

NEW REMAINS OF *BRACHYPOTHERIUM FATEHJANGENSE* FROM LOWER SIWALIK HILLS, PUNJAB, PAKISTAN

A. M. Khan, A. Habib, M. A. Khan*, M. Ali and M. Akhtar*

Department of Zoology, University of the Punjab, Lahore (AMK, AH, MA, MA),

*Department of Zoology, Government College University Faisalabad (MAK).

Corresponding author email: memorablefish123@gmail.com

ABSTRACT

The new unpublished remains of *Brachypotherium* are described. The material collected from the Chinji Formation includes four upper premolars; two upper molars; one lower premolar and a fourth lower milk molar. On the basis of brachydont teeth, the large size, wide and evenly flat or slightly concave ectoloph surface behind the rather insignificant paracone rib in the lower milk molar, persistence of internal cingula on its upper cheek teeth and of the external cingula on its upper and lower molars, the specimens are assigned to *Brachypotherium fatehjangense*.

Keywords: *Brachypotherium fatehjangense*, Chinji Formation, Lower Siwaliks.

INTRODUCTION

The genus *Brachypotherium* is well known from the Western Europe, Central Europe, Anatolia (Turkey) and from Dhok Pathan, Nagri, Upper Chinji and Middle Chinji Groups of the Siwaliks (Heissig, 2003). Heissig (1972) claimed to have identified *Brachypotherium* as far back as in the Kamlial Formation of the Lower Siwaliks. *Brachypotherium* have a dental formula of 1.0.4.3 / 1.0.4.3., with well-developed upper and lower tusks. The lower tusks of the genus are long, sub-parallel and pointing upwards (Cooper, 1934). *Brachypotherium* has rather primitive teeth but developed some specializations of its own (Gentry, 1987).

The new remains are collected from the Chinji Formation of the Lower Siwaliks during various field works made by the students of the Zoology Department, Punjab University, Lahore, Pakistan for the last decade. Therefore, exact locality positions are not known and prefer to use the Chinji Formation for the material; the only locality information is known from the preliminary data. The "Chinji Zone" of Pilgrim (1913) and "Chinji Stage" of Pascoe (1963) consists of interbedded sandstone, silty clay and siltstone were later on reformed as "Chinji Formation". The type section is exposed near Chinji village (Late. 32° 41' N., Long. 72° 22' E.). The Chinji Formation in the Potwar Plateau is dominantly composed of bright red and brown orange siltstone interbedded with ash-gray sandstone (Willis and Behrensmeyer, 1994).

MATERIALS AND METHODS

The available material of *Brachypotherium* from the Chinji and the Nagri formations comprises some

isolated and partially broken premolars and molars. Determination at species level can be attempted for the teeth, based on extensive and reliably determined material from the Middle Siwalik localities. The specimens were found partly exposed and collected during the various field work by the authors (AMK, AH, MAK, MA and MA).

The fossils are housed in the Abu Bakr Fossil Display and Research Center of the Department of Zoology, University of the Punjab, Lahore, Pakistan. The specimens catalogue in two series i.e. serially catalogue number and the yearly catalogue number. The upper figure denotes the collection year, while the lower one denotes the serial number of the respective specimen. Measurements of the specimens are given in millimeters, and taken with the help of metric Vernier Calipers. Tooth cusp nomenclature follows Heissig (1972). Tooth length and breadth were measured at occlusal level.

SYSTEMATIC PALAEONTOLOGY

Superfamily RHINOCEROTOIDEA Gray, 1825

Family RHINOCEROTIDAE Gray, 1821

Tribe RHINOCEROTINI Gray, 1821

Genus *BRACHYPOTHERIUM* Roger, 1904

Brachypotherium fatehjangense (Pilgrim, 1910)

(Plate 1, figs 1-7; Table 1-2)

Type specimen: 1956, 2: 428, a second right lower premolar.

Distribution: Lower to Middle Siwaliks.

