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ABOUT OSTRICH EGGSHELL BEADS

by

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INTRODUCTION

A perusal of archaeology's dominant models of the cognitive, symbolic, linguistic, intellectual and even technological evolution of Pleistocene humans as developed in recent decades, and the data such models are based on, provides a bleak picture. For instance, widely disseminated models for the beginnings of palaeoart, language origins and the advent of marine navigation are incompatible with the available relevant evidence. Our earliest evidence for hafted tools, stone walls, production of petroglyphs, use of resinous or mastic substances, seafaring, dwelling construction, use of strings and knots, use of pigment, drilling or boring, underground mining, apparent recognition of iconographic properties, collection of exotic but non-utilitarian manuports, wooden artefacts, ivory artefacts, bone artefacts, barbed harpoons, possible musical instruments, portable palaeoart objects, blade industries and many other types of evidence is often falsely attributed to the Upper Palaeolithic period. This widespread lack of relevant knowledge still leads to the publication of syntheses whose principal redeeming feature it is that they provide means of studying the epistemology of the discipline (e.g. Gamble 1993; Mithen 1990; Noble and Davidson 1996).

One of the most useful sources of information for the cognitive as well as technological and even social context of manufacture and use of artefacts are beads and pendants. With very few exceptions they can be readily identified: utilitarian uses of small perforated objects would be as pulling handles, buckles or quangings (Boas 1888: Figs. 15, 17, 121d), but judging from the ethnographic record such artefacts are fairly distinctive, and they are readily identifiable from their use wear marks. For instance, nobody would seriously entertain the idea that small circular, centrally perforated and repeatedly produced objects of ostrich eggshell were anything other than 'decorative' beads, whatever their actual use or purpose may have been. Or that animal canines perforated near their root were used as pulling handles or weights of some sort. But such objects can tell us a great deal about the technological capacities of the people who fashioned them, and even about the societies that provided a meaningful context in which such products may have been objects of symbolism. For instance, both beads and pendants can function only in conjunction with the use of strings of some type: without them it is rather futile to embark on the very difficult process of perforating a tooth. Moreover, the use of cordage and beads demands, for all practical purposes, the use of knots, because without them it is almost impossible to join the ends of a string to prevent the loss of the beads. In fact, joining the ends of a string without the use of knotting is technologically even more complex than the use of knots, so we can reasonably deduce the use of both strings and knots from the presence of beads and pendants.

But the perhaps most important deductions such objects permit us relate to the cultural system their use postulates. Irrespective of whether they indicate vanity, ethnic or personal identity, social or political status, or are used to ward off spells and spirits, they convey complex information about the wearer which it would be impossible to create a context for without the use of a communication system such as language. We have many other indicators of possible language use during the Lower and Middle Palaeolithic (e.g. other forms of symbolism, or successful ocean navigation), and the very early use of beads and pendants provides similarly crucial evidence which, collectively, renders the hitherto dominant model of cognitive evolution completely superseded. We can no longer afford to ignore this kind of evidence (Bednarik 1994a, 1995a). In the case of beads and pendants, the superseded consensus view is well summarized in White's work (1989, 1992, 1993a, 1993b), which he has not been able to defend convincingly when confronted with the relevant evidence he had not been aware of (White 1995).

EARLY OSTRICH EGGSHELL BEADS

To understand the significance of flat disc beads manufactured from ostrich eggshell, and their role in interpreting the cognitive evolution of humans, we need first to consider two factors: the distributions, in both time and space, of such finds, and the taphonomic explanation of both these distributions.

It is quite clear that disc beads made from ostrich eggshell are a form of artefact that would not have been made in very small numbers by any one of the societies that used them. Their role would have always been non-utilitarian, ideological, emblemic or symbolic. To provide them with a social meaning it would have been essential that they were made in quite large numbers, because it is repeated and 'structured' use which confers meaning on symbolic artefacts. Even a single wearer of such jewellery is likely to have worn a certain number of the beads in order to achieve a decorative effect, and not just one or two specimens.

