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Tragoportax (mammalia, Bovidae) From The Dhok Pathan Formation Of The Middle Siwaliks, Northern Pakistan

Ammara Nawaz[1], Hasnain Nangyal[2], Nighat Ziaudin[3], Ali Raza[4] and Upvan Bhushan[5]

[1]Department of Zoology Punjab University Lahore, Punjab, Pakistan.
[2]Department of Botany Hazara University Mansehra, KP, Pakistan.
[3]Department of Biochemistry Agriculture University Faisalabad, Punjab Pakistan.
[4]Department of Zoology Gujrat University, Punjab Pakistan.
[5]Department of Botany University of Jammu and Khasmir, India.

Abstract:

Dhok pathan formation of Chakwal district, Punjab Pakistan is famous for the formation of new bovid remains of Tragoportax punjabicus. The recovered material consists of upper and lower dentition with isolated molars too. All the fossil remains has been described in detail to establish the Taxonomic Position of the specimen up to species level. Material is described fully in the thesis and measurements were also taken then compared with the previously described fossils of Tragoportax punjabicusto get a satisfactory conclusion. Abundance of boselaphines in Dhok Pathan Formation indicate that Siwaliks was inhabited by great variety of boselaphines and many new forms appeared in Miocene and diversified in the later epochs including the studied specie Tragoportax punjabicus .The collected fossils of boselaphine fauna greatly helps in the reconstruction of paleohabitat, paleoenvironment and other conditions of the ancient and extinct animals specially Tragoportax punjabicus in Dhok Pathan Formation of Middle Siwaliks. The collected fossils show similarity with the established diagnostic features of the genus Tragoportax and the species Tragoportax punjabicus was established due to most sibling similarities including description of theupper molars which arequadrate, moderately hypsodont, outer folds and ribs rather strong, median rib in posterior lobe is weaker than in anterior lobe, entostyles present in all the molars.

KEY WORDS:

Tragoportax, Dhok Pathan, Siwaliks, Fossils, molars.

INTRODUCTION:

Siwaliks include sub – Himalayan range of Indo-Pak sub-continent. It extends West Northwards from river Tista in Sikkum state. Northwestern India, Nepal, Assam, Burma and some area of Bhutan too.The name Siwaliks is derived after the hills of the same name near Hindu Holy cityof Hardwar; from here the first paleontological treasures were found that made this area famous worldwide after wards. . Due to volcanic activities in this area the Strata is uniform andfossils are scattered. It is actually composed of alluvial detritus derived from the sub aerial erosion of the mountains, carried by their many rivers and streams and deposited at their foot hills [1].

