

Additional *Giraffokeryx* Remains (Artiodactyla: Ruminantia: Giraffidae) from the Chinji Formation of Lower Siwaliks, Northern Pakistan

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Abstract.— Additional giraffid remains comprising upper dentition, recovered from the Middle Miocene localities of the Chinji Formation (Lower Siwaliks) in northern Pakistan, are discussed here. The remains are assigned to *Giraffokeryx punjabiensis*. The material is collected from the six Middle Miocene localities of the Pakistani Siwaliks nearby Chinji Rest House, Rakh Wasnal, Dhok Bun Ameer Khatoon, Chabbar Sayadan, Bhelomar and Parrhewala. These localities represent three levels of the Chinji Formation: the lower Chinji (Wasnal, Chinji Rest House, Dhok Bun Ameer Khatoon), the middle Chinji (Chabbar Sayadan) and the upper Chinji (Bhelomar and Parrhewala). *Giraffokeryx punjabiensis* is present 14.2 – 11.2 Ma in the Lower Siwaliks and reflects wide spread occurrence in the Middle Miocene of the Indian Subcontinent.

Keywords: Vertebrates, Giraffids, Artiodactyla, Middle Miocene, Siwaliks.

INTRODUCTION

Giraffidae first appeared in the Early Miocene of Africa by the presence of *Zaraffa* and *Prolybitherium* (Churcher, 1978; Geraads, 1996). The family was widespread both in Africa and Eurasia, and included several genera. The Siwalik giraffid research history goes back to the 19th century, when Cautley (1838) discovered an elongated third cervical vertebra of a large-sized giraffid. Many specimens were later identified by Falconer and Cautley (1843), Pilgrim (1911), Matthew (1929), Colbert (1933, 1935), Sarwar and Akhtar (1987), Khan *et al.* (2005, 2010), and Bhatti *et al.* (2012a, b). Nevertheless, giraffid history is not clearly deciphered in the Siwaliks (Gentry, 1999). The Siwalik giraffids can be divided in two groups: small size and large size. These species can be differentiated on the basis of dental morphology and skull patterns. The small forms comprise the genera *Propalaeomeryx*, *Progiraffa*, *Giraffokeryx* and *Giraffa*, and the large forms include *Bramatherium*, *Indratherium*, *Sivatherium*, *Hydaspitherium*, *Helladotherium*, and *Vishnutherium*. Many of the

taxa listed above are now being synonymised.

Giraffokeryx punjabiensis was identified by Pilgrim (1911) from the Chinji Formation of Phadial, northern Pakistan, based on a number of teeth. Pilgrim's work was supplemented by Matthew (1929) and Colbert (1933). Colbert (1933) recovered a skull from the Middle Miocene of northern Punjab and referred it to *Giraffokeryx* – one of the most complete descriptions of *Giraffokeryx* to this day. *Giraffokeryx punjabiensis* disappeared from the Nagri Formation about 10 Ma, and only large giraffes were present for the rest of Miocene (Barry *et al.*, 1982). A few specimens were reported from the base of the Nagri Formation, near the boundary between the Chinji and Nagri formations (Khan *et al.*, 2012).

The Chinji Formation is characterized by the presence of *Dryopithecus*, *Sivacanthion*, *Dissopsalis*, *Vishnucyon*, *Sivaelurus*, *Gomphotherium*, *Gaindatherium*, *Bunolistriodon*, *Listriodon*, *Tetraconodon*, *Hyotherium*, *Microstonyx*, *Hemimeryx*, *Dorcabune*, *Sanitherium*,

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Abbreviations: Ca, Circa; Ma, Million years ago; AMNH, American Museum of Natural History, New York, USA; GSI, Geological Survey of India; PUPC, Punjab University Paleontological Collection, Lahore, Pakistan; GCUPC, Government College University Paleontological Collection, Lahore, Pakistan; P, Premolar; M, Molar; W/L, Width/Length ratio; r, Right; l, Left; mm, Millimeters.

