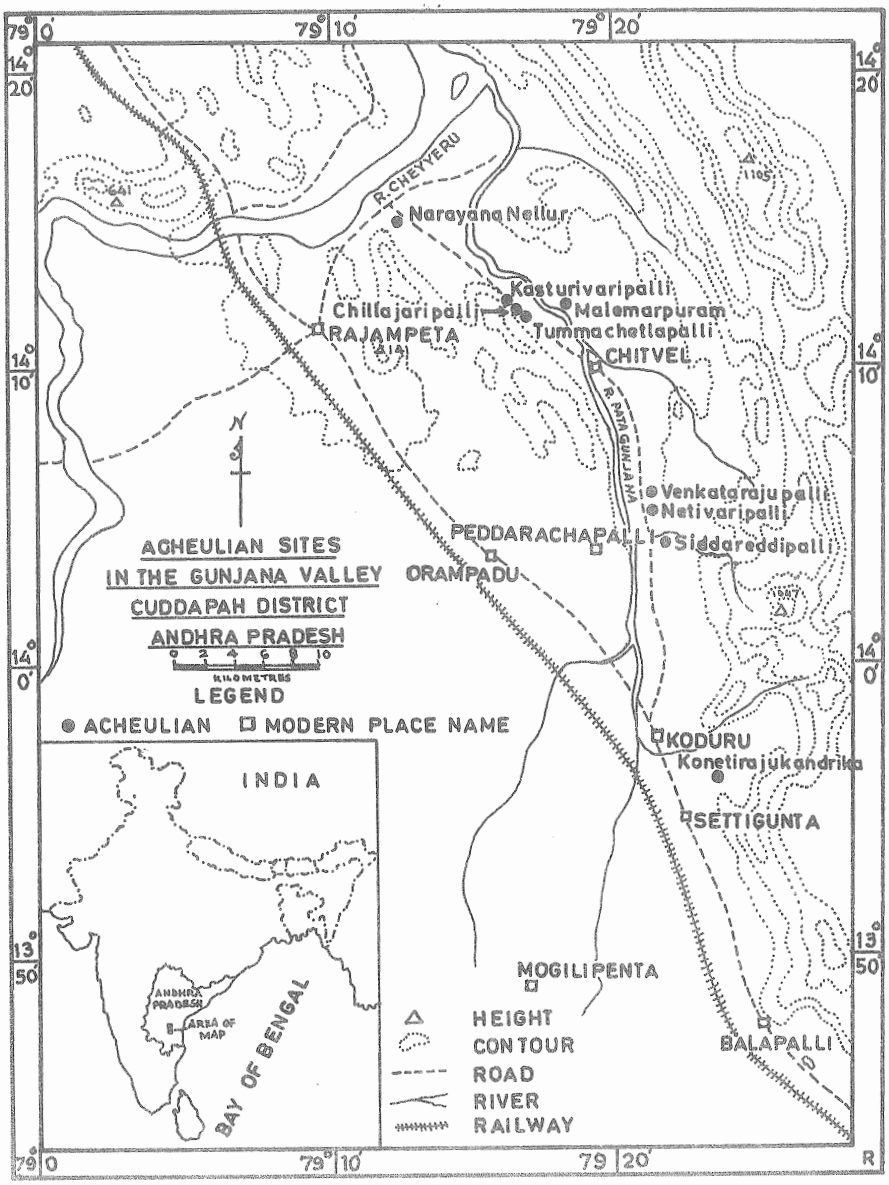

Figure 1. Acheulian sites in the Gunjana Valley, Andhra Pradesh.

