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## A New Large *Bramatherium* Giraffe *Bramatherium giganteus* sp. Nov. From Siwalik Formations, Punjab, Pakistan

<sup>1</sup>Aleem Ahmed Khan and <sup>2</sup>Mohammad Sarwar

<sup>1</sup>Zoology Division, Institute of Pure & Applied Biology, Bahauddin Zakariya University, Multan, Pakistan

<sup>2</sup>Zoology Department, University of the Punjab, New Campus, Lahore, Pakistan

**Abstract:** The specimen under study (P.U.P.C. No.66/24) is a left upper second molar found in Sardhok, Gujrat district, Punjab, Pakistan. It was probably the largest *Bramatherium* giraffe known from its genus. It occurs in the lower Pleistocene Pinjorian stage of the upper Siwalik formations. Given the morphology of that specimen, it is referable to the genus *Bramatherium*. This genus is known only by two species i.e. *Bramatherium perimense* and *B. progressus*. The last upper molar in *Bramatherium perimense* appears too small to be compared with the specimen described here and may be further distinguished from *Bramatherium progressus*, in having larger size. Moreover, the tooth described here is characterized by its quite gigantic size as well as its significantly high crown and well pronounced median rib of the outer cusps in the upper molar with respect to the British Museum specimen No.48933 which is the type specimen of *B. perimense*. The specialized characters of P.U.P.C. No.66/24 warrant the erection of a new species *Bramatherium giganteus* sp. Nov.

**Key words:** *Bramatherium*, giraffe, Siwalik

### Introduction

The fossil Chinese record shown by Bohlin (1927) and that of Asia shown by Colbert (1935) indicates that the giraffids had their origin in the Holarctic Region. Whereas, Geraads (1996) refers to as certain primitive giraffes actually originated from African region. The great variety of forms found in the Pliocene Asiatic shows the rapidity of evolution in the family Giraffidae. The Siwalik giraffes may be placed in three subfamilies i.e. Palaeotraginae, Sivatheriinae and Giraffinae. Palaeotraginae comprises the genus *Giraffokeryx*. Palaeotragines are also known elsewhere in the world. Sivatheriinae includes the genera *Sivatherium*, *Bramatherium*, *Hydaspietherium* and *Helladotherium*. Genus *Giraffa* is placed in the subfamily Giraffinae. *Giraffokeryx*, *Bramatherium* and *Helladotherium* are also found elsewhere. These 3 subfamilies emerged simultaneously but their migration to the Siwalik region occurred at different times. Palaeotragines and Giraffines came earlier than the Sivatheriines (Akhtar *et al.*, 1991).

Although Sivatheriines are undoubtedly present in Africa in late Miocene times (Guerin, 1966; Geraads, 1985; 1994; 1996) but *Bramatherium* seems absent from Africa and this genus is known certainly from Asia only (Geraads and Güleç 1999). First scientific mention of the Siwalik giraffes goes back to 1836 when Falconer and Cautley described a large massive giraffe, *Sivatherium giganteum* from the Upper Siwaliks. Since that time, a number of genera and species have been recorded from various formations of the Siwaliks by different workers such as Lydekker (1876, 1878), Pilgrim (1910) and Matthew (1929). Biostratigraphical status of the Siwalik giraffids was first reviewed by Matthew (1929) and then by Colbert (1935).

Siwalik Giraffes are of two types, one including smaller while the other comprising larger forms. The larger ones include the genera *Bramatherium*, *Indrathierium*, *Hydaspietherium*, *Helladotherium*, *Sivatherium* and *Vishnuthierium*. All of these are known from Upper and Middle/Upper Siwaliks. In the Potwar plateau, the upper Siwaliks are the best exposed in Pabbi hills situated east of River Jhelum. Village Sardhok is situated in these low altitude hills, south of Lahore-Islamabad G.T. road. The area surrounding this village offers the best exposure of the upper Siwaliks and is famous for the presence of larger Giraffids typical of the lower Pleistocene age i.e., Pinjorian (Khan, 1987; Khan *et al.*, 1993).

### Materials and Methods

The specimen studied was collected in the upper Siwaliks, village Sardhok, district Gujrat, Punjab, Pakistan. Subsequently the specimen was thoroughly washed in the Palaeontological Laboratory of the Zoology Department, University of the Punjab. To remove the unwanted siliceous or clay material, light hammers, chisels and fine needles were used (Falconer, 1845). Various types of adhesives were used during preparation of the material.

