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PALAEOECOLOGY AND ADDITIONAL MATERIAL OF *ELEPHAS* (ELEPHANTIDEA, PROBOSCIDEA) FROM TATROT FORMATION OF UPPER SIWALIKS OF NORTH INDIA

SURESH KUMAR AND HARI BHAJAN SINGH CHAUHAN

ABSTRACT

The present paper describes and reports fossil material of Elephas planifrons from the Tatrot Formation (Pliocene) of the Upper Siwaliks of north India. The present specimen (HNBUA/SK- 16/3), is a part of a left maxillary third molar collected from northwest of Khetpurali Village near Naraingarh Town (Haryana). The present paper restricts itself to systematic description of Elephas planifrons collected from Tatrot Formation of Upper Siwaliks of India. However, some comments about the palaeoecological conditions in the form of the habitat spectra have been included, which indicate a more open landscape with bushland, grassland and scattered wood cover.

Keywords: *Elephas, Elephantidae, Tatrot, Upper Siwaliks*

INTRODUCTION

The Upper Siwaliks of Indian Subcontinent exposed near Naraingarh Town, Haryana have yielded a rich collection of fossil mammals (Gaur, 1987; Kumar, 2009, 2014, 2022; Kumar and Gaur, 2013, 2015). The studies on fossil proboscidean were carried out by various authors namely Osborn (1942), Chakravarti (1965), Aguirre (1969), Maglio (1973), Nanda (1976), Sarwar (1977), Tassy (1983), Ganju (1985), Gaur (1981,1986,1987), Rai (2004) and Kundel *et al.* (2017). The fossil taxon *Elephas* was erected by Linnaeus (1758). The genus *Elephas* from the Upper Siwaliks of Indian Subcontinent are represented by three species, viz. *E. planifrons, E. hysudricus, E. platycephalus* (Gaur, 1987). There are only two living species of elephants, namely *Elephas maximus* (Asian) and *Loxodonta africana* (African), which are present today. The present paper is mainly focused on the systematic description of *Elephas planifrons* collected from Tatrot Formation of Upper Siwaliks of north India. In

Suresh Kumar (Corresponding Author), Assistant Professor, Department of Anthropology, Hemvati Nandan Bahuguna University, Garhwal, Srinagar-246174, India E-mail: sureshmalhotra76@yahoomail.co.in; **Hari Bhajan Singh Chauhan**, Professor & Head, Department of Anthropology, Hemvati Nandan Bahuguna University, Garhwal, Srinagar-246174, India, E-mail: hbsanthro@gmail.com

addition, some comments about the palaeoecological conditions in the form of the habitat spectra have also been included.

The fossil material under description (HNBUA/SK- 16/3), is a part of left maxillary M^3 of *Elephas planifrons* was collected *in situ* from the Tatrot Formation (Figure-1) of the Upper Siwaliks of north India. The fossil specimen was collected from greyish brown sandstone layer of Tatrot Formation exposed about 0.55 km northwest of Khetpurali Village (Figure-3).

Table-1: Comparative measurements (mm) of the maxillary third molars of Elephas planifrons

Measurement		Present specimen	*Elehas planifrons* Gaur, 1987		*Archidiskodon planifrons* Nanda, 1976	*Archidiskodon. planifrons* Osborn, 1942, p. 954			*Archidiskodon planifrons* Falconer and Cautley,1846, Pl.14, fig.8
		HNBUA/SK 16/3	PUA 78/80	PUA 77/106	CASGF A/216	198.8	199.5	198.8	
Maximum mesio-distal diameter (L)	M^3	70.1+	169.8+	115.5+	232	254.0	219.0	201.0	270
Maximum bucco-lingual diameter (B)	M^3	94.04	85.5	107.5	93	96.5	100.	88.0	93
Maximum height	M^3	71.0	73.3	64.0	72	102.0	88.0	95.0	
Numbers of ridges	M^3	6+	11	3.5+	12	12+	12	11+	6+
Thickness of enamel	M^3	3.5	3.5	4.4	3.5	--	--	--	--
Lamellar frequency	M^3	5.5*	6.5	--	4.8	5.5-6.0	4.0	5.5	3.3

*Estimated

MATERIAL

The present paper is based on a fossil specimen (HNBUA/SK- 16/3) collected by the first author from northwest of Khetpurali Village of Panchkula District of Haryana State.

