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***Dorcatherium majus*, a Study of Upper Dentition from the Lower and Middle Siwaliks of Pakistan**

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Abstract: *Dorcatherium majus*, comparatively a large tragulid is studied from the Lower and Middle Siwaliks of Pakistan. *D. majus* is only found from the fresh water deposits along the foot hills of Himalayas. A number of localities are thoroughly visited from the Potwar Plateau of northern Pakistan and collected worth describing specimens of *D. majus*. Eight specimens are described in this study and all belong to the upper dentition of *D. majus*.

Key words: *Dorcatherium majus*, fossil, siwaliks

INTRODUCTION

The artiodactyls constitute an existing group, the most abundant in forms, the most dominant and the most widely distributed of all the ungulates. The origin of almost all of its recognized families are traced to the Upper, Middle or Late Eocene and are well documented by both dentition and skeletal material (Carroll, 1988). No fossil record of artiodactyla is known from the Late Palaeocene (Hunt, 1997). The artiodactyls developed into a large number of varieties by the end of Eocene (Romer, 1974). They maintained a stable dominance from the Early Oligocene until their apparently enormous Plio-Pleistocene radiation (Cifelli, 1980).

The early groups of artiodactyls were with complete dentition. The molar teeth in the Early Eocene genera were prominently bunodont rather than selenodont, there was a pattern of moderately blunt cusps; selenodont tendencies appeared in later genera. Later on in Eocene the general trend of dentition of artiodactyls is toward two major directions, one toward the Suina, having low-crowned bunodont dentition, also bearing primitive type of incisors, the other toward the Tylopoda and Ruminantia having high crowned selenodont dentition. The suborders Tylopoda and Ruminantia are more closely similar to each other than either to the Suina. The actual position of the Tylopods lies in between the Suina and Ruminantia. There is also a third group Palaeodonta, which is assumed to be very close to the point of origin of the artiodactyls. There are certain other trends in dentition, which appeared in the course of evolution. There is a strong trend toward the reduction of upper incisors, which resulted in their complete suppression in many artiodactyls, to be replaced by a tough pad against

which the lower incisor teeth bite. The lower canines assumed the shape of an incisor. In some other artiodactyls the canines are large dagger-like teeth used for fighting and defense (Colbert, 1980). There is another trend toward the squarishness by the formation of hypocone on the posterior inner corner of the upper molars, not in all but in most of the primitive artiodactyls. The advanced forms of artiodactyls are lacking this new cusp, the hypocone.

Systematic palaeontology:

Suborder: Ruminantia Scopoli, 1777

Family: Tragulidae Milne-Edwards, 1864

Genus: *Dorcatherium* Kaup, 1833

Type species: *Dorcatherium nauii* Kaup, 1833.

Diagnosis: The cheek teeth are prominently hypsodont. The upper molars bear strongly developed styles and basal cingulum. The lower molars are characterized, either by well-developed median basal pillar or by a vestigial median basal pillar.

Included species: *Dorcatherium majus*, *Dorcatherium minus*, *Dorcatherium minimus*, *Dorcatherium nagrii*.

Distribution: Europe, East Africa and the Siwaliks.

***Dorcatherium majus* (Lydekker, 1876):**

Type specimen: GSI B197, two upper molars (Colbert, 1935).

Material: PUPC No. 95/3, an isolated right fourth upper premolar, collected from Hasnot, Jhelum district, the Punjab province, Pakistan; PUPC No. 68/250, an isolated left second upper molar, collected from Nagri, Chakwal district, the Punjab province, Pakistan; PUPC No. 68/33, an isolated left second upper molar, collected from Chinji, Chakwal district, the Punjab province, Pakistan;

PUPC No. 85/15, an isolated left second upper molar, collected from Hasnot, Jhelum district, the Punjab province, Pakistan; PUPC No. 85/21, an isolated right second upper molar collected from Hasnot, Jhelum district, the Punjab province, Pakistan; PUPC No. 67/191, a left maxillary fragment having M^{2,3} collected from Chinji, Chakwal district, the Punjab province, Pakistan; PUPC No. 87/328, a fragment of right maxilla bearing M^{2,3}, collected from Dhokpathan, Chakwal district, the Punjab province, Pakistan; PUPC No. 87/197, an isolated left third upper molar, collected from Dhokpathan, district Chakwal, the Punjab province, Pakistan.

