Mesolithic Hunter-Gatherers of Keonjhar District, Orissa, India

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THE MESOLITHIC IS the most prolific and widely distributed prehistoric cultural period in the Indian subcontinent. It has been found in a wide variety of geographical situations and ecological habitats. The stone industries of the Mesolithic period generally indicate adaptation to the early postglacial Holocene environment, the period between the final Upper Palaeolithic and the introduction of agriculture. The Mesolithic is characterized by the appearance of small, highly differentiated stone implements, suggesting a foraging economy with emphasis on small game hunting and fishing. This cultural period has a considerable duration, ranging from c. 8000 to c. 10,000 B.C. Chronologically, it clearly predates the Neolithic, yet as exemplified by subsistence strategies, Mesolithic adaptations continued well into the Holocene in parts of South Asia. In areas such as Gujarat and Rajasthan, there is clear evidence of cultural contacts between hunter-gatherer groups with Mesolithic tools and prehistoric food-producing cultures, including the Harappan civilization (Possehl and Kennedy 1979). Further, in rare cases this way of life outlived the Neolithic and Chalcolithic periods and survived into the Iron Age and even into the Early Historical period (Hooja 1988). Additionally, hunter-gatherer economies sometimes acquired Neolithic traits, such as sedentary residential patterns and the domestication of animals. Thus, the geographical diversity and cultural variability represented by Indian Mesolithic sites are quite impressive.

In the past, the Indian Mesolithic Culture has always been identified as synonymous with microlithic artifacts. In this paper, I attempt to explain the occurrence of larger artifacts as an integral part of many Mesolithic sites in India. The data from this research point to simplifications and gaps in Indian Mesolithic studies with regard to the occurrence of microliths and heavy-duty implements. Although the co-occurrence of heavy implements and microliths is a phenomenon conditioned by environmental factors, this cannot be, at least for the present, extrapolated as a pattern for the whole subcontinent.

This paper presents a brief account of a complex of Mesolithic sites identified during a regional survey of the district of Keonjhar (Orissa) on the eastern coast of India (Fig. 1). It summarizes six seasons of fieldwork undertaken between 1983 and 1989. In addition to microlithic assemblages of siliceous materials, these sites also

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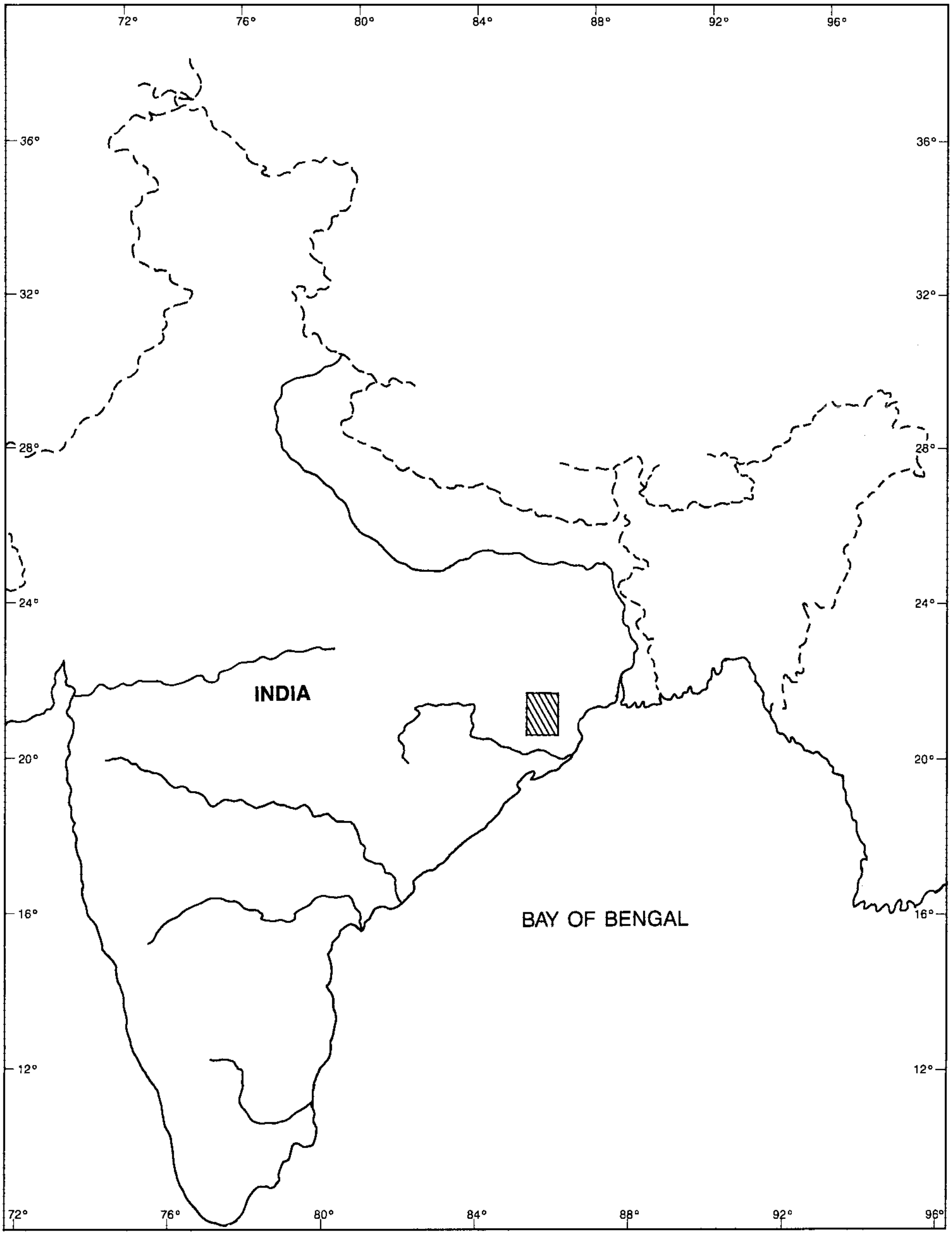

Fig. 1. Map of India showing area of study.

yielded a variety of heavy-duty implements made of coarse-grained stone, such as dolerite. Heavy-duty implements are a category of artifact that has been neglected in Indian Mesolithic studies, contributing to the view of the Mesolithic as characterized by microlithic assemblages. The Keonjhar complex of sites reveals that human adaptations during the Mesolithic were variable in India, and this may reflect a dynamic we do not yet fully understand.

In the following pages, I discuss the nature of Mesolithic sites in Keonjhar District and of the artifactual collections from them. This discussion is followed by observations of the role played by heavy-duty tools as a component in the functioning of the total cultural system. Finally, I attempt to place the Keonjhar Mesolithic data in the context of Mesolithic studies both in India and elsewhere.

THE REGION

Keonjhar District is located in the northern part of the state of Orissa, between 21°01′ and 22°10′ north and 84°10′ and 86°22′ east. It has an area of 8330 km^2 and is surrounded by Singhbhum District (Bihar) to the north, Dhenkanal and Sundergarh districts to the west, and Mayurbhanj and Balasore districts to the east. The district itself consists of two physiographic units: Lower Keonjhar, a fertile and densely populated plain; and Upper Keonjhar, a thickly forested and hilly tract intersected by narrow valleys. The latter zone is the habitat of an important ethnographic group known as the Juang, who practice shifting cultivation.

Geologically, the area is an extension of the Chhota-Nagpur Region, and it is drained by the Baitarani River and its numerous tributaries. The average annual precipitation is 1600 mm. The vegetation is of the tropical deciduous type, and the climate is characterized by hot summers, high humidity, and well-distributed rainfall.

THE SITES

Intensive exploration undertaken for six seasons in the Champua, Ghasipura, Ghatgaon, Palaspal, Harichandanpur, and Patana taluks resulted in the discovery of 58 Mesolithic sites (Fig. 2). Most of these were associated with granitic outcrops, while a few were found in the foothills lying close to streams. The surface spread of artifacts at individual sites varies widely. The largest measures about 20,000 m^2; the smallest ones have an extent of only 100 m^2. Most of the sites are located in dense forest.