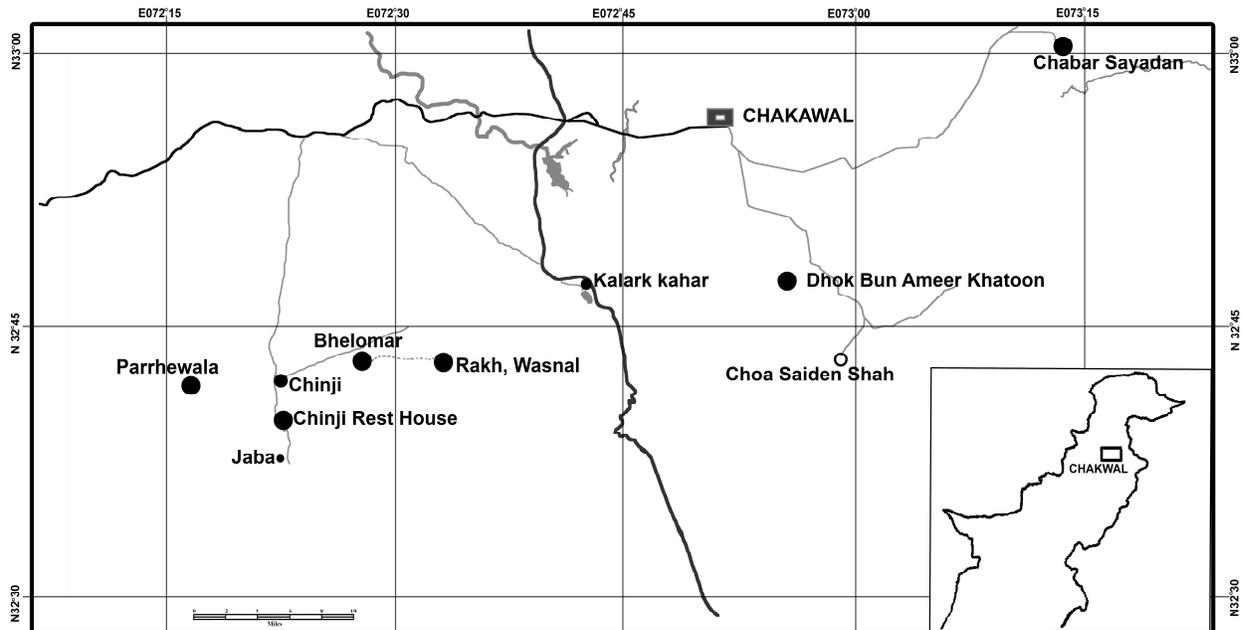


Fig. 1. Simplified map of the Potwar Plateau in northern Pakistan with reference localities of the Lower Siwaliks.

Giraffa, and *Giraffokeryx* (Pilgrim, 1911, 1913; Colbert, 1935; Matthew, 1929; Khan *et al.*, 2008, 2009, 2010; Khan and Akhtar, 2011). Three giraffid genera (*Progiraffa*, *Giraffa*, and *Giraffokeryx*) have been recorded from the Chinji Formation.

We here describe additional remains of *Giraffokeryx punjabiensis* from six localities, namely Chinji Rest House, Rakh Wasnal, Dhok Bun Ameer Khatoon, Chahbar Sayadan, Bhelomar, and Parrhewala, comprising three levels of the Chinji Formation (lower, middle and upper), in northern Pakistan (Fig. 1).

Geography and geology

The Chinji Formation is about 2300 ft (around 700 m) in thickness. The type section is located south of the Chinji village (Lat. 32° 41' N; Long. 72° 22' E) in the Chakwal district, the Punjab province, Pakistan (Khan and Opdyke, 1993). This formation consists of bright red clay and subordinate ash grey sandstone (Willis and Behrensmeyer, 1994). The clay is red, ash grey to brown, fine to medium grained with scattered pebbles of quartz (Khan *et al.*, 2009). In the type section, the ratio of siltstone to sandstone is 4:1. According to Badgley and Tauxe (1990), the most

important facies of the Chinji Formation is argillites. This formation is about 11.2 to 14.2 Ma in age (Barry *et al.*, 2002).

Chinji Rest House. Chinji Rest House (Lat. 32° 39' N; Long. 72° 22' E) is located about 3 km south of the Chinji village, the Chakwal district, northern Pakistan (Fig. 1). The outcrops are composed of sandstone and siltstone. The sandstone is bluish grey to brownish grey, whereas the silts vary in color from brownish to yellowish and grayish to tan. The sandstone components are dominant over clays and fossils are mostly found in these former. The clays are somewhat compact, with nodules, and are mostly non-fossiliferous. The basal fauna of the Chinji Formation is contained in these sediments (Barry *et al.*, 2002).

Rakh Wasnal. Rakh Wasnal (Lat. 32° 43' N; Long. 72° 33' E) is located about 4 km east of the Bhilomar village from where Ghabir River turns northwards (Fig. 1). The bright red clays are dominant and richly fossiliferous. The sandstone layers are usually thin and poorly cemented. These outcrops also yielded the basal fauna of the Chinji Formation (Sarwar, 1990).

