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Stone Technology in India

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Introduction

Rock and water, representing the hard and soft components of the planet earth, form the basis of all organic life including the human species. The findings of prehistoric archaeology from Omo and Gona valleys of Ethiopia reveal that man's utilization of stone for making artefacts has an antiquity of 2.5 million years (Fig.1).

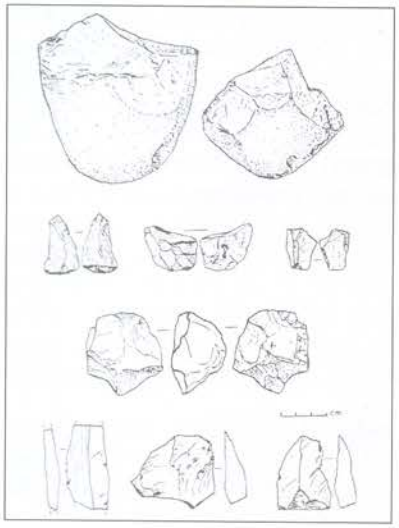

Fig. 1. 2.5 million-year-old stone artefacts (chopper and flakes) from Omo and Hadar valleys in Ethiopia.

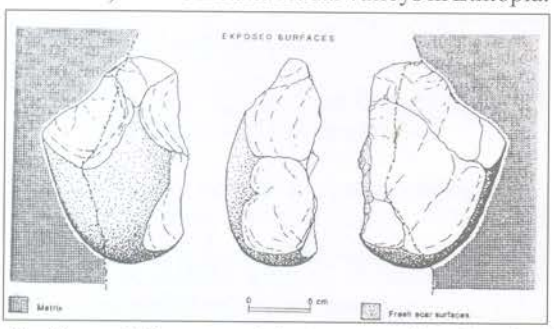

Fig. 2. Two-million-year-old stone artefact (core) from Riwat in Pakistan.

The discoveries at Riwat near Peshawar (Fig.2) and Uttarbaini in Jammu show that tool-making traditions began two million years ago in the Indian subcontinent. Such findings are used by archaeologists to define man as the tool-maker. This essay seeks to present an overview of man's use of stone in India across ages for catering to his material, emotional or religious, and aesthetic military needs.

Stoutly opposing the long-entrenched Biblical view of the origin of world and man in 4004 B.C., Charless Lyell argued that the various rock formations we see on the earth formed one after the other over a long period of time due to natural processes such as volcanism, erosion and deposition which are still active. He thus founded the discipline of geology and published his three-volume book entitled *The Principles of Geology* between 1830 and 1833. Geologists group rock formations into three major types on the basis of natural processes which led to their formation. These are a) volcanic rocks like basalts and granites resulting from outpouring and cooling of magma; b) sedimentary rocks like shales, limestones and sandstones resulting from deposition and hardening of soft sediments like clays, silts and sands by water and other agencies; and c) metamorphic rocks like gneisses, schists and marbles resulting from transformation of previously existing rocks due to heat and pressure.

By developing appropriate techniques and methods human communities in India made use of these various rock types right from the Stone Age. This long story of man-stone interaction can be divided into four major periods: a) Stone Age or prehistoric phase lasting till about 3000 B.C.; b) Protohistoric phase lasting till about the middle of the first millennium B.C.; c) Historical period lasting till about the 12th century A.D.; and d) Medieval period from the 12th century A.D. till the rise of colonial power. Let us examine how and for what purposes stone was used in these periods.

Prehistoric Period

It is very probable that organic materials like wood and animal bones were also used by prehistoric groups for preparing tools and weapons but unfortunately very few examples have survived the ravages of time. Stone was the most commonly used material and therefore prehistoric technology is often regarded as synonymous with stone technology. Depending upon improvements made by man both in the techniques used for working stone and in the types of artefacts fashioned out of it, prehistoric period is divided into Palaeolithic (Old Stone Age) and Mesolithic (Middle Stone Age), the former subdivided into Lower, Middle and Upper stages. During this long period of infancy man led a nomadic, hunting-gathering way of life. Based upon the evidence of absolute dates provided by scientific methods, the Lower Palaeolithic in India is dated from about two million years to two lakh years

ago; the Middle Palaeolithic from two lakh years to 40,000 years ago; the Upper Palaeolithic from 40,000 years to 10,000 years ago. The Mesolithic lasted from 10,000 years to 5000 years ago. These chronological ranges are broad ones and overlook both regional variations and cases of cultural continuity. The following aspects of stone technology during these stages are noteworthy.

