

New Fossils of *Elachistoceras* (Bovidae: Mammalia) from Chinji Formation (Middle Miocene) of Pakistan

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Abstract.— This paper report the dental remains ascribed to *Elachistoceras* from the Chinji type Locality of the Chinji Formation. *Elachistoceras* is a tiny bovid recorded from the Chinji and Nagri formations of the Middle Siwaliks. Remains of *Elachistoceras* are normally scarce and they constitute a very rare faunal element in the Siwaliks of Pakistan. The new material documents the presence of *Elachistoceras* in the Chinji type locality of Chakwal, Punjab, Pakistan.

Keywords: Boselaphini, antelopes, vertebrates, Siwaliks, Miocene, Chinji.

INTRODUCTION

The material comes from the outcrops exposed in the south of the Chinji type locality of the Chinji Formation, Potwar Plateau of northern Pakistan. The Chinji Formation is widely exposed in the area. The fossiliferous deposits consist of shales, siltstones and sand stones. The locality represents lateral facies associations and pedogenesis within the fine grained fossil-bearing floodplain deposits that are characteristic of fluvial depositional environment (Behrensmeyer, 1987, 1988; Willis, 1993; Behrensmeyer *et al.*, 1995; Barry *et al.*, 2002).

The Chinji type locality is a rich upper middle Miocene locality of the Siwaliks and located in the Potwar Plateau of the northern Pakistan (Raza, 1983). Barry *et al.* (2002) place the locality between the upper middle Miocene and lower late Miocene. Nevertheless, the remains of *Elachistoceras* Thomas, 1977 are rare finds and until now previous workers have only discovered a few specimens from the Siwaliks (Thomas, 1977, 1984; Akhtar, 1992; Khan *et al.*, 2009a). New findings from the area near the south of Chinji provide new information about the upper and lower dentitions of the tiny Siwalik boselaphine *Elachistoceras*.

Abbreviations

PC-GCUF, Palaeontological Collection of Government College University Faisalabad, Punjab, Pakistan; PUPC, Punjab University Paleontological Collection, Punjab, Pakistan; AMNH, American Museum of Natural History; GSP, Geological Survey of Pakistan; GSI, Geological Survey of India; YPM, Yale Peabody Museum; Ma, million years; M, upper molar; m, lower molar; mm, millimeters.

MATERIALS AND METHODS

The described specimens in this paper were collected from the sediments of the Chinji type locality, Chakwal district, Punjab, Pakistan and housed in the Palaeontology laboratory of the Zoology Department, GC University Faisalabad, Punjab, Pakistan. A number of field trips were carried out to the various sites of the type locality and a few specimens of the smallest Siwalik bovid were discovered. Mostly the specimens were found partly exposed and were excavated. Each specimen was wrapped with a cotton piece to avoid the shocks of transportation. The specimens were washed and cleaned in the Palaeontology laboratory of the Zoology Department, GC University Faisalabad, Punjab, Pakistan. Dust particles, clay and other hardly adjoined sedimentary particles were removed with the help of fine needles and brushes. The material is assembled by various types of gums (resins) such as Magic and Elfy.

A hand lens was used for keen observation of very small and ambiguous morphological

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characters. The catalogue number of the specimens consists of series *i.e.*, yearly catalogued number and serial catalogued number, so figures of the specimen represent the collection year (numerator) and serial number (denominator) of that year (*e.g.*, 03/11). Upper case is used for upper dentition and lower case for lower dentition. All specimens are observed for the description of morphological characters along with a discussion of their systematic determination. Various measurements of the specimens were taken by a metric vernier caliper and expressed in millimeters (mm). Tooth length and width were measured at the occlusal level. Height was measured on the metastylid of lower molar and protocone of the upper molar. The tooth crown terminology follows Thomas (1977) and Gentry and Hooker (1988).

SYSTEMATIC PALAEOLOGY

Order Artiodactyla Owen, 1848
 Family Bovidae Gray, 1821
 Subfamily Bovinae Gray, 1821
 Tribe Boselaphini Knottnerus-Meyer, 1907
 Genus *Elachistoceras* Thomas, 1977

Elachistoceras cf. khauristanensis Thomas, 1977

Type specimen

GSP 4262 – left horn-core with partial frontal.

