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DISCOVERY OF A DECIDUOUS PREMOLAR OF *DORCATHERIUM MINUS* FROM THE MIDDLE SIWALIKS OF PAKISTAN

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Abstract: *Dorcatherium minus* is known from the Lower and the Middle Siwaliks of Pakistan. A fourth upper deciduous premolar (DP^4) is discovered for the first time from the Middle Siwalik Hills of Pakistan. The specimen is collected from Hasnot district Jhelum the Punjab province, Pakistan which is hitherto unknown from the Middle Siwaliks.

Key words: *Dorcatherium minus*, Deciduous premolar, Hasnot and Tragulidae.

INTRODUCTION

Tragulids comprise a family of ruminants that are known from the rocks of Eocene (Vislobokova, 2001). The earliest tragulids, dependent on stable warm forests, are known in East Africa, Pakistan, and Europe by 18.0 million years (myr) (Gentry, 2000). Traguloids have occurred in both Eurasia and North America since the Middle Eocene (Vislobokova, 2001). Three groups, archaeomerycids, lophiomerycids, and bachitheriids, seem to exist only in Eurasia. Gelocids and tragulids occurred in Eurasia and Africa respectively. In America, traguloids were represented by leptomerycids and gelocids. Hypertraguloids, a mainly North American group, were spread from the late Middle Eocene through to the beginning of the Oligocene in both the Old and New Worlds and up to the Early Miocene in North America. The presence of Hypertraguloidea gen. *et* sp. is also reported from the Middle Eocene Khaichin Ula II Fauna from Mongolia (Badamgarav and Reshetov, 1985). In the Late Eocene to the Early Oligocene of Mongolia, hypertraguloids were represented by *Praetragulus* (Vislobokova, 1998). Although, there is no direct evidence on the place of origin of tragulines, Asia seems to be very plausible as the site of their early development. The primitive structure and a large diversity of Eocene tragulines in Asia also confirm the Asian origin of this group (Vislobokova, 1997). Several traguline genera occurred in the Middle Eocene of Asia. The most ancient of them were represented by the archaeomerycids *Archaeomeryx* and *Xinjiangmeryx*. *Archaeomeryx* is known in the Irdinmanhan and Sharamurunian mammal ages of China, which are correlated to most of the Rhenanian (Late Lutetian to Early Bartonian) of Western Europe and to the Uintan of North America (Matthew and Granger, 1925; Tong *et al.*, 1995). The extant genus *Tragulus* is found in low hilly areas

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of India. The extinct genus *Dorcatherium* is known from Asia (Lydekker, 1876; Matthew, 1929; Corbert & Hill, 1980), Europe and Africa. Until now many species of the genus *Dorcatherium* have been reported from Africa, Europe and Asia. The three Pakistani species of the genus *Dorcatherium, D. minimus*, *D. minus* and *D. majus* are found from the Siwaliks of Pakistan, however, *D. minimus* has been rejected already owing to describe on the basis of single isolated teeth.

SYSTEMATIC PALAEONTOLGY

Family Tragulidae Milne Edwards, 1864
Genus *Dorcatherium* Kaup, 1833

Type species

Dorcatherium naui Kaup, 1833

Generic diagnosis

The cheek teeth are prominently hypsodont. The upper molars bear strongly developed styles and basal cingulum. The lower molars are characterized, either by a well-developed ectostylids or by a vestigial ectostylids and posteriorly directed double fold protoconids.

Included species

Dorcatherium naui Kaup, 1833; *Dorcatherium puyhauberti* Arambourg & Piveteau, 1929; *Dorcatherium crassum* Lartet, 1837; *Dorcatherium chappuisi* Arambourg, 1933; *Dorcatherium parvum* Whitworth, 1958; *Dorcatherium pigotti* Whitworth, 1958; *Dorcatherium songhorensis* Whitworth, 1958; *Dorcatherium libiensis* Hamilton, 1973; *Dorcatherium majus* Lydekker, 1876; *Dorcatherium minus* Lydekker, 1876; *Dorcatherium minimus* West, 1980; *Dorcatherium nagrii* Guar *et al*., 1983.

DISTRIBUTION

The genus *Dorcatherium* is known from the Lower Miocene of Europe by Kaup (1833) and Arambourg & Piveteau (1929). It is also reported from the Miocene deposits of East Africa by Lartet (1837), Arambourg (1933), Whitworth (1958) and Hamilton (1973). From the Siwaliks, *Dorcatherium* is reported by Lydekker (1876), Colbert (1935), Prasad (1968), Sahni *et al*. (1980), West (1980) and Guar *et al*. (1983).

