

NEW AND SOME ADDITIONAL FOSSIL MAMMALS FROM THE SIWALIKS EXPOSED AT NURPUR, KANGRA DISTRICT (H. P.), INDIA, WITH REMARKS ON SIWALIK GIRAFFIDS

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ABSTRACT

A new subspecies of a fossil sivatheriid, *Bramatherium megacephalum minus*, and some additional fossil mammals are described from the Neogene Siwalik deposits of Nurpur. . These mammals provide useful information regarding the age of the 'Nurpur Zone'. A brief review of Siwalik giraffids is also presented.

INTRODUCTION

The Neogene/Quaternary deposits of the Indian subcontinent have been the subject of a number of scientific investigations for over a century. Most of the Siwalik localities have been explored for vertebrate fossils, especially the mammals. Nevertheless, the Siwaliks of Kangra district have not been thoroughly investigated. Pandey and Sastry (1968), Gupta (1969, 1970), Gupta *et al.* (1979), Sahni and Gupta (1980) and Kaul and Vasishat (1981) are some of the earlier workers who published on the fossil mammals of the Neogene Siwalik deposits of Kangra District. The age of these rocks is still debated. Sahni and Khan (1964) referred to these deposits as the 'Nurpur Zone'. No radiometric or palaeomagnetic dates are available. Moreover, due to limited explorations of these sediments, the faunal associations have also not been properly worked out. Efforts in this direction were initiated by the Anthropology Department, Panjab University, Chandigarh in October, 1980 and reports on the fossil mammals and their palaeoenvironment were published by Gaur *et al.* (1983a, b) and Vasishat *et al.* (1983).

In this communication, we describe a new and some already known fossil mammals from the Miocene deposits of Nurpur, District Kangra, Himachal Pradesh (Fig. 1). The Siwaliks in this area constitute low subparallel hills with gently to steeply dipping beds of greyish and reddish brown fine-to medium-grained sandstone, silt and variegated clay. In general, the sandstone alternates with clay and the conglomeratic beds are very rare. Cross-stratification, ripple marks,

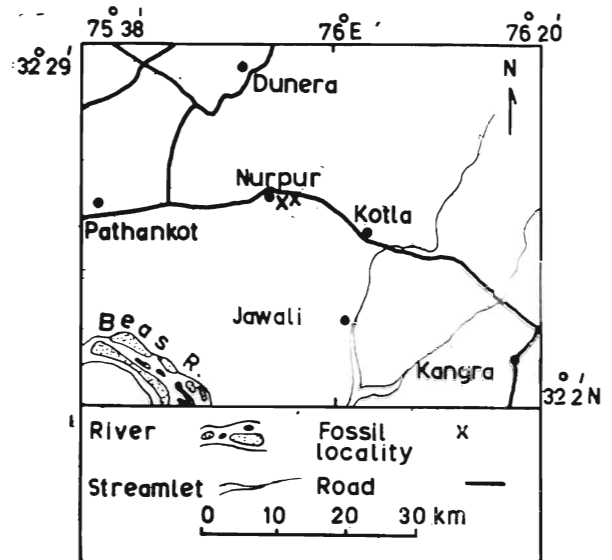


Figure 1. Locality map of the area.

horizontal bedding, etc. are some of the sedimentary structures observed by the authors. On the whole, the dark chocolate clays have yielded the maximum fossil material. Besides a new sivatheriid subspecies, we describe here *Hipparion antilopinum*, *Cermohipparion theobaldi*, and *Protragocerus glutens*. Apart from these, fragments of deinotheriid teeth and a beautifully preserved mammalian femur, probably of a hyaenid carnivore, were also recovered.