Type locality

YGSP 182, situated at the right bank of Soan river near Ganda Kas, district Chakwal, Punjab, Pakistan.

Stratigraphic range

Lower and Middle Siwaliks (Thomas, 1977, 1984; Khan *et al.*, 2009a; unpublished data).

Diagnosis

Bovid of very small size, close to that of Steenbok (*Raphicerus campestris*). Rectilinear horn cores of very small dimensions, has oval section. The teeth reflect typical Boselaphini pattern: Molars rather brachydonts; definitely convex, non smooth lingual wall; enamel rugosed; presence of a weak

caprine fold (or antero-stylid); less developed lingual furrows distinguished from Cephalophinae (Thomas, 1977).

Studied material

PC-GCUF 01/11 – left M1, PC-GCUF 02/11 – left m1, PC-GCUF 03/11 – left mandibular ramus with m2-3.

Description

The first upper molar is three rooted tooth with partially broken protocone (Fig. 1A). The molar is brachydont and in early wear. The molar morphology strongly reflects the pattern of boselaphine molar with pronounced styles and long anteroposteriorly. The mesostyle is more prominent than the others. The paraconus rib is stronger than the metaconus rib. The labial cones are completely preserved with pointed apices. The lingual cones are somewhat constricted with narrow transverse valley. There is no entostyle. The enamel is shiny and rugose. The pre-proto-meta-cristae are larger than the post- proto-meta-cristae.

The lower left molar PC-GCUF 02/11 is brachydont and in middle wear (Fig. 1B). The stylids are diverted and the ribs are prominent. The lingual wall is convex and non smooth. The ectostylid is present. The protoconid is constricted. The lingual furrow is shallow. The light basal cingulid is present all over the crown. A weak anterior transverse flange is present. The fossettes are crescentic. The protoconid is more crescentic than the hypoconid.

The molars in the mandibular fragment are unworn and preserved with shiny enamel (Fig. 1C). The lingual walls are convex and non smooth with reflective stylids and ribs. The metaconid and hypoconulid of the m3 are damaged. The anterior transverse flange is stronger in the m2 than the m3. The ectostylid is present in the m2 but it is absent in the m3. The lingual apices of the molars are sharp and they are higher than the labial ones. The labially and lingually flattened metaconid and entoconid are slightly oblique to the long axis of the tooth and separated by a lingual embayment.

