

6. Karabatsos, K., in *St. Louis Encephalitis Washington D C.* (ed. Monach, T. P.), American Public Health Association, 1980, pp. 105-158.
7. Matsumura, T., Shikari, E., Hotta, S. and Sashikara, T., *Proc. Soc. Exp. Biol. (N.Y.)*, 1972, 141, 599-605.
8. Reed, L. J. and Muench, H., *Am. J. Hyg.*, 1938, 27, 493.
9. Snedecor, G. W. and Cochran, W. G., *Statistical Methods*, Oxford and IBM, Calcutta, 6th edn, 1967, pp. 120-122.
10. Gollins, S. W. and Porterfield, J. S., *J. Gen. Virol.*, 1986, 67, 1941-1950.
11. Bloedhorn, H., *Zentralbl. Bakteriol. Parasitenkl. Infektionskr. Hyg. Abt. I*, 1963, 190, 149-153.

ACKNOWLEDGEMENTS. We thank Ms C. A. D'Mello, Mr M. P. Rajarshi and Mr K. Vijaya Simha for their skilled technical assistance.

Received 9 September 1997; accepted 17 October 1997

A new human fossil find from the Central Narmada Basin and its chronology

Anek Ram Sankhyan

Anthropological Survey of India, 27 Jawaharlal Nehru Road, Calcutta 700 016, India

We report here a clavicle fossil finding of the Early Stone Age Man from the Central Narmada basin in its bio-cultural context that sheds new light on the evolution of *Homo sapiens* in South Asia.

FOLLOWING the discovery of a partial cranium¹ of Fossil Man from the Central Narmada Valley, the Anthropological Survey of India launched an extensive hunt for the fossil and lithic relics of the Palaeolithic Man in the Central Narmada basin. Explorations were conducted during 1983 to 1992 between Jabalpur and Punasa (Khandwa) covering 50 sites that yielded a rich assemblage of over 700 lithic artifacts, mammalian fossils and a hominid clavicle. A monograph on these findings is in preparation. A brief reporting of the important hominid fossil finding in its bio-cultural context is made here retaining the detailed account slated for elsewhere.

The present hominid fossil (Figure 1) was recovered from the unit I of the Boulder Conglomerate² bed at Hathnora that previously yielded the hominid partial cranium. Hathnora is located 22 km crow-flight distance north-east of the town of Hoshangabad along the right bank of the Narmada in Sehore District (Madhya Pradesh). The specimen is a fully fossilized right hominid clavicle and is well preserved except for a minor erosion near the medial end. The robust and rugose character of the specimen and the fused medial epiphysis³ indicate an adult person in the age group of about 25 to 30 years.

The maximum total length of the fossil clavicle is 90 mm, which characterizes it as the shortest clavicle among the Middle to Late Pleistocene hominids, including East African *Homo erectus*, European and Middle East Neanderthals/early *Homo sapiens*. It is comparable only to the modern human pygmies, the Onges and the Andamanese in clavicular length. However, in its highly robust character (with very high caliber index of 45.6) it has no parallels among the known extinct and extant hominid clavicles. Coupled with other unique morphological characters like very rugose and rugged subclavian area, less-expanded medial epiphysis, well-developed rhomboid fossa, less axial torsion and relatively-flattened diaphysis, the Narmada hominid clavicle characterizes an archaic, robust, short and stocky hominid. On these counts, it stands uniquely different from African *Homo erectus* as well as from the Neanderthals and western archaic *Homo sapiens*. The present postcranial evidence thus opens up a new dimension for understanding the phylogenetic relationships of the Narmada hominid, which is hitherto considered either to be similar to the South-East Asian *Homo erectus*⁴ or to an European Neanderthal/archaic *Homo sapiens* on partial cranial⁵ or cultural⁶ evidence.

The lithic cultural evidence recovered by us from Hathnora comprises of 36 Late Acheulian to Microlithic tools. But most of these are surface collections from the top of the Boulder Conglomerate platform and probably was derived from the upper Concretionary Clays and Black Cotton Soil. Only 11 tools chiselled out from the unit I Boulder Conglomerate bed may be considered of *in situ* nature. These are assignable to the terminal phase of the Acheulian culture and include two small hand-axes, one flattish and another miniature biconvex, two small V-shaped cleavers, one flattish bifacial chopper, a small discoid, an awl, a backed knife, two side-cum-end scrapers and a notched one, all made on reddish, purplish and greenish quartzite pebbles. Late Acheulian tools have also been reported by other workers⁶⁻⁹ from the Hathnora Boulder Conglomerate as well as from the



Figure 1. Inferior view of the Narmada hominid right clavicle.

overlying Pink Clays. As such, although our collection from the Boulder Conglomerate horizon of the Central Narmada basin elsewhere is very rich in Early as well as Middle Acheulian tools, yet the Narmada Man at Hathnora could be associated with the Late Acheulian culture on the evidence available at present.