On account of its fine-grained texture quartzite was used for making tools during the Lower Palaeolithic stage. Wherever it was not available, local rocks like basalts, granites, fossil wood and even limestone were made use of, thereby revealing Early Man's level of adaptability to a given set of landscape conditions. With the help of hammerstones consisting of rounded blocks of chert, quartzite or dolerite, river cobbles or fresh nodules/chunks of quartzite and other suitable rocks were flaked from one or both surfaces and fashioned into chopping tools. In many cases large flakes were struck off from these cores and, by means of soft hammers of wood or bone, these flakes were in turn transformed into other tool-types such as handaxes, cleavers, knives, awl, points, etc. In size these measured 10 to 15 cm. long. As the American anthropologist Leslie White pointed out, these artefacts served extrasomatic means of adaptation to man and were used for various life-sustaining activities such as hunting, digging up of tubers and roots, animal butchering, and cutting down of shrubs and bushes for laying one's camp.

Excavations at sites like Chirki-Nevasa (Maharashtra), Paisra (Bihar) and Bhimbetka (Madhya Pradesh) gave some interesting information about Lower Palaeolithic technology. This cultural stage is also called the Acheulian, after the French site of St. Acheul. Isampur, located in Hunsgi valley of North Karnataka, is another important locality, occupying an area of three-quarters of a hectare. Excavations conducted here from 1997 to 2001 made it possible to understand various aspects of site history: its location close to a palaeochannel with a perennial waterbody and affording a good view of the surrounding uplands; on-the-spot occurrence of limestone blocks ideally suited for flaking; procurement of suitable nodules of chert, quartzite and basalt from the vicinity to serve as hammerstones; shaping of limestone blocks into cores by knocking off irregular projections; detachment of large flakes from these cores; and reshaping of these flakes into handaxes, cleavers, knives, perforators, chopping tools, etc. In the main trench (70 m^2) excavated on this site five or six chipping clusters (measuring 6 to 7 m^2 in extent) were exposed with artefacts lying in various stages of manufacture (Fig.3).

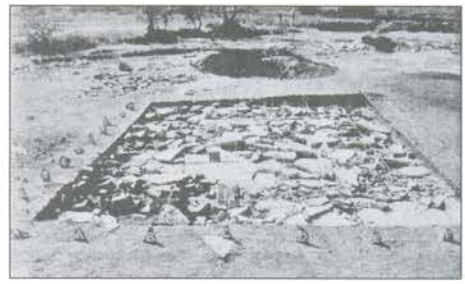

Fig. 3a. 1.2 million-year-old Lower Palaeolithic (Acheulian) cultural level exposed in excavation at Isampur in Karnataka.

Fig. 3b. Close-up of a chipping cluster.

At these working clusters two or three persons were actually sitting and carrying out tool-manufacturing activities.

Stone technology was far from static in the Lower Palaeolithic and, on the contrary, showed progressive developments both in the methods of working and in tool-types. In the case of sites of the Hunsgi and Baichbal valleys, three stages of development were identified. In the early and middle stages the tools were large in size with thick and sinuous edges (Fig.4).

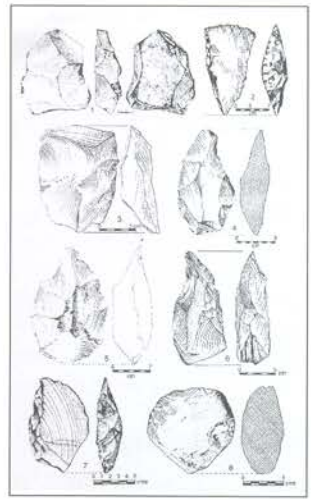

Fig. 4. Early Acheulian artefacts from Isampur in Hunsgi valley, Karnataka (core, cleavers, handaxes, perforator, knife and hammerstone).

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In the final stage handaxes and cleavers became thinner and smaller and were obtained by fine quality chipping (Fig.5). It is probable that these artefacts were no longer held in hand but were hafted to wooden shafts to form spear- and lance-heads or axe-like cutting tools.