Dhok Bun Amir Khatoon. Dhok Bun Amir Khatoon (Lat. 32° 47' N, Long. 72° 55' E) is situated

about 50 km northeast of the Chinji stratotype, Chinji Formation (Fig. 1). The outcrops comprise shales, siltstones, and sandstones, deposited in a fluvial environment, rich in unweathered igneous minerals. The biostratigraphic range of the assemblage suggests the age is comprised between 14.2 and 11.2 Ma (Cheema, 2003; Khan *et al.*, 2008, 2011).

Chabbar Sayadan. It is a small village located at about 17 km of Sohawa at the western base of Bakrala ridge (Late. 33° 00' N; Long. 73° 22' E) (Fig. 1). The outcrops are predominantly red claystones placed on subordinate hard grey sandstone with interbedding narrow beds of siliceous nodules. The majority of fossils are found in claystones. It belongs to the middle part of the Chinji Formation (Sarwar, 1990).

Bhelomar. The outcrops of the Bhelomar area (Lat. 32° 43' N; Long. 72° 27' E) are located at about 1.5 km east of the Bhilomar village (Fig. 1). The outcrops belong to the upper portion of the Chinji Formation. The rocks are low hillocks exposed by the erosion of the upper lying alluvium. The strata comprise typical exposure of the Chinji rocks, i.e. bright red clays with subordinate light grey sandstone. Both components are equally fossiliferous (Khan *et al.*, 2012).

Parrhewala: Parrhewala (Lat. 32° 41' N; Long. 72° 16' E) is the name of a local farm located at about 1 km south-east of the Chinji village (Fig. 1). The rocks are predominantly bright red clays with abundant siliceous nodules forming pseudoconglomerates (Sarwar, 1990).

MATERIALS AND METHODS

Several field trips were arranged to search for the fossil remains of *Giraffokeryx punjabiensis* from the Chinji Formation of Pakistan. The localities, such as Wasnal, Parrhewala, Dhok Bun Ameer Khatoon, Chinji Rest House, Bhelomar and Chabbar Sayadan were explored, and many fossils were discovered. The material comprises maxillary fragments, isolated premolars and molars. The surrounding sedimentary matrix was carefully removed with the help of chisels, pin headed hammer, various types of needles and brushes.

The material was carefully washed and

cleaned in the paleontology laboratory of Zoology Department of GC University, Lahore. Broken parts were carefully assembled by using various types of glue. The tightly encrusting sediments were removed by using hydrochloric, phosphoric and acetic acid. A hand lens was used for morphological analysis and observation of taxonomic features. Each specimen was labelled with the collection year as well as the serial number of the respective year e.g. in 1141/09, the nominator denotes the serial number of the collection, and the denominator indicates the collection year.

Various measurements were taken using a digital vernier caliper and are expressed in millimeters. This material is compared with the specimens present in the American Museum of Natural History New York, Indian Museum, Calcutta and Punjab University Paleontological Collection Stored in Zoology Department, University of the Punjab, Lahore, Pakistan. The systematics follows Solounias (2007), and the identification and terminology follow Hamilton (1973), Gentry (1994), Gentry *et al.* (1999) and Khan *et al.* (2009).

SYSTEMATIC PALAEOLOGY

Order Artiodactyla Owen, 1848
 Suborder Ruminantia Scopoli, 1777
 Infraorder Pecora Linnaeus, 1758
 Superfamily Giraffoidea Gray, 1821
 Family Giraffidae Gray, 1821
 Subfamily Giraffokerycinae Solounias, 2007
 Genus *GIRAFFOKERYX* Pilgrim, 1910

Type species

Giraffokeryx punjabiensis Pilgrim, 1910.

Generic diagnosis

Moderate-sized genus having brachyodont cheek teeth with rugose enamel sculpture. Length of limbs and feet is medium. Two pairs of ossicones are present, one pair projects from the anterior extremities of the frontal bone and the other pair is situated on the fronto-parietal region. The anterior horns are in front of the orbits, whereas the posterior horns overhang the temporal fossa (Pilgrim, 1910; Matthew, 1929; Colbert, 1933, 1935; Solounias, 2007).