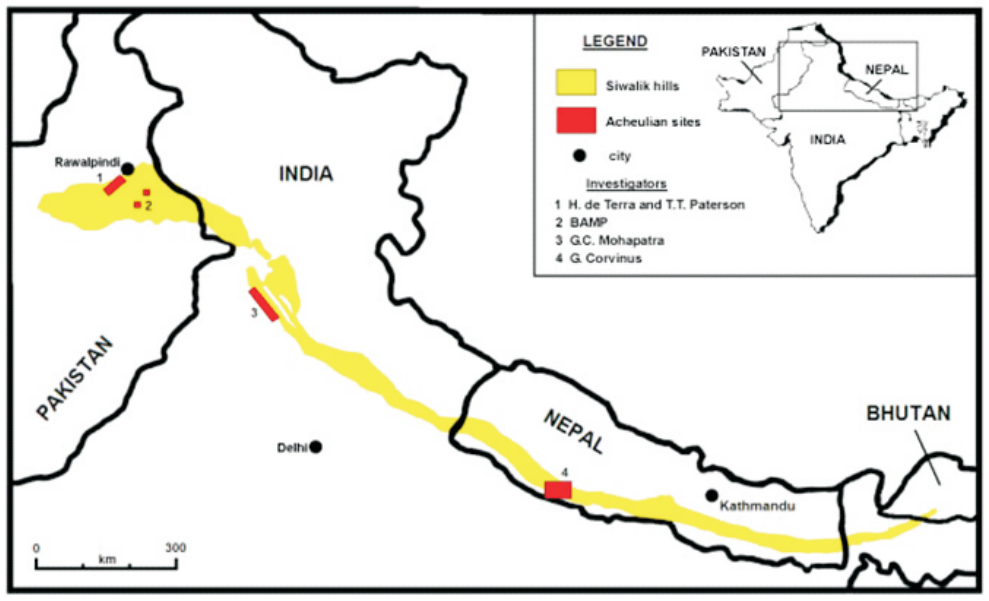


Figure 1: Distribution of Siwalik sediments and theassociated sites

Siwalik Geology

Geology of Siwaliks has been well studied and documented by national and international researchers since 18th century. Work on Siwaliks geology and plaenotology was done by the workers of American and Britian[2-6].Geologically Himalayas that was famous for foreland basin which is filled with molasses type sediments of Neogene and early quaternary age , developed at the foothills of Himalayan mountain belt. Formation of Siwaliks basin and the collision of Indian and Eurasian plates about 60 million yearsago. It caused uplift of the Himalayan hills too [7-9].

Siwalik Biostratography

Miocene sediments of Siwaliks are fluvial in origin some sections exceed 300m. It isdifficult in Siwaliks to delineate theboundaries between the formations, but in sedimentological and geological view it is easy to see the Siwalik sequence as a single genetic unit. But now by using magnetostratigraphy it is possible to separate these formations which are necessary in fossil recognition. Pilgrim (1910, 1913) first recognized a series of successive "faunalzones", a term comparable to modern use of "Stage." These divisions were made on the basis of lithological criteria and containedfauna. But the boundaries of these faunal zones were not properly drawn. Now faunal zones are used primarily as, lithostratographic "formations "or as chronostratographic "zones".

Siwalik Sedimentology

A good record of changing depositional environments that was provided by Siwaliks of fauna and flora that is significant due to hydrologic, sedimentologic and tectonic processes and forms of the modern Indo – Gangetic fluvial basin are probably very similar to those in the past (about 20million years ago) and therefore provide a valuable analogue for studying the Siwaliks [8].

In Potwar plateau, in Pakistan Siwalik sediments are extensive. It expands from Jhelum in the East Indus River toSalt range in the South to the Margalla [10]. Siwalik Sedimentation exceeds 10cmper thousand years [11].

Siwalik Stratigraphy

The lithostratigraphic rank "Group" was designated by Danilchik and Shah, (1967). Stratigraphic committee of Pakistan formalized the Siwalik group include.

SUB-GROUP	FORMATION	Corvinus & Rimal, 2001 (ma ago)	Prasad, 2001 (ma ago)
Upper Siwaliks	Upper Boulder Conglomerate	5.9 - ?	0.9 - 0.2
	Lower Boulder Conglomerate		
	Pinjore		2.4 - 0.9
	Tatrot		5.1 - 2.4
Middle Siwaliks	Dhok Pathan	7.9 - 5.9	10.8 - 5.1
	Nagri	10.1 - 7.9	
	Chinji	13.1- 10.1	
Lower Siwaliks	Kamlial	--	18.3 - 10.8

Figure 3: Lithostratigraphy of the Siwalik group in the Potwar Plateau Pakistan.

Upper Siwalik sub group

It is about 6000 feet thick (3.5 – 1.0 Ma).Tatrot, Pinjor and boulder conglomerates zones or stages are sub groups of upper Siwalik. Depending upon the lithostratigraphy these zones are collectively called Soan formation.

Middle Siwaliks

This zone is lithologically different from overlying Chinjizone.about 6000 feet in thickness. It consists of two distinct formations lower, Nagri Formation and upper Dhok Pthan.

Lower Siwalik sub-group

High sinuosity meandering streams with broad flood plains is about 4000 feet that is characterized by depositional environment. At outcrop level it is mediumgrained, grey to greenish blue and purple sandstone, inner bedded with reddish brown to gray hard mudstone and paleosoles.

Siwalik Lithology

It is thought that all the formations of Siwalik group are very similar on a broad geographic range. This is actually due to broad similarities in tectonic activity and climate changes and other processes. Lithologically Siwalik group is made up of enormous thickness of detritus rocks, clay, sand, stones, conglomerates and mud stones having accumulative thickness of more than 5000m [12-13].

Mangnetostratigraphy

To provide precise chronologies of very old sedimentary records of terrestrial environment Mangnetostratigraphy is used. Northern Pakistan Siwaliks is the best example of best – dated sequence of deleted animal fossils in Neogene in a single terrestrial biogeography province [11]. The lithographic constrains do not effect magnetic polarity Relative abundance of iron oxide determines the polarity of the area.Magnatozones may be as short as 50,000 years has been detected in some areas [14].