SYSTEMATIC PALAEOLOGY

Order Perrisodactyla OWEN, 1948

Subfamily Equinae STEINMAN ET DODERLEIN, 1890

Genus *Hipparion* DE CHRISTOL, 1832

Species *Hipparion antilopinum* FALCONER AND GAUTLEY, 1849

(Plate I Ia-c, 2a-c)

Material : PUA-NC-61/85, a right P²; PUA-NC-57/85
LEFT M₂

Description :

P² (PUA-NC-61/85)

Present specimen is not very well preserved and is damaged on the mesial side. Its length exceeds the breadth. Paracone and the lingual enamel wall of the oval-shaped protocone are slightly chipped. The mesostyle is the strongest style, and the parastyle and metastyle are only slightly developed. The distal border of prefossette and the mesial border of postfossette are highly plicated and display numerous fine and a few deep enamel folds. The prefossette is relatively longer and its enamel borders are more crenulated than the postfossette. The hypocone has been partially eroded. The tooth is dark brown and well-worn.

M₂ (PUA-NC-57/85)

This tooth is roughly rectangular in shape and is slightly damaged. On the distal side the hypoconulid is broken. The mesiobuccal protoconid is also slightly chipped. On the lingual side the metaconid and the metastylid form a well-developed 'double knot', typical of equids. The metaconid is larger and more rounded than the metastylid. The metaflexid is bucco-lingually compressed in the middle. The buccal depression is narrow and very deep, and nearly touches the lingual depression. The lingual depression is wide and roughly U-shaped. The tooth enamel is greyish brown and slightly rugose on the buccal side. The cement is poorly preserved. The molar shows moderate wear.

Horizon : Upper Chinji or Lower Nagri Formation

Locality : Nurpur Chogn.

Genus *Cormohipparion* SKINNER AND MACFADDEN, 1977

Species *Cormohipparion theobaldi* (LYDEKKER, 1877)

(Plate I—3a-c, 4a-c)

Material : PUA-NC-59/85, a left P⁴; PUA-NC/129, M₁

Description :

P⁴ (PUA-NC-59/85)

It is a roughly squarish and a well-preserved tooth. The enamel wall of the protoconule and the parastyle

are slightly chipped. Most of the crown details of this hypsodont tooth are clear, except in the middle of the crown. The protocone is oval and placed on the mesio-lingual aspect of the crown. The hypocone is small and pinched off from the rest of the crown. The parastyle is stronger than the mesostyle, and the metastyle is only slightly developed. The medial enamel borders of the pre- and postfossettes display numerous fine enamel plications. Some enamel folds can also be seen on the mesial border of prefossette. This dark tooth displays moderate wear.

M₁ (PUA-NC/129)

The present tooth is nearly rectangular in outline and well preserved. It is moderately worn and all the crown details can be clearly differentiated. The mesio-lingual metaconid is roughly rounded and connected to an oval-shaped metaconid to form the 'double knot' of the equids. The entoconid is the largest of the lingual conids. An enamel fold originating from the mesial border of the entoconid blocks the lingual opening of the entoflexid which is larger than the metaflexid. The hypoconulid is relatively small and mesio-distally compressed. The lingual depression is wide and U-shaped. The buccal depression is shallower than that in the M₂ of *Hipparion antilopinum* (PUA-NC-57/85). The protoconid is comparatively smaller than the hypoconid. The cement is moderately developed on the buccal and lingual sides of the molar. The measurements of hipparionids in the present collection are presented in Table 1.

Horizon : Upper Chinji or Lower Nagri Formation.

Locality : Nurpur Chogan.

Table 1. Measurements (in mm) of cheek teeth of hipparionids from Siwaliks of Nurpur.

Sr. No.	Measurement	<i>Hipparion antilopinum</i> <i>Cormohipparion theobaldi</i>			
		P ₂ PUA-NC 61/85	M ₂ PUA-NC 57/85	P ⁴ PUA-NC 58/85	M PUA-NC 129
1	Maximum mesio-distal diameter (L)	33.0	24.4	29.2	25.4
2	Maximum bucco-lingual diameter (B)	25.0	13.0	27.0	15.4
3	Maximum crown height	37.0	48.0	48.0	31.0
4	Index (B/L × 100)	75.7	53.3	92.5	59.1

- Order Artiodactyla OWEN, 1848
 Family Giraffidae GRAY, 1821
 Genus *Bramatherium* FALCONER, 1845
 Type Species *Bramatherium perimense* FALCONER, 1845
 Species *Bramatherium egacephalum*
 Subspecies *Bramatherium acephalmuegm minus* n. sub sp.

