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A FOSSIL ELEPHANT FROM THE MIDDLE PLEISTOCENE ALLUVIAL DEPOSIT OF NARMADA VALLEY, M. P.

C. TRIPATHI AND P. K. BASU

GEOLOGICAL SURVEY OF INDIA, 3 GOKHALE MARG, LUCKNOW 226001.

ABSTRACT

An upper jaw containing M^3 of a fossil elephant is described from the Middle Pleistocene alluvial deposits of Narmada Valley, near Dongaria Hoshangabad district, M. P. and is compared with those of the known species of *Elephas* occurring in Indian Subcontinent, Southeast Asia and Japan. This Narmada form, though conforming to *E. namadicus* Falconer & Cautley in molar tooth morphologies, shows quite high dental indices, typical of the latter. Relation of this Narmada form with those of Bankura in West Bengal, Son Valley in Madhya Pradesh and *E. naumani* of Japan has been discussed. A new subspecific or specific status to this Narmada form may well be justified; it is however not being done presently because of the scanty nature of material at hand. As such, this form is provisionally classed as the *Elephas namadicus*.

INTRODUCTION

The genus *Elephas* is represented in the Indian subcontinent by three extinct species viz; *E. planifrons* Falconer & Cautley, *E. hysudricus* Falconer & Cautley and *E. namadicus* Falconer & Cautley and the only extant species *E. maximus* Linnaeus i.e., the Asiatic elephant. The first two species are known from the Tatrot-Pinjor formations (Upper Siwaliks) of Lower Pleistocene age (Upper Pliocene to Lower Pleistocene of Opdyke et al., 1979; Azzaroli et al., 1981). The third species i.e. *E. namadicus*, on the other hand, is the only recognisable true elephant from the Middle Pleistocene alluvial deposits of the Peninsular India, e. g. Godavary alluvium, Narmada alluvium etc. Of much surprise is the absence of any fossil record of the extant species *E. maximus*, not explicable with any reason till now. The other fossil forms of *Elephas* known from Southeast and East Asia are *E. hysudrindicus* Dubois in Java and *E. naumani* Makiyama (*E. namadicus naumani* Makiyama) in Japan, both from Mid-Upper Pleistocene deposits.

Purpose of this paper is to describe an upper jaw containing both the last molars of a fossil elephant from the Middle Pleistocene alluvial deposits of Narmada Valley, M. P. and to compare this form with allied species of *Elephas*, especially *E. namadicus* and thus assess its taxonomic status as well as its phyletic position, if any. The specimen was collected by one of the authors (C. Tripathi) form the right bank of Narmada River near Dongaria, district Hoshangabad, M. P. in 1971 along with 3 Acheulian hand axes, all lying together in a gravelly matrix.

SYSTEMATIC DESCRIPTION

Family Elephantidae GRAY, 1821
Genus *Elephas* LINNAEUS 1935

Elephas cf. *namadicus*
(Pls. I and II)

Material : An upper jaw (GSI Type No. 18683) of an adult elephant, with partially preserved LM^3, RM^3 and RM^2 ; palate and broken bases of maxillo-premaxillary tusk sheaths.

Locality : Around Dongria village along Narmada River (22° 54′ 00″ : 77° 50′ 05″), district Hoshangabad, M. P.

Horizon : A 3 m. thick gravel bed lying directly over the Deccan Trap. Lower Narmada deposit, Middle Pleistocene. Above this gravel bed a 16. m. thick brown concretionary clay bed is found which is full of calcareous concretions.

DESCRIPTION

Upper Jaw : Just from the anterior root of the zygomatic process this jaw is broken dorsally. The posterior border of its palate is parabolic with a median interpalatine ridge projecting slightly; width of the palate at posterior border and between the anterior border of M^3 is 10 cm and 8 cm respectively. Distance between the check teeth and the base of the maxillo-premaxillary tusk sheaths is 10 cm; bases seem to be circular in outline.

Left third molar : This tooth is broken posteriorly from behind the 13th ridge plate, moderately worn, exposing the 10 ridge plates in the occlusal plane. The

grinding surface is narrowing posteriorly. The anterior five plates are maturely worn to expose the characters of 'Full Plates'. The worn enamel figures are irregular in outline; enamel coarsely and strongly folded showing mainly close folds. Coarse median loops are often present. Thickness of the enamel in the unfolded part of the enamel figure is 2 mm. The lingual halves of the three anterior plates are anteriorly placed than the corresponding buccal halves. The posterior five plates are less worn than the anterior ones. The wear figures of 6th and 7th plates are with central enamel portion and two lateral rings. The maximum number of lamellae in an unworn plate is 6. The ridge plates are thin, more or less closely spaced and is bathed competely in small cement. The maximum height of the crown is 205 mm and is measured on 12th plate. The maximum width of the crown is 69.9 mm and is on 4th plates. The plates are strongly ribbed laterally.