My explorations were mainly restricted to tracts along the banks of smaller streams originating from the western hills, all of which join the Baitarani River draining the eastern portion of the district. This restriction was decided upon because of the better chances of preservation of primary sites along smaller streams, whose fluvial activity is far less destructive than that of the major river.

The majority of sites discovered in the area are primary in nature and still preserve habitation deposits. Various site features noted during the survey (location away from the riverbank, discreteness of scatters of stone artifacts, regular association of raw material blocks and waste products, and lack of certain features, such as surface smoothing of artifacts, associated with river action) indicate that most of the sites are well preserved and are unconnected with any fluvial activity. The

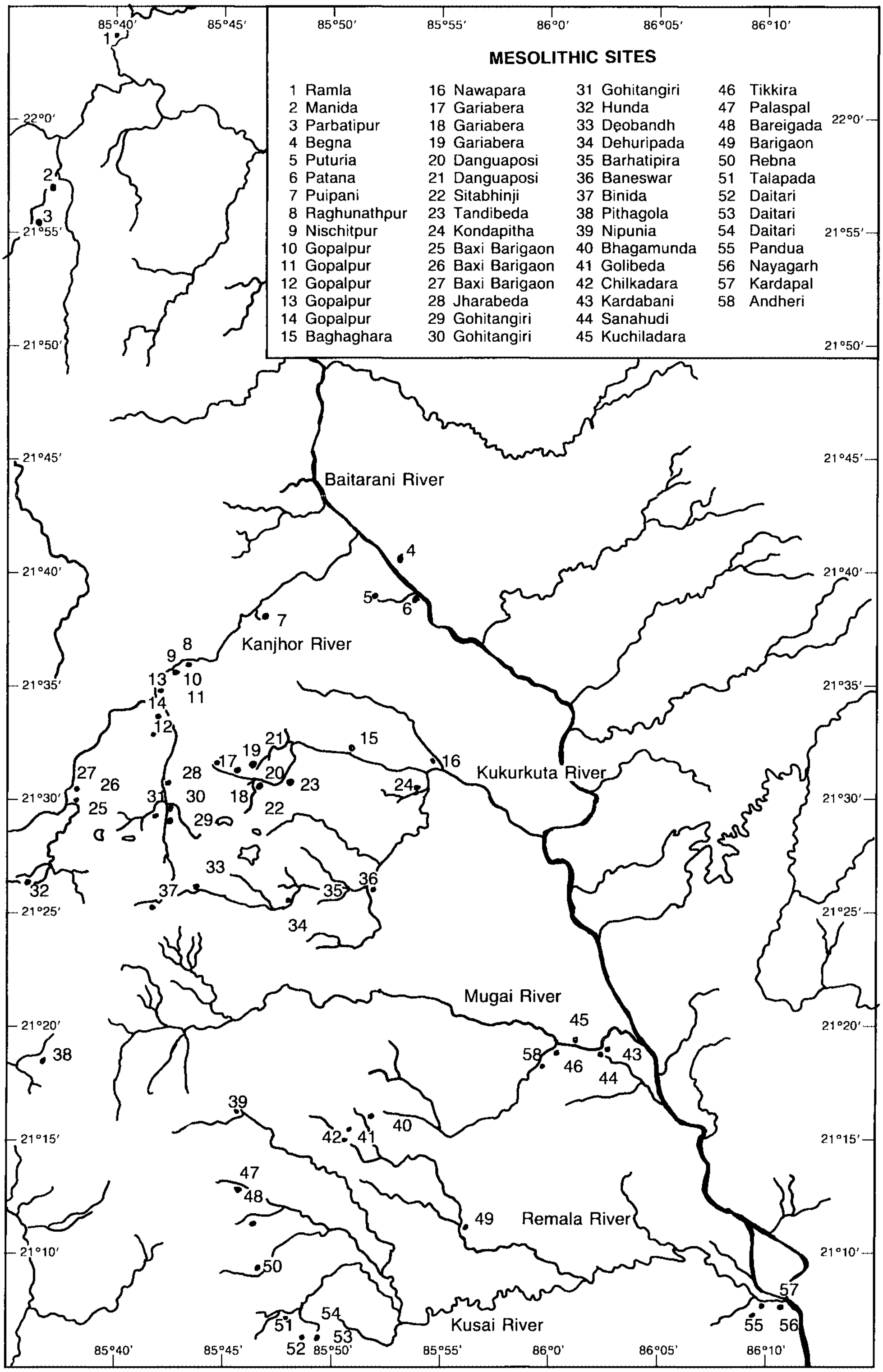

Fig. 2. Mesolithic sites in Keonjhar District, Orissa.

occurrence of isolated Mesolithic artifacts on rock outcrops was also observed at quite a few places. Although these occurrences may not be regarded as "sites" in the conventional sense, their significance for interpreting the character of the Mesolithic cultural system cannot be entirely ignored. These sites may be interpreted as short-duration, single-episode spots involving an individual or a small group engaged in food-collecting or food-processing activities lasting from a few hours to a few days. As such, these sites may have served as satellites of larger sites (Foley 1981:164–166; Paddayya 1991:131; Thomas 1975:62). Some of the large sites, such as Gariabera locality 1, Nischitpur, Tikkira, and Kardabani, exhibit certain features that suggest that these sites witnessed repeated human occupation. These features include differential weathering and reflaking noticeable on some of the specimens.

Some of these open-air sites seem to have been connected with occupational activities. Many of the sites were associated with granitic outcrops rising 5–10 m above the plain. The possibility of obtaining a commanding view of the surrounding plains, the availability of hard ground for habitation purposes, and the ubiquity of rock boulders for raising shelters must have been among the considerations that influenced the settlers to select these outcrops as locales for their encampments. Also noteworthy is the nearness of the sites to streams and gullies. The dense forests and hills around would have provided a variety of game and wild vegetable food.

THE LITHIC INDUSTRY

The lithic industry of the Keonjhar Mesolithic consists of two distinct and yet complementary components: microlithic and heavy-duty tools. The lithic assemblages of these components occur separately at 14 and 5 sites respectively; at the remaining 39 sites, they occur together (Table 1). The two components distinguish themselves from each other in several ways in terms of raw material and functional attributes. These distinctive features notwithstanding, these two lithic assemblage types constitute complementary aspects of a unitary process of Mesolithic adaptation in the area.

The microlithic assemblages from these sites compare well with one another in terms of both raw material and typo-technological features. Hence these may be said to constitute a single relatively homogeneous industry. Chert is the most common raw material exploited for manufacturing microlithic artifacts and for producing shaped artifacts. The other materials, in descending order, are quartz, chalcedony, and dolerite (Fig. 3). Chert occurs in secondary form as veins and also in the river gravels. Quartz also occurs in veins at several places in the district. Sites whose microlithic assemblage is dominated by quartz have a low proportion of shaped artifacts and a high proportion of chips.

A well-developed blade technology is the most outstanding feature of the microlithic assemblages. The industry is evident in blades, flakes, and nodules of various sizes. The flakes and blades of different shapes and sizes have been struck off from a variety of cores. A few cores, especially the fluted ones, indicate that the blades have been removed in one of several ways: in one direction, in two directions either from one end and side or from both ends, in three directions, or sometimes in multiple directions (Fig. 4). The flake cores generally show irregular scars.