Geographic distribution

Giraffokeryx is best known from the Siwaliks (Pakistan, India) (Pilgrim, 1910; Bhatti, 2005; Bhatti *et al.*, 2007a, b, 2012a; Khan *et al.*, 2010), Dang Valley (Nepal), Belomechetskaia (Russian Federation), Fort Ternan (Kenya) and Turkey (Colbert, 1935; Churcher, 1970; Geraads, 1986; Janis and Scott, 1987; Gentry and Hooker, 1988; Gentry, 1990; West *et al.*, 1991; Pickford *et al.*, 2000; Geraads and Aslan, 2003). *Giraffokeryx* is recorded from Southern Asia, Africa and few Astaracian age localities of Europe (Gentry, 1990).

Giraffokeryx punjabiensis Pilgrim, 1910

Lectotype

GSI B502, a third molar of the right maxilla.

Type locality

Chinji village (Lower Siwaliks), Chakwal district, the Punjab province, Pakistan (Colbert, 1935).

Stratigraphic range

Lower Siwaliks and the lower portion of the Middle Siwaliks (Chinji – basal Nagri, Daud Khel Fauna (Mianawali, Punjab), Manchar (Sind, Yale GSP locality 4 and 15)) (Pilgrim, 1910; Matthew, 1929; Colbert, 1935; Hussain and West, 1979; Raza *et al.*, 1984; Bhatti, 2005; Khan *et al.*, 2010; Bhatti *et al.*, 2007a, b, 2012a).

Geographic distribution

Giraffokeryx punjabiensis is recorded from south Asia (Pilgrim, 1910; Colbert, 1935; Bhatti, 2005; Bhatti *et al.*, 2007a, b, 2012a; Khan *et al.*, 2010). It is also known from Eurasia and the Greco-Iranian province (Kostopoulos and Sarac, 2005).

Specific diagnosis

The major cusps are in a straight line. The upper molars are subhypsodont and large, with prominent parastyles and mesostyles, stylids are weakly developed or absent. Entostyle/ectostylid is tiny or absent. The anterior rib is more prominent as compared to posterior one (Pilgrim, 1910, 1911;

Colbert 1935; Bhatti, 2005; Bhatti *et al.*, 2012a).

Localities and age

The material was collected from the Chinji Formation of the Lower Siwaliks of Pakistan: the lower Chinji (Wasnal, Chinji Rest House, Dhok Bun Ameer Khatoon) with an age range of circa 14.2–13.2 Ma, the middle Chinji (Chabbar Sayadan) with estimated age of 13.2–12.2 Ma, and the upper Chinji (Bhelomar and Parrhewala) that is 12.2–11.2 Ma in age. The Chinji Formation is assigned a Middle Miocene age, from 14.2–11.2 Ma (Barry *et al.*, 2002; Nanda, 2002, 2008).

New material (in parenthesis the inventory number and the locality name are given)

IP³ (GCUPC 1141/09, Chabbar Sayadan), rP^{3s} (GCUPC 1173/09, Bhelomar; GCUPC 1072/09, Wasnal), IP⁴ (GCUPC 707/05, Chinji Rest House), a left maxillary ramus with P⁴-M¹ (GCUPC 706/05, Chinji Rest House), rM¹ (GCUPC 1185/12, Dhok Bun Ameer Khatoon), IM² (GCUPC 1172/09, Bhelomar; GCUPC 1187/12, GCUPC 1188/12, Dhok Bun Ameer Khatoon; GCUPC 1353/09, Chinji Rest House), rM² (GCUPC 1183/12, GCUPC 1184/12, Parrhewala; GCUPC 1167/12, Dhok Bun Ameer Khatoon; GCUPC 1144/09, Bhelomar), a left maxillary ramus bearing M²⁻³ (GCUPC 1135/09, Chinji Rest House), rM³ (GCUPC 1148/12, Dhok Bun Ameer Khatoon).

Description

P³. Third premolars are excellently preserved and moderately worn (Fig. 2A-C). The cingulum is present labio-lingually and it is quite thin antero-posteriorly. A thick layer of enamel with shiny surface can be observed all around the crown surface. The fossette is quite large, shallow and crescent shape. The protocone is present antero-lingually with its preprotocrista longer than the postprotocrista. There is no clear cut demarcation between the metaconule and the protocone. The paracone, higher than the protocone, is spade-shaped and largely worn out. The enamel of the paracone is thick and crenulated and it is folded antero-labially to form the parastyle. It is narrow anteriorly and broad posteriorly. The enamel folding of the paracone extends posteriorly and the one of



Fig. 2. *Giraffokeryx punjabiensis*: A, GCUPC 1141/09, IP³; B, GCUPC 1173/09, rP³; C, GCUPC 1072/09, rP³; D, GCUPC 707/05, IP⁴; E, GCUPC 706/05, left maxillary ramus with P⁴-M¹; F, GCUPC 1185/12, rM¹. Views are occlusal (Aa, Ba, Ca, Da, Ea, Fa), lingual (Ab, Bb, Cb, Db, Eb, Fb) and labial (Ac, Bc, Cc, Dc, Ec, Fc). Scale bar 10 mm.

the metacone anteriorly, to form a thick pillar like structure called mesostyle. The mesostyle is higher than the parastyle and the metastyle.