Right second molar : The last six ridge plates of this tooth are preserved and others were shed away. The three anterior ridge plates are broken. The 5th ridge plate is best preserved. It is evenly and closely folded with pointed median expansion.

Right third molar : The tooth is broken from behind the 12th ridge plate. The anterior six ridge-plates entered the grinding surface. The first two plates exhibit the character of maturely worn plates. The 1st plate is elliptical in outline, evenly and closely folded with pointed median expansions. The lingual portion of the plate still retains circular ring of enamel. The enamel figure of the 2nd plate is irregular in outline, with close to weak folding and median expansion. The enamel is thin to moderately thick. Plates are thin, closly spaced, bathed completely in small cement and ribbed strongly.

DISCUSSION

The origin and evolution of the family Elephantidae was due to presumed major adaptive shift from the ancestral gomphothere type of combined grinding-shearing dentition with lateral component to jaw movement, to a more nearly forward and exclusively horizontal shearing one (Maglio, 1972). This resulted in the rapid adaptive radiation and geographic expansion of the family. The phyletic trends in each lineages can be recognised in dental and cranial characters. Maglio (1972, 1973), Aguirre (1969) have shown that the different dental indices and dimensions can be used to distinguish between different species. These are: i) Increase in number of ridge plates especially on M^3, ii) Progressive thinning of the enamel covering the crown, iii) Increase in crown height which is expressed as ratio K= H/A, where K is the hypsodonty index, H is the maximum height of the unworn ridge plate and A is the maximum width of the crown, iv) Increase in relative packing of plates per unit molar length i.e., lamellar frequency (=no. of plates per 10 cm unit of length).

Aguirre (1969) prefers to use functional density of plates instead of using lamellar frequency. Functional density of plates is expressed by a formula Q=100 U/Lf where Q is the functional density, U is the number of plates actually working and Lf is the actual length of the grinding surface. This is, however, not agreed by Maglio, because, according to him, the functional density would vary in an individual during its life time, where as lamellar frequency is an invariable parameter. The authors are also inclined to agree with Maglio's contention.

Besides these biometrical parametres, morphological characters of the worn enamel figures of the ridge-plates also seem to be more or less species-constant. It has also been seen that the enamel tends to be more and more folded and plicated in advanced forms.

The present Narmada specimen when compared in molar morphology with the allied species of *Elephas*, shows its close resemblence with *E. namadicus* Falconer & Cautley, *E. antiquus* Falconer and *E. namadicus naumani* Makiyama. Maglio (1973) subsumed *E. antiquus*, *E. namadicus naumani* in *E. namadicus*, because in all these forms, the worn enamel figures of the ridge-plates usually show regular elongate, elliptical outline with even and close folds often with *pointed median expansion* on the vertical face of the plates. Moreover, at a medium stage wear, the worn ridge-plates show two lateral rings and a broad central portion of enamel (Maglio, 1973). Same observations on the similarily of molar morphologies in these forms were also made by Aguirre (1969). The worn enamel figures of *E. plainiforms*, *E. hysudricus*, *E. hysudrindicus* and *E. maximus* generally show irregular outline with small open folds in the middle without any median expansion. Median expansion, if present in *E. hysudricus*, is weakly developed (Maglio, 1973). The present Narmada specimen shows its ready distinction with these species of *Elephas* in having pointed median expansion of the enamel figure as seen in *E. namadicus*.

Kamei & Taruno (1973) consider the Japanese elephant (=*E. namadicus naumani* Makiyama) as a separate species *E. naumani* (Makiyama), because the individual upper third molars of this elephant show a constant high hypsodonty index (230—320) and lamellar frequency (6-8) while conforming to *E. namadicus* in molar tooth morphologies (as in Maglio 1973). Moreover, the tusks of *E. naumani* are strongly curved in mature males (Osborn, 1942; Hasegawa, 1972) where as these are straight in *E. namadicus* (Aguirre, 1969; Maglio, 1973). Further, the Japanese elephant from Lake Nojiri was associated with subarctic type of fauna (Kamei & Taruno, 1973) and thus was ecologically and geogra-

phically separated from the type population of *E. namadicus*.

Most of the biometrical parameters of *E. namadicus* as shown in Maglio (1973) are wide ranging. These are: width of the crown (62-101 mm), height of the crown (137-218 mm), lamellar frequency (4.5-7.7), thickness of enamel (1.8-3.0 mm) and hypsodonty index (135.6-298.6). It will be evident from the table that the values of these parameters for other species of *Elephas* are not as wide ranging as in *E. namadicus*. The higher values of these parameters for *E. namadicus* are seemingly those of latest mutants.