TABLE 1. MESOLITHIC SITES OF KEONJHAR, ORISSA, GROUPED BY TYPES OF IMPLEMENTS YIELDED

HEAVY IMPLEMENTS	MICROLITHS	HEAVY IMPLEMENTS AND MICROLITHS
Golibeda (41)	Rebna (50)	Gariabera (17)
Binida (37)	Kardapal (57)	Gariabera (18)
Gopalpur (13)	Pandua (55)	Gariabera (19)
Gopalpur (14)	Baxi barigaon (25)	Palaspal (47)
Bhagamunda (40)	Baxi barigaon (26)	Nischitpur (9)[a]
	Baxi barigaon (27)	Kardabani (43)
	Puipani (7)	Gopalpur (10)
	Manida (2)	Gopalpur (11)
	Parbatipur (3)	Gopalpur (12)
	Begna (4)	Pithagola (38)
	Sitabhinji (22)	Deobandh (33)
	Nayagarh (56)	Puturia (5)
	Gohitangiri (30)	Daitari (52)
	Daitari (54)	Daitari (53)
		Danguaposi (20)
		Danguaposi (21)
		Tandibeda (23)
		Barigaon (49)
		Baghaghara (15)
		Dehuripada (34)
		Bareigada (48)
		Patana (6)
		Hunda (32)
		Kuchiladara (45)
		Sanahudi (44)
		Andheri (58)
		Tikkira (46)
		Jharabeda (28)
		Raghunathpur (8)[a]
		Baneswar (36)
		Talapada (51)
		Chilkadara (42)
		Kondapitha (24)
		Nipunia (39)
		Ramla (1)
		Nawapara (16)
		Barhatipira (35)
		Gohitangiri (29)
		Gohitanjiri (31)

Note: Numbers in parentheses refer to map locations in Figure 2.
[a] Dam site.

A few small cores are roughly round in shape and have centrally directed scars—an indication that they were probably prepared before removing the flakes (Fig. 5:*J,K,L*). The blades and flakes have been removed by a soft hammer of bone or wood, by the punch, or by pressure technique.

Several blades and flakes have further been worked by various kinds of retouch and converted into tools. The microlithic industry of this region consists of retouched blades, backed blades, blunted back and obliquely truncated blades,

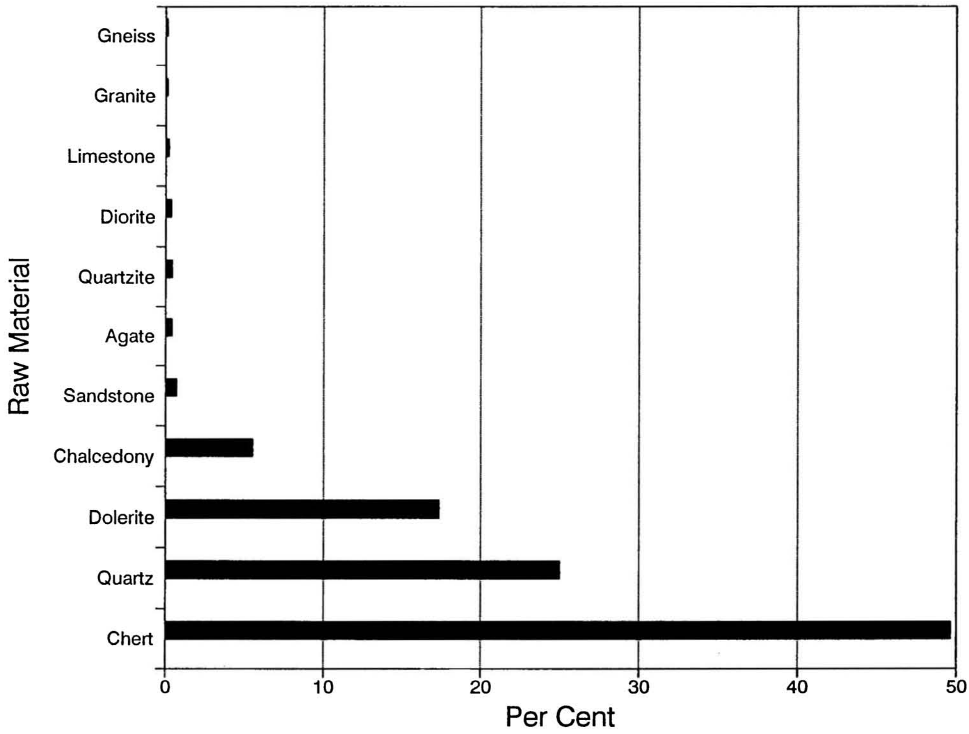

Fig. 3. Relative frequency of raw material used in Mesolithic industry.

blunted back and truncated blades, truncated blades, notched blades, denticulate blades, points, lunates, triangles, trapezes, and burins. All these tools are prepared by both unifacial and bifacial working. (See Fig. 6.) The flake tools and the tools made on nodules, such as various types of scrapers, borers, and points, generally have a fine unifacial and bifacial retouch (Fig. 5:*A–G*).

By far the most interesting aspect of these assemblages concerns the occurrence of heavy-duty tools. These differ radically from the microlithic component of the lithic technology in terms of both raw material and typo-technological features. Out of a total 58 sites, these artifacts occur at 39. At many of these sites, the presence of debitage testifies to on-the-spot manufacture. Moreover, these artifacts occur together with the microlithic artifacts. There is no stratigraphic data to separate the two components or to suggest they were deposited at different times. Thus, it is clear that the heavy-duty tools found in this area form an integral part of the Mesolithic Culture of the Keonjhar Region. A frequency distribution of shaped tools is given in Table 2.

Dolerite was the principal raw material used for manufacturing the heavy implements at the Keonjhar Mesolithic sites. This occurs in the form of dykes throughout the entire region. It is the most widespread and easily collected rock type in the area. Besides this, other rock types used for tool making were sandstone, quartzite, diorite, granite, and gneiss (Fig. 3).

Technologically, the heavy tools show sophisticated workmanship. Suitable raw materials were exploited to achieve an effective working edge relative to the

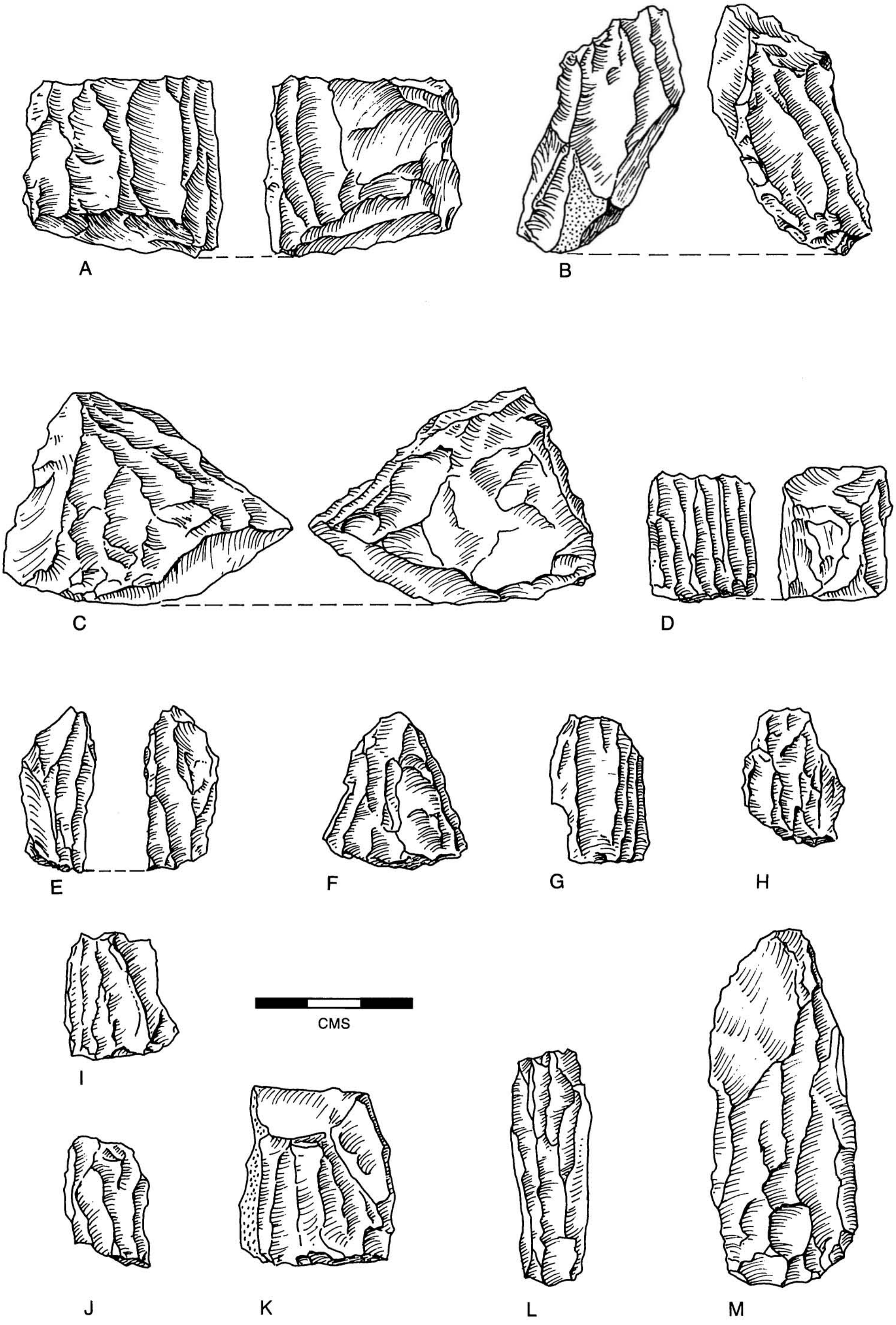

Fig. 4. Blades cores (*A–M*) from Mesolithic sites.

