ABOUT PALAEOLITHIC OSTRICH EGGSHELL IN INDIA

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A review is presented of the evidence for Late Pleistocene ostrich eggshell engraving and shaping in India. The engraved specimen from Patne, dated to c.25,000 years ago, is considered authentic, as are some specimens of ostrich eggshell beads. All other examples of putative carving on ostrich eggshell from India are considered to be probably of natural origin.

INTRODUCTION

In 1988, G. Kumar and colleagues summarised the accumulated evidence of ostrich in India, represented mostly by the fragments of eggshell which have been found at over forty localities (Fig. 1). Kumar *et al.* (1988) also presented certain evidence that some of these fragments had been the target of various artistic activities during the Upper Palaeolithic. Such evidence consists of engravings on the outer, i.e. convex surface of some specimens; of centrally perforated, disc-shaped beads; and of larger, supposedly circular discs with smoothed edges. The article was debated by Nandadeva (1988), Tyagi (1988) and Wakankar (1988). Several of the claims of Kumar *et al.* were rejected in this debate, including some far-reaching conclusions about Upper Palaeolithic art evolution in India and the iconographic identification of one engraving (rejected by both Nandadeva and Tyagi). The small scale of the engravings was also queried. Nandadeva (1988) specifically expressed concern about most of the engravings:

> Except for those on the fragment from Patne the supposed engravings are obscure. Tiny lines of such nature are sometimes created by natural decay - these pieces are as old as 31,000 years - and no doubt such natural lines can resemble figures or motifs to the imaginative mind.

In the context of early global art evolution, the evidence relating to the Indian ostrich eggshell fragments is of great importance, as they are among the earliest known artistic evidence from Asia (Bednarik 1994). The many unresolved issues relating to these finds therefore need to be examined in more detail. One point of concern is that, in writing their paper, Kumar and colleagues had not actually examined all the specimens themselves, especially not the crucial ones from Patne. It was essential to conduct a

IPPA Bulletin 13, 1993:34-43
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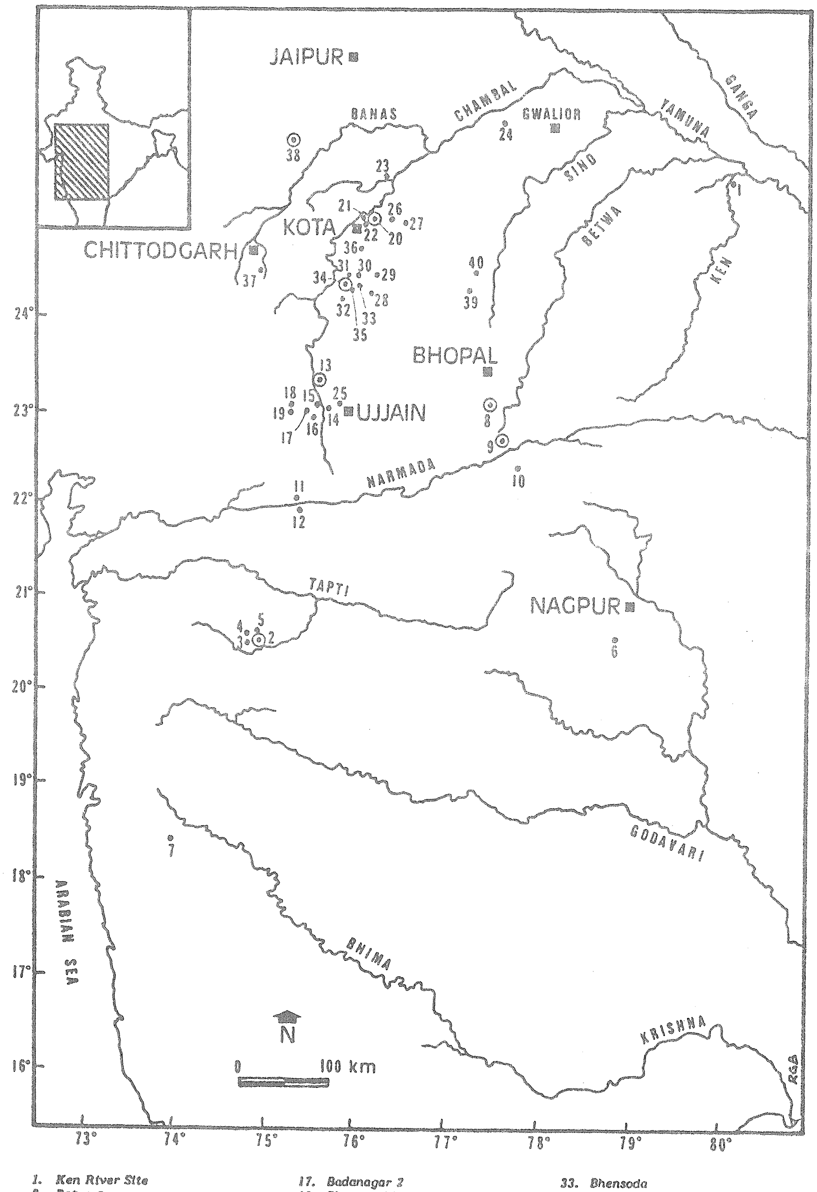

