ANCIENT INDIA

Bulletin of the Archaeological Survey of India

NUMBER 17

1961

CONTENTS

EDITED AND PUBLISHED BY THE DIRECTOR GENERAL OF ARCHAEOLOGY IN INDIA, NEW DELHI

PRINTED AT THE JOB PRESS PRIVATE LTD., KANPUR

1961

Price Rs. 4·50 *or* 7*s.* (*post free in India*)

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THE DIRECTOR GENERAL OF ARCHAEOLOGY IN INDIA,
GOVERNMENT OF INDIA,
NEW DELHI, 11.

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NOTES

THE REGULAR READERS OF 'ANCIENT INDIA' MAY RECALL THAT ITS NUMBER 9 (1953) was produced as a Special Number to commemorate the Jubilee of the ARCHAEOLOGICAL SURVEY OF INDIA. In December this year (1961), we are celebrating the Centenary of the SURVEY. That an organization only fifty years old in 1952 should now become a centennial may seem to be a jugglery to many, but not to those who may recall what was stated in the introductory articles in Number 9 itself.

While the ARCHAEOLOGICAL SURVEY OF INDIA was placed on a solid basis in 1902 (permanency was to come four years later), which would justify the issue of the Jubilee Number in 1953, the origin of the SURVEY dates back to 1861, which, in turn, would explain its Centenary Celebration in 1961.

* * * * * *

The SURVEY had a humble origin in 1861, with an Archaeological Surveyor, Alexander Cunningham, as its sole member, for 'employment in Bihar and elsewhere'. Fruitful yet shaky even then, the SURVEY underwent many vicissitudes thereafter. But all vacillation of policy, indecision on the respective responsibilities of the Central and Local Governments, dispute over whether Government should take the responsibility of the preservation of monuments, hesitation over the acceptance of any financial commitments—all characterizing the archaeological history of the country in the last quarter of the nineteenth century—were broadly swept away at the turn of the century, as a result of the enunciation of liberal policies and bold steps to execute them.

All this is now a matter of historical interest. The present-day ARCHAEOLOGICAL SURVEY OF INDIA, the nucleus of which was formed just a hundred years back, is a consolidated organization with very definite and comprehensive functions to perform. From a single-man show in 1861, it has now attained great proportions, with a broad-based pyramidal structure. Its functions are well-defined: they comprise the preservation of all important monuments in the country, explorations and excavations, epigraphical research, application of scientific methods to archaeology, maintenance of archaeological museums, training—in fact, they comprehend all branches of archaeology in its widest denotation. And we fancy that it has not always been without credit that the SURVEY has discharged all these functions.

With pardonable pride, therefore, do we celebrate the Centenary of the ARCHAEOLOGICAL SURVEY OF INDIA. Let our Centenary be not merely the commemoration of the past but the promise of a still brighter future.

* * * * * *

A chief item of the Centenary Celebration will be an International Conference on Asian Archaeology. There is no causal connexion between the two. Yet we thought that the Celebration might provide a suitable forum for bringing together the distinguished workers on Asian archaeology for discussing common problems of technology, for taking stock of our present-day knowledge and, if possible, for devising ways and means for periodical contacts.

The response to our call has been most encouraging; it has assured us of a truly international gathering and has brought to focus the need for such a gathering. We sincerely hope that the Conference—and through it the Centenary of the ARCHAEOLOGICAL SURVEY OF INDIA—will leave a lasting impress on archaeological pursuits in Asia.

* * * * * *

The present Number of *Ancient India* is, however, by no means a souvenir of the past nor an indicative of the forthcoming events. We shall, no doubt, have the privilege of publishing in the next Number at least some of the more important papers presented at the International Conference on Asian Archaeology.

A. Ghosh

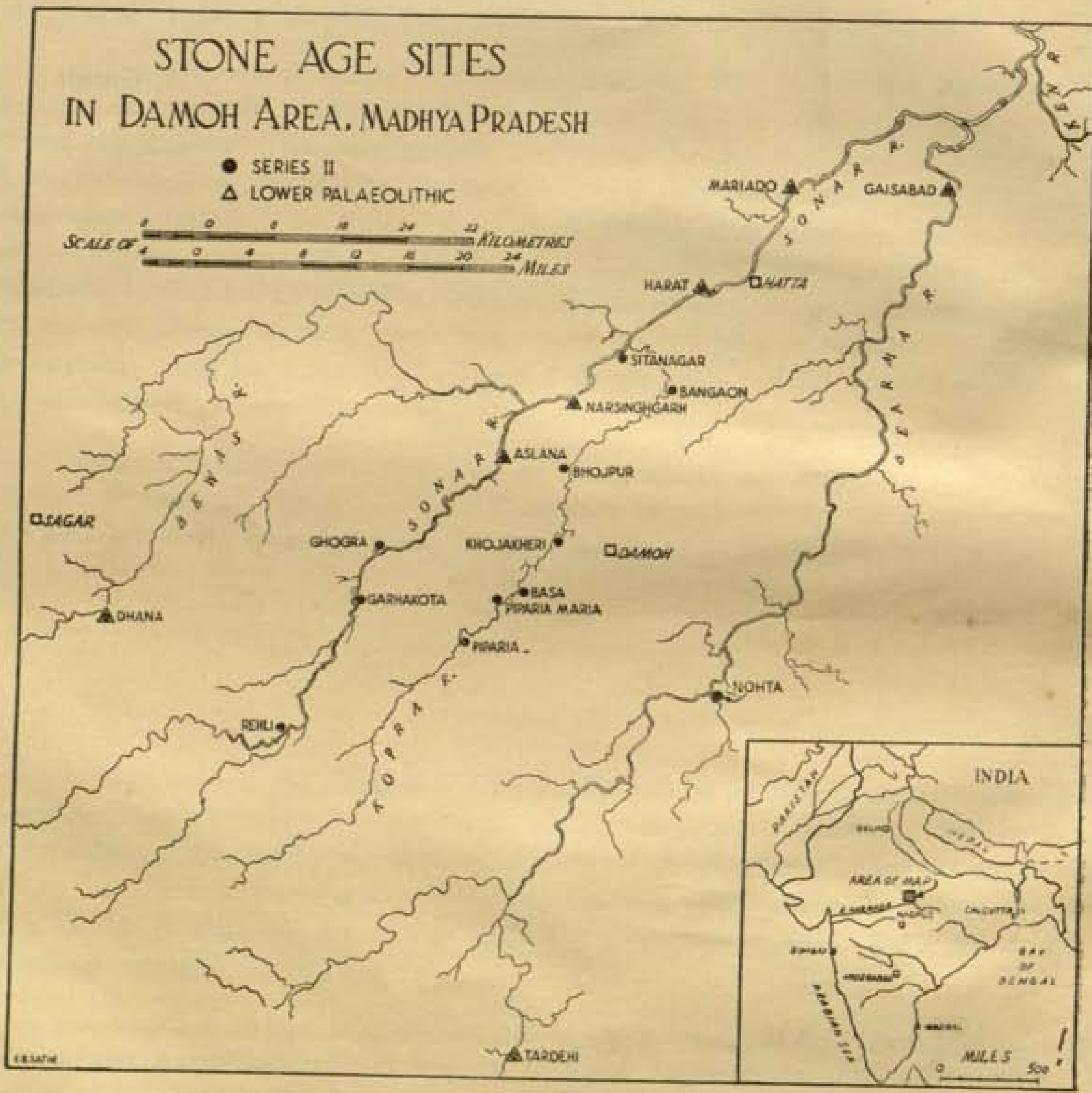

STONE AGE SITES
IN DAMOH AREA, MADHYA PRADESH
SERIES II
LOWER PALAEOLITHIC
SCALE OF
KILOMETRES
MILES
SONAR R.
BENAS R.
KOPRA R.
BEARMA R.
MARIADO
GAISABAD
HARAT
HATTA
SITANAGAR
BANGAON
NARSINGHGARH
ASLANA
BHOJPUR
SAGAR
GHOGRA
KHOJAKHERI
DAMOH
GARHAKOTA
BASA
PIPARIA MARIA
DHANA
PIPARIA
NOHTA
REHLI
TARDEHI
INDIA
AREA OF MAP
BAY OF BENGAL
ARABIAN SEA
MILES

FIG. 1

STONE-AGE INDUSTRIES OF THE DAMOH AREA, MADHYA PRADESH

By R. V. Joshi

CONTENTS

1. GENERAL

ALTHOUGH NO PREHISTORIC SURVEY OF DAMOH AND SAGAR DISTRICTS, MADHYA Pradesh, was carried out systematically in the past, sporadic occurrences of Stone-Age artefacts in the area have been reported from time to time at Deori, Burdhana, Sigrampur, etc., in Sagar District.[1] During the present writer's brief visit, in 1957, to the valleys of the rivers Sonar and Kopra, near the township of Damoh, three Stone-Age sites, not noticed before, were located.[2] The tool-collection consisted of (i) Acheulian bifaces of the Early Stone Age, (ii) a flake-blade-scraper assemblage corresponding to the so-called Series II type of implements, possibly of the Middle to the Upper Stone Age, and (iii) microliths. A well-cemented gravel at Harat, near Hatta, yielded a few early

[1] W. L. Wilson, *Proc. Asiatic Soc., Bengal*, 1867, pp. 142-43; J. Coggin Brown, *Catalogue of Prehistoric Antiquities in Indian Museum at Calcutta* (Simla, 1917), pp. 62-66.

[2] *Indian Archaeology 1957-58—A Review* (1958), p. 26.

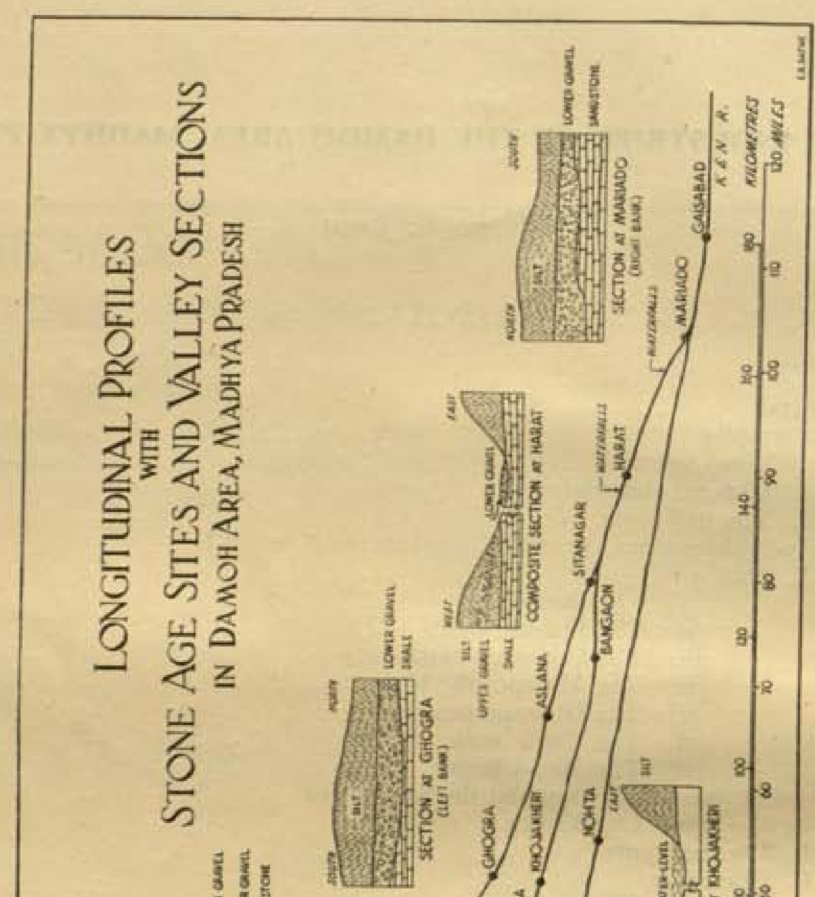

LONGITUDINAL PROFILES
WITH
STONE AGE SITES AND VALLEY SECTIONS
IN DAMOH AREA, MADHYA PRADESH
ABOVE MEAN SEA-LEVEL
FEET
METRES
SECTION AT REHLI
SECTION AT GHOGRA (LEFT BANK)
COMPOSITE SECTION AT HARAT
SECTION AT MARIADO (RIGHT BANK)
SECTION AT KHOJAKHERI
SONAR R.
KOPRA R.
BEARMA R.
KEN R.
TARDEHI
REHLI
BASA
GHOGRA
KHOJAKHERI
ASLANA
SITANAGAR
SANGAON
NOHTA
HARAT
MARIADO
GAISABAD
WATERFALLS
KILOMETRES
MILES

FIG. 2

palaeolithic tools *in situ*. As the area seemed to be promising, a detailed investigation, in November-December 1958, of the valleys of three major streams in the area, the Sonar, Kopra and Bearma, was undertaken. As a result thereof, fifteen Stone-Age sites were discovered (fig. 1), and tool-bearing Quaternary deposits were noticed on the Sonar at Rehli, Ghogra and Harat. An account of this investigation is given in the following pages.[1]

The surveyed area, lying approximately between 78°45′ and 79°30′ East Longitude and 24°20′ and 23°15′ North Latitude, falls partly in Sagar and partly in Damoh Districts. It comes under the drainage-system of the Yamuna, and due to its situation close to the Narmada basin, from which it is separated by the Vindhyan hills, it affords an ideal ground for a comparative study in the Stone-Age environments and cultures of the Narmada and the Yamuna regions.

The streams emerge from the spurs of the Vindhyas, which form the Narmada divide, about 100 miles south of Damoh and 70 miles south of Sagar, and, running almost parallel for some distance towards north-east, coalesce with one another and finally drain into the Ken, a major southern affluent of the Yamuna (fig. 2).

The region (fig. 3) is underlain chiefly by the Vindhyan rocks comprising sandstones and shales. In the upper reaches of these streams are outcrops of the Deccan Trap and the Bagh and Lameta formations. To the north of this region occur granites interspersed here and there by small outliers of the Bijawars. To the south, beyond the Narmada divide, is the Narmada basin filled in heavily with the older alluvium. It may be mentioned that the raw material for the Lower Palaeolithic industries of the region was drawn from the Vindhyan rocks, while the Deccan Trap and its associated Inter-Trappean formations account for most of the chert material that was utilized for the working of the Series II type of tools.

The streams have in general graded profiles, the average gradient being 4·97 ft./mile in the Sonar, 5·24 ft./mile in the Kopra and 3·09 ft./mile in the Bearma. The Vindhyan rocks, such as sandstones and shales, traversed by the rivers have influenced the gradient locally here and there, causing small waterfalls or rapids, such as are seen at Harat, Mariado, etc., on the Sonar. An interesting aspect of the long profile of the Sonar is that the stream has a comparatively steep gradient between Rehli and Ghogra and again between Sitanagar and Mariado, between which places occur the implementiferous deposits (fig. 2). The tool-bearing gravels at Rehli and Ghogra are about 5 to 10 ft. above the present water-level and lie over the Vindhyan rocks, the contact of which is about 5 to 6 ft. above the water-level. It seems, therefore, that the steepening of the gradient took place subsequent to the formation of the gravel-bed, possibly under the conditions of increased water-velocity caused by a change of climate from the drier to the wet.

2. STRATIGRAPHY

The tool-bearing Pleistocene gravel in this tract rests directly on the country-rock, which is either sandstone or shale. The surface of the sandstone does not show any weathering, but the shales, being comparatively soft, are crumpled, and at Rehli (pl. I) they have imparted a red colour to the overlying gravel-conglomerate. Due to their horizontally-bedded character erosion is not apparent. But a considerable disturbance at the contact of the gravel and the rock seems to have taken place, as blocks of underlying

[1] A short report has appeared in *Indian Archaeology 1958-59—A Review* (1959), p. 26.

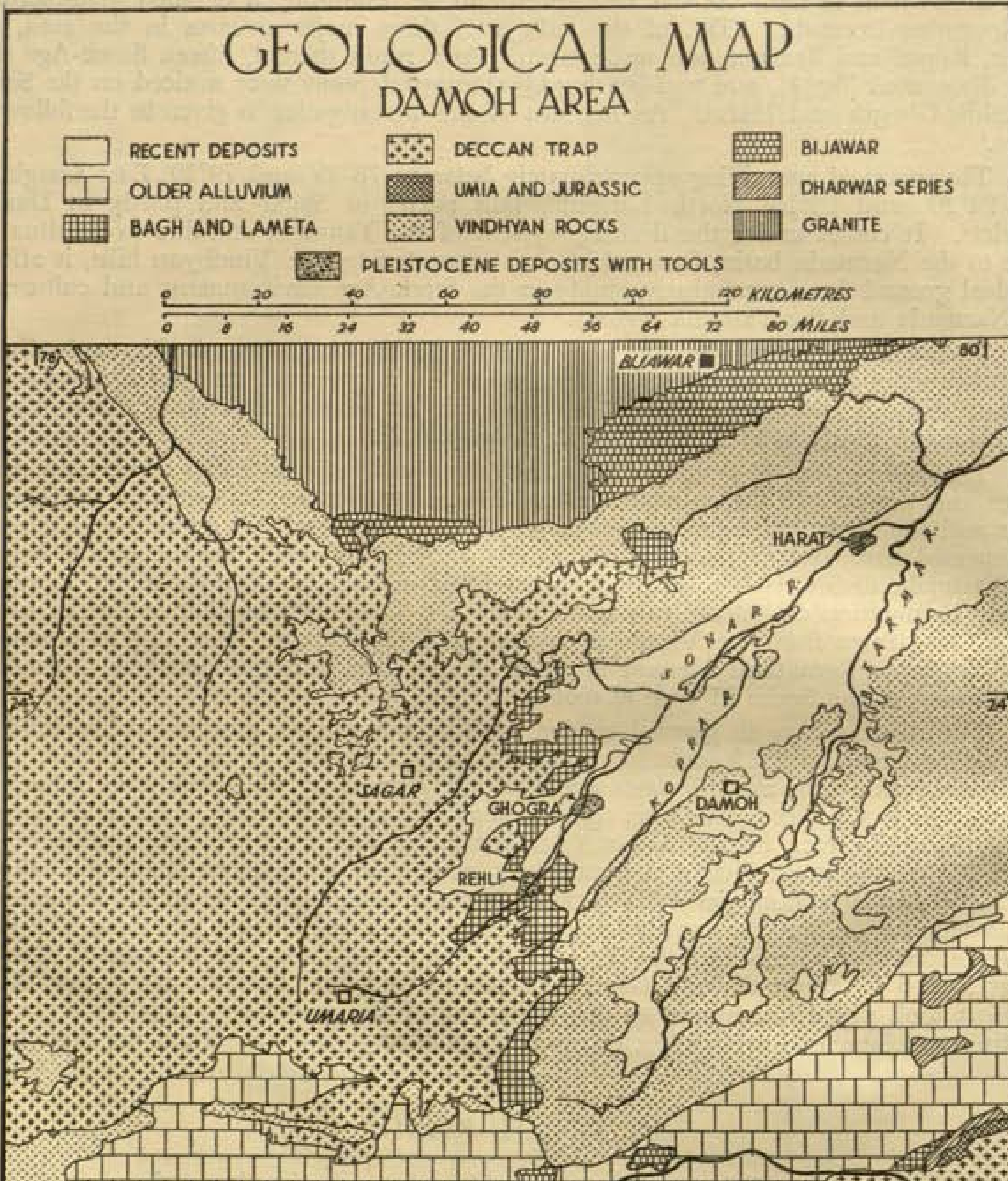
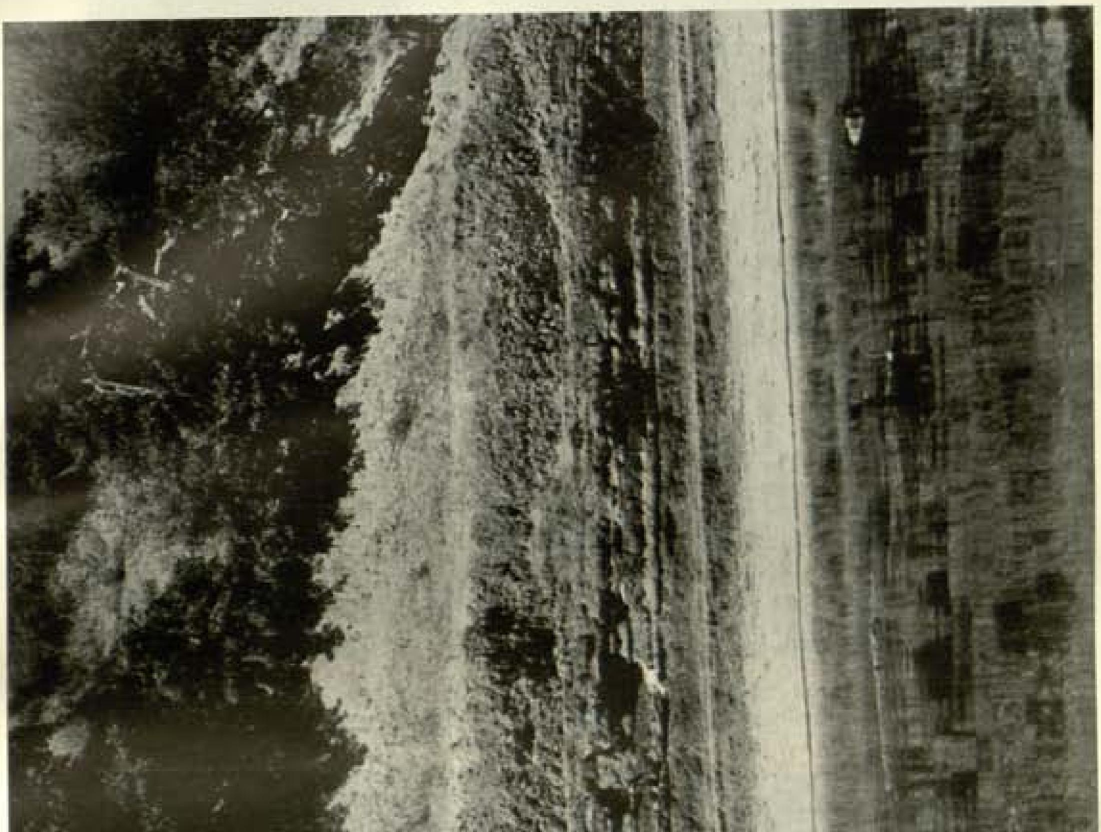
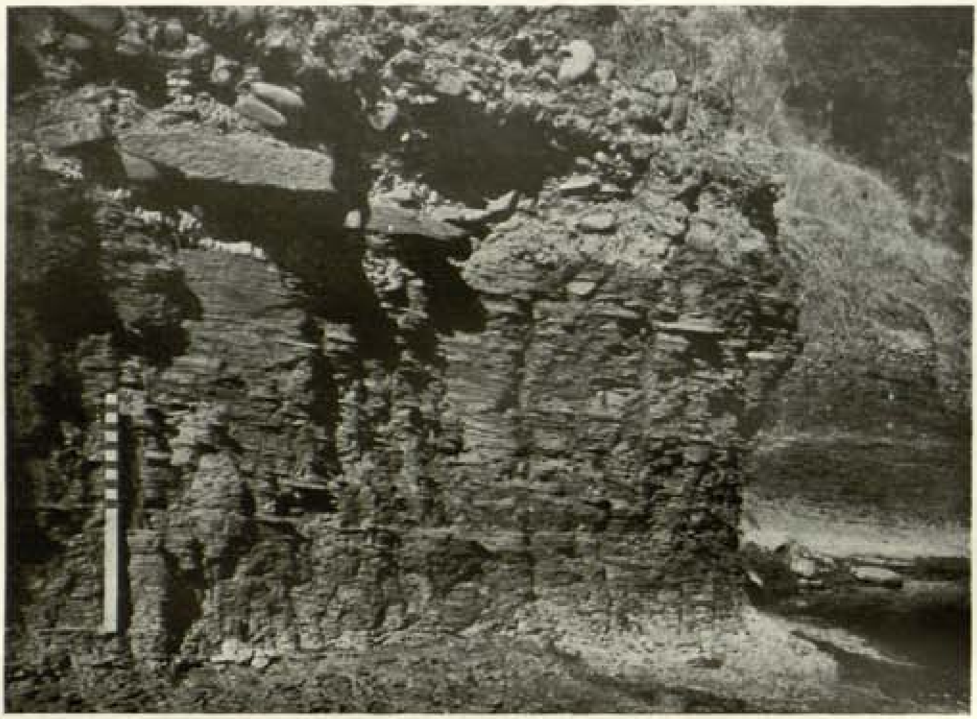

GEOLOGICAL MAP
DAMOH AREA
RECENT DEPOSITS
OLDER ALLUVIUM
BAGH AND LAMETA
DECCAN TRAP
UMIA AND JURASSIC
VINDHYAN ROCKS
BIJAWAR
DHARWAR SERIES
GRANITE
PLEISTOCENE DEPOSITS WITH TOOLS
0 20 40 60 80 100 120 KILOMETRES
0 8 16 24 32 40 48 56 64 72 80 MILES
BIJAWAR
HARAT
SONAR R.
KOPRA R.
BEARMA R.
SAGAR
GHOGRA
DAMOH
REHLI
UMARIA
NARMADA R.
NARSINGHPUR
78°
80°
24°

FIG. 3



Panoramic view of the left bank of the Sonar near Rehli. *See p. 7*



A. *Section on the left bank of the Sonar near Rehli, showing conglomeratic lower gravel on sandstones and erosional unconformity. See p. 9*

B. *Section on the right bank of the Sonar near Rehli, showing loosely-cemented upper gravel and sand. See p. 9*

A. *Section on the left bank of the Sonar at Ghogra, showing tool-bearing lower gravel.* *See p. 9*

B. *Section in the bed of the Sonar at Harat, showing the lower conglomeratic gravel resting on the flaggy sandstones.* *See p. 9*

To face pl. II

A. *Bed of the Bearma at Tardehi, showing tool-bearing gravel. See p. 9*

B. *Cliff-section of the left bank of the Kopra. See pp. 9 and 21*

To face p. 9

rock have been incorporated in the gravel and the surface appears uneven—a feature particularly seen near Ghogra. The compact gravel varies in thickness from 4 to 10 ft. and is composed of water-worn quartzite pebbles, of sizes up to 6 inches in diameter, occasionally mixed with pieces of flaggy sandstone and shale; its sand-content is negligible. The cementing-material is mostly calcareous tinted red or yellow, due to ferruginous clayey matter.

This section may be observed for nearly 50 yds. at Rehli (pl. II A) and for about 100 yds. at Ghogra (pl. III A), while at Harat (pl. III B) it occurs almost in the river-bed and runs for nearly 70 yds. At Basa and Mariado only small patches of the gravel are visible.

The gravel-bed was disturbed considerably by erosion even before the deposition of the overlying silt, which has a variable thickness from 10 to 25 ft. In its lower horizons, in contact with the gravel, it is hardened due to calcareous matter that binds the underlying gravel and contains numerous *kankar*-nodules. On the top of it has developed the recent soil, 1 to 2 ft. thick. The compact tool-bearing gravel was noticed not only in the cliff-sections on the banks but also in the bed of the river, as at Harat, thus indicating a regular and extensive gravel-deposit and not a local phenomenon caused by erosion of and deposition on the banks in the river-meanders.

Another deposit of a comparatively loosely-cemented gravel was noticed on the right bank of the Sonar near Rehli and was traced to a distance of nearly three-fourths of a mile downstream (pl. II B). At places the maximum thickness of the gravel is nearly 20 ft., and the exposures in small gullies that have cut through it show its landward extension for about 200 ft. Sometimes the entire cliff is composed of such gravel without any superimposed deposit of silt. Its contact with the underlying country-rock over which it rests is uneven. The gravel is composed of pebbles and sand, the latter sometimes predominating. Except a sort of cross-bedding or lamination here and there, it does not show any stratification or any kind of assortment of its contents. Wherever it is more sandy, it is hardened due to cementation. The gravel also contains numerous land and freshwater molluscan shells. The characters of this gravel are different from the early tool-bearing gravel-conglomerate exposed on the opposite bank at the same locality. It appears to be a redeposited gravel, more or less a fan-gravel, of later age.

The presence of chert nodules in this gravel is significant, as they are not noticed in the early tool-bearing gravel. In all probability the mixed sandy gravel on the bank here is the horizon for chert artefacts comprising flakes, blades and scrapers. It appears to have been deposited by the sluggish waters of heavily-loaded streams, possibly during a dry or semi-arid climatic condition. This is corroborated by the find of a similar gravel at Harat on the Sonar, where, on the left bank of the river, near the waterfalls, is an accumulation of gravel composing pebbles of sandstone, quartzite and small nodules of a variety of secondary siliceous minerals and sands. It is not a thoroughly-consolidated deposit and does not show any bedded character. This gravel yielded a good number of tools of Series II (below, p. 20).

A profusion of loose pebbly gravel was noticed on the Bearma at Tardehi (pl. IV A) in its source region, and again at Gaisabad almost near its confluence with the Ken, where a collection of rolled biface tools was made. The major course of this river is through a deeply-cut channel in the sandstones, and, except the silt-banks at places, nowhere any compact gravel-bed was met with. A thin layer of it was noticed on the Kopra river (pl. IV B) around Piparia and Khojakheri at the water-level. The bed of the Kopra near Sitanagar, in the vicinity of which village it meets the Sonar, is strewn with well-rounded pebbles of sandstone and chert but is devoid of any tools.

The gravel-bed at all the localities on these rivers is overlain by a thick deposit of yellowish brown silty-clay showing little laminations in the upper horizons; at a number of places the river-banks are composed entirely of this material. It did not yield any artefacts or fossils. Prior to its deposition, the gravel-bed seems to have undergone erosion, as is evident from its uneven contact with the overlying silt-deposit.

From this data the chronological sequence of events in the area may be summarized as follows.

1. Prior to the deposition of the implement-bearing gravel the rocks had been subjected to an intensive erosion. The flaggy sandstones and shales, due to their fragile nature and close joints, were eroded unevenly. This seems to have taken place in a comparatively-drier condition of climate, as the underlying rocks do not show much chemical decomposition and the fragments of these rocks which got mixed up with the overlying conglomerate show only mechanical disintegration.

2. The pebbles in the gravel-conglomerate are mostly of quartzite that is available only in the source-region of the three streams. (It is important to note here that all the early tools are made on quartzite.) It seems that the settlements of the Early Man were located on the spurs of the hills and in the proximity of the source of the streams. The earlier crude Abbevillean bifaces and accompanying pebble implements were manufactured in this period prior to the formation of the gravel-bed.

3. The later habitations occurred a little downstream around Rehli on the gravel-spreads formed due to the shifting of shingle from upstream. The earliest tools were also drifted along with the river-gravel and got partly rolled. During the formation of the gravel-bed (the implementiferous gravel-conglomerate noticed on the Sonar), these earliest tools were incorporated in the gravel along with the freshly manufactured later (Acheulian) implements, as noticed at Rehli. It may be stated here that the earliest tools of a comparatively-crude workmanship occur invariably in a rolled condition even in the upper reaches of these streams. The base-level of the rivers at this period was higher by at least 6 to 8 ft. than that of the present day.

4. This lower tool-bearing gravel was subjected later on to an intensive erosion, possibly under the conditions of increased precipitation, with the result that only in a few places it has survived. The deposition of the silt on the gravel brought the wet phase to an end and the river became graded.

5. The succeeding climatic phase was drier (a semi-arid climate), when the underlying gravel was cemented by calcareous material derived from the overlying silt. The occasional floods in the rivers of this period eroded the silt here and there and replaced it by the pebbly rubble mixed with much sand (the upper gravel-bed). The gravel on the right bank of the Sonar at Rehli may have been formed in this way. The cherts, chalcedony and allied siliceous minerals, derived partly from the Vindhyan rocks and partly from the Deccan Trap, are commonly met with in this deposit. The authors of the flake-blade-scraper industry utilized this material extensively for their tools.

6. A comparatively mild wet climate prevailed in the following period, when the rivers further deepened their channels by cutting into the bed-rocks. The silt of the earlier phase was not much affected, as the flood-water did not rise to that level. A little deposit of silty clay was formed on the gravel of the preceding phase. This climate was not much different from that of today.

From the list of the Stone-Age sites in this area (fig. 1), it will be evident that the Bearma valley was not much frequented by the Early Man except in its upper reaches in the hilly tract, as, apart from the sites at Tardehi and Gaisabad, no Stone-Age sites have been traced on this river. The tools found at Gaisabad near the confluence of the Bearma and the Ken are heavily rolled, indicating a long-distance transportation from upstream. As many as nine sites were found on the Sonar, and almost all of them yielded early Stone-Age tools. But such sites are singularly absent on the Kopra, which, on the other hand, provided the majority of the sites with the scraper-flake-tool industry. Only one microlithic site was noticed on the Navgaja hill within the boundaries of Damoh town. The collection consisted of a few flakes and fluted cores made on chalcedony.

3. EARLY STONE-AGE TOOLS

A. General observations

Over one hundred artefacts were collected during the survey from nine sites; of them twentyfour were obtained *in situ* from the undisturbed compact gravel-conglomerate, and the rest were found in the loose gravel-spreads in the river-beds. Stratigraphically, the industry represented by the artefacts does not permit any division into earlier and later stages, as those recovered from the compact gravel come from a single gravel-bed. However, an attempt has been made here to bring out certain distinctive features, keeping in view the physical characters, such as rolling and weathering, and the technique of manufacture of the artefacts obtained from the cemented gravel on the one hand, and of those found in loose river-gravels on the other.

The following observations may be made on the collection of tools found *in situ*. No pebble-butted handaxe was found in the compact gravel. The two handaxes obtained from that deposit are fully flaked out of pebbles, as noticed from a tiny patch of cortex on each of them. The workmanship is, however, crude and the implemen s are much rolled. One handaxe made on a pebble-flake of chert comes from the conglomeratic gravel; it is fresh and less rolled and is neatly worked (fig. 4, *12;* pl. V A, *12*). Likewise, one ovate made on a side-flake is fully worked along the edges and the front by step-technique, leaving a plain undersurface (fig. 4, *18;* pl. V B, *18*).

Out of six cleavers recovered from the compact gravel, five are made on end-flakes and one on a side-struck flake (fig. 5, *22* and *24-28;* pl. VI C, *22* and *24-28*). Of these, only two are fully flaked on both the faces by step-technique and their cross-sections are symmetrically biconvex. The remaining four (three on end-flakes and one on a side-flake) bear the original pebble-cortex on the front and have a partially-trimmed undersurface. Further, these specimens are more rolled than the two neatly-worked cleavers.

The collection also includes three medium-sized bifacial choppers (fig. 6, *101* and *106;* pl. VI B, *101*) and two discoidal cores on pebbles, all being more or less rolled. Of the flakes, of which there are eight specimens, two from Ghogra and six from Rehli, none has a prepared striking-platform, and the latter are invariably inclined at an obtuse angle with the plain primary flake-surface (fig. 6, *45, 46, 52* and *55;* pl. VII B, *45* and *46*). A few are secondarily retouched on the edges; all the specimens are more or less rolled.

The collection thus comprises both rolled tools showing crude workmanship and less-worn ones of better workmanship. Typologically, the former set of tools belongs to the Abbevillean to early Acheulian stages and the latter shows the mid-Acheulian technique. Considering the fact that a large proportion of pebble handaxes and other accompanying tools having Abbevillean characters mostly occurs in the loose gravel in a

TABLE I

SITE- AND TYPE-WISE DISTRIBUTION OF THE LOWER PALAEOLITHIC TOOLS

TOOLS AND THEIR CONDITION / *Sites*	HANDAXES			OVATES			CLEAVERS			SCRAPERS			FLAKES			CORES AND CORE-CHOPPERS			TOTAL
	R	SR	UR	R	SR	UR	R	SR	UR	R	SR	UR	R	SR	UR	R	SR	UR	
Sonar valley Rehli	—	—	—	—	1	—	—	3	1	—	1	1	—	1	3	2	—	—	13
Ghogra	1	—	—	—	—	—	2	—	—	—	—	—	—	1	1	5	2	—	12
Harat	1	—	—	—	1	—	—	2	—	1	1	—	1	—	1	3	—	—	11
Narsinghgarh	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	3	5	—	11
Mariado	3	—	1	—	—	—	—	—	—	—	—	—	2	—	—	3	3	—	12
Aslana	—	—	—	—	—	—	2	—	—	—	1	—	—	—	—	1	1	—	5
Bearma valley Tardehi	1	—	—	—	—	—	2	1	—	2	—	—	5	—	—	3	1	—	15
Gaisabad	4	1	—	3	—	—	—	1	—	—	2	—	4	1	—	12	5	1	34
Kopra valley Piparia	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
TOTAL	12	2	1	4	2	—	6	7	1	3	5	1	12	3	5	32	17	1	114

R = rolled; SR = semi-rolled; UR = unrolled

rolled condition, it appears that these tools are earlier than the formation of the gravel-bed; those which display better technique seem to have been made almost at the close of the aggradation of the gravel, so that they were subjected to the least amount of abrasion.

B. The tool-types

The collection may be divided into the following main types: handaxes; ovates; cleavers; pointed tools; scrapers; flakes; and cores and core-scrapers.

The adjoining table (Table I) shows the site- and type-wise distribution of the tools.

DESCRIPTION OF THE TOOLS

A. Handaxes

I. Handaxes on cores.—

The handaxes on cores are worked on medium-sized ovoid or subrectangular pebbles by bold flaking along the margin in one or both the directions. The flaking is not extended all over the body and patches of original pebble-cortex are left on either surface in the middle and on the butt-end. The tools are considerably rolled.

(i) Rounded or slightly-conical pebble-butt, sides converging into a tapering working-end. Freely flaked on one edge in one direction and alternately on the other. No secondary trimming. A patch of *kankary* yellow clay is seen on one edge. Rolled. Fig. 4, *1*; pl. V A, *1*.

(ii) On a subrectangular pebble, broad and straight pebble-butt. The point has been achieved by bold flaking at one corner on both the faces but the flaking has not been carried beyond half the distance along the length of the tool. Slightly retouched near the point. Rolled. Fig. 4, *2*; pl. VI A, *2*.

(iii) Thick subtriangular body, thick round pebble-butt. Boldly flaked alternately, producing an uneven edge. Prominent keel occurs on both surfaces due to intersection of the scars. The mid-longitudinal cross-section is rhomboid. No secondary working. Rolled. Fig. 4, *3*.

(iv) Same as (ii), but of a smaller size. Fig. 4, *4*; pl. V B, *4*.

(v) Roughly almond-shaped body with bold alternate flaking along the margin, resulting in a marked wavy edge. Much rolled. Fig. 4, *5*; pl. V A, *5*.

(vi) Subtriangular handaxe on thick pebble. Boldly flaked almost all round, resulting in a wavy edge. The front face shows crude step-flaking. Fig. 4, *6*; pl. V A, *6*.

II. Handaxes on flakes.—

The second group of handaxes consists of those which are made out of pebble-flakes. They are mostly unifacial, worked on the front only, the undersurface being a plain primary flake-surface.

(i) Made on a subtriangular end-flake. The upper surface shows only three broad and deep scars, two on one side and one on the other, leaving a rectangular cortical patch on the left. The butt is situated on the unflaked striking-platform. The undersurface is a plain primary flake-surface. Rolled. Fig. 4, *8*; pl. V A, *8*.

(ii) Same as above, but much rolled. Fig. 4, *9*; pl. V A, *9*.

(iii) Made on a side-flake. Freely chipped all along the edge on the exterior. The tool is thick in the middle and thin near the butt. The intersection of the two scars has produced a prominent mid-rib near the working-end. Cross-section in the middle of the length is plano-convex and near the point triangular. A little secondary trimming is visible on the left side. Rolled. Fig. 4, *10*; pl. V A, *10*.

(iv) Same as above, but of a smaller size. Rolled. Fig. 4, *11*; pl. V A, *11*.