Discussion

The non smooth convex lingual walls of the

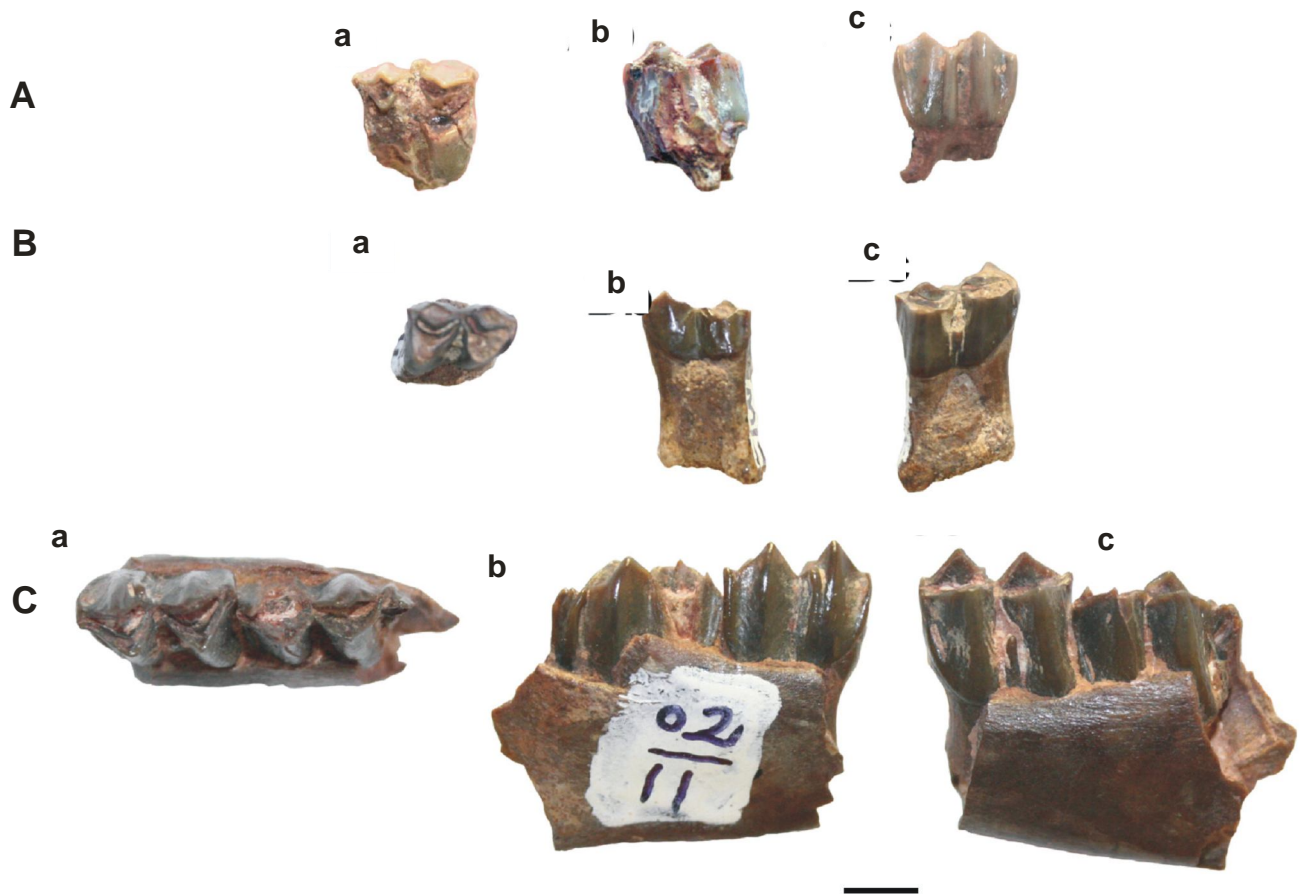


Fig. 1. *Elachistoceras* cf. *khauristanensis*: A, PC-GCUF 01/11 – left M1; B, PC-GCUF 02/11 – left m1; C, PC-GCUF 03/11 – left mandibular ramus with m2-3. Views are occlusal (Aa, Ba, Ca), lingual (Ab, Bb, Cb) and labial (Ac, Bc, Cc). Scale bar equals 5 mm.

studied lower molars distinct them from *Neotragini* Sclater and Thomas, 1894 and the shallow lingual furrow from *Cephalophinae* Gray, 1871 as it has deep lingual furrows in the lower molars (Thomas, 1977, 1984). The presence of pronounced styles and ribs, long antero-posteriorly, brachydonty, definitely convex non smooth lingual wall, rugose enamel and anterior transverse flange associate them to a small sized boselaphine (Pilgrim, 1937, 1939; Gentry *et al.*, 1999; Khan *et al.*, 2009b, 2010). The upper molar is characterized by the absence of post interlobe, pronounced styles and ribs. The molar differs from that of *Tetracerus quadricornis* (de Blainville, 1816) in the absence of post-interlobe. These features are being the characteristics of *Elachistoceras*, a tiny bovid erected by Thomas

(1977) from the Chinji and Nagri formations of the Siwaliks.

The apices of the paraconids and the metaconids are sharp. A deep median valley of the trigonid and the talonid and well developed hypoconulid development are the characteristic features of the studied specimens. Furthermore, the studied teeth show typical features of *Elachistoceras* (Thomas, 1977). The studied teeth have almost same relative proportions (Table I, Fig. 2) of the width/length as the teeth of *Elachistoceras khauristanensis* described in Thomas (1977). However, the material is too complete to identify it at the species level and it is assigned to *Elachistoceras* cf. *khauristanensis*.

Table I.- Comparative measurements of the studied cheek teeth of *Elachistoceras* cf. *khauristanensis* in mm.