And yet, wherever ostrich eggshell beads have been found in Pleistocene deposits, only extremely small numbers were recovered. Similarly, these occurrences are also extremely isolated in both time and space: major intervening time spans have yielded no such artefacts, nor have vast geographic regions in which the ostrich did occur. There is a very strong case here for taphonomic reasoning of the type I have developed (Bednarik 1986, 1994b, 1995b), according to which we are almost certainly dealing with a phenomenon of a very long *taphonomic lag time*. The extreme paucity of Pleistocene finds can realistically be explained by postulating that they are from beyond the *taphonomic threshold* of the phenomenon category in question.

For instance, we have only a few specimens from the entire Palaeolithic of India (Bednarik 1993a, 1993b), two from Bhimbetka (central India) and three from Patne (peninsular India) (Fig. 1a–c). Two of the latter are not perforated, although one is centrally scored to receive a stone drill. The Bhimbetka specimens were found in the neck region of a human burial, so it is possible that they once formed part of a necklace. While the Patne specimens range from 7 mm to about 10 mm diameter and are rather angular, those from Bhimbetka III A-28 measure about 6 and 7 mm respectively and are well rounded.

Over forty Indian sites have yielded fragments of late Pleistocene ostrich eggshell, and artefacts made of this medium have been reported from seven sites (Kumar *et al.* 1988). Radiocarbon dates ranging from about 39,000 to 25,000 years BP seem to relate to these finds, but it must be cautioned that, of the 46 'engraved' fragments I have examined (which are all those that have been found in India), 45 bear no anthropic decoration, they were marked by a complex natural process which I have described in detail, and which also affects other mineralized calcium carbonate-dominated substances of animal origin (Bednarik 1992b, 1993a). I have also explained the importance of considering sedimentary environments to understand the spatial and temporal distribution of all of these finds.

The ostrich (*Struthio* sp.), now extinct in Asia, seems to have been widely distributed in the not so distant past. Other Asian regions producing ostrich eggshell beads are Siberia (Krasnyi Yar, Trans-Baykal), Inner Mongolia (Hutouliang) and the Gobi desert in northern China and Mongolia. In particular, an Epipalaeolithic or perhaps Mesolithic stone tool industry of the

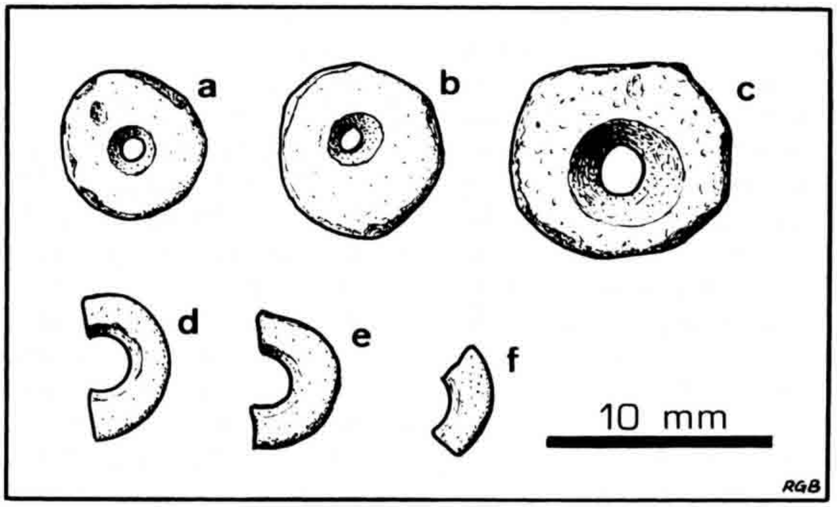

Fig. 1. Pleistocene beads made of ostrich eggshell, from India (a–c) and Libya (d–f): a, b – Bhimbetka III A-28, Upper Palaeolithic; c – Patne, Upper Palaeolithic; d, e, f – El Greifa site E, Late Acheulian.

Gobi, usually named after the site of Shabarak-usu, has produced many disc beads, made of freshwater shells as well as ostrich eggshell (Narr 1966, 366). This tradition, typically of non-geometric microliths, is not safely dated but seems to precede the local Neolithic (Bednarik and You 1991). Depictions of ostrich have been reported from among the petroglyphs of Inner Mongolia but their identification has been questioned (Bednarik and Li 1991; Tang 1993) and cannot be demonstrated.