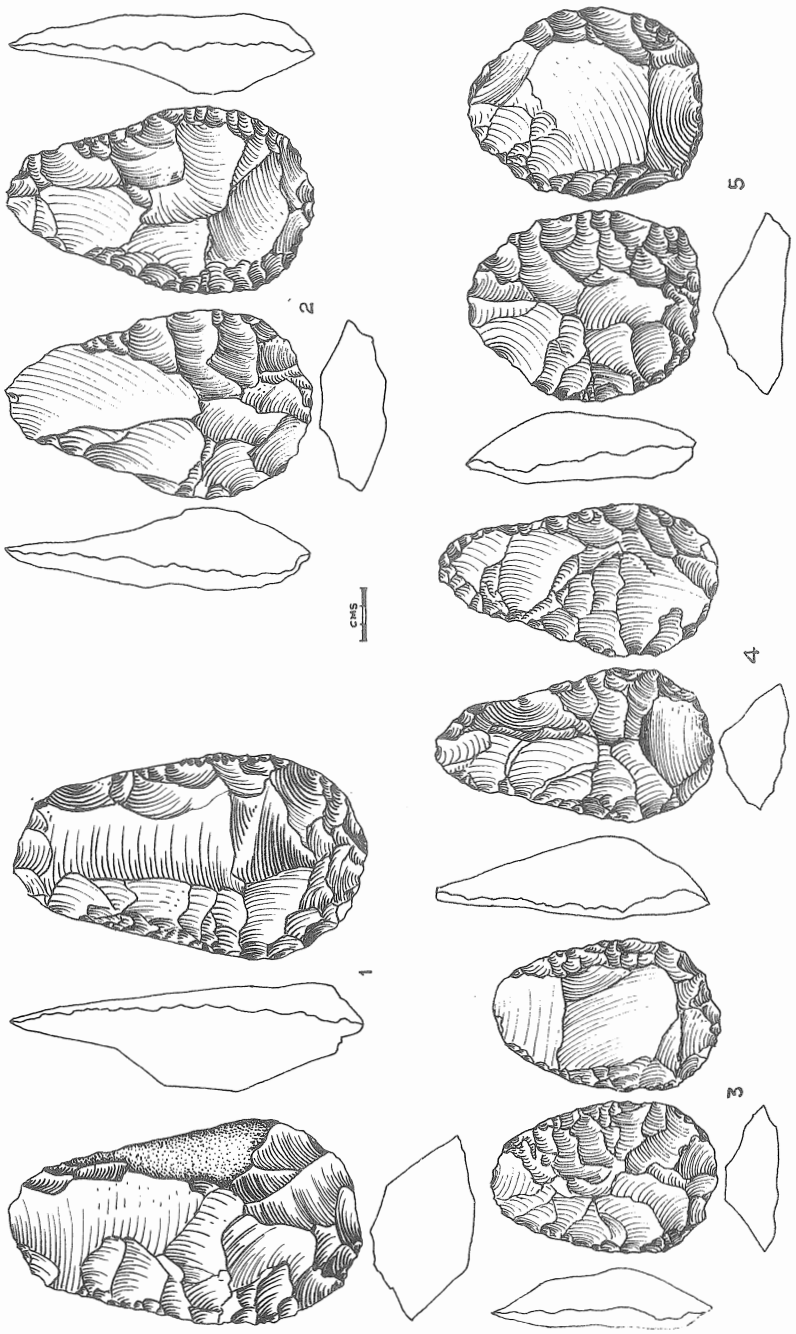

Figure 2. Handaxes (all ovates) from the Gunjana Valley.

	NVP		VRP		TCP		NNR	
	No.	%	No.	%	No.	%	No.	%
Handaxes	78	48.15	66	55.46	55	75.34	38	80.85
Cleavers	12	7.14	8	6.72	6	8.22	2	4.26
Choppers	7	4.32	3	2.52	2	2.74	-	-
Knives	9	5.56	8	6.72	1	1.37	-	-
Discoids	11	6.79	6	5.04	1	1.37	-	-
Scrapers	23	14.20	19	15.97	-	-	-	-
Flakes	15	9.26	6	5.04	8	10.96	7	14.89
Points	5	3.09	-	-	-	-	-	-
Miscell-aneous	2	1.13	3	3.52	-	-	-	-
Totals	162	100.01	119	99.99	73	100.00	47	100.00

Table 1. Artefact categories from Acheulian sites.

NVP = NETIVARIPALLI; VRP = VENKATARAJUPALLI; TCP = TUMMACHETLAPALLI; NNR = NARAYANA NELLORE.

Table 1 lists the stone tools recovered from the four richest sites: Netivaripalli (NVP), Venkatarajupalli (VRP), Tummachetlapalli (TPC), and Narayana Nellore (NNR). Netivaripalli lies about 1 km from the right bank of the main channel of the Gunjana River, and comprises a diffuse occupation scatter covering a total area of approximately 1 km^2, within which artefacts occur at restricted spots along the margins of runnels, mostly on patches of red sandy loam. Venkatarajupalli has a similar topographical and ecological setting.

Tummachetlapalli lies about 1 km west of the left bank of the main channel of the Gunjana, and the artefacts here are exposed on rock benches along small ephemeral streams. They are fresh and relatively undisturbed. The site extends over an area of about 500 x 200 m in a typical thorny thicket vegetation zone. Narayana Nellore is situated 1.5 km southeast of the Cheyyeru River and 4 km west of the Gunjana, and extends over an area of 600 x 200 m. Fresh artefacts are scattered widely on a red loam surface.

METRICAL ANALYSIS

Following the work of D.A. Roe (1976) on the large cutting tools from Kalambo Falls, 237 handaxes from the four sites described above were subjected to metrical analysis. The following measurements were taken for each handaxe (Fig. 3, here reproduced on page 26):

1. Weight in grams (W)
2. Maximum length in millimetres from butt to apex in the long axis (L).
3. Maximum breadth in millimetres taken perpendicular to the long axis (B)
4. Maximum thickness in millimetres (Th)
5. Thickness of tip in millimetres at a point one fifth of the length from the tip end (T_1)
6. Breadth in millimetres at a point one fifth of the length from the tip end (B_1)
7. Breadth in millimetres at a point one fifth of the length from the butt end (B_2)
8. Distance in millimetres from the butt end to the point of maximum breadth in the long axis (L_1)

From these basic measurements, the following indices were calculated; thickness over breadth (Th/B); T_1 over length (T_1/L); breadth over length (B/L); B_1 over B_2; and L_1 over L.