Siwaliks Petrography

Study of petrography especially heavy minerals fraction of Siwaliks has provided a way to create boundaries between the different Stratiographic horizons. This is because the Siwalik clastics have been derived from an active organic belt and sediments formed during a particular organic cycle differ from those of the other. This method also has many limitations.

Siwalik Taphonomy

Rich vertebrate fossils record in predominantly fluvial deposits from Neogene is present in Potwar Plateau of northern Pakistan [15]. Taphonomic research focuses on studying the distribution of fossil location among the depositional environment. This study includes the study of sedimentary environment and stratigraphy span of fossils.

Siwaliks Paleoecology

By studying the nature of palaeosols of Siwaliks it was determined that paleoclimate during deposition of Siwaliks was humid, sub – tropical to tropical and monsoonal [16-17]. It was confirmed by isotopic study of marine of microfossils [27], plant material [18] and climate modeling [19] Siwaliks depositional environment contains small to big channels, rare ponds and swamp deposits.

MATERIALS AND METHODS

The described material comprises of isolated dentition, maxilla and mandible fragments, and isolated molars. The material includes the newly collected specimens from the Dhok Pathan type locality under the supervision of Prof. Dr Muhammad Akhtar. Almost all fossil specimens were found weathering out from or in situ within the light colored sandstone with alternate clay and orange shale. Fossils were generally very well preserved. The studied material is housed in the Paleontology Laboratory of the Zoology Department of the Punjab University, in Lahore, Pakistan. The specimens are catalogued in two series i.e. yearly catalogue number and the serial catalogue number.

Generic Diagnosis (Geraads and Spassov, 2004)

European *Cervus elaphusgenerally* have large size.Postcornual fronto-parietal have flat or slightly concave well defined depressed surface area, usually bordered laterally by well-marked temporal ridges and caudally by a step leading to a slightly raised plateau. Adult male horn-cores are long and slender, usually curved backwards, with a triangular to subtriangular cross-section, well-marked posterolateral keel and flattened lateral sides, but are less compressed than in Miotragocerus.

Stratigraphic Range:

Middle Siwaliks.

Geographic Distribution:

From the Vallesian/Turolian boundary (or lateVallesian) to the end of the Turolian, perhaps earliest Pliocene in Africa. From southeastern Europe and the northern Paratethys region through Asia Minor and the Middle East to Africa and the northern part of the Indian subcontinent (and possibly central Asia) [23].

Tragoportax punjabicus (Pilgrim, 1910)

Type Specimen: Skull: GSI B486

Emended Diagnosis (modified from Pilgrim 1937, 1939 and, Spassov and Geraads, 2004)

A Tragoportax with moderately long curved horn-cores with a large antero-posterior diameter, faintly twisted, slight torsion, cross-section triangular to subtriangular, well-marked posterolateral and

flattened sides.

Studied material

PUPC 13/26, upper left P3-P4; PUPC 13/25, right upper M1-2; PUPC 09/97, left upper M1-2; PUPC 13/24, isolated right upper M3; PUPC 09/83, broken right mandibular ramus with p4-m2.

Locality of the studied material

The Dhok Pathan Formation north of Dhok Pathan village, the middle Siwaliks, district Chakwal, Punjab, Pakistan

Description

Upper Premolars

The P^3 in PUPC13/26 have triangular tooth that indicates all the morphological characteristics (Fig.1a. 1b). The enamel is wrinkled and rogues. A prominent central cavity is present. A small, very thin, transverse enamel layer connects the posterior end of the protocone with the hypocone.