(Plate I—5a-c)

- Pilgrim, G. E. 1910 *Fac. Geol. Surv. India*, XL, Pt. 3, pp. 185-205.
 Pilgrim, G. E. 1911 *Pal. Indica. N. S.*, IV, No. 1, pp. 17-18.
 Matthew, W. D. 1929 *Bull. Amer. Mus. Nat. Hist.*, LVI, pp. 544-545.
 Colbert, E. H. 1935 *Trans. Amer. Phil. Soc.*, N. S., XXVI, pp. 364-365.

Subspecific diagnosis :

A small subspecies of *Bramatherium* ; about 10-20% smaller than the smallest specimen of *B. megacephalum*, and about 15-20% larger than *Giraffa punjabiensis*. Upper molars moderately hypsodont with strong styles, well-developed ribs, and rugose enamel. Molar lobes slightly obliquely placed; hypocone with a very strong, deep, and distally directed enamel fold. M³ with well-developed cingulum on the lingual and mesial halves of the mesial and buccal sides, respectively. Much smaller than other *Bramatherium* species.

Lectotype : A. M. No. 19488, a right maxilla with P⁴-M³.

Horizon : Middle Siwaliks

Locality : Four miles east of Dhokpathan, Pakistan.

New Material : A right M³ (PUA-NC/136)

Description :

M³ (PUA-NC/136)

The present molar is moderately hypsodont and roughly squarish in outline. A small part of the maxilla holds four robust roots of this molar which has rugose enamel. The paracone is slightly chipped at the top. Both the lobes of the molar are slightly obliquely oriented, the distal one more so. The styles are very strong and prominent while the ribs are relatively less strong. The mesial rib is more prominent than the distal one. A very strong enamel fold starts from the distal half of hypocone and travels disto-buccally to almost touch the lingual wall of the metacone. Well-defined cingular developments can be differentiated on the mesial half of buccal side and lingual half of mesial side. The mesial enamel wall of the molar displays a well-defined pressure facet. The tooth shows moderate wear.

Remarks :

If one goes through the literature, one comes across more than a dozen giraffid genera, namely *Propalaeo-*

meryx, *Giraffokeryx*, *Helladotherium*, *Giraffa*, *Hanootherium*, 'Orasius', *Camelopardalis*, *Indrathierium*, *Sivatherium* ? *Vishnuthierium*, *Hydasphitherium*, *Bramatherium*, *Hydesphidotherium*, etc., with a number of species reported from the Siwaliks of the Indian subcontinent since the middle of the last century. Many of these taxa have been synonymised and some given new names. A brief review of the giraffids from the Indian Siwaliks will not be out of place.

Propalaeomeryx sivalensis was proposed by Lydekker (1883) for a single tooth of a small giraffid. This taxon was considered to be of 'little value' by Colbert (1935). A mandible described as *Propalaeomeryx* by Pilgrim (1911, pl. 1, Fig. 3) was considered by Matthew (1929) to be too large to be referred to *Propalaeomeryx*. The generic name *Helladotherium* was applied by Pilgrim (1910, 1911) to the *Hydasphitherium grande* of Lydekker (1878). Later workers, including Matthew (1929) and Colbert (1935), reassigned *Helladotherium* to its original taxon *Hydesphitherium grande*. Matthew (1929) demonstrated that the genus *Helladotherium* never reached the Siwalik region and was probably restricted to Europe or Asia minor. Colbert (1935) and Matthew (1929) further pointed out that *Helladotherium* was probably a hornless female of *Hydasphitherium* or *Bramatherium*.

Genus *Giraffa* has been of great controversy and many new generic names were proposed for *Giraffa* material. Bohlin (1927) assigned the *Giraffa punjabiensis* of Pilgrim (1910) to a new genus *Hanootherium*. Matthew (1929) and Colbert (1935), however, synonymised *Hanootherium* again with *Giraffa*. Genus 'Orasius', created by Wagner (1857), was also shown to be synonymous with *Giraffa* by Matthew (1929) and Colbert (1935). Another giraffid taxon, *Camelopardalis affinis*, proposed by Falconer and Cautley (1843), was assigned to *Giraffa sivalensis* by Colbert (1935).