Handaxe sizes

The frequency distributions of weight and length are considered as basic data concerning implement sizes; the longer and heavier an implement, the greater its size. Comparison of the Gunjana industry with that of Chirki-Nevasa in Maharashtra shows that mean lengths and weights vary considerably.

	NVP(n=78)	VRP(n=66)	TCP(n=55)	NNR(n=38)	Pooled(N=237)
W	267.9±142.1 (53.0)	289.4±146.6 (50.7)	444.6±212.1 (47.7)	407.9±215.1 (52.8)	337.3±188.7 (56.0)
L	109.2±20.0 (18.3)	111.5±18.4 (16.5)	136.6±28.7 (21.0)	130.8±25.9 (19.9)	120.1±25.6 (21.5)
B	73.21±12.8 (17.4)	76.5±12.6 (16.4)	85.6±16.5 (19.2)	85.5±13.7 (16.1)	79.0±14.8 (18.7)
Th	32.3±8.0 (24.8)	32.4±8.5 (26.1)	43.9±17.6 (40.1)	30.0±14.7 (48.9)	34.7±13.1 (37.8)
T_1	17.7±13.2 (18.1)	19.7±4.6 (23.3)	20.0±6.9 (34.6)	20.6±5.4 (26.3)	19.3±5.1 (26.4)
L_1	43.2±10.5 (24.4)	45.8±10.1 (22.1)	50.5±11.7 (23.2)	47.9±12.1 (25.3)	46.4±11.2 (24.2)
B_1	51.0±10.6 (20.8)	50.0±9.0 (18.0)	49.7±13.9 (27.9)	50.0±12.5 (24.9)	50.3±11.3 (22.5)
B_2	66.3±12.9 (19.5)	65.6±11.8 (17.9)	75.4±15.9 (21.0)	74.5±14.1 (19.0)	69.5±14.2 (20.4)
Th/B	0.44±0.10 (21.6)	0.44±0.09 (19.7)	0.49±0.16 (31.7)	0.46±0.13 (27.6)	0.46±0.12 (25.6)
T_1/L	0.16±0.03 (19.9)	0.18±0.03 (17.6)	0.15±0.04 (25.7)	0.16±0.04 (23.9)	0.16±0.04 (22.0)
B/L	0.69±0.11 (14.4)	0.68±0.10 (14.0)	0.64±0.12 (18.3)	0.67±0.10 (15.6)	0.67±0.10 (15.5)
B_1/B_2	0.78±0.14 (17.4)	0.76±0.11 (14.9)	0.68±0.14 (22.5)	0.68±0.14 (20.3)	0.73±0.14 (19.3)
L_1/L	0.40±0.07 (16.9)	0.41±0.06 (14.1)	0.37±0.07 (22.2)	0.37±0.07 (17.8)	0.39±0.07 (18.3)
NFS	24.9±10.5 (42.1)	18.9±5.8 (30.7)	27.6±13.4 (48.5)	23.1±9.3 (40.0)	23.6±10.5 (40.6)

Table 2. Means, standard deviations and coefficients of variation for linear dimensions and indices of handaxes from the Gunjana valley. Figures within brackets are percentage coefficients of variation. NFS = number of flake scars.

The Chirki industry is assigned to the Early or Middle Acheulian by Corvinus (1970), an attribution supported by Joshi and Marathe (1976, 1977, 1985). Lengths of the Chirki handaxes range from 90mm to 190mm; the majority fall between 120 mm and 160 mm, and the mean length is 137.9 mm. In the Gunjana industry, although the length range is again from 90 mm to 190 mm, the majority fall between 90 mm and 150 mm and mean length is only 120 mm (Table 2 and Fig. 4).

In weight, the Chirki handaxes range from 100 gm to 1000 gm; the majority (67%) fall between 400 gm and 800 gm and the mean weight is 539 gm. In the Gunjana industry the majority are between 100 gm and 400 gm (Table 2 and Fig. 5) and the mean is only 337.3 gm. These figures indicate that the handaxes from Chirki are longer and heavier than those from the Gunjana valley, and are therefore larger in size.

David Gilead (1970) carried out a metrical analysis of handaxes from Israel, and was able to show that mean length diminished with time, although he could not assert that this trend exactly followed a chronological sequence. Nevertheless, it was evident here that the smaller and lighter tools appeared in the later industries of the Lower Palaeolithic, thus indicating a degree of technological refinement with the passage of time.