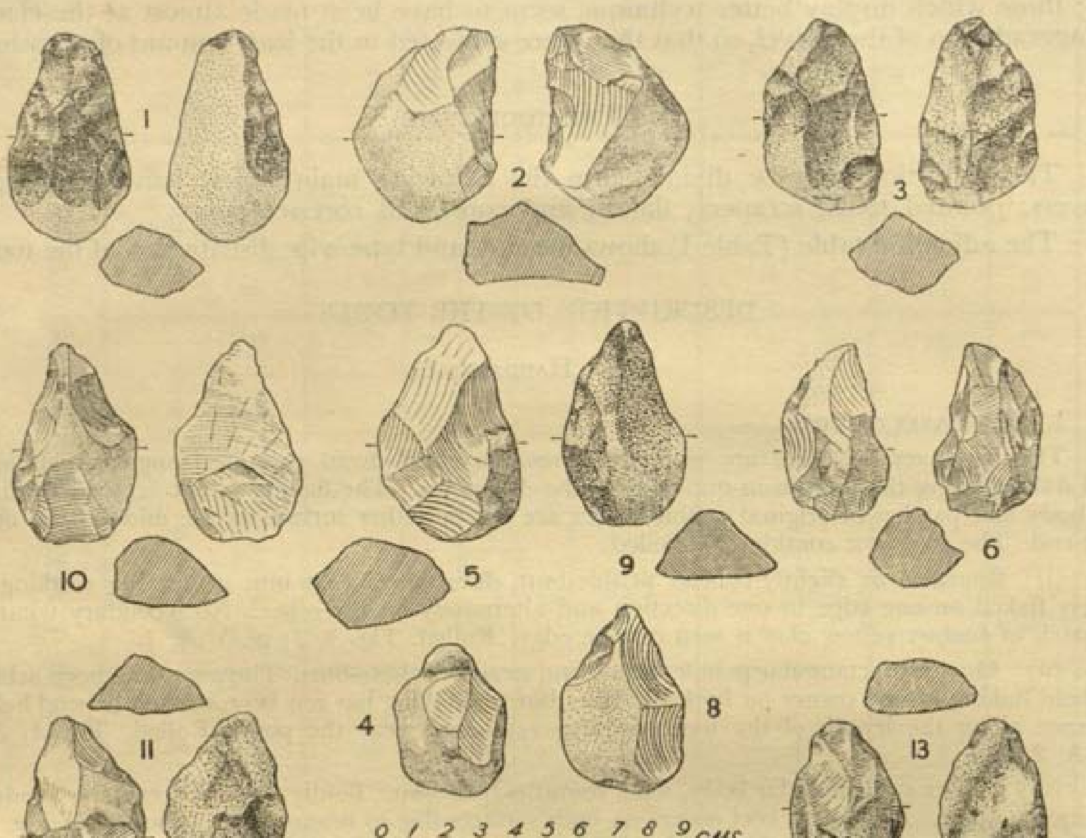


FIG. 4. *Early Stone-Age tools: 1-6, handaxes on core; 8-14, handaxes on flake; 15 and 17-20, ovates*

(v) Subtriangular small handaxe on brown chert-flake, alternately worked around the edge, leaving a small cortex-patch on the front. Convex butt. Little rolled. Fig. 4, *12*; pl. V A, *12*.

(vi) On a side-flake. Almond-shaped body with a thin tongue-like working-edge and broad butt. The only three scar-beds on the front near the point are shallow and indicate oblique flaking from the margin towards the central thick region. Much rolled. Fig. 4, *13*; pl. V B, *13*.

(vii) On a subrectangular side-flake from a pebble. One of the long sides is alternately flaked, resulting in a zigzag edge. The opposite side is flaked on the upper surface only, leaving a ribbon-like pebble-cortex in the middle. Secondarily trimmed near the point. Section roughly parallelogrammatic. Early Acheulian. Fig. 4, *14*; pl. V B, *14*.

B. Ovates

The ovates in the collection are made on flakes and are worked along the periphery by alternate flaking.

(i) Trimmed around the periphery on both the faces. One face carries a patch of hard calcareous sandy cementing-material by which it was bound with the gravel-bed. Crude workmanship. Much rolled. Early Acheulian. Fig. 4, *15*; pl. V B, *15*.

(ii) Broken at one end. Marginally trimmed alternately producing a mild wavy edge. Some scar-beds indicate a kind of step-flaking. More neatly worked than the above. Much rolled. Fig. 4, *17*; pl. V B, *17*;.

(iii) On a side-flake fully flaked on the front by step-technique. But for the trimming on the striking-platform, the undersurface is a plain primary flake-surface. Cross-section asymmetrically biconvex. Slightly retouched. Little rolled. Middle Acheulian. Fig. 4, *18*; pl. V B, *18*.

(iv) Oblong ovate on end-flake. Rolled. Fig. 4, *19*; pl. V B, *19*.

(v) Almond-shaped tool with a thin tongue-like point and thick butt. Worked all over, leaving a small patch of cortex on one surface near the butt-end. Middle Acheulian. Fig. 4, *20*; pl. V B, *20*.

C. Cleavers

The cleavers are made on flakes, mostly end-flakes, and are generally slightly rolled. On the basis of the nature of the cutting-edge, the butt and the sides, they can be classified into five groups.

I. Cleavers with convex butt, parallel sides and straight cutting-edge.—

(i) On a thick end-flake. The undersurface is a primary flake-surface and on this side working is seen only in the removal of the butt. The front is convex and is completely flaked by step-technique. Cutting-edge slightly oblique and worn. Cross-section plano-convex. Rolled. Middle Acheulian. Fig. 5, *22*; pl. VI C, *22*.

(ii) On an end-flake from a pebble. Slightly conical to convex butt. Worked along the two parallel sides alternately by step-technique. Finely retouched along the cutting edge, but the front, which is mostly covered by the original pebble-surface, and the under-surface, which is a primary flake-surface, are unworked. Rolled. Early to Middle Acheulian. Fig. 5, *24*; pl. VI C, *24*.

(iii) A perfect U-shaped cleaver finely trimmed all over. Alternately-trimmed parallel sides and convex flaked butt. The cutting-edge is straight and little abraded. Section biconvex. Middle to Late Acheulian. Fig. 5, *25*; pl. VI C, *25*.

II. Cleaver with angular butt, parallel or slightly divergent sides and broad and straight cutting-edge.—

On an end-flake, flaked all over both the surfaces by step-technique. The butt carries a patch of cortex. The cutting-edge is thin and abraded. Slight secondary retouch on one side. Section parallelogrammatic. Almost fresh. Middle Acheulian. Fig. 5, *28*; pl. VI C, *28*.

III. Cleavers with sides convergent towards short angular butt and broad cutting-edge.—

(i) On a side-flake. Angular butt with one side covered with original pebble-cortex; the other side carries a large scar of the flake taken on the front from the side. The underside is a plain primary flake-surface. The cutting-edge is broad and finely retouched, perhaps to strengthen the edge against break during use. Also finely trimmed on one side near the butt. Section asymmetrically biconvex, thick on one side and tapering towards the other. Middle Acheulian. Pl. VI C, *26*.

(ii) Similar to above. The slightly-convex butt and upper high surface are completely covered by the pebble-surface. But for a very limited trimming on one side, the undersurface is a plain primary flake-surface. On the front steeply worked on one side by step-technique, while the other side shows scars of bold flaking. Retouched on the straight cutting-edge. Rolled. Early Acheulian. Fig. 5, *27*; pl. VI C, *27*.

IV. Cleaver with large finely-flaked and elaborately trimmed body.—

Alternately-flaked convex or round butt and sides, converging towards a short cutting-edge. Beautifully retouched all along the margin. Section biconvex. Advanced Acheulian. Fig. 5, *21*.

V. Cleavers with rectangular butt, almost convergent sides and straight or oblique cutting-edge.—

(i) On a thick rectangular end-flake. The front is steeply flaked along the two sides which converge towards a short (shorter than the butt) freshly-broken cutting-edge. The underside is a plain primary flake-surface with a prominent bulb of percussion. Secondary retouch on sides. Cross-section biconvex to trapezoid. A little rolled. Middle Acheulian. Fig. 5, *30*; pl. VI C, *30*.

(ii) On a rectangular end-flake. Boldly flaked alternately along the two parallel sides. The butt is straight and unworked, striking-platform obliquely inclined to the primary flake-surface. Subsequent trimming has produced scar-beds reminiscent of step-technique. The oblique cutting-edge is much abraded. A little rolled. Fig. 5, *31*; pl. VI C, *31*.

(iii) On a thick rectangular end-flake similar to (i), but with parallel sides. Section rhomboid. Much rolled. This may be classified as a chisel. Fig. 5, *32*; pl. VI C, *32*.

D. Pointed-tools

There are a few artefacts in this collection having a short thick point.

(i) On a medium-sized flat-based discoid pebble. The front carries two broad U-shaped scar-beds, one on either side, meeting at a strong point. On the underside a deep cut has been taken vertically for a short distance down from the point. The tool has a flat base and a humped upper face. The unworked pebble-surface provides a good hand-grip. A little rolled. It may have served as a borer. Fig. 6, *43*; pl. VII A, *43*.

(ii) A small plano-convex pebble has been steeply flaked on the front, the scars converging into a point. On the flat undersurface, an obliquely-directed flake near the point has reduced the thickness and improved the pointed end. A borer on pebble. Fig. 6, *81*.

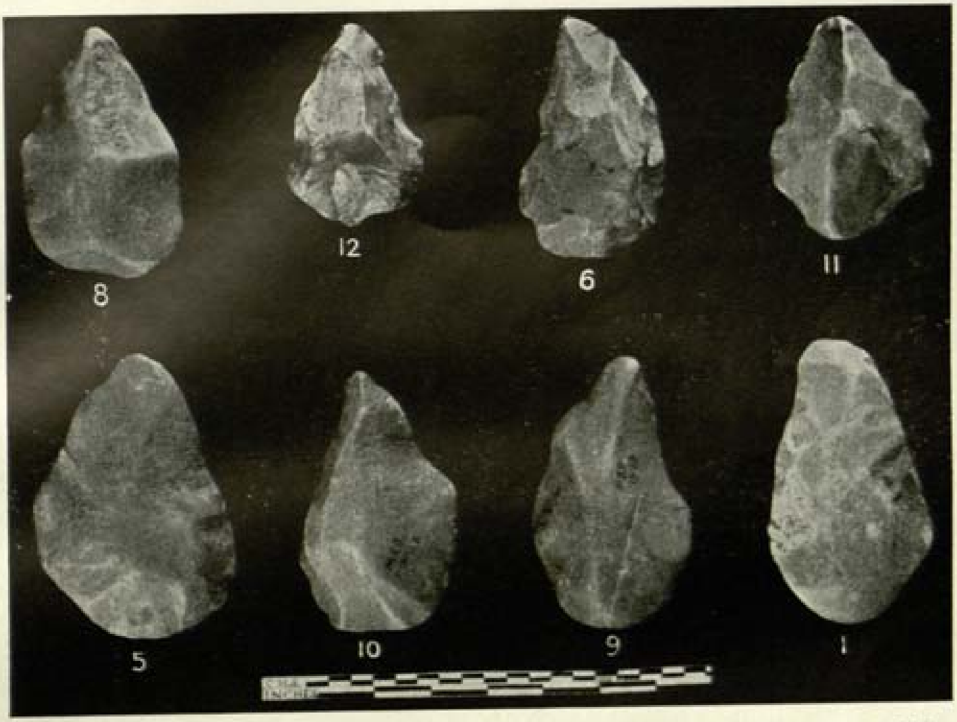
(iii) Made on a discoidal pebble, this specimen has two large scar-beds on the upper surface intersecting into a rough point. The undersurface is unworked. Fig. 6, *94*; pl. VII A, *94*.

(iv) An ovoid side-flake from a thoroughly-rolled pebble has been flaked at one end of the major axis resulting in a short projecting point. Fig. 6, *42*; pl. VII A, *42*.

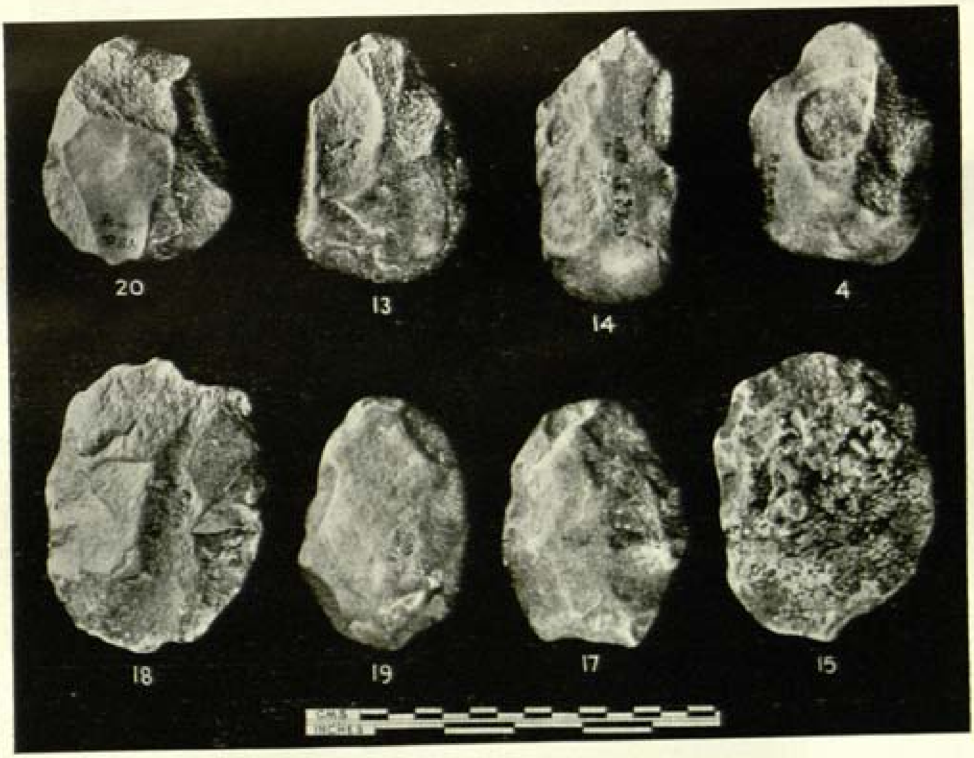
E. Scrapers on flakes

(i) Subtriangular body. All the three sides have been trimmed forming triple-edged scraper. Rolled. Fig. 5, *33*; pl. VII A, *33*.

(ii) Subtriangular end-flake with a narrow unfaceted and wide-angle striking-platform. Finely retouched around the edge. Almost fresh. Fig. 5, *34*; pl. VII A, *34*.



A. *Early Stone-Age tools: 1, 5 and 6, handaxes on core; 8-12, handaxes on flake. See pp. 11, 13 and 15*

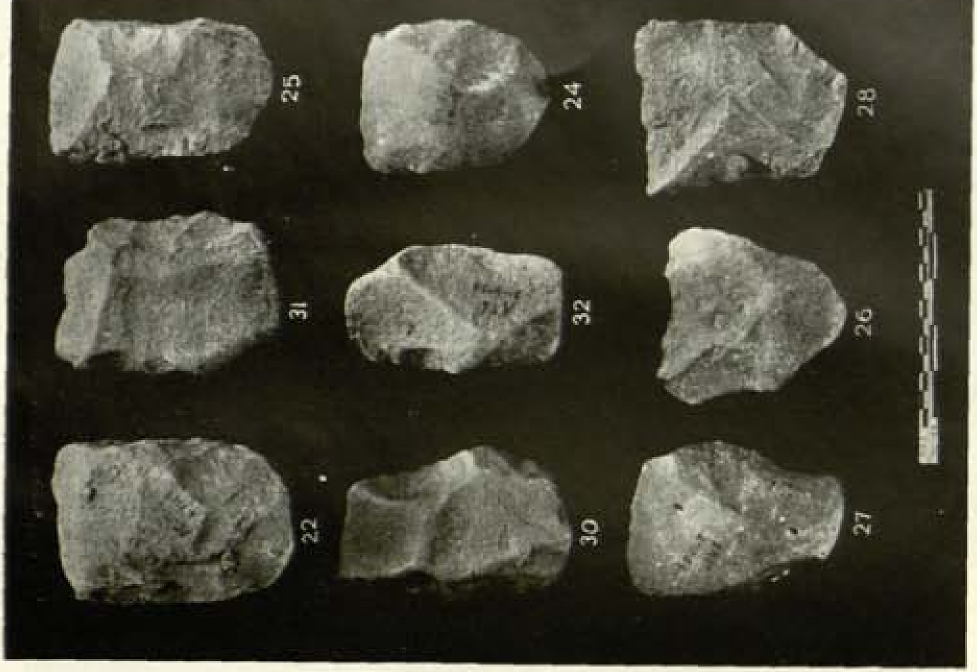


B. *Early Stone-Age tools: 4, handaxe on core; 13 and 14, handaxes on flake; 15 and 17-20, ovates. See pp. 11, 13 and 15*

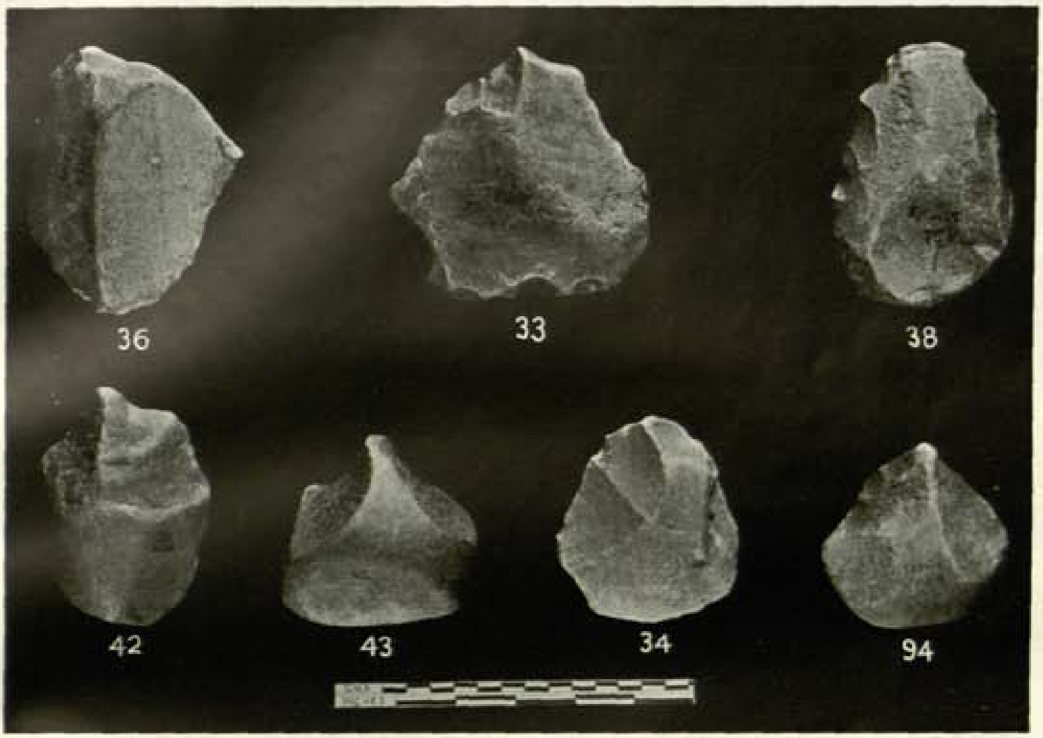
To face p. 16

A. *Early Stone-Age tool: handaxe on core. See p. 13*

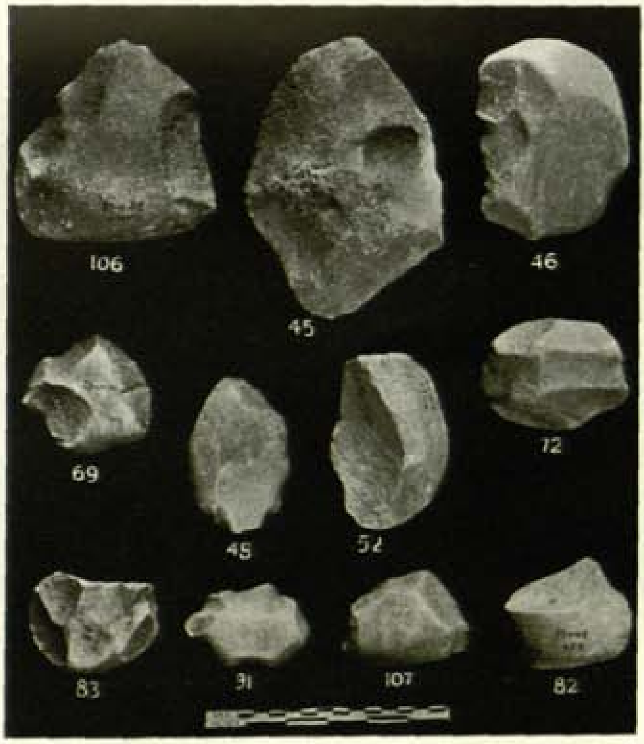
B. *Early Stone-Age tool: chopper. See pp. 11 and 20*



C. *Early Stone-Age tools: cleavers. See pp. 11, 15 and 16*



A. *Early Stone-Age tools: 33, 34, 36 and 38, scrapers; 42, 43 and 94, pointed tools. See pp. 16 and 19*



B. *Early Stone-Age tools: 45, 46, 48 and 52, flakes; 82, 83, 91, 106 and 107, choppers; 69 and 72, cores. See pp. 11, 19 and 20*

Series II tools: scrapers. See pp. 26 and 28

To face p. 17

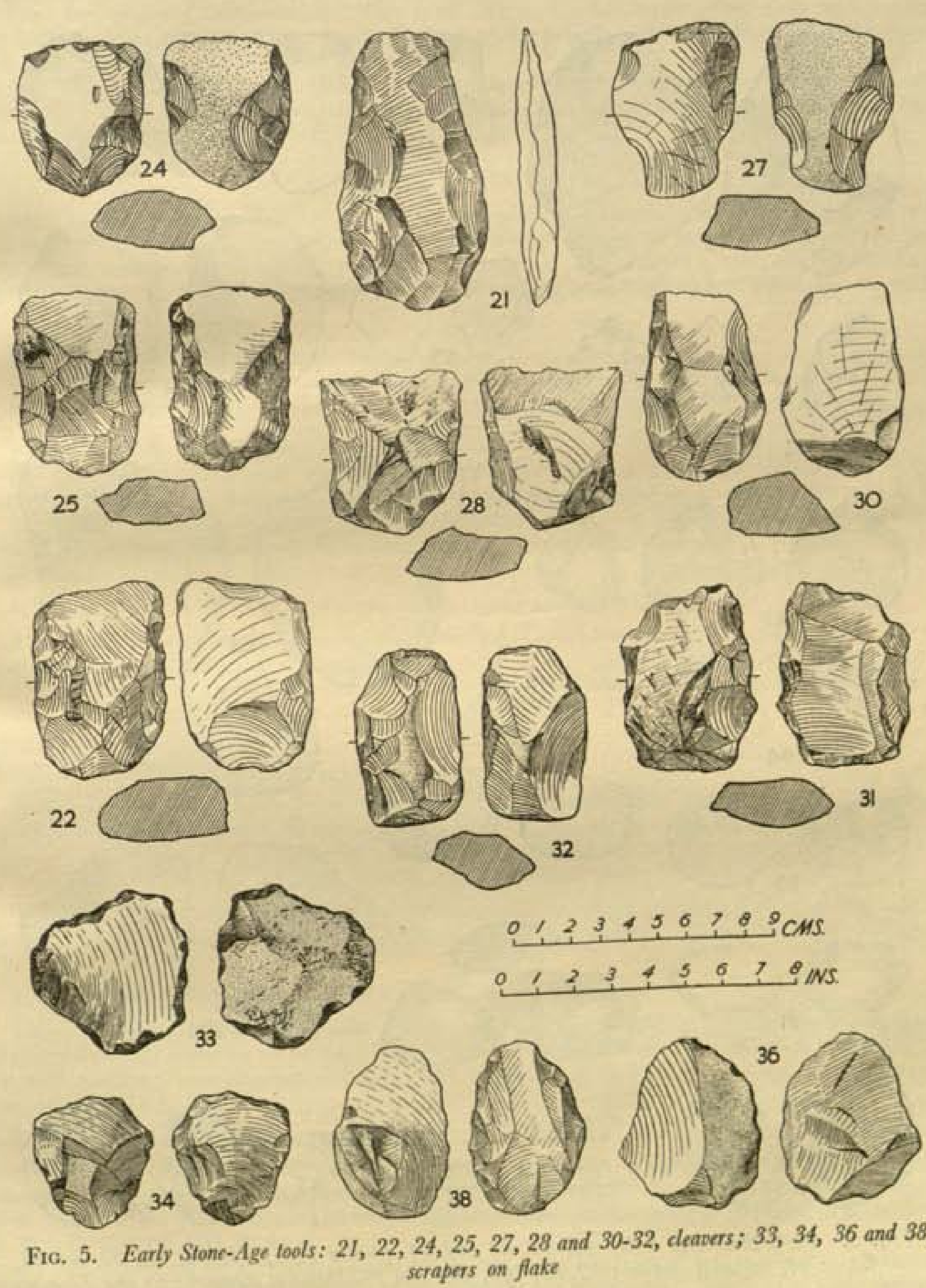


FIG. 5. *Early Stone-Age tools: 21, 22, 24, 25, 27, 28 and 30-32, cleavers; 33, 34, 36 and 38, scrapers on flake*

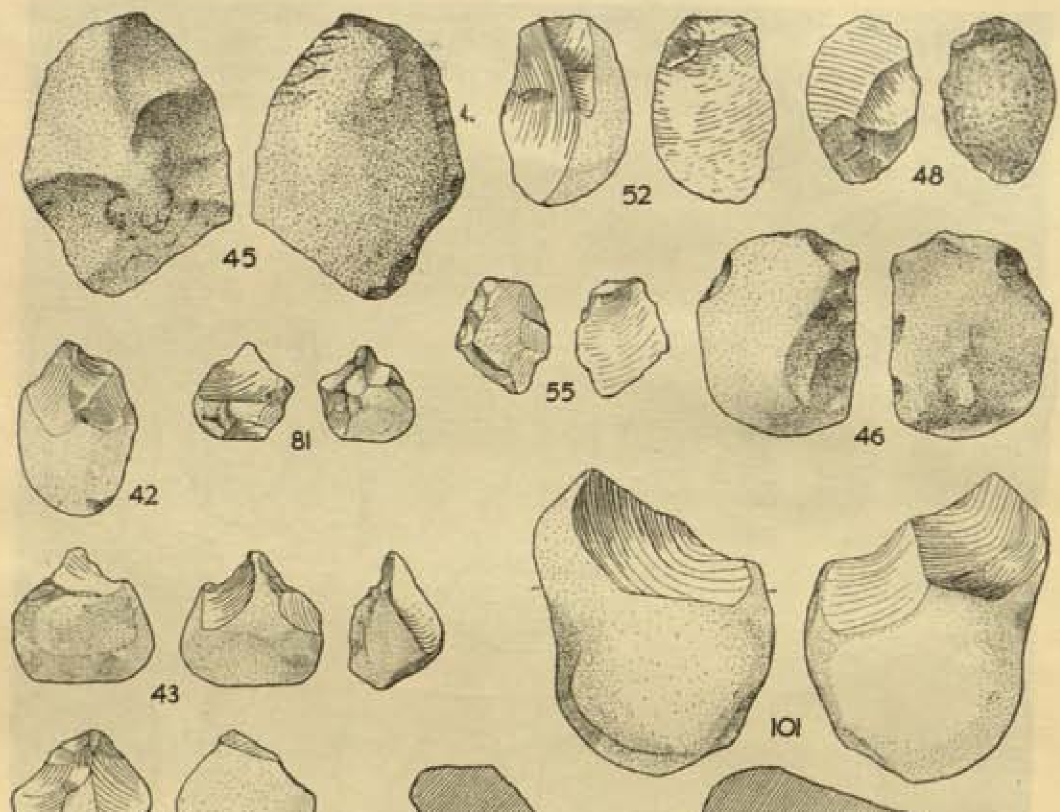


FIG. 6. *Early Stone-Age tools: 42, 43, 81 and 94, pointed tools; 45, 46, 48, 52 and 55, flakes; 91, unifacial chopper; 82, 83, 101, 106 and 107, bifacial choppers; 69 and 72, cores*

(iii) Ovoid or almond-shaped body, plain and broad striking-platform making an angle of 120° with the primary flake-surface. The front carries a wide longitudinal scar which occupies nearly half the front surface, the remaining half being the pebble-surface trimmed all along the edge. Fig. 5, *36*; pl. VII A, *36*.

(iv) An ovoid thick flake with convex pebble-cortexed platform and prominent bulb of percussion. Flaked along the sides with blows directed transversely towards the butt-end. Further minutely trimmed on one side. Fig. 5, *38*; pl. VII A, *38*.

F. Flakes

Most of the twentyfive flakes obtained in the exploration are taken out from the rolled pebbles which were not prepared for the purpose, so that their upper surface is invariably covered by pebble-cortex. The undersurface is a plain primary flake-surface which makes a wide angle with the plain striking-platform. A few of them show a slight secondary trimming on the sides, but beyond this there is no dressing.

I. Thick subrectangular flakes.—

(i) From a much weathered sandstone pebble. Fig. 6, *45*; pl. VII B, *45*.

(ii) Steep free flaking on the front on one lateral side. Fig. 6, *46*; pl. VII B, *46*.

II. Oval or almond-shaped flakes.—

(i) Retouched along one edge. May have been used as a convex side-scraper. On its undersurface the bulb has been erased by the removal of flattish step-flakes. Fig. 6, *48*; pl. VII B, *48*.

(ii) With plain obtuse-angled striking-platform. The front shows a large longitudinal scar on one side; the opposite side is thick and cortex-covered. No secondary retouch. Fig. 6, *52*; pl. VII B, *52*.

III. Oval-shaped flakes with the front showing scar-beds.—

The scar-beds, two to three in number, are large and cover nearly half the area; they are formed by obliquely-directed blows from one side. The opposite side is thick and is covered by the pebble-surface, thus providing a hand-grip. The lower surface is unworked. The thin long edge has been retouched particularly in one specimen. The tools could have been used as side-scrapers.

IV. Subtriangular small flake.—

Small subtriangular flake from a weathered quartzite pebble with a plain and wide-angle platform. Secondarily worked all along the periphery. Fig. 6, *55*.

G. Cores and core-choppers

The tools of this category, which constitute nearly one-third of the total collection, are made on thoroughly rolled quartzite pebbles of different sizes and shapes. There are both unifacial and bifacial types.

I. Unifacial choppers or steep scrapers on pebbles.—

Generally oval or flattish discoidal pebbles are preferred for the unifacially-worked choppers or more correctly steep scrapers on pebbles. A typical one is described here. Flattish ellipsoidal to the major axis resulting into an uneven edge. The underside is unworked. A side-scraper on pebble. Fig. 6, *91*; pl. VII B, *91*.

II. Bifacial core-choppers.—

(i) From a small discoidal pebble two large flakes have been removed along the margin; the scar-beds intersect each other and form a mild medial ridge. On the other face only one large flake is taken on the same side. The remaining unworked pebble-surface provides a suitable hand-rest. Fig. 6, *82*; pl. VII B, *82*.

(ii) A somewhat small rectangular pebble has been alternately worked along the three sides leaving the fourth long side unworked. The cutting-edge is uneven. There is a slight secondary, work along the edge resulting in short step-flake scars. A side-chopper on pebble. Fig. 6, *107*; pl. VII B, *107*.

(iii) Same as (i) but further flaked, secondarily along the edge, which, although sinuous, is well-defined. Fig. 6, *83*; pl. VII B, *83*.

(iv) On a medium-sized triangular discoidal pebble steeply flaked along the two sides, leaving the third side and the central portion unworked. Fig. 6, *106*; pl. VII B, *106*.

(v) Worked on a large ellipsoidal pebble, it is boldly flaked at one end of the major axis, alternately resulting in two deep scar-beds on one side and one on the other. A heavy Clactonian type of chopper with pebble-butt. Fig. 6, *101*; pl. VI B, *101*.

III. Cores.—

They can be grouped into: *discoidal cores,* made on medium-size lumps or pebbles of quartzite and showing alternate flaking along the periphery; and *irregular cores.* A typical specimen of each group is described below.

(i) Discoidal core on a discoidal pebble flaked alternately along the periphery, resulting in an equatorial wavy edge. Small cortical patches are seen in the centre on both faces. Fig. 6, *69*; pl. VII B, *69*.

(ii) Irregular core on a block of quartzite showing crude alternate flaking along the margin. Fig. 6, *72*; pl. VII B, *72*.

4. FLAKE-BLADE-SCRAPER ASSEMBLAGE IMPLEMENTS OF SERIES II

A. Stratigraphy

(i) *The Damoh area*

Another prolific Stone-Age industry of the Damoh area is represented by flakes, flake-blades, scrapers, etc., of diminutive size, invariably worked on varieties of chert, jasper and allied siliceous material. As will be seen from the following discussion, this industry is comparable with what has been labelled 'Series II' by H. D. Sankalia, who first noticed it on the river Pravara, Ahmadnagar District, Maharashtra State.[1] In the present area, the sites yielding such type of implements are commonly located in the Kopra valley but are poorly represented in the valleys of the Sonar and the Bearma.

Upwards of two hundred tools were obtained during the survey, mostly from the loose gravel in the river-beds and therefore unstratified. Those recovered from stratified deposits constitute a small number.

The deposit containing these tools is generally a medium- to fine-grained gravel mixed with much sand. Its components are a few small-sized water-worn pebbles of quartzite, subround fragments of the Vindhyan sandstones and shales and a large quantity of sandy material consisting of lumps of chert, jasper, chalcedony, etc., the latter two mostly derived from the disintegrated Deccan Trap. The chert material is derived partly from the conglomeratic rocks of the Vindhyan and Cuddapah formations and partly from the Infra- and Inter-Trappean rocks associated with the flows of the Deccan Trap. Usually the deposit is poorly consolidated and does not show any layered structure except a sort of a cross- or current-bedding here and there, indicative of shallow-water deposition. It occasionally contains freshwater molluscan shells; no other fossil has yet been found. Unfortunately, no large-sized section of this deposit is available on the Kopra,

[1] H. D. Sankalia, 'Animal-fossils and palaeolithic industries from the Pravara basin at Nevasa, District Ahmadnagar', *Ancient India,* no. 12 (1956), pp. 35-52.

which, as stated above (p. 9), yielded the largest number of tools, and the valley of which is generally devoid of early tools (p. 11).

At Khojakheri, about 7 miles west of Damoh, the Kopra has a closely-meandering course, the area within the bends being extremely gullied. In one of the meanders on the left bank below the village, a ½- to 1-ft. thick fine gravel was noticed almost at the water-level, superimposed by a 20- to 25-ft. thick silt-deposit (pl. IV B). This sandy gravel contains nodules of chert, and two or three tools were obtained from it. Similarly, near Basa and Piparia-Maria small patches of the gravel were again seen on the left bank, but they did not yield any artefacts. The size and composition of the components of the gravel-spreads, from which the major collection of tools was made, compare well with those of the tool-bearing gravel-bed. The characters of a similar gravel-bed on the right bank of the Sonar near Rehli have been already detailed above (p. 9).

At this stage, it would be interesting to review the characters of the deposits bearing similar industries noticed in other parts of India.

As stated above (p. 20), Sankalia first reported, in 1956, the occurrence, in stratified deposits in the Pravara basin, of this type of lithic industry, which he designated tentatively as 'Series II'. In the following years several new sites with this industry have been brought to light. The characters of the tool-bearing deposits of a few of them are described below.

(ii) *The Pravara basin*[1]

Three gravel-beds have been noticed in the Pravara basin near Nevasa. The lower bed generally yields tools of the earlier industry, while those of the Series II come from Gravels II and III. The components of the lower gravel are mostly pebbles of the Deccan Trap and dolerite with a subordinate amount of secondary minerals derived from the disintegrated Trap-rock. The gravel is usually coarse and well-cemented. The contents of Gravels II and III are fine-grained, in places predominantly sandy, and occasionally showing cross-bedding. These gravels are also generally compact.

Between Gravels I and II there is a conspicuous break caused by an intervening yellow fissured clay. The contact between Gravels II and III, however, is not marked clearly, but the latter deposit is much finer; possibly Gravels II and III represent one cycle of aggradation with coarser facies at the bottom (i.e. Gravel II).

(iii) *The Godavari basin*[2]

Near Gangapur, about 5 miles from Nasik, on the Godavari, Sovani noticed the following section. The bed-rock (the Deccan Trap) is covered by a hard cemented gravel (Gravel I), which, in succession, is overlain by a yellow silt. Over this is another gravel, less coarse-textured than Gravel I, which yielded rolled Early to Middle Acheulian tools. This gravel in turn was capped by a moderately-thick deposit of 5½ ft. of a fine and partly-cemented gravel (Gravel III), which, in all probability, is the finer facies of the underlying coarser gravel, i.e. Gravel II. Over it was the thick deposit of silt. No tool was found in Gravel II.

[1] Sankalia, *op. cit.*

[2] *Indian Archaeology 1956-57—A Review* (1957), p. 11. K. D. Banerjee's observations on the same basin are embodied in his unpublished thesis for Ph. D. of the University of Poona.

(iv) *The Malaprabha basin*[1]

Tools of the type of Series II have been reported only from one site on the Malaprabha, viz. Taminhal, Mysore State. The section in the old river-bank at the site is as follows. On the weathered granite-gneiss covered by the mottled clay is a conglomeratic gravel containing Lower Palaeolithic implements. It is capped by a sandy deposit, on which rests a smaller gravel, from which come tools of Series II. Over this is a brown clay, which again is overlain by fine sand and a little gravel. The last is covered by the recent deposit of dark clay.

(v) *The Ghataprabha basin*[2]

The tool-bearing deposit in this basin is not properly exposed, and most of the specimens come from the loose gravel. A kind of loosely-consolidated medium-sized gravel is noticed near Bagalkot, District Bijapur, Mysore State, on the left bank in the bed of the river, which is littered with a number of tools. Its relation with the earlier or later deposits is not quite clear due to heavy silting in the river-bed.

(vi) *The Tapti basin*[3]

A portion of the Tapti valley between Prakasha and Ukai in West Khandesh District, Maharashtra State, was recently surveyed by the author; a large collection of tools of Series II was made from the loose gravel, and a few others were obtained from the cemented gravel near Uddhamgadh. The sections observed in this tract are as follows. A little downstream from Manjarod a section shows weathered pink and vesicular Trap-rock at the water-level, overlain by 3 to 4 in. of brownish silt, which, in succession, is covered by 2 ft. of thick gravel-bed consisting of small pebbles of trap-rock, chert, jasper, chalcedony, etc. Upwards, this pebbly gravel is sandy, the sandy portion being 8 to 10 ft. thick and showing current-bedding. There is no break between the lower gravel and the overlying sands, the whole being a single aggradational deposit. The gravel is further overlain by a thick yellow silty deposit, at places more than 30 ft. thick. This gravel yielded a few tools of Series II.

The Panjra, a tributary of the Tapti, near Dhulia, shows a layer of current-bedded hard sandy-gravel resting on the Deccan Trap. A few flakes of chalcedony were recovered from it.

At Amoda on the Kan, a tributary of the Panjra river, below a huge deposit of calcareous tufa, there was some trap-gravel resting on the Deccan Trap, from which a cleaver-like flake and a scraper, both on trap and of a large size, were removed. It seems to be a lower gravel yielding tools of earlier industry. The tufa was overlain by cemented fine gravel containing numerous nodules of siliceous material, but no tool was found in it. This, in turn, was covered by a 2- to 3-ft. thick silt.

On the right bank of the Tapti near Uddhamgadh the cemented gravel consisting of pebbles of trap and chert lies on the country-rock, the Deccan Trap, and is itself overlain by a 2-ft. thick layer of cross-bedded sands. The sands are highly cemented, and wherever the lower gravel has been eroded, they project out of the section to form short platforms slightly away from the main bank, which is wholly made of silt. From

[1] R. V. Joshi, *Pleistocene Studies in the Malaprabha Basin* (1955), pp. 29-31.
[2] This site was visited by the author in 1956 with Dr. Sankalia.
[3] *Indian Archaeology 1958-59—A Review*, pp. 22-25.

the section, at the junction of the gravel and sands, were obtained four or five tools of Series II type. A patch of this deposit is also seen a little further close to the water-level, but it is much disturbed and appears to be partly reconstituted.

The stratigraphy of the tool-bearing deposits in the examined portion of the Tapti may thus be summarized as follows.

1. There is no earlier tool-bearing gravel in this portion of the Tapti proper. The gravel-bed observed in the tributary of the Panjra is, however, the earliest deposit containing tools of handaxe facies, worked on the trap-rock. This is Gravel I.

2. Gravel I is overlain by a yellowish brown clay-silt, noticed below the gravel-bed at Manjarod; it is represented as a calcareous deposit at Amoda, on the Kan.

3. Above it is the medium trap-gravel, which at places is slightly pebbly, becoming finer, and therefore sandy, upwards. The sands are cross-bedded and on account of their fine texture are firmly cemented. This is Gravel II, and it is the horizon yielding tools of Series II.

4. Over this is the thick yellow silty deposit, on the top of which occur microliths.

(vii) *The Wuna basin*

The author's recent survey of a section on the right bank of the Wuna, in Nagpur District, Bombay State, a tributary of the Wardha river, has shown a 4- to 6-ft. thick coarse sandy gravel on the weathered Deccan Trap. The rock displays spheroidal weathering, and the gravel lies between the partially-weathered trap-boulders. The gravel is highly cemented, so that the tools embedded therein had to be chiselled out. Nearly thirtyfive implements of the flake-blade-scraper industry worked on chert were obtained from the gravel and many more were picked up from the river-bed. The implementiferous gravel is the only deposit noticed in the Nagpur area so far, and as such there is no sufficient stratigraphic evidence to show how it stands in relation to the gravel containing earlier tool-industries. But considering its composition and texture and the tool-contents, it may be regarded tentatively as contemporary to Gravel II of the Tapti and the Pravara.