1. Ken River Site
2. Patne ⊙
3. Ashta
4. Kakarda
5. Tisi
6. Shindi
7. Poona
8. Bhopal ⊙
9. Bhimbetka ⊙
10. Hoshangabad
11. Chotabarda
12. Ratikheda
13. Nagda ⊙
14. Dangawada
15. Rajota
16. Badanagar 1
17. Badanagar 2
18. Bherupachlana
19. Runija
20. Chandresal ⊙
21. Badikhedali
22. Chandresal-IV
23. Lakheri
24. Phadgarh
25. Banyakhedi
26. Palayatha
27. Khajurna
28. Pagaria-awar
29. Nandikheda
30. Osama
31. Bhanpura
32. Garoth
33. Bhensoda
34. Ramnagar ⊙
35. Kherkhedi
36. Chechat
37. Kalyanpura
38. Kekadi ⊙
39. Janjalinaka
40. Ruthiai
41. Kunwargram-nanuk-chachnoma

• Ostrich eggshell sites

⊙ Ostrich eggshell beads, discs and engraved pieces

FIGURE 1. THE LOCATIONS OF FIND SITES OF OSTRICH EGGSHELL IN INDIA

Drawn by R.G. Bednarik, after Kumar *et al.* 1988 comprehensive comparative study, combining microscopy with a critical overall approach. During 1990, G. Kumar and I conducted a major study tour of India, examining all known or alleged Palaeolithic art of that country. This led us to many collections and sites, and even prompted the unexpected discovery of new evidence (Bednarik *et al.* 1991; Bednarik 1990, 1992a). Here I will present my findings on the ostrich eggshell fragments only.

First I would like to raise some preliminary points. Kumar *et al.* (1988) have attributed the Chandresal samples (of about 39,000 and 36,500 years BP respectively) and those from Nagda and Ramnagar (both greater than 31,000 years BP) to the Upper Palaeolithic period. As these dates were obtained from the shells' calcium carbonate they are effectively minimum dates. If there should have been any post-depositional precipitation of carbonate in the fabric of the shell, the result would have been a rejuvenating effect on the radiocarbon age, because any such precipitate would have a higher content of 14C. This is quite possible at both Chandresal and Ramnagar, where carbonate laterisation is extensive, with well developed zones of concretions.

Another cautionary note concerns the lower limit of the Upper Palaeolithic in India. That period may have begun comparatively late (Misra 1977), and there are radiocarbon dates from Middle Palaeolithic deposits of 31,980+5715/-3340 BP (TF-345) from Mula Dam, and 33,700+1820/-1625 BP (TF-967) from Ratikarar (Agrawal and Kusumgar 1974:44). Hence, the Middle Palaeolithic continues somewhat longer in India than in other regions. It seems therefore premature to attribute the Chandresal and Ramnagar finds to the Upper Palaeolithic, in the absence of clearly associated lithics. They are likely to predate that period, irrespective of perceived stratigraphical relationship. Both Middle and Upper Palaeolithic tool types occur at these sites, but both Chandresal and Ramnagar possess no clear sediment stratigraphy. In particular, the strata of concretions, which have been interpreted as evidence of stratification, merely mimic a stratigraphy; they are post-depositional de-calcification phenomena.