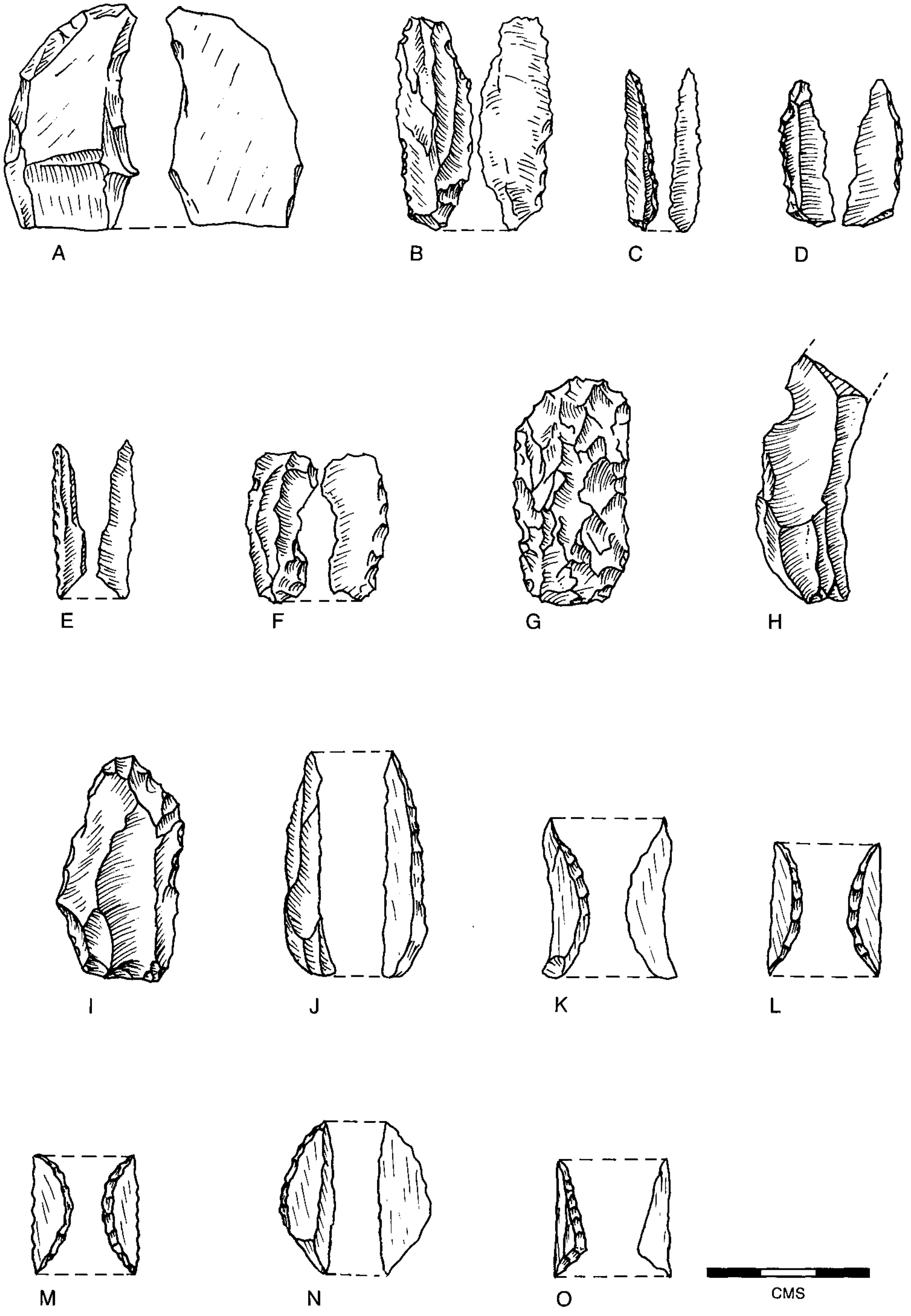

Fig. 5. Convex scraper (*A*), side and end scraper (*B*), denticulate scraper (*C*), double side scraper (*D,E*), discoidal scraper (*F*), borer (*G*), utilized flake (*H*), side flake (*J*), flake cores (*I,K,L*).

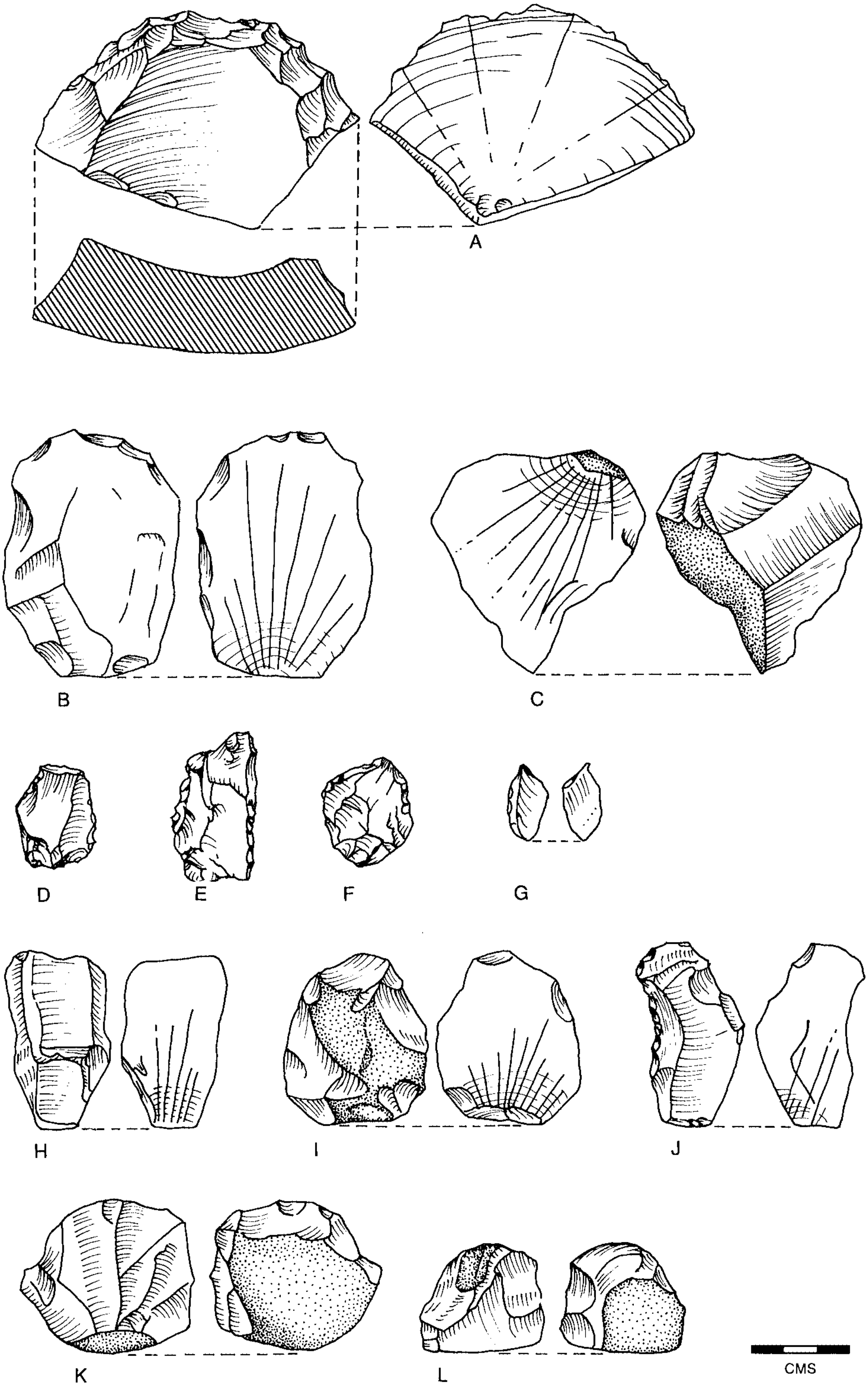

Fig. 6. Microlithic blades (*B,D,F–K,O*), points (*C,E*), lunates (*L,M,N*), triangle (*A*).