Localities: Hasnot, Nagri, Chinji, Dhokpathan.

Stratigraphic range: Lower to Middle Siwaliks.

Diagnosis: *Dorcatherium majus* is a species larger than *Dorcatherium minus* and is equal in size to the *Dorcabune*. It is characterized by strong parastyle and mesostyle, well-developed cingulum in upper molars and stoutly developed median basal pillar in lower molars.

DESCRIPTION

Specimen PUPC No. 95/3 (Fig. 1) under study is an isolated upper fourth premolar of the right side. The tooth is in a fine state of preservation. It is in the early stage of wear. The wear is relatively more confined to the posterior half of the tooth. It is subhypsodont and broad crowned. The enamel is moderately thick and rugose. It is somewhat more wrinkled on the antero-internal side and on the external furrow between the median rib and the metastyle. Its average thickness over the crown of the tooth is 0.8 mm. The central cavity is simply crescentic in form without any spur projecting from its walls. The cingulum is strongly developed at the postero-internal surface. The outer cusp forms a very slight prominence on the external face of the tooth. The protocone is highly reduced and present at the antero-internal side of the premolar. The paracone is comparatively higher than the metacone. The parastyle is well developed. The mesostyle is strongly developed and comparatively higher vertically than the other styles. It is closer to the parastyle. The metastyle is also well developed. Although the dental morphology of the molars is well known but that of the premolars is almost unknown. The present collection consists of a right upper last premolar. The specimen under study, PUPC No. 95/3 gives first information about the upper last premolar, which is being described for the first time. The distinct feature of the specimen under study is the presence of the parastyle, which is very strongly developed. On the inner side of the tooth, there is a very strong posterior cingulum.

Specimens (PUPC No. 68/250, PUPC No. 68/33 (Fig. 2), PUPC No. 85/15, PUPC No. 85/21) are upper



Fig. 1: The upper fourth premolar



Fig. 2: The upper second molar

second molars. The molars are well preserved and quadrate in its general appearance. These are transversely more wide anteriorly than posteriorly and moderately worn. The molars are brachyodont and broad crowned. The enamel is uniformly thick as 0.85 mm in the molars and extensively wrinkled. Cingulum is thick and well developed on the lingual side especially at the entrance of the transverse valley, whereas on the anterior and posterior sides of the molars the cingulum becomes thin but high, it is entirely absent around the labial cones. The anterior and posterior central cavities are deep and wide. All the four major cusps are inclined towards the median longitudinal axis of the molars, but the degree of inclination is greater in the inner cusps than the outer ones. The protocone is more worn than all other ones. It

exhibits semi-crescentic shape, as its anterior arm is longer than the posterior arm. The anterior arm is linked with the parastyle through a thin ridge of enamel, the posterior arm, on the other hand, is free. The paracone is higher than the protocone. Its anterior and posterior ridges seem to be equally worn. The metacone is the highest cone among all the cones. It is also equally worn anteriorly and posteriorly. Its median rib is weakly formed. Mesostyle is moderately developed whereas metastyle is very weak. The hypocone is more crescentic than the protocone, because both of its anterior and posterior arms are almost equal in length, exhibiting V-shaped structure. Its anterior arm is linked with the posterior half of the paracone, whereas its posterior arm is free.