The debate following the paper of Kumar *et al.* (1988) addressed the question of the identification of the shell fragments at some length, and here at least conclusive evidence has since become available. In addition to the initial identification by the Natural History Section of the British Museum (Sankalia 1974), a recent study has involved precise taxonomic identification of some specimens, based on shell structure and using SEM (Sahni *et al.* 1990). In particular, the surface pits consisting of clusters of pores were considered, as well as the division of the shell into three vague structural layers. The attribution to *Struthio* is unequivocally confirmed by Sahni and colleagues, and it is suggested that, on the basis of pit formation, the Indian shell specimens closely resemble those of *Struthio camelus molybdophanes*, although the authors warn against relying on pore structure and morphology for sub-species determination because these features are quite variable and may be palaeoenvironment-dependent.

I have examined forty-six "decorated" ostrich eggshell fragments, including those in the possession of Dr G. Kumar (Agra, U.P.), the large collection in the hands of R.K. Pancholi (Lotkhedi, M.P.), and the specimens held at the Department of Archaeology at Deccan College (Pune, Maharashtra). I have also examined numerous unmarked specimens, including eight specimens *in situ* at two of the sites, and I have studied the find sites Chandresal, Ramnagar and Bhimbetka (Kumar *et al.* 1988: Table 1), their sediments and their archaeology. I begin by reviewing the engraved Patne specimen.

THE PATNE ENGRAVING

The sole engraved Patne fragment (Fig. 2) is better preserved than most other ostrich eggshell from India. In several parts of the outer (convex) surface, calcium carbonate accretions remain in place, some of which are quite crystalline in texture. But when found the specimen bore more encrustation, and this, together with a high pH environment, has apparently facilitated the preservation of the fragment. There are several faint scratch lines on undecorated parts of the outer surface which appear to be much more recent than the deeply engraved lines, and one of them shows two distinct striae.

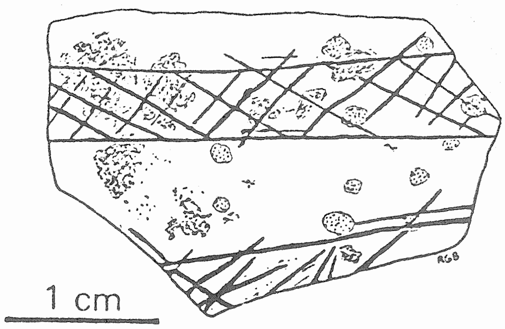

FIGURE 2: THE ENGRAVED OSTRICH EGGSHELL FRAGMENT FROM PATNE

The specimen's maximum dimensions are 28.9 x 20.5 x 1.9 mm. The band with the cross-hatching is 4.8 mm wide, its two bordering lines being almost perfectly parallel. The hatching is at an angle ranging from, to the "outer" border, 30-32° one way and 27-47° the other, and individual lines are spaced from 0.8 mm to 2.7 mm apart, i.e. the spacing is quite variable. The second, truncated design is less regular. Its cross-hatching often over-runs the border line or stops short of it, and there is greater variation in the line depths throughout this design.

Much of the material that was removed in fashioning the individual grooves of the engraving was not removed by the abrasive action itself, but rather by incidental splintering, and the microscopic traces of this process are readily recognisable along the edges of many grooves. In fact few of the groove edges are free of such damage, and if all abrasive action had been in one direction it would be possible to determine the same from the regularity in this splintering effect along groove edges (Fig. 3, left). The jagged pattern suggests that abrasive action with the stone tool was usually in both directions, and this is confirmed by the presence of duplication traces in some grooves, where the remnants of previous grooves can just be discerned (Fig. 3, right). The surface of the groove floors is far too corroded to permit the identification of striations, and even less the determination of tool direction by means of the transverse tear marks identified by d'Errico (1988) and myself (Bednarik 1992b) on other materials.