Handaxe refinement

To determine the refinement or flatness of an implement Roe used the ratio Th/B, because where implements are broken the length is the dimension most often affected by damage. A lower value of Th/B indicates a greater degree of refinement. In the Gunjana handaxe assemblages the Th/B ratio ranges from 0.1 to 0.8. However, a majority of the handaxes (60%) have values below 0.5, and the mean value is only 0.46 (Fig. 6 and Table 2). In the Chirki assemblage over 80% of the handaxes have Th/B values above 0.56, the range being from 0.30 to 0.95 with a mean value of 0.64 (Joshi *et al.* 1976:7). These values clearly indicate that the Gunjana assemblages are more refined than those of Chirki.

Assessment of refinement cannot be allowed to depend solely on the Th/B index, however, as sometimes it can give misleadingly high values. To avoid this error Roe used the T_1/L ratio to check the results of Th/B. The T_1/L ratio for Gunjana handaxes ranges overall from 0.080 to 0.260 with a mean value of 0.16 (Table 2), thus indicating the refined nature of the tips of handaxes.

Handaxe Shape

Three ratios, B/L, B_1/B_2 and L_1/L, are combined for preparing shape diagrams for handaxes. B/L reflects the broadness or narrowness of the implement, B_1/B_2 pointedness or bluntness of the tip, and L_1/L the position of maximum breadth measured as a distance from the butt end in relation to length. The handaxes are divided into 3 categories arbitrarily according to L_1/L values; up

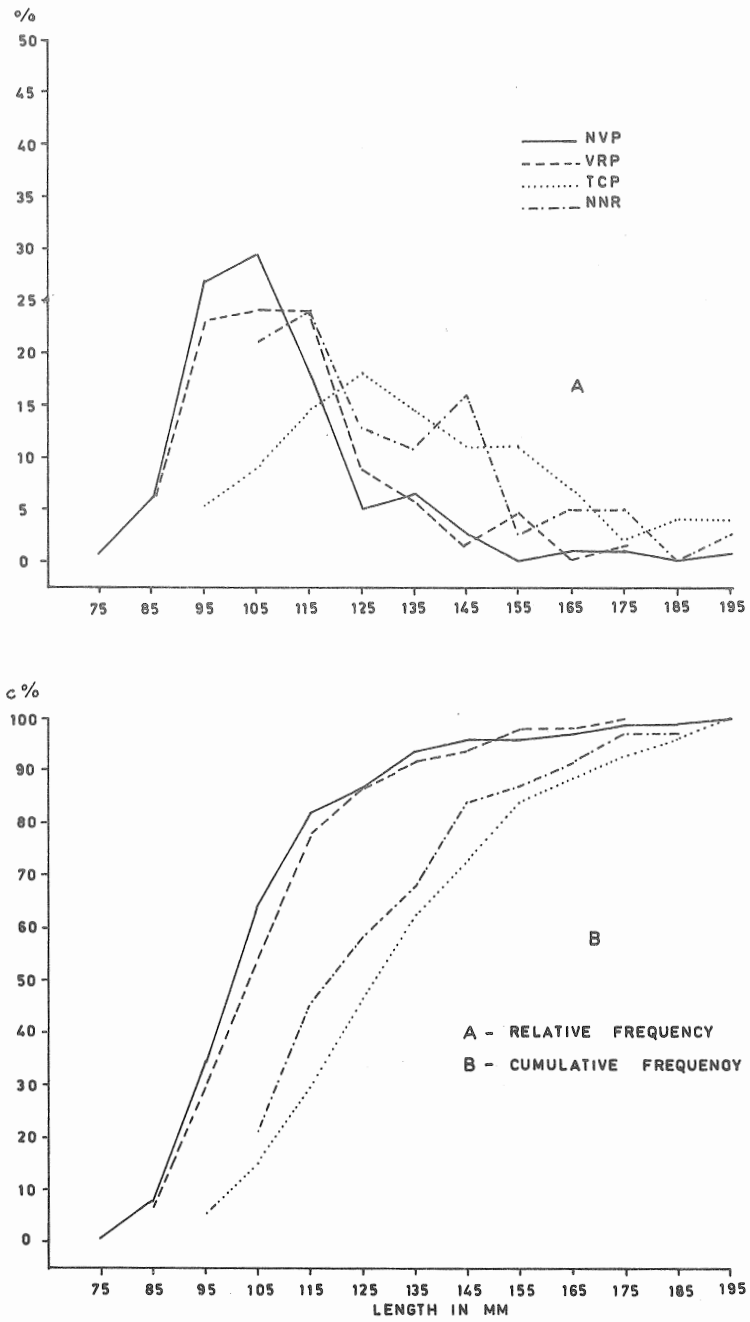

Figure 4. Length distributions in Gunjana handaxes.