Referred Material: PUPC 07/105 and PUPC 07/109 right upper second premolars, PUPC 02/148 a damaged right upper second premolar, PUPC 07/106 a left upper third premolar, PUPC 07/108 a left upper first molar, PUPC 02/151 a damaged right upper third molar, PUPC

07/104 a left lower second milk molar, PUPC 08 a right lower second premolar (PUPC-Punjab University Palaeontological Collection).

Locality: Chinji Formation of Pakistan (Lower Siwaliks).

Description: PUPC 07/105, the median valley is very open, antecrochet is moderately present, ectoloph is broken and the metaloph is complete. The premolar is in late wear. Cingulum and crista are absent. The premolar is slightly worn on the anterior side. Crochet is prominently present. Posterior fossette is also present. Anterior fossette is present but it is in late wear. Protocone is slightly extended.

The median valley is moderately deep in PUPC 07/109 and the ectoloph is broken completely. The cingulum is present heavily on the anterior side. The tubercles are present very prominently on the lingual and on the posterior side. Anterior fossette is very prominent. Protocone is slightly extended. Antecrochet is very prominent. Crista and crochet are absent.

PUPC 02/148 is a damaged specimen however, the crochet is absent. The protocone is slightly extended as compared to the hypocone in PUPC 07/106. The metaloph is incomplete and the protoloph has broken away. The protocone is a strong lingual-anterior pillar, well separated from the hypocone pillar due to the presence of a medisinus. Crista and crochet are absent. Parastyle has broken off. Medifossette is present.

In PUPC 07/108, protocone is somewhat constricted. Metaloph has broken away. The hypocone is not constricted and the molar is covered with thin irregular cement on its anterior and posterior sides. Protocone slightly extended. Hypocone slightly cracked due to prolonged seasonal weathering. The entrance of the median valley is open but it is narrow anteriorly owing to the presence of antecrochet. The median valley is much more widely open. The anterior, posterior and lingual cingulum is well developed. The lingual cingulum forms a weak pillar at the entrance of the median valley. The anterior fossette is very prominent. Crochet is absent. Ectoloph has broken off. The enamel is rugose and is mostly present all over the crown. The molar is in late wear. Crista is absent. Medifossette is present. Antecrochet is weakly present. Metastyle and parastyle are broken.

PUPC 02/151 is a right third upper molar. The molar is largely broken. The parastyle is marked forming an obtuse angle with the ectometaloph. The protoloph is present with strong anterior constriction. The molar is roughly triangular shaped due to the bending back of the ectoloph and its fusion with the metaloph. The protocone and medisinus have broken away. Two spur-like enamel projections are present in the broken medisinus and extend along its vertical height. The enamel is moderate in thickness. Vertical groove is present prominently on the labial side. Cingulum is present on the posterior side.

Posterior fossette is also present. Parastyle fold is weakly present. Crochet is absent. Hypocone is broken. Paracone is present.

PUPC 07/104 is a left second lower milk premolar. Median valley is present on the lingual side and it is moderately deep. The median valley possesses a V-shaped profile in the lingual view. Anterior side of the premolar is slightly extended. The premolar is mostly broken posteriorly. Ectolophid is complete. The ectolophid (labial) groove is U-shaped, prominent and smooth. Posterior valley is weakly present because it is in late wear. Crista is absent. Labial and lingual cingula are present. The premolar is in late wear, so most of the characters are inconspicuous.

The observed characters in the new remains that are reduced paraconid and an open posterior valley, low and asymmetrical anterior cingulum (less than half of the apparent height of crown most of it being situated labially to the anterior crest), the posterior cingulum extends until the posterior groove of the ectolophid (its height is important on the posterior side and decreases anteriorly until the level of the anterior cingulum) correspond to *B. fatehjangense*. All these characters are observed in the studied material, which clearly identify it to genus *Brachypotherium*. The specimens morphologically and metrically (Table 1-2; Figs. 1-7) resemble to *B. fatehjangense* and the new remains recovered from the Chinji Formation are assigned to *B. fatehjangense*.