P⁴. The pressure mark is present on the antero-posterior sides of crown (Fig. 2D, E). In general contour, the teeth resemble a half-moon. The enamel lining of protocone is continuous antero-posteriorly, thus dividing the tooth into two equal halves. A strong median rib is present. A prominent parastyle is present. A metastyle is moderately present. A short spur projects posteriorly in the median fossette. The occlusal outline of the premolar is nearly rectangular, being much broader transversely than long. A praeprotocrista unites the

protocone with the parastyle.

M¹. All the four principal cusps are well preserved (Fig. 2E, F). The protocone is V-shaped, half worn, and the dentine is exposed forming a V-shaped dentinal islet. The metaconule is similar in shape and size to the protocone. A thin layer of cement is present at the lateral margin of the metaconule. The paracone is an inverted V-shaped structure. Its enamel border is shiny and crenulated. The enamel lining of the paracone is directed forward and backward to form a very thick pillar-like parastyle antero-labially. The metacone is vertically higher than the metaconule. The enamel lining of premaxilla extends anteriorly and the

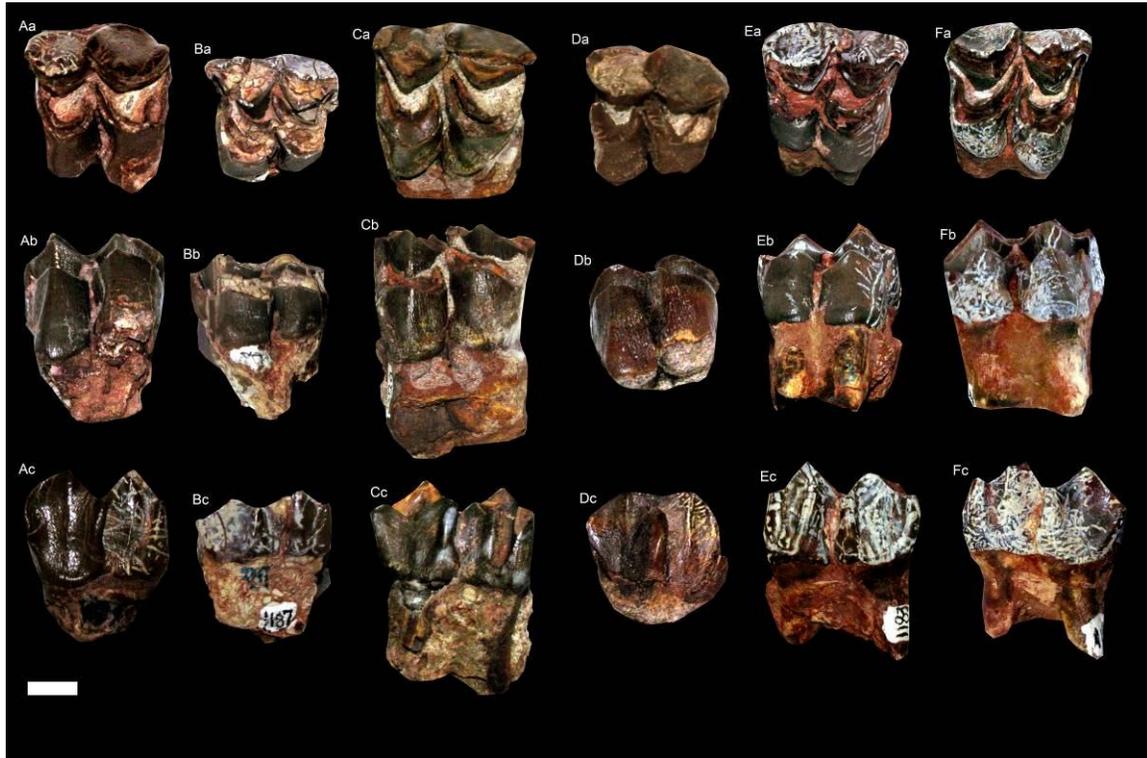


Fig. 3. *Giraffokeryx punjabiensis*: A, GCUPC 1172/09, IM²; B, GCUPC 1187/12, IM²; C, GCUPC 1188/12, IM²; D, GCUPC 1353/09, IM²; E, GCUPC 1183/12, rM²; F, GCUPC 1184/12, rM². Views are occlusal (Aa, Ba, Ca, Da, Ea, Fa), lingual (Ab, Bb, Cb, Db, Eb, Fb) and labial (Ac, Bc, Cc, Dc, Ec, Fc). Scale bar 10 mm.