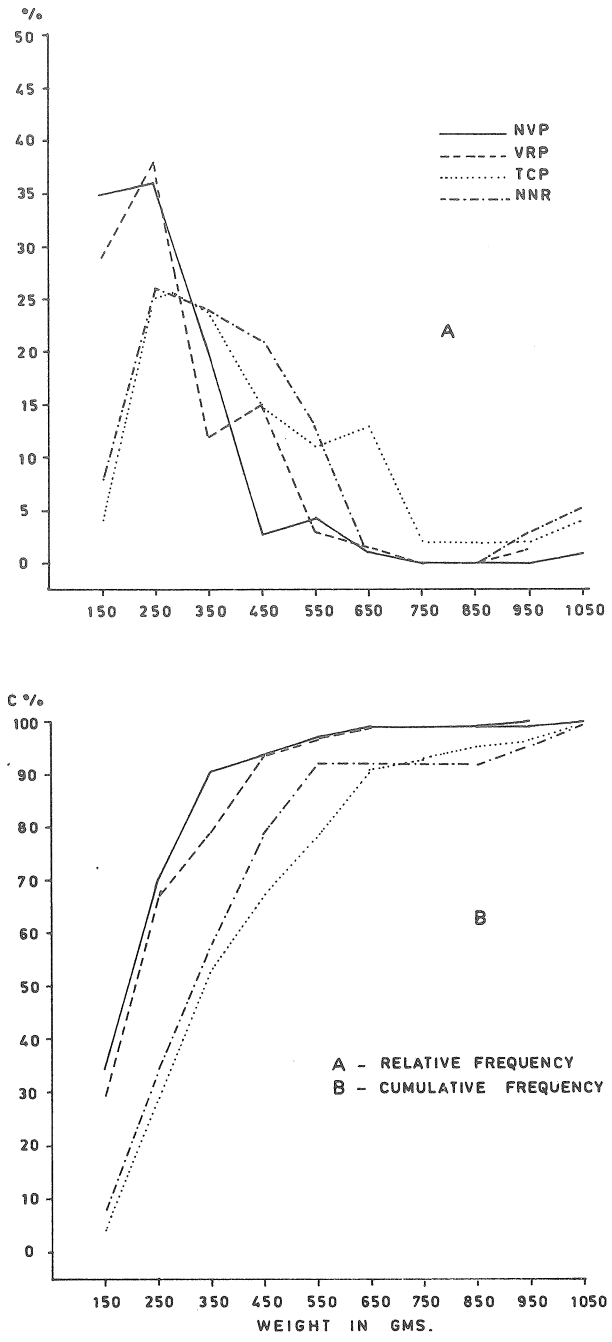

Figure 5. Weight distributions in Gunjana handaxes.

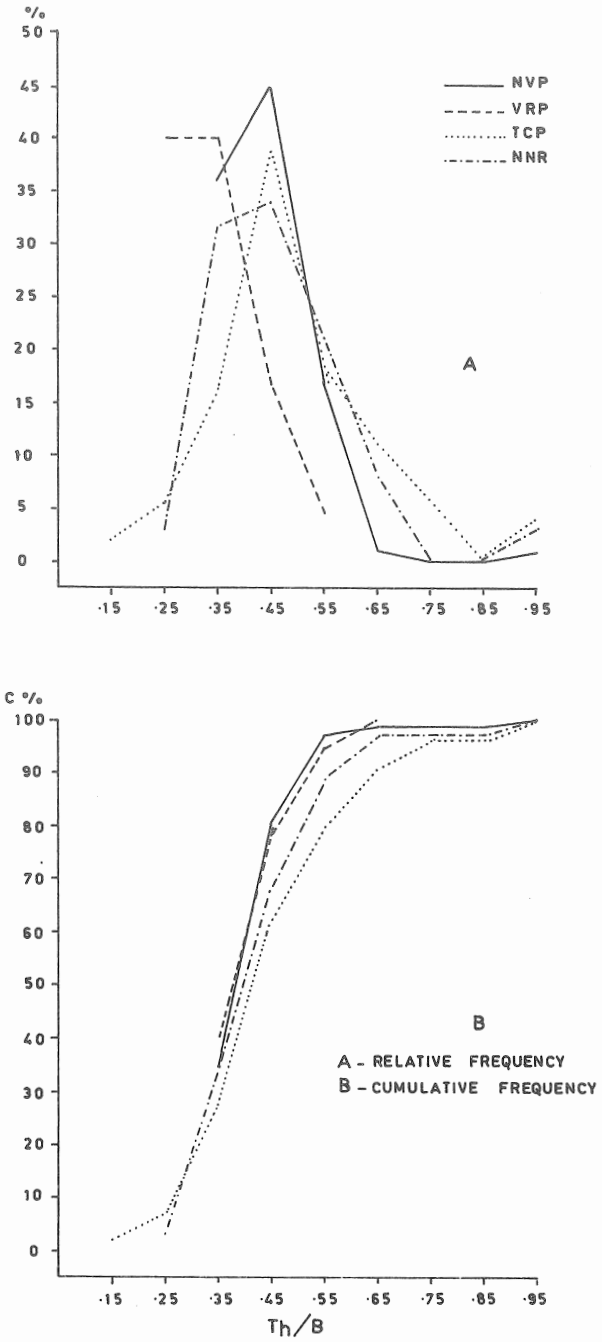

Figure 6. Distribution of Th/B for Gunjana handaxes.