TABLE 2. FREQUENCY DISTRIBUTION OF SHAPED TOOLS FROM MESOLITHIC SITES OF KEONJHAR

TOOL TYPES	SITE CLASS I (6 SITES) NO. (%)	SITE CLASS II (9 SITES) NO. (%)	SITE CLASS III (38 SITES) NO. (%)	SITE CLASS IV (5 SITES) NO. (%)
Heavy Implements				
Celt[a]	132 (20.15)	8 (1.61)	22 (2.53)	2 (15.38)
Pick	3 (0.46)	0	1 (0.11)	0
Knife	5 (0.76)	4 (0.80)	4 (0.46)	0
Cleaver	1 (0.15)	0	0	0
Core scraper	60 (9.16)	19 (3.82)	65 (7.46)	8 (61.54)
Chopper	1 (0.15)	2 (0.40)	2 (0.24)	1 (7.70)
Limace[a]	2 (0.31)	0	0	0
Large scraper	0	0	10 (1.15)	0
Microliths				
Retouched blade	329 (50.23)	339 (68.07)	516 (59.24)	0
Point	24 (3.66)	12 (2.41)	15 (1.72)	0
Lunate	10 (1.53)	10 (2.01)	6 (0.69)	0
Triangle	2 (0.31)	2 (0.40)	0	0
Trapèze[a]	1 (0.15)	0	0	0
Burin	2 (0.31)	0	1 (0.11)	0
Scraper	78 (11.91)	101 (20.28)	224 (25.72)	2 (15.38)
Borer	5 (0.76)	1 (0.20)	5 (0.57)	0
Totals	655 (100.00)	498 (100.00)	871 (100.00)	13 (100.00)

Note: Retouched blades and scrapers include all types of blades and scrapers.
[a] *Celt* is a groundstone axe; *limace* is a thick, leaf-shaped flaked stone tool unifacially retouched on both edges; *trapèze* is a kind of microlith.

shape and size of the type of tool fabricated. The lithic types comprise core scrapers (Fig. 7); picks, cleavers, knives, choppers, and limaces (Fig. 8); and celts, fashioned by means of flaking, pecking, grinding, and polishing (Fig. 9).

The core scraper is predominant among these heavy-duty implements. In general, these tools have steep edges obtained by means of steep flaking and are very similar to the specimens obtained from archaeological contexts in Australia (Gould 1971; Lampert 1977; Mulvaney 1969), New Guinea (Kamminga 1978:308), Indonesia (Bartstra 1976:90), Mexico and the western United States (Hester and Heizer 1972:107), and South Africa (Sampson 1974). Most of these implements were prepared by minimum flaking along their margins, leaving much of the cortex intact. In all cases, the flat bottom of the raw material has been retained. Flake scars are generally shallow and do not show any prior preparation of the core. The nature of flaking suggests use of a controlled hammer technique, and the secondary working along the margins is uncommon.

It is generally agreed that these core scrapers served as wood-working tools (Kamminga 1978:309). It has been hypothesized through edge-angle analysis (Ferguson 1980:56–72; Hayden 1979:124–125; Wilmsen 1968:156–161) of various classes of tools that specimens with high edge-angles (above 55–60°) were meant for such wood-working operations as scraping or planing or smoothing of a wood surface, while the examples with low edge-angles were used for chopping or cutting. The edge-angle analysis of core scrapers from Keonjhar sites shows that

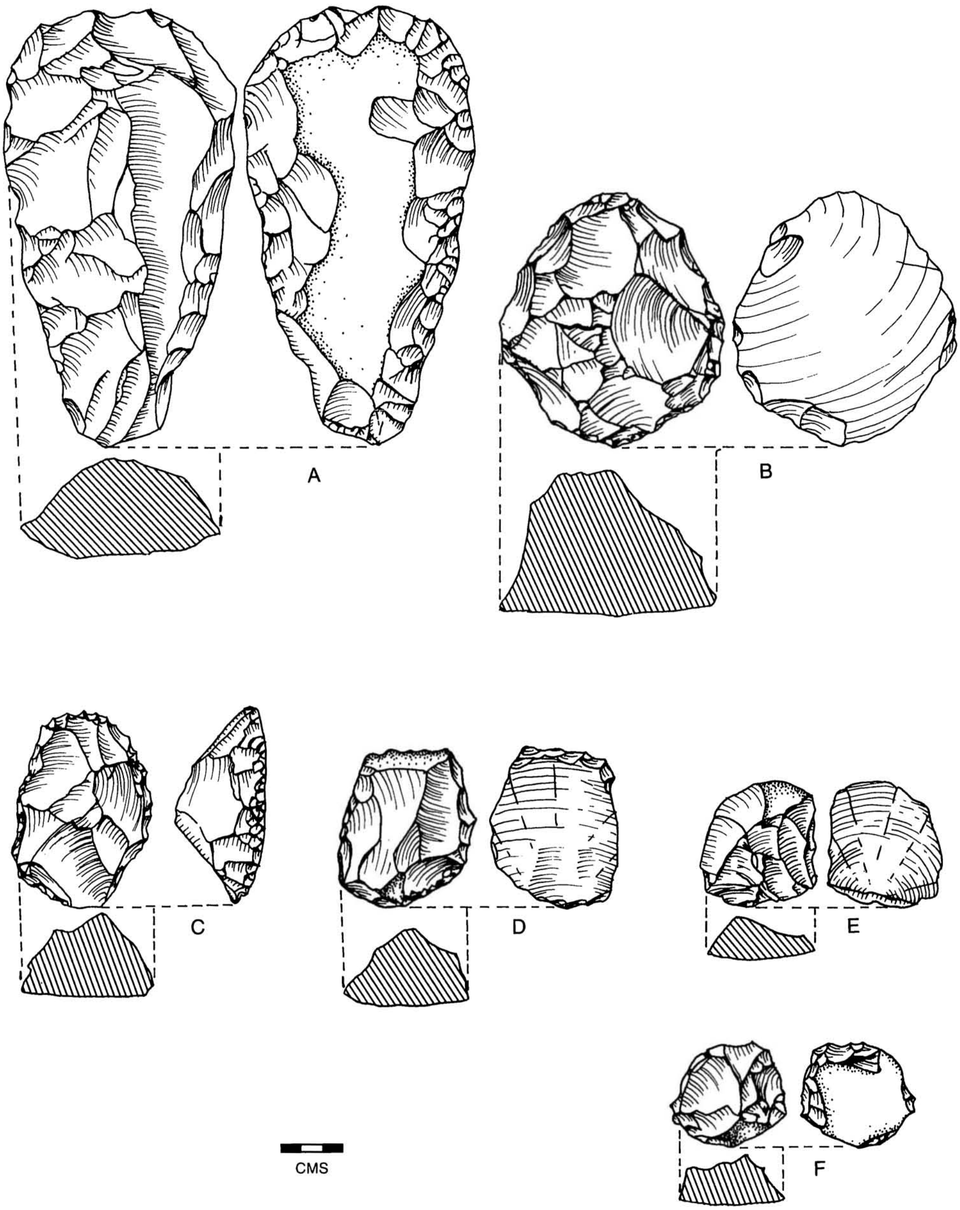

Fig. 7. Core scrapers (*A–F*).