Photographs were taken with the help of Minolta 135 Camera. To obtain maximum contrast, the ratio of potassium bromide was changed during the preparation of developer for printing. The specimen collected during or after 1965 show the collection year and the serial of that year, i.e., P.U.P.C.66/24. The upper figure denotes the collection year and the lower one, the serial number of the respective year collection.

### Results

#### Systematic paleontology

Order : Artiodactyla (Owen, 1848)  
Sub order : Ruminantia (Scopoli, 1777)  
Infra order : Pecora (Linnaeus, 1758)  
Superfamily : Cervoidea (Goldfuss, 1820)  
Family : Giraffidae (Gray, 1821)  
Subfamily : Sivatheriinae (Zittel, 1893)  
Genus : *Bramatherium* (Falconer, 1845)  
Syn. : ? *Helladotherium* (Gaudry, 1860)

*Hydaspietherium* (Lydekker, 1877)

*Bramatherium giganteus*

*Bramatherium giganteus* sp. Nov.

Table 1: Measurements (in mm) of M<sup>2</sup> (P.U.P.C.66/24) in *Bramatherium giganteus* new species

|                    |        |
|--------------------|--------|
| L (Fig. 2b)        | 56.0   |
| L (ant. half)      | 26.6   |
| L (post. half)     | 32.5   |
| W                  | 53     |
| W (ant. half)      | 38.15  |
| W(r.)* (ant. half) | 56.3   |
| W (post. half)     | 53     |
| W/L index          | 94.64  |
| H                  | 56.5   |
| H(r.)**            | 59.6   |
| H/W index          | 112.45 |
| En. th.***         | 2      |

\* Reconstructed crown width

\*\* Reconstructed crown height

\*\*\* Average enamel thickness

P.U.P.C Punjab University Palaeontological Collection

H Maximum preserved crown height

W Maximum preserved crown width

L Maximum preserved anteroposterior crown length

H/W Index H/W x 100 (considering reconstructed measurements)

W/L Index W/L x 100 (considering reconstructed measurements)

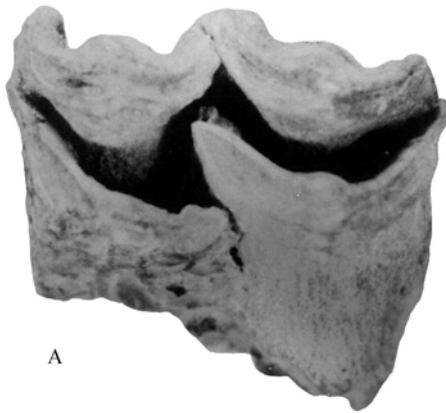
**Type:** P. U. P. C. No. 66/24, an upper second molar of left side. The specimen is housed at Paleontology Lab., the department of Zoology, University of the Punjab, Lahore, Pakistan.

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Table 2: Comparative measurements (in mm) of the IM<sup>2</sup> in various genera of large giraffids and in *Bramatherium giganteus* new species.

| Species                                       | L     | W     | H  | W/L index | H/W index |
|---|-------|-------|----|-----------|-----------|
| <i>Hydaspitherium</i>                         | 38    | 40    | -  | 107       | -         |
| <i>Helladotherium</i>                         | 44    | 44    | 42 | 100       | 96        |
| <i>Vishnutherium</i>                          | 45-49 | 41    | -  | 84-92     | -         |
| <i>Sivatherium</i>                            | 55-56 | 52-56 | 41 | 95-100    | 74-79     |
| <i>Bramatherium perimense</i>                 | 42    | 39    | -  | 94        | -         |
| <i>Bramatherium giganteus</i> (P.U.P.C.66/24) | 56    | 58    | 57 | 95        | 112       |

- data not available



A



B

Fig. 1: *Bramatherium giganteus* sp. Nova  
A: Crown view B: Lateral view

**Type locality:** Sardhok, district Gujrat, Punjab, Pakistan.

**Horizon:** Pinjorian (early Pleistocene) of the Upper Siwaliks .

**Diagnosis:** Probably the largest of the known *Bramatherium* giraffids. Protocone is L-shaped. Median folds of the outer cusps are isolated whereas, median ribs of the outer cusps are well pronounced.

**Etymology:** A well pronounced height of the crown is the significant feature for characterizing it as new species of the genus *Bramatherium* (Table 1).