(viii) *The Son and the Ken basins*[1]

These two rivers are the southern affluents of the Yamuna, draining parts of Panna and Rewa Districts of Madhya Pradesh. In its upper reaches the Ken collects the waters of the Sonar and the Bearma of the Damoh area. A recent exploration in this tract has brought to light nearly fifteen Stone-Age sites, ranging from the Lower Palaeolithic handaxe culture, through the Middle Stone-Age industries, to the microliths occurring at the same site either in combination or individually. The basal gravel yielding early implements is rarely noticed in an undisturbed condition, its pebble-contents and accompanying tools either being washed off from the gravel-beds and left loose in the river-beds, or being covered with alluvium and talus outwash.

Only at Bariarpur, a site on the Ken, west of Panna, a well-preserved, though loosely-consolidated, pebbly gravel, occupying a terrace slightly higher than the present river-bed, provided a number of implements of the handaxe facies on quartzite pebbles. Artefacts of Series II were picked up from the fine gravel lying at a lower level than this early terrace-gravel.

[1] *Indian Archaeology 1957-58—A Review*, pp. 25-26.

A beautiful section of the gravel-bed containing the flake-blade-scraper assemblage is noticed at Kohari on the Baghain, a tributary of the Ken. This river has preserved the Middle Stone-Age flake-scraper industry lain *in situ* in its lower gravel and thus gives a convenient type-section for that industry by its stratigraphic context, richness and variety. The implementiferous gravel here rests on sandstones and is overlain by about 15-ft. thick alluvium.

In the examined stretch, the Son has not shown any lower gravel containing Early Palaeolithic tools *in situ* but has yielded the flake-blade-scraper assemblage, apparently *in situ*, at a level of nearly 25-ft. in eroded exposures of fine sand and coarse silt, as at Chorhat and Markandeya Bridge near Sarsi. The tools of this assemblage are, as usual, made on chert and jasper and roughly represent the same types, viz. scrapers and points on flakes or flake-blades.

(ix) *Conclusions*

The above review of the tool-bearing deposits noticed at some of the recently-explored sites leads us to the following conclusions.

1. The sediments containing the flake-blade industries are later than those containing the Lower Palaeolithic tools, typified by the handaxe. Between these two deposits of gravels there is a bed of silt devoid of any tool industry.

2. The fine texture and the cross-bedding or lamination of the sediments associated with the tools of Series II indicate their deposition under comparatively dry conditions. There are evidences to show the erosion of this deposit and also of a part of its underlying older gravel. No fossils have been found in the gravel except a few molluscan shells, such as are commonly met with even in the present river-beds.

Some sites yielding tools of the Series II industry have been located in the vicinity of the outcrops of the raw material, away from the river-banks, as at Koradih near Nagpur, where the tools do not seem to have been much disturbed, as they occur in the fields not very deep from the surface. But this does not mean that they are of recent date, as wherever such tools are found in river-sections, there is a thick deposit of silt overlying the tool-bearing gravel.

B. The tool-types

Except a very few tools which are on chalcedony, the majority are prepared out of brown or reddish-brown chert. The tools obtained from the gravel-beds are almost fresh, while those collected from the loose gravel show slight rolling and smoothening of their original sharp edges or points. The more rolled tools are difficult to distinguish from the rest of the gravel-element, as they have lost all their identification-marks as tools except some faint outlines indicating shapes. Such specimens, although collected at the start of the exploration were discarded later on and have not been taken into account in working out the proportions of different tool-types in the collection.

The flakes and short blade-flakes predominate. The majority of them have obtuse-angled plain striking-platform and unworked undersurface. Those with cortex-covered fronts are evidently waste flakes removed from the pebbles in their initial dressing before the flakes were taken out for tools. But in a fairly large number of flakes the upper surface carries either roughly longitudinal or converging scars, indicative of their removal from partially or fully-prepared cores. Such flakes do not necessarily have faceted striking-platforms.

Next to the flakes which usually have been utilized for dressing into tools, the blades form about 15 per cent of the total collection. They are thicker than those of the microlithic type. The most prevalent type in them is the backed blade: the back is either covered with original pebble-cortex or in a few cases intentionally prepared. Such blades could have been used directly without further treatment. There are some parallel-sided blades, comparatively thick, retouched into side-scrapers, and some are notched at one or two places on the sides. They are rarely utilized for making points.

Besides flakes and blades, the authors of this industry used nodules or naturally-cleaved tabular pieces of chert for making tools. An interesting type of such material is a piece removed from the corner of a rectangular block of chert with three vertical sharp edges that converge into a point. Such pieces may have been utilized directly for digging or piercing without further retouch. The flat tabular nodules have been used for making hollow scrapers or side-scrapers. Some borers and points are also made on nodules.

The flakes are further worked into tools by retouching along one or two edges as side-scrapers, the steep retouch at one end in thick flakes producing end-scrapers. A few flakes have been dressed into points. In one or two specimens a conspicuous tang at one end is visible.

A few of the cores may have been suitably used as end-scrapers or worked into awls or borers. There are two or three rod-like alternately-flaked cores, producing two longitudinal parallel wavy edges and medial ridges on either face, so that the cross-section in the middle is rhomboid. At one end the two faces meet into a chisel-edge. Such tools may have served as chisels or retouchers.

It is difficult to apply any rigid scheme for grouping this assemblage into types. They cannot be subdivided on the consideration of shapes as, except blades, tools having identical shapes are rarely met with. It has been stated above (p. 24) that the majority of the tools are worked on flakes and these flakes have triangular, subrectangular or quadrilateral forms. The industry is, therefore, divided into the following types based upon the possible use of each, although some of the implements may have served more than one purpose: scrapers; tools with point (points and borers); blades; flakes; nodules; and cores and core-choppers. Table II shows a generalized site-wise distribution of these types.

DESCRIPTION OF THE TOOLS

A. Scrapers

(i) *Side-scrapers*

I. Subtriangular side-scrapers with straight edges.—

(i) On a thick large and roughly triangular end-flake of dirty grey chert. The two lateral sides are crudely trimmed steeply, while the third one is partly worked. Fig. 7, *16*.

(ii) Subtriangular small flake. The two sides are finely retouched, and the third one carries the plain platform. Fig. 7, *11*.

(iii) Subtriangular, somewhat leaf-shaped end-flake with an unfaceted striking-platform inclined at an obtuse angle with the plain primary flake-surface. Only two long sides finely worked. Fig. 7, *59*.

II. Subrectangular side-scrapers with straight edges.—

(i) Made on a thin rectangular bladish end-flake having a wide-angled plain platform and unworked undersurface. One of the two long sides is thick and is covered by pebble-cortex. The opposite thin side is finely retouched. Fig. 7, *5*; pl. VIII, *5*.

TABLE II

SITE- AND TYPE-WISE DISTRIBUTION OF TOOLS OF SERIES II

Sites \ Tools	Flakes	Blades and flake-blades	Nodules	Cores	Total
Sonar valley					
Harat	18	7	4	3	32
Narsinghgarh	4	—	2	2	8
Garhakota	4	5	—	2	11
Sitanagar	2	2	—	—	4
Aslana	1	1	—	—	2
Mariado	4	2	—	2	8
Bearma valley					
Gaisabad	10	—	—	1	11
Tardehi	3	1	2	1	7
Kopra valley					
Piparia	13	5	5	3	26
Bangaon	13	11	9	7	40
Basa	7	3	1	1	12
Kopra	19	19	10	15	63
Total	98	56	33	37	224

(ii) Subrectangular thick flake removed from a partially-prepared core has been secondarily retouched along the two long parallel sides which converge into a dull point. Cross-section in the middle of the length is triangular. Fig. 7, *13*; pl. VIII, *13*.

(iii) On a small side-flake with roughly rectangular to oval outline finely retouched all along the margin. Fig. 7, *23*; pl. VIII, *23*.

(iv) Somewhat similar to (i), but on a thick flake. Only one long side is trimmed into a scraper-edge. Fig. 7, *21*; pl. VIII, *21*.

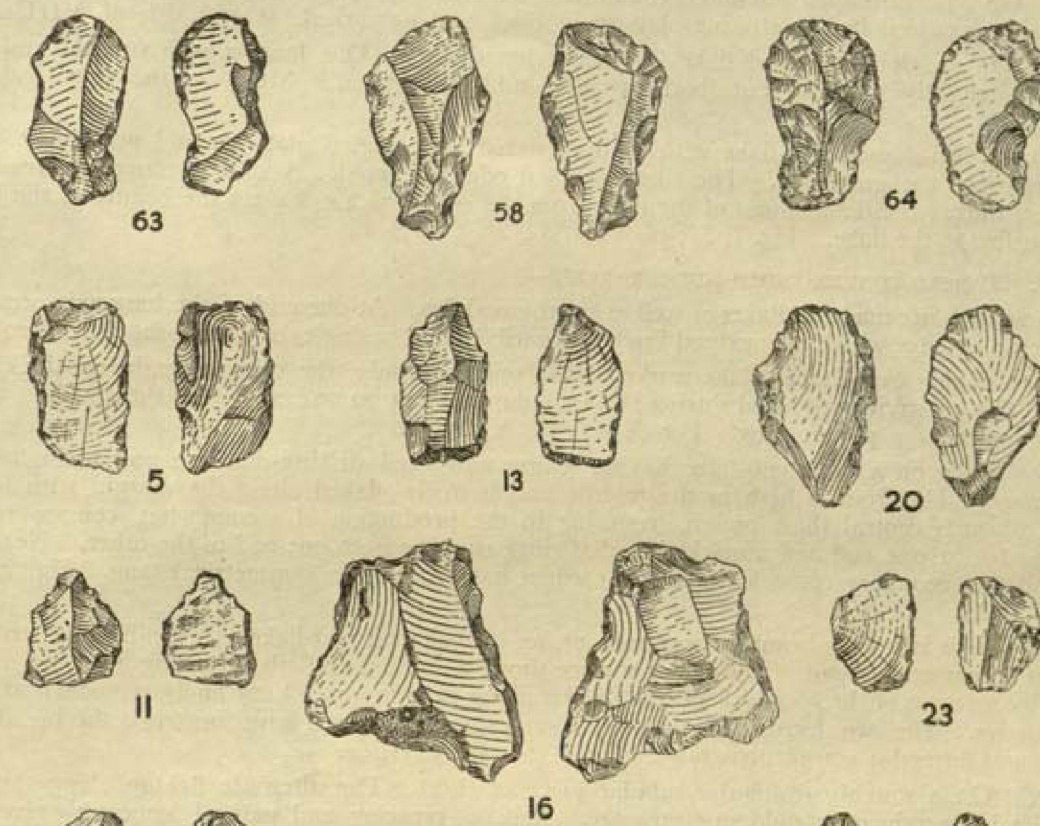


FIG. 7. *Series II tools: side-scrapers*

III. Side-scrapers on oval or leaf-shaped flakes with convex working-edges.—

(i) On an oval-shaped side-flake, the undersurface worked only along one convex edge. The opposite side occupied by the striking-platform is thick and unworked. Fig. 7, *20*; pl. VIII, *20*.

(ii) On an elongated oval flake from a prepared core. One long edge is straight and the opposite is slightly convex, but both are secondarily worked. Much worn. Fig. 7, *56*; pl. VIII, *56*.

(iii) A leaf-shaped side-flake with cortex-covered wide-angled platform and prominent bulb of percussion on the underside. The single worked edge is curved. A kind of tang has resulted at one end during the detachment of the flake from the core which enhances the beauty of the leaf-shaped outline of the flake. Fig. 7, *57*; pl. VIII, *57*.

IV. Tanged convex-ended side-scrapers.—

These tools are made on flakes as well as on the nodules. At one end of the long axis occurs a convex scraping-edge which may extend further towards the other single- or double-shouldered end.

(i) Roughly oval-shaped flake worked along one edge only, the other edge being thick and broken. The concavity produced during the secondary flaking on one edge near the end has given the appearance of a pseudo-tang. Fig. 7, *63*; pl. VIII, *63*.

(ii) Made on a thick end-flake having a tiny unworked striking-platform and plain flattish undersurface. The front is high in the middle and is freely flaked along the margin with blows directed towards central thick region, resulting in the production of a somewhat convex rough scraping-edge at one end and a marked medial ridge running from one end to the other. Near the other end the secondary retouch on both the edges has produced a symmetrical tang. Fig. 7, *62*; pl. VIII, *62*.

(iii) This is a very beautiful specimen on an oval-shaped end-flake. A small plain striking-platform occurs at one end. The upper surface shows a marked mid-rib extending from end to end formed by meeting of the scar-beds of free flaking along the margin. Very finely retouched around the thin edge. The two deep scar-beds, one on each side at one end, have shortened the breadth of the tool and formed a conspicuous tang. Fig. 7, *64*; pl. VIII, *64*.

(iv) On a roughly triangular tabular piece of chert. The alternate flaking along the two long sides has produced a mild uneven edge. A little tapering and natural concavity gives the appearance of a pseudo-tang at one end. Fig. 7, *58*; pl. VIII, *58*.

(v) Similar to above but more shapely. It is made on a rod-like chert piece. Due to medial cleavage-ribs on either face, the cross-section in the middle is rhomboid. The two long parallel edges are much worn and the working is hardly noticeable. A deep flaking on one end of the tool has formed a single shoulder. Fig. 7, *60*; pl. VIII, *60*.

V. Side-cum-end scrapers.—

(i) Made on a small subrectangular blade-like flake, it is steeply retouched on one long thick side which curves round at both ends. The other parallel side is thin and broken, perhaps due to use. Fig. 8, *15*; pl. IX, *15*.

(ii) *End-scrapers*

The implements of this group are made on subtriangular flakes or nodules. The two converging sides are usually thick, and the third side perpendicular to the long axis is thin and worked into a scraper-edge. The first two of the following appear to be tranchets.

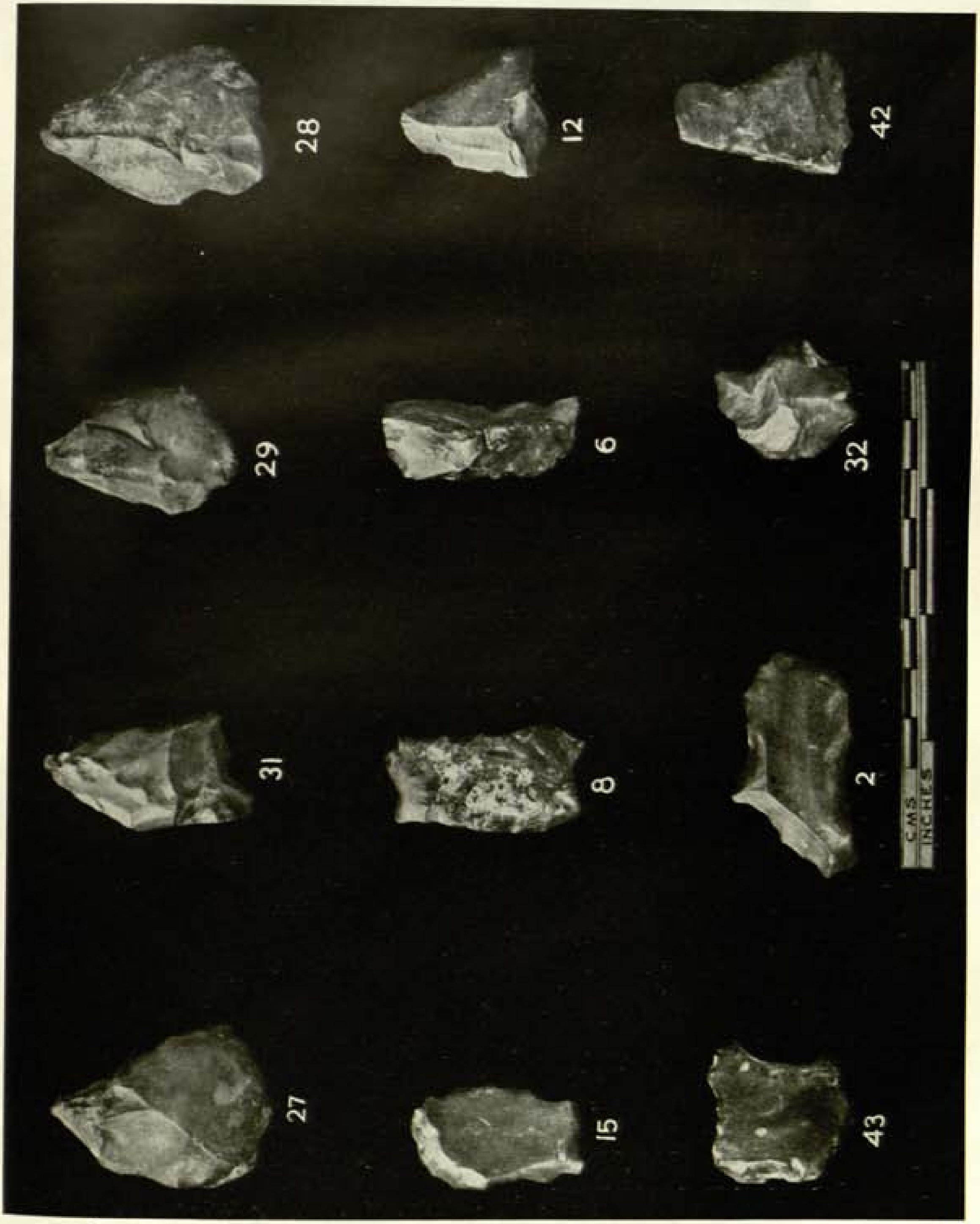
(i) On a subtriangular flake, the two lateral thick sides are partly worked steeply, while the third slightly-convex scraping-edge is finely retouched. Fig. 8, *27*; pl. IX, *27*.

(ii) Made on a flat triangular flake. The working-edge is abraded and the other two sides are unworked. Fig. 8, *30*.

(iii) On a thick triangular nodule with straight scraping-edge. Fig. 8, *28*; pl. IX, *28*.

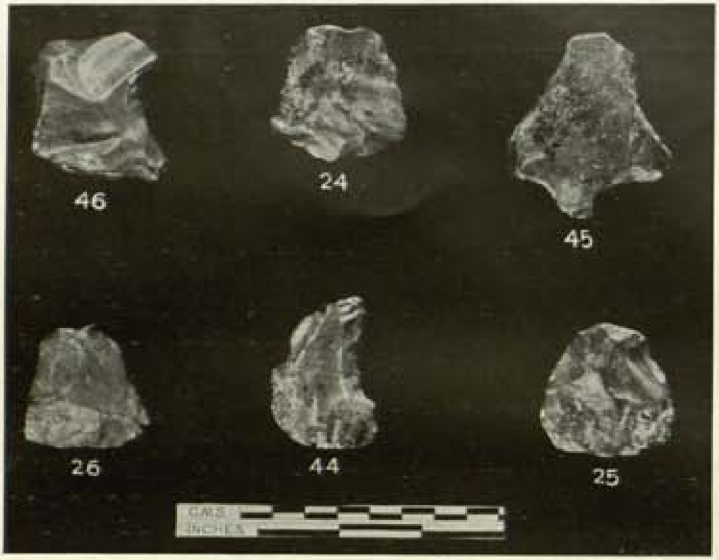
(iv) Similar to above. Rolled. Fig. 8, *29*; pl. IX, *29*.

PLATE IX

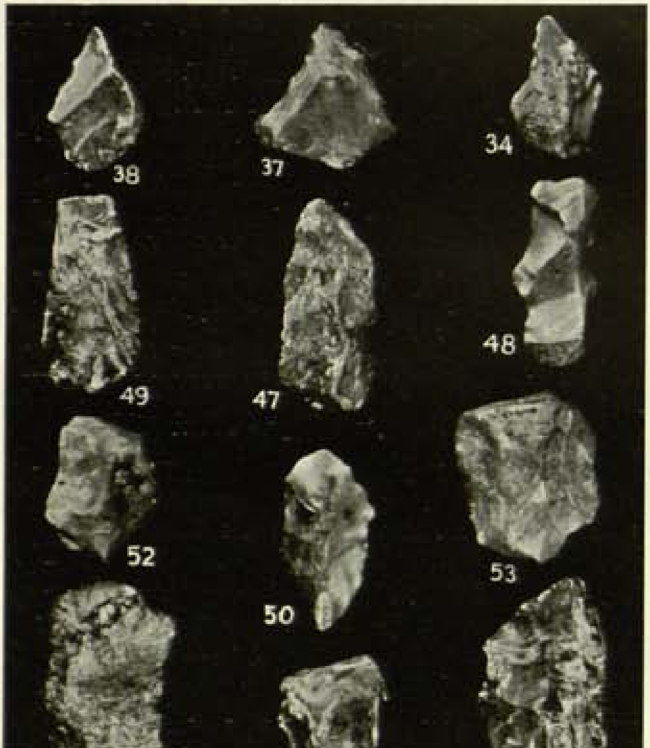


Series II tools: 2 and 32, points; 6, 8 and 12, blades; 15, side-cum-end scraper; 27-29 and 31, end scrapers; 42 and 43, concave scrapers. *See pp. 28, 30 and 32*

To face p. 28



A. *Series II tools: 44-46, concave scrapers; 24-26, flakes. See pp. 30 and 32*



B. *Series II tools: 3, blade; 37, borer; 34 and 38, points; 47-50, nodules; 51 and 52, choppers; 53 and 54, core scrapers. See pp. 30, 32 and 33*

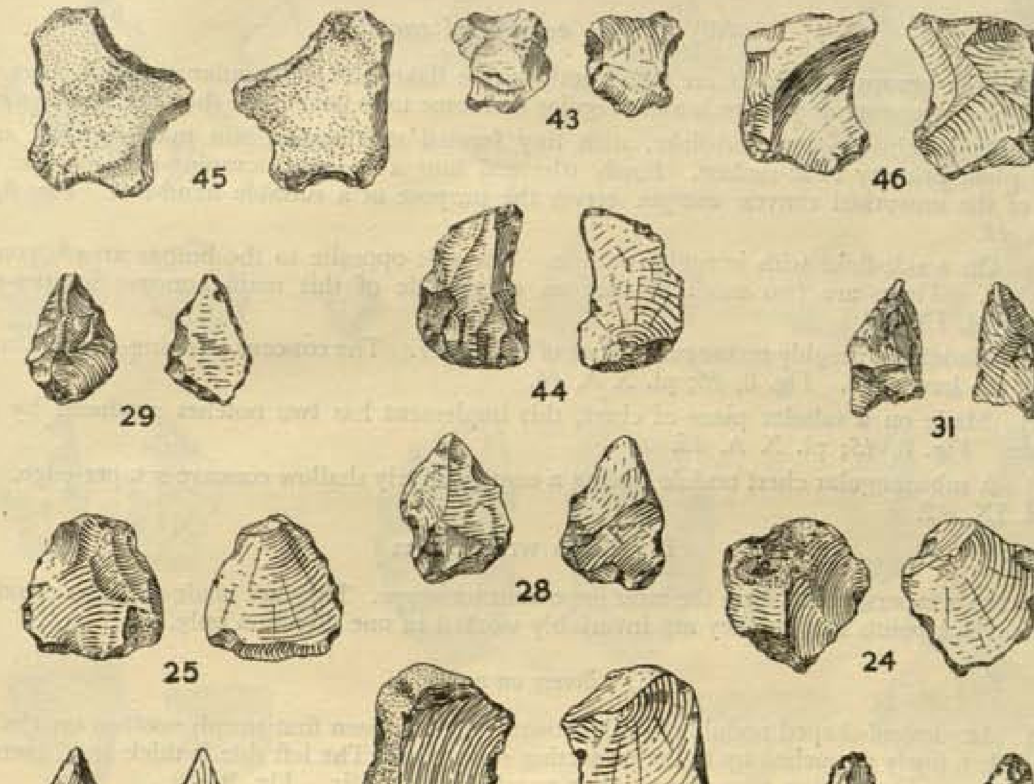


FIG. 8. *Series II tools: 3, 6, 8 and 12, blades; 15, side-scraper; 24-26, flakes; 27-31, end-scrapers; 42-46 concave and notched scrapers*

(v) Similar to (iii). The finely-trimmed scraping-edge is slightly concave. Fig. 8, *31*; pl. IX, *31*.

(iii) *Concave and notched scrapers*

Like other groups these tools are made both on the flakes and the tabular pieces of chert. In the flakes the concave scraping-edge is more regular and some tools have more than one concave edge.

(i) On a subtriangular end-flake, with tiny faceted striking-platform making right angles with the plain primary flake-surface. Finely trimmed into a concave scraping-edge on one side, the rest of the unworked convex margin serves the purpose of a suitable hand-rest. Fig. 8, *44*; pl. X A, *44*.

(ii) On a side-flake with irregular outline. The side opposite to the bulbar area is concave and worked. There are two small notches on either side of this main concave scraper-edge. Fig. 8, *43*; pl. IX, *43*.

(iii) Made on a roughly rectangular block of red jasper. The concave scraping-edge is situated on one of the long sides. Fig. 8, *46*; pl. X A, *46*.

(iv) Made on a tabular piece of chert, this implement has two notches produced by steep retouching. Fig. 8, *45*; pl. X A, *45*.

(v) A subtriangular chert nodule having a comparatively shallow concave scraper-edge. Fig. 8, *42*; pl. IX, *42*.

B. Tools with points

Next to scrapers, points form the most important tool-type. They are made on flakes or nodules and are uniface points in that they are invariably worked in one direction only.

(i) *Borers on nodules*

(i) An almond-shaped nodule of dark brown chert has been first steeply worked on the right edge and then finely retouched up to the projecting stout point. The left side is thick and covered by pebble-surface. The section near the point is parallelogrammatic. Fig. 9, *40*.

(ii) Subtriangular piece of chert having a flattish or slightly-concave base and trihedral front. Steeply retouched on the two lateral sides which converge into a point. This may have served as a side-scraper-*cum*-borer. The cross-section near the point is triangular. Fig. 9, *37*; pl. X B, *37*.

(iii) Same as above but more symmetrical in outline. Fig. 9, *39*.

(iv) A small rhomboid-shaped nodule has been finely trimmed on the two edges that meet at a fine point. The undersurface shows a deep negative scar. Fig. 9, *33*.

(ii) *Points on flakes or flake-blades*

(i) Almond-shaped uniface point on an end-flake. The unworked lower surface shows a minute plain striking-platform. On the upper face there is a mid-rib running from the point and meeting another two transverse ridges in the centre of the tool with the result that the cross-section is triangular. Fig. 9, *38*; pl. X B, *38*.

(ii) Same as above but with a more projected point. It is made on a simple end-flake from a weathered pebble of chalcedony. The whole of the upper surface is covered by the pebble cortex and the underside is also plain. Fig. 9, *34*; pl. X B, *34*.

(iii) Beautiful symmetrical arrow-head on a small flake. The shape is like a pointed oval minutely retouched all along the margin. The front shows a mild mid-rib extending from the point down to the opposite end. Fig. 9, *35*.

(iv) Made on a subtriangular chert flake. The bulb of percussion is situated obliquely at one corner. The tool has been very finely worked from the upper side along the two lateral edges producing a sharp point. The base shows a slight natural depression which gives the appearance of a hollow base. Fig. 9, *36*.

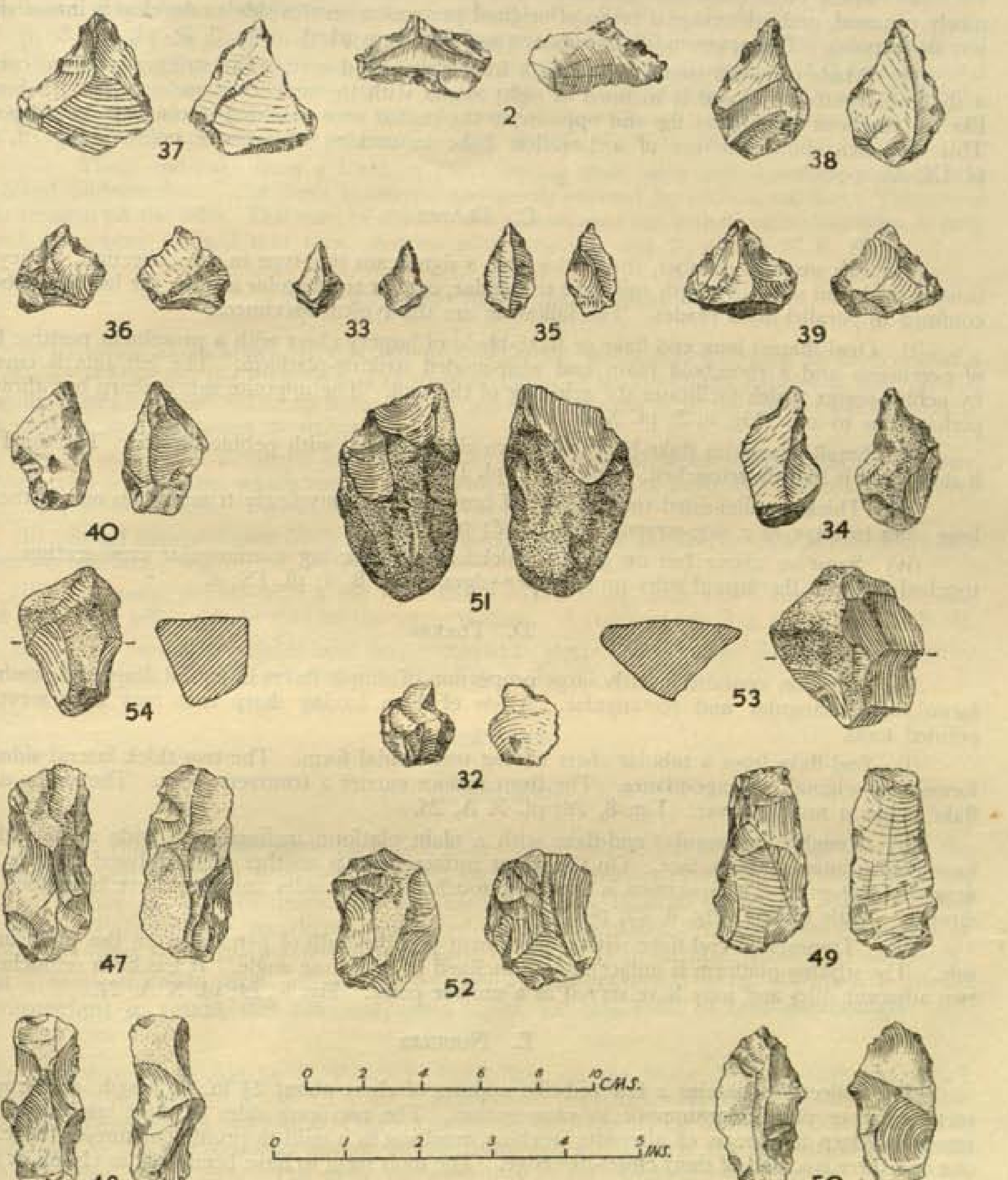


FIG. 9. *Series II tools: 33, 37, 39 and 40, borers; 2, 32, 34-36 and 38, points; 47-50, nodules; 53 and 54, core scrapers; 51, pebble chopper; 52, discoidal core*

(v) Made on a blade-like end-flake. The point occurs on one of the longer sides which is nicely trimmed, and advantage is taken of original protrusion on this side to develop it into a short but sharp point. The opposite side is concave and slightly worked. Fig. 9, *2*; pl. IX, *2*.

(vi) Made on small round flake struck from a prepared core. The striking-platform carries a shallow negative scar and is inclined at right angles with the unworked undersurface. A burin-like cut has been taken from the end opposite to the bulbar area resulting into a thin broad point. This specimen shows the use of a Levallois flake in making a burinate point. Fig. 9, *32*; pl. IX, *32*.

C. Blades

Although small in number, the blades form a significant tool-type in this collection. They are usually thick and short in length and have triangular, oval or rectangular shapes, the last shape being confined to parallel-sided blades. The following are the typical specimens.

(i) Oval-shaped long end-flake or flake-blade of jaspery chert with a prominent positive bulb of percussion and a rhomboid plain and wide-angled striking-platform. The left side is covered by pebble-cortex which facilitates the gripping of the tool. The opposite side is sharp but abraded, perhaps due to use. Fig. 8, *3*; pl. X B, *3*.

(ii) Small triangular flake-blade with two sides covered with pebble-surface. The third side is sharp and is slightly retouched. Fig. 8, *12*; pl. IX, *12*.

(iii) Thick parallel-sided rough blade of brown chalcedony finely trimmed on one of the two long sides to serve as a side-scraper. Fig. 8, *8*; pl. IX, *8*.

(iv) Same as above but on green chalcedony and having a triangular cross-section. Retouched on both the lateral sides into scraper-edges. Fig. 8, *6*; pl. IX, *6*.

D. Flakes

The collection contains a fairly large proportion of simple flakes of varied shapes, the common forms being triangular and rectangular. A few of them having sharp ends may have served as pointed tools.

(i) End-flake from a tabular chert having trapezoidal form. The two thick lateral sides are formed by original cleavage-planes. The front surface carries a transverse scar. The shape of the flake is like a small cleaver. Fig. 8, *26*; pl. X A, *26*.

(ii) Roughly rectangular end-flake with a plain platform inclined at a wide angle with the unworked primary flake-surface. On the upper surface there is another small diffused positive bulb near the butt-end. The specimen is slightly retouched on the sides and may have been used as a scraper. Little rolled. Fig. 8, *25*; pl. X A, *25*.

(iii) Trapezoidal end-flake with a prominent positive bulb of percussion on the plain underside. The striking-platform is unfaceted and inclined at an obtuse angle. It has been retouched on two adjacent sides and may have served as a uniface point. Fig. 8, *24*; pl. X A, *24*.

E. Nodules

The collection contains a few rod-like nodules of chert about 2¼ in. in length and roughly rectangular or parallelogrammatic in cross-section. The two long sides of these specimens show somewhat deep flake-scars of alternate working, resulting in a mild to prominent uneven edge. At one end there is a kind of short chisel-like edge. The tools seem to have been used as chisels or small picks.

(i) A rough nodular vein-chert has been freely flaked alternately along the two long sides. The two unworked edges form irregular mid-ribs, one on each of the two faces. On the top of one end there is a small flat surface, while the other shows a short, sharp and strong chisel-edge of 3 in. The cross-section is parallelogrammatic. Fig. 9, *47*; pl. X B, *47*.

(ii) Similar to above, but the marginal scar-beds are more deep and large culminating in the mid-ribs on either face. Section is roughly rhomboid. Fig. 9, *48*; pl. X B, *48*.

(iii) Thick flake taken from a corner of a chert block along the edge, so that the cross-section in the middle is triangular, the front showing mid-ribs formed due to meeting of the two natural cleavage-planes. It is flaked alternately along one edge and on the other, from the underside only. The bulb is removed in chipping. The tool has two pointed ends and may have served as a short pick. Cross-section approximately triangular. Fig. 9, *50*; pl. X B, *50*.

(iv) Thick end-flake from a block of chert having plain wide-angled striking-platform and unworked undersurface. The front is convex and partly covered by cortical patches. There is a slight retouch on the sides. This may be classed as a side-scraper but with its chisel-like edge, it may as well have been utilized that way. Section plano-convex. Fig. 9, *49*; pl. X B, *49*.

F. Cores and core-choppers

As has been stated above (p. 25), the authors of this tool industry utilized all kinds of flakes and chunks of chert for the manufacture of their artefacts. The blocks and pebbles of this material naturally must have been flaked up to the last bit of a core, with the result that large cores have rarely been used as small choppers or retouchers.

(i) At one end of the major axis of a dark-brown ellipsoidal pebble, flattish flakes have been removed, two on one side, which meet a single wide flat scar on the other side into a sharp uneven edge. A pebble-chopper. Fig. 9, *51*; pl. X B, *51*.

(ii) Small discoidal core freely flaked alternately along the periphery. A small cortical patch is seen on one face. Fig. 9, *52*; pl. X B, *52*.

(iii) Discoidal pebble with a flat base and humped front, from which two short blade-like flakes have been taken side by side on the upper surface. A core-scraper. Fig. 9, *53*; pl. X B, *53*.

(iv) Two rectangular flakes have been removed by steep flaking on one side of a subtriangular rolled tabular block of chert. A core-scraper. Fig. 9, *54*; pl. X B, *54*.

C. Discussion

(i) *Nomenclature*

Similar types of tools made on small flakes and bladish flakes usually of chert or the like fine-grained material had been noticed by a few scholars even before Sankalia, who, as stated above (p. 20), distinguished this assemblage in 1956 as Series II, Series I being the Lower Palaeolithic handaxe industry.[1] In subsequent reports, such types of implements have been freely referred to as tools of Series II or Middle Stone-Age artefacts.[2] Until a more suitable term, supported by better stratigraphical data, is found, it would be convenient to retain this currently-used name for this kind of tool-assemblage.

[1] L. A. Cammiade and M. C. Burkitt, 'Fresh light on the Stone Age in south-east Asia', *Antiquity*, 1930, pp. 327-29; K. R. U. Todd, 'Palaeolithic industries of Bombay', *Jour. Roy. Anthropological Inst. Great Britain and Ireland*, LXIX (1939), pp. 257-72; H. De Terra and T. T. Paterson, *Studies on the Ice Age and Associated Human Cultures* (Washington, 1939), p. 320; V. D. Krishnaswami and K. V. Soundara Rajan, 'The lithic tool-industries of the Singrauli basin, District Mirzapur', *Ancient India*, no. 7 (1951), pp. 40-65; K. V. Soundara Rajan, 'Stone Age industries near Giddalur, District Kurnool', *Ancient India*, no. 8 (1952), pp. 64-92.

[2] B. Subbarao, *The Personality of India*, 2nd ed. (Baroda, 1958), p. 62; S. C. Malik, *Stone Age industries of the Bombay and Satara Districts* (Baroda, 1959), p. 43. K. D. Banerjee, in his unpublished thesis has suggested the term 'Nevasian' for such types of tools.

(ii) *Comparison with European and African industries*

A typological comparison between this industry and the corresponding ones in Europe and Africa is difficult, for there is no single known industry either in or outside India which is identical in all respects to that of the present one. Moreover, while attempting any possible correlation between the industries of two distant regions, their environmental characters cannot be ignored. With these limitations we shall try to note the elements that are common between this industry and the comparable ones in Europe and Africa.

In Europe, the Upper Levalloiso-Mousterian yields a somewhat more developed assemblage and the leading types in it are side-scrapers and points. The industry in the Damoh area has a little admixture of Levalloisian flakes and Mousterian side-scrapers, but there is no stratigraphical evidence to carry out any further correlation. It should be noted here that even in the Levallois VI and VII stages, flakes with unfaceted striking-platforms are quite common, and this is exactly the case in the Damoh area. In Europe, although the blade-element is present even in the Acheulian and Levalloisian stages, it forms the main characteristic feature of the Upper Palaeolithic industries. Our collection, and also those from different regions in India, contain variable proportion of blades and the tools made on them.

The Aterian, which is a variant of the European Mousterian has a tanged point comparable with a one in the Damoh collection, although in the Aterian it is made on blades or flake-blades having faceted platforms.

Comparison with the Proto-Stillbay and Stillbay industries of Africa[1] will have to be ruled out, as in those industries the Levalloisian technique has been normally used for getting flakes on which the tools have been prepared, although all the types of tools, viz. points, scrapers and backed blades, composing these industries, are noticed in our collection as well.

In the Smithfield-A industry of East Griqualand (Africa) belonging to the Later Stone Age, the flakes used in tool-making have a unfaceted wide-angled striking-platform, and they are prepared by block-on-block technique.[2] This industry also contains a large number of scrapers, particularly hollow scrapers, and along with them are found scrapers, flake-blades and rolled artefacts of Early Stone Age.

All these features have been noticed in the flake-blade-scraper assemblage of the Damoh area. The Smithfield industry of Africa is, however, characterized by its microlithic type of implements. Thus, no close parallelism can be established between these two industries, although there is some similarity as far as the technique of producing flakes and the types of tools, particularly the scrapers, are concerned.

Now, since no known industry of either Europe or Africa can be compared with that of the Damoh area strictly on a stratigraphic basis, the latter industry, on purely typological evidence, may be regarded as showing a sort of techno-typological level comparable with that between the Late Middle Stone Age and the Later Stone Age of Africa and also the characteristics mostly of the early Upper Palaeolithic industries of Europe.

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[1] Neville Jones, *The Prehistory of Southern Rhodesia* (Cambridge, 1949), pp. 49-50.

[2] B. D. Malan, *A Preliminary Account of the Archaeology of East Griqualand*, Archaeological Series, VIII (Johannesburg, 1955), p. 10; Revil Mason, 'Notes on the Later Stone Age in south-west Africa', *South African Archaeological Bulletin*, no. 36 (1954).

(iii) *Comparison with the Narmada industry*

Against the three groups of deposits, each consisting of gravel and clay, as observed in the Narmada basin, the area under description has only two gravel-beds, which are underlain and overlain respectively by the silt-deposits. The non-fossiliferous nature of the deposits of the Damoh area precludes its comparison with those of the Narmada region strictly on the basis of stratigraphy. As a negative evidence, it may be stated that the Damoh area does not have very coarse and bouldery type of gravel-bed comparable with Gravel I of the Narmada. But this may be due to the smaller size of the streams and their limited erosive and transporting capacities. The components of both the Gravel I and II of the Narmada are pebbles of quartzite, and very rarely fragments of trap appear only in the Gravel II. In the Damoh area, the first (lower) gravel is composed of pebbles of quartzites and sandstones, and only in the upper gravel appear pieces of disintegrated Deccan Trap and its secondary minerals. In the Narmada deposits, the sands replacing Gravel II contain an appreciable quantity of sediments derived from the Deccan Trap.