COMPARISON AND DISCUSSION

B. fatehjangense shows many similarities with *B. brachypus* on the basis of the characters discussed below. Compared to *B. brachypus* from France, described by Cerdeño (1993), the lower second milk premolar seems smaller in width as compared to the premolars and molars. The left lower second milk premolar in *B. fatehjangense* is also smaller in width and compressed as compared to premolars and molars. The lower second milk premolar in *B. brachypus* is also smaller in size and a little conical. *B. fatehjangense* is also of small size and is mostly conical.

B. fatehjangense also show dissimilarities with *B. brachypus* on the basis of the characters discussed below. In *B. brachypus* cingulum is present at the ends of the labial face. In *B. fatehjangense* labial and lingual cingulum is present. Some convexity is also present on the labial furrow of *B. brachypus*. But the labial furrow of *B. fatehjangense* shows very prominent convexity. Teeth of *B. brachypus* are larger than the teeth of *B. fatehjangense*. *B. brachypus* has great dimensions; very thick enamel and furrow of the ectolophid is very inconspicuous (Antoine *et al.*, 2000). *B. fatehjangense* has smaller dimensions; moderate enamel and furrow of the ectolophid is very conspicuous. The upper second premolars of *B. brachypus* differs from *B. fatehjangense*

Table 1. Dimensions of *Brachypotherium fatehjangense* from the Miocene of Pakistan. All measurements are expressed in millimeters. In case of width, maximum crown width has been taken. ^aFrom Heissig (1972).

Taxon	Specimen	Locus/level	Age	Length	Width
<i>Brachypotherium fatehjangense</i>	PUPC 07/105 right P2	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	27.1	-
<i>B. fatehjangense</i>	PUPC 07/109 right P2	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	25.2	-
<i>B. fatehjangense</i>	PUPC 02/148 right P2	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	25.4	-
<i>B. fatehjangense</i>	PUPC 07/106 left P3	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	27.9	-
<i>B. fatehjangense</i>	PUPC 07/108 left M1	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	33.2	-
<i>B. fatehjangense</i>	PUPC 02/151 right M3	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	26.2	-
<i>B. fatehjangense</i>	PUPC 07/104 left dP/2	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	28.1	19.4
<i>B. fatehjangense</i>	PUPC 08 right P/2	Chinji (Lower Siwalik, Pakistan)	Lower Miocene	29.0	22.0
<i>B. fatehjangense^a</i>	1956, 2: 428 right P/2	Middle Chinji (Lower Siwalik, Pakistan)	Middle Miocene	27.0	16.0

Table 2. Comparative measurements of the cheek teeth of *Brachypotherium fatehjangense*, *Brachypotherium brachypus*, *Brachypotherium perimense* in millimeters.

	P ²		P ³		M ¹		M ³		dP/2		P/2	
	L	W	L	W	L	W	L	W	L	W	L	W
<i>B. fatehjangense^a</i>	25.2	-	27.9	-	33.2	-	28.1	19.4	28.1	19.4	32.3	19.6
	25.4	-										
	27.1	-										
<i>B. brachypus</i>	32.6	-	35.5	-	46.3	-	30.0	16.7	30.0	16.7	-	-
	34.5	-										
	34.9	-										
<i>B. perimense</i>	32.5	-	-	-	-	-	29.7	15.6	29.7	15.6	-	-
<i>B. fatehjangense^b</i>	-	-	-	-	-	-	-	-	-	-	29.0	22.0

In case of width, maximum crown width has been taken. ^a*B. fatehjangense* from chinji formation. ^bfrom Chavasseau *et al.*, (2006).