Southern African sites have yielded finds of ostrich eggshell from the Middle Stone Age to the proto-Historic period. Decorated specimens from the Howieson's Poort phase in Apollo 11 Cave, Namibia (Wendt 1974), may well be 70,000–80,000 years old, even older. This site has also produced beads made of eggshell from a layer thought to be 22,000 years old. Diepkloof Cave in the south-western Cape, South Africa (Beaumont 1992; Bednarik 1993c), has yielded about a dozen decorated ostrich eggshell fragments of the Middle Stone Age. Ostrich eggshell beads from Bushman Shelter near Ohrigstad, Transvaal, have been suggested to date from somewhere between 12,000 and 47,000 years ago (Kumar *et al.* 1990).

At the other end of the time scale we still have similar beads in recent centuries from southern African traditions. For instance they are found in the Smithfield B, a tool complex of the subcontinent's interior regions of the 14th to 17th centuries (Hirschberg 1966). The use of ostrich eggshell for a variety of purposes, including the production of disc beads, continued to be practised by the Bushmen of southern Africa, and has been described ethnographically (e.g. Campbell 1815; Arbousseet and Daumas 1852; Bleek 1928; Dunn 1931; Forde 1934; Clark 1959; Silberbauer 1965). Woodhouse (1997) has provided an excellent summary of these eyewitness accounts, and on the production of ostrich eggshell beads in southern Africa.

In the northern half of Africa we have evidence for the use of ostrich eggshell from two pre-Historic periods: the Capsian of northern Algeria and Tunisia, and the Acheulian of the Fezzan in Libya. The Capsian is an Epipalaeolithic blade and burin industry of the first half of the Holocene, and it includes not only numerous figurative and non-figurative engravings on ostrich eggshell fragments (Camps-Fabrer 1966), but also beads of gastropod shells, teeth and small stones (Camps-Fabrer 1975: 280–282). Almost any excavation of major Capsian deposits produces ostrich eggshell beads. Even containers of wholly preserved ostrich eggs have been recovered from the Capsian, and from their decoration we may assume that the engraved fragments found may well be from such containers. Saharan rock art depictions convincingly resembling the ostrich are known and may well be of the mid-Holocene (e.g. at Wadi Mathendous, Fezzan).

The three fragments of disc beads from a major Libyan occupation site of the Acheulian are of considerably greater age (Ziegert 1995). They are also made from ostrich eggshell, and closely resemble those from other regions and later periods. These first Acheulian ostrich eggshell beads ever reported (Fig. 1d–f) come from the El Greifa site complex (Wadi el Adjal, nahe Ubari), located on a peninsula of the huge Fezzan Lake (about 200,000 km^2) of the Pleistocene, which then occupied a large part of south-western Libya. This locality provides ample evidence of Early, Middle and Late Acheulian occupations, of perhaps semi-permanent dwelling structures on the lake shore, of extensive quarrying of quartzite, and of annual burning of the reed belt along the shore for a period of many millennia. The excellent preservation conditions led to finds of insect remains, seeds and bone at the site, and the recovery of ostrich eggshell fragments from deposits of 200,000 – 180,000 years BP, dated by the U/Th isotopes of the calcareous sediments. Of particular interest are the remains of a distinctive round stone arrangement of the Late Acheulian which are believed to be of a dwelling. The site's lithic inventory includes generally 'handaxes', scrapers, borers and burins, but is dominated by large Acheulian types.

The near-perfect rounded circumference and perforation of the ostrich eggshell beads from El Greifa site E demonstrate that even hominids of the Acheulian possessed a well-developed technology of working this fragile medium with the greatest possible confidence and skill. Moreover, the beautifully fashioned beads indicate the existence of a differentiated sense of the self that may not have differed significantly from that of modern humans. These perfectly made artefacts also imply the existence of the social structures necessary to provide an ideological context for the production and use of complex body decoration. The three beads are preserved as fragments only (about 58%, 54% and 28% preserved respectively), but they share a similar perforation diameter of about 1.7 mm, and even their external diameter is very consistent (5.8–6.2 mm). This consistency in size and the near-perfect rounding of all preserved edges, internal and external, suggest the use of a standardized manufacturing process, a characteristic these beads seem to share with the much later beads of the Upper Palaeolithic as well as various cultural traditions of the Holocene.