From the lower group of the Narmada deposits come fresh tools of the Acheulian facies along with rolled tools of Abbevillean and early Acheulian characters.[1] This, therefore, appears to be the true Acheulian horizon, which has been dated to the Middle Pleistocene from the associated fossil-remains. On the basis of the culture-contents this horizon, however, seems to be absent in the Damoh deposits.

The gravel of the second (upper) group of the Narmada has yielded fresh Late Sohan type of tools along with rolled tools of Abbevilleo-Acheulian facies. McCown and Banerjee noted the absence of Late Sohan tools and the presence of the Nevasian (Middle Palaeolithic) industry in this horizon.[2]

The fossil-contents of this deposit are of Middle Pleistocene type.[3] The true Nevasian horizon at Kalegaon on the Godavari river has yielded the fossil of *Bos namadicus Falc* (Middle Pleistocene).[4] Subbarao ascribes an Upper Pleistocene date for this horizon,[5] while Banerjee considers the beginning of the Late Pleistocene period as appropriate for the deposits containing true Nevasian tools.[6] The lower gravel of Damoh has yielded fresh retouched flakes with a plain obtuse-angled platform along with rolled specimens of Abbevilleo-Acheulian facies. These flakes are completely different from the large heavy Clactonian flakes of the lower group of the Narmada. Besides, the heavy choppers of the lower group of the Narmada are absent from the lower gravel of Damoh. Thus, on the basis of culture-contents, this gravel of Damoh is comparable with the second gravel (upper group) of the Narmada.

De Terra traced the horizon of a flake-industry, on flint and jasper, to the gravel and sand underlying the later alluvia, which include the black cotton soil.[7] This horizon may, therefore, be equated to the second gravel of Damoh on the basis of typology as well as of general comparative stratigraphy.

It should be noted here that after the deposition of the upper group, the Narmada basin witnessed extensive erosion and marked changes in the landforms and gradients

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[1] De Terra and Paterson, *op. cit.*

[2] Information from Dr. K. D. Banerjee.

[3] De Terra and Paterson, *op. cit.*, p. 319.

[4] *Indian Archaeology 1956-57—A Review*, p. 1.

[5] H. D. Sankalia, B. Subbarao and S. B. Deo, *The Excavations at Maheshwar and Navdatoli 1952-53* (Poona-Baroda, 1958), p. 38.

[6] Banerjee, *op. cit.*

[7] De Terra and Paterson, *op. cit.*, p. 320.

of the streams. When the gradient was re-established, a new cycle began with the aggradation, comprising fine gravel and sands, which form the basal deposits of the later alluvia. There is, however, no palaeontological data to find out whether such environmental changes coincided with the coming of the people bringing the flake-blade industry in the Damoh area.

As a result of his survey near Maheswar, Subbarao has assigned the Narmada Terrace 2 as the possible horizon of Series II tools.[1] Stratigraphically, this terrace is later than De Terra's upper group and earlier than the basal gravel of the later alluvia. In the absence of the fossils, the deposits of this terrace at the moment cannot be properly dated.

5. ACKNOWLEDGEMENTS

During this work the author was assisted by the technical staff of the Prehistory Branch of the Archaeological Survey of India. Shri A. V. Krishnamurthy, Technical Assistant, helped in the preliminary work on the collections. Shri S. K. Rode, Photographer, did all the photographic work, and the drawings and maps were prepared by Shri E. R. Sathe and Shri Ranjit Kumar Roy, Draftsmen. To all these persons the author's thanks are due.

[*Received on the 16th November 1960.—Ed.*]

[1] B. Subbarao, *op. cit.*, pp. 57-59.

THE MICROLITHIC SITE OF BIRBHANPUR: A GEOCHRONOLOGICAL STUDY

By Dr. B. B. Lal and S. B. Lal

CONTENTS

1. INTRODUCTION

THE MICROLITHIC SITE OF BIRBHANPUR NEAR DURGAPUR IN DISTRICT BURDWAN, WEST Bengal, was excavated in the years 1954 and 1957 by Shri B. B. Lal.[1] The site is important on account of the high antiquity of its microlithic industry, as archaeologically revealed by the non-geometric character of the tools and absence of pottery associated with them. The results of mechanical and chemical analyses of the soil-samples and the study of some sand-grains of the site have already been published by one of the present writers.[2] In view of the considerable importance of the site in the context of the current studies in prehistoric archaeology in different parts of the country, it was thought necessary to carry out a more detailed geochronological investigation with a view to studying the climatic conditions and environments prevailing at the site during prehistoric times and, if possible, to adducing further evidence regarding its chronology. Thus, Trench BBP-1 was taken up for this detailed investigation.

2. TOPOGRAPHY

All round the site of Trench BBP-1, there seems to be nothing but sand. The site, situated at the lower level of the terrace T_{n-1} of the Damodar, does not show any rock in its neighbourhood, but near Trench BBP-2, about 100 yds. to the south of the over-bridge, located about 6 furlongs to the north-west of Durgapur railway-station, are exposed a few beds of sandstone which is coarse in texture and white in colour. This region falls in laterite zone as described by Roy.[3] These sandstone-beds dip towards the south

[1] B. B. Lal, 'Birbhanpur, a microlithic site in the Damodar valley, West Bengal', *Ancient India*, no. 14 (1958), pp. 4-39.

[2] 'Environmental conditions at Birbhanpur during the times', *ibid.*, pp. 39-48.

[3] A. K. Roy, *Rec. Geological Surv. Ind.*, LXXVII, no. 6, pl. I.

and show a little folding, one limb dipping towards the west and the other towards the east, both of them vanishing near the overbridge.

3. THE ANALYSES

A. Mechanical analysis

The technique of mechanical analysis and the quantitative data on the size-frequency distribution of the samples from both the trenches have already been described. In Table II (below, p. 40A) are recorded the values of size-parameters as calculated from cumulative curves based on the published results of the mechanical analysis of samples from Trench BBP-1. The figures shown are for each layer, i.e., they represent the average result of the number of samples collected from one particular layer.

I. Mean average diameter (Ma).—The average size was determined by the intersection of the cumulative curves and the straight line drawn at 50 percentile. Thus, the values for the layers 5, 4, 3, 2, 1C and 1B of Trench BBP-1[1] are 0·15 mm., 0·13 mm., 0·09 mm., 0·10 mm., 0·11 mm., and 0·01 mm. respectively. These figures lie in the fine sand-grade (International Scale). Moreover, heavy-mineral and light-crop studies have demonstrated a general similarity in the mineral suits of these layers and those of the bed-rock, four samples of which were collected from the lower levels of the railway-cutting near the overbridge. This similarity is particularly pronounced in the layers underlying the implementiferous horizon. This horizon, represented by layer 2 of the trench, should have been exposed to agents of weathering before the settlement of the microlithic man, as is shown by the general lowering in the average grain-size, which could have resulted as a consequence of denudation. This is a possibility which cannot be ruled out, in view of the fact that the Ma of the upper and lower layers is greater than that of layer 2. However, it is also probable that the material deposited in the layer was generally of a finer grade, so that the lowering of the Ma of the grains in layer 2 might not have been really produced by denudation.

In this case, we shall take the help of the soil-profile based on the chemical analysis of the samples of these layers. According to the soil-profile (fig. 1), the B-horizon lies between layers 3 and 4, and this is indicative of the fact that weathering took place at layer 2, which, in turn, produced the general lowering of the Ma. On the other hand, if we consult size-parameters of the bed-rock (Table II), we find that the average grain-size lies in the coarse sand-grade, the value being 0·39 mm. There is, therefore, a material difference between the Ma of the grains of the bed-rock specimens and that of the specimens of layer 2. It can thus be said with confidence that to diminish the Ma from 0·39 mm. to 0·10 mm. or lower, an extensive weathering must have taken place.

II. Sorting coefficient (So).—According to Trask,[2] a sorting coefficient of 2·5 indicates a well-sorted sediment; if this value lies between 2·5 and 4·5 (nearly 3·0), it indicates a poorly-sorted sediment. The values of the sorting coefficients in this case are 1·70, 1·40, 2·90, 3·35, 4·00 and 1·50 in layers 5, 4, 3, 2, 1C and 1B respectively, and that of the bed-rock is 2·01 based on four specimens. Thus we see that the soils of layers 5, 4 and 1B are well-sorted and those of layers, 3, 2 and 1C show a poor sorting.

[1] Lal, *op. cit.*, p. 10, fig. 4.

[2] P. D. Trask, *Origin and Environment of Source Sediments of Petroleum* (1932), p. 67.

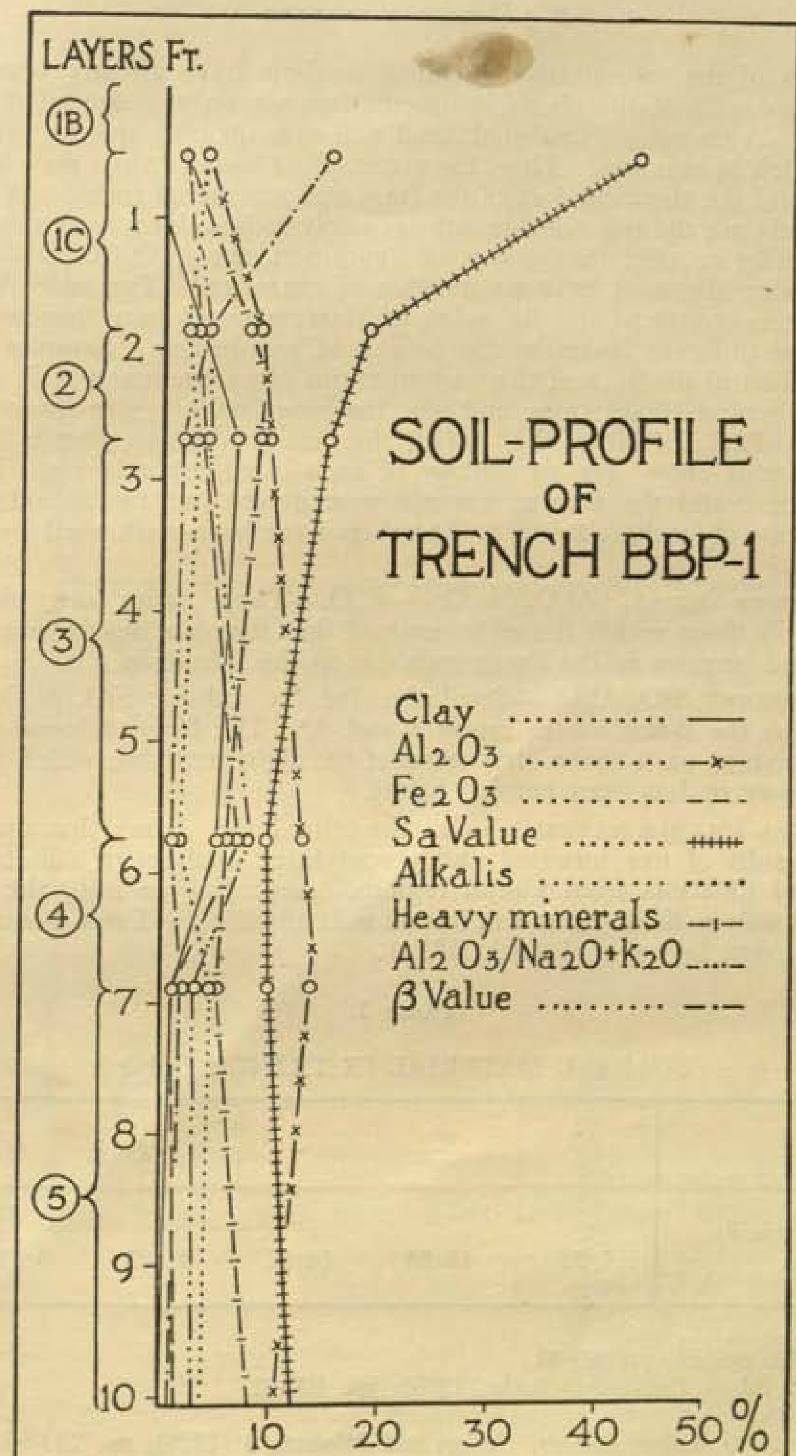

LAYERS FT.
1B
1C
2
3
4
5
1
2
3
4
5
6
7
8
9
10
10
20
30
40
50%
SOIL-PROFILE
OF
TRENCH BBP-1
Clay
Al2 O3
Fe2 O3
Sa Value
Alkalis
Heavy minerals
Al2 O3/Na2O+K2O
β Value

FIG. 1

B. Chemical analysis

The results of the quantitative chemical analysis have already been published.[1] The chemical character of the clastic sediment depends on the size of the grains and their maturity.[2] A completely-matured sand will contain only quartz, while the clay-portion will be rich in alumina. Thus, the order of the loss of oxides may be determined by a comparison of the chemical data of the fresh and weathered rocks. As alumina and, in most cases, soda are the two constituents not likely to be added to or substracted from the sediment during or after the process of deposition, the $Al_2O_3/Na_2O + K_2O$ ratio is calculated as giving the most appropriate idea of maturity.[3] The ratio $Al_2O_3/Na_2O + K_2O$, which is the inverse of the Ba value of Harrassowitz,[4] may thus be taken as the maturity-index of different layers in the process of weathering. Samples from Trench BBP-1 were studied in detail, and the various ratios often encountered in soil-literature, viz. Sa value, alumina-alkalis ratio and the leaching factor β, are shown in Table II and plotted in fig. 1. Here the curves for clay, alumina, ferric oxide, alkalis and heavy minerals show the percentage of each in different layers. The Sa value, the maturity-index, and the β value are not percentages but the actual values, being ratios. In the case of leaching factor β, the values have been multiplied by ten and then plotted.

I. Maturity index, $Al_2O_3/Na_2O + K_2O$.—These ratios are plotted on the soil-profile (fig. 1), from which it can be noticed that they are nearly constant in layers 1B, 1C and 2 but increase in the lower ones, i.e. in the B-horizon.

II. Sa value, SiO_2/Al_2O_3.—Similarly, the Sa value,[5] SiO_2/Al_2O_3, is plotted, and it also shows the B-horizon in layers 3 and 4.[1] The heavy-mineral profile (fig. 1) supports these results, as it shows that some of the light material, which is mobile, has been washed away or has been carried below.

III. Total soluble material.—On the other hand, Jenny[6] has quoted Hilgard[7] as giving the results of five hundred and seventythree analyses of soils from arid and six hundred and ninetysix from humid regions. According to him, the total soluble material in arid soils is 30·84 % and in humid soils 15·83 %. Table I shows the soluble material in different layers of Trench BBP-1.

Table I

SOLUBLE MATERIAL IN TRENCH BBP-1

Layer	*1B*	*1C*	*2*	*3*	*4*	*5*
Percentage of soluble material	7·92	16·84	14·92	31·23	8·04	—

[1] *Ancient India*, no. 14, pp. 39-48.
[2] F. J. Petti Johan, *Sedimentary Rocks* (1956), pp. 100-02.
[3] *Ibid.*, p. 103.
[4] H. Harrassowitz, *Laterit Fortschr. Geology und Palaeont.*, 4 (1926), pp. 253-56.
[5] H. Jenny, *Factors of Soil Formation* (1914), p. 26.
[6] *Ibid.*, p. 27.
[7] E. W. Hilgard, *Soils* (New York, 1914).

TABLE II

PETROGRAPHIC AND CHEMICAL DATA

Layers	Opaques	Garnet		Tourmaline	Epidote		Kyanite	Zircon		Rutile	Hornblende	Size-parameter					Al_2O_3/Na_2O+K_2O	β	Sa value SiO_2/Al_2O_3	Depth from surface	Thickness	Nature of layers
		Coloured	*Colourless*		*Green*	*Rest*		*Coloured*	*Colourless*			*Ma*	*So*	*Sk*	*Logsk*	*K*						
Trench BBP-1 1B	55·52	—	—	4·37	0·46	8·97	0·23	4·83	21.39	3·68	0·46	0·10	1·50	1·08	0·0334	0·26	1·01	1·58	43·75	6½ in.	6½ in.	Sandy earth
1C	67·45	0·05	0·22	3·21	0·14	7·33	0·21	1·84	16·06	2·56	0·60	0·11	4·00	0·38	$\bar{1}$·5790	0·30	3·84	0·41	17·57	1 ft. 10½ in.	1 ft. 4 in.	Light-brown sandy earth
2	76·64	—	0·10	3·17	—	6·88	0·20	1·15	9·43	1·59	0·57	0·10	3·35	0·37	$\bar{1}$·5680	0·26	3·20	0·49	14·76	2 ft. 7½ in.	9 in.	Earth with coarse granules
3	81·76	—	—	1·67	—	4·13	—	1·04	10·08	1·65	—	0·90	2·90	0·38	$\bar{1}$·5790	0·24	7·96	0·20	9·57	5 ft. 9½ in.	3 ft. 2 in.	Lateritic gravel and stone fragments
4	76·00	—	—	1·27	—	6·70	—	2·23	8·66	5·08	—	0·13	1·40	0·80	$\bar{1}$·9030	0·13	3·11	0·39	9·45	6 ft. 11 in.	1½ in.	Mottled silty sand
5	70·53	0·19	0·19	5·86	—	8·29	—	2·11	9 87	2·22	0·19	0·15	1·70	0·52	$\bar{1}$·7160	0·30	3·17	0·54	12·31	10 ft. 1 in.	3 ft. 2 in.	Decayed sandstone
Bed-rock	86·16	0·43	4·92	1·39	—	3·10	—	1·12	2·45	0·49	—	0·39	2·10	0·34	$\bar{1}$·5350	0·17	—	—	—	20 ft.	20 ft.	Coarse-grained ferruginous sandstone

As the soluble material in layer 2 is 14·92%, we can conclude that the climate prevailing at the time of the microlithic man was humid.

IV. Fe_2O_3.—The Fe_2O_3 profile reaches its maximum in layer 3, indicating weathering in the two overlying layers.

V. β VALUE.—The leaching factor β is given in Table II and plotted on fig. 1. As will be noted from the figures, the top-most layer 1B has a β value of 1·58, which, according to Jenny,[1] does not indicate weathering. These values for layers 1C, 2, 3, 4 and 5 are 0·41, 0·49, 0·20, 0·39 and 0·54 respectively and show weathering.

C. HEAVY-MINERAL ANALYSIS

For the study of heavy minerals it is necessary to isolate them from the bulk of the specimens, and for this the fine sand-fraction 0·10-0·21 mm. (separated during mechanical analysis) was put in bromoform. The grains were thoroughly stirred and left in the separating funnel for about half-an-hour. The light fraction floated on the surface of bromoform (sp. gr. 2·85) and the heavy minerals settled down. For a complete separation, the separating funnel was once more shaken, and after half-an-hour the heavies were collected on a filter-paper by decantation. They were then dried and weighed. After coning and quartering, the grains were mounted on slides in canada balsam. The grains were then counted under the microscope and the percentage calculated, as shown in Table II. The study of these heavy minerals was done in liquid mounts before actual counting.

Iron ores (magnetite and illmenite), zircon, epidote, tourmaline, rutile and garnet were found to form the bulk of the heavies. Kyanite and hornblende were also found but in very small amounts. The percentage of each of these heavy minerals is shown in Table II. Sillimanite, monazite, sphene and zoisite, which were present in insignificant quantities, have not been shown in this Table. The heavy minerals are described below.

I. GARNET.—It will be noticed that garnet is present in layer 5 but is absent in the upper layers. It again appears in the implementiferous layer 2 and the one overlying it, but in insignificant proportions. In the bed-rock, however, the percentage is much higher. Its absence in layers 4 and 3 shows weathering and supports the view that layer 2 must have been the land-surface for the microlithic man.

II. EPIDOTE.—Brown, yellow and rarely colourless epidote is present throughout the section as well as in the bed-rock. This mineral is quite stable, though it shows signs of weathering in layers 4, 3, 2 and 1B. Green epidote makes its appearance in layer 1C.

III. ZIRCON.—This mineral is present throughout the section. Its percentage in the layers below layer 2 lies between 10·58 and 11·98 and swells to 17·90 in layer 1C and 26·22 in layer 1B.

IV. KYANITE AND HORNBLENDE.—These minerals are absent in the bed-rock and the layers underlying layer 2. They are, however, present in layer 2, 1C and 1B. In layer 2, it must have come through infiltration. That layer shows a transition in the mineral suits, i.e. garnet and green epidote zones on the one hand and zircon and hornblende zones on the other.

It is interesting to note that the percentage of hornblende is very small, the values being 0·19%, 0·57%, 0·60% and 0·46% in layers 5, 2, 1C and 1B respectively. Even in the topmost layer, 1B, this percentage is 0·46.

[1] Jenny, *op. cit.*, p. 27.

It should be noted here that Roy[1] collected five samples from the Damodar river-bed at Asansol and Champadanga, and the amount of hornblende in these is 37·15% (the range being from 35·21 to 40·48%), whereas in our samples the maximum amount is 0·60%. In view of this enormous divergence, samples were collected from the bed of the Damodar about a mile away from Trench BBP-1. The results of the heavy-mineral analysis of these samples is given in Table III.

TABLE III

HEAVY-MINERAL ANALYSIS

MINERALS	SIZE				AVERAGE	FRE-QUENCY[2]
	0·50-1·00 mm.	*0·21-0·50 mm.*	*0·10-0·21 mm.*	*0·01-0·10 mm.*		
Opaques	73·97	46·91	26·91	41·45	47·31	7
Hornblende	17·68	43·60	59·46	30·67	37·85	7
Epidote						
Rest	—	1·31	0·33	3·22	1·21	2
Green	—	0·47	1·65	0·47	0·64	1
Garnet						
Colourless	—	—	1·65	2·99	1·16	2
Pink	2·72	3·93	1·32	0·69	2·16	3
Tourmaline						
Pink	—	—	—	—	—	—
Brown	1·36	1·88	4·92	0·69	2·05	3
Zircon						
Colourless	—	—	0·99	12·88	3·46	3
Pink	—	—	—	3·45	0·86	1
Rutile	—	—	—	0·69	0·17	1
Biotite	1·36	0·94	2·31	0·23	1·21	2
Zoisite	—	—	—	0·69	0·17	1

In view of the above, the total absence of hornblende in layers underlying layer 2 would appear to be intriguing. The relatively-lower proportion of hornblende in the top-layer 1B (0·46%) can hardly be expected in the valley of the Damodar, the bed of which contains hornblende to the extent of 37 to 40%. It seems that this mineral has completely altered or has been washed away by denudation. Alternatively, the site represents a

[1] Roy, *op. cit.*

[2] Evans, Hayman and Majeed, *Quart. Jour. Geol., Min. and Met. Soc. Ind.*, 6 (1934), pp. 40-41.

pre-hornblende phase. The first alternative is more probable, as the mineral is not absent from the site, the percentages being 0·57, 0·60 and 0·46 in layers 2, 1C and 1B respectively. It is highly probable that hornblende originally present in these layers has been altered to ferruginous clay.[1]

A few grains of hornblende show signs of alteration. It is, therefore, not unlikely that hornblende, originally present in the layers 1C and 1B in the same high proportion as is demonstrated in the samples described by Roy and above, may have had sufficient time to undergo a complete alteration to clay. It would once again point to a fairly-long period of weathering of the layers overlying the implementiferous horizon. As an alternative to this alteration hypothesis, it may be postulated that the site represents a pre-hornblende phase in the geomorphic activity of the Damodar and that at a certain stage in its down-cutting, the river cut through some hornblendic igneous rocks and deposited this mineral in a high percentage on the younger terraces. Thus judged, the site would appear to have existed long before the appearance of hornblende. If this is correct, it would not be unreasonable to assign a very high antiquity to the microlithic industry of Birbhanpur.

D. Light crops

The light crops of detrital minerals obtained from bromoform separation consist of quartz, orthoclase, microcline, mica and some rock-fragments. Quartz grains ranging in size from 0·21 mm. to 0·50 mm. and 0·01 mm. to 0·10 mm. were subjected to a detailed examination of the surface-features. The investigation of quartz grains of a size less than 0·37 mm. or nearly of this value shows that they are generally polished, but grains larger than this size are generally dull. Further, the larger grains ranging from 1 mm. to 2 mm. and 0·5 mm. to 1 mm. are more rounded and more spherical than the smaller ones. Grains of the size of 0·01 mm. to 0·10 mm. and 0·21 mm. to 0·50 mm. are mostly sub-angular. Smaller grains (0·01 mm. and less) are more rounded in the implementiferous layer, while above and below that layer, they are sub-angular. It appears, therefore, that the implementiferous layer was exposed to weathering for a very long period and would have been the land-surface for the microlithic man of Birbhanpur.

4. ACKNOWLEDGEMENTS

Grateful acknowledgement is made of the help rendered by Shri H. C. Bhardwaj, Chemical Assistant, who furnished analytical data on the total soluble matter of the samples. Thanks are similarly due to Shri D. S. Srivastava, also Chemical Assistant, who separated the heavy minerals, prepared slides and scored these minerals while counting them.

[*Received on the 6th August 1959.—Ed.*]

[1] G. D. Merill, *A Treatise on Rocks, Rock Weathering and Soils* (1921), p. 19.

PLATE XI

Photomicrographs of quartz grains

1, crushed quartz grains: polished and with angularity

2, quartz grains of bed-rock: round and with dull lustre

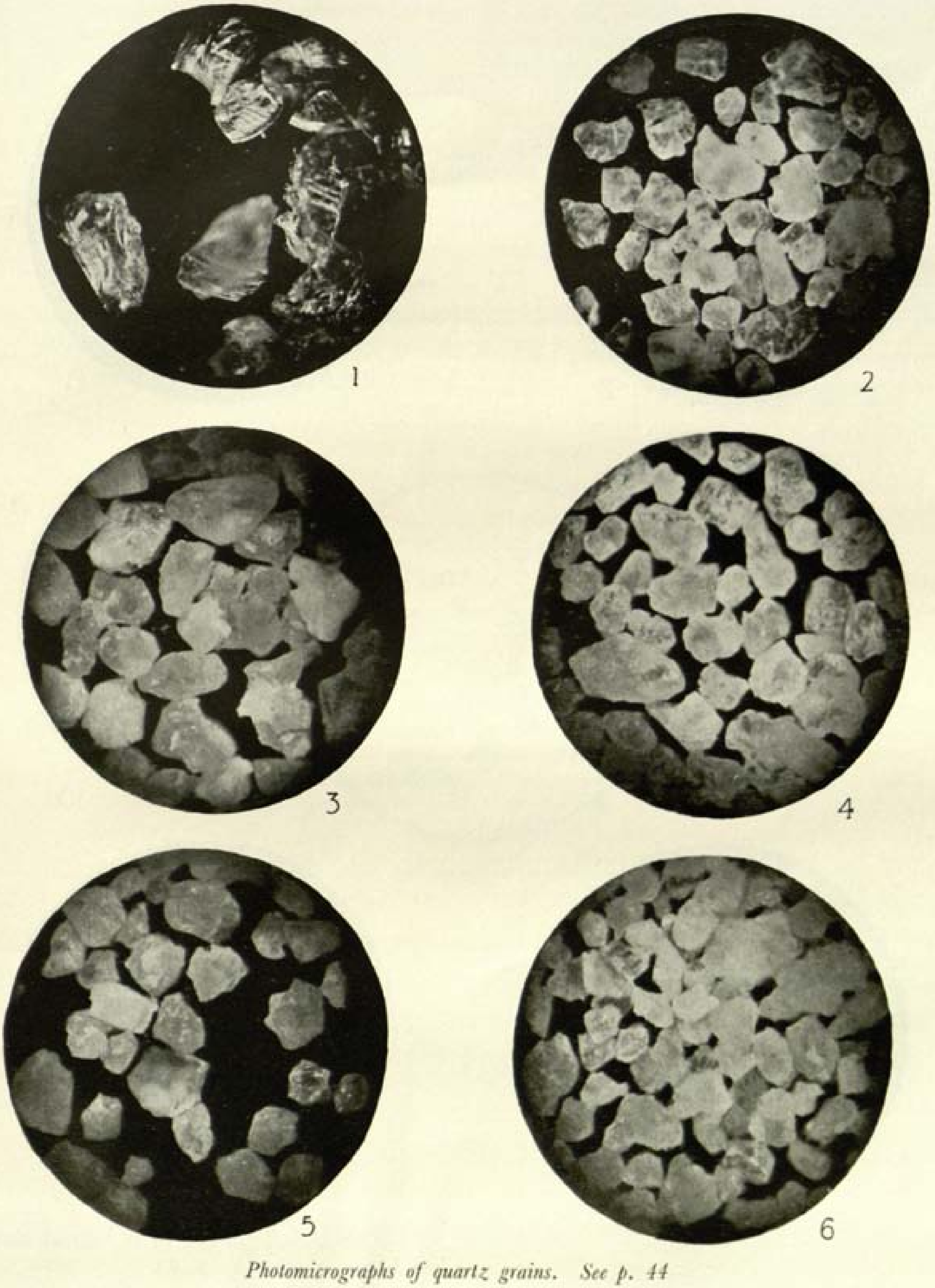
3, quartz grains of the topmost layer of Trench BBP-1: comparatively more angular and polished

4, quartz grains of layer overlying the implementiferous layer: semi-polished and less rounded

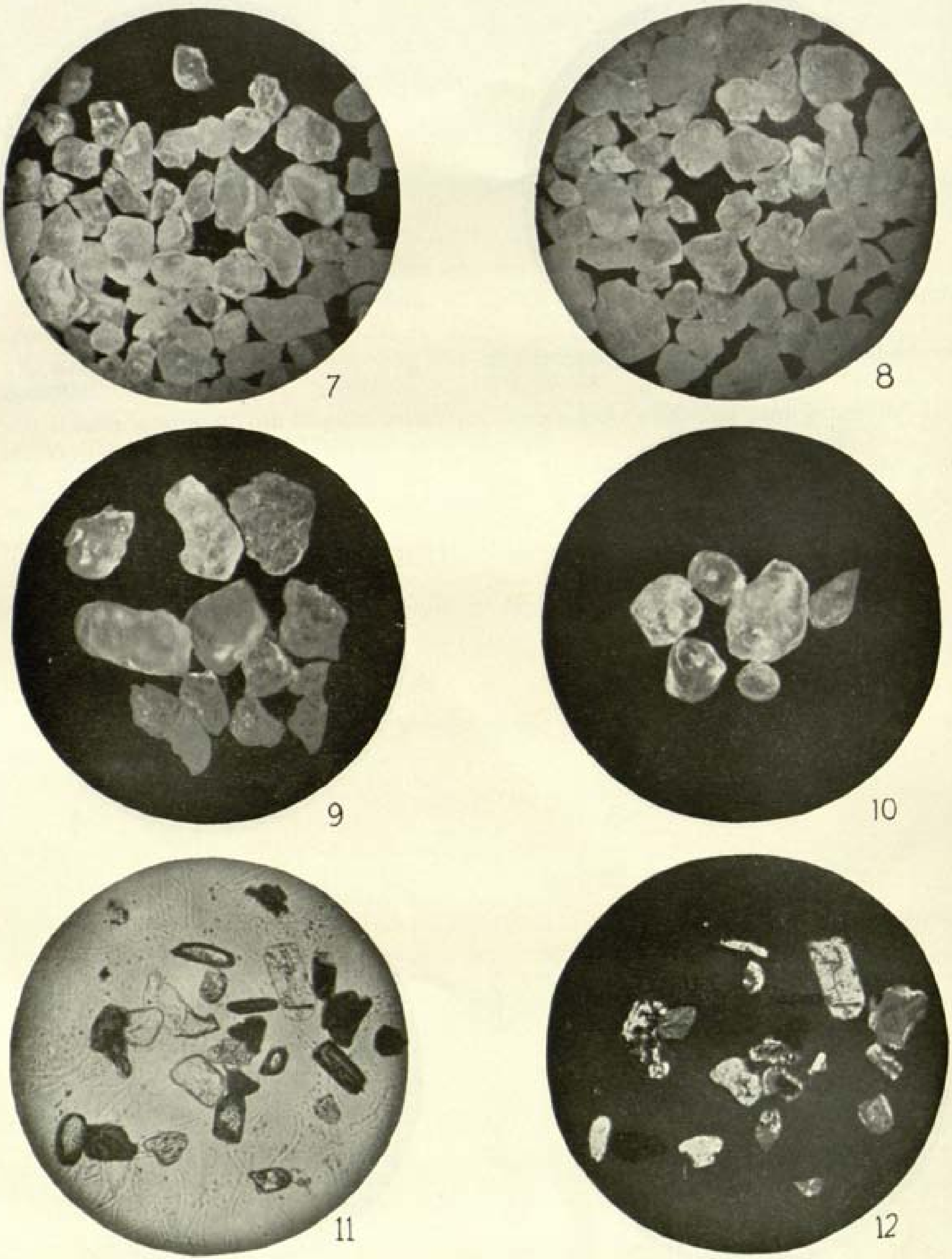
5, quartz grains of the implementiferous layer: more rounded and generally dull; the latter, like milky grain, is felspar

6, quartz grains of layer below the implementiferous layer: generally dull; a few rounded

Scale $\times$ *17*



Photomicrographs of quartz grains. See p. 44



Photomicrographs of quartz grains and heavy minerals. *See p. 45*

PLATE XII

Photomicrographs of quartz grains and heavy minerals

7, quartz grains of the topmost layer of Trench BBP-2: semi-polished and angular
8, quartz grains of layer 3: generally dull; a few semi-polished and angular
9, quartz grains of the implementiferous layer: dull and angular to sub-round
10, quartz grains of *teri* sand (south India)[1]: rounded and polished
11, heavy minerals in polarized light
[Key:

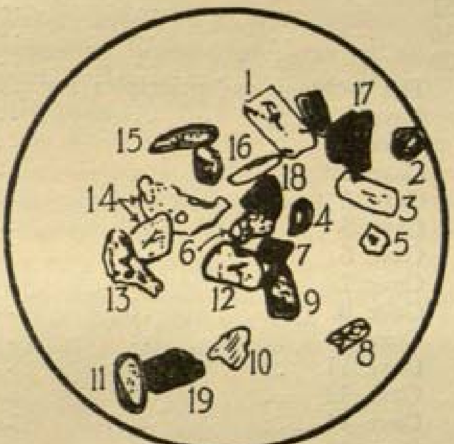


FIG. 2

1, 3 and 7, tourmaline; 2 and 16, rutile; 4, 5, 8-12 and 15, zircon; 6 and 13, epidote; 14, garnet; 17-19, opaques.]

Scale × 17

[1] F. E. Zeuner and B. Allchin, 'The microlithic sites of Tinnevelly District, Madras State', *Ancient India*, no. 12 (1956), pp. 4-20.

REPAIRS TO THE ELLORA CAVES

By R. SENGUPTA

CONTENTS

1. INTRODUCTION

SITUATED AT A DISTANCE OF ABOUT 18 MILES TO THE NORTH-NORTH-WEST OF Aurangabad, the headquarters of a District of the same name in Maharashtra, the celebrated rock-cut caves at Ellora (20°00′ N. Lat.; 75°05′ E. Long.) lie in the midst of attractive surroundings on the Paithan-Aurangabad-Ellora-Chalisgaon road, which almost coincides with an ancient trade-route. While the total number of caves excavated in the Ellora hill, known as Chāraṇādri, at different heights, is upwards of fifty, those at the foot of the hill, generally facing west, are conveniently numbered 1 to 34, irrespective of any chronological sequence. The caves of Brāhmaṇical origin, bearing numbers 14 to 29 in the series, occupy the central portion of the hill and are flanked by the twelve Buddhist caves on the south and five Jaina ones on the north. Thus, the first (Buddhist) cave is in the southern extremity of the curvature of the hill, whereas the last (Jaina) one is at the northern end.

2. GEOLOGY

The caves lie in the hilly tracts of the Deccan Trap formation, which, on weathering, gives the hills a characteristic appearance of terraces with a flat summit. The Ellora hill rises abruptly from the plains on the west and south and has a general elevation of about 2100 ft. above the mean sea-level, with the slopes and drainage-courses in the same directions. The main drainage is through the nullahs known as the Gan, Khadki and Khohri on the west and the Nagjhari on the south, all of which rise in the Ellora plateau and ultimately drain their waters into the Shiv, a stream of the Godavari system.

The hill is made of extensive horizontal flows of trap alternating with vesicular trap-beds, vesicular trap forming the upper portion of each of the massive trap-beds. The rock-cut caves have mostly been carved out of the fine-grained and jointed trap-beds, care having been taken all the time to minimize labour by taking advantage of the intermediary joints in the horizontal plane and master-joints in the vertical plane. It may be guessed that the nature of the rock, which is responsive to chisel, was one of the factors which induced the people in western India to carve out hundreds of caves in this region right from the second century B.C. Because of its comparatively soft nature, the rock weathers by exfoliation, shell by shell, with hard fresh rock forming the core. The shell grades into *morum* and clay, and with each erosion of the decomposed product an undecomposed or superficially-decomposed layer of the rock is laid bare.

3. HISTORY

Although the area had been inhabitated in the late Middle Stone Age, as evidenced from the occurrence of stone tools on jasper, attributable to an industry of the pre-microlithic facies, and subsequently in the microlithic and chalcolithic periods,[1] the history of the caves begins within historical times, a little over five hundred years after the birth of Christ. It is surprising that the Śātavāhanas, whose coins have been picked up from the vicinity of the caves and during whose times the trade-route was in use, have not left any trace of their activity on this hill. Though the chronology of the caves, together with their authorship, remains to be established on a firm ground, it is accepted on all hands that the caves are to be broadly differentiated between those excavated during the times of the Rāshṭrakūṭas and those excavated before and after them. In the former series can be included, with some amount of certainty, such excavations as Caves 11 and 12 in the Buddhist group, Caves 15, 16 and 22 to 28 in the Brāhmaṇical group and Caves 30 to 32 in the Jaina group. It is true that the rock-cut

[1] K. V. Soundara Rajan and R. Sengupta, 'Flake and blade tool industries from Ellora', *Proc., 48th Session, Ind. Science Cong.* (Calcutta, 1961), p. 449.

temples produced prior to the Rāshṭrakūṭas are no less significant, but with the excavation of Cave 15, Dantidurga (*circa* 753-57), the Rāshṭrakūṭa king whose inscription is found on the back wall of the western porch of the *maṇḍapa* in the forecourt of the cave, ushered in a new idiom in plastic art which spelt dynamic energy, vigour and some amount of aggressiveness—in keeping with the spirit of the resurgence. Architecture too received a new impetus. If Cave 15 (Daśāvatāra) is to be taken as the budding of a new conception in terms of magnificence and expansiveness, in Cave 16 (Kailāsa) one finds its flowering, which is not only the crowning glory of the Rāshṭrakūṭas achieved by Kṛishṇarāja I (757-73), the successor and uncle of Dantidurga, but also the apogee of all Indian rock-architecture. And quite justifiably does the panegyric in the Baroda copper-plate grant (812-13) of Karka II say about this temple of Śiva built by Kṛishṇarāja:

Elāpur-āchala-gat-ādbhuta-sanniveśaṁ
yad=vīkshya vismita-vimāna-char-āmarendrāḥ ।
etat svayambhu Śiva-dhāma na kṛitrime śrīr=
dṛishṭ=edṛiś=īti satataṁ bahu charchayanti ॥
bhūyas=tathāvidha-kṛitau vyavasāya-hāni-
r=etan=mayā katham=aho kṛitam=ity-akasmāt ।
kartt=āpi yasya khalu vismayam=āpa śilpī
tan-nāma-kīrttanam=akārayyata yena rājñā ॥

'(*That king*) by whom, verily, was caused to be constructed a temple on the hill at Elāpura (Ellora), of wonderful structure,—on seeing which the best of the immortals who move in celestial cars, struck with astonishment, think much constantly, saying, "This temple of Śiva is self-existent; in a thing made by art such beauty is not seen",—a temple, the architect-builder of which, in consequence of the failure of his energy as regards (*the construction of*) another such work, was himself suddenly struck with astonishment, saying, "Oh, how was it that I built it!"'[1]

Since then the Kailāsa has held its head high, never to be surpassed by anything of its like. The attempt of the Jainas to achieve a similar feat, though on a smaller scale, ended in an incomplete excavation, Cave 30, which earned for itself the name Chhoṭā-Kailāsa. They kept their work in progress at Ellora even after the Rāshṭrakūṭas had been supplanted by the later Chālukya king Taila II (973-97), and their last-dated (1234-35) work[2] was carried out when the Yādava king Śiṅghaṇa was in power at Devagiri (Daulatabad).