SYSTEMATIC DESCRIPTION

Class	Mammalia	Linnaeus, 1758
Order	Proboscidea	Illiger, 1811
Family	Elephantidae	Gray, 1821
Genus	*Elephas*	Linnaeus, 1758
Species	*Elephas planifrons*	Falconer and Cautley, 1845

Present Material: HNBUA/SK- 16/3, part of a left maxillary M^3 (Figure-2a,b,c) .

Horizon: Upper Siwaliks, Tatrot Formation.

Locality: About 0.55 km northwest of Khetpurali Village.

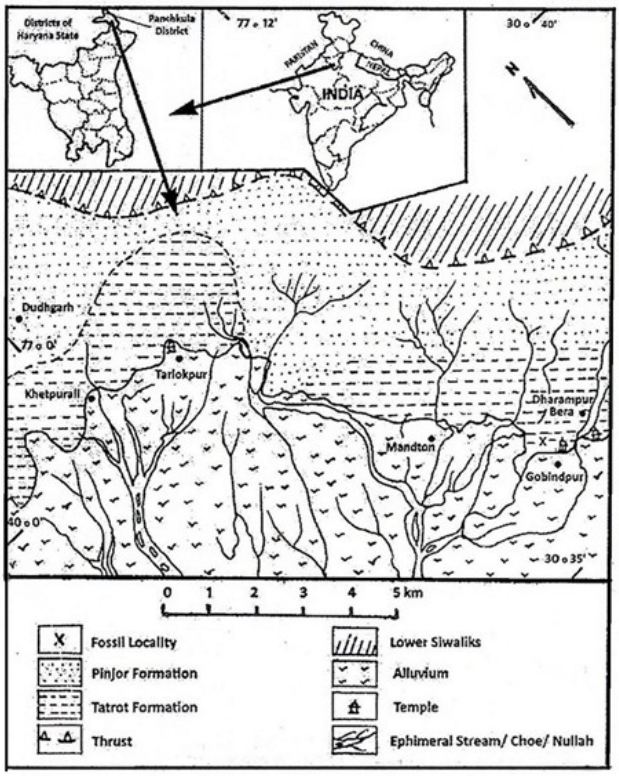

Figure-1: Generalised locality map of the area (After Kumar and Gaur, 2013)

The present specimen (HNBUA/SK- 16/3), is a part of a left maxillary third molar M^3. In the anterior part of the molar the plates have been somewhat distorted due to the excessive wear. Distally the molar is broken in the middle of the sixth plate only the anterior wall of the sixth plate is preserved. The anterior side is heavily worn than the posterior side. The occlusal aspect of molar displays six plates. The plate shows some enamel folding. A majority of the plates show lozenge-shaped expansion in the middle, which is a characteristic feature of *Elephas planifrons*. The space between the plates is completely filled with brownish cement, which also covers the lingual and buccal sides of the molar. The enamel shows crimping, particularly in the expanded part of the plates and in its upper portions. Although only, six plates of this specimen are preserved, but the estimated lamellar frequency of the specimen could be roughly 5.5mm. The molar shows a slight reduction in plate width towards the posterior side. The roots are completely broken in the present specimen. The maximum thickness of enamel was found to be 3.45 mm.

The **first plate** is heavily worn and only a small part of enamel plate is visible on the antero-buccal aspect, which is mainly fused with the second plate

as a result of having abrasion. The **second plate** is also heavily worn and only the small part of the anterior wall on the buccal side and only the posterior enamel wall is preserved. The enamel shows characteristic crimping. The valley between the second and third enamel plate is slightly broad in the buccal side and becomes narrow towards the lingual side. The posterior enamel of second plate and anterior enamel of third plate almost touch each other in the middle. The **third plate** is slightly larger than the second plate. The enamel on the lingual corner of this plate is slightly broken. The crimping of the enamel can be seen in this plate also. A thick layer of cement can be seen between the plates. The plate displays the characteristic widening in the middle. The valley between the third and fourth plate is narrow in the middle due the median expansion of the plates.