REPLICATION OF OSTRICH EGGSHELL BEADS

Kumar has conducted experimental replication work with heavily weathered ostrich eggshell fragments collected from Chandresal, India, which may be in the order of 36,000–39,000 years old (Kumar *et al.* 1990: 36). He used Mesolithic stone tools to produce the perforations of two experimental beads, which took him 10 to 12 minutes to drill through, working from both sides. In my own replication work I have always used fresh ostrich eggshell, because that is what was presumably used in the distant past, and I applied freshly made stone tools of different types and materials to establish relative suitability (Bednarik 1991, 1992b, 1993a). I found it difficult to economically drill through the unweathered shell using thin pointed tools of cryptocrystalline sedimentary silica. The most effective tools for this purpose were found to be rather coarse-grained quartzites and quartz (Bednarik 1991). With them I drilled through the shell of a complete ostrich egg in 70–90 seconds, i.e. working from just one side.

The immediate purpose of my experimental replication work between 1990 and 1996 was to determine the technological processes involved in the production of beads of, and engravings on, ostrich eggshell. The results relating to engravings have been reported (Bednarik 1992b), here I will summarize my findings relating to beads, and their implications in terms of the cultural context of the production of the beads.

I have found it easy to reconstruct the production processes for these beads. The raw material is of unusually consistent properties: the shell thickness is uniform, as is the three-layered morphology of the shell (described in detail by Sahni *et al.* 1990). The only significant material variable is attributable to the shell's curvature, which is of a much smaller radius at the ends of the egg than it is along the sides. During the periods in question, only stone tools were available to work the shell. Replication soon established for me that the procedure used followed a specific pattern, as demanded by the morphology and dimensions of the end product, by work traces and by the nature of the available stone implements. For instance I found that it was difficult and uneconomical to first shape the bead and then drill it, and that it was marginally easier to drill from the concave side than from the convex. Thus experimentation succeeded in establishing the work process quite convincingly. Once