In the pre-Rāshṭrakūṭa phase the mention of the name of the earlier Chālukyas, the predecessors of the Rāshṭrakūṭas, is but logical, though there is no epigraphical evidence about their activities at Ellora. This phase comprises all the first ten Buddhist and the other Brāhmaṇical excavations excepting Cave 21, Rāmeśvara, which claims a different authorship by its singular character and is attributable to a date anterior to the rest. This cave, unlike the other Brāhmaṇical excavations at Ellora, has an image of Lakulīśa on the architrave of the main entrance to the temple and is purely Śaiva in character. It may, therefore, be ascribed to the Kalachuris of Māhishmatī, who were avowed Pāśupatas, styling themselves *parama-māheśvara*, and who appear to have wielded power over a territory from Nasik to a part of the ancient Aśmaka country, including Bhogavardhana, where a piece of land was granted by one of its rulers,

[1] J. F. Fleet in *Indian Antiquary*, XII (1883), p. 159; corrections by R. G. Bhandarkar in *ibid.*, pp. 228-29.

[2] J. Burgess and J. Fergusson, *Cave Temples of India* (London, 1880), p. 502.

Śaṅkaragaṇa, in 596-97.[1] Bhogavardhana has been identified with modern Bhokardan in Aurangabad District, about 50 miles to the east of Ellora. The Kalachuri association of this cave is also indicated by the find of a silver coin of Kṛishṇarāja[2] (*circa* 550-75) just in front of the cave.

Thus, if one was to put the ruling dynasties associated with Ellora in a sequence, one might say that the activities at Ellora were probably initiated by the Kalachuris, to be followed by the Chālukyas in an atmosphere of tolerance. The successors of the Chālukyas, the Rāshṭrakūṭas, kept the atmosphere alive for the followers of the three religions in the ninth century, to vie with each other in representing their respective religious art. It was this atmosphere of 'peaceful co-existence' that made it possible for the different religious communities to forget their rivalry and Ellora witnessed them working together, borrowing motives and conceptions from each other. The Jainas were active at Ellora even during the rule of the Yādavas in the thirteenth century.

Unlike the Ajanta caves, the caves at Ellora were never lost in oblivion because of their close proximity to the ancient thoroughfare and the accounts left by eminent persons from time to time. Among them the name of the Arab geographer Al-Mas'ūdī (tenth century) stands first.[3] Subsequently, Firishta[4] mentioned the caves in connexion with the romantic capture of the princess Deval-devī by the party of imperial soldiers in pursuit of king Karan Rāi of Gujarat. Later, Thevenot (in 1633-67),[5] Niccolao Manucci (1653-1708),[6] Charles Warre Malet (in 1794)[7] and Seely (in 1824)[8] wrote on these caves.

Prior to the Nizāms, the Holkars were the owners of the caves and continued to be so till the last part of the nineteenth century. They used to auction the caves for the right of worship and collection of a sort of entrance-fee.[9] The village, together with the caves, was subsequently exchanged with some land near Hyderabad, after which the Nizāms acquired ownership of the caves.

4. THE REPAIRS

A. Before 1910

The earliest reference to repairs carried out at Ellora is found in an Urdū work,[10] which refers to the approach-roads to the caves being repaired and the caves being cleaned for the visit of Sulṭān Ḥasan Gangū Bahmanī, who camped at the site for a week to enjoy the splendid works of art. The date of his arrival at the caves is given

[1] V. V. Mirashi, *Inscriptions of the Chedi-Kalachuri Era*, Corpus Inscriptionum Indicarum, IV (Ootacamund, 1955), pp. 38-44.

[2] R. Sengupta in *Jour. Numismatic Soc. Ind.*, XXII (1960), pp. 193-95.

[3] C. Barbier de Meynard, *Maçoudi—Les Prairies d'Or*, tome quatriéme (Paris, 1914), p. 95.

[4] John Briggs, *History of the Rise of the Mahomedan Power in India* (London, 1829), I, p. 367.

[5] *The Travels of Monsieur de Thevenot into the Levant* (London, 1687), pt. iii, pp. 74-76.

[6] Niccolao Manucci, *Storia do Mogor*, tr. William Irvine, I (London, 1907), pp. 152-53.

[7] *Asiatic Researches*, VI (1799), pp. 389-423.

[8] John B. Seely, *The Wonders of Elora* (London, 1824).

[9] *Ibid.*, p. 314, mentions a large establishment maintained by the Holkars at Ellora. Longhurst also was aware of this, as he mentions in his report, *Progress Rep. Arch. Surv. Ind., Western Circle*, 1910-11, p. 26, the leasing out of the caves in the past for religious and pecuniary purposes.

[10] Muḥammad 'Abdu'l-Jabbār Ṣūfī, *Tadhkira-i-Salāṭīn-i-Dakan* (Hyderabad, A. H. 1328), pp. 147-50.

as 25th Shawwāl, A. H. 753 (A.D. 1352). Next, after a long gap, it is recorded[1] that in 1876 the Buddhist monastery Do-thāl (Cave 11) and the unfinished Jaina temple Chhoṭā-Kailāsa (Cave 30) were cleared of débris.

In spite of the wide publicity given to Ellora in publications,[2] there was no scheme of repairs to the caves in the nineteenth century, even during those brief sporadic periods when the Government became alive to its responsibility towards national monuments. Ellora seems to have remained outside the purview of Major H. H. Cole, who, as Curator of Ancient Monuments, reported on a large number of monuments, including Ajanta.

B. 1910-14

Systematic repairs started in 1910, probably at the instance of Lord Curzon, who visited the caves in 1899 and again in 1907. Officers of the Western Circle of the Archaeological Survey of India started regular inspections of the monuments and suggested measures of conservation, to be carried out by the Hyderabad State. Reports of works carried out were incorporated in the Survey's reports.[3] Between the years 1910 and 1913 a sum of Rs. 7729 was spent towards conservation. In Cave 16 the bridge connecting the southern porch of the *sabhā-maṇḍapa* with the Paralaṅkā to the south had fallen with a portion of the façade and floor of the first floor of the Paralaṅkā, together with whatever support it might have had below it, so that the remaining portion of the floor was overhanging. Supports in ashlar-masonry pillars were therefore erected and a flight of steps (pl. XIII) leading to the first floor from the ground floor of the Paralaṅkā was constructed in the same masonry. In addition, dwarf masonry-walls were constructed in front of the caves to stop rain-water from flowing inside.

C. 1914-47

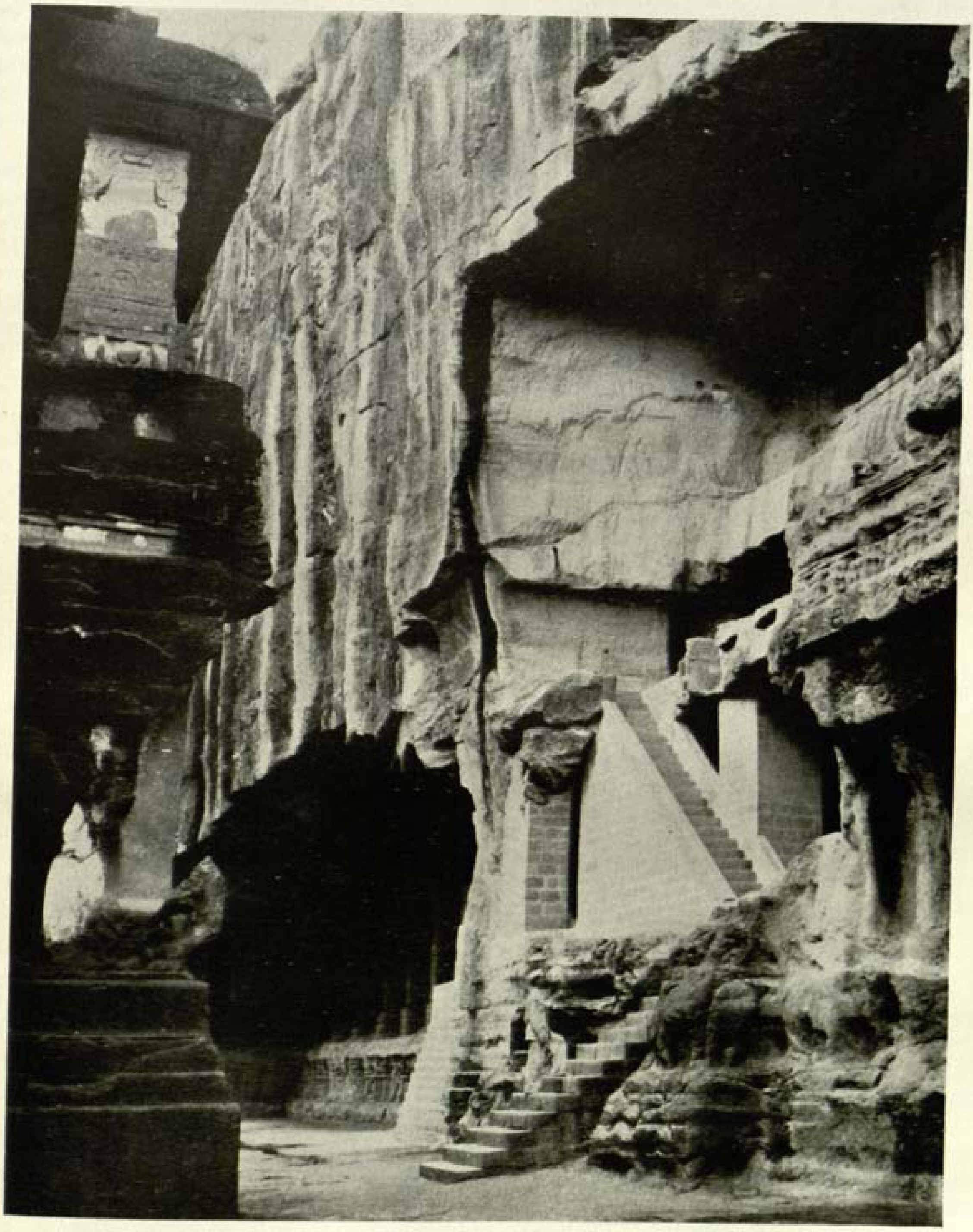
In 1914, the Hyderabad State created its own Archaeological Department under a Director and started publishing its annual archaeological reports. Though the works were executed at the instance of the Director by the State Public Works Department, on important matters and problems the Director General of Archaeology in India was consulted. On the recommendations of Sir John Marshall, extensive repairs were carried out in 1924-25 to the copiously-leaking roof of the *gopuram* of Cave 16. Age-long leakage of water had caused flaking in the stone, resulting in the thinning of the roof-slab, which was threatening to crumble down. As a remedial measure a network of mild-steel joists were erected (pl. XIV A) below the roof, to be propped up by a number of ashlar-masonry pillars, at a cost of Rs. 10,400.

In the following year, repairs were spread over three caves, of which those to Cave 10, the only *chaitya*-hall at Ellora, deserve mention. The cell on the northern wing of the first floor, which had been abandoned in an unfinished state, due to fault in the rock, had a leaky roof in a bad condition; this was grouted from the top and the surface was treated

[1] J. Burgess, *Report on the Elura Cave Temples*, Arch. Surv. West. Ind., V (London, 1883), p. 13. A comparison of the photographs taken by Burgess during his survey during 1877-80 with some undated but evidently older photographs existing in the South-western Circle of the Survey shows that besides the Do-thāl and Chhoṭā-Kailāsa, a few other caves were cleared probably in 1876 or so, though there is no published record to that effect.

[2] Seely, *op. cit.*; J. Fergusson, *Illustrations of Rock-cut Temples of India* (London, 1845); Burgess and Fergusson, *op. cit.*; Burgess, *op. cit.*

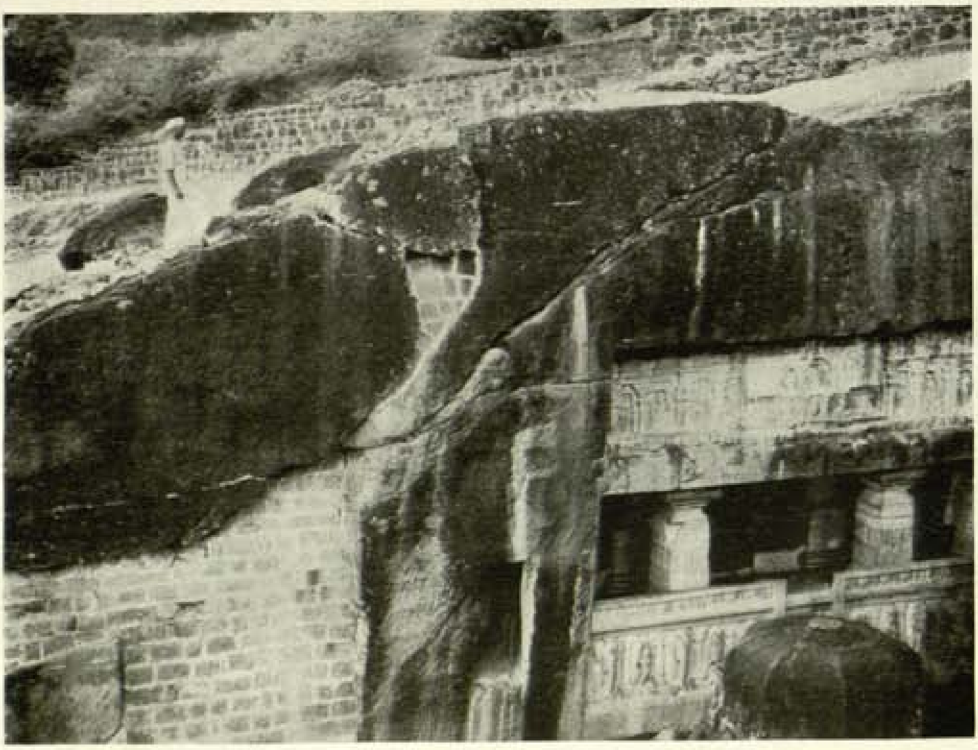
[3] *Progress Report, Arch. Surv. Ind., Western Circle, 1909-10*, p. 23; *1910-11*, pp. 26-28; *1912-13*, p. 13.



Cave 16: ashlar-masonry supports and steps in the Paralaṅkā. See p. 50

To face p. 50

A. *Cave 16: ashlar-masonry supports. See p. 50*



B. *Cave 32: ashlar-masonry supports. See pp. 51 and 54*

To face p. 51

with concrete to make the roof watertight. The weakest part of the roof of the verandah in front of the cell was supported with an ashlar-masonry pillar. The uneven rock-floor of the front porch in the first floor was also repaired. The other works included the provision of ashlar-masonry pillars to the cracked ceiling of the *sabhā-maṇḍapa* of Cave 6 and repairs to the main entrance to Cave 15, also in ashlar-masonry.[1] The works carried out in the succeeding years seem to have been more or less of a routine type, such as clearance of débris, repairs to roads, provision of drainage and erection of ashlar-masonry supports. The repairs to Cave 32, although of the nature of the last category, need special mention. The left wall of the forecourt of the cave, at its junction with the screen-wall, had a yawning gap with loose boulders at the top precariously held. (The fall of such loose boulders must have brought down in 1874 the beautiful monolithic *māna-stambha* in the courtyard, near the wall.) After giving proper support with ashlar-masonry from below (pl. XIV B) and filling in the gap, the extant loose portions of the rock were secured and all cracks were filled.

D. 1947-53

This phase saw the integration of the State of Hyderabad with the Indian Union. In 1948 the necessity of a closer attention to the Ajanta and Ellora caves was felt and a committee of experts was appointed to go into the question of effective and systematic way of preservation of the monuments. The experts visited the Ellora caves between the 29th June and the 5th July 1949, and submitted to the Hyderabad Government their observations on the caves. In addition to specific suggestions for individual caves, the general measures suggested by the committee were:—(1) provision of surface-drains, to be made of masonry, over the caves on the scarp of the hill to divert rain-water from coming on the surface of the caves, behind the parapet-walls erected in the past to serve the same purpose; (2) grouting of cracks; (3) erection of masonry-supports wherever necessary; (4) reproduction of the missing portions of the different members of the caves; (5) provision of doors to the shrines to stop bat-nuisance; and (6) restoration of the missing portions of sculptures, etc.

During the next few years the works were carried out, on the basis of the suggestions embodied in the report, by the State Department of Archaeology, which, from 1950 to 1953, acted as the agent of the Archaeological Survey of India in respect of monuments of national importance in Hyderabad State, in the list of which, it need hardly be said, the Ellora caves figured. During this period overhead drains were constructed, as recommended by the expert committee, at a cost of Rs. 47,000, and the rock-cut drain in the courtyard of Cave 16 was deepened for the proper drainage of rain water.

In July 1953, the Survey took direct charge of those monuments, and the office of the South-western (formerly Western) Circle of the Department was shifted somewhat later from Poona to Aurangabad for a more effective control on Ajanta and Ellora.

E. 1953-56

Following the recommendations of the expert committee, the shrine-doors of the Buddhist and Jaina caves were provided with expanded-metal shutters. The damaged floors and pillars of Caves 2 and 3 were repaired in cement-concrete, using mild-steel bars

[1] This portion has recently been redone with cement-concrete, coloured and chiselled to match the surroundings (p. 61).

for reinforcement in certain pillars. As stagnation of water, mostly due to overflow into the cave through the damaged portion of the cistern by the side of Cave 3, was apparently the cause of the decay of the rock-floor of that cave, the damaged portion of the cistern was suitably repaired and a drain provided at the floor-level for the drainage.

In the group of caves known as Gaṇeśa-leṇā, above Cave 27, the first cave on the left flank of the hill, containing some beautiful paintings of the ninth century in the ceiling of the porch, was taken up for treatment. During the monsoons the heavy rush of water, issuing from the valley behind and drained as a waterfall by the side of Cave 29 (Sītā-kī-nahānī), cuts off the caves on the left flank from the rest on the other side. For an easy approach even during the rains, a bridge was constructed over the stream. Conservation to the cave proper consisted of repairs to the decayed bottom of walls, door-jambs, brackets of pillars, etc. To save the paintings from further damage, all openings were closed with wire-netting fixed on wooden frames. To divert the surface-water running along the façade, a drain and a drip-line were cut on the brow of the hill in the rock. The amounts spent during this period towards maintenance and special repairs were Rs. 46,907 and Rs. 20,175 respectively.

F. 1956-60

(i) *The problems and principles*

By now, the Survey had thoroughly acquainted itself with the problems of conservation at Ellora and Ajanta and could confidently formulate its own policies in these respects. Instead of taking up repairs sporadically, a planned programme to cover the caves systematically from one end to the other was to be taken up for thorough repairs to each cave, so that there would be little need for any other major work there in the next few years; this, however, would not preclude the execution of urgent work in other caves. Thus, though Caves 1 to 9 were included in the first phase of the work, several other caves have been dealt with during these years, as will be seen from the following pages.[1] Proposals alternative to those of the Expert Committee were formulated wherever necessary, in conformity with the general principles of conservation of the Survey derived out of its long experience and technical knowledge.

The problems of conservation of the rock-cut caves of the Deccan differ in many ways from those of structural monuments. The greatest difficulty confronted by the conservator here is the limited available knowledge of the structure of the inscrutable mass of rock in which the caves are excavated. The problem of the leakage in the roof of the Main Cave at Elephanta and of Cave 1 at Ajanta are the two instances in point. Even then, it must be noted that the Survey has risen up to the challenge and with its progressive knowledge and resourcefulness the day is not far off when the problem will be completely wiped out, for the work done so far at Elephanta has yielded encouraging results.

The nature of the rock being soft, it is easily susceptible to the deteriorating action of water, and it is no knowing which of the intervening formative layers or seams permits percolation. It is only when the outlet is visible on the surface that the oozing water is amenable to disciplined channelling. The overhead drains and dwarf masonry-walls constructed in the past, regardless of such considerations, left out the outlets appearing immediately above the caves at large, which still allowed the water to flow along the façade

[1] From 1956, the present writer has been intimately associated with the works at Ellora, first as Special Officer and later on as Assistant Engineer.

and travel inside to bring in decay in the rock-carvings. Fig. 1 will make the point clear. The longitudinal section of Cave 2 shows a typical example that the drain at A is not helpful in stopping water from flowing on the façade. The section shows the two soft zones, B and C, through which water oozes. The lower zone, C, which strikes against the somewhat-convex ceiling of the front porch of the cave cannot be made waterfree in the ordinary way, so a drain just below the upper soft zone, B, has been provided. In Cave 14 (fig. 2), however, full advantage has been taken of the rock-formation itself to

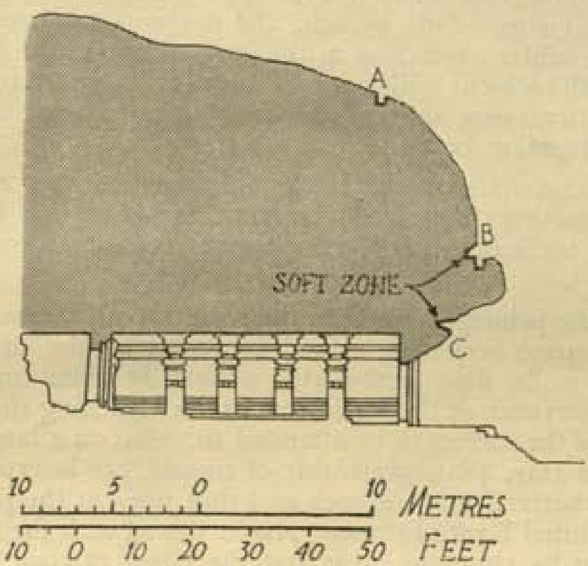


FIG. 1. *Cave 2: section*

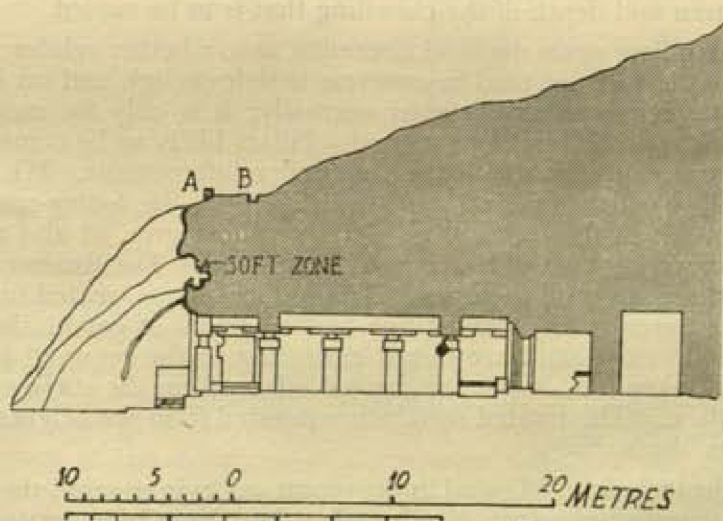


FIG. 2. *Cave 14: section*

divert the surface-water by cutting a drain at the lowest level of the scarp. Here also, the functions of the dwarf-wall at A and the drain at B disprove the expectations. While rock-cut drains along the zone of seepage would divert the maximum quantity of surface-water, a drip-line in the ledge would save the remaining portion. Once the cave is thus sealed from the onslaught of water, the decayed members can be suitably repaired and a new lease of life ensured to them for many years to come.

An important innovation has been the large-scale introduction of cement-concrete, reinforced as necessary, in repairs, in preference to ashlar-masonry; by its homogeneity and mass, cement-concrete has been considered much more suitable to match the adjoining rock-surface and to simulate rock-cut architecture, for it can be moulded, tinted and chiselled according to requirements. Side by side, the decision has been taken to replace by cement-concrete all the ashlar-work done in the past, mostly in the form of replacement of decayed or disappeared rock-cut pillars or of support to overhanging rock-ceiling (cf. pl. XIV B); in the latter cases, the endeavour is to strengthen the rock itself, so the intrusive pillars can altogether be done away ith.

In the past, accumulations of débris in front of the caves were taken for granted; they were sometimes supported by retaining-wall and paths laid over them. Now the original rock-surfaces are exposed wherever possible, sometimes with interesting results.

Such have been the principles to guide the repairs to all the caves; nevertheless, their application has to be varied according to and governed by the situation of a particular work. For repairs to walls, door-jambs, etc., ordinarily plain cement-concrete is used, after, of course, the observance of the preliminaries like chiselling the exfoliated portions of the rock and washing of the surface to be attended to. But on a large vertical plane where concrete is not likely to stay, pins, preferably of copper, are inserted to provide a proper anchorage of the new material into the rock and thus prevent the possibility of falling off. Subsequently, a duly-tinted layer of cement-plaster mixed with the required grade of sand is applied for finishing by chisel to bring out the effect of rock. The grade of sand is decided by the structure of the rock to be imitated; so also does the thickness of the plaster depend on the pattern and depth of the chiselling that is to be copied.

Repairs to the pillars again demand discretion as to whether reinforcement should be used or not. Since the mixture used in concrete is rich enough and on its own can bear moderate weight, no reinforcement is used normally; it is only for moulding, wherever necessary, that a few rods for binding are used. Pillars likely to be commissioned to bear load are invariably strengthened with the required reinforcement. While redoing those previous ashlar-pillars which have no structural function, the facing-stones are removed and all holes and voids in the core are filled for a proper grip, as also to prevent cracks developing on the covering coat of concrete to be applied. The treatment of the surface, however, remains the same in all the cases. To produce on the treated surface the bubble-holes found on the parent rock, formed due to the escape of gas in the emergent lava, nodules of stone and coarse sand are mixed according to the required proportion in the coating-plaster and taken out, to get the desired effects from the surface when the initial setting has taken place. The treated surface is separated from the original by a demarcating line incised on the surface.

Such being the technique followed in the recent works in general, the items mentioned below cave-wise are not discussed in details, unless there have been departures from the set forms or an individual case merits a special discussion.

The magnitude of the care bestowed by the Archaeological Survey of India on the preservation of and improvements to the caves can be gauged from the fact that it has spent well-nigh two lakhs of rupees over them between 1956 and 1960.

(ii) *Cave 1*

Clearance of débris from the front of Caves 1 to 4 has brought to light many original features hitherto unknown (pl. XV). In Cave 1 in particular, the revelation has re-oriented the idea about the plan of the cave. What was thought to be a bare hall with cells in the back and one of the side walls with pillars in front has actually turned out to be a *vihāra* with a regular front portico (fig. 3) with a raised plinth and cells at ends originally separated by a screen-wall duly pierced by an entrance and most probably side-windows or doors, as are usually met with in the like excavations. Although no indication is available of the base of pillars on the much-disturbed floor of the portico, it is almost certain that the missing roof of the portico was supported by pillars in front. The steps at the centre are preceded by a *chandraśilā.*

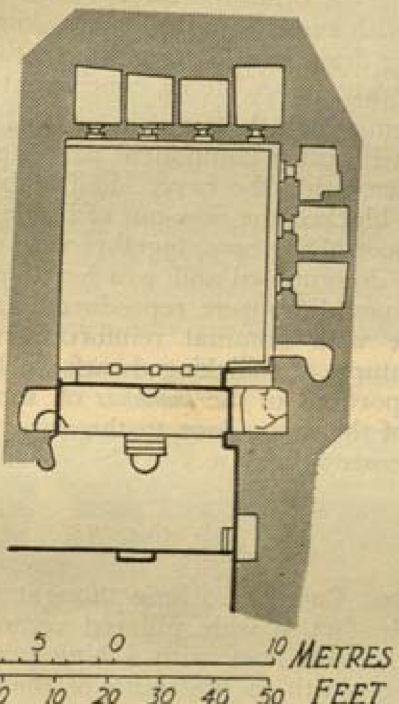


FIG. 3. *Cave 1: plan. The thick lines indicate the newly-exposed area*

Age-long seepage of water through the seams of the rock has brought down the front portion of the cave, and stagnation of water inside the cave from the same source has damaged the floor and the base of walls. To divert and stop such water from entering into the cave a drain was cut in the façade. The floor, together with the bottom of walls and damaged portions of the door-jambs of the cells, was repaired in tinted cement-concrete chiselled to match the adjoining surfaces. The most notable work in this cave, however, is a massive concrete wall, 1 ft. 6 in. thick, along the north wall erected in replacement of the original decayed wall, to support the cracked roof at that end.

With the sealing of the source of water-leakage through the oblique aperture in the south-western cell, the repairs to the recently-exposed portion of the cave and the provision of support to the overhanging front rock by the reconstruction of the missing screen-wall in cement-concrete, there will be very little of importance left unattended to in this cave by way of conservation.

(iii) *Cave 2*

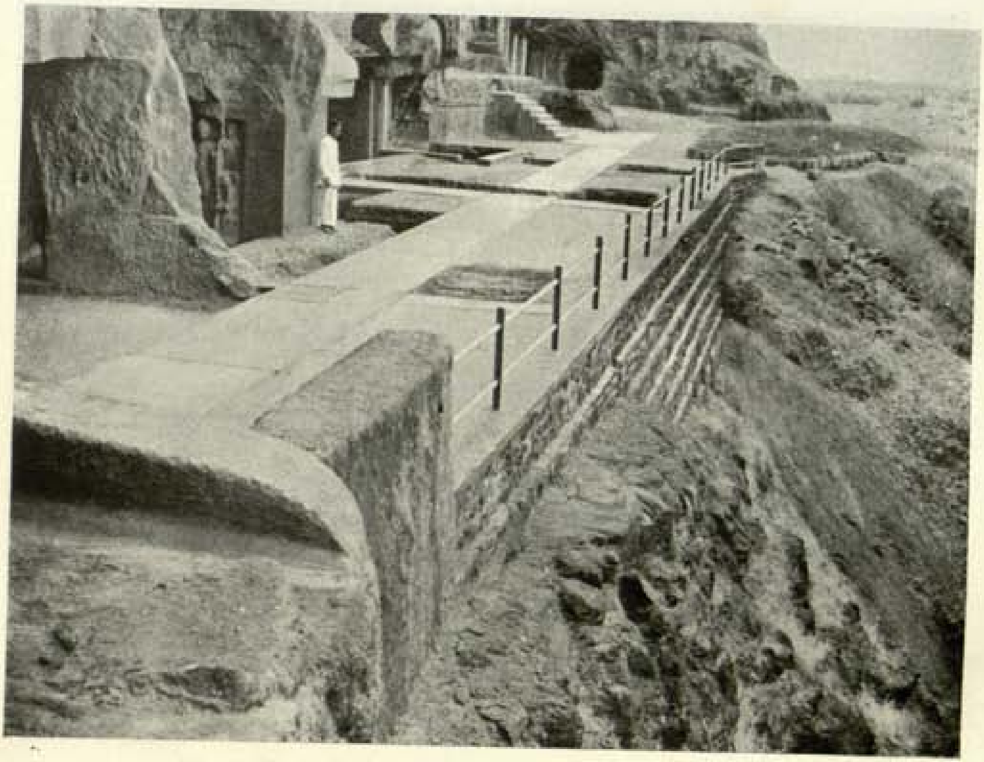
The façade of Cave 2 also has disintegrated and disappeared due to percolation of water through the intervening layers in the rock. In fact, all the caves in the sector between Caves 1 and 6 have suffered similarly due to this malady. While the rock-cut drain provided on the façade will drain away most of the descending water, the top of the cave is being combed to trace the source of water that finds its way out at the entrance with a view to sealing it. Precautions have been taken to locate the surface-drains immediately below the lowest stratum of the percolating joint to collect the maximum quantity of water and to make the drain itself impervious to water, by plastering the outer wall and floor of the drain with cement-mortar mixed with a patent waterproofing-agent. The inner or back wall of the drain was left unplastered for the seepage to occur, to avoid the creation of a head of water with all its consequent pressure.

A common malady from which the caves in general suffer is the wearing out of the floors and wall-bases along with other component parts up to the height of the past accumulation of débris and water inside the cave. Fall of boulders and deposition of earth at the entrance of the caves blocked the flow-out of inside water. To this Cave 2 was no exception. The damaged floor of the cave, together with other such portions, was repaired. After chiselling out the decomposed and weathered portions of the heavily-damaged lateral galleries the heavy mouldings were reproduced, fashioning them after the extant portion in cement-concrete with nominal reinforcement. The available portions of the central band with sculptures of rollicking dwarfs, in bas-relief in compartments, were preserved. The damaged portions of the *kumbhas* of some of the pillars were repaired. The bottom of the *śākhās* of the main door to the cave, repaired in the past in ashlar-masonry, was redone in cement-concrete.

(iv) *Cave 3*

Clearance revealed that Cave 3, so long thought to have a floor lower than the ground-level outside, has, in fact, a wide pillared verandah in front, at the same level as the floor, extending to a lower floor with a high plinth and a flight of steps at the centre. The portion of the plinth to the south of the steps was found to be decorated with heavy mouldings, the corresponding portion of the north having been left unfinished. Much of the frontal portion has disappeared and the steps now end abruptly with a deep fall connecting with nothing. The cave has now emerged as a superior specimen of a *vihāra* (fig. 4).

A portion of the wall of the cistern attached to the cave on the south being damaged, water was overflowing into the cave; to add to the trouble, there was the usual flow of water on the surface to cause damage. The portion of the damaged wall was repaired in coursed rubble-masonry plastered with cement-mortar and damaged members of the cave and portions of walls, including the pillars, were repaired in cement-concrete. The cracked roof of the cell to the north of the verandah, previously supported by an ashlar-pillar (pl. XVI A), obstructing the view of the enshrined Buddha image, was removed (pl. XVI B) to provide a reinforced cement-concrete beam concealed within the ceiling with supports in the right and back walls. The crack on the roof was then completely sealed off from the top by clamps and cement-grouting. Besides the cutting



A. *Caves 1 to 4: front retaining-wall, hiding original features.* *See p. 55*

B. *Caves 1 to 4: original features exposed in front after removal of retaining-wall.* *See p. 55*

A. *Cave 3: cell to the north, before repairs. See p. 56*

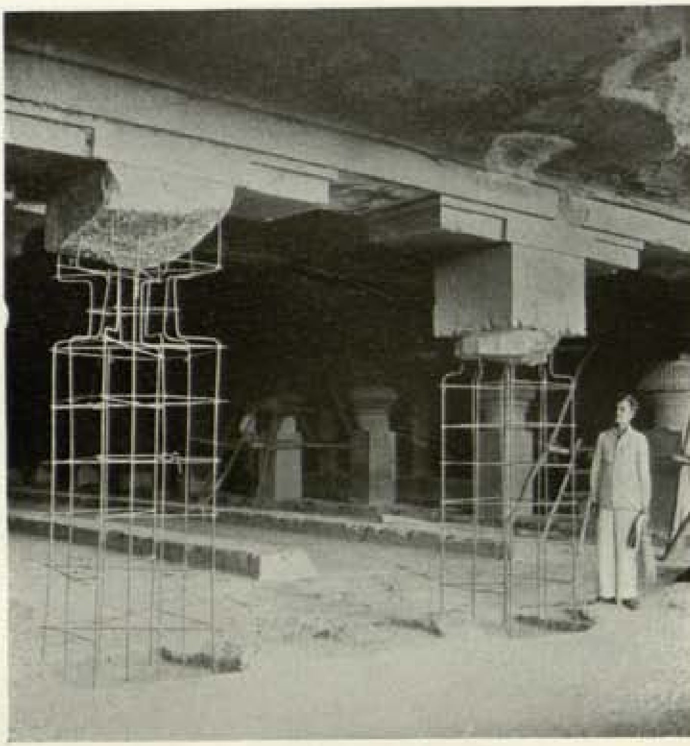
B. *Cave 3: cell to the north, after repairs. See p. 56*

To face pl. XVII

A. *Cave 4: verandah-pillars during repairs. See p. 57*

B. *Cave 4: verandah-pillars after repairs. See p. 57*

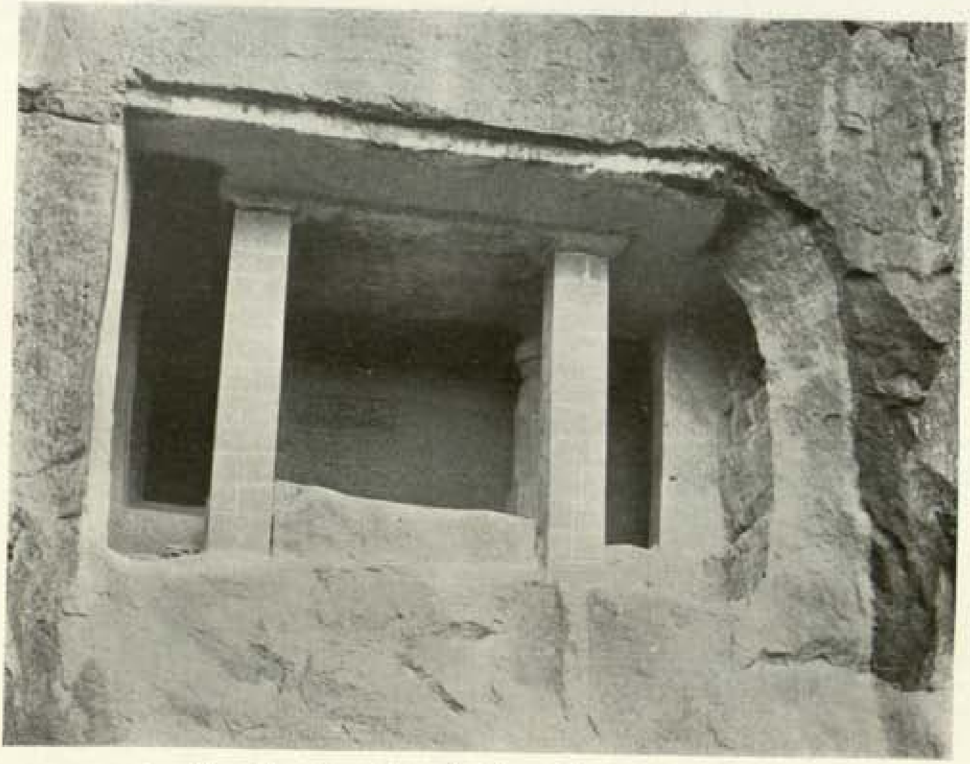
To face pl. XVI



A. *Cave 5: front pillars, during repairs.* *See p. 58*

B. *Cave 5: front pillars, after repairs.* *See p. 58*

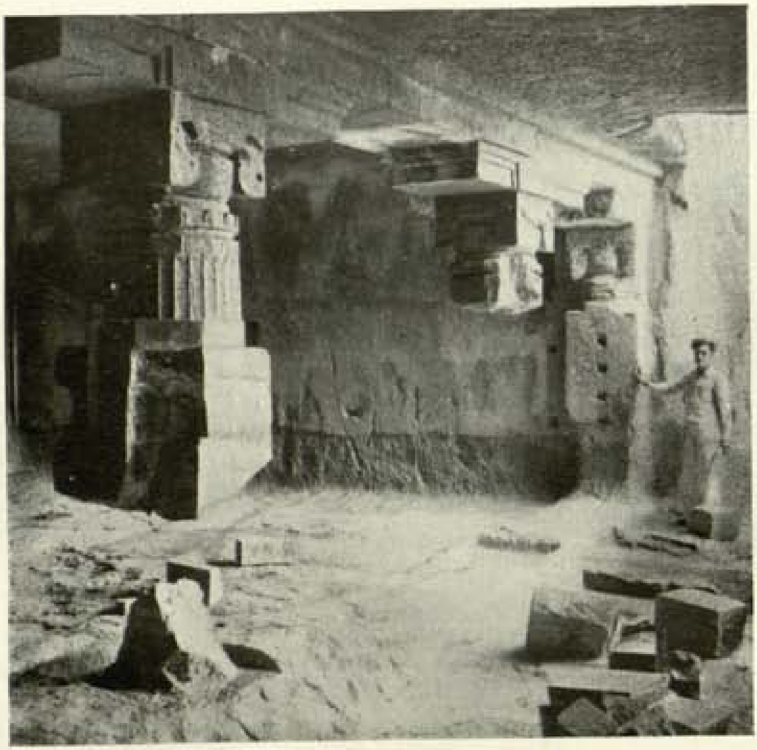
To face pl. XIX



A. *Cave 6: ashlar-pillars in front of maṇḍapa. See p. 58*

B. *Cave 6: ashlar-pillars removed and replaced by concrete pillars. See p. 58*

To face pl. XVIII



A. *Cave 8: front pillars, before repairs.* *See p. 58*

B. *Cave 8: front pillars, after repairs.* *See p. 58*

of a surface-drain above, the channel of a drip-line was cut in the rock-ledge in front. The exposed floor of the front verandah is now (1960) being treated.