one of the postparacrista posteriorly and outwardly to form a very strong and thick mesostyle. The paracone and metacone are provided labially with thin pillar-like median ribs. The transverse valley is linear and shallow, whereas the longitudinal valley is wavy and deep.

*M*². The antero-posterior contact facets are similar, indicating the presence of the second molars from the molar series (Fig. 3A-F; Fig. 4A-C). The teeth are squared in outline. The four principal cusps are well differentiated. The protocone is V-shaped: the preprotocrista is more elongated than the postprotocrista. The premetaconulcrista is U-shaped, whereas the postmetaconulcrista is somewhat V-shaped. The metaconule is contiguous with the metacone through a narrow channel on the posterior end. The metacone is similar in shape and size to the paracone and is present postero-labially. The prefossette is narrow and the postfossette is wide and narrow. The transverse valley is straight and opens labio-lingually, and the longitudinal valley is

irregular.

*M*³. The third molars are similar to the second ones in the general morphology (Fig. 4C, D). The metastyle is comparatively better developed.

COMPARISON AND DISCUSSION

The specimens are rugose and the rugosity is a prominent feature in the family Giraffidae. Furthermore, the specimens have typical giraffid characteristics, such as the rugose enamel and the obliquity of the labial cusps (Pilgrim, 1911; Matthew, 1929; Colbert, 1935; Bhatti *et al.*, 2012a) (Figs. 2-5). According to the recent revision performed by Solounias (2007), the family Giraffidae comprises seven subfamilies, four of which are reported from the Siwaliks: Palaeotraginae, Giraffokerycinae, Giraffinae and Sivatheriinae. Palaeotraginae comprises the genera *Propalaeomeryx* and *Progiraffa*. Giraffinae includes the genus *Giraffa*, and the subfamily Sivatheriinae is



Fig. 4. *Giraffokeryx punjabiensis*: A, GCUPC 1167/12, rM²; B, GCUPC 1144/09, rM²; C, GCUPC 1135/09, left maxillary ramus bearing M²⁻³; D, GCUPC 1148/12, rM³. Views are occlusal (Aa, Ba, Ca, Da), lingual (Ab, Bb, Cb, Db) and labial (Ac, Bc, Cc, Dc). Scale bar 10 mm.

represented by *Sivatherium*, *Bramatherium*, *Helladotherium*, *Hydaspitherium* and *Vishnutherium*. The genus *Giraffokeryx* is placed in the subfamily Giraffokerycinae.

Both large and small genera are present in the Siwaliks. The specimens under study are smaller in size, so they cannot be directly compared to the maxillae and mandibles of the large subfamily Sivatheriinae (*Helladotherium*, *Hydaspitherium*, *Vishnutherium*, *Sivatherium*, and *Bramatherium*) (Khan *et al.*, 2010; Bhatti *et al.*, 2012a, b). They can be referred to the small subfamilies Palaeotraginae (*Propalaeomeryx* and *Progiraffa*), Giraffinae (*Giraffa*), and Giraffokerycinae (*Giraffokeryx*). The specimens differ from Palaeotraginae in having a relatively higher degree of hypsodonty. The sample differs from Giraffinae in having less developed external folds (de Bonis *et al.*, 1997; Solounias,

2007).

The specimens exhibit the following characteristics: brachyodont jugal teeth with rugose enamel, weak styles/stylids and entostyles/ectostylids, and weak median ribs. The P³s are narrow-crowned with crescent fossettes. These premolars are longer than the P⁴s (Table I). In the upper molars, the parastyles and mesostyles are well differentiated, and the metastyles are weakly developed. The median ribs are incipiently developed and the entostyles are absent. These features associate the sample to the subfamily Giraffokerycinae and to the genus *Giraffokeryx* (Pilgrim, 1911; Matthew, 1929; Colbert, 1935; Harris *et al.*, 2010; Bhatti *et al.*, 2012a). This genus is distinguished by brachyodont to subhypsodont teeth with some degree of variation.