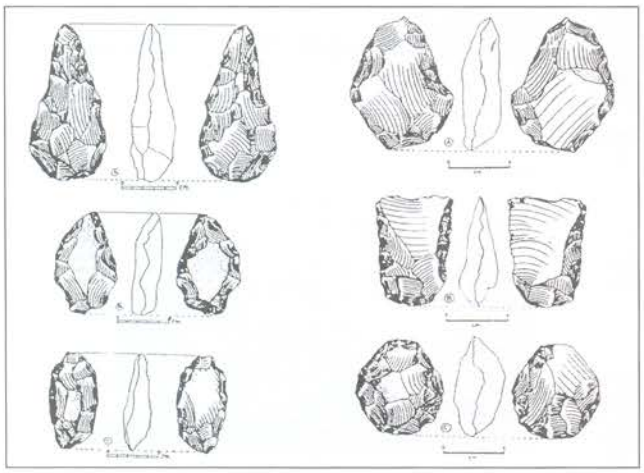

Fig. 5. Evolved Acheulian artefacts from Mudnur in Baichbal Valley, Karnataka (thin cleaver, handaxe, leaf-shaped points and discoids).

Employing the principles of Genetic Epistemology developed by the famous Swiss psychologist Jean Piaget, Thomas Wynn and other American anthropologists studied the Lower Palaeolithic tools for making inferences about the level of cognitive abilities possessed by Stone Age groups. They concluded that the preparation of handaxes and other tools already involved developed mental operations like reversibility and whole-part relations, which are characteristic of modern man.

The succeeding Middle Palaeolithic stage witnessed important technological developments. First, although quartzite use continued in some areas, siliceous materials like chert, jasper and agate, obtained as pebbles or nodules, were used now in many areas. These were flaked with stone or soft (bone or wooden) hammers and the resultant flakes were retouched along edges and transformed into smaller (6 to 8 cm across) tools such as scrapers bearing edges of different shapes, points, borers and knives. Excavations at Samnapur in Madhya Pradesh exposed an extensive tool-making and occupation site (Fig.6). Free availability of siliceous materials on the landscape and reduced size of artefacts, permitting easy transportation, enabled the Middle Palaeolithic groups to penetrate into new areas.

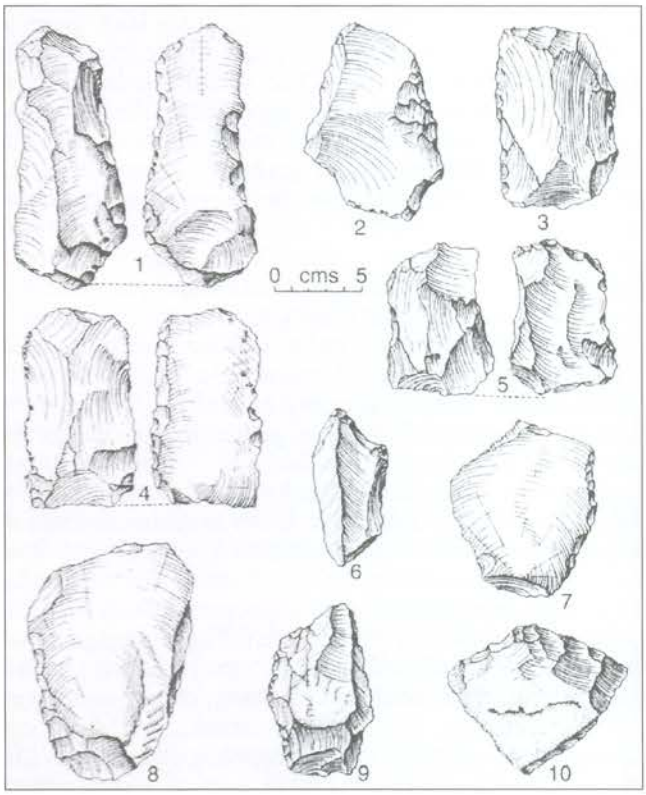

Fig. 6. Middle Palaeolithic artefacts (scrapers, knives, etc.) from Samnapur excavation, Madhya Pradesh.

Further technological refinements took place in the Upper Palaeolithic stage. Long, parallel-sided blades (8 to 10 cm long) were detached from cylindrical cores of siliceous materials; and these were retouched into blunted blades, penknives, points, scrapers and burins (Fig.7).