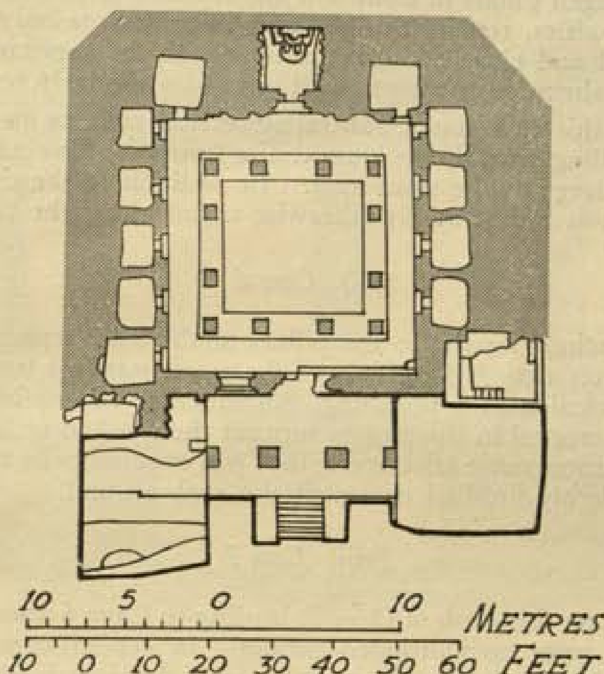


FIG. 4. *Cave 3: plan. The thick lines indicate the recently-exposed area*

(v) *Cave 4*

The floor of Cave 4, together with that of the cell in its south, and the bottom of the walls were repaired in cement-concrete. Out of the two pillars separating the hall from the back corridor, the one to the left was completely renovated on old lines (pl. XVII), while the other was partially repaired. The terminal pilasters were also repaired from the bottom.

The cracks in the walls of the first floor of the cave, created by the jerk of the falling of the western portion of the shrine, were made good by the insertion of clamps and grouting with cement-mortar. The leaking floor was also suitably repaired.

(vi) *Cave 5*

The magnificent *vihāra* represented by Cave 5 has suffered from both natural forces and human vandalism. Surface-water from up the hill at the top of this cave had washed away much of its projecting hood and had also loosened some boulders, which were threatening to tumble down. The untamed gush of water in the monsoons must also have contributed towards the disappearance of the portion of the top floor of Cave 4, approached from the front of Cave 5. The loose boulders were secured properly by dowels all along the lines of cleavage and all visible cracks were completely sealed off by grouting with cement-mortar. The work of the provision of a cement-concrete cantilever shed, anchored into the roof and finished to maintain the contour of the rock-surface, is in progress; this will throw the water away at a considerable distance, so that the area will be saved from the onslaught of falling water and the resultant deterioration.

The heavily-damaged pillars in front and about half-a-dozen on the sides, separating the nave from the side-aisles, repaired in the past in ashlar-masonry, were all redone in cement-concrete, tinted and chiselled to be in tune with the surviving ones (pl. XVIII). The door-jambs of the shrine in the north wall were also similarly repaired.

Since the top of this cave has a natural slope and collects and discharges surface-water from the surrounding area, the rock-cut drains from both Caves 9 and 4 were directed to meet here and discharge at the same spot. In addition to the drain, a drip-line was incised to cut off the water that might otherwise travel along the ceiling.

(vii) *Cave 6*

Excepting some minor repairs to the pillars at the sides separating the central hall from the lateral ones, repairs to the pillars of the small *maṇḍapa* between Caves 6 and 9 (pl. XIX) and the provision of a throating, not much work has been done in Cave 6. The two ashlar-pillars erected in the past to support the cracked ceiling are being brought forward to serve the purpose more effectively; they will eventually be covered with a blanket of cement-concrete roughly finished to match the rock around.

(viii) *Cave 7*

The ruined steps on the south of Cave 7, leading to Cave 6 above, repaired in ashlar-masonry in the past, were reconditioned properly in cement-concrete. The damaged pillars and the decayed bottoms of walls, together with the door-jambs, were also repaired. Fissures appearing on the façade were grouted with cement-mortar.

(ix) *Cave 8*

Cave 8, a *vihāra* with a *sāndhāra-garbhagṛiha*, i.e. a shrine with a circumambulatory passage, the only one of its kind at Ellora, had its floor, walls and pillars damaged due to accumulation of water and débris. While minor repairs were done to the floor, the decomposed portions of the walls, etc. were chiselled out and made good in cement-concrete. The pillars in front (pl. XX) and the bases of those at the back and the door-jambs were similarly repaired. A drip-line was cut in the rock-ledge projecting at the roof-level.

During the work it was observed that the small shrine with a raised plinth in the north wall had a pit, at the centre of the floor in front of the image of Buddha, communicating to a wider space at the irregularly-dug bottom (fig. 5). As the location of the pit does not favour its having been a cistern, it is perhaps to be regarded as a private store. Débris filling the pit, comprising brickbats, rubble, earth and ash, were removed and a cement-concrete lid was put over the opening to prevent accident. Of the antiquities recovered from the débris, mention may be made of a stone disk ear-ornament, iron arrow-heads, a barrel-shaped ivory handle decorated with ringlets and beads of agate, carnelian, etc.

Outside the cave, to protect the imposing sculptured panel of Kubera and Hārītī on the north wall, exposed to the weather-action as a consequence of the loss of the western end of the niche, a reinforced cement-concrete hood was provided in extension of the existing ledge and a return-wall with a broken edge was constructed, keeping its outer face in harmony with the undulated rock-surface. The drip-line was also continued beyond the outer extremity.

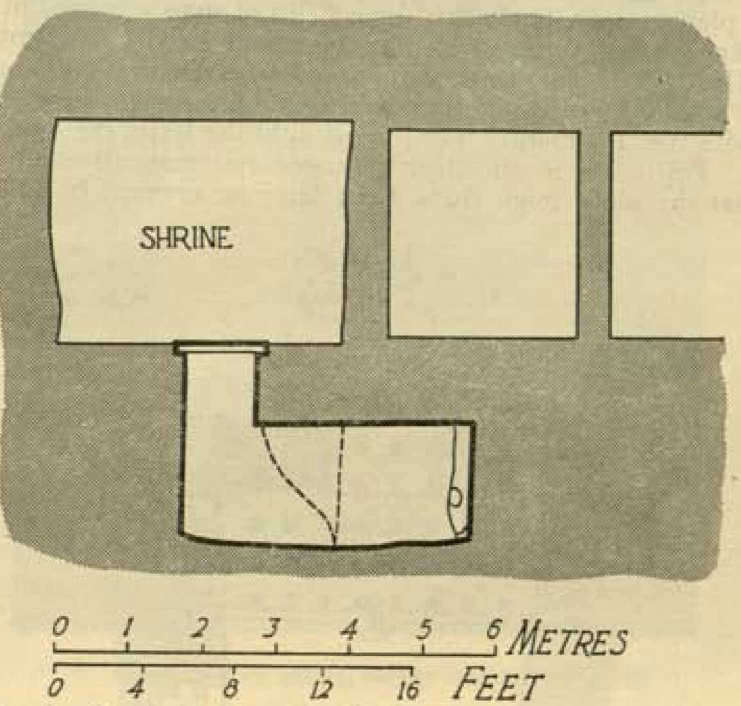


FIG. 5. *Cave 8: section. The thick lines indicate the recently-exposed pit in front of the shrine*

(x) *Cave 9*

Of this simple shrine the pillars in front and the terminal pilasters were repaired (pl. XXI). The horizontal joints striking against the beautiful façade composed of tastefully-carved *udgamas* were filled up and a throating, together with a surface-drain at the top, was provided to save the façade from further deterioration.

The phased programme referred to above (p. 52) was to cover the group up to this cave but, as already stated, caves beyond this limit were attended to ahead of the schedule during the period under review. Such important works are detailed below.

(xi) *Cave 11*

Some of the worn-out rock-steps, subsequently repaired in masonry, leading to the elevated spacious front court were redesigned and substituted by either rock-cut or cement-concrete ones. For the easy drainage of rain-water all pits in the floor of the front-court were filled and a shallow drain cut, joining it with the gutter, also cut by the side of the steps in front. The damaged pillars in the verandah of the ground floor were repaired. The flight of steps on the north leading to the first floor of this three-storeyed monastery, in a bad shape, was repaired by the cutting out of new steps and mending of the existing ones as necessary.

(xii) *Cave 12*

Clearance of débris from in front of this imposing three-storeyed monastery revealed a wide elevated platform (fig. 6) reached by a flight of steps provided at the centre of the plinth and flanked by sculptures of elephants in bold relief. The entire length of the plinth (pl. XXII A), it is now seen, was carved with heavy mouldings with a central band decorated with conventional diamonds and lotus-designs in niches separated by vertical bands with rosette-designs. On the north of the steps, the designs are flanked by dancing dwarfs. Post-holes in the floor arranged systematically and holes on the side walls suggest that the place might have been later on covered by a lean-to roof.

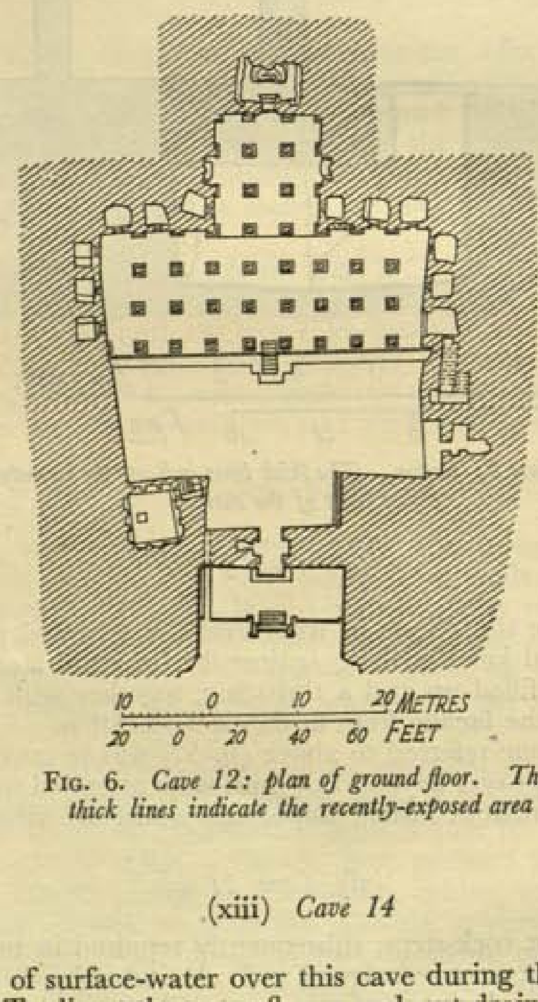


FIG. 6. *Cave 12: plan of ground floor. The thick lines indicate the recently-exposed area*

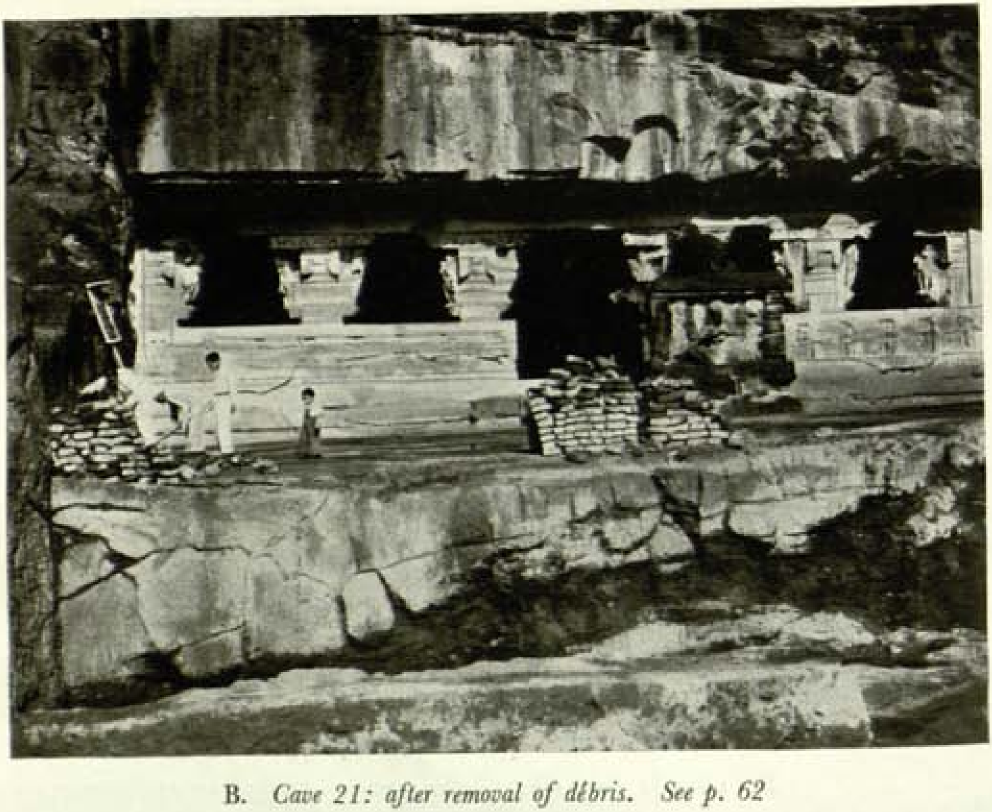
(xiii) *Cave 14*

Continuous flow of surface-water over this cave during the rains has weathered the façade considerably. To divert the water-flow a rock-cut drain was excavated immediately above the roof-level. There will be a drip-line in addition, when a portion of the projected ceiling is reconstructed. After the removal of the unsightly and incongruous ramp made of loose rubble, put up in the past in front of the cave, remnants of the rock-cut steps were laid bare and were repaired in cement-concrete. Side by side, the south pilaster and the damaged plinth were also repaired and the mouldings on it reproduced.

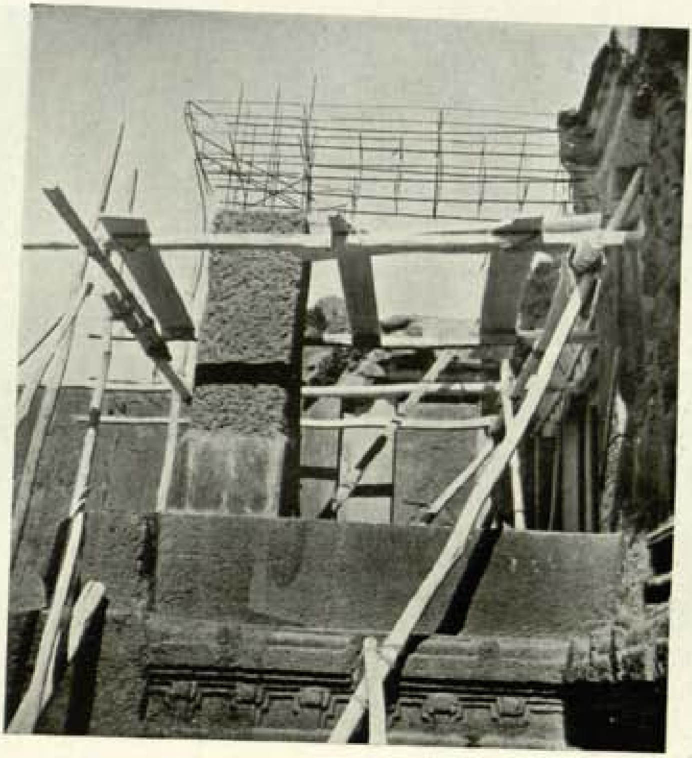
A. *Cave 9: front pillars, during repairs. See p. 59*

B. *Cave 9: front pillars, after repairs. See p. 59*

A. *Cave 12: after removal of débris. See p. 60*



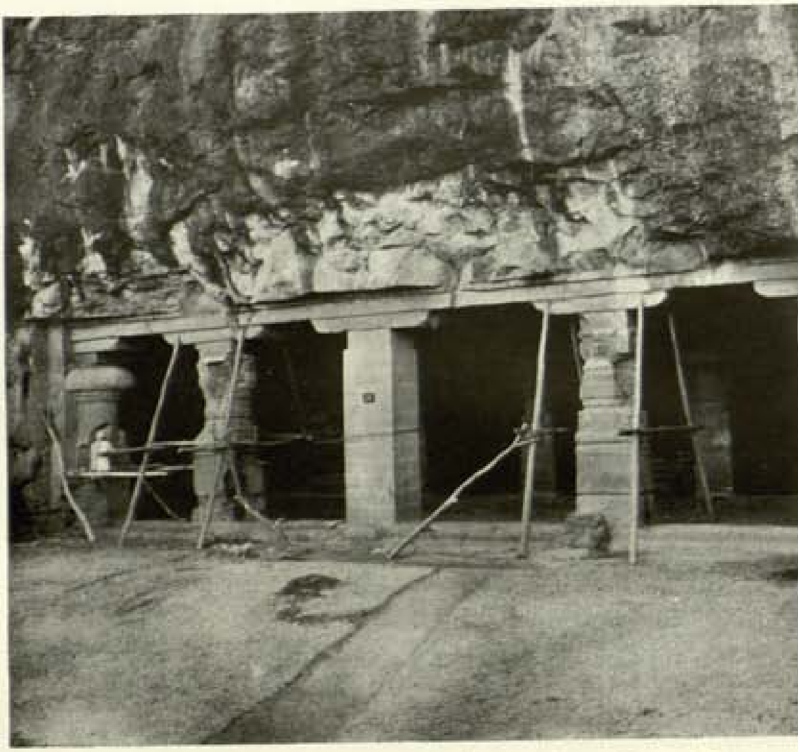
B. *Cave 21: after removal of débris. See p. 62*



A. *Cave 15: porch in front of maṇḍapa, during repairs.*
See p. 61

B. *Cave 15: porch in front of maṇḍapa, after repairs.*
See p. 61

To face pl. XXII



A. *Cave 26: front pillars, during repairs. See p. 64*

B. *Cave 26: front pillars, after repairs. See p. 64*

To face p. 61

(xiv) *Cave 15*

The famous inscription of the Rāshṭrakūṭa king Dantidurga, the only major inscription at Ellora, on the outer face of the western wall of the monolithic *maṇḍapa* in front of Cave 15, had till now been exposed to weather due to fall of the roof of the porch. To check the lithic document from further obliteration, the missing pillar on the south-western corner was rebuilt in reinforced cement-concrete and a roof of the same material and original thickness was put up, duly anchored to the extant portion in the north-eastern corner and reproducing the available corresponding mouldings on the cornice (pl. XXIII).[1]

It was observed that during the post-monsoon months, water trickled through a fine crack across the middle of the Bhū-Varāha sculpture on the north wall of Cave 14 situated below the huge cistern to the south of this cave. After a proper investigation of the source of this water the joints in the walls of the cistern were pointed with cement-mortar. The result has been satisfactory, as the trickling has stopped. The damaged screen-wall and the door in it, repaired in ashlar-masonry in the past, were redone in cement-concrete and the series of high-level steps leading to the forecourt of the cave were reconditioned by chiselling and in cement-concrete as found necessary. To expose the platforms flanking the steps near the entrance and also to bring the small cave in the north wall to view, the débris on the sides were removed.

(xv) *Cave 16*

The unseemly repairs done in the past to the door-jambs at the entrance to this important edifice had to be redone in a proper manner in tinted cement-concrete, chiselled to conform to the adjoining surfaces.

A superficial clearance of débris from the open area in front of the screen-wall of the cave revealed the existence of a frieze of sculptures of fighting animals at the bottom of the wall and an expansive raised platform terminated by a dwarf-wall. While the northern portion was limitedly available, the southern portion was missing and its indications only could be traced. With the finding of such features it became imperative that all surviving traces should be exposed and the level of the ground in front of the cave lowered down to the original. The entire ground was then excavated down to an average depth of about 3 ft. In the course of the digging, several fragments of sculptures were recovered, many of them presumably once adorning the great temple. As a result of the lowering of the ground-level, the drains from the inner court of the temple had to be re-orientated and reconstructed.

(xvi) *Cave 19*

Cave 19, one of the earlier Brāhmaṇical excavations at Ellora, had a faulty roof which leaked heavily during the rains. With a view to stopping the leakage, débris was cleared from the roof-top and all visible cracks were grouted with cement-mortar; this was followed by the laying of a layer of cement-concrete over the roof. The operation has brought encouraging results, though the leakage has not been stopped entirely, as some of the sources of leakage appear to remain yet uncovered beyond the area attended to. Efforts are being made to trace and treat them.

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[1] Cf. *Indian Archaeology 1957-58—A Review* (New Delhi, 1958), p. 97 and pl. CX.

(xvii) *Cave 21*

To divert the surface-water falling in front of this otherwise well-preserved cave, a drain was cut into the rock at the top. Outside the cave, to the south, the top of the damaged west wall of the roofless small shrine of Kārttikeya was made watertight by the filling of the cracks and cavities were filled with liquid cement-mortar.

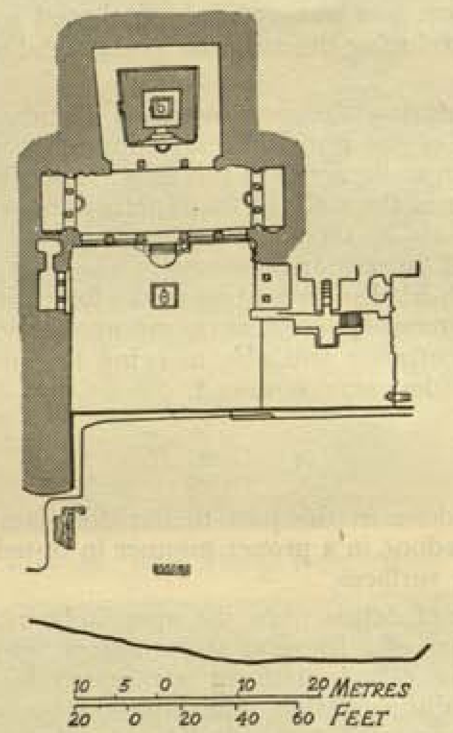


FIG. 7. *Cave 21: plan. The thick lines indicate the recently-exposed area*

Like Caves 3 and 12, indications in front of this cave showed the existence of an expansive high platform as a forecourt. The appearance of a few courses of a brick structure in the course of the removal of débris in front and the discovery of ancient coins, beads, etc., from time to time from the vicinity, made it desirable that the débris should be removed carefully as a whole to find out the nature of the structure and its relationship with the cave and also to expose the original architectural features. Clearance down to a depth of 8 ft. 3 in. laid bare the plain face of the high plinth, at places damaged, a drain at the toe and an irregular rock-floor (fig. 7; pl. XXII B). Several walls of bricks, $17\frac{1}{2}$ to 18 in. long, $8\frac{3}{4}$ to 9 in. wide and 3 to $3\frac{1}{2}$ in. thick, of an uncertain character, were exposed.

A variety of antiquities ranging in date from the first-second century A.D. to more recent times goes to show the importance of the débris. The pottery consisted of pieces of the sprinkler in the Red Polished Ware and other sherds of recognizable shapes and decorated pieces, as found elsewhere in the early historical levels. Notable were two terracotta cylinder-seals of identical dimensions for decorating pottery; one of them had an elephant driven by a man and the other a rolling scroll with lilies. A number of beads on agate, carnelian, glass, faïence, etc. were obtained; of them, cylinder beads of cupreous glass, eye-beads, gadrooned beads, segmented beads with gold foil, beads with yellow matrix covered with blue or green glass and spacers of faïence and carnelian may be mentioned.

The numismatic collection from this limited area comprised copper coins which can perhaps be ascribed to Kumāragupta I, Kumāragupta II, a silver issue of the Kalachuri king Kṛishṇarāja, small silver pieces probably struck by the Kadambas, a Pallava coin, a Chola coin, Gadhaiyā coins and a Tibetan coin of the medieval period. Two terracotta coin-moulds, one each of the Traikūṭaka king Darhasena and of the Gadhaiyā type, add to the list of interesting finds. The Muslim coins were no less interesting. The Sultanate was fairly well-represented by the coins of the Khaljīs and Tughluqs, whereas those of the Mughuls and Bahmanīs naturally occurred.

Other interesting objects were a copper seal in the shape of a ring with four letters reading Datteśvaraḥ in the fourth-fifth century characters[1] and an intaglio depicting a crab of fine workmanship on lapis lazuli.

(xviii) *Cave 25*

Although no structural repair of importance was carried out in this cave, a large-scale clearance was undertaken in front, a consequence of which was the exposure of a portion of what turned out to be a high podium. Further removal of débris brought to view the unique features of a high plinth-wall (fig. 8) with an aperture in the centre having a

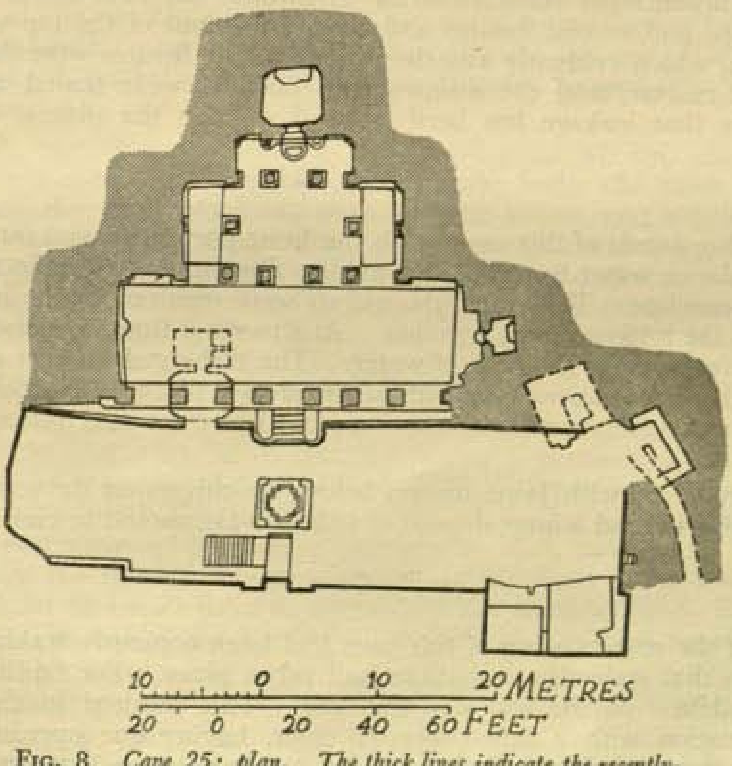


FIG. 8. *Cave 25: plan. The thick lines indicate the recently-exposed area*

[1]Reading and dating by Dr. D. C. Sircar.

damaged image of Gaja-Lakshmī on the back wall and steps cut in the rock to the left, leading to the top of the platform. In the raised plinth of the cave proper was found an unfinished cell with three pits and a fourth in front of it at a lower floor-level.

(xix) *Cave 26*

The cracked front pillars in the centre of this cave had been provided in the past with iron stirrups exposed on the outside. To do away with this obtrusive feature, the stirrups, after being coated with an anti-corrosive paint, were embedded at their proper places in the rock and were covered with tinted cement-plaster, chiselled to match the stone (pl. XXIV). The pillar to the north was rebuilt in cement-concrete after the dismantling of the veneering pieces of the ashlar-masonry erected in the past, the core having been grouted with cement-mortar before the application of the covering layer of concrete.

(xx) *Cave 30*

Fashioned by the Jainas after the great Kailāsa temple, this unfinished monolithic temple had the roof of both the *gopura* and the *sabhā-maṇḍapa* leaking. After the scraping out of the decomposed layer of rock from the roof of the *gopura*, all visible cracks and crevices were filled with liquid cement-mortar and the roof was covered with a 4-in. layer of cement-concrete to make it waterproof. Cracks appearing on the walls were also sealed off. The affected portions of the walls flanking the main entrance to the *gopura* were treated with roughly-finished cement-mortar to imitate the rock-surface. The terrace of the *sabhā-maṇḍapa* had several fissures and certain portions of the top were reduced to a friable condition, which evidently absorbed water. The fissures were duly cleaned and filled with cement-mortar, and the disintegrated portions were sealed and made good. Observations show that leakage has been stopped at both the places.

(xxi) *Cave 30A*

The projecting *kapota* of this cave, with the front portion carved out as a monolith, being broken at places, water from the roof used to flow in and get collected on the lower floor of the *sabhā-maṇḍapa*. The vulnerable points were repaired by the insertion of mild-steel bars to hold the broken pieces together. At the same time, a surface-drain was cut into the rock above to divert the rush of water. The dislodged portion of the *kakshāsana* to the right of the entrance was refixed in its proper place. The raised level of the front court, holding water at places, was excavated and levelled properly for the easy drainage of water.

A small excavation with Jaina images below the culvert on the road leading to this cave, so long hidden behind a huge deposit of débris, was exposed to view after clearance.

(xxii) *Cave 32*

The roof of the eastern wing of this cave had been copiously leaking quite for some time, so much so that stalactite formations had taken place. For finding out the source of leakage, the débris on the top was removed. This resulted in the discovery of a tunnel-like excavation with a lime-concreted floor, having one opening on the façade and the other on the roof of the cell: it provided communication between this cell and the main cave and was connected with a slit in the wall for the drainage of water that would ooze out of the softer zone of the rock at the sides of the tunnel. As this system, evidently an early attempt at tackling the drainage-problem, was no longer functioning, the dead concrete was picked up and the opening in the roof was closed. After the grouting of the fissures with cement-mortar, the floor was cement-concreted to a thickness of 4 in. with a slope towards the outside, taking care that water oozing out of the softer material on the eastern side drained out easily. The arrangement has proved to be a complete success, for there has not been any leakage since then in that area.

The corresponding roof on the western side is also being likewise treated, the leakage here being through a crack on the south wall, developed most probably due to a jerk when a portion from the top had slid down in the past. After the scraping out of the roof was exposed a wide yawning gap, which permitted water to percolate through the crack. The gap is being suitably filled.

(xxiii) *Cave 33*

The curvilinear ceiling of the corridor on the south of this cave was very much damaged. The disintegrated portion was chiselled off and the ceiling was reproduced in cement-concrete with mild-steel bars.

(xxiv) *Repairs to sculptures*

Since the restoration of sculptures for its own sake is against the accepted principles of the Archaeological Survey of India, it could not naturally agree with the Expert Committee (p. 51) in its recommendations on such restorations. Instead, the Survey decided that only such repairs as were necessary for the prevention of further deterioration of the damaged sculptures should be carried out. Accordingly, the services of two qualified modellers were secured for such repairs.

In Cave 2, the colossal figure of the Bodhisattva at the south standing as a *dvāra-pāla* had developed several cracks all along the body, the more ominous of them being on the back, due to constant exposure to water-action, and was in danger of being dislodged. The sketch of the image (fig. 9, *1*) shows the extent of the damage. To fasten the sculpture back to the wall, eight copper pins and dowels were put in through holes drilled in the body at vulnerable points. The cracks were then filled with liquid cement-mortar tinted to match the stone. The image of Buddha in the iconostasis of the south gallery, together with the flanking Bodhisattvas, had been heavily damaged: while almost all the sculptures had cracks, the image of the Buddha in the second panel from the east had the legs below the knees fractured (fig. 9, *2;* pl. XXV). Besides repairs to the cracks on the images, the fractured portions of the latter were re-set with copper pins and cement-mortar mixed with rock-powder to attain the original effect. The missing portion of the left leg from the ankle upwards was roughly reproduced to support the overhanging portion. Consistently with principles, no attempt was made to reproduce the missing fingers or details of the face. The wide crack running from the halo behind Buddha's head to beyond the left shoulder of the Bodhisattva to the right was filled. The top of the left foot of Buddha in the third panel, which had run to pieces, was suitably repaired.

The *dvāra-pāla* of Cave 3 had a deep crack from the top of the *jaṭā-makuṭa* down to the right breast, a cavity in the belly and a pair of damaged feet; all these were mended. The downward crack to the right side of the head of the flying figure to right, which had been responsible for the loss of the left elbow leaving the forearm with insufficient support, was repaired and the breach in the arm filled. The image of the

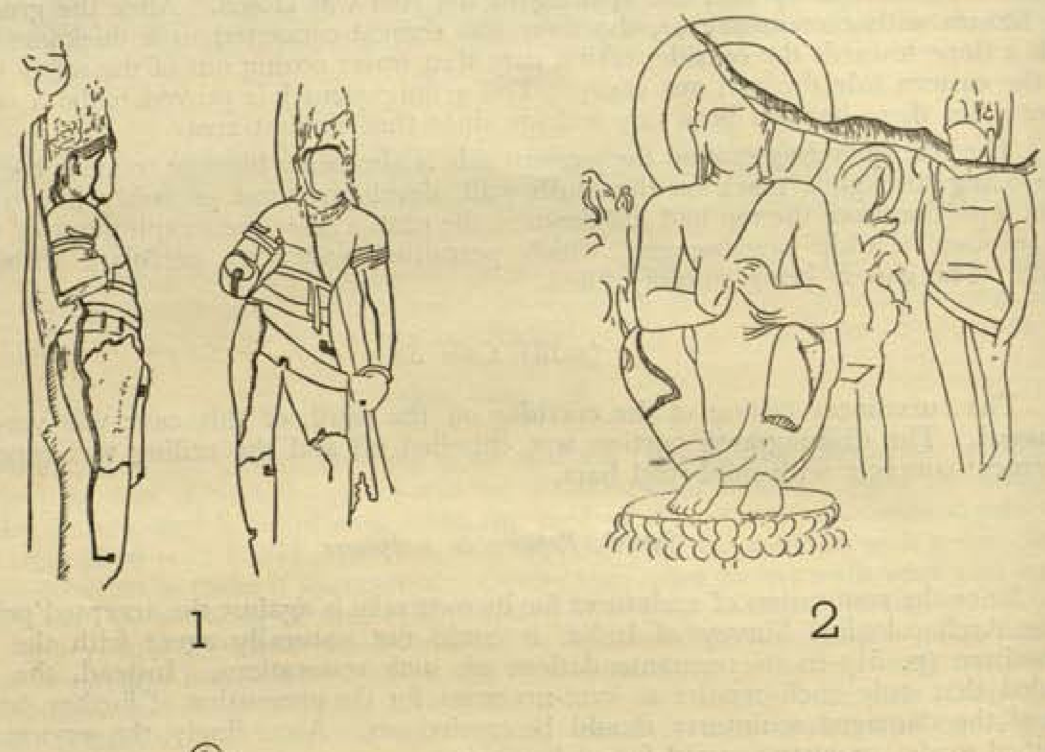
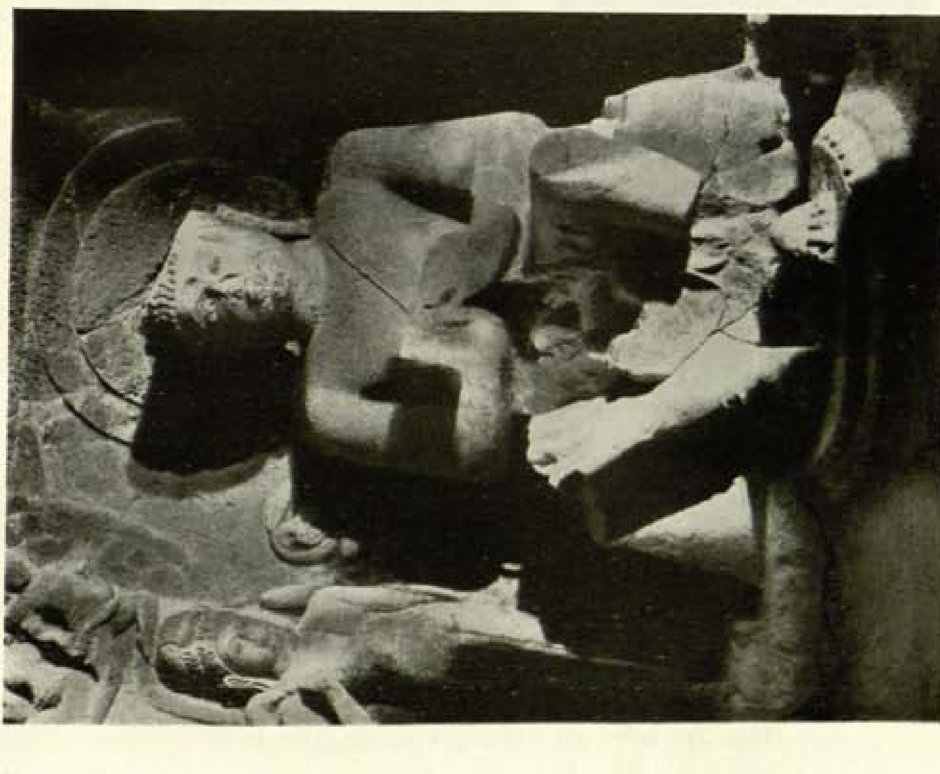
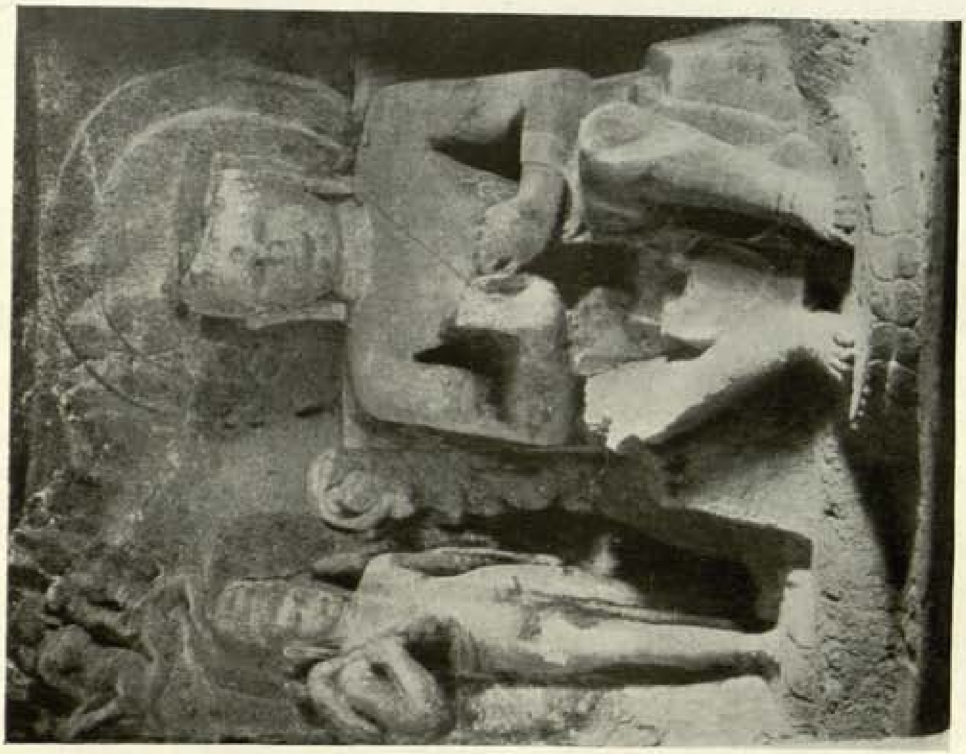


FIG. 9. *Damaged sculptures. 1. Cave 2: the Bodhisattva, ht. 11 ft. 4 in. 2. Cave 2: Buddha and the Bodhisattva, ht. of former 7 ft. 3. Cave 3: Bodhisattva Maitreya, ht. 8 ft. 10 in. 4. Cave 11: Buddha, ht. 1 ft. 3 in.*



A. *Cave 2: image of Buddha, before repairs. See p. 65*



B. *Cave 2: image of Buddha, after repairs. See p. 65*

Cave 21: image of Gaṅgā, after repairs. See p. 67

To face p. 67

Bodhisattva Maitreya to the left of Buddha on the back wall of the shrine with a beautiful head had a depression in the belly, a crack from the same region to the left thigh and a lean left leg (fig. 9, *3*), the resultants of weathering and falling of a chunk of stone from the groin to the ankle. After the filling of the crack and the depression, the leg was reconditioned. Outside, on the north wall of the front verandah of the cave, the sculptures were repaired by way of the filling of the cracks running across and of the cavities in them.

The fall of the western portion of the shrine on the first floor of Cave 4 had caused several cracks in the image of Maitreya, the left *dvāra-pāla*. All such cracks were cleaned and filled with liquid cement-mortar. Cracks on the images on the walls of the passage connecting Caves 6 and 9, which had developed for similar reasons, were also suitably treated.

The panel of sculptures of Kubera and Hāritī, only of its kind at Ellora, on the outer wall of Cave 8, recently provided with a protective hood (p. 58), had a deep crack affecting the thighs of both the images, and several cavities had been formed due to the exfoliation of the rock. All these defects were made good in tinted cement-mortar in conformity with the general appearance of the rock.

The ground floor of Cave 11 having remained covered with débris till 1876 (p. 50), which explains its being called Do-thāl ('two-storeyed'), despite its being in three-storeys, the sculptures of the back wall of the porch had considerably weathered. The most affected of them was the image of Buddha (fig. 9, *4*), with a wide gap running across the right elbow and the belly and deep cavities in the chest and shoulders. The missing bottom portion of the triad with Tārā and the deep scar below the waist of the four-armed Avalokiteśvara were preserved from decay by filling the crevices and making good of the weathered portions after the scooping out of the decomposed portions.

The impressive image of Gaja-Lakshmī facing the entrance of Cave 16 had portions of its legs and belly missing. These portions were repaired. In the famous sculptured panel of *Rāvaṇānugraha-mūrti* in the plinth on the south, the image of Rāvaṇa had the back and shoulders damaged and cracks running in all directions, so that, deprived of its sense of solidity, much of force and vigour of the sculpture was lost. To bring out its forcefulness and to make it solid as a symbol of strength, as it verily depicts, all such damages and cracks were repaired so as to merge with the mass of rock. The wide natural joints across the elephant-caryatids and the south *dhvaja-stambha* in the courtyard were filled. In some cases where these joints struck the trunks of the elephants and endangered their safety, copper clamps were inserted as reinforcement.