Morphometrically, the teeth resemble the earlier

Table I.- Comparative dental measurements of the cheek teeth of the Siwalik *Giraffokeryx* in mm (millimeters). * the studied specimens. Referred data are taken from Pilgrim (1911), Colbert (1935), Barry *et al.* (2005), Bhatti (2005), and Bhatti *et al.* (2012a).

Taxa	Number	Nature / Position	Length	Width	W/L
<i>G. punjabiensis</i>	GCUPC 1141/09*	P ³	22.5	21.7	0.96
	GCUPC 1173/09*	P ³	22.7	21.4	0.94
	GCUPC 1072/09*	P ³	22.5	19.4	0.86
	GCUPC 707/05*	P ⁴	19.3	23.5	1.22
	GCUPC 706/05*	P ⁴	19.3	23.2	1.20
		M ¹	26.2	27.1	1.03
	GCUPC 1185/12*	M ¹	27.5	28.0	1.01
	GCUPC 1172/09*	M ²	27.5	28.3	1.03
	GCUPC 1187/12*	M ²	28.4	26.3	0.92
	GCUPC 1188/12*	M ²	29.5	27.1	0.91
	GCUPC 1353/09*	M ²	26.1	26.7	1.02
	GCUPC 1183/12*	M ²	27.3	25.7	0.94
	GCUPC 1184/12*	M ²	29.4	28.1	0.95
	GCUPC 1167/12*	M ²	27.2	25.1	0.92
	GCUPC 1144/09*	M ²	24.1	26.2	1.08
	GCUPC 1135/09*	M ²	26.7	25.3	0.94
		M ³	25.0	25.5	1.02
	GCUPC 1148/12*	M ³	27.3	27.9	1.02
	AMNH 19475	P ³	20.5	20.0	0.97
		P ⁴	17.5	21.0	1.20
		M ²	25.0	27.0	1.08
		M ³	24.5	26.0	1.06
	AMNH 19930	P ³	22	20.0	0.90
		P ⁴	19.5	23.5	1.20
		M ¹	26.5	28.0	1.05
	PUPC 94/11	P ³	23.0	22.0	0.95
	GSI B509	P ⁴	20.6	24.7	1.19
	AMNH 19325	P ⁴	18.0	24.0	1.33
		M ²	29.5	27.0	0.91
		M ³	27.5	28.0	1.01
	AMNH 19330	P ⁴	17.0	23.0	1.35
	PUPC 94/12	P ⁴	20.0	24.0	1.20
	PUPC 66/95	M ¹	26.0	28.0	1.07
	GSI B505	M ²	30.2	28.2	0.93
	AMNH 19320	M ²	29.0	28.5	0.98
	AMNH 19325	M ²	29.5	27.0	0.91
	AMNH 19611	M ²	27.0	26.0	0.96
	AMNH 19632	M ²	28.0	24.0	0.85
	AMNH 19611	M ²	27.0	25.5	0.94
		M ³	25.0	25.0	1.00
PUPC 69/37	M ²	29.0	29.0	1.00	
PUPC 94/1	M ²	27.0	25.0	0.92	
PUPC 94/3	M ²	27.5	26.1	0.94	
<i>Progiraffa exigua</i>	H 312	P ³	18.5	15.1	0.81
		M ¹	22.3	21.7	0.97
		M ²	24.0	25.9	1.07
		M ³	24.3	23.7	0.97
	M ³	26.7	29.1	1.08	
<i>Giraffa priscilla</i>	H 664	M ³	26.7	29.1	1.08
	PUPC 02/99	P ³	19.0	21.0	1.07
		P ⁴	19.5	18.0	0.94
		M ¹	24.0	24.0	1.00
	M ²	25.0	28.0	1.12	