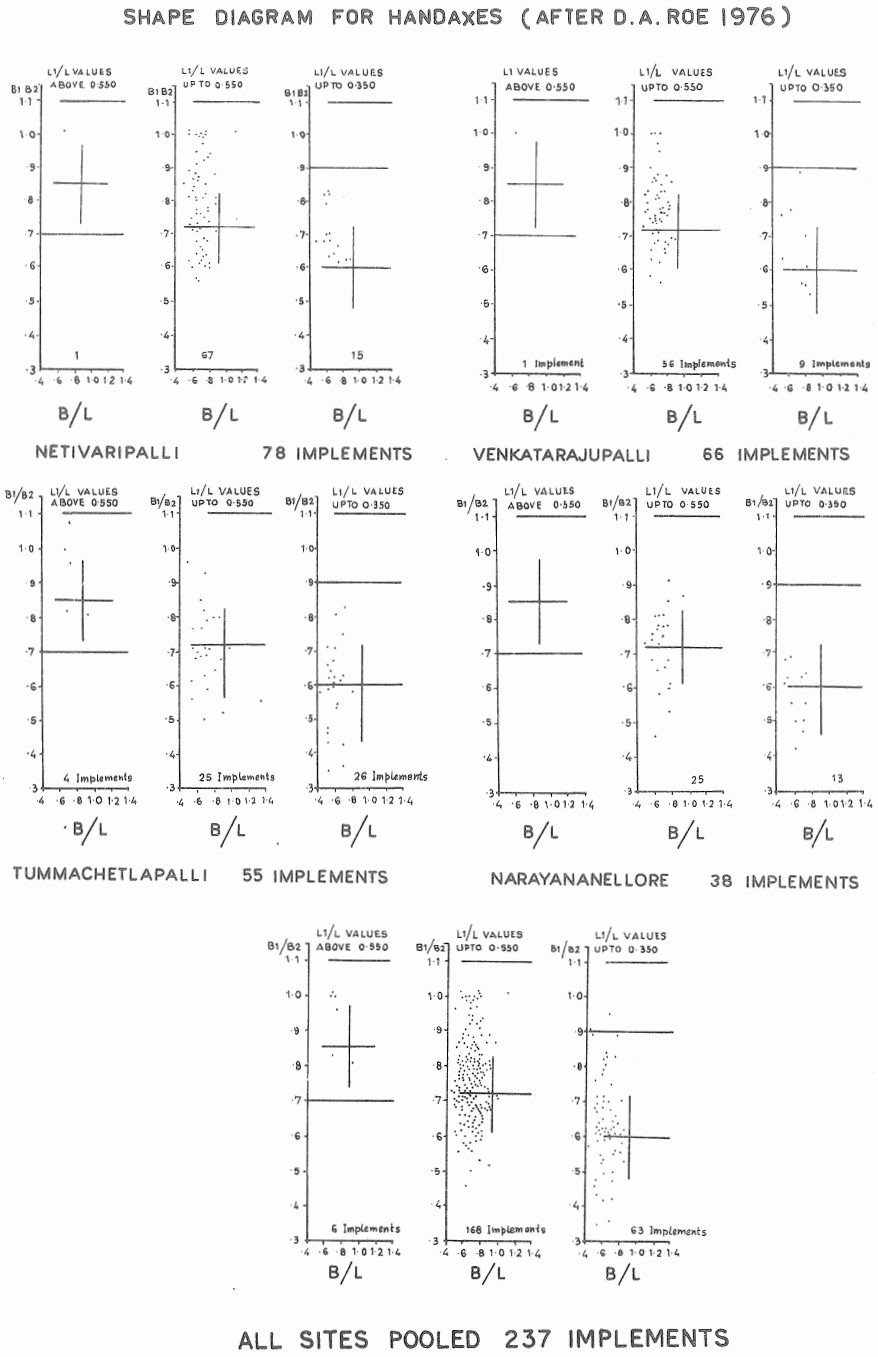

Figure 7. Shape diagrams for Gunjana Valley handaxes.

to 0.35, 0.36 to 0.55, and 0.56 and above. Each of the assemblage diagrams presented in Figure 7 is divided into three parts according to this classification.

The position of each dot in these diagrams reflects several aspects of the plan shape of the implement. The diagram for the pooled data from the four Gunjana assemblages (Fig. 7, base) shows 70.9% (n=168) in the centre section, 26.6% (n=63) in the right hand section, and only 2.5% (n=6) in the left hand section. Thus, these handaxe assemblages are predominately of ovate shape (centre section), followed by narrow triangular and lanceolate forms (right-hand section), with only a very few broad and blunt implements (left-hand section). This again shows the advanced nature of the Gunjana handaxe assemblages. In sum, the Gunjana handaxe assemblages may be assigned to a late phase of the Acheulian on techno-typological grounds.