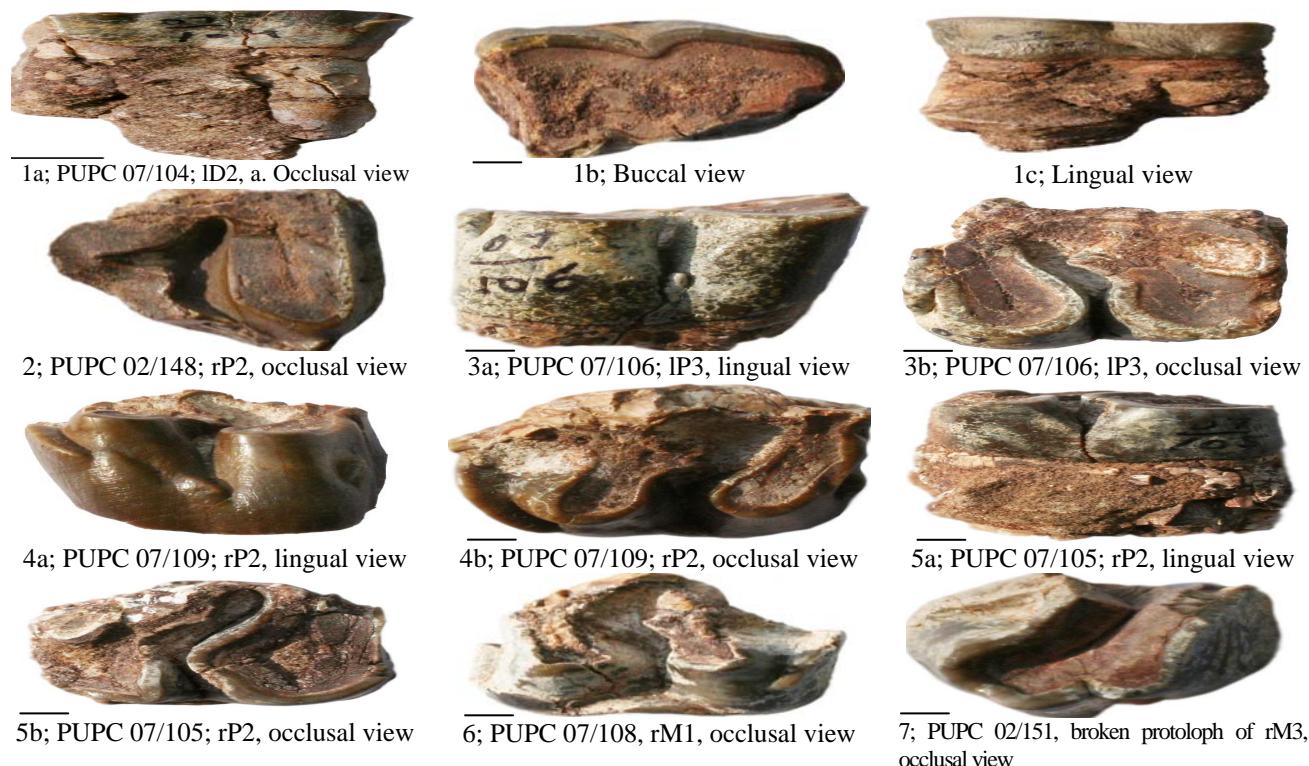


Plate 1; Figs. 1-7, *Brachypotherium fatehjangense*, Scale bar 20mm

because in *B. fatehjangense* labial cingulum and crista are present. While crista is absent in the premolars of *B. fatehjangense*. This character separates *B. fatehjangense* from *B. brachypus*. In the upper third premolar of *brachypus* from Chevilly, cingulum and crista are present, but crista is absent in the premolars of *B. fatehjangense*. This character separates *B. fatehjangense* from *B. brachypus*. The upper first molar of *B. brachypus* from Baigneaux, differs from *B. fatehjangense* due to presence of a continual lingual cingulum and crista (Cerdeño, 1993). While crista is absent in the molars of *B. fatehjangense*. The upper third molar of *B. brachypus* from Baigneaux, differs from *B. fatehjangense* due to presence of antecrochet; continuous lingual cingulum and crista; the third molar of *B. brachypus* is a little broader as compared to other *Brachypotherium* species (Cerdeño, 1993).

The lower second milk premolar of the *B. perimense* differs from *B. fatehjangense* because smooth external groove is present but is hardly marked (Heissig, 1972). While in *B. fatehjangense* the external or vertical groove is prominently marked. The lower second milk premolar of *B. perimense* differs from *B. fatehjangense* by having wider milk premolars with close dimensions (Cerdeño and Hussain, 1997).