Pilgrim (1910) created a new genus *Indrathierium majorii* for a skull (Brit. Mus. No. 39523) recovered from Upper Siwaliks. After-re-examination of this specimen, later workers including Bohlin (1927), Matthew (1929) and Colbert (1935) concluded that *Indrathierium* was a hornless female of *Sivatherium* and, therefore, synonymous with *Sivatherium giganteum*.

Another genus, *Vishnuthierium*, was created by Lydekker (1876). Matthew (1929) provisionally referred some specimens intermediate in size between *Hydasphitherium megacephalum* and 'Giraffa' *punjabiensis* to ? *Vishnuthierium*. However, he was of the opinion that these specimens could belong to a smaller species of *Hydasphitherium*. Matthew, 1929, p. 545. Colbert (1935) referred a relatively small maxilla (A. M. No. 19488) to *Hydasphitherium megacephalum* with the remarks that the specimen was much smaller than the typical *Hydasphitherium megacephalum* and was closer in size and mor-

phology to those specimens which Matthew (1929) had provisionally assigned to ? *Vishnutherium*. Commenting on the American Museum specimens of *Hydaspathierium*, Colbert (1935) states "the specimens in the collection made by Mr. Brown are smaller than the typical *Hydaspathierium megacephalum* and are equal to *Vishnutherium iravaticum* in size. The last two molars of the maxillary fragment (A. M. 19488) are almost identical to the corresponding teeth in *Vishnutherium*." Colbert (1935) further suggested that the specimens referred to *Vishnutherium* probably belonged to a smaller species of *Hydaspathierium*. We also feel that the teeth referred to ? *Vishnutherium* are not much different in morphology from those of *Hydaspathierium megacephalum*. Therefore, the creation of a separate genus for these specimens is not well-founded. However, the differences are enough to warrant a distinct subspecific status for ? *Vishnutherium* material.

Another species *Hydaspathierium birmanicus* was created by Pilgrim (1910). Colbert (1935) did not consider it as a valid species due to the insufficient nature of the material and inadequate grounds.

Lewis (1939) further reduced the number of Siwalik giraffid genera. After a careful examination of the holotype skulls of *Bramatherium* and *Hydaspathierium*, Lewis (1939) concluded that these were not much different and probably belonged to a single genus. He synonymised *Hydaspathierium* with *Bramatherium*, and retained the latter which had priority in literature over the former. This view was ignored by later workers such as Singer and Bone (1960) and Harris (1974). Hamilton (1978), however, supported the contention of Lewis and considered *Hydaspathierium* as a junior synonym of *Bramatherium*. Hamilton (1978) recognised two species of *Bramatherium*, viz. *B. perimense* and *B. megacephalum*. We fully agree with the view points of Lewis (1939) and Hamilton (1978). But we feel that the genus *Bramatherium* was more varied, as is evident from the size variation within the genus (Table 2). The specimens referred earlier to '*Vishnutherium*' have differences in size and morphology with those of *B. perimense* and *B. megacephalum*, more with the former than the latter. These differences might warrant the emplacement of ? '*Vishnutherium*' material in a new species. But since the differences are more in size and less in morphology, it will be appropriate to assign the ? '*Vishnutherium*' material and one specimen (A. M. 19488) described by Colbert (1935) as '*Hydaspathierium megacephalum*' to a new subspecies of *Bramatherium megacephalum*, viz. *B. megacephalum minus*. Due to its completeness, American Museum specimen (A. M. 19488) is considered as the type material. On the basis of the foregoing, the existing situation of the Siwalik giraffids of India may be summarised as Under :

S	<i>Giraffokeryx</i>	<i>G. punjabiensis</i>
I		
V		
A	<i>Giraffa</i>	<i>G. sivalensis</i>
T		<i>G. punjabiensis</i>
H		
E		
R		<i>B. perimense</i>
I	<i>Bramatherium</i>	<i>B. megacephalum</i>
I		
N		<i>B. megacephalum minus</i>
A		sub n. sp.
E	<i>Sivatherium</i>	<i>S. giganteum</i>

Comparisons :