In this context, the present Narmada specimen shows much advanced characters in having very high hypsodonty index (293. 2), high lamellar frequency (7.5) and thin enamel (2 mm). Length of M^3 of this specimen can not be ascertained, and so also the total number of ridge-plates, as this is broken after 13th plate (in LM^3). These 13 plates are accommodated in a length of 168 mm. whereas the number of plates are rather less in other species in the same length of 168 mm (Table 1). This would indicate the present form as a small toothed animal of moderate size even if it possessed 19 or 20 ridge-plates.

The recently described M^3 of *Palaeoloxodon* sp. (=*Elephas* sp. by the authors) form the Upper Pleistocene alluvial deposits of Bankura, W. Wengal (Dassarma et. al., 1982) is also narrow, highly hypsodont (=280) and has a lameller frequency 6 with enamel thickness 2.3 mm, and this is more or less similar with the present Narmada specimen though the latter shows higher lamellar frequency (>.5). This Bankura M^3 and an M^2 from Son Valley have been shown by Dassarma et al. (1982, 1977) to closely compare with those of *E. naumani*, especially with the most advanced forms of latest Pleistocene.

A big tusk (1970 mm long measured along the curvature) was also reported in close proximity of M^3 in Bankura by Dassarma et al., (1982). According to them, this tusk, in all probability, belonged to an elephant possessing that M^3. This curve-tusked elephant having molar comparable to *E. naumani* which is also curve-tusked, suggests its probable distinction from the straight-tusked *E. namadicus* (including *E. antiquus*).

The type population of *E. namadicus* from Narmada Valley has broad M^3 (width=101 mm). Other dental characters such as hypsodonty index, thickness of enamel etc. are not known to the authors for its comparison with the present Narmada and Bankura specimens. As it has been mentioned that M^3 of Narmada specimen is identical with M^3 of curve-tusked Bankura elephant it may seem that this present Narmada elephant was not strainght-tusked like *E. namadicus* (including *E. antiquus*). Forms of *E. naumani* of latest Ple-

Table 1. Dimensions and indices of upper third molars of species of *Elephas* and present Narmada form. (GSI Type No. 18683).

	E. planifrons[1]	*E. hysudricus*[1]	*E. hysudrindicus*[1]	*E. maximus*[1]	*E. namadicus*[1]	*E. naumani*[2]	E. S/at (Bankura Specimen)	Present specimen (GSI Type No. 18683).
No. of plates	8—12 10(M)	12—15 13.5(M)	18	22—27	12—16 14.3(M)	17—19	18	13+
Length of molar	201—292 238.2(M)	235—302 267.7(M)	293.2—316.6 304.9(M)	244—282	223—317 271.3(M)	211—278	315	168+
Width of Crown	86—111 98.7(M)	93—107 97.2(M)	72.3-82.5 77.4(M)	80—98	61—101 84(M)	81—95	86	69.9
Height of Crown	76—129 94.2(M)	108—137.2 125.4(M)	128.4—149.3 138.8(M)	187—214	137—218 175.5(M)	195—254	246	205
Lamellar frequency	2.6—5.5 4.2(M)	3.9—6.5 5.4(M)	6.5	5.0—9.0	4.5—7.7 5.7(M)	6—7	6	7.5
Enamel thickness	2.8—4.8 3.9(M)	2.5—4.8 3.2(M)	2.6—2.7 2.6(M)	2.5—3.0	1.8—3.0 2.4(M)	2.0—3.2	2.3	2.0
Hypsodonty index	80—110.0 97.6(M)	112.5—147.2 131.2(M)	177.5—182.3 197.9(M)	150—250	135.6—298.6 212.4(M)	230—320	280	293.2

1—Maglio (1973) M indicates Mean Value.
2—Kamei & Taruno (1973)
3—Dassarma *et al*,, (1982)

istocene deposits show aavancement especially in hypsodenty index (230-320) over the forms from older deposits and thus may deserve new subspecific or specific status (Kamei & Taruno, op. cit.). M^3 of the present Narmada and Bankura elephants show rather very high hypsodonty index which fall in the much higher part of this value of *E. namadicus*. These narrow, hyperhypsodont molars with curved tusk (in case of Bankura) are suggestive of at least a subspecific status for these forms. The skull of *E. namadicus* is characterised by the presence of a strong frontoparietal transverse torus overhanging the forehead. We are not aware if the present Narmada and Bankura elephants also possessed this cranial character. We also do not know the exact horizon of type *E. namadicus* in relation to these forms and so cannot substantiate their subspecific or specific status employing the standard statistical methods. It seems, therefore, preferable to place the present Narmada specimen provisionally as *Elephas* cf. *namadicus* until more comparable material is found form well-documented stratigraphic horizons.