Individual grooves are up to about 1 mm wide, and the jagged edges seem to be attributable to the flaking of the thin external layer of the eggshell. Sahni *et al.* (1990: Fig. 2) have identified a three-layered structure in Indian ostrich eggshell: a thin (< 0.1 mm) outer veneer they call the external layer; the main body accounting for about three-quarters of the shell's thickness, called the prismatic layer due to its vertical columnar structure; and the inner mammillary layer in which the prisms terminate. The engraved lines on the Patne specimen are mostly up to about 0.15-0.20 mm deep, while the microscopic scars of pressure scales along their edges are only between one-tenth and one-quarter of the groove depth (Fig. 4). This seems to coincide with the thickness of Sahni's external layer.

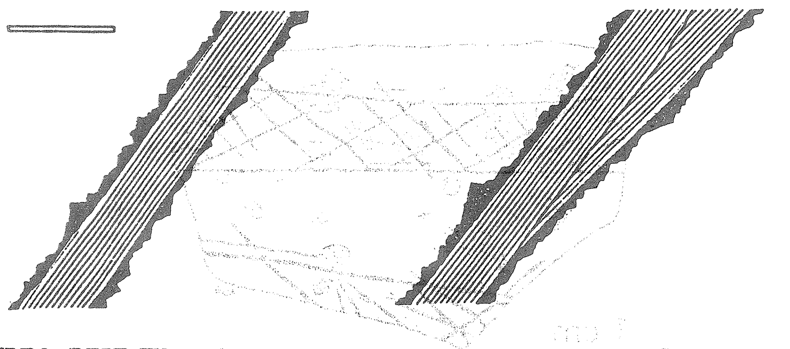

FIGURE 3: (LEFT) TYPICAL ENGRAVED GROOVE ON THE PATNE SPECIMEN, WITH THE SPLINTERING SCARS SHOWN IN BLACK ON EITHER SIDE OF THE GROOVE; (RIGHT) CLOSE-UP VIEW OF DUPLICATION OF A GROOVE ON THE PATNE SPECIMEN (SCALE = 1 MM)

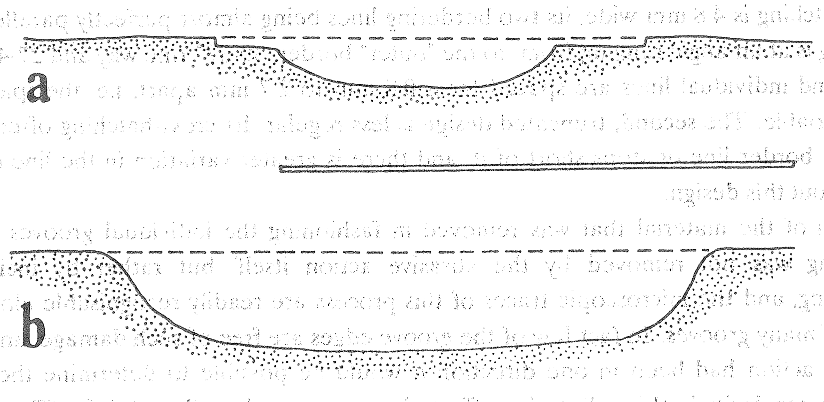

FIGURE 4: COMPARISON OF TYPICAL CROSS-SECTIONS OF: (A) AN ENGRAVED GROOVE ON THE PATNE SPECIMEN; AND (B) A GROOVE PRODUCED BY ROOT ACTION, AS IT IS FOUND ON MANY OSTRICH EGGSHELL FRAGMENTS AND ON OTHER CALCAREOUS MATERIALS, SUCH AS SIBERIAN MAMMOTH IVORY (SCALE = 1 MM)

All of this shows beyond reasonable doubt that the specimen was engraved with a hard tool, presumably a stone tool. A prehistoric antiquity for the markings is indicated by the corrosion of the grooves in comparison to apparently recent damage, and by their calcite encrustation. The specimen is from a deposit that has been dated to 25,000±200 years BP (Grn-7200) (Sali 1980), i.e. it is of the early Upper Palaeolithic. Conversely, the ostrich is thought to have become extinct in India during the early Holocene. Other eggshell specimens from Patne are discussed below.