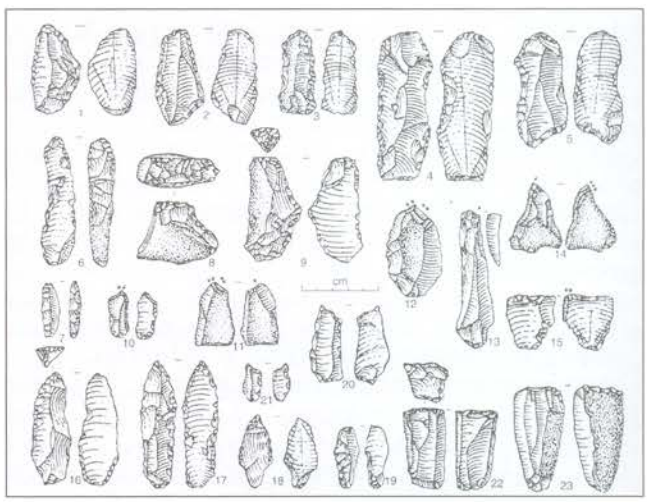

Fig. 7. Blade-tools of the Upper Palaeolithic stage from the Shorapur Doab, Karnataka.

Excavations at Patne in Maharashtra exposed evidence of three developmental stages in Upper Palaeolithic technology. Kurnool caves gave evidence of bone tools. Blade-tool tradition continued into the Mesolithic but became much smaller or microlithic (2 to 3 cm long) (Fig.8).

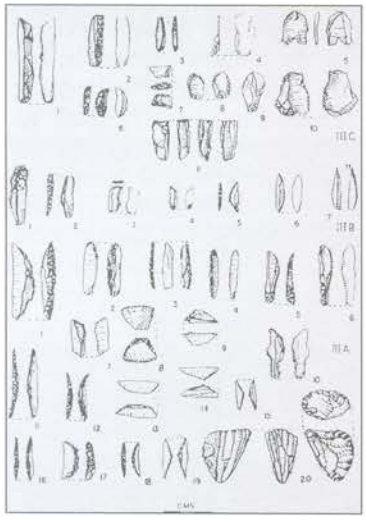

Fig. 8. Microlithic artefacts (blades, crescents, triangles, etc.) from Patne excavation, Maharashtra.

Recent excavations in Jwalapuram caves of Kurnool region revealed a continuous sequence of microlithic tradition dated between 35,000 and 10,000 years ago. The microlithic artefacts were used as insets for preparing composite tools like harpoons, arrowheads, saw-edged tools and knives (Fig.9). These technological developments facilitated hunting of fast-moving game. Mesolithic groups occupied all ecological zones in the country.

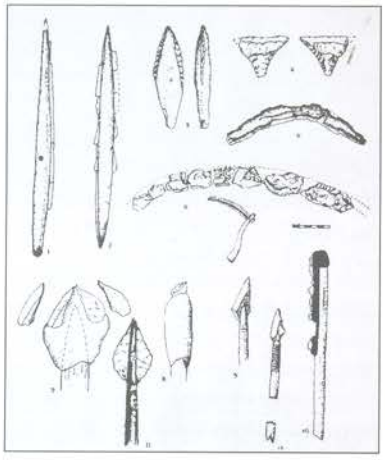

Fig. 9. Composite tools (arrowheads, sickles, knives) with hafted microliths from various sites in Europe, West Asia and Australia.

But the above observations should not be taken to mean that prehistoric groups used stone only for making tools and weapons. From the late Palaeolithic/Mesolithic stage onwards, flat rock surfaces in caves and on hillsides were used for executing bruisings and paintings of animals and other figures (Fig.10). The Bhimbetka complex of caves near Bhopal is a well-known site from this point of view.

Fig. 10. Bruisings of bulls on standing granite rock from the Neolithic site of Maski, Karnataka.

There are also clues that the Stone Age groups already started attributing divine qualities to queer-looking or attractive stone blocks found in nature. For example, the late Palaeolithic site of Baghor I on the Son river in Madhya Pradesh revealed in excavation a stone rubble platform on which a triangular-shaped stone block (15 cm high) with bright-coloured natural laminations was installed and probably worshipped as manifestation of *Mai* or Mother Goddess, exactly like what the Kols and other local groups still do (Fig.11).