DORCATHERIUM MINUS Lydekker 1876

Type specimen

Right molars (M^{1-2}) (GSI B195)

Material

A fragment of right maxilla having DP^4 and M^{1-3} (PUPC 04/30)

Locality

Hasnot

Stratigraphic range

Lower and Middle Siwaliks

Diagnosis

A small species of the genus *Dorcatherium* with sub-hypsodont molar and broad crowned molars having well developed cingulum, rugosity, styles, moderately developed ribs and vestigial ectostylids.

Description

PUPC 04/30 (Fig. 1a, b) includes a deciduous premolar (DP^4) and three molars (M^{1-3}). The DP^4 is being described for the first time from the Middle Siwaliks of Pakistan. The DP^4 is in late stage of wear and the dentine is visible all over the crown surface. The DP^4 is a molariform tooth with a low nonsymmetrical crown that is strongly expanded on the buccal side. The DP^4 has a very small hypocone and metacone. As the DP^4 is a low crowned and embedded in matrix so the styles and ribs are not clearly visible. However, its parastyle seems to be stronger than the other styles. The enamel is present on the lingual as well as the buccal sides but it is missing on the outer surface of the hypocone. The fossettes look to be absent owing to late stage of wear. The protoconule is lower in height and broad than the other major cusps. The first molar of PUPC 04/30 is in middle stage of wear and well preserved. The tooth is a half worn causing the exposure of the dentine of all the four cones. The enamel is 0.4 mm thick, and is very finely plicated all around the tooth. A well-developed cingulum is present all around the tooth but on the buccal side of the tooth. The transverse valley is very small in size. The tooth is in an equilateral rectangle in shape. It is a broad crowned and sub-hypsodont. The buccal cones of the tooth are higher than the lingual ones. The protocone is less crescentic as its inner border is rounded and outer border is straight, parallel to the longitudinal axis of the dentary. The praeprotocrista abruptly narrows towards the buccal side and become linked with praeparacrista, while the praeprotocrista is broader and pointed at its posterior end. Although the paracone is damaged but its remnants indicate that the parastyle was well developed. The mesostyle is well developed and seems to be more associated with the metacone. The metacone is comparatively broader than the paracone. The postmetacrista is slightly broader than the praemetacrista. The hypocone exhibits strongly crescentic appearance and the praehypocrista is free and is penetrated between the two buccal cones, whereas the posthypocrista is continuous with posterior end of the metacone through a ridge of the enamel. The posthypocrista is longer and narrower than the praehypocrista.

The anterior side of the hypocone is slightly pinched due to pressure of the posterior end of the protocone. The anterior and posterior fossettes are moderately developed.

The 2nd tooth is in the best form of preservation. It is a complete tooth and is in an early stage of wear. The tooth is a sub-hypsodont and broad crowned. The tooth is a squarish in its general appearance. The enamel is 0.5 mm thick and is finely wrinkled all around the tooth except the buccal side of the tooth where it has become very faint.

A well-developed cingulum is present on all sides of the tooth except on the buccal side and is comparatively strongly developed around the protocone. The transverse valley is moderately deep and continuous with the anterior fossette through a very narrow channel. The lingual and buccal cones are inclined towards the median longitudinal axis of the tooth. The degree of the inclination in the lingual cones is greater than the buccal ones. The protocone is almost L-shaped and the praeprotocrista is narrow and much longer than the postprotocrista and it is continuous along the anterior side of the paracone. The posterior end of the postprotocrista seems to be striking at the mid of the praehypocrista. However, there is very minute but visible gap between the two cristae. The buccal cones are higher than the lingual ones. The mesostyle is more developed than the parastyle and the metastyle. The metastyle is almost negligibly developed. The median rib of the paracone is strongly developed, whereas that of the metacone it is very weakly developed. The praeparacrista is comparatively narrower than the postparacrista. The praemetacrista and the postmetacrista are equally narrow. The hypocone is crescentic and its praehypocrista and posthypocrista are also almost equal in length. The praehypocrista is free, not coinciding with any other cone and the posthypocrista is linked with the postmetacrista through the ridge of the enamel. The anterior fossette is narrow anteriorly and much broader posteriorly and the posterior fossette is almost uniformly deep and wide.

The 3rd molar of PUPC 04/30 is a complete and well-preserved tooth. The tooth is entirely unworn, so the thickness of the enamel could not be measured. It is a broad crowned and sub-hypsodont. The enamel is very finely rugose all around the tooth. This rugosity is more prominent on the lingual side of the inner cones. A well-developed cingulum is present on the anterior, lingual and posterior sides. The transverse valley is deep enough. The protocone is pointed at the top and the other three cones are damaged at the top. All the cones are inclined towards the median longitudinal axis of the tooth. The lingual cones are much more inclined than the buccal cones. The protocone exhibits selenodonty. The praeprotocrista seems to be longer than the postprotocrista and the postprotocrista strikes the middle part of the praehypocrista. The parastyle is well developed and unusually it is the strongest among all the styles. The hypocone is also crescentic with equally long praehypocrista and posthypocrista. The anterior and posterior fossettes are isolated and deep enough. The measurements are provided in Table 1.