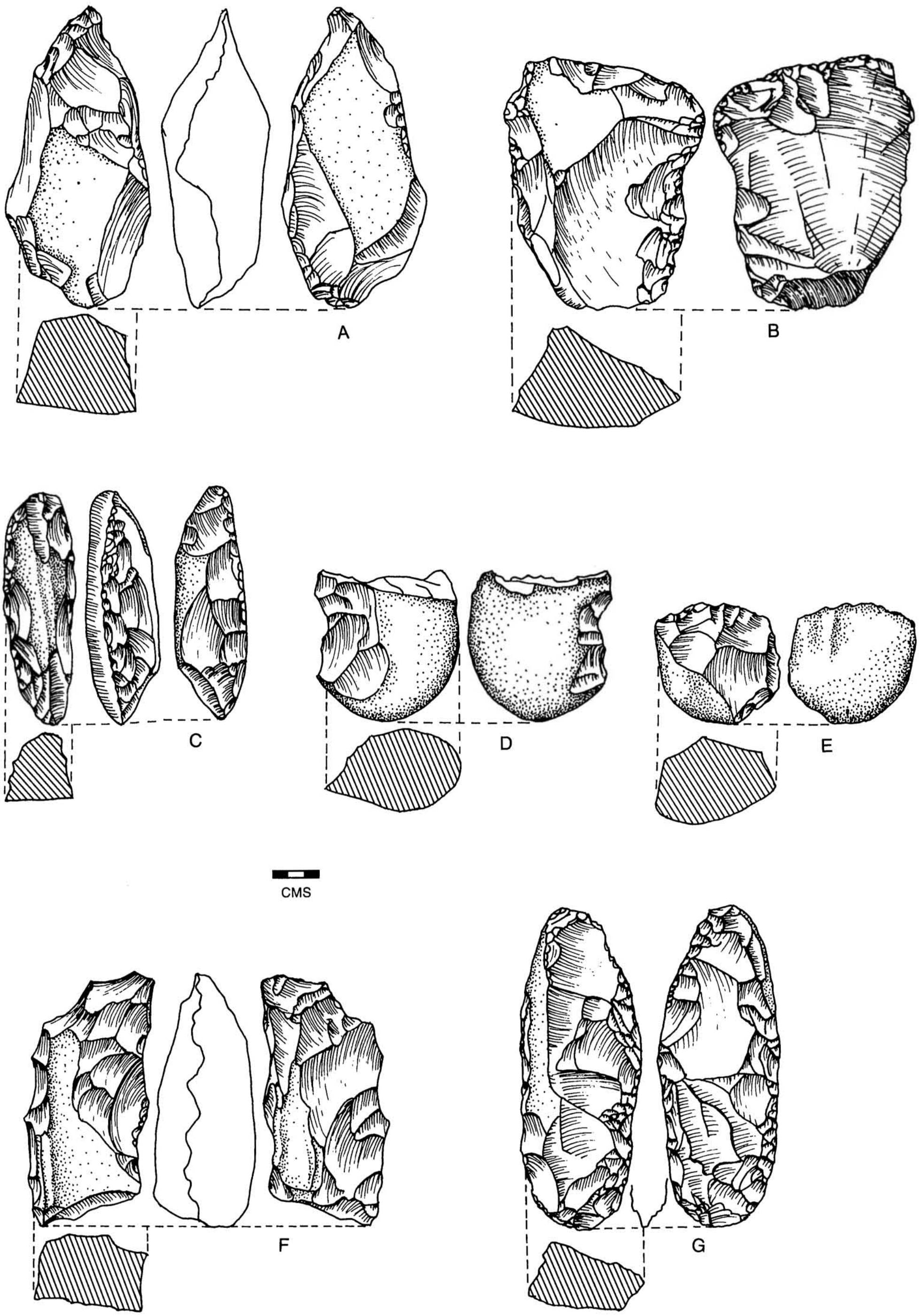

Fig. 8. Pick (*A*), cleaver (*B*), knives (*F,G*), choppers (*D,E*), limace (*C*).

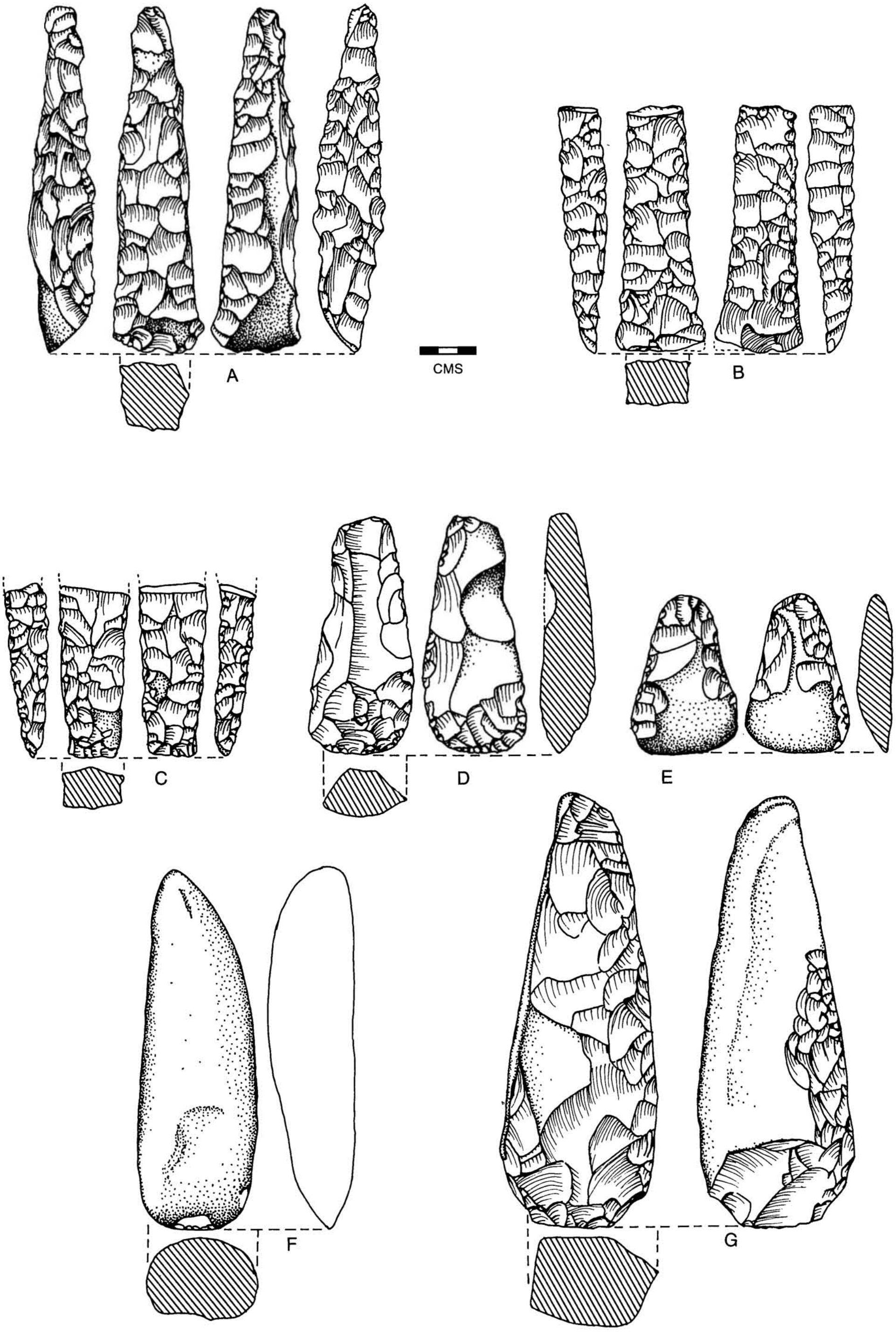

Fig. 9. Celts (*A–G*).

most tools are in the range of 55–80°, lending support to the hypothesis of wood working.