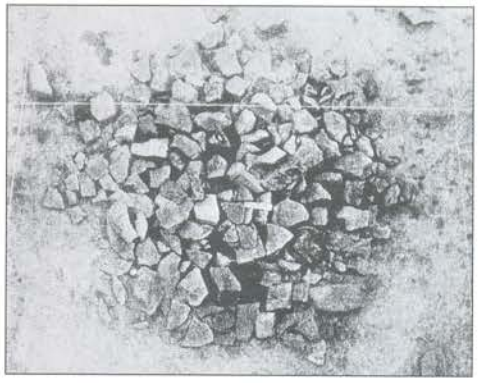

Fig. 11a. Stone rubble platform (shrine?) exposed in excavation at the late Palaeolithic site of Baghor I in Madhya Pradesh.

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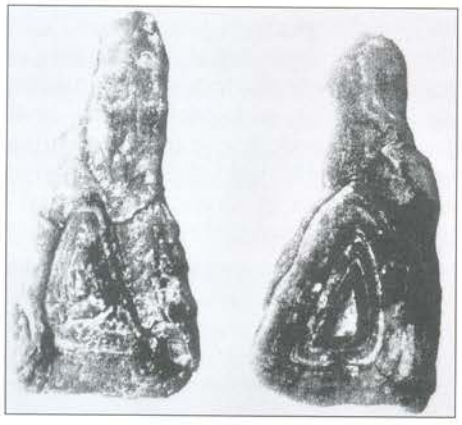

Fig. 11b. Obverse and reverse position of a triangular shaped sandstone block from Baghor I bearing coloured laminations and probably worshipped as a manifestation of mother goddess.

Protohistoric Period

Blade tools of siliceous materials continued into the Neolithic or New Stone Age which winessed the emergence of first agropastoral communities. This stage also saw the introduction of a new stone tool tradition consisting of ground and polished tools. While artefact types like querns, rubberstones and hammerstones were used for processing plant foods such as grains and seeds, sharp-edged tools like axes, adzes, chisels and hoe-blades were employed for wood-working including house-building, vegetation clearance and primitive agriculture (Fig.12).

Fig. 12a. Neolithic stone querns and rubber stones.

Fig. 12b. Polished axes from Budihal, North Karnataka.

The introduction of iron technology in the early part of the first millennium B.C. brought about a revolutionary change in man's use of stone. Aside from its use for making tools and implements, stone was now also used for raising imposing stone memorials (hence called megaliths) for the dead. Iron implements such as axes, adzes, chisels, points and earth-digging implements facilitated dislodgement of large blocks or slabs (up to three metres in length) from hillsides and their transportation for several kilometers across the landscape. These blocks were used for constructing four or five major tomb types called stone circles, stone cists, menhirs, dolmens and stone alignments. Sites housing dozens of such tombs or memorials for the dead are a common sight in South India and Vidarbha (Fig.13 and 14). Iron technology also facilitated creation of small irrigation tanks in basin-like natural depressions formed in hilly areas.

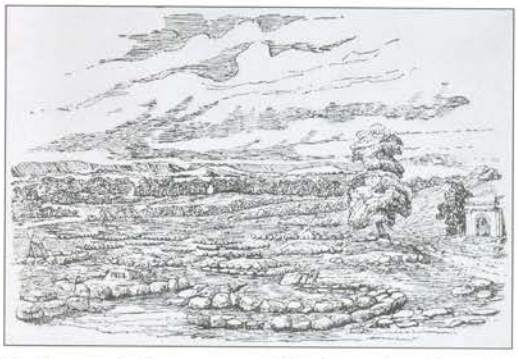

Fig. 13. Stone circle graves of the Iron Age from Jewargi, North Karnataka.

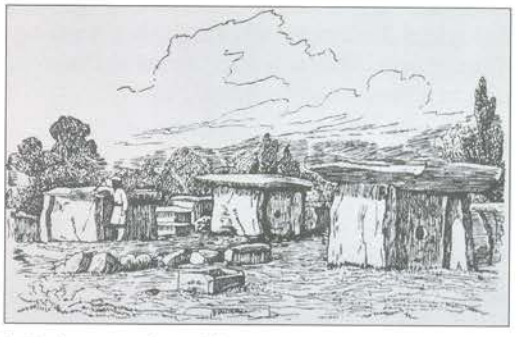

Fig. 14. Dolmens or box-like memorial tombs of the Iron Age from Rajankolur, North Karnataka.