Present M³ differs from those of *Sivatherium* by its much smaller size. Besides size, it differs from *Sivatherium* by the presence of less outbowed and less rounded ribs, slightly oblique orientation of molar lobes, and less hypsodont nature. It is much larger than the same in *Giraffokeryx punjabiensis* (Table 2) and is about 15-20% larger than the M³ or *Giraffa*. Morphologically, it comes closer to *Bramatherium*. It differs from both *Bramatherium perimense* and *Bramatherium megacephalum* by its smaller size, being 10-20% smaller. The M³ in *B. perimense* is broader as compared to the present M³. The presence of a strong enamel fold on the distal aspect of the hypocone further differentiates the present M³ from those of *B. perimense* and *B. megacephalum*. This feature is not very well-developed in the above species of *Bramatherium*. In morphology as well as size, it comes much closer to the ? '*Vishnutherium*' specimens which have been assigned to a new subspecies of *B. megacephalum*, viz. *B. megacephalum minus*, on the preceding pages. Therefore, in view of its morphological and metrical similarities, the present M³ (PUA-NC/136) is assigned to the proposed new subspecies of *B. megacephalum*, viz. *B. megacephalum minus*.

Horizon : Upper Chinji or Lower Nagri Formation.

Locality : Nurpur Chogan, Kangra District (H. P.)

Etymology : The subspecies has been so named due to its smaller size.

Family Bovidae GRAY, 1821

Tribe Boselaphini SIMPSON, 1945

Genus *Protragocerus* DEPERET, 1887

Species *Protragocerus glutens* (PILGRIM), 1937.

(Plate II—1a-c, 2a-c)

Material : PUA-FRN/111, a left M²; PUA-NC/60/85, a right mandibular fragment with M₂+M₃.

Table 2 : Measurements (in mm) of Upper molars of some fossils giraffid from Indian Siwaliks.

S. No.	Measurement	<i>Bramatherium megacephalum minus subn. sp.</i>			"Hydaspherium" *			<i>Giraffa punjabiensis</i> *	<i>Giraffokeryx punjabiensis</i>	<i>Bramatherium perimense</i> *
		PUA-NC/136 present specimen	Matthew 1929 Ind. Mus. No. K16/483 (p. 545)	Colbert, 1935 A. M. 19488	" <i>H. megacephalum</i> " Matthew 1929 Ind. Mus. No. B512, Fig. 45	" <i>H. grande</i> " Matthew 1929 G. S. I. Nos. B 135, 155 Fig. 46	" <i>H. meganum</i> " Matthew 1929 G. S. I. Nos. B 514, Fig. 47			
1.	Max. mesio-distal dia (L) M ¹	—	—	36.0	43.0	44.5	46.2	34.0	22.0	39.5
2.	Max. Bucco-lingual dia (B)	—	—	35.0	39.0	48.0	50.0	32.0	24.0	48.0
3.	Index (B/L × 100)	—	—	97.2	90.7	107.8	108.2	94.1	109.0	121.5
4.	Max. Mesio-distal dia (L)	—	39.0	37.5	46.0	51.0	53.6	33.0	25.0	42.0
5.	Max. bucco-lingual dia (B) M ²	—	40.2	40.0	43.5	50.0	54.8	33.0	27.0	48.5
6.	Index (B/L × 100)	—	103.1	106.6	94.5	98.0	102.2	100.0	108.0	115.5
7.	Max. mesio-distal dia (L)	36.5	35.6	38.8	44.0	47.0	54.8	29.6	24.0	38.0
8.	Max. bucco-lingual dia (B) M ¹	37.0	38.0	39.2	41.0	45.4	56.0	31.0	26.0	42.5
9.	Index (B/L × 100)	101.3	106.7	101.0	93.2	96.6	102.2	104.7	108.3	111.8
10.	Max. crown height	31.0	—	—	—	—	—	—	—	—

*Measurements calculated from the figure.