In view of the limited scope of the data, especially the absence of organic remains such as charcoal obtained from surface sites for chronology, no absolute dates could be obtained for the Keonjhar Mesolithic sites. But many of the sites have yielded edge-ground tools, and at the sites a well-developed blade technology characterizes the microlithic assemblages. On this evidence, these sites may be dated to between about 5000 and 2000 B.C. One must keep in mind, however, that these dates are tentative, subject to change or modification in light of future finds in these areas.

THE ROLE OF HEAVY-DUTY TOOLS IN THE KEONJHAR MESOLITHIC SETTLEMENT SYSTEM

Keonjhar District forms part of a distinct ecological zone. As described above, it receives high rainfall and has tropical deciduous vegetation. All the known Mesolithic sites are surrounded by stretches of thick forest. Given the locational features of the sites, it is reasonable to assume that the Mesolithic culture flourished in a comparable forested ecological setting. The present-day populations of the area, chiefly the Juang, practice extensive forest clearing and wood working as a part of daily sustenance. In carrying out forest clearance and other domestic and outdoor wood-working activities, the Mesolithic groups may have employed a large number of heavy-duty tools of the types recovered from Keonjhar sites, described above.

In the past, many workers in India have reported heavy-duty implements along with microlithic artifacts from Mesolithic sites (Allchin 1966; Allchin and Satyanarayan 1959; Cammiade and Burkitt 1930; Ghose 1970; Issac 1960; Majumdar and Rajguru 1966; Mallik 1959; Nanda 1983; Paddayya 1974; Pandey 1982; Rami Reddy 1976; Sankalia 1969; Sharma and Clark 1983; Subbarao 1948; Subrahmanyam et al. 1975). Unfortunately, however, the culture-historical approach adopted thus far in Indian prehistoric studies has caused workers to overlook the significance of this artifactual component of the industry. Instead, there has been undue emphasis on the typological aspects of microlithic artifacts. What is required is a shift of focus of the study of lithic assemblages from typological approaches to those that emphasize the understanding of sites in terms of human adaptation to the biophysical environment of the area. From such a perspective it is possible to describe the role played by the heavy-duty tool component in the operation of the Mesolithic settlement system. In this respect, the lithic data from Keonjhar may serve as a real eye-opener.

SITE CATEGORIES FROM THE KEONJHAR AREA

The Mesolithic sites of Keonjhar can be divided into four major classes (Table 2).

Class I — The first class includes sites that are characterized by artifact scatters covering an extensive area but show a marked tendency toward concentration of artifacts at several spots. The area occupied by these sites is in the range of 5000–20,000 m^2. There are six sites in this class, which display the following noteworthy features:

Manufacturing of stone tools is a very conspicuous characteristic, with distinct clusters of microlithic and heavy-duty tools. Numerous chips and flakes—flaking debitage—are found at these sites.

Almost all have habitational deposits that are a few centimeters deep.

At one-half of the sites, some tools appear fresh, while others exhibit patination. This may be due to different episodes of occupation. We do not have any clear evidence to indicate whether these sites were occupied by the same group or by different groups.

These sites have the greatest number and diversity of tool types for both heavy implements and microliths. Assuming that the longer a site is occupied, the more artifacts will be deposited and that differences in artifact density are a good indicator of the relative duration of a settlement, the duration of occupation at these locales was apparently longer than at the other groups of sites.

At several sites, celts make up over 75 percent of the entire assemblage. Some of these are unfinished and broken, suggesting that these implements were being made at certain locations, which might also have served as locations for the production of tools, and perhaps of trade (barter) involving people who specialized in their manufacture.

Class II — The second class consists of medium-size settlements (500–2500 m^2), identified on the basis of concentrated artifact distributions that exhibit a more or less uniform density over a well-defined regular area. Nine sites fall into this category. Microlithics predominate at these sites, and most occur as retouched blades or scrapers.

Class III — The third class includes sites that can be shown to occupy a very restricted area, measuring no more than 100–500 m^2. This class comprises the largest number (38) of sites in the Keonjhar District. Not only are these sites small, they also tend to have light scatters of microliths with a few heavy implements.

Class IV — The occurrence of isolated artifacts is the main characteristic of sites in the fourth class. There are five sites in this category, and heavy implements predominate, perhaps because of their greater visibility.

Based on the presence or absence of either microliths or heavy implements, three types of sites may be recognized: those yielding microlithic implements, those providing both microlithic and heavy implements, and those yielding mainly heavy implements. These three types of sites may occur in the same general locale but at varying distances and may differ markedly in terms of frequencies and internal distribution of artifacts. Although the assemblages in this region apparently belong to a single lithic tradition, the site types in a particular ecozone may be interpreted as representing different sets of activities related to a particular resource or spectrum of resources constituting a set of opportunities for exploitation. Thus, three sites within a locality could have served three separate purposes that were nevertheless interrelated either functionally, temporally, or both. In other words, a particular set of opportunities related to a population's adaptation was not necessarily associated with just one type of site but may have involved three different stations within one locale (Cooper 1983:258). These findings fit in well with the concept of organizational variability first developed by Binford and Binford (1966). All of these site types may well belong to a single cultural tradition; the differences in their tool types would be due to the different activities or range of activities at the places where sites were formed.

The majority of small sites (Class IV) appear to qualify as extractive locations of an ephemeral nature—that is, specific-purpose localities where only certain kinds of resources were sought and a limited number of activities took place. Examples of extractive sites include hunting stations, butchering sites, kill sites, gathering sites, and chipping stations. Such sites are ancillary to base camps and are normally occupied for brief periods. In general, they are quite small, often not revisited, and rarely occupied by the full complement of individuals who make up the primary subsistence unit.

The large sites (Class I), interpreted as base camps, have the widest array of features and a variety of tools associated with diverse maintenance activities. Most probably these sites were seasonal summer encampments where plant foods were more plentiful. This corresponds with the present-day Juang subsistence pattern. Although the Juang lead a sedentary life, they exploit the abundance of plant foods available in this season (Mohanty 1989). Some of these large sites would certainly permit the aggregation at a central locale of numerous families of a single band or similar social group. Perhaps the ceremonial activities of the band took place at those times. Such seasonal cohesion is typical of centrally based hunter-gatherers in many areas of the world. During the rest of the year when food resources are more dispersed, the bands scatter in smaller groups of one or a few families (Jacobson 1976, 1980; Paddayya 1982; Tacon 1991).

The occurrence of these large scatters of stone tools may then be partly explained by connecting these assemblages with small-scale variation across environmental niches in different parts of the area, the range of resources available in a particular ecozone, and also the time of year during which a site was occupied (Steward 1967:240). In view of this, it is possible that in the case of large sites, which seem to combine frequency variations characteristic of sites belonging to classes II, III, and IV, the occurrence of diverse nearby resources was a factor leading to the formation of large lithic scatters covering a considerable area. On the other hand, the occurrence of smaller sites, such as those grouped under classes II, III, and IV, probably represents adjustments to a different set of circumstances, which required segmenting different activities and conducting them in separate though interrelated sites that are now distinguished by varying ratios of the major lithic components. Therefore, the overall distribution of sites in this area may be attributed to the varying articulation of principal economic and social activities. Variability in artifact frequencies among sites may also be partly attributed to seasonal fluctuations in subsistence activities (Binford 1983:339–343; Cooper 1983:259–260; Paddayya 1991:131). Interestingly, the subsistence pattern of the Juang is characteristically geared to seasonality of climate. This seasonal factor, combined with varying ecological features, may have required a network of small, functionally complementary sites, such as occurred archaeologically in the Keonjhar area.

CONCLUSION

In the preceding pages, I have presented a partial account of the Indian Mesolithic settlement system. This account is rather speculative and should be supported by further archaeological evidence. First, the absence of organic remains constitutes a major hindrance for making inferences about the subsistence resources or season of occupation of sites. Second, the general absence of adequate predictive models of the relationships between stone tools and human behavior precludes definitive statements about the group size or the duration of occupation.

In addition to the unavoidably partial and speculative nature of this discussion, other potential problems must be recognized. First, some types of sites may not appear archaeologically. For example, stone tools may not occur at certain kinds of sites, such as fishing stations. Sites lacking lithic artifacts would no longer be visible due to the acidic soils of Keonjhar. Their absence may distort any reconstruction of settlement systems.