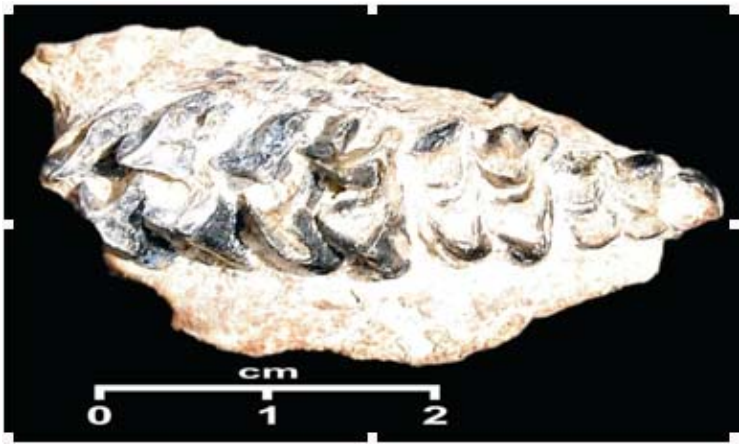

Figure 1: *D. minus*, occlusal view of a fragment of right maxilla having upper fourth deciduous premolar, and first, second, and third molars (PUPC 04/30).

Figure 2: *D. minus*, buccal view of a fragment of right maxilla having upper fourth deciduous premolar, and first, second, and third molars (PUPC 04/30).

Table 1: Comparative measurements of the cheek teeth of *Dorcatherium minus* Lydekker in mm (millimeters).

Number	Nature	Position	Length	Width	W/L ratio
PUPC 04/30	a fragment of right maxilla having DP^4 and M^{1-3}	DP^4	9.6	5.0	0.52
		M^1	8.0	7.0	0.88
		M^2	9.2	7.8	0.84
		M^3	9.4	8.4	0.89
PUPC 04/60	a fragment of left maxilla having M^{1-3}	M^1	9.0	9.0	1.0
		M^2	10.0	10.0	1.0
		M^3	10.0	8.0	0.8
PUPC 03/15	right molar	M^2	11.0	13.0	1.1
PUPC 06/06	right molar	M^2	10.6	9.0	0.84
PUPC 86/200	left molar	M^2	11.0	11.9	1.08
PUPC 04/13	left molar	M^2	11.2	9.5	0.84
PUPC 06/4	right molar	M^3	9.1	9.1	1.0
PUPC 04/3	left molar	M^1	9.6	6.1	0.63
PUPC 68/355	left molar	M^1	9.2	10.2	1.1
PUPC 87/40	left molar	M^1	10.0	11.7	1.1
PUPC 87/84	left molar	M^1	9.3	10.0	1.0
PUPC 95/01	right molar	M^1	9.3	9.0	0.96
PUPC 02/01	right molar	M^1	8.0	10.0	1.2
AMNH 19517	left molar	M^1	12.0	11.0	0.91
AMNH 29856	left molar	M^2	11.3	12.0	1.0
AMNH 29856	left molar	M^3	11.5	13.0	1.1

DISCUSSION

The specimen PUPC 04/30 is a small enough to consider it for Bovidae, Cervidae and Giraffidae. The presence of cingulum proves its inclusion in the family Tragulidae. There are two genera *Dorcatherium* and *Dorcabune* of family Tragulidae present in the Siwaliks. The *Dorcabune* is large extinct tragulid of the Siwaliks and have heavy median ribs than *Dorcatherium*. In *Dorcabune* the molars are large, broad crowned and median ribs are well pronounced. The absence of these characteristics proves that the studied specimens belong to genus *Dorcatherium*. The specimen is referred to the genus *Dorcatherium* on the basis of well-developed styles and basal cingulum in upper molars and a median basal pillar in the lower molars. There are two species of the genus i.e., *D.*

majus and *D. minus*. *D. majus* includes the large animals as in *Dorcabune* and *D. minus* belongs to small animals. The morphologically and metrically the studied specimens agree with the species *D. minus*. The DP^4 is being described for the first time from the Middle Siwaliks of Pakistan. The milk molar (deciduous premolar) is a molariform tooth with a low nonsymmetrical crown that is strongly expanded on the buccal side. The milk molar has a very small hypocone and metacone. As the milk molar is a low crowned and embedded in matrix so the styles and ribs are not clearly visible. However, its parastyle seems to be stronger than the other styles. The protoconule is lower in height and broad than the other major cusps. These characteristics are also found in the milk molar of *Lophiomeryx*, *Praetragulus*, *Bachitherium*, *Tragulus* and *Hyemoschus*.

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