SPECIMENS WITH TAPHONOMIC MARKINGS

The groove markings on the remaining forty-five "decorated" eggshell fragments from India differ significantly from those observed on the Patne specimen. They are of about twice the width, and distinctively rounded in section. There is never any splintering of the external layer evident, and since these markings are usually sinuous and convoluted, rarely straight, it is in my view practically impossible that they could have been engraved with stone tools (having conducted extensive engraving and drilling experiments with stone implements on modern African ostrich eggshell). Most specimens are too small to allow an informed opinion about overall arrangements of markings, but the few larger specimens, particularly one from Ramnagar which was assembled from four fragments and now measures 52 x 49 mm, suggest that the grooves meander over the surface, frequently fade out or are of varying depth. This largest known fragment is also the only one bearing clear markings on the inside (the concave surface), but they are considerably fainter than those on the convex surfaces. The solution process apparently causing these channels is thus significantly more effective on the smooth external layer of the eggshell than on its mammillary layer. It is also notable that the density and depth of grooves varies considerably on different parts of the large specimen's convex surface, and they seem to be deepest where they are most dense.

While there is no doubt that the extant surface of these grooves was formed by a solution process, this does not necessarily exclude the possibility that pre-existing anthropic markings were merely emphasised by such a process, perhaps because the removal of a resistant surface layer had exposed a more soluble layer beneath. However, this is most unlikely. I have not observed any morphological arrangements that suggest intentionality in their production, no repeated patterning other than what can easily be accounted for by natural processes, and no iconographic or recognisable geometric patterns. More importantly, as stated already, it would be exceedingly difficult to engrave some of the arrangements with a stone tool, especially without damaging adjacent surfaces. Consequently I have detected no evidence that would support an anthropic origin of these markings.

Very similar surface markings occur frequently on Palaeolithic ivory objects from Siberia and Russia, where I have described them from sites such as Kostenki, Avdeevo, Mal'ta and Buret', as well as from mammoth ivory objects of more recent periods (Bednarik 1992c). Here, the markings can be observed on larger areas, and it has never been suggested that they are of anthropic origin: they have always been assumed to be taphonomic. I have explained their formation as the result of a mycorrhizal symbiosis between the fungi and bacteria at plant rootlets, proposing that the respiratory carbon dioxide of the microbiota reacts with the moisture in the soil to form carbonic acid, which dissolves calcium carbonate. Ivory is a form of dentine, i.e. calcium carbonate, together with other calcium minerals and cartilage. Ostrich eggshell is another mineralized calcareous substance of animal origin, and at some Indian sites it has been subjected to precisely the same erosional process. Similar effects can be observed on other archaeological finds, such as limestone, gastropod shells and even on bone or teeth. Bone consists largely of calcium phosphate and calcium carbonate (once the organic constituents, collagen and fat, have decayed) and surface grooves similar to those I have described here have been misinterpreted as Palaeolithic engravings on bone fragments in Spain (Freeman 1979) and China (You 1984), for example. The problem is thus not unique, but one rather widely experienced by archaeologists.

OSTRICH EGGSHELL BEADS

Four perforated discs have been reported from the Upper Palaeolithic of India, two from Patne and two from Bhimbetka. They are without doubt authentic. There is also a circular disc from Patne, with one side scored to receive a drill, and one of the beads from that site is fractured. These specimens are of about 10 mm diameter, whereas two from Bhimbetka are of only 6 mm diameter. Kumar has conducted replication experiments, drilling through heavily weathered Pleistocene ostrich eggshell with Mesolithic bladelets in 10 to 12 minutes (Kumar *et al.* 1990: 36). In my own replication work I found it quite impossible to drill unweathered ostrich eggshell economically with a thin pointed tool of cryptocrystalline sedimentary silica. The materials experiencing the least wear and that are the most effective are rather coarse-grained quartzites and quartz (Bednarik 1991). With them I have drilled through fresh eggshell in 70-90 seconds, applying the drill from only one side. At least some of the Palaeolithic beads from India were drilled from both sides. Kumar has suggested (pers. comm.) that the perforated blanks were then threaded onto a rod and their margins smoothed collectively to obtain uniform diameter and shape.

His view was perhaps prompted by the two beads from Bhimbetka, which are similar in shape and size. They were found in the neck region of an Upper Palaeolithic human burial found at Bhim III A-28. It has therefore been suggested that they may have been part of a necklace made mostly of perishable beads (Kumar *et al.* 1988:46). In addition to the described perforated beads, Kumar and colleagues also describe two fragments they consider to be parts of larger circular discs. One, from Nagda, would have been of about 35 mm diameter before it broke, the other, from Kekadi, about 21 mm. Kumar *et al.* (1988) report traces of trimming along the edge they consider to have been part of the circumference.