Number	Description	Length	Width	W/L ratio
PC-GCUF 01/11*	M1	8.7	8.5	0.97
PC-GCUF 02/11*	m1	8.7	5.6	0.64
PC-GCUF 03/11*	m2	9.7	5.7	0.58
	m3	ca 12	5.0	0.41
GSP 7047	M1	8.4	7.6	0.90
GSP 1155	M3	8.6	7.5	0.87
PUPC 97/19	m1	9.5	6.2	0.65
	m2	9.0	7.0	0.77
	m3	12.5	6.0	0.48
PUPC 97/18	m3	13.4	7.6	0.56
GSP 4278	m1	8.2	5.1	0.62
	m2	8.9	5.4	0.60
GSP 5116	m3	11.6	5.4	0.46
AMNH 101235	m1	8.5	5.4	0.63
	m2	8.9	6.0	0.67
AMNH 19763	m1	8.5	5.4	0.63
	m2	7.8	5.6	0.71
YPM 19362	m1	6.7	4.0	0.59
	m2	7.7	4.8	0.62
	m3	11	4.5	0.40
YPM 19522	m1	7.9	4.8	0.60
	m2	8.7	5.0	0.57
	m3	11	4.7	0.42
AMNH 101228	m3	10.8	4.9	0.45
GSI K21/963	m1	7.3	4.8	0.65
	m2	8.9	5.2	0.58

*Studied specimens. Referred data are taken from Thomas (1977) and Khan *et al.* (2009a).

CONCLUSIONS

The Chinji type locality has been dated upper middle Miocene and is thus earlier than the Nagri. The Chinji *Elachistoceras* cf. *khauristanensis* is older than *Elachistoceras khauristanensis* from the Nagri but they have almost same size. One may suppose that during the Chinji and Nagri formations the size of *Elachistoceras* remained same. *Elachistoceras* is associated with *Dorcatherium* Kaup and Scholl, 1834 in the type locality indicates more or less closed and humid habitats. The fauna of the Chinji suggests wet lands with dense forested pockets, where the animals could hide in vegetation from predators.

● *E. cf. khauristanensis* ■ *E. khauristanensis*

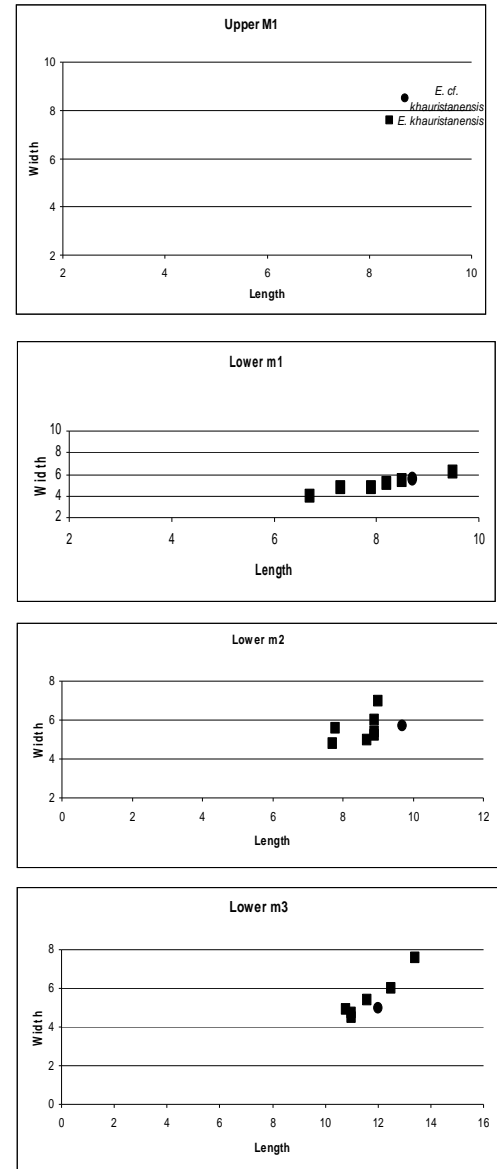


Fig. 2. Size variation in *Elachistoceras*.

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