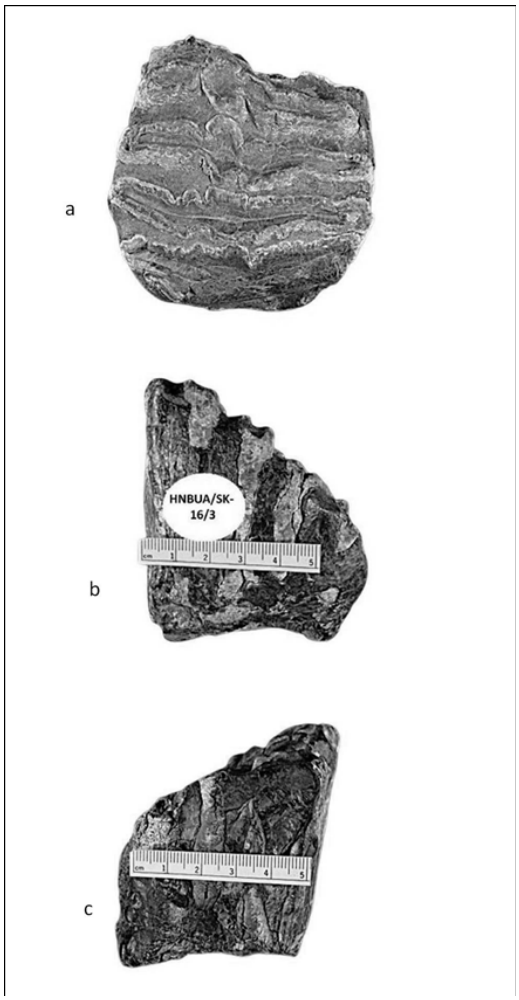

Figure-2: HNBUA/SK-16/3, a part of left maxillary molar of *Elephas planifrons* from Tatrot Formation (a- occlusal view; b- buccal view; c- lingual view)

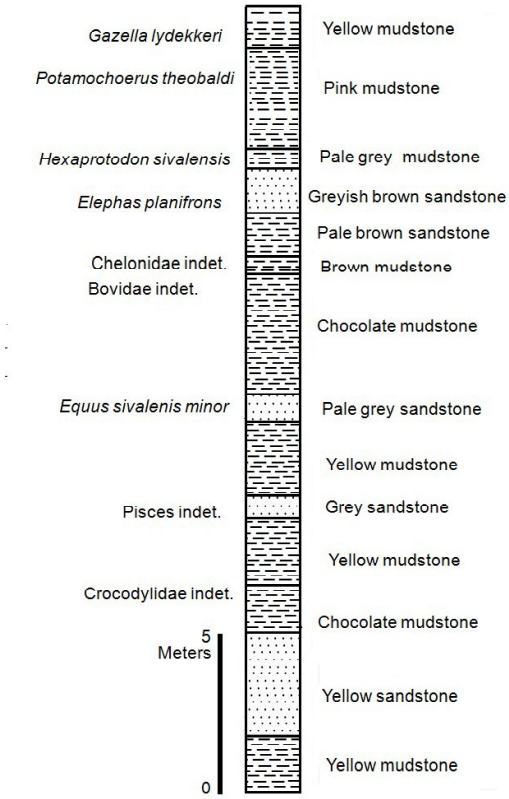

Figure 2: Local stratigraphic section of the Tatrot Formation of the locality

Figure-3: Local stratigraphic section of the Tatrot Formation of the locality (After Kumar and Gaur, 2013)

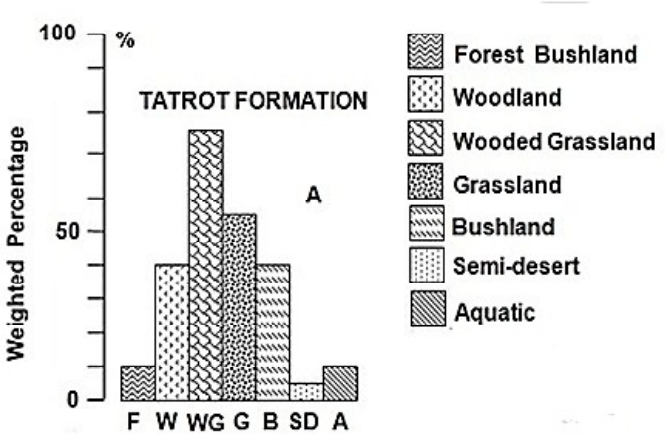

Figure-4: Habitat spectra analysis of Tatrot mammalian fauna showing major habitats (Modified after Gaur and Chopra, 1984; Gaur, 1987)