THE EARLY USE OF OSTRICH EGGSHELL

The Palaeolithic use of ostrich eggshell, for utilitarian containers and for decorative or ornamental purposes, is not at all restricted to India. Evidence of such use has been found in four world regions (Bednarik 1992c). The early use of ostrich eggshell is in fact of major importance to palaeoart studies. Particularly, southern Africa has recently yielded finds of decorated eggshell that are of enormous antiquity, being among the earliest evidence of art production in the world. Those from the Howieson's Poort phase of the MSA at Apollo 11 Cave (Wendt 1974) are perhaps 70,000 to 80,000 years old, although a greater age has also been proposed. About a dozen decorated ostrich eggshell fragments have now been recovered from Diepkloof Cave in the south-western Cape, South Africa (Beaufort 1992), and they are also of the Middle Stone Age. In southern Africa, the use of ostrich eggs has survived into the ethnographic present, for instance among the Bushmen.

The beads and decorated ostrich eggshell containers found in the Sahara have been attributed to the Capsian (Camps-Fabrer 1966), an Epipalaeolithic blade and burin industry of the early Holocene. The engraved decorations include both figurative and non-figurative elements, but no matching rock art has been found in the region. Ostrich depictions in the Saharan rock art are still common from the subsequent Neolithic period. Finally, disc beads of ostrich eggshell are found in the Gobi desert of northern China, where the bird is thought to have been extinct since the final Pleistocene. They are attributed to a late Palaeolithic industry (Bednarik and You 1991). Depictions of ostrich have been reported in Inner Mongolia, but their identification has been questioned (Bednarik and Li 1991; Tang 1993). Beads of the early Upper Palaeolithic of western and eastern Europe have been made from ivory, and are particularly well known from Sungir' in Russia (Bader 1978) and from the French Aurignacian (White 1989).

SUMMARY

It would be premature, however, to deduce from this global distribution of ostrich eggshell artefacts more than is scientifically defensible. The eggshell can only survive in certain environments, particularly in a high soil pH. At the sites where I measured the same, it was always above pH 8.2 at exposures; thus the unleached soil conditions may be close to the abrasion pH of calcium carbonate. Another environmental factor facilitating survival of the eggshell is low precipitation. Arid or semi-arid conditions are ideal, and they happen to coincide with the preferred habitat of the ostrich. It is most important to appreciate that the archaeological distribution of these finds is merely the result of a series of taphonomic selection processes. To use such indices of chronological or geographical distribution patterning without the application of taphonomic logic (Bednarik 1993) can only lead to archaeological misinterpretation. In the same sense it is unscientific to state that the chronological distribution of beads on the archaeological record can tell us the beginning of human self-adornment; it can only tell us, at the very best, the beginning of the use of non-perishable beads.

In terms of archaeological interpretation, very little can thus be said about the Indian evidence of Palaeolithic ostrich eggshell use. Nearly all of the forty-six "decorated" fragments known bear natural groove markings caused by chemical solution, and only one has been shown to bear anthropic engravings, the fragment from Patne. Leaving aside the central Indian petroglyphs I discovered in 1990, and accepting my interpretation of the "mother goddess" of Lohanda Nala (Bednarik 1992a), the Patne eggshell fragment is the only specimen of Palaeolithic art currently known from India. Wakankar (1987:181) does illustrate a few apparently decorated bone objects from Bhimbetka, two of which bear engraved patterns resembling those on the Patne find, but he omits to mention whether these objects are from the Upper Palaeolithic deposit. Sonawane (1991) describes them as being of the Mesolithic period. The pattern engraved on the Patne fragment vaguely resembles that on the late Palaeolithic pebble from Urkan e-Rub, Israel (Hovers 1990), and one might perceive a faint stylistic resemblance to the only known Palaeolithic art of China, the engraved antler fragment from Longgu Cave (Bednarik 1992d). The very few Indian beads of ostrich eggshell may confirm a widespread Eurasian use of beads during the early Upper Palaeolithic, but their scarcity only underscores the serious discontinuities in the known archaeological record.

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