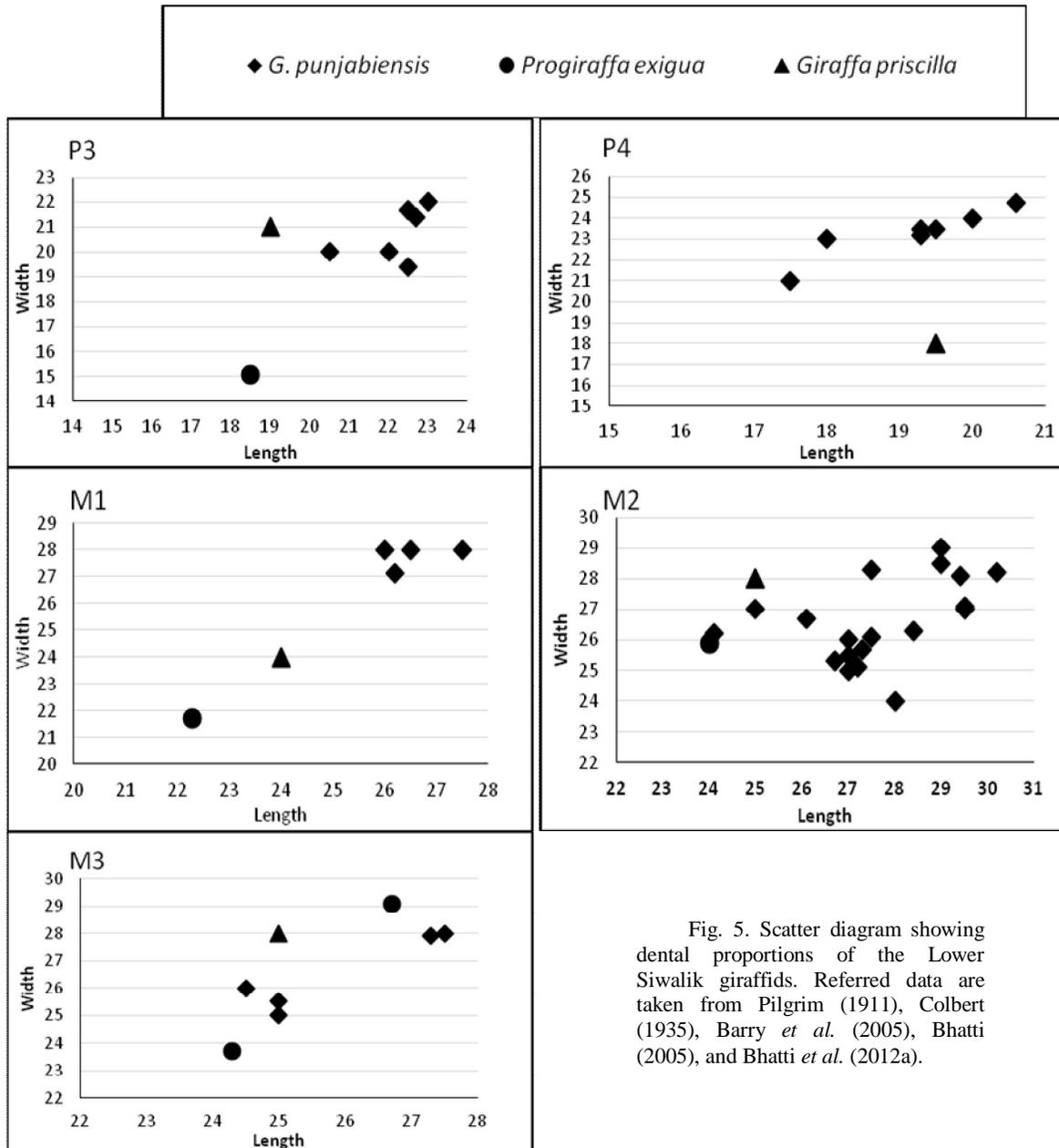


Fig. 5. Scatter diagram showing dental proportions of the Lower Siwalik giraffids. Referred data are taken from Pilgrim (1911), Colbert (1935), Barry *et al.* (2005), Bhatti (2005), and Bhatti *et al.* (2012a).

collected specimens of the species *Giraffokeryx punjabiensis* present in the American Museum of Natural History New York, USA, the Indian Museum, Kolkata, India and the Punjab University Paleontological Collection Stored in Zoology Department, University of the Punjab, Lahore, Pakistan (Figs. 2-5) (Pilgrim, 1910, 1911; Matthew, 1929; Colbert, 1935; Harris *et al.*, 2010; Bhatti *et al.*, 2012a).

CONCLUSIONS

Giraffokeryx appears to be a common faunal element in the Middle Miocene fauna of the Siwaliks. It is present in different levels of the Chinji Formation having an age span of 14.2 – 11.2 Ma. A few specimens were recorded from the base of the Nagri Formation and the species completely disappeared around 10 Ma from the Indian

Subcontinent. The presence of *Giraffokeryx punjabiensis* all over the Chinji Formation shows its wide spread distribution in the Subcontinent.

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