PUPC No. 67/191 Maxilla (Fig. 3A and B) includes a left maxillary fragment having M^{2-3} . It is damaged anteriorly as well as posteriorly. The total antero-posterior length of the maxilla is 30.85 mm. The thickness of maxilla on the labial side is 10.2 mm, which is uniform almost along the whole labial length of the fragment, whereas on the lingual side its thickness decrease antero-posteriorly i.e., 9.6 mm at the anterior ends below the protocone of second molar and 3.6 mm below the hypocone of third molar at the posterior end. The molars are complete and well preserved. The molars are squarish in general appearance. The cingulum is very low along lower border on the lingual side of the protocone at about the entrance of the transverse valley. On the anterior side of the protocone it seems to be damaged. The cingulum becomes very weak towards the lingual side of hypocone, then slightly rises up and ultimately disappears on the posterior side. The enamel is very finely and extensively wrinkled all around the molars. The transverse valley is deep and long enough and continuous with anterior central cavity. The anterior and posterior central cavities are deep and wide. The posterior central cavity is completely isolated, whereas anterior one is continuous with the transverse valley as discussed earlier.

PUPC No. 87/328 Maxilla is an excellent part of the right maxilla bearing M^{2-3} . The whole part of the maxilla is broken away in front of the teeth. The molars are completely preserved and squarish in shape. The molars are in an early stage of wear and so the dentine can be seen in all the four cusps. The cingulum is moderately developed at the anterior and posterior face of the molars but comparatively well developed towards the inner side especially at the entrance of the transverse valley between the two inner cusps. The enamel is wrinkled and indicates a uniform thickness all over the crown of the tooth. Its average thickness is about 1.1 mm. The central cavities are wide and deep. The outer cusps are relatively higher vertically than the inner cusps. The protocone is almost L-shaped. The innermost lingual part of the

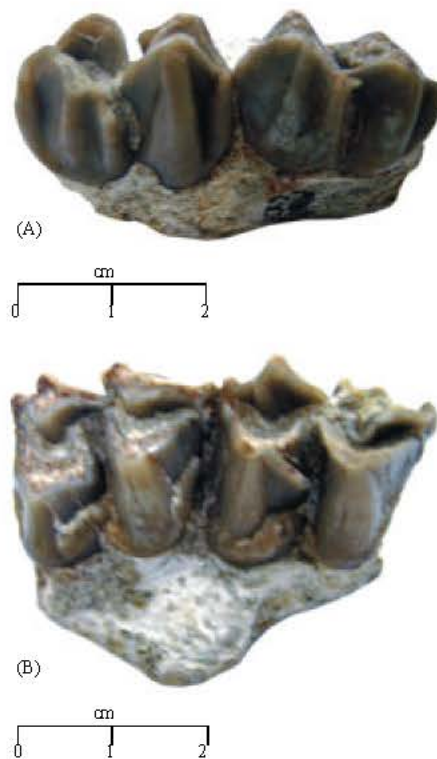


Fig. 3: (A) Buccal view of maxilla having second and third molars and (B) Lingual view of maxilla having second and third molars

protocone is moderately pointed. It would become almost rounded in some later stage of wear. Its posterior end strikes at the middle of the anterior limb of the hypocone. The anterior limb of the protocone gradually decreases in thickness towards the paracone. The paracone is relatively smaller in antero-posterior length than the metacone.

PUPC No. 87/197 is a finely preserved last upper molar of the left side. It is in very early stage of wear. The paracone is slightly touched by wear and rest of the crown is practically unworn. All the cusps are pointed at the top. The molar is subhypsodont and broad crowned. The central cavities are wide and deep enough. The tooth is almost quadrate in shape. The cingulum is weakly developed at the anterior and posterior face of the tooth but well developed towards the inner side of the protocone especially at the entrance of valley between the two inner cusps. The protocone is crescentic in shape. The innermost lingual part of the protocone is pointed but would gradually become blunt and would be almost rounded in the late stage of wear. The paracone is relatively smaller in the antero-posterior length than the metacone. A very small transverse enamel ridge connects

Table 1: Comparative dental measurements (mm) of upper fourth premolar in *Dorcatherium majus* Lydekker

PUPC No. 95/3	No. type specimen P ⁴
L	14.00
W	15.00
W/L index	107.14
H	12.00
H/W index	80.00