The cultural, biostratigraphic and absolute chronology of the Narmada Man at Hathnora is, however, debatable. The appearance of Acheulian culture in India is considered an event of earlier to 0.4 million years¹⁰ BP on Th²³⁰/U²³⁴ dating. The mammalian fauna in our collection from the Boulder Conglomerate horizon include cranial, dental and postcranial material belonging to *Bubalus palaeindicus*, *Bos namadicus*, *Equus namadicus*, *Elephas namadicus*, *Stegodon* sp., *Hexaprotodon palaeindicus*, *Cervus duvauceli*, etc. These are indicative of a Middle/late Middle to early Upper Pleistocene age, as also inferred by other workers. Coupled with the biostratigraphic and cultural evidence, the youngest Toba Ash horizon (ca. 75000 yrs BP) in the Narmada basin provides an estimate of 0.2 to 0.3 Myr¹¹ for the Hathnora Man. But considering the upper age limit of 0.7 Myr¹² for the Narmada sequence based on palaeomagnetic dates, the current opinion on Hathnora Man's dating is of an age above half a million years BP. This now seems reasonable in view of a K-Ar date of 0.67 ± 0.03 Myr¹³ for the Early Acheulian culture at Bori, Pune.

Our detailed Narmada Report would attempt reassessment of the evolutionary relationships of the Narmada Man in a global framework.

1. Sonakia, A., *Rec. Geol. Surv. India*, 1984, **113**, 159-172.
2. Khan, A. A. and Sonakia, A., *J. Geol. Soc. India*, 1992, **39**, 147-154.
3. Jit, I. and Kulkarni, M., *Indian J. Med. Res.*, 1976, **64**, 773-782.
4. Lumley, M.-A. de and Sonakia, A., *L'Anthropologie*, 1985, **89**, 13-61.
5. Kennedy, K. A. R., Sonakia, A., Chiment, J. and Verma, K. K., *Am. J. Phys. Anthropol.*, 1991, **86**, 475-496.
6. Badam, G. L., Ganjoo, R. K., Salahuddin, R. K. G. and Rajaguru, S. N., *Curr. Sci.*, 1986, **55**, 143-145.
7. Badam, G. L., in *Perspectives in Human Evolution* (eds Sahni, A. and Gaur, R.), Renaissance Publishing House, Delhi, 1989, pp. 153-171.
8. Bhattacharya, D. K. and Sonakia, A., *Changing Perspectives of Anthropology in India* (ed. Tiwari, S. C.), Today and Tomorrow's Printers and Publishers, New Delhi, 1989, pp. 313-320.
9. Lumley, H. de and Sonakia, A., *L'Anthropologie*, 1985, **89**, 3-12.
10. Misra, S., *Curr. Anthropol.*, 1992, **33**, 325-328.
11. Acharyya, S. K. and Basu, P. K., *Quat. Res.*, 1993, **40**, 10-19.
12. Agarwal, D. P., Kotlia, B. S. and Kusumgar, S., *Proc. Indian Natl. Sci. Acad.*, 1988, **A54**, 418-424.
13. Misra, S., Venkatesan, T. R., Rajaguru, S. N. and Somayajulu, B. L. K., *Curr. Anthropol.*, 1995, **36**, 847-851.

ACKNOWLEDGEMENTS. I express my gratitude to Drs R. K. Bhattacharya (Director), D. Tyagi and G. C. Ghosh for logistic support, and to several co-field explorers, notably Dr V. V. Rao, K.

Bagai, T. Basu, A. D. W. Rector and B. Bhattacharya. I was greatly benefitted through the expert discussions and data of Prof. Inderjit Diwan, and also from the comments of Professors Rewa Chowdhury, S. Kaul, Surya Prakash, A. K. Kalla and K. K. Guha. Other notable experts who examined the specimen include Drs A. C. Nanda, A. Sonakia, P. K. Basu, P. K. Mukhopadhyay, M. Ghosh, R. Gaur, M. P. Sachadeva, D. P. Das, S. Barua, etc. to whom also I owe thanks.

Received 28 February 1997; revised accepted 20 October 1997.

The mode of epibiont attachment on molluscs in Chandipur Beach, Orissa and its palaeontological implications

Tuhin Ghosh

Department of Geological Sciences, Jadavpur University, Calcutta 700 032, India

Epibionts attach themselves on hard parts of other organisms so as to complete their own life cycles. Host organisms may be dead or alive during the attachment time. Chandipur coast in Orissa, offers to study various types of marine epibiont attachments on other animals, particularly on molluscs. The nature of attachments provides clues to deduce life modes of the host molluscs and timing of attachments. Its paleontological implications are also explored.

EPIBIONTS attach themselves on live or dead shells of other organisms. The host may be sessile or mobile. Even in rock records there are numerous examples where epibionts are attached to diverse groups of host animals. The relationship between them is usually symbiotic or may be, in some cases, parasitic. In any case, it is possible to deduce the life habit and timing of attachment from the nature of attachment. By drawing analogy from the recent epibiont attachment we can have better insight into the problems encountered in the rock records.

The present study concerns observations on various epibiont attachments on different kinds of host organisms which help in determining the life habit of the latter and the timing of attachment, i.e. whether host was alive or dead during the epibiont infestation.

The Chandipur coast in Balasore district, Orissa (Figure 1) is characterized by very wide (~4 km) tidal flat fringed by a narrow beach on the northern side. The Buribalam river and its emerged terrace now covered with marsh is on the east; southward beyond the tidal flat and shoreface of the Balasore shelf is planer¹. The beach is skirted by aeolian dunes beyond which, further landward lies recent alluvium bordered by Nilgiri hills which are situated about 40 km from the studied coastline². The coastal zone is presently undergoing intense