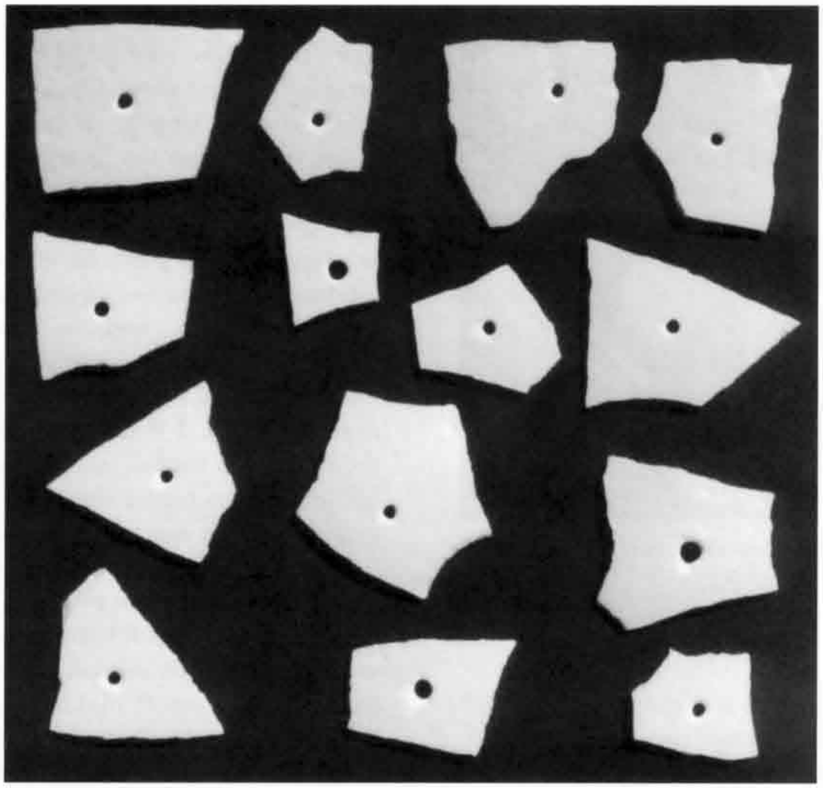

Fig. 2. Fragments of modern ostrich eggshell (of *Struthio camelus*), broken for replicative bead production and perforated. c. 1:1.

drained of its contents, an ostrich egg was probably dried and broken into fragments. These were then reduced further, into polygonal pieces of about 1–2 cm^2 area. This is best done by carefully breaking the shell between fingers, probing for already existing fracture lines. The small fragments were then drilled individually, which is a little more difficult than drilling into the complete egg (Fig. 2). An experienced operator takes between 70 and 145 seconds (average 121 secs, n=11) to perforate the dry shell from one side. (I consider that I became an 'experienced operator' after attempting to produce 25 or 30 beads, and quantitative production details reported here refer only to subsequent work.) No significant differences in drilling time were noted according to direction (from outside or inside), but the outer veneer (<0.1 mm; Sahni *et al.* 1990) is somewhat harder to start from, and is of course of convex surface, so I came to prefer the concave mammilary innermost layer (Sahni *et al.* 1990: Fig. 2) to start drilling from. Contrary to various opinions stated, I do not believe that ostrich eggshell beads were usually drilled from both directions, as it is very difficult to meet up with the centre of the first indentation. It is much easier to ream out the opening once the boring tool breaks through, using the point of a thin prismatic sliver of chert.

I also drilled shell fragments previously soaked in water for 24 hours, taking from 80 to 140 seconds (average 118 secs, n=11), which suggests that this does not affect workability of the shell. The principal variable in drilling time is clearly the quality of the stone tool point, and this can vary considerably. In my replicative work I used a variety of stone tool materials, including cryptocrystalline flint, microcrystalline chert of various types, chalcedony, coarse and fine quartzites, and quartz crystal. I also tried out a variety of tool morphologies, finding that thin points became blunt very quickly, as did finely-grained materials. Nevertheless, all materials I used necessitated the application of two or more points to produce a single perforation economically, so the time of making or resharpening borers has to be added to production time. Stout angular points on flakes of 1–2 mm thickness near their end were found to be the most effec-

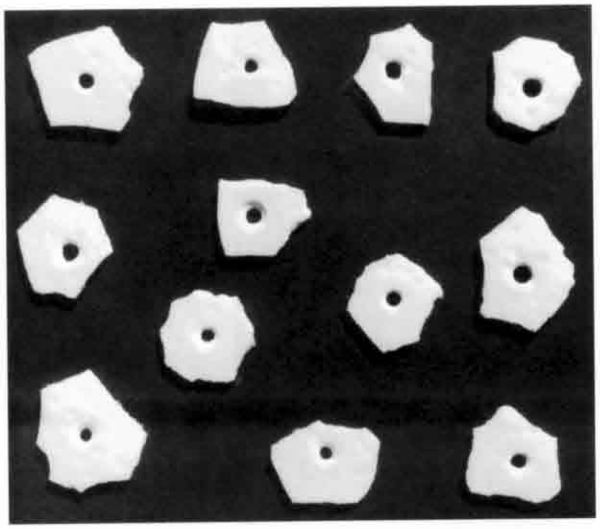

Fig. 3. Drilled and trimmed replicative bead roughs. c. 1:1.

tive, and excessive pressure is counterproductive as it accelerates the wear of the tool point exponentially.

Once the perforation is complete it is reamed out from the other (convex or outer) side, using slender bladelets or prismatic points, which may be quite fragile. The duration of this process depends on the desired hole diameter, but in about one minute an even diameter of around 2 mm, eliminating much of the drilling cone, can be attained. It is clear from my work that the three perforated beads of the Indian Upper Palaeolithic were reamed out by alternating rotation of the borer: this usually results in a slightly oblong perforation, as already noted by Semenov (1964: 78) in drilling through other materials with stone tools.