**Description:** The tooth, P.U.P.C. 66/24 (Fig. 1 A, B) is quite gigantic. In general contours, it is square-shaped with almost equal length and width of the crown. It is nicely preserved except for the antero-internal side. The tooth was in early stage of wear, which is indicated by the partial unworn surface of the posterior cusps. The overall contours of the molar tooth indicate that it was inserted into the left maxilla.

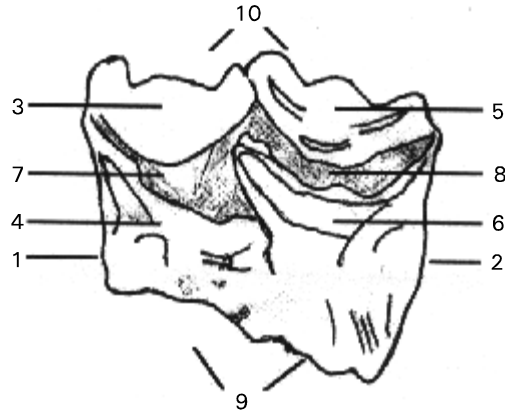


Fig. 2a: Crown view of *Bramatherium giganteus* (sp. nova)  
1, Anterior side; 2, posterior side; 3, Paracone; 4 Protocone; 5, Metacone; 6, Metaconule; 7, Ant. Longitudinal valley; 8, Post. long valley; 9, Lingual side; 10, Bucca side.

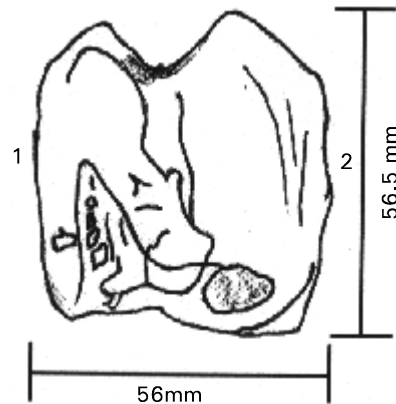


Fig. 2B: Lateral view of *Bramatherium giganteus* (sp. nova)  
1 Anterior side 2 Posterior side

The presence of a weak pressure mark at the posterior face of the tooth indicates that it was not the last of the molar series. Since the anterior half is fairly bigger than the posterior half, the tooth can be labeled as the second molar of the series. Cingulum can be seen anteriorly, posteriorly as well as outwardly. The inner face of the protocone is damaged but even then it can be said that a weak cingulum was present at the inner side of the tooth. It is inferred from the inner face of the metaconule and the opening of the transverse valley. Anterior cingulum is weaker than the posterior one, however, it covers the whole surface. To the outer side, it runs upwards to meet the parastyle. Inwardly, it slopes down to the crown base. The overall shape of the posterior cingulum is also the same but being comparatively stronger, it produces a sort of shelf at the middle length. Outwardly, the cingulum covers only

the paracone where it is crenulated and folded structure. Anterior half of the tooth is narrower longitudinally than the posterior one. Protocone is damaged at the inner face. The damaged face gives the details of the tooth structure. Enamel layer is moderately thick, the pulp cavity extends far up in the crown of the cusp. Protocone is L-shaped with the posterior limb comparatively longer than the anterior one. The posterior limb is free for most of the vertical depth. However, it is so much close to the metaconule that it completely blocks the longitudinal valley at the lingual side. Looking at its worn surface, a vertical ridge can be seen close to the posterior end towards the longitudinal valley. This limb slopes abruptly towards the metaconule. It remains equally thicker throughout its length. The anterior limb gradually reduces in thickness towards the outer side. It gently slopes anteriorly where ultimately it is connected with the paracone through a shallow and narrow ridge. The anterior face of the cusp is somewhat corrugated. At present, the protocone is low in vertical crown height than the paracone.

Paracone is excellently preserved and is much folded anteriorly, posteriorly and in the middle producing thereby parastyle, mesostyle and the median rib. Paracone is spindle shaped with maximum thickness in the middle, where it produces a median rib at the buccal side and a bulging in the longitudinal valley. The anterior side is much folded. This vertical fold or parastyle becomes stronger and stronger towards the crown apex. Towards the apex, it overlaps the outer surface of the cone to some extent. The outer surface of the cusp is highly corrugated. The cusp is highest in the middle, sloping down towards the anterior and posterior ends.

Like the anterior end, the posterior end is also highly folded. For the small distance, it is free from the metacone, however, they are so close together that they appear to be fused. The posterior end of the paracone and the anterior end of the metacone form a vertical loop known as mesostyle. Metacone plays a major role in the formation of mesostyle. The longitudinal valley between the anterior cusps is transversely narrower anteriorly than posteriorly. Posteriorly, it becomes fairly wide and is continuous with the valley present between the posterior cusps through a narrow channel.