The cracks on the sculpture of Gaṅgā (pl. XXVI) on the outer left wall of Cave 21, on the images in the *Kalyāṇasundara-mūrti* panel inside and the two *dvāra-pālas* flanking the shrine were all suitably repaired.

[*Received on the 22nd June 1960.—Ed.*]

QUATERNARY PEBBLE, CORE AND FLAKE CULTURES OF INDIA—AN APPRAISAL OF THE DATA

By K. V. SOUNDARA RAJAN

CONTENTS

1. INTRODUCTION

RECENT WORK IN PREHISTORIC ARCHAEOLOGY HAS BROUGHT OUT ENOUGH MATERIAL to convince one that the patterns of tool-fabrication and their spatial and chronological advancements are infinitely more complicated than what was thought to be even two decades back, and any oversimplification of their behaviour is thus prone to be fallacious. The wide specializations that tool industries manifest even within limited geographical zones would show that the genius of the early man, as revealed in the artefacts that he fashioned for a variety of uses, was subject only to ecology, availability of raw material and desired function. In the following pages, it is intended mainly to trace the broad technological criteria involved in the tool facies and industries of differing cultural stages in Stone-Age India in the light of recent research, with a view to comparing their interrelated tendencies with those in the other Asian-African areas. It is admitted that dependable climatic and stratigraphical data are not adequately documented in the Indian subcontinent, although the broad landmarks in culture-evolution in the Quaternary in this zone would seem to have been outlined, if not established, in recent times. It would thus be best to deal with the regions on the basis of the one or the other of the great Stone-Age tool culture families to which individual industries may belong.

In a masterly survey of the prevailing trends of Stone-Age cultures two decades back, Menghin divided the entire Stone-Age world into three broad culture-provinces, viz. those of bone culture, flake culture and core or handaxe culture.[1] According to him,

[1] O. Menghin in *Early Man*, ed. G. G. MacCurdy (Philadelphia, New York and London, 1937), pp. 303-04.

bone culture was invented in arctic or semi-arctic latitudes, under the temperate zones of central and east Europe and the entire U.S.S.R. flake cultures dominated, and in sub-tropical and tropical areas of the Asian-African continent the great handaxe cultures prevailed. He showed the functional efficiency of handaxes in lush vegetation-infested tropical jungles and the comparative merit of smaller and sharp-edged flakes and blades in the milder northern zones. He also demonstrated with a reasonable emphasis that the great handaxe cultures of south Africa and the Indian subcontinent had spread northwards and met the flake cultures. But, at the same time, he felt it difficult to associate identical horizons to similar industries on pebbles and flakes and opined that there had been different kinds of industries on pebbles and flakes, largely influenced by contacts, rock-material and environment. Thus, in Egypt we have pebble-tool types both in the Early Stone-Age and in the comparatively young Late Stone-Age contexts. In India, we have to contend with pebble elements occurring with handaxes and a divergent but largely contemporary pebble element of the Sohan cultures of the Panjab valleys. Thus, the problem resolves itself into a series of subsidiary, nevertheless important, homogeneous subculture-provinces within a greater complex of industrial techniques. Recent trends to separate techniques from cultures to avoid confusion of correlation over widely-separated areas have also made significant contributions towards a better understanding of the Stone-Age problems.

2. PRIMITIVE TOOL-TECHNIQUES AND THEIR IMPLICATIONS

It is not generally gainsaid that the earliest tools of the primitive man, made not through a premeditated technique but casually, would have resulted in the unifacial chopper-scraper kind on a readily-available tabular pebble and subsequently on a split pebble or on a mere plain thick flake detached by a knock from a stone block.

The fashioning of a primitive tool on a split pebble has the main advantage that the sharp margin already provided by the splitting would, if chipped further unifacially, result in a very efficient cutting- or chopping-edge. It may be incidentally noted that in the first-known instance the splitting may have been naturally caused by concussion between pebbles. Only at a subsequent stage was this patent advantage grasped by the Stone-Age man; this led him to split a pebble on purpose. The split-pebble tool was thus an intermediate stage between an efficient unifacial chipping and a deliberate bifacial flaking.

The primitive pebble tools (or, rather, tools with primitive single or two-directional flakings, as Leakey would caution us to have)[1] are found variously in the Kafuan of Uganda, the Oldowan of Kenya, the Pre-Stellenbosch of south Africa, the Sohan of Panjab, the early stage of the Madrasian, mainly of peninsular India, the Choukoutienian of China, the Anyathian of Burma, the Patjitanian of Java, etc. These are not homotoxial. The Kafuan and Oldowan (Olduvai Bed I) are singularly devoid of any handaxes and even of any specific tendency towards them. They are thus undoubtedly pre-handaxe (or pre-Chelles-Acheul of the African terminology). Of the two again, the Oldowan should represent the developed stages of the Kafuan, as it abounds in two-directionally flaked pebble tools and is stratigraphically posterior to the Kafuan, of which itself four stages of development have been recorded. It is of interest to note also that the Kafuan types are from Uganda only, indicating that no region outside equatorial Africa can, at this stage, be seriously

[1] L. S. B. Leaky, *Olduvai Gorge* (Cambridge, 1951), pp. 34-35.

suggested as the cradle of the human race. As Lowe has put it,[1] not only was it in Africa that man first emerged as the tool-maker but also it was in the equatorial region of this continent that he emerged, and since all the Australopithecine types from Sterkfontain, Taungs, Kromdraai and Swartkarns have been found in identical levels, but none of them in association with these primitive tools, it would be fair to conclude that there were more advanced men living contemporaneously with the Australopithecine, who made the Kafuan tools.

The Chinese, Burmese and Javanese industries are again devoid of the handaxe, although, according to Movius,[2] the Javanese would seem to have some specimens akin to it. While the flake-accompaniment of these pebble industries in Africa is nondescript and not worthy of detailed consideration, the corresponding assemblages of the mentioned cultures of east Asia have a definable status and range from types with the crude plain platform to the 'proto-Levallois' stage. The Panjab Sohan has the unique distinction of diversity from its broad unity with the east Asian cultures, in its robust pebble-tool element and an evolving, progressive and refined flake facies, ranging from crude plain-platformed types through true 'Levallois'-inspired, prepared-platform types to small flake-blade assemblages, these typologically ranging between the Early and Middle Stone Ages and belonging stratigraphically to the late II IGl to III IGl of the Kashmir Pleistocene. The pebble tools which accompany the early stages of the (Madrasian) Chelles-Acheul cultures of peninsular India, on the other hand, have a great affinity with the African in their typology, lack of distinctive flake facies and progressive decrease and disappearance of pebble tools in the Acheulian culture-stage of the handaxe family. It is thus in contradistinction to the 'Sohan' industries in both typology and chronology, since in the latter area even after the handaxe culture had died out, the flake culture proceeded with further development and refinement as at Chauntra in III Gl gravels and silts. The problem thus assumes added importance, and recent discoveries of a pebble-tool element at sites like Bariarpur on the Ken near Panna (Madhya Pradesh), which have otherwise produced distinctive artefacts of the handaxe family,[3] have spearheaded the issue towards a proper classification of what should constitute the 'Sohan' and 'Madrasian' pebble cultures in a mixed assemblage, in what degrees and in what zones. In other words, the identification of the concerned pebble facies at each of the sites, with their proper parent culture, is called for.

It is, of course, not necessary nor indeed correct to visualize any contemporaneity for these pebble cultures, since it is directly concerned with the evolving primate and his environment. As a matter of fact, we find the African pebble industries like the Kafuan and, partly, the Oldowan resting mainly on the Lower Pleistocene horizon, while the south-east Asian as well as the Indian pebble tools would, as far as known, seem to belong to the Mid-Pleistocene.

When, subsequent to the pebble stage, the early man had given attention towards fashioning a conventional tool, the technique of marginal bifacial trimming evolved by him, perhaps from primitive 'Clactonian' industries, to get a continuous sharp edge and to have one end narrowing down to a convenient thrusting tip, constituted the basic

[1] C. van Riet Lowe, 'The Kafuan Culture', *Third Pan-African Congress on Prehistory, Livingstone, 1955* (London, 1957), p. 209.

[2] H. L. Movius (Jr.), 'Early Man and Pleistocene stratigraphy in southern and eastern Africa', *Papers of the Peabody Museum of American Archaeology aud Ethnography, Harvard University*, XIX, no. 3 (Cambridge, Mass., 1944).

[3] *Indian Archaeology 1957-58—A Review* (New Delhi, 1958), pp. 25-26.

mastery achieved by him. It was indeed the forerunner of most of the great multiplicity of tool-types that were to follow across the span of time. This conventionalized handaxe-technique would answer for almost the entire Abbevillean of Europe, the Stellenbosch of Africa and the Madrasian of India. It must also be understood that, if sufficient skill was achieved in the development of the bifacial core-technique of the great handaxe culture, the advanced 'Acheulian' handaxes and ovates were often enough only technologically, but not invariably in efficiency, superior to the earlier ones. They represent the secondary trend towards a technological, if non-functional, refinement—ever present in all cultural progress.

It is extremely interesting to observe that within bifacial core-technique would have to be classed even the evolved 'Acheulian' tools, which are not necessarily made on cores but may be bifacially fabricated on large flakes. This would focus one's attention on the fact not only that, given greater application, man began to shed the tendency to resort to heavy unwieldy cores for making his tools and fashioned them out of handy large flakes, but also that this had its basis often on the nature of the available raw material. In a place where shaly rock or trap was easily available, it was felt quite uneconomical to undertake rigorous labour of getting core tools made out of an enormous chunk of quartzite boulder brought from afar. It was felt easier to shatter a large flake out of the more tractable local material and chip it to the required tool. This tendency would also signify a progressive step for the early man as the tool-maker in that an implied guidance was there for him to interest himself in flakes rather than in large massive cores for his bifacial tools. Herein lies the very germ of the flake-tool cultures, which so proliferates in a subsequent stage when the early man took to tools of a diminishing size and of a more specialized structure. The great handaxe cultures of Africa and India have indeed the core-*cum*-flake element in them, each more or less taking a complementary part. As Lowe points out,[1] in Stellenbosch III we find the first deliberately-shaped cores and flakes with the striking-platform prepared in such a way that we are impelled to see in them possible, if indeed not probable, roots of the technique similar to what characterizes the true European 'Levallois'. Thus, the specialization of the prepared-platform flake-technique happened much earlier in these regions than in Europe. This aspect, viz. the vertical difference in the development of the 'Levallois' flake-technique in both European and African cultures, has been eloquently brought out by Lowe.[2] It is important to note that the Indian typological sequence would very closely follow the African in that in both we have: (a) the rudimentary pebble-tool industries similar to the Kafuan and Oldowan as parts of the evolution of the handaxe cultures; (b) the 'Victoria West' type of tool, implying the rudimentary advance made in the flake-fabrication; (c) the successive developments of the bifacial tools on cores and flakes, and in the cleaver from the bifacial, through the single and double 'Vaal' techniques, to the horseshoe cleaver and that with trapezium section; and (d) the 'Levallois'-technique flakes fashioned into smaller-sized flake tools of various types, ultimately tending to disperse into more specialized and gradually-diminishing-sized assemblages of the Middle Stone Age, as in the Deccan and central India. All this also suggests that the variations in the climatic regimes have not been so cataclysmal as to warrant any fundamental changes in techniques except in the size and variety of tool-types and that the fauna to contend with was such as could be more easily tracked down by lighter missiles.

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[1] C. van Riet Lowe, 'The evolution of the Levallois technique in south Africa', *Man*, XLV (1945), pp. 49-59.

[2] *Ibid.*

3. THE PANJAB SOHAN INDUSTRY

In India the term 'Sohan' has often enough been temptingly and indiscriminately used for pebble tools in general. At the outset, it may be mentioned that the only area where these Sohan-culture tools have been identified and described in their geological and physiographic set-up is Panjab, where De Terra and Paterson discovered the industries of this culture occurring in the various terraces, T_1-T_4, of the valley of the Indus (above its confluence with the Jhelum) and in the valley of the Sohan (an affluent of the Indus joining it above Attock) in the Potwar plain.[1] These industries were characterized by the twin elements of pebble and flake, in a proper evolutionary sequence. In the early stage, as in T_1 of the II IGl period of the Panjab Potwar, the pebbles were mostly large, and both unifacial and bifacial chopper-like tools occurred; large, thick and usually cortex-sided and platformed flakes prevailed alongside and gradually progressed towards the 'Levallois' forms of flakes and cores. These tendencies, designated as the 'Early Sohan' by De Terra and Paterson, were examined in the Indus valley and in some localities in the Sohan valley. The subsequent stages of T_2 and T_3, respectively of the III Gl, III IGl and IV Gl, were established mainly in the Sohan valley proper, where they were named as the 'Late Sohan' or 'typical Sohan' and the 'Evolved Sohan' industries respectively; they were seen to have attained a high proficiency in the prepared-platform flakes and appropriate cores and refined diminutive-sized pebble tools, gradually giving place to small blades and retouched flakes and push-plane scrapers, as in the T_4 stage. It was thus seen that a tool culture *the main progressive trend of which was towards a flourishing flake industry* comprising flakes, blades and scrapers was nevertheless *retaining to a degree the basic pebble tradition which was one of its main diagnostic features*, even in its advanced stages.

Now the picture of this strong, indigenous and well-developed pebble-flake culture of the Indus-Sohan area was made more interesting by the fact that alongside the tools of the so-called Early Sohan and Late Sohan group were found rolled and, in many cases, 'derived' tool-specimens of the bifacial handaxe family also, such as the handaxes, cleavers and the like, almost running parallel in their co-occurrence with the 'Sohan' culture. They were noticed in the Abbevillean and Early Acheulian forms in the Potwar and Sohan valley proper of the III IGl gravels and upper loess of T_2. The authors of the discovery were agreed that there were no proper stratigraphic data available as regards the actual relationship between the 'Sohan' elements, since, as far as observed, the bifacial tools were themselves found in a mixed assemblage with only their *état physique* and typology as the basis for any tentative division that could be attempted. However, their stratigraphic position immediately between the loessic formation of the Third Glaciation and the boulder-conglomerate made it possible for them to date the Abbevilleo-Acheulian in the Cis-Himalayan regions as the early Second Interglacial. Very recently, the study of the Sohan culture on the Indian side of the Panjab Siwaliks has been taken up with fruitful results.[2]

4. SITES IN PENINSULAR INDIA

This fact of the occurrence of the bifacial core-tool family of the Madrasian or peninsular complex in the area which is the homeland of the Sohan culture and from the

[1] H. De Terra and T. T. Paterson, *Studies on the Ice Age in India and associated Human Cultures* (Washington, 1939).

[2] B. B. Lal, 'Palaeoliths from the Beas and Banganga valleys, Panjab', *Ancient India*, no. 12 (1956), pp. 58-92.

early II IGl onwards is important enough to be noted, since, comparatively, the occurrence of rolled forms of Early Sohan tools in the basal gravels of T_2 of the Third Glaciation means the existence of the Early Sohan industry itself, datable mainly to the latter part of II IGl, according to De Terra. This should give the necessary caution in the approach to the question of the mutual relationship, chronologically and spatially, of the Sohan and peninsular bifacial cultures. It was held nearly two decades past that the central Indian and Gujarat areas, viz. the Narmada-Sabarmati axis, were the meeting-place of the Sohan and Madrasian cultures.[1] But it would be rather anamolous, since even in the Potwar Panjab the two cultures had met already during the late II IGl, though the nature of the contact is not yet fully revealed. De Terra says: 'The Madrasian facies of the Abbevillean clearly extended all across the Peninsular India to Himalayan Hills. In this distribution, we recognize a great expansion of the earliest Stone-Age cultures.'[2] Therefore, it would need much more than a mere collection of pebble tools in a place, otherwise yielding handaxes and the like, to deserve the label of the 'meeting-place' of the Sohan and Madras cultures. The intervening areas between central India and Panjab have not also revealed sites wherein the Sohan traits are dominant.

In the Sabarmati valley of Gujarat, the lateritized pebble-gravels enclose remains not only of handaxe but of pebble choppers of the Early Sohan types (according to Krishnaswami),[3] although Zeuner is inclined to describe the latter as 'Late Sohan'.[4] In the lower (basal) gravels of the Narmada, however, there are according to Paterson, the so-called Pre-Sohan flakes, crude rolled Abbevillean types and fresh Acheulian bifaces and cleavers, together with cores and rolled flakes of the Early Sohan. This may mean that while Abbevilleo-Acheulian tools may be *in situ*, the other elements may have been redeposited, particularly since the laterite in the middle Narmada around Hoshangabad does not immediately underlie the gravels. There is, in fact, a dense mantle of alluvium running to hundreds of feet between the basal gravels and the laterite substratum. This would show that the Narmada laterite is, relatively speaking, earlier than the Gujarat laterite; the basal gravel itself, on palaeontological grounds, has been dated to the late Mid-Pleistocene. In the light of the Potwar evidence of an Abbevillean occurrence in Panjab in Early II IGl, it would be rather unreasonable to attribute an Early-Sohan origin to the pebble-tool facies found on the Narmada occurring with Abbevillean tools in the late Middle Pleistocene (not to speak of the induction of the Pre-Sohan here). On the Sabarmati again, it has been seen that the pebble tools present in the basal gravels disappeared in the silt. The general trend of the evidence seems more towards a chthonic association of the Abbevillean-Acheulian and pebble-tool elements in the Narmada-Sabarmati area (relatively early in the Narmada area and late in the Sabarmati). Correspondingly, the ambit of diffusion and impact of the Panjab Sohan culture outside its primary zone will have to be over a rather restricted area, the exact limits of which are not, however, clear, at present. But their evolution in the Narmada lower and upper gravels, as adumbrated by Paterson, would seem to stretch the Sohan ambit too far, for which convincing cultural and chronological data are alike absent. Indeed, the climatological and cultural data adduced for the Panjab Siwaliks and Kashmir Himalayan area would seem to hold good mainly for that area only and cannot, at this stage of research, be conducive to its correlations with the central Indian zone.

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[1] Cf. V. D. Krishnaswami in *Ancient India*, no. 3 (1947), p. 32; *ibid.*, no. 9 (1953), p. 60.

[2] H. De Terra in *Early Man*, ed. G. G. MacCurdy, *op. cit.*, p. 267.

[3] Krishnaswami, *op. cit.* (1953).

[4] F. E. Zeuner, *Stone Age and Pleistocene Chronology in Gujarat*, Deccan College Monograph Series, no. 6 (Poona, 1950).

On the other hand, butted pebble tools found in the pre-laterite boulder-conglomerate of Madras (Vadamaduri) show a more developed stage than the mere large Pre-Sohan flakes found in the boulder-conglomerate of the Potwar (Panjab). Again, the laterite of the Narmada and the laterite formed over the boulder-conglomerate of the Madras region may not perhaps themselves be contemporary, according to De Terra, since the former area has tools in the basal gravel not showing lateritization, while in the latter area the tools on the laterite terrace show staining *in situ*. This, however, brings in the question of the age of the interior and coastal laterites of the peninsula, about which De Terra's view[1] is that the coastal laterites of Madras, Bombay and Gujarat may be later than the inland laterites, such as those on the Narmada.

Does it suggest any likelihood of a 'pre-lower-gravel culture' to be found in the Narmada valley, at least in the Hoshangabad area, in the mid-Narmada stretch, consisting entirely of the pebble element (akin to the Kafuan or Oldowan Bed I facies and placed in the Lower Pleistocene)? Such a culture could, if available, have pertained to the erosional phase of the basal laterite itself and might be stained with it. However, in the lower Narmada, around Navdatoli (pl. XXVII), there are two gravels (one thin gravel resting on the basal trap-rock itself at a few places and the other separated from it by a thick deposit of clay), both of which are reported to be yielding early Stone-Age tools, though too few in number for a detailed study. It would be worth while to fix the lower and upper limits of the tool culture contained in these two gravels. There is also the need for the plotting of the highest terrace of the Narmada, the aggradational deposits of which partly found their way into the bed as basal gravels. The terraces of the Narmada would indeed seem to be prospective in the area around Maheswar, as recently shown by Sankalia and Subbarao,[2] although one has to be very cautious when dealing with terraces not yielding gravels or tools.

5. THE CENTRAL INDIAN SETTING

It is interesting to see in this connexion that in Madhya Pradesh the area around Damoh in the valley of the Sonar, an affluent of the Ken, running away from the Narmada towards north-east along the mildly-tilted Vindhyan plateau, yields a new relationship. Here the lower gravels, where they are seen to exist (pl. XXVIII A), have yielded what is mainly an Abbevilleo-Acheulian (Madrasian) assemblage; the lower clay has not yet been observed. The upper gravels, where observed (pl. XXVIII B), yield tools similar to the typical flake-blade-scraper outfit of the Narmada and Godavari—now usually called Series II. It would be very significant to find out what the industry in the lower clay is like, if and when found. But as it is, one feature stands out, viz. the total absence of any Early Sohan tools in the lower gravels of the Sonar in the Damoh area, as far as explored.

In the Rewa-Panna area also, in the valleys of the rivers Son and Ken, we find in the lower gravels what are predominantly the Abbevilleo-Acheulian tool-types with a robust pebble facies at one of the sites, Bariarpur (pl. XXIX A), on the Ken near Panna[3] (Appendix II, p. 81), and a predominantly flake-scraper-point assemblage in the second gravel, wherever available. On the Baghain, a cemented basal gravel *in situ* has

[1] De Terra and Paterson, *op. cit.*

[2] Cf. B. Subbarao, *The Personality of India*, M. S. University Archaeological Series, no. 3 (Baroda, 1958), pp. 57-59.

[3] *Indian Archaeology 1957-58—A Review*, p. 26.

Nullah-section upstream of Navdatoli on the Narmada, showing the basal and second gravels. *See p. 74*

To face p. 74

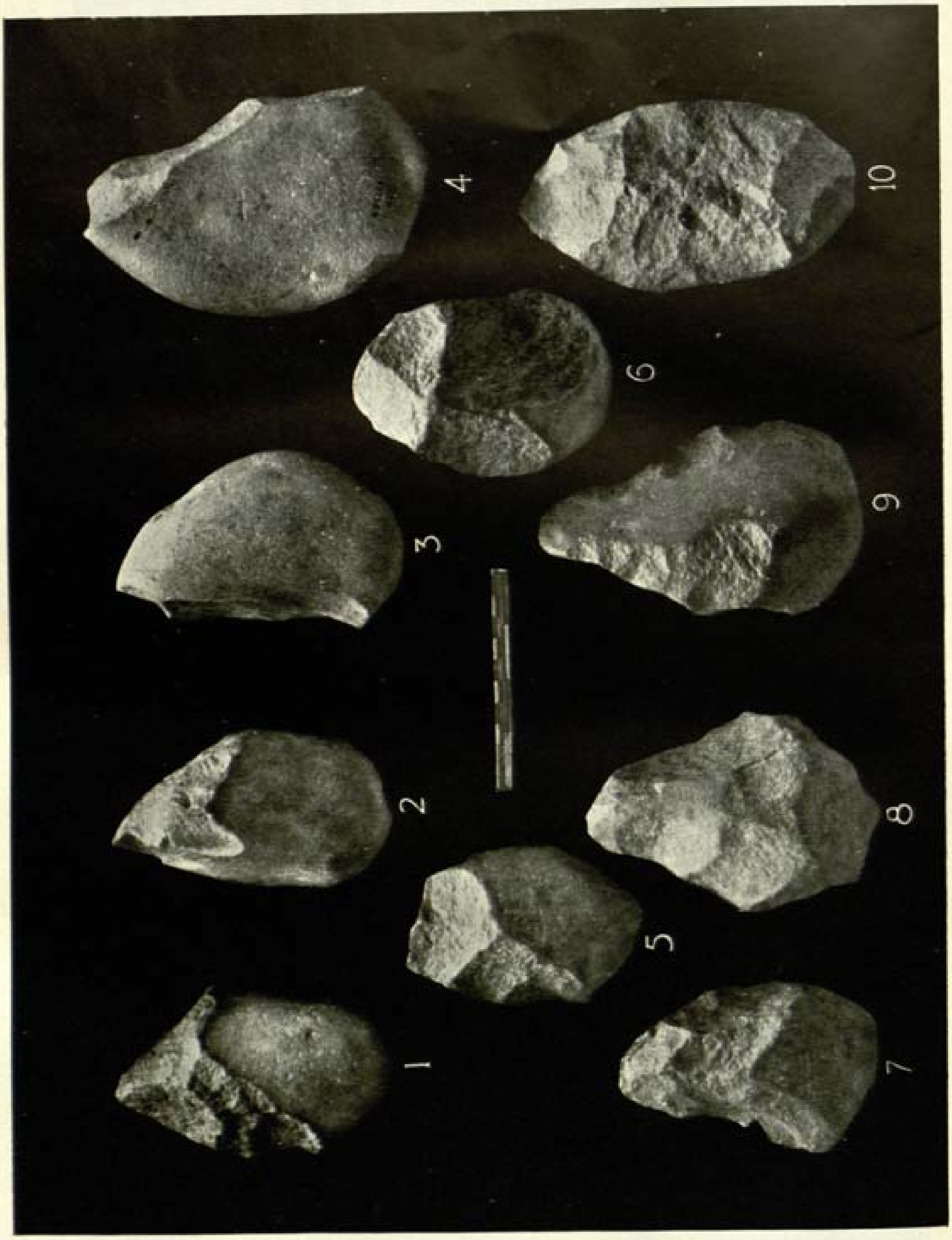
A. *Cemented conglomerate near Harat on the Sonar, yielding Lower Palaeolithic tools. See p. 74*

B. *Left-bank section of the Kopra, showing the top pink silt underlain by fine gravel yielding Middle Stone-Age tools. See p. 74*

To face pl. XXIX

A. *Bariarpur: top terrace, with surface-scatter of tools.* *See p. 74*

B. *Section on the Parvati near Pilukheri, showing hardened calcareous gravel-patches on basal trap, with the second and third gravels above, capped with silt.* *See p. 75*



Bariarpur: tools illustrating the progressive development of the handaxe from the ovoid pebble. *See p. 81*

To face p. 75

yielded the flake-scraper-point industry in the section or derived from the bed.[1] On the whole, it would seem that the Sohan influence is again largely absent in this area. In the Mirzapur region, on the other hand, the pebble tools and flakes are seemingly somewhat akin to the Sohan, but the published result[2] may well bear further scrutiny. The study of the collections from the Chambal basin also seems to suggest an absence of any clear-cut Sohan impact in the flake facies accompanying the bifacial groups, which are themselves essentially Abbevilleo-Acheulian in character. Of the affluents of the Chambal, recent work on the Parvati (pl. XXIX B) by the present author[3] and on the Shivna by Khatri[4] has revealed the occurrence of basically-bifacial tool industries, unrelated to the Sohan. When the industries of central Indian river-valleys like those of the Betwa and Dhasan, affluents of the Yamuna, are also mapped, the picture might get clearer.

Whenever we are confronted with mixed assemblages of pebble and handaxe elements, it is imperative to state (a) if the typology of the collection of the tools as a whole would indicate the presence of Sohan types—both core and flake, and (b) whether the tools are attributable to the Early Sohan or the Late Sohan stage, both on stratigraphic and typological evidences, if existing. We see that at a site where the pebble element is present in a plethoric multitude and great variety, as at Bariarpur, it is demonstrable from typology and technique that the tools relate themselves to the handaxe-evolution. There is also a significant lack at this site of the typical flakes of the Sohan group as in the type-areas like the Potwar and Siwaliks (Beas and Sutlej valleys).

To quote Menghin, 'Basing his opinions on the condition of East Africa, Leakey seems to be convinced of a genetic connection between the pebble and handaxe culture, the former being the ancestor of the latter. In Egypt, on the contrary, the pebble culture is nothing but a local variation of the Levelloisian-Mousterian relationship under handaxe influence. The Sohanian of the Indus region too inclines more towards the flake industries. It is of course possible that the different pebble cultures have nothing at all to do with one another. They may be products of local conditions and it is perhaps only the raw-material which gives them a certain similarity.'[5]

6. COMPONENT FACTORS OF THE SOHAN INDUSTRY

It would appear, in the sequel, that in the Sohan industry itself, there are two component factors, viz. (a) the pebble element and (b) the flake element. While the former, in its early stages, is, by and large, similar to the pebble tools of primitive origin as anywhere else during a subsequent developed stage, they tend to become more like pebble cores rather than pebble tools as such. The accent in the developed stage is, in other words, mainly on the flakes and the technique of their production. Here, the overwhelming influence of the 'prepared-platform' technique is apparent, and that affects the pebble-components as well as the flakes and cores in this developed stage. Shorn of this powerful 'prepared-platform' or 'prepared-core' technique, the Panjab pebble industries, by themselves, do not show any independent physical evolution—as is most

[1] *Indian Archaeology 1957-58—A Review*, p. 26.

[2] V. D. Krishnaswami and K. V. Soundara Rajan, 'The lithic tool-industries of the Singrauli basin, District Mirzapur', *Ancient India*, no. 7 (1951), pp. 40-65.

[3] *Indian Archaeology 1956-57—A Review* (New Delhi, 1957), p. 11.

[4] *Ibid.*

[5] Menghin, *op. cit.*, p. 312.

apparent at a site like Guler in the Banganga valley,[1] where, besides a monotonous repetition of unifacial and bifacial tools, there is no other development discernible in the tool facies. This fact would support the contention that the Sohan culture, taken as a whole, is more a pure prepared-core culture, in which primitive pebble elements occur as inseparable adjuncts. By the same token, it is restricted to a limited zone and does not have any large functional application to suit different climates. There is an interesting evidence brought out in Arabia by Caton Thompson, wherein, in the south Arabian area around the Persian Gulf, sites yielding tools similar to the Sohan culture and presumably occurring under analogous climatic régimes have been noticed.[2] Later developments of these industries during the early Neolithic have their counterparts in Egypt and possibly also in the north-west of the Indian sub-continent.

As regards the southern variant of the Indian pebble complex, while it may be said that migrationally-relatable industries similar to the Kafuan of Africa have not been found in a separate horizon of that age in India, they may not again be genetically relatable to either the Sohan or south-east Asian pebble complex. As already pointed out, for aught we know the Indian industries may be starting from the pebble and Abbevillean facies only. It is only the Narmada area, as stated above (p. 74), that is likely to give a clue to a pre-lower-gravel industry, if any.

The evidence from Mayurbhanj, as recently re-assessed and modified,[3] also indicates a mainly pebble plus Abbevillean beginning for the tool industry, to be placed in the Mid-Pleistocene. The Bariarpur site, mentioned above (p. 74), is also similar in its typological framework.

It seems to the writer that the upper gravels of the Narmada have a degree of similarity, in stage and in climate, to the corresponding gravel-phases of the Son, the Ken and the Baghain of central India and the upper gravels of the Godavari basin. These industries, which are essentially flake-blade-scraper-point assemblages, inspired by a clear mastery of the 'prepared-platform' technique, have sometimes a residuary but a diagnostic pebble element also, usually on diminutive or less-than-medium-sized pebbles. Thus, there is a degree of likeness in, though not any genetic contact with, (i) certain tool-types of the Late Sohan of the Panjab and the Middle Stone-Age tools of the Narmada-Godavari areas, which have possible genetic links with the Ken-Son-Baghain areas (upper gravels of the first two and basal gravels of the third), (ii) Series II and III of Cammiade and Burkitt,[4] (iii) the flake-blade group from Giddalur II[5] and (iv) the flake-blade-scraper groups from Nagarjunakonda.[6] They all signify the differentiation of the basic Lower Palaeolithic cultures into small tool industries in the Upper Pleistocene, and they involved, besides, a switch-over, as a rule, to a more tractable silicious material, like chert, jasper, agate and chalcedony. They have thus an identifiable cultural kinship and, owing to the comparatively easy intercommunication in the Late Pleistocene,

[1] Lal, *op. cit.*

[2] G. Caton Thompson, 'Some palaeoliths from Arabia', *Proc. Prehistoric Society*, N.S. 19, no. 9 (1953), p. 215.

[3] N. K. Bose, D. Sen and G. S. Ray, 'Geological and cultural evidences of the Stone Age in Mayurbhanj', *Man in India*, 38, no. 1 (1958), pp. 49-55.

[4] L. A. Cammiade and M. C. Burkitt, 'Fresh light on the Stone Ages of south-east Asia', *Antiquity*, IV (1930), pp. 327-39.

[5] K. V. Soundara Rajan, 'Stone Age industries near Giddalur, District Kurnool', *Ancient India*, no. 8 (1952), pp. 64-92.

[6] K. V. Soundara Rajan, 'Studies in the Stone Age of Nagarjunakonda and its neighbourhood', *ibid.*, no. 14 (1958), pp. 49-113.

might, to some extent, have interacted also. The strong family-similarity that the central Indian and the Deccan Middle-Stone-Age groups bear typologically with the African cultures, particularly from the end of the Fauresmith cultures onwards down to the Still Bay and Magosian, is also to be noted. The basic differences are mainly related to climate, availability of raw material and the differential evolution of human ingenuity in these widely-separated areas. Influences working from different directions fused in the Middle Stone Age with an expression of local potentialities and traditions. In India, where specialized regional industries have not been properly identified and described, the solution largely lies in taking geographically-viable zones and making detailed investigations of the Early Stone-Age industry and the developed flake industries of the Middle Stone Age and defining the techno-typological traits of both, specifying outstanding or recurrent types as well as unique types, so that their results may the compared with those in other zones. Only by such a systematic study will the patterns of industrial overlap and distribution be apparent. In the Rewa-Panna area, a recent small beginning has paid dividends, and we have at least two type-sites—one for the Early Stone Age at Bariarpur on the Ken and the other for Middle Stone Age in the Baghain valley, besides sites on the Son having great affinity with both and one another. The stretches of the upper Narmada and the upper Son need, therefore, to be systematically explored; they are quite rich in tool-bearing sites, and the similarity in raw material in these areas argues for a basic homogeneity in their culture-traits. Such explorations in limited areas would help in establishing the regional variations more easily than in widely-separated areas.

7. OBSERVATIONS ON TERMINOLOGY AND CORRELATION

It would as well be proper at this stage also to emphasize the need for giving currency to existing terms of direct, if perhaps restrictive, utility. The cultural meanings of these terms should generally be sufficiently clearly identifiable before they are extensively employed. In recent years, two specific terms have come for extensive use in palaeolithic studies—viz. the Upper Palaeolithic and Series II, the latter being comparatively of very recent inception. Both the terms have, presumably, common values, since they would tend to cover much of the 'Middle Stone Age' of the African terminology.

But of these two terms the first obviously lacks the necessary clear-cut stratigraphic data to sustain any given generic name. Indeed, the term 'Middle Stone Age' itself, as an inclusive term, came in for wide comment in Africa. Malan has only recently pleaded that the term may be conveniently retained and defined in its cultural scope as connoting a group of cultures differing from region to region and with different names, but *all having a great deal common with regard to technique and typology, such as absence of handaxes and cleavers, the presence of the faceted-platform techniques, convergent and parallel flaking on flake blades, and, further, a variety of flake-tool forms.*[1] It would be noted immediately that the local varieties mentioned above do indeed subscribe broadly to these requirements and, to that extent, may perhaps be covered by the term Middle Stone Age alike on typology and technique. But it would do well to be cautious as regards their chronological contemporaneity or relative succession.

While the second term 'Series II' may be adequate for one small area, it may be too inclusive for another area and may even involve a generalization ahead of any stratigraphical corroboration. Further, terminology is only a label to describe aspects of

[1] B. D. Malan, 'The term Middle Stone Age', *Third Pan-African Congress on Prehistory, op. cit.*, pp. 223-27.

industries as effectively as possible, and thus, it is necessary to tally the meanings of *existing* terms before giving currency to others. Now, Cammiade evolved the terms 'Series I, II, III, IV' for the lower Deccan area of Andhra Pradesh, with type-zones in Kurnool District.[1] We should, therefore, try to see how his terminology, backed by (albeit composite) climatological data, can be equated with others, e.g. the Series II of the Godavari in the first instance. If Series II is to be entirely of the Middle Stone Age of Malan's cultural scope, have we any typological proof for the range of corresponding industries preceding Series II—all appearing in the earlier gravels? Is there no scope, again, for fresh facets and industries likely to be brought out (within the limits of Series I and II themselves) in some regions in India, besides the currently-known industries comprised within the Pleistocene?

Such issues indeed involve a lot of regional, specialized and thorough-going surveys and cannot be lightly faced. Until such surveys are undertaken, we should give currency only to terms of approved connotation or those the implications of which are specified. Otherwise, terms based on numeral series generally tend to create an illusion of validity, by repetition, for widely-separated areas.

It may be mentioned that regarding climatic correlation, there is a marked difference of opinion even among workers in Europe and Africa. For instance, the pluvial and glacial eras have not yet been correlated *in toto* even for African zones, where climatic factors can be reconstructed to a great degree. We can do no better than quote Cooke[2] here: 'There is some evidence in the Periglacial areas of ice-age Europe, America and Asia that periods of glacial maximum were also periods of higher rainfall. In East Africa there is some evidence of a similar relationship between advance of high mountain glaciers and increased rainfall. These indications have led some authorities to suggest that 'pluvial' periods in non-glaciated areas coincide closely (or even exactly) with 'glacial' periods; conversely dry periods ('interpluvials') are correlated with interglacials.... One cannot help concluding that the *precise* equivalence of glacial and pluvial periods is highly improbable, though.... a less precise equivalence exists for some areas.... This is largely a meteorological problem and it is probable that an adequate theory will eventually come to light.. The equatorial region is likely to have changes of precipitation fairly closely related to polar glaciation but the regions of semi-arid climate related to sub-tropical, anticyclonic belt are likely to be particularly sensitive to latitudinal shifting of pressure systems.. The geological and archaeological evidence from Africa may well provide the meteorologist with the ultimate key to the formulation of acceptable theory of Pleistocene climatology'.

It has, however, been illustrated that the general trends of the Stone-Age cultures in the Pleistocene and early Holocene periods in India and Africa are considerably similar. The outstanding tools (such as the pebble tools of Kafuan and Oldowan; the rostrocarinates; the 'Victoria West' types and the 'Vaal technique' cleavers; the 'Oldowan' (Beds II-IV) handaxes in their evolving stages; the flake-made handaxes and points similar to Fauresmith; the points and scrapers in their proliferous variations as in the African 'Still Bay' industries; and pressure-flaked points in the Holocene *teris* comparable with the African 'Magosian') indeed eloquently testify to the great parallelism in tool-evolution and -techniques. Even certain highly-specialized types like the concavo-convex scraper, typical of the Smithfield industry of south Africa and the Aterian of Egypt, get repeated

[1] Cammiade etc., *op. cit.*

[2] H. B. S. Cooke, 'The problem of Quaternary Glacio-pluvial correlation in East and Southern Africa', *Third Pan-African Congress on Prehistory*, *op. cit.*, pp. 51-55.

in some of the south Indian industries as at Giddalur (District Kurnool).[1] On the other hand, the classic Upper Palaeolithic array of the European classification is notably absent, in an equivalent horizon and facies, although the blades and burins, which do occur in the Middle Stone Age of India at many sites, have a limited typological correspondence, though not identity, to the Upper Palaeolithic of Europe. Only the Levalloisian and Mousterian industries have corresponding, but to some extent mixed, groups in India. More conspicuously, there is the almost total lack of analogy borne by the palaeolithic cultures of the south-east Asia with those of India. These south-west Asian industries seem, however, to have a bearing on the Levallois-Mousterian cultures of south central Asia, and some of them have besides an Upper Palaeolithic bone-*cum*-stone tool stage, also allied to the European, as shown by the Indonesian evidence (see Table, p. 80). Probably, the highly insular situation of Indonesia warranted, in the Late Pleistocene, operations like marine-hunting and -fishing, with harpoons and other bone outfit, as the occupation of the by-then *Homo sapiens* there, broadly similar to the bone cultures of sub-arctic Europe in the Late Pleistocene and Neolithic stages.

Thus, in the Palaeolithic, the genetic affiliations of India are, broadly speaking, more with Africa and to much less extent, with Europe, but none too significantly with east Asia. A comparative chart detailing the cultures and chronological horizons in the Stone Age of the Old World, together with the broad climatic contexts thereof, based on the results of published researches, is appended (p. 80).

There are enough grounds, therefore, to hope that further intensive work in India would produce evidence, which would throw pointed light on the differentiation in tool cultures in the Quaternary bearing upon environment and raw material. May it also be hoped that fossil-data regarding the authors of some of these industries will be forthcoming.

8. ACKNOWLEDGEMENTS

The author gratefully acknowledges the help rendered by the following persons of the Archaeological Survey of India in the preparation of the illustrations: Shri S. K. Rode, Photographer of Prehistory Branch, Nagpur, for the photographs, and Shri M. D. Puranik, Assistant Draftsman, Excavations Branch, Nagpur, and Shri Amir Singh, Draftsman, Headquarters Office, for the line-drawings. He has also to thank the Superintendent, Archaeological Section, Indian Museum, Calcutta, for all assistance in the study and the preparation of the photographs of tools in the Indian Museum collection.