Before commencing the abrading of the still angular fragment, the excess area is trimmed off by gripping the piece firmly between two fingers in the area that is to form the final bead, and pressing its convex side against a stone surface. This process of snapping off small angular fragments until the actual bead blank is obtained (Fig. 3) requires skill and judgment: if the bead is incorrectly held or handled, it can easily crack through the perforation (see bottom right specimen in Fig. 4). The average time of the trimming process is 34 seconds.

Grinding the excess material from the fragment's edge is easy, although very demanding on the operator's finger tips. I found it convenient to divide this process into two steps, first grinding the bead blank into a roughly circular shape of under 10 mm diameter, resembling the Patne specimen in Figure 1. This requires between 65 and 270 seconds (mean 217 secs, n=12), the duration being related directly to the amount of excess material to be removed. Siliceous sandstone, silcrete or quartzite provide excellent grinding surfaces, and an experienced craftsman should not break any pieces in this process (Fig. 4).

In attempting to replicate the Acheulian specimens from El Greifa, I found that I had to further refine the product of the last step. It takes between 580 and 645 seconds to reduce the <10 mm beads to almost perfectly round specimens of about 6 mm diameter (mean 618 secs, n=12). On this basis we can estimate that the average time it took to produce one of the El Greifa ostrich eggshell beads, assuming that the maker was a skilled craftsman, was in the order of 18 minutes, or about 25 minutes if we include the time of preparing and resharpening stone points (Fig. 5).

Both the beads and the stone tools used in their manufacture (Fig. 5) were examined under a stereoscopic optical microscope at low to medium magnifications. The information so gained is not only useful in the microscopic study of pre-Historic bead specimens and stone borers, it also explained the surprisingly rapid blunting I experienced with the stone tools. Expecting to find significant microscopic spalling on working edges, I was surprised to see that the 'blunting' of borers was not so much due to wear, but due to clogging up of recesses with highly compacted calcium carbonate. Nevertheless, a characteristic type of wear sheen was also noted on the edges at the point of many tools.

The ground and powdered eggshell material was also examined and was found to contain surprisingly large chips of eggshell layer, measuring commonly 0.1–0.5 mm, but in rare cases up to 1.8 mm length. However, over half the volume of the white powder is of much smaller grainsize, most of it 2–20 µm. Differences in its composition were noted according to the rock type used: a gritty siliceous sandstone and a silcrete produced slightly different cumulative grain size distribution curves than a dense central Indian quartzite.

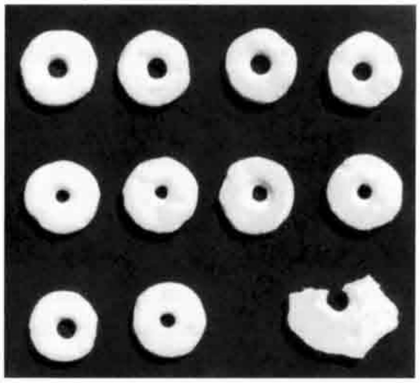

Fig. 4. Finished replicative ostrich eggshell beads of just under 10 mm diameter, matching those found archaeologically. The specimen on the lower right has fractured through the perforation during trimming. c. 1 : 1.

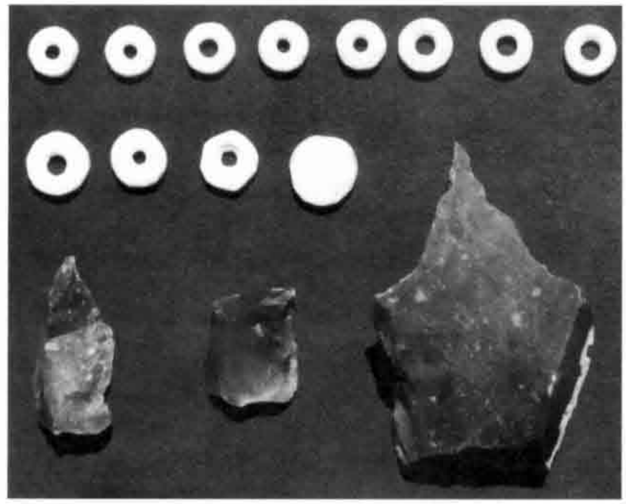

Fig. 5. Replicas of the Acheulian ostrich eggshell beads from El Greifa site E, Libya. Using Acheulian stone tool types, these take an experienced operator about 25 minutes each to produce. Three of the stone borers used experimentally are also shown. c. 1 : 1.