Description :

M²(PUA-FRN/111)

The present molar is brachydont and shows high wear. Its width exceeds its length. The protocone is partially broken. The metacone is considerably larger than the paracone. The styles and ribs are well-developed. Mesostyle is much stronger than both the parastyle and metastyle. The anterior rib is slightly better developed than the posterior one. Lingual basal pillar is small and roughly triangular in shape with the apex directed towards the buccal side. Due to excessive wear the pre- and post-fossettes have united in the bucco-medial aspect of the molar forming a continuous fossette. Well defined pressure facetes, one each on the mesial and distal sides of the molar, can be easily demarcated. The roots are not preserved and the molar is broken at the cervical margin. The tooth enamel is faintly rugose and shining. The lobes of the molar are slightly obliquely oriented.

PUA-NC 60:85

The present mandibular fragment preserves a partial M₂ and M₃.

The second molar is roughly rectangular in shape. The paraconid and a part of the protoconid are broken.

On the buccal side, a well-developed and oval-shaped external basal pillar can be seen between protoconid and hypoconid. The ribs and stylids are less prominent. The buccal margins of the lobes are nearly pointed. The post-fossettid is narrow in the middle. The molar has a rugose and shining enamel, and is moderately worn.

The third molar is also rectangular in shape. Most of its morphological details are similar to M₂. The distalmost part of the tooth is not preserved. The meso- and metastylids are difficult to distinguish and the parastylid is slightly developed. A well-developed and roughly round external basal pillar is present between protoconid and hypoconid. The pre-fossettid is slightly larger than the post-fossettid. The goat fold and cingular developments are not discernible. The enamel of this moderately worn molar is slightly rugose. The measurements of this specimen are given in Table 3.

REMARKS ON THE AGE OF 'NURPUR ZONE'

The sediments referable to the 'Nurpur Zone' (Sahni & Khan, 1964) have not been assigned a definite age. Some workers consider these deposits to be equivalent to the Chinji Formation of Lower Siwalik while some others equate these with the Nagri Formation of Middle Siwalik. This situation has arisen primarily

Table 3 : Measurements (in mm) of the Upper and Lower molars of *Protragocerus glutens* from Nurpur Siwaliks.

Sr. No.	Measurement	PUA-FRN/111 M ₂	PUA-NC M ₂	60/85 M ₃
1	Maximum mesio-distal diameter (L)	16.7	18.0*	23.5*
2	Maximum bucco-lingual diameter (B)	18.0	12.2	12.0
3	Maximum crown height	7.0	7.7	8.0
4	Index (B L × 100)	107.8	67.8	51.0

*Approximate

due to the paucity of mammalian fossils thereby making faunal correlations with other deposits difficult. The present report adds to the meager fossil mammal record from the 'Nurpur Zone'. The fossil mammals in the present collection include some taxa, such as *Hipparion antilopinum* and *cormohipparion theobaldi*, which are typical of Nagri and younger Formations. The presence of these forms warrants a Nagri age of 'Nurpur Zone'. However, hipparionids have also been reported from the Chinji Formation of Kalagarh area (U. P.) by Tiwari (1983). There are some other forms, such as *Protragocerus glutens* and *Deinotherium*, which are found in Chinji Formation or Lower Nagri Formation. Further explorations of these sediments are suggested to work out in detail the faunal associations of the 'Nurpur Zone' which shall greatly help to correlate them with other better dated faunal assemblages of Lower and Middle Siwaliks.

Horizon : Upper Chinji or Lower Nagri Formation.

Locality : Nurpur.

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EXPLANATION OF PLATES

PLATE I

1, 2. *Hipparion antilopinum*

1a—occlusal, 1b—buccal, 1c—lingual views of P⁴.

2a—occlusal, 2b—buccal, 2c—lingual views of M₂.

3, 4. *Cormohipparion theobaldi*

3a—occlusal, 3b—buccal, 3c—lingual views of P⁴.

4a—occlusal, 4b—buccal, 4c—lingual views of M₁.

5 M³ of *Bramatherium megacephalum minus* n ps.

a—occlusal view, b—buccal view, c—lingual view.

PLATE II

1, and 2. *Protragocerus glulns*

1a—occlusal, 1b—buccal, 1c—lingual views of M³.

2a—occlusal, 2b—buccal, 2c—lingual views of M₂+M₃.

(Bar represents 2.0 cm)