Historical Period

In the historical period the use of stone for mega-purposes proliferated further and assumed many forms. Besides improvements in iron technology, religious developments like the rise of Jainism and Buddhism and new political processes like Magadhan ascendancy and state formation led to exploitation of stone on a large scale and for different purposes.

First, stone was quarried from hillsides and freely used for raising imposing religious monuments like temples (e.g. Khajuraho, Konark and Halebid) and stupas (e.g. Amaravati, Sanchi and Bharhut) (Fig.15 and 16). This obviously involved transportation of large blocks over long distances from hillside quarries. For example, the limestone slabs bearing figures in bas-relief used for encasing the Amaravati stupa were obtained from Macherla quarry lying some 70 to 80 km further upstream on the Krishna river.

Fig.15. Temple of Chandela period at Khajuraho in Madhya Pradesh.

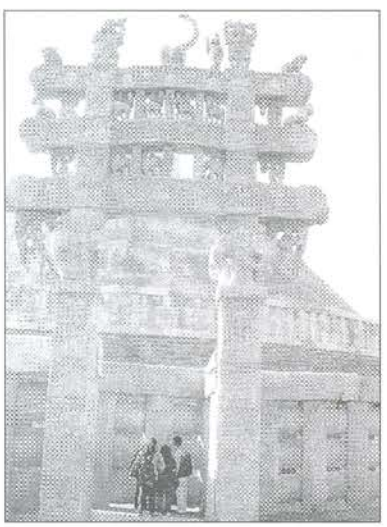

Fig.16. Stupa at Sanchi in Madhya Pradesh.

A second category of religious monuments consists of excavations made into hills e.g. Hathigumpha caves in Orissa, Elephanta, Karle and Ajanata caves in Maharashtra and caves for the Ajivaka sect dug in the Barbara hills of Bihar. Monuments sculpted out of hillsides represent another imposing category. You have, for example, the famous Kailasa temple at Ellora and the rock-cut rathas of the Pallava period at Mahabalipuram (Fig.17 and 18). The creation of these structures implies that the artisans carefully surveyed the hillsides and satisfied themselves about the hard and flawless character of rockbeds before the commencement of actual excavation.

Fig. 17. Kailas temple at Ellora in Maharashtra.

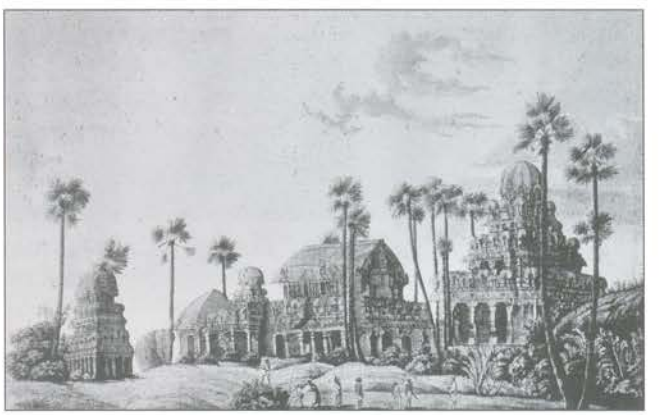

Fig. 18. Sketch of five rock-cut rathas at Mahabalipuram (1816).

A third use to which stone was put in the historical period concerns the preparation of sculptures and images. Regular quarries came up for this purpose near hillsides. For example, Vidula Jayaswal's investigations have shown how the famous Chunar quarry in Bihar was used during the Mauryan and Gupta periods. Various rocks like sandstone, basalt, granite and limestone were used for preparing statues and images. Consider, for example, the famous Sarnath sandstone pillar with lion capital bearing inimitable polish or the majestic Gomateswara statue at Sravana Belgola in Karnataka (Fig.19). No less imposing are the low-relief figures forming part of the Descent of Ganga or Arjuna's penance panel on the rock face at Mahabalipuram or sculpted friezes on temple walls (Fig.20), as for instance at Khajuraho or Belur and Halebid or the thousand and odd sculpted divinities of the Hindu pantheon decorating the sides of the 11th century step-well at Patan in Gujarat.

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Fig. 19. Gomateswara statue at Sravana Belgola in Karnataka (Colin Mackenzie collection of drawings, 1806).