Second, in addition to stone, the technological system of the Mesolithic peoples must also have exploited bone, wood, leather, mastic, plants, and other materials that are most unlikely to survive the passage of time. We should expect that the functions at one time served by stone may at other times have been served by wood or bone, as they were later served by metals. Therefore, one must always provide for such complications in a settlement system analysis.

Despite these limitations, heavy implements have been documented in regular association with microlithic artifacts at Mesolithic sites in the Keonjhar District, Orissa. Although these have been found in many Mesolithic sites in India, the functional-ecological role the implements may have played has not previously been discussed. The coexistence of heavy implements and microliths is consistent with similar occurrences in other areas both within and outside India. This heavy-duty tool component pertained to forest clearing, wood working, house construction, and food procurement and preparation.

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REFERENCES

ALLCHIN, BRIDGET
1966 *The Stone-Tipped Arrow: Late Stone Age Hunters of the Tropical World.* London: Phoenix House.

ALLCHIN, BRIDGET, AND A. SATYANARAYAN
1959 A late Stone Age site near Kandarpur Museum (A.P.). *Man* 310:197.

BARTSTRA, GERT-JAN.
1976 *Contributions to the Study of the Paleolithic Patjitan Culture, Java, Indonesia.* Leiden: Rijksuniversiteit te Groningen.

BINFORD, LEWIS R.
1983 *Working at Archaeology.* New York: Academic Press.

BINFORD, LEWIS R., AND S.R. BINFORD
1966 A preliminary analysis of functional variability in the Mousterian of Levallois Facies. *American Anthropologist* 68:238–295.

CAMMIADE, L.A., AND M.C. BURKITT
1930 Stone Ages in Southeast India. *Antiquity* 4:327–339.

COOPER, Z.M.
1983 Prehistoric Habitation Patterns around Chitrakot Falls, Bastar District, M.P. Ph.D. diss. University of Poona.

FERGUSON, W.C.
1980 Edge angle classification of the Quininup Brook implements: Testing the ethnographic analogy. *Oceania* 15:56–72.

FOLEY, R.
1981 Off-site archaeology: An alternative approach for the short-sighted, in *Pattern of the Past: Studies in Honour of David Clark*: 157–183, ed. I. Hodder, G.L. Issac, and N. Hammond. Cambridge: Cambridge University Press.

GHOSE, A.K.
1970 The Palaeolithic cultures of Singhbhum. *Transactions of the American Philosophical Society* 60:1–68.

GOULD, RICHARD A.
1971 The archaeologist as ethnographer: A case from the Western Desert of Australia. *World Archaeology* 3:143–177.

HAYDEN, BRIAN
1979 *Palaeolithic Reflections: Lithic Technology and Ethnographic Excavations among the Australian Aborigines*. Atlantic Highlands, N.J.: Humanities Press.

HESTER, THOMAS R., AND R.F. HEIZER
1972 Problems in the functional interpretation of artifacts: Scraper plains from Mitla and Yagul, Oaxaca. *Contributions to the University of California Archaeological Research Facility* 14:107–123.

HOOJA, RIMA
1988 *The Ahar Culture and Beyond: Settlements and Frontiers of Mesolithic and Early Agricultural Sites in Rajasthan*. Oxford: BAR 412.

ISSAC, N.
1960 The Stone Age Cultures of Kurnool. Ph.D. diss., University of Poona.

JACOBSON, J.
1976 Evidence for prehistoric habitation patterns in eastern Malwa, in *Ecological Backgrounds of South Asian Prehistory*: 1–6, ed. K.A.R. Kennedy and G.C. Possehl. Ithaca, N.Y.: Cornell University Press.

1980 Investigations of late Stone Age cultural adaptations in the central Vindhyas. *Man and Environment* 4:65–82.

KAMMINGA, JOHAN
1978 Journey into the Microcosmos: A Functional Analysis of Certain Classes of Prehistoric Australian Stone Tools. Ph.D. diss., University of Sydney.

KHANNA, GURCHARAM S.
1988 Reassessing the Mesolithic of India. Ph.D. diss., University of California at Berkeley.

LAMPERT, RONALD J.
1977 Kangaroo Island and the antiquity of Australians, in *Stone Tools as Cultural Markers*: 213–218, ed. R.V.S. Wright. Canberra: Australian Institute of Aboriginal Studies.

MAJUMDAR, G.G., AND S.N. RAJGURU
1966 *Ash-Mound Excavations at Kupgal*. Poona: Deccan College.

MALLIK, S.C.
1959 Recent explorations in Hoshangabad. *Journal of M.S. University of Baroda* 7:27–39.

MOHANTY, PRADEEP
1989 Mesolithic Settlement System of Keonjhar District, Orissa. Ph.D. diss., University of Poona.

MULVANEY, DEREK J.
1969 *The Prehistory of Australia*. London: Thames and Hudson.

NANDA, S.C.
1983 *Stone Age Cultures of Indravati Basin, Koraput District, Orissa*. Ph.D. diss., University of Poona.

PADDAYYA, K.
1974 The Mesolithic culture of Shorapur Doab. *Anthropos* 69:590–607.
1982 *The Acheulian Culture of the Hunsqi Valley (Peninsular India): A Settlement System Perspective*. Poona: Deccan College.
1991 The Acheulian Culture of the Hunsi-Baichbal Valleys, Peninsular India: A Processual Study. *Quartar* 41–42:111–138.

PANDEY, R.P.
1982 Archaeology of Upper Mahavadi Valley, Madhya Pradesh. Ph.D. diss., University of Poona.

POSSEHL, GREGORY L., AND K.A.R. KENNEDY
1979 Hunter-gatherer/agriculturist exchange in prehistory: An Indian example. *Current Anthropology* 20:592–593.

RAJENDRAN, P.
1983 The coastal Mesolithic industries of South India and their chronology. *Indo-Pacific Prehistory Association* 4:18–31.

RAMI REDDY, V.
1976 *The Prehistoric and Protohistoric Cultures of Palavoy, South India*. Hyderabad: Government of Andhra Pradesh.

SAMPSON, CLAVIL G.
1974 *The Stone Age Archaeology of Southern Africa*. New York: Academic Press.

SANKALIA, HASMUKHLAL D.
1969 *Mesolithic and Pre-Mesolithic Industries from the Excavation at Sanganakallu, Bellary*. Poona: Deccan College.

SHARMA, G.R., AND J.D. CLARK
1983 *Paleoenvironments and Prehistory in the Middle Son Valley*. Allahabad: Abinash Prakashan.

STEWARD, J.
1967 Comments on K.C. Chang's paper on "Major aspects of the interrelationship of archaeology and ethnology." *Current Anthropology* 8:239–240.

SUBBARAO, BENDAPUDI
1948 *Stone Age Cultures of Bellary*. Poona: Deccan College.

SUBRAHMANYAM, RAYAPROLU, ET AL.
1975 *Nagarjunakonda* (1954), Vol. I. Memoir No. 75. New Delhi: Archaeological Survey of India.

TACON, PAUL S.C.
1991 The power of stone: Symbolic aspects of stone use and tool development in western Arnhem Land, Australia. *Antiquity* 65:192–207.

THOMAS, D.H.
1975 Non-site sampling in archaeology: Up the creek without a site? in *Sampling in Archaeology*: 61–81, ed. J.W. Muller. Tucson: University of Arizona Press.

WILMSEN, EDWIN N.
1968 Functional analysis of flaked stone artifacts. *American Antiquity* 33:156–161.

ABSTRACT

An extensive archaeological exploration between 1983 and 1989, spanning six seasons, resulted in the discovery of 58 Mesolithic sites in Keonjhar District, Orissa, India. In addition to microlithic artifacts, the most noteworthy feature of these assemblages is the common occurrence of heavy-duty implements; the raw materials selected for these are different from those used for manufacturing microliths. The category of heavy-duty tools has been given a low priority in Indian Mesolithic studies. This paper attempts to account for the heavy-duty tool component in functional-ecological terms. KEYWORDS: Keonjhar, India, South Asia, Mesolithic, heavy-duty implements, microliths.