The enamel of the **fourth plate** is slightly chipped on the lingual corner. The fourth plate shows the complete enamel loop. Like the previous plates, the fourth plate is expanded, both anteriorly and posteriorly, in its middle. The valley between the fourth and fifth plate has considerably narrowed down in the middle due to expansion of plates of fourth and fifth plates. The **fifth plate** is well-preserved and the least worn. It is slightly smaller than the previous plates. The buccal side shows an enamel island. A lozenge- shaped central enamel loop is clearly visible in the centre. As in the case of the previous plates, the enamel border, of this plate also shows crimping. The cement-filled valley in between the fifth and sixth plate is narrow in the middle. The sixth plate is only partially preserved and only its anterior border is present.

DISCUSSION

Since, the discovery of *Elephas planifrons* by Falconer and Cautley (1845) there is some confusion regarding its generic name. However, subsequent workers gave different names to it, such as *Elephas* (*Loxodon*) *planifrons* (Falconer, 1868), *Loxodon planifrons* (Lydekker, 1880) and *Archidiskodon planifrons* (Pohling, 1882). Osborn (1942), considered the genus *Archidiskodon* as a valid genus with two known species namely, *Archidiskodon meriodionalis* and *Archidiskodon planifrons*. Garutt (1957), later on assigned *Archidiskodon planifrons* to the genus *Protelephas*. Gaur (1987) preferred to use the name *Elephas planifrons* instead of *Archidiskodon planifrons*. Maglio (1973), while carrying out a detailed revision of family Elepahntidae, rejected the validity of the genus *Archidiskodon* and grouped it under the genus *Mammuthus*. However, Azzaroli (1977) differed Maglio (1973) and retained *Archidiskodon* as a separate genus different from *Mammuthus*. The species *Elephas planifrons* was assumed to be ancestral to the European species *Elephas meridionalis*. The present author has used the name *Elephas planifrons* instead of *Archidiskodon planifrons* following Falconer (1868), Aguirre (1969) and Gaur (1981, 1987).

The present specimen is easily differentiated from the genus *Stegodon* by its relatively higher ridges and V- shaped valleys, which are completely filled with cement. Further, the present specimen can be distinguished from *Elephas hysudricus* by the presence of mid expansion of plates which is a characteristic feature of this species. The present specimen shows some folding of enamel, which is completely different from the very fine and minute enamel folding seen in the species, *Elephas hysudricus*. The enamel thickness of the present specimen is 5.5mm, which falls in the range of *A. planifrons* when plotted on the chart of Aguirre (1969). Gromova (1968) suggested lamellar frequency range for the genus *Archidiskodon* ranged from 4 to 6.5 mm. However, Osborn (1942) has recorded lamellar frequencies up to 6 mm for the maxillary molars of *E. planifrons*. Though the complete molar is not preserved in the present case, but the estimated lamellar frequency of the present specimen could be 5.5 mm which falls with the range of *Archidiskodon* a suggested by Gromova (1968). Thus,

the morphological characters, enamel thickness and lamellar frequency of the present fossil material a left M^3 falls well within the range of *Elephas planifrons*. Thus, it is assigned here to *Elephas planifrons*.

Palaeoecological Conditions during Tatrots:

The Middle Sivaliks of the Indian Subcontinent were characterised by woodland and open woodland conditions (Gaur, 2016). During Pliocene, the landscape started changing and the more wooded conditions of the Miocene time changed to more open country conditions, with distinctly less tree cover. It is believed that elephantids, such as *Elephas planifrons*, had some role in opening up the erstwhile wooded landscape (Gaur, 1987). Researchers, such as Gaur and Chopra (1984), Gaur (1987, 2016), utilised the habitat spectra analysis of mammalian fauna of Upper Siwalik deposits (Figure-4) to reconstruct the palaeoecological and palaeoenvironmental conditions of this area and concluded that the Tatrot climate was less humid than the Middle Sivaliks and its landscape largely consisted of scattered tree cover with bushland and some grass covered areas.

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