B. Fatehjangense has been discovered from the Chauntha, Burma (Chavasseau *et al.*, 2006) and from the chinji formation (Heissig, 1972). *Brachypotherium fatehjangense* is also found in nagri, upper chinji and lower chinji of the siwalik regions (Heissig, 2003). The chinji formation of the lower siwaliks shows drier habitat (Heissig, 2003), because of which *b. Fatehjangense* of the chinji formation, lower siwaliks, is morphologically different (smaller in size) from *brachypotherium perimense* from the manchar formation of sind and dang valley of Nepal, which is larger in size because of having humid/swampy habitat (West *et al.*, 1978). The *brachypotherium* is supposed to have a preference for soft diet and a more forested environment (Andrew *et al.*, 1996, 1997), which is comparable to the middle miocene dhok pathan formation in the siwaliks.

REFERENCES

Andrews, P., T. Harrison, E. Delson, R. L. Bernor and L. Martin, (1996). Distribution and biochronology of European and southwest Asian Miocene catarrhines. In (R.L. Bernor, V. Fahlbusch & H.W. Mittman, Eds) The Evolution of Western EurasianNeogene Mammal Faunas, New York: Columbia University Press: pp, 168-207.

Andrews, P., J. Lord, and E. M. N. Evans, (1997). Patterns of ecological diversity in fossil and modern mammalian faunas. Biological Journal of the Linnaean Society, 11:177-205.

Antoine, P. O., C. Bulot and L. Ginsburg (2000). Les rhinocérotides (Mammalia, Perissodactyla) de l'Orléanien des basins de la Garonne et de la Loire (France): intérêt biostratigraphique. C.R. Acad. Sci., Paris, série II, 330: 571-576.

Cerdeño, E., and T. Hussain (1997). On the Rhinocerotidae from the Miocene Manchar Formation, Sind, Pakistan. Pakistan J. Zool., Vol. 29(3), pp. 263-276.

Cerdeño, E. (1993). Étude sur *Diaceratherium aurelianense* et *Brachypotherium brachypus* (Rhinocerotidae, Mammalia) du Miocène moyen de France. Bull. Mus. Natl. Hist. nat., Paris, 15: 25-77.

Chavasseau, O., Y. Chaimanee, S. T. Tun, A. N. Soe, J. C. Barry, B. Marandat, J., Sudre, L. Marivaux, S. Ducrocq and J. J. Jaeger (2006). Chauntha, a new Middle Miocene mammal locality from the Irrawaddy Formation, Myanmar. J. Asian Earth Sci., 28: 354-362.

Cooper, F. (1934). The Extinct Rhinoceros of Baluchistan. Philosophical Transactions of the Royal Society of London, Vol. 223, pp. 569-616.

Gentry, A. W. (1987). Rhinoceros from the Miocene of Saudi Arabia. Bull. Br. Mus. Nat. Hist. (Geol.), 41(4): 409-432.

Heissig, K. (1972). Palaontologische und geologische Untersuchungen im Tertiär von Pakistan; 5: Rhinocerotidae aus den unteren und mittleren Siwalik-Schichten. Abh. bayer. Akad. Wissen. math. naturw. Kl., 152: 1-112.

Heissig, K. (2003). Change and Continuity in Rhinoceros faunas of Western Eurasia from the Middle to the Upper Miocene. EEDEN, Stará Lesná, 35-37.

Pascoe, E. H. (1963). A manual of geology of India and Burma. Ibid, Calcutta, 111: 1344-2130.

Pilgrim, G. E. (1910). Preliminary note on a revised classification of the tertiary freshwater deposits of India. Record of the Geological Survey of India, 40: 185-205.

Pilgrim, G. E. (1913). Correlation of the Siwaliks with Mammal Horizons of Europe. Rec. Geol. Surv. India, 43(4): 264-326.

West, R. M., J. R. Lukacs, J. R. J. Munthe and S. T. Hussain (1978). Vertebrate Fauna from Neogene Siwalik Group, Dang Valley, Western Nepal. J. Paleontology, 52(5): 1015-1022.

Willis, B. I. and A. K. Behrensmeyer, (1994). Architecture of Miocene overbank deposits in northern Pakistan. J. Sedimentary Res., B64: 60-67.