Metacone is comparatively much longer than the paracone. Its enamel surface is as much corrugated as that of the paracone. Towards the crown base, its length is the same as that of the paracone. The overall shape of the metacone is like that of the paracone. However, its anterior and posterior folds are comparatively weaker than those of the paracone. Metacone is comparatively less worn than the paracone. The crescent of this cusp is the highest in the middle with anterior and posterior slopes. Like paracone, metacone is also spindle-shaped with maximum thickness in the middle of the cusp. The median rib is comparatively blunt and round. The posterior wing of the metacone is very slightly worn with little exposure of its dentinal material. Posteriorly, it becomes much narrow to form a shallow ridge. This shallow ridge is connected with the hypocone through a narrower rounded loop. The inner enamel border of the cusp is simple and rounded. The valley present between the posterior cusps is comparatively shallower. It remains uniform in transverse diameter throughout its extent.

Metaconule is typically crescentic with anterior and posterior wings of equal dimensions. It is maximum high in the center with gentle slopes at either sides. Outer margin of the cusp is vertical whereas, the inner or lingual side is slopping with conspicuous rugosity. The outer border is not simple, rather it is folded. A vertical fold of moderate size can be seen in the center of the cusp and a weak one close to the posterior end. This posterior fold is developed at both borders of the cusp at the same point.

### Discussion

Being a squared and tetra tuberculated tooth, it can be referred to some herbivorous mammalian group. Since the cusps are crescentic in outline, it can safely be included in the sub-order

Ruminantia of the order artiodactyla (Romer, 1974; Zittel, 1925). Tooth being very large in size, it can be referred to the superfamily Cervoidea. Since the enamel layer is strongly rugose, the tooth can be referred to the family giraffidae (Zittel, 1925; Romer, 1974). Regarding size, giraffes can be placed in two groups i.e., smaller and larger. Smaller forms include the genera *Giraffokeryx*, *Progiraffa* and *Giraffa* while all others are the larger forms. The larger forms comprise the following genera: *Sivatherium*, *Hydasphtherium*, *Helladotherium*, *Bramatherium* and *Vishnutherium*. However, an additional larger form, *Indraththerium*, is usually distinguished from all species because of the striking excess of breadth over length in the molars (Pilgrim, 1910). In the genus *Sivatherium* the protocone is truly crescentic and its posterior limb is projected backwardly (Falconer and Cautley, 1836) whereas it is L-shaped in the specimen described here. In the genus *Helladotherium*, the molars display an enamel island in the hypocone (Gaudry, 1861), whereas, there is no such development in the molar under study. Moreover, *Helladotherium* was comparatively a smaller form (Table 2). Like the specimen under study, the members of the genus *Hydasphtherium* were also gigantic giraffid. Regarding the size, it is close to the members of the genus *Hydasphtherium*. However, the two differ in the structure of protocone which is crescentic in *Hydasphtherium* (Lydekker, 1880) but L-shaped in P.U.P.C. No. 66/24. In the genus *Vishnutherium* the molars show rather crescentic inner cusps (Lydekker, 1876), hence different from the L-shaped inner cusps of the specimen described in this paper. The upper molars in the genus *Indraththerium* are similar to those of *Hydasphtherium grande* (Pilgrim, 1911), thus different from the specimen under study. In the genus *Bramatherium*, the protocone is not perfectly V-shaped and its posterior limb is somewhat L-shaped (Falconer, 1845). It is therefore, advisable to regard the specimen under study as congeneric with *Bramatherium*. The genus is known only by two species i.e. *Bramatherium perimense* and *B. progressus*. *Bramatherium perimense* is known from Perim Island Dhok Pathan, while *B. progressus* is paratypic. The last upper molar in *Bramatherium perimense* is too small to be compared with the specimen under study (Table 2) and may be also distinguished from *Bramatherium progressus*, in having a larger size. Moreover, the tooth is quite gigantic with significantly high crown and well pronounced median rib of the outer cusps in the molar under study with respect to the specimen (No.48933) of the British Museum that is the type specimen of *B. perimense*. Being different from *B. perimense* and congeneric with this genus *Bramatherium*, the specimen under study is clearly referable to a new species. Due to these major distinct features it is being designated as *Bramatherium giganteus* new species (Table 2).

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