Another significant criterion of the degree of technological refinement of an implement is the number and nature of its trimming scars. In an appraisal of the African Acheulian, Desmond Clark (1970:81) says that the components of the Lower Acheulian

> ...are chiefly characterised by the bold nature and small number of the flake scars as well as by the lack of refinement which comes from using a hard hammer or anvil of stone for working the tools. Otherwise Lower Acheulian aggregates fairly closely resemble those of the Upper and later stage.

Clark further asserts (1970:90) that Lower Acheulian handaxes "mostly show a minimal number of flake scars - often not more than eight or ten - while the edges are irregular, not straight".

Taking this criterion into account, then perhaps the designation of Chirki and Hunsgi (Paddayya 1982) as Lower or Early Acheulian stands valid, since both these assemblages show less than 10 flake scars per handaxe on the average. The Gunjana assemblage, which shows 24 flake scars per handaxe on average (Table 2), can be placed in the Upper or Late Acheulian. Joshi and Marathe (1985) have also assigned to a late phase the Acheulian industry from Paleru, in the Prakasham district of Andhra Pradesh. This industry has 20 flake scars per handaxe on average, and is dominated by ovate shapes (Rao 1979).

DISCUSSION

To date, no site in the Indian sub-continent has clearly revealed the Acheulian technological phases in a stratified context. Although the Indolav-Ki-Dhani site in the Thar (Misra *et al*. 1982) seems promising, the lithic assemblage from the lower levels is too ill-defined for certainty. This situation has forced Indian prehistorians to study Acheulian industries on techno-typological grounds, and to subdivide the Acheulian into Early, Middle and Late, or Lower, Middle and Upper phases. These divisions are purely arbitrary and have been based mostly on intuitive assessment.

t VALUES OF VARIOUS LINEAR DIMENSIONS AND INDICES FOR PAIRED SITES

W

	VRP	TCP	NNR
NVP	0·89 X	5·38 *	3·64 *
VRP		4·58 *	3·02 *
TCP			0·81 X

L

	VRP	TCP	NNR
NVP	0·72 X	6·11 *	4·52 *
VRP		5·60 *	4·04 *
TCP			1·02 X

B

	VRP	TCP	NNR
NVP	1·56 X	4·65 *	4·64 *
VRP		3·33 *	3·32 *
TCP			0·01 X

Th

	VRP	TCP	NNR
NVP	0·08 X	4·57 *	0·91 X
VRP		4·33 *	0·93 X
TCP			4·14 *

T_1

	VRP	TCP	NNR
NVP	2·83 *	2·26 *	3·05 *
VRP		0·33 X	0·95 X
TCP			0·49 X

L_1

	VRP	TCP	NNR
NVP	1·48 X	3·71 *	2·04 *
VRP		2·38 *	0·92 X
TCP			1·05 X

B_1

	VRP	TCP	NNR
NVP	0·63 X	0·58 X	0·44 X
VRP		0·12 X	0·00 X
TCP			1·00 X

B_2

	VRP	TCP	NNR
NVP	0·33 X	3·50 *	3·02 *
VRP		3·77 *	3·27 *
TCP			0·28 X

Th / B

	VRP	TCP	NNR
NVP	0·25 X	2·18 *	0·97 X
VRP		2·36 *	1·15 X
TCP			0·98 X

T_1 / L

	VRP	TCP	NNR
NVP	2·67 *	2·71 *	0·27 X
VRP		4·85 *	2·17 *
TCP			1·84 X

B / L

	VRP	TCP	NNR
NVP	0·18 X	2·33 *	0·94 X
VRP		2·13 *	0·78 X
TCP			1·13 X

B_1 / B_2

	VRP	TCP	NNR
NVP	0·67 X	4·02 *	3·77 *
VRP		3·58 *	3·35 *
TCP			0·03 X

L_1 / L

	VRP	TCP	NNR
NVP	1·32 X	1·85 X	2·53 *
VRP		2·90 *	3·68 *
TCP			0·44 X

NFS

	VRP	TCP	NNR
NVP	4·33 *	1·26 X	0·93 X
VRP		4·49 *	2·54 *
TCP			1·92 X

* SIGNIFICANT AT P=0·05
X NOT SIGNIFICANT

NVP NETIVARIPALLI
VRP VENKATARAJUPALLI
TCP TUMMACHETLAPALLI
NNR NARAYANANELLORE

Figure 8. Statistical comparisons of Gunjana handaxe assemblages.

The proportions of handaxes and cleavers have also been taken into account as indicators of technological evolution; industries dominated by handaxes are treated as Early to Middle Acheulian, and those dominated by cleavers as Late or Upper Acheulian. In a preliminary study of the Bhimbetka rock shelter III F-23, Misra (1976:36) compared lithic assemblages from six excavated Acheulian sites, and assigned the Bhimbetka industry to a very late phase of the Acheulian owing to the absence of chopper-chopping tools, the low percentage of bifaces, the high ratio of cleavers to handaxes, the very high percentages of non-biface flake tools, blades and Levallois flakes, and the greater use of the soft hammer technique.