[1] Soundara Rajan, *op. cit.* (1952).

TABLE SHOWING THE CULTURAL AND CHRONOLOGICAL HORIZONS OF THE PREHISTORIC CULTURES IN THE OLD WORLD

CLIMATE	EUROPEAN: TYPOLOGICAL EQUIVALENTS GLACIAL DATA	AFRICA: SOMALILAND	AFRICA: EAST AFRICA	AFRICA: RHODESIA	AFRICA: SOUTH AFRICA	INDIA: CLIMATE	INDIA: GLACIAL SEQUENCE	INDIA: DEPOSIT	INDIA: TOOL INDUSTRIES: MADRAS	INDIA: TOOL INDUSTRIES: DECCAN	INDIA: TOOL INDUSTRIES: NARMADA	INDIA: TOOL INDUSTRIES: PANJAB	JAVA	AGE
NAKURAN WET	NEOLITHIC	SOMALI WILTON DOIAN	WILTON C NEOLITHIC CULTURES	WILTON	SMITHFIELD WILTON	POST-PLUVIAL VI & VII					MICROLITHS IN BLACK SOIL			EPI-PLEISTOCENE; RECENT
DRY POST-PLUVIAL								EITHER REDCLAY OR BLACK SOIL OVERLAIN BY SAND	TERI MICRO-LITHS			EVOLVED SOHAN		
MAKALIAN-WET	MESOLITHIC	HARGESIAN SOMALI MAGOSIAN	WILTON A & B ELEMENTEITAN LATE STILLBAY-UPPER MAGOSIAN LATE STILLBAY-LOWER MAGOSIAN	RHODESIAN MAGOSIAN	MAGOSIAN		IV GL			SERIES III & IV INDUSTRIES	PROTO-MICROLITHS			
DRY	WÜRM	SOMALI-STILL BAY	UPPER AURIGNACIAN STILL BAY (3 PHASES)	STILL BAY CULTURES	MIDDLE STONE AGE COMPLEX								TJABENGE FLAKE INDUSTRY OF SOUTH CELEBES	UPPER PLEISTOCENE
GAMBLIAN PLUVIAL	PALAEOLITHIC	LEVALLOSIAN	LOWER AURIGNACIAN DEVELOPED LEVALLOIS			HUMID-PLUVIAL V	III IGL	FLUVIATILE DEPOSITS NO LATERITIZATION	LATE-LEVALLOIS FLAKES	DEVELOPED FLAKE-INDUSTRY (SERIES II)	FLAKE-BLADE SCRAPER-POINT INDUSTRY IN UPPER GRAVELS	LATE SOHAN		
		ACHEULIO-LEVALLOSIAN			SOUTH AFRICAN SANGOAN								NOTOPURO BEDS HOMOSOLOENSIS SANGIRAN FLAKE INDUSTRY	
INTER-PLUVIAL		UPPER ACHEULIAN			FAURESMITH									
KANJERAN PLUVIAL	RISS	NO RECOGNIZED EARLY CULTURES	KENYA FAURESMITH; ACHEULIAN 1-6 Etc.	LEVALLOIS SANGOAN	CHELLES ACHEUL	DRY PLUVIAL IV	III GL	LATERITIZATION IN SOME AREAS GRAVELS & CLAY	LATE ACHEULIAN	(SERIES II) FLAKE INDUSTRY BEGINS - HANDAXE SURVIVES	LOWER CLAY SIMILAR TO DECCAN	EARLY SOHAN		MIDDLE PLEISTOCENE
INTER-PLUVIAL			CHELLIAN 1-5			VIOLENT PLUVIAL III	II IGL	RIVER-GRAVELS CUTTING THE PENE PLAIN	EARLY ACHEULIAN	HANDAXES (SERIES I) ENDS			KABU-BEDS -B- PATJITANIAN PEBBLE INDUSTRY	
KAMASIAN PLUVIAL	MINDEL		OLDOWAN	HANDAXES FLAKES & CORES	OLDOWAN	DRY PLUVIAL II	II IGL		ABBEVILLEO ACHEULIAN + PEBBLE TOOLS	SERIES I HANDAXES + PEBBLE TOOLS	LOWER GRAVEL	PRE-SOHAN	KABU-BEDS -A- TRINIL BONE BED PITHECANTHROPUS ERECTUS	
INTER-PLUVIAL; KAGERAN PLUVIAL	GÜNZ		KAFUAN PEBBLE TOOLS	NO TOOLS	DEVELOPED KAFUAN; PRE-CHELLES-ACHEUL	LONG PLUVIAL I	I IGL I IGL	LATERITIC FORMATIONS						LOWER PLEISTOCENE

M.D. PURANIK

AFTER CLARK, KRISHNASWAMI AND HEKEERAN

Appendix I

PRELIMINARY TABULAR ANALYSIS OF BARIARPUR TOOL-TYPES[1]

Types	No. of tools in each category and in groups		Percentage of the total in groups	
Pebble tools	38	44	33·92	39·28
Rostoid tools	6		5·36	
Bifacial tools (up to Early Acheulian stage)				
Handaxes	32	41	28·57	36·61
Cleavers	9		8·04	
Cores				
Main platform	7	10		8·93
Prepared platform	3			
Flakes				
Main platform	12	17		15·18
Prepared or right-angled platform	5			
Total		112		100·00

Appendix II

DEVELOPMENT OF THE MADRAS HANDAXE FROM THE PEBBLE

The stages in the development of the bifacial handaxe of the Madras industry from the pebble, as demonstrated from the Bariarpur site,[2] are detailed below (figs. 1 and 2; pl. XXX).

1. Keeled, unifacial chopper with totally-cortexed underside, exactly similar to the chopper of Olduvai culture at Olduvai, Tanganyika.[3]
2. Similar tool, with free flaking on the underside also.
3. Side marginal trimming from tip to grip-end with meagre reverse flaking also.
4. Continuation of the side marginal trimming around the tip, which gets broadened in the process. Bifacial, though mostly free-flaked.
5. Typical, bold alternate-flaking technique, working around the tip and grip-ends.
6. Typical 'Early-to-Middle Abbevillean' alternately-flaked bifacial with cortexed grip with blunted upper ends.

[1] Above, p. 74.
[2] Above, p. 74.
[3] Cf. Sonia Cole, *Prehistory of East Africa*, Pelican Series (Hammersorth, 1954), fig. 9.

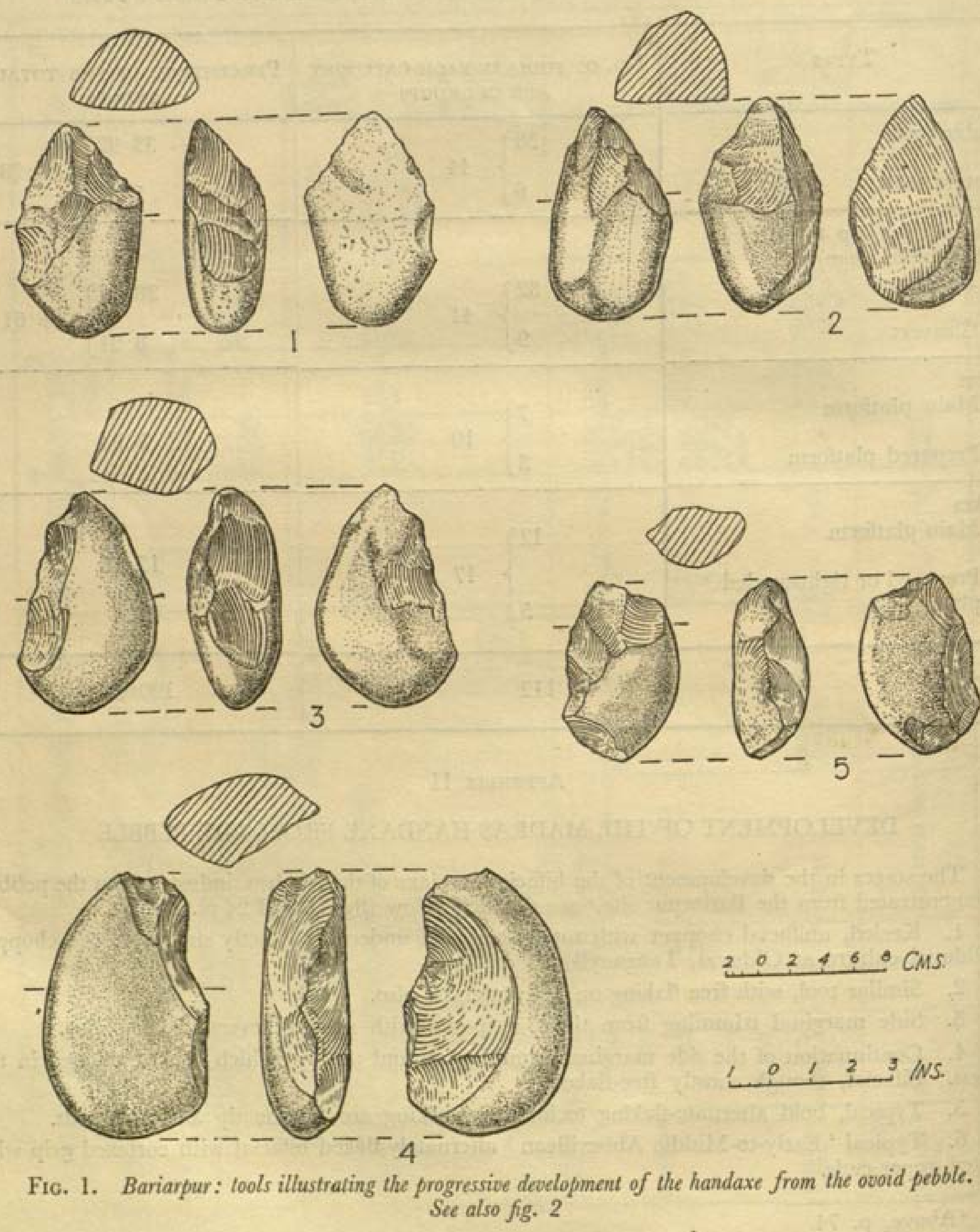


FIG. 1. *Bariarpur: tools illustrating the progressive development of the handaxe from the ovoid pebble. See also fig. 2*

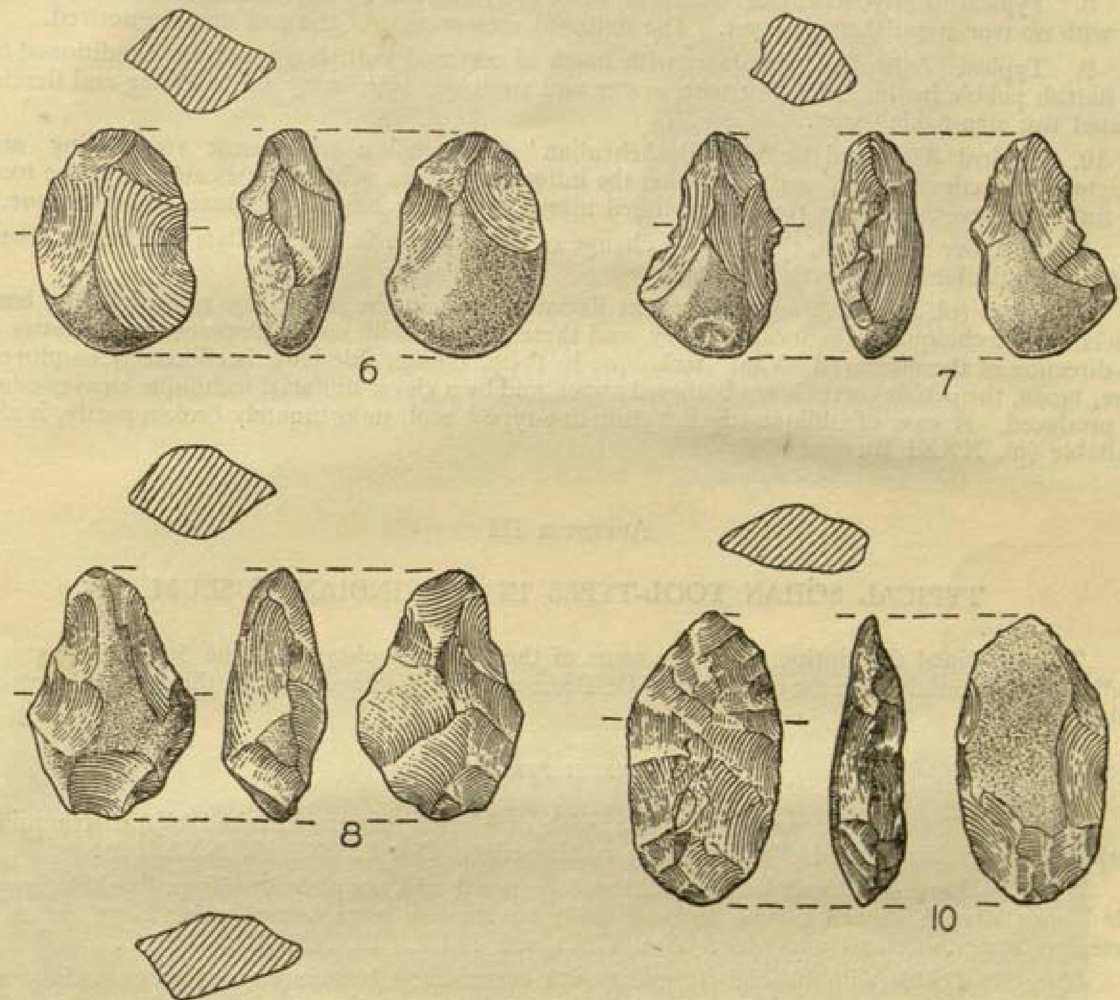


FIG. 2. *Bariarpur: tools illustrating the progressive development of the handaxe from the ovoid pebble. See also fig. 1*

7. More extensive resolved flaking, tending to make the upper end narrower and the tool itself more slender.

8. Typical 'Early-Acheulian' handaxe, extensively chipped by alternate and resolved flaking, but with no true step-flaked edge yet. The flattened cross-section of the tool may be noticed.

9. Typical 'Acheulian' handaxe, with much of cortexed butt, body and tip (conditioned by the flattish pebble in this case), but with neater and straighter side, marginal trimming and slender pointed tip; step-flaking seen.

10. Typical developed or 'Middle-Acheulian' ovoid biface with neat step-flaking and straight, sharp edge; cortex, again, indicates the influence that the pebble-shape causes over the tool; the finish, however, indicates the accomplished mastery over the bifacial handaxe tool-technique.

In the above specimens, the gradual change of cross-section from quadrilateral through rhomboidal to lenticular section is to be noted.

The cores (pl. XXXI A) and cleavers at Bariarpur are, in the main, also related to the basic bifacial core-technique of the local industry, and there is practically no development in the latter in the direction of the advanced 'Vaal' technique in them, though side-blow is effectively employed. Here, again, the pebble cortex is not bothered about, and by a clever unifacial technique cleaver-edges are produced. A case of oblique-edged 'guillotine-type' tool, unfortunately broken partly, is also available (pl. XXXI B).

Appendix III

TYPICAL SOHAN TOOL-TYPES IN THE INDIAN MUSEUM

The subjoined description relates to some of the typical tool-types of the Sohan industry as studied by the author from the collection of De Terra and Paterson available in the Indian Museum, Calcutta.

Early Sohan: pebble tools

Type 1. Globular and unifacial pebble, with developing traces of limited bifacial trimming; steep edge-scars, round and slight steeping cutting-edge. No. 12576. Pl. XXXII A.

Type 2. Large-sized and bifacially-chipped or nosed and peripherally-chipped pebble, upper side having steep V-shaped margin and underside having two large lateral scars; large patch of cortex on upper side and underside. Nos. 12571 and 12574. Pl. XXXII B and C.

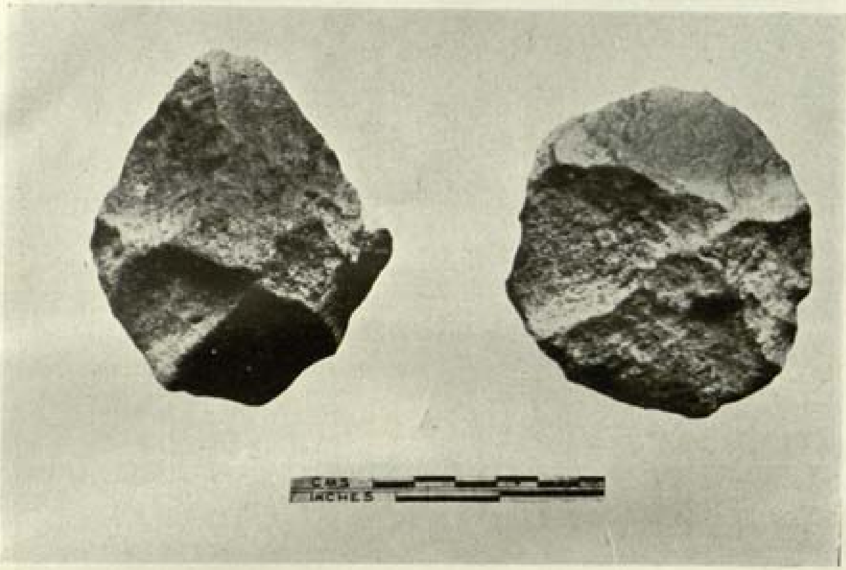
Type 3. Pebble with bifacial trimming with cortex-like ribbon around the equatorial zone, excepting along the cutting-edge; stepped flaking and more or less straight working-edge. No. 12573. Pl. XXXII D.

Early Sohan: flakes

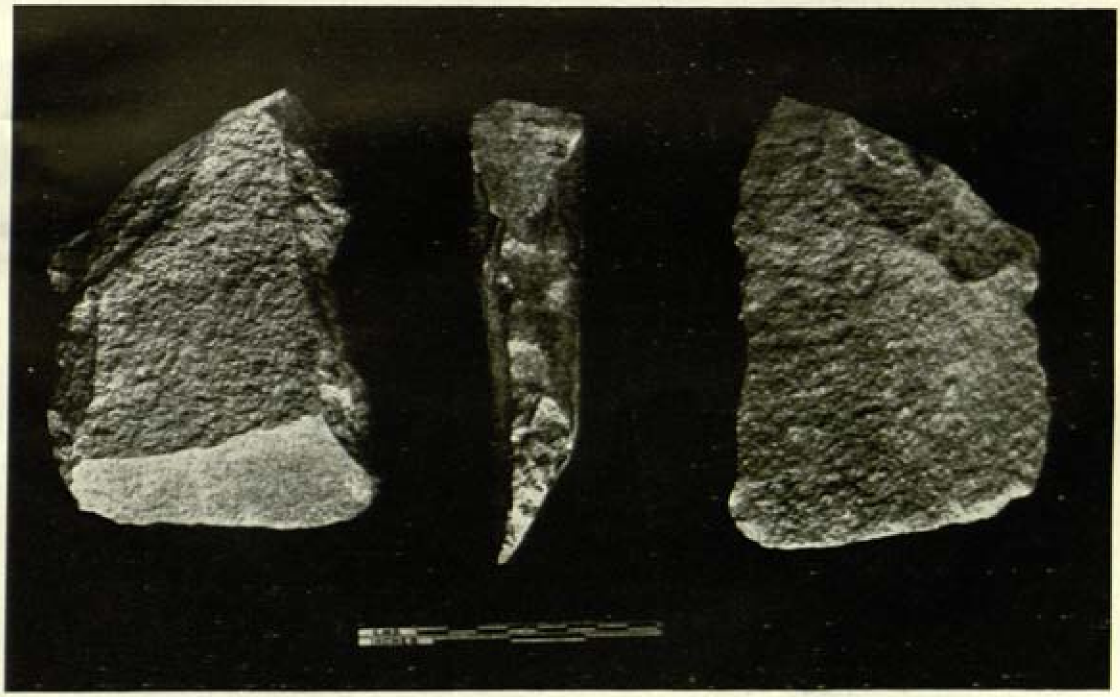
Type 1. Thick flake with triangular section; large plain platform formed by an oblique first flake-scar; cortex to the left of mid-rib and upper right on the upper side; right edge steeply retouched up to the pointed tip; chatter-marks visible. A side-scraper (?). No. 12578. Pl. XXXIII A.

Type 2. Oval flake with plain platform on the ventral left margin and partial retouch towards the bottom edge; dorsal side which has mostly cortex has a part of the upper right edge flaked stepped-wise and retouched. A scraper (?). No. 12582. Pl. XXXIII B.

Type 3. Beautiful symmetric, tongue-shaped flake with a slightly-dished plain platform, prominent but 'eraillured' bulbar scar; the dorsal side, left of mid-rib, carefully retouched up to the nosed lower tip and partially on the right edge too; slight inverse retouch on the upper ventral edge towards and below the platform. Scraper-*cum*-cutting-tool. Mousteroid? No. 12581. Pl. XXXIII C.



A. *Bariarpur: core tools. See p. 84*

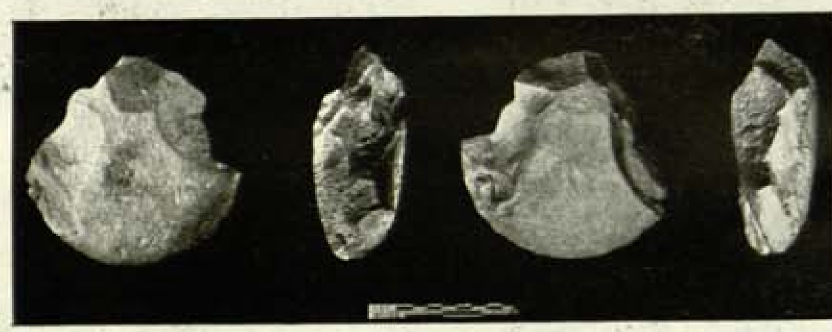


B. *Bariarpur: cleavers (guillotine type). See p. 84*

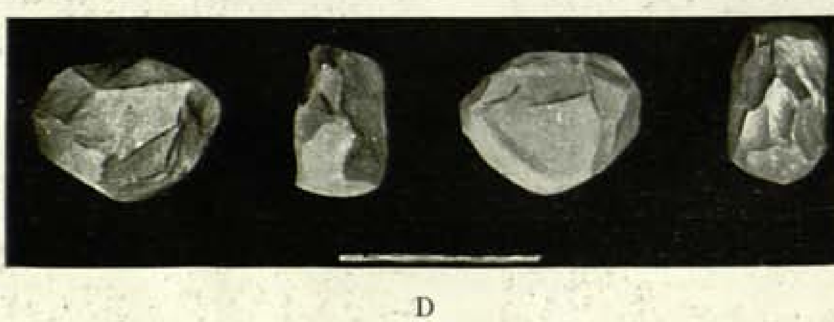
To face p. 84

A

B

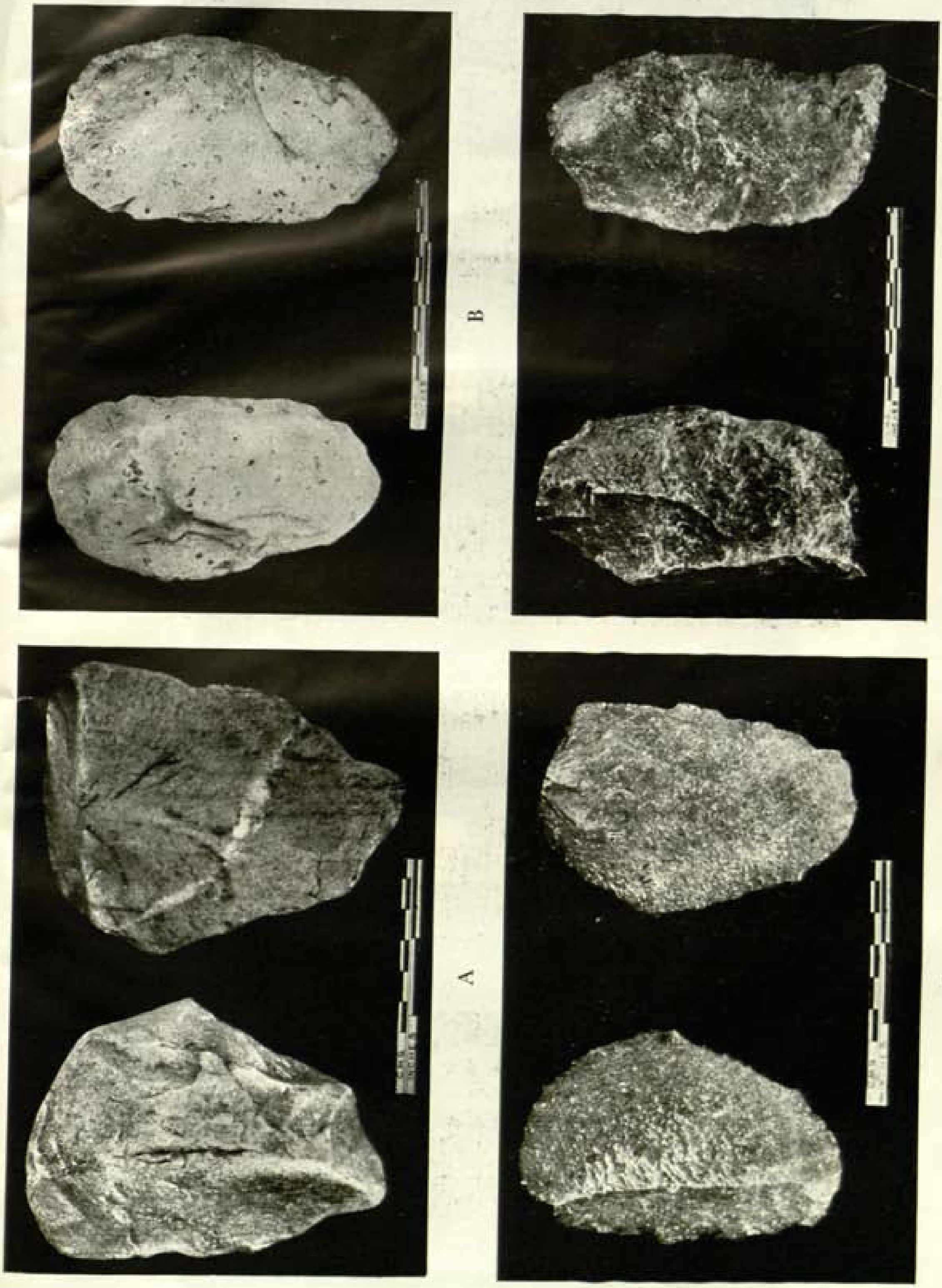


C

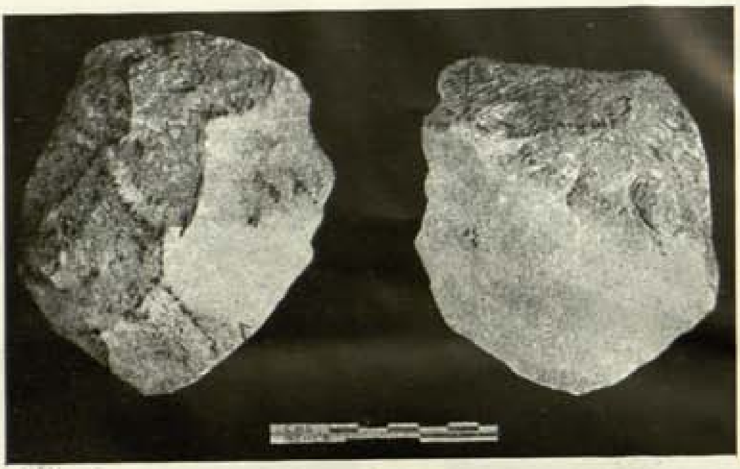


D

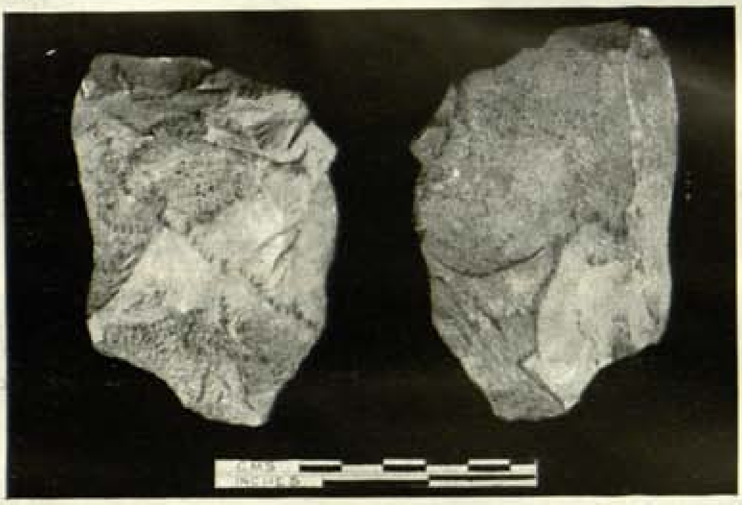
Early Sohan pebble tools. A, *Type 1;* B *and* C, *Type 2;* D, *Type 3.*
See p. 84



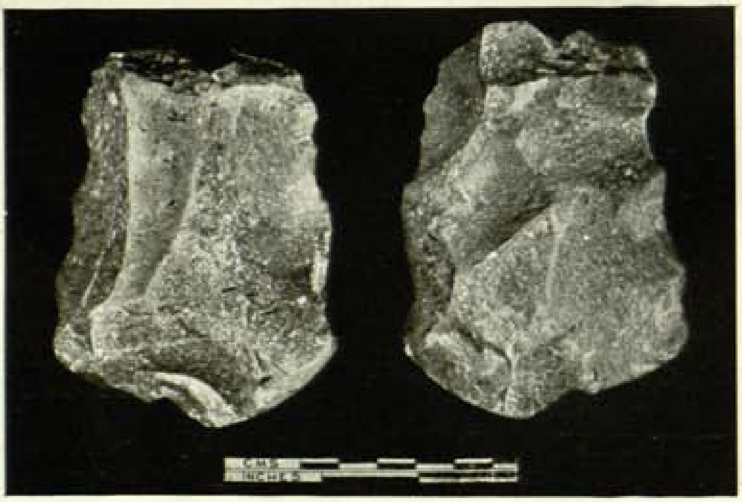
Early Sohan flakes. A, *Type 1;* B, *Type 2;* C, *Type 3;* D, *Type 4.* *See pp. 84 and 85*



A



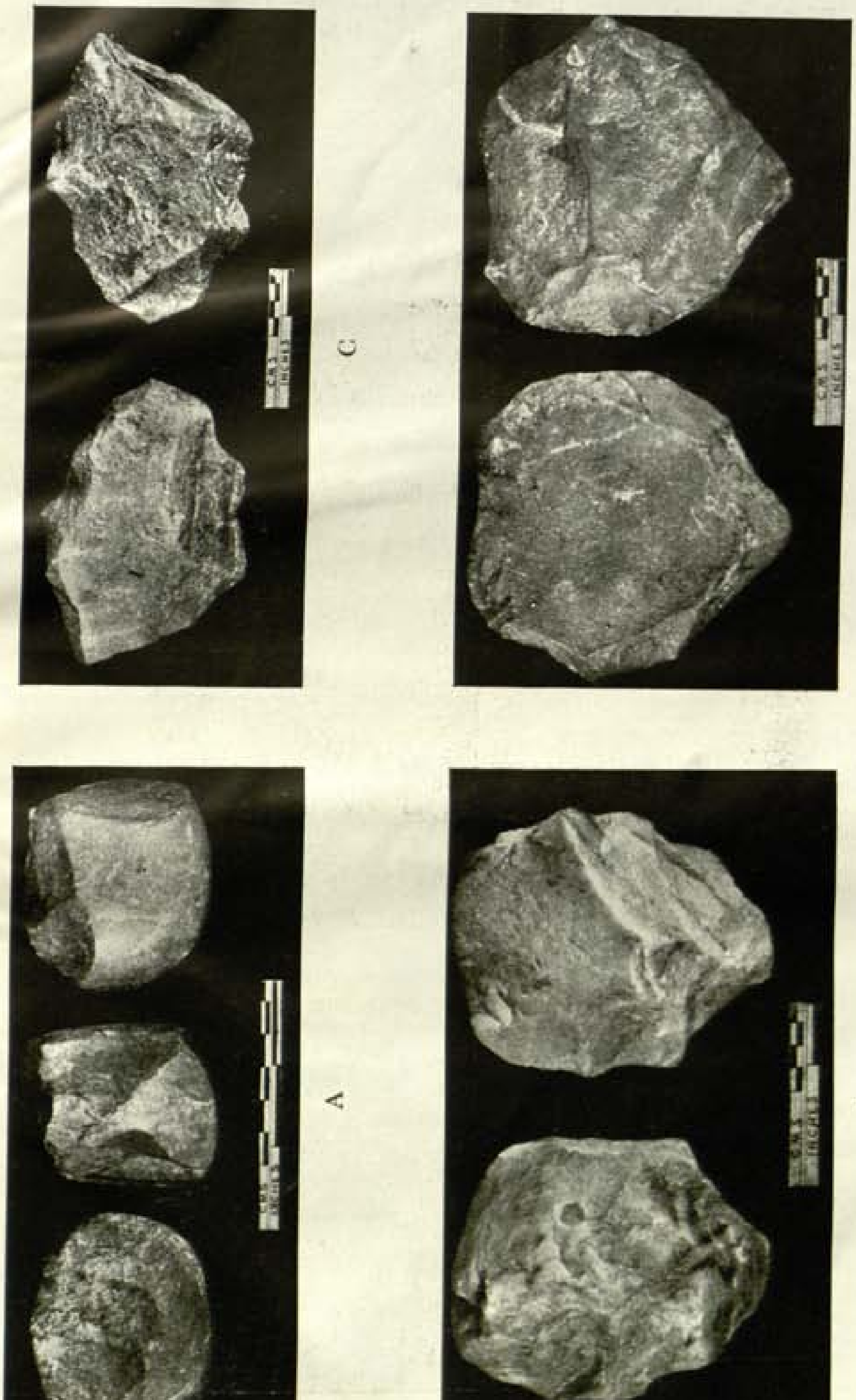
B



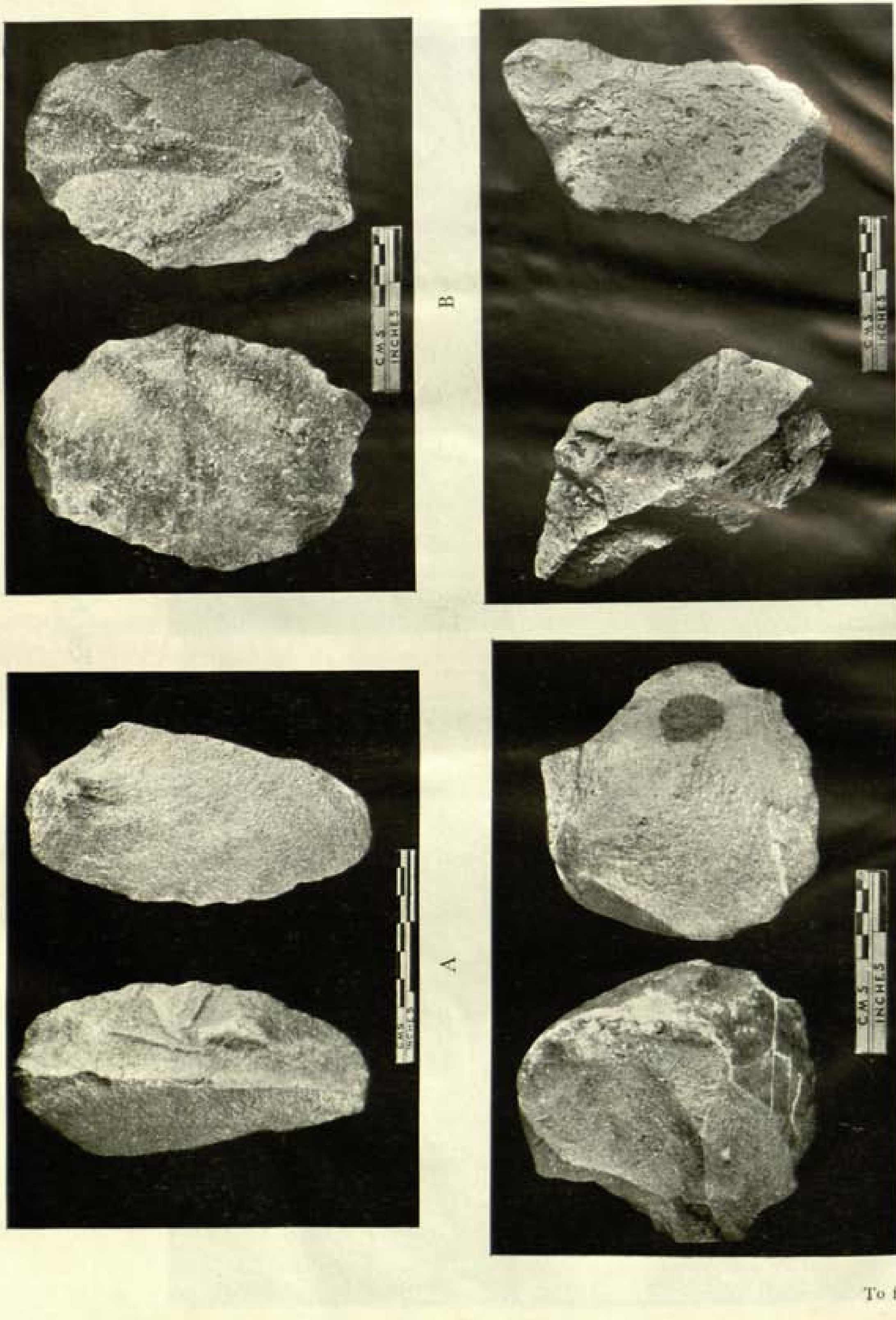
C

Late Sohan cores. A, *Type 1;* B, *Type 2;* C, *Type 3.* *See p. 85*

To face pl. XXXV



Other Late Sohan cores. A, *Type a*; B, *Type b*; C *and* D, *Type c.* *See p. 85*



Late Sohan flakes. A, *Type 1;* B, *Type 2;* C, *Type 3;* D, *Type 5.* *See p. 85*

To face p. 85

Type 4. Beautiful long slender prepared-platform flake with faceted platform, bulging bulbar scar and crooked lower tip, partly formed by cortex; upper side shows limited primary flaking; limited retouch seen on the ventral upper right edge and dorsal lower left edge. A cutting-tool (?). No. 12579. Pl. XXXIII D.

LATE SOHAN: CORES

Type 1. Bifacial trimming on flattish ellipsoidal pebble-core with a single large longitudinal scar on the underside; the upper side revealing a continuous series of straight flake-scars, so as to suggest a technique of removal of flakes as much as to prepare the core into a tool; subsequent trimming on the upper body also. No. 12596. Pl. XXXIV A.

Type 2. Roughly similar to core of Type 3, but technically earlier than it and nearer to the biconical cores with a humped upper side. The underside has two directional scars. No. 12604. Pl. XXXIV B.

Type 3. Flattish subrectangular core with cortical patches only here and there; flake-scars detached from two or more directions from the upper and lower edges in bipolar technique. Advanced 'Levallois' type of core. No. 12595. Pl. XXXIV C.

There are also core-types in which (*a*) there is a large cortical patch and the scars are taken in such a way that the angle formed by the two flake-scar sides is a right angle or nearly so and not acute, as in a normal pebble chopper, thus indicating their deliberately-prepared core facies (no. 12626, pl. XXXV A); (*b*) the form is more typical or irregular, with less cortical surface than (*a*) and with multi-directional platforms, suggesting a trend towards a pure prepared-platform industry (no. 12624, pl. XXXV B); and (*c*) the typical tortoise-core of the prepared-platform industry (nos. 12612 and 12630, pl. XXXV C and D). All these show great familiarity with the prepared-platform technique in the main and indicate a pure Levallois-like industry.

LATE SOHAN: FLAKES

These are divisible into the following six broad categories.

Type 1. Largish flake, either oblong or cordate, with oblique platform and without any secondary retouch. No. 12652. Pl. XXXVI A.

Type 2. Longish flake with prepared platform, with elaborate retouch all along the edges. No. 12647. Pl. XXXVI B.

Type 3. Largish as well as small flake with cortex platform in continuation of body-cortex but very elaborate retouch all along the edges. No. 12655. Pl. XXXVI C.

Type 4. Largish flake with retouched edges but with the platform disappearing owing to convergence of two scars on either side at the same bulbar point. Nos. 12686 and 12643.

Type 5. Medium and small flake with plain right-angular or dished platforms; mostly elongated flake-blade type, with much delicate retouch. One or two discoid flake-scrapers. No. 12658. Pl. XXXVI D.

Type 6. Thin, small faceted-platformed, profusely-trimmed and retouched flake. Blade and bladish tool as well as both side- and end-scraper. Nos. 12676 and 12683.

[*Received on the 10th April 1959.—Ed.*]

Edited and published by the Director General of Archaeology in India. Printed by M. C. Khunnah, B.Sc. (Engg.), at the Job Press Private Limited, Kanpur.

Archaeological Survey of India
New Delhi