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EXPLANATION OF PLATES

PLATE I

Elephas cf. *namadicus*
(GSI TYPE NO. 18683)
Upper Jaw

1— Palatal view exhibiting RM^2, RM^3 & LM^3 X.4
2— Left lateral view X.4

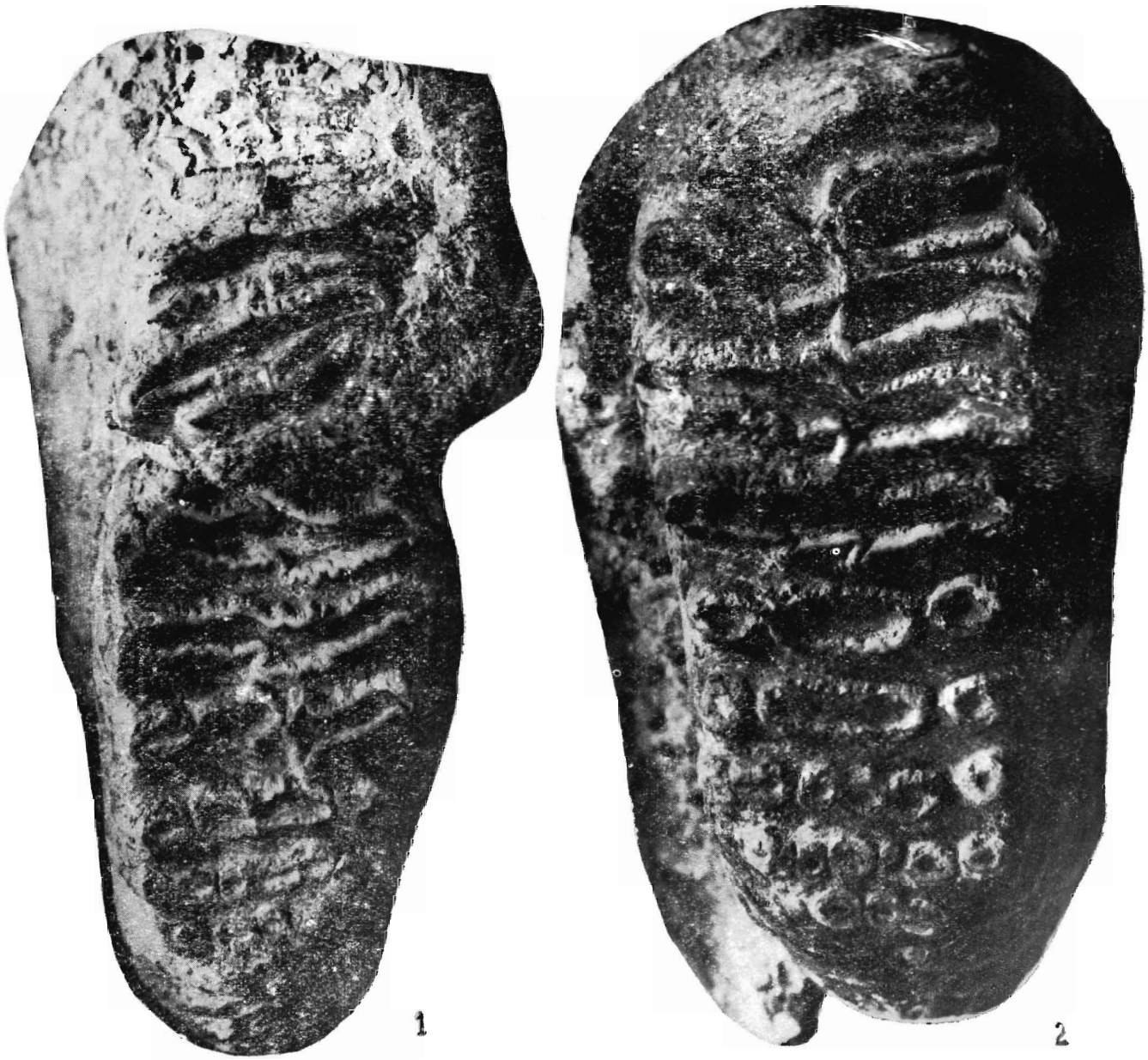
PLATE II

Elephas cf. *namadicus*
(GSI TYPE NO. 18683)

1— RM^3 & RM^2, Occlusal view X.8
2— LM^3, Occlusal view, Natural size

1

2


1
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