DISCUSSION

There are important inferences to be drawn from this replication work. In particular it showed that the Acheulian specimens are of considerably finer workmanship than those we have of the Upper Palaeolithic (cf. Fig. 1), and it gave me an appreciation of this difference in both manufacturing effort and perceptual ideals of the makers. The near-perfect roundness of the older beads can be obtained only by constant checking of the shape during the final abrading process; it is the outcome of a very determined, purpose-mediated effort to produce high-quality work. Moreover, the dimensions of these beads imply that their makers drew from the experience of a long tradition of manufacturing such products. Their diameter of about 6 mm is close to the structurally possible minimum for these objects, with a perforation of almost 2 mm. If they were ground down to a smaller size they would soon fracture, and holding beads of under 6 mm to grind them to still smaller size becomes increasingly difficult. Since there is a much greater effort in making a smaller bead than a larger, and since a larger is surely easier to see, we have to assume that the greater effort was justified by some non-utilitarian motive. By far the most logical explanation is that the society in question placed a high value on utmost standard of craftsmanship, and on pushing its technology to the possible limit. In other words, the exceedingly small and well-made beads communicate, at the very least, a desire for perfection. But in addition, the most rational explanation we have for their quality relates to the cultural context that might have provided an impetus for highest possible perfection, i.e. for making beads both as small and as perfectly proportioned as possible. These objects may thus be seen as indicating social complexity and the existence of abstract value systems during the Late Acheulian period.

The excellent rounding of the circumferential edge and the even width of the ring indicate more than an acute sense of aesthetics or an appreciation of a perfect form. They imply also a surprising appreciation of an essentially abstract, geometric form, many tens of thousands of years before the marking on the Tata nummulite (Bednarik 1992a: Fig. 4), which is of the Mousterian of Hungary. However, naturally perforated apparent disc beads of fossils such as crinoid columnar segments have been found in Acheulian depositis since Acheulian stone tolls were first recognized (Prestwich 1859; Goren-Inbar *et al.* 1991).

For orthodox archaeologists with their essentially false models of cognitive evolution (Bednarik 1995b, 1996a) this sophistication probably seems extraordinary. They may speculate on whether language was possible prior to 35,000 BP (Davidson and Noble

1989) or 60,000 BP (Noble and Davidson 1996), unaware that even *Homo erectus* must have had language to navigate the sea and colonize new islands (Maringer and Verhoeven 1970, 1977). They may be unaware that petroglyphs, too, were produced in the Acheulian (Bednarik 1993b), that haematite or other iron compounds were used as pigment up to 900 millennia ago (Bednarik 1994b), that hafted tools with wooden handles, stone-walled dwellings and portable engravings date from the Lower Palaeolithic (Bednarik 1992a, 1995a), and that the oldest beads or pendants we know about may be close to 300 millennia old (Bednarik 1992a). The latter include a perfectly perforated wolf incisor from the Repolusthöhle in Austria, which confirms the very high standard of workmanship in drilling through extremely difficult media. Unfortunately systematic neglect of replicative work in the study of non-lithic Pleistocene assemblages, such as that pioneered by Semenov (1964) and still largely ignored by Western specialists, may be a significant factor in preserving the antiquated and fallacious models of human cognitive, intellectual and technological evolution during the Pleistocene that continue to shape opinions in this discipline. Ideas and models based on quite inadequate understanding of the technologies of the distant past are thus fostered, leading to a massively skewed 'understanding' of the cognitive and intellectual context of these technologies which probably bears no relation to 'what really happened' in that distant past.

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