Table 2: Comparative dental measurements (mm) of M² in *Dorcatherium majus* Lydekker

Measurements	PUPC No.						Am. Mus. No. 19302	GSI No. B.198
	67/191	68/33	68/250	85/15	85/21	87/328		
L	13.30	13.35	15.75	19.00	18.00	17.75	18.5	19.6
W	14.50	14.55	16.40	20.00	22.00	19.00	21.5	19.6
W/L index	109.02	108.98	104.12	105.25	122.22	107.04	116.0	100.0
H	8.15	7.15	11.10	17.00	14.20	13.00	-	-
H/W index	56.20	49.14	67.68	85.00	64.54	68.42	-	-

Table 3: Comparative dental measurements (mm) of M² in *Dorcatherium majus* Lydekker

Measurements	PUPC No.			Am. Mus. No. 19354	GSI No. 198
	67/191	87/197	87/328		
L	13.65	20.50	19.10	20.5	20.1
W	15.25	22.00	18.20	23.5	19.2
W/L index	111.72	107.31	95.28	114.6	95.0
H	8.70	18.20	16.65	-	14.6
H/W index	57.04	82.72	91.48	-	76.0

the anterior arm of the protocone with the paracone. The parastyle is very well developed. It is not vertical but inclined. The posterior half of the paracone is relatively thicker than the anterior half. Its median rib is very stoutly developed. The mesostyle is well developed and divergent. The metacone is very thin on its upper end becomes thick towards its base. Its anterior and posterior arms are inclined towards the labial side at their ends. Its median rib and metastyle are moderately developed. The hypocone is also crescentic in shape exhibiting more affinity towards the V-shaped structure. The posterior limb of the hypocone is thicker than the anterior limb. The comparative measurements are provided in Table 1-3.

DISCUSSION

The species *Dorcatherium majus* is characterized by hypsodont and selenodont teeth, bearing large size almost equal to that of the largest species of *Dorcabune* (Colbert, 1935). The upper molars are distinguished by their squarish appearance and strongly developed parastyle, mesostyle and cingula. Metastyle is always found weakly formed. The inner cusps seem to be more inclined towards the median longitudinal axis than the outer ones. Enamel is plicated and the central cavities are well developed.

The specimens belonging to upper dentition comprising premolar and molars are PUPC No. 67/191, 68/33, 68/250, 85/15, 85/21, 87/197, 87/328 and 95/3. The specimen PUPC No. 95/3 (Table 1) comprises an isolated

fourth upper molar of the right side. It is not known by Lydekker (1876), Pilgrim (1915) and Colbert (1935) etc. So this specimen is very important as it provide the first description of the fourth upper premolar of *Dorcatherium majus*. The important features displayed by this specimen that it is sub-hypsodont and broad crowned with plicated enamel and well developed styles. The specimens PUPC No. 67/191, 68/33 and 68/250 bearing second upper molar are although smaller in all of their measurements regarding lengths and widths as compared to those of the type specimen Am. Mus. No. 19302, but their indices of W/L display very close similarity among them i.e., they all are broad crowned (Table 2).

The remaining specimens PUPC No. 85/15, 85/21, 87/197 and 87/328 exhibit a close relationship with the type specimens Amer. Mus. No. 19302 (Colbert, 1935) and GSI B.198 (Pilgrim, 1915) in respect of their dental measurement regarding length, width and indices of W/L (Table 3). The dental measurements of specimens PUPC Nos. 67/191, 87/197 and 87/328 comprising third upper molar are compared with those of type specimens Amer. Mus. No. 19354 and G.S.I. No. 198 in Table 3. The PUPC No. 67/191 is markedly different in its length and width from those of both type specimens, but its W/L index lies close to that of type specimen Amer. Mus. No. 19354. The second specimen PUPC No. 87/197 exhibits close resemblances with Amer. Mus. No. 19354, whereas third specimen PUPC No. 87/328 resembles with G.S.I. No. 198.

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