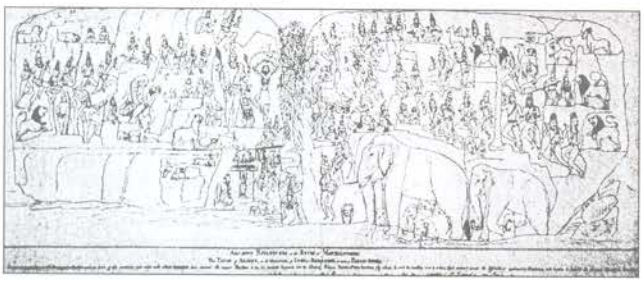

Fig. 20. Arjuna's penance or Descent of Ganga panel sculpted on rock cliff at Mahabalipuram (Colin Mackenzie's drawing, 1808).

Let us also remember that in the historical period stone was used for engraving inscriptions recording the achievements of rulers (e.g. the Hathigumpha inscription of the Kalinga ruler Kharavela or the Aihole inscription of Chalukya ruler Pulakeshin or the Nasik inscription recording the achieyements of the Satavahana ruler Gautamiputra Satakarni or the ethico-religious precepts of the Dhamma policy of Asoka (Fig.21).

Fig. 21. Edict of Asoka in Brahmi script on the Girnar Gujarat.

Medieval Period

These various uses of stone for religious and mundane purposes continued in the medieval period. Now came to the fore its use for military purposes. Consider, for instance, the way the Vijayanagara rulers subdued the rugged granite hills of the Tungabhadra Valley and built one of the richest and beautiful towns of the medieval period. Equally, look at how the Maratha chiefs overpowered the lofty Sahyadris and raised dozens of forts on their summits (Fig.22). Likewise, in the north the Rajput rulers developed a series of hill-forts. This is of course not to say that the use of stone for expressing human emotions like love and respect for the dead was given up. Then we would not be having amidst us monuments like the Humayun's tomb in Delhi or Taj Mahal in Agra or Golgumbaz in Bijapur.

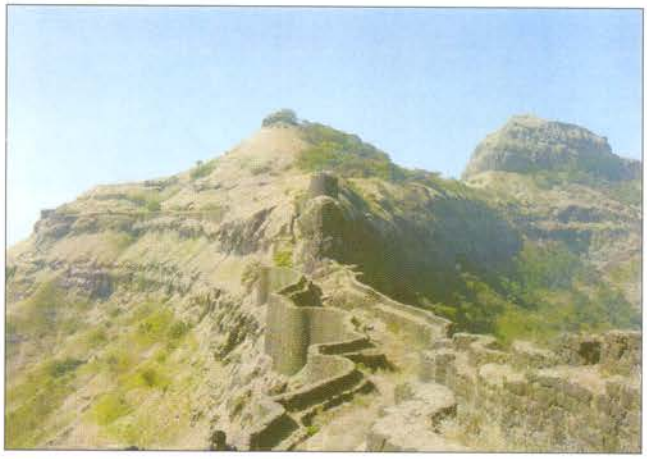

Fig. 22. Fort at Rajgadh in Maharashtra (first capital of Chatrapati Shivaji).

Conclusion

Notwithstanding all developments in modern technology and increasing use of artificial materials, stone continues to be used extensively in modern India – be it for building construction, be it for making *pathas*

Fig. 23a. Workshop for making flat grinding stones (*pathas*) and other domestic implements, Pune City.

Fig. 23b. Finished implements.

and grinding stones which are found even in the urban households (Fig.23), be it for creating images of the Nataraja and other divinities or be it for creating works of art like the expensive and large-sized marble figures of tigers and elephants. Indeed, stone has surpassed time.

In this review we have tried to capture in a non-technical language the two-million-year-long story of man's use of stone for various purposes. We have considered how beginning with his simple flaking technology to create crude tools that served as his extracorporeal limbs for obtaining wild plant and animal foods, man enhanced his understanding of stone's properties and how he used it not only to subserve his lower as well as higher level material needs but also to give concrete expression to his emotional urges like aesthetic appreciation, love and respect to departed ones and religious feelings. The essence of our story is that stone has not only responded to the various callings of human urges but has preserved the consequences of actions emanating from these urges in a solid and interpretable manner. Although mute by its geological nature, in interaction with man stone began to take shapes and speak!

Recommended Readings

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