Misra also recognised two successive Acheulian phases, and assigned the Lalitpur, Adamgarh, Kuliana, Mahadeo Piparia (river-bed gravel), Chirki-Nevasa, Anagwadi and Hunsgi assemblages to the earlier one. These are characterised in general by high percentages of chopper-chopping tools and bifaces, low percentages of non-biface tools made on flakes, high ratios of handaxes to cleavers, low incidences of blades and Levallois flakes, and a predominance of the stone hammer technique.

Using uranium/thorium decay series dates for miliolite overlying the Acheulian implementiferous gravel at Umrethi in the Hiran Valley in Saurashtra, Marathe (1981:115) has shown that the Acheulian here is older than 120,000 years B.P., and thus belongs to the late Middle Pleistocene. However, the total number of lithic artefacts from the entire Hiran Valley is given as only 19 (Marathe 1981:92), so it is clearly difficult to assess the nature of the Acheulian at this site.

In the absence of geochronological and radiometric dates from southeastern India, metrical analysis thus seems to be helpful for comparing Acheulian industries from different regions. Comparison of the Gunjana assemblages with that from Chirki-Nevasa seems to suggest that the former might belong to a later phase of the Acheulian. Moreover, metrical analysis can also be useful for the delineation of intersite assemblage variability.

For instance, as will be evident from Table 2 and Figure 8, the differences in t-values for linear measurements and indices between TCP and NNR, and NVP and VRP, are statistically significant (except for B_1) for most attributes. From a locational point of view it is interesting to note that both TCP and NNR lie downstream from Chitvel, while NVP and VRP are upstream and lie very close to each other (Fig.1). The makers of the tools in these two zones may thus have had differing functional needs, or perhaps varied manufacturing skills. Another look at the shape diagrams (Fig. 7) supports this impression of differentiation; the Acheulian bands upstream of Chitvel had a preference for more ovate handaxes, while those downstream preferred both ovates and narrow and pointed ones.

Metrical analysis thus appears to be useful for delineation of variations in lithic attributes, and these variations can in turn

guide conjecture concerning the possible group differences of the people responsible for handaxe manufacture.

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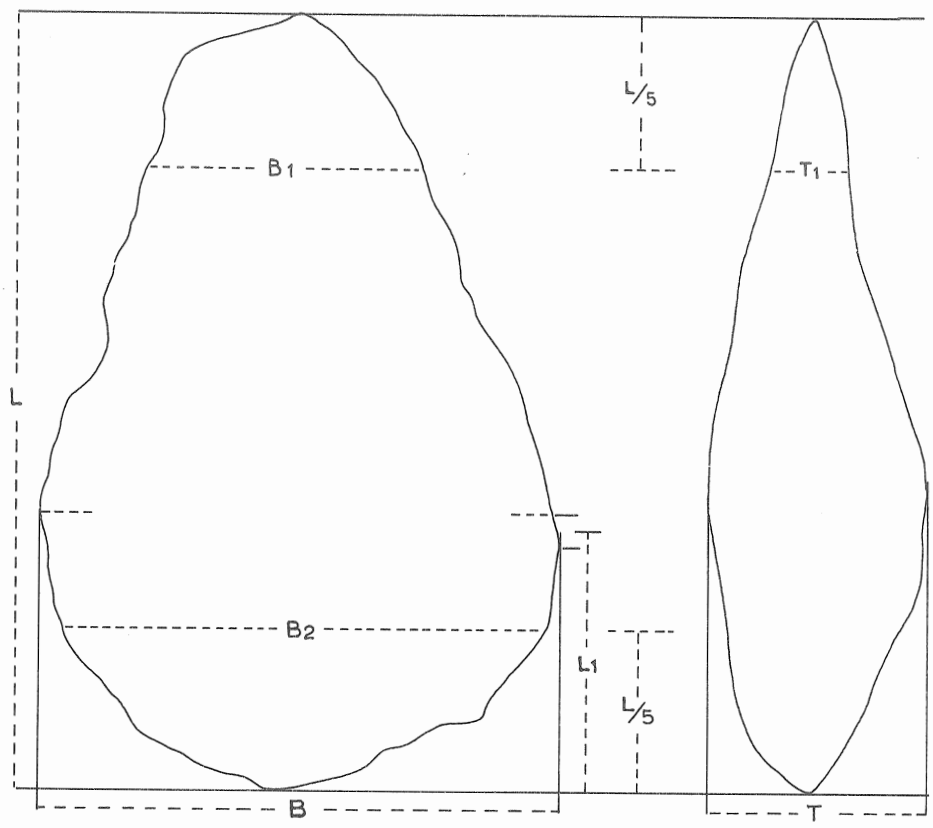

Figure 3 (see page 14). Metrical attributes of a handaxe (after Roe 1976).