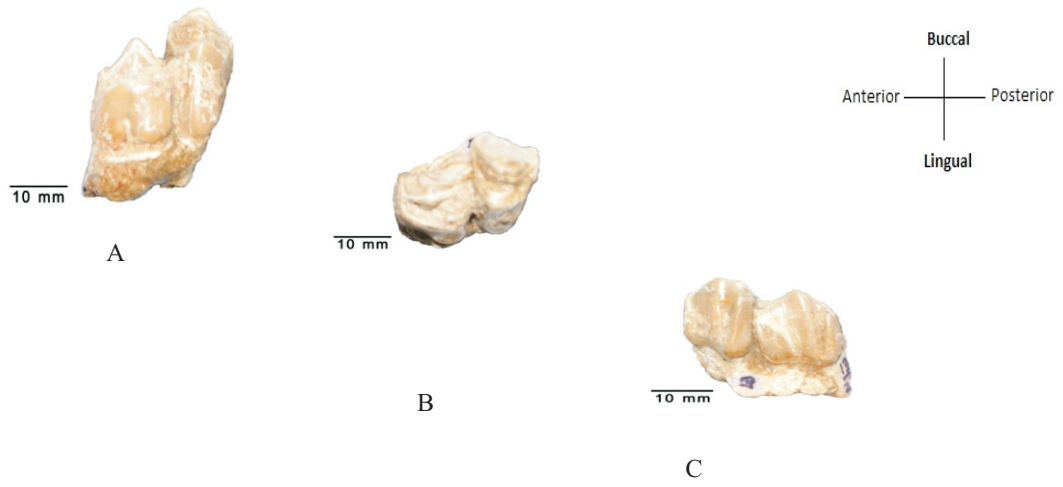
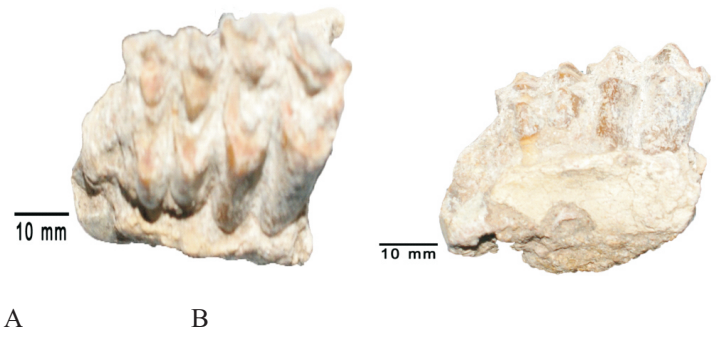


Figure 6: PUPC 13/26 IP3, IP4Scale bar 10mm. a.Lingual view, b.occlusal view ,c.Buccal view

Molars

The molars are hypsodont andquadrate. The enamel is rugose. The molar longer than the premolar. The entostyle is present in all molars. The entostyles are slightly shifted towards the hypocone. The metastyle is strong and posteriorly extended on M2.



A B

Figure 7: PUPC09/97 IM1,IM2 .scale bar 10mm. A.Occlusal view, B.lingual view.

Lower Dentition

The P4 in PUPC 09/83 has a strong paraconid, metaconid and entoconid. The entoconid is fused with the endostylid. Hypoconid is noteworthy and has a deep and narrow valley in front of it. The P4 is extended antero-posteriorly. The metaconid of the premolar is larger than the P3. It is T-shaped on the P4, with an open anterior valley.

The M1 ectostylid is strong and almost circular in cross section. The principal conids are well developed and crescentic. The metaconid and the entoconid are spindle shaped with narrowing borders.

The M2 is somewhat worn out on the lingual side. The overall contour indicates that it is subhypsodont and narrow crowned tooth. A very small ectostylid is located in the transverse valley between the protoconid and the hypoconid.

Fig 10.PUPC 09/83 rP4, M1, M2. Scale bar 10mm. a. occlusal view, b. lingual view

COMPARISON AND DISCUSSION

Some herbivorous mammalian group can be ascribed as a quadrangle and tetra-tuberculated in morphology [20,28]. Bovidae family is compressed external cusps support. Teeth are small in size and selenodont. The teeth show some differences in morphology from dental remains of *Pachyportax* and *Selenoportax* by their smaller size and the weaker basal pillar [21-22]. The P3 in the present sample indicates inflated hypocones which is the feature of the genus Tragoportax. The P4 exhibit a T-shaped facet of the genus *Tragoportax* [23].

According to Pilgrim (1937, 1939) the genus *Tragoportax* in the Siwaliks is known by five species including *T. perimensis, T. islami, T. salmontanus, T. browni* and *T. punjabicus*. The species are distinguished from one another on the basis of horn-cores. *Tragoportax perimensis* and *T. islami* are known by the meager fossil record from the Siwaliks of Pakistan. Kostopoulos [24] comprehensively revised the systematic position of the Samos bovids and *synonymised T. curvicornis* and *T. browni* with *T. punjubicus*. Kostopoulos [24] adapted Moya-Sola's recommendations to synonymies *T. browni* with *T. punjabicus* because both of them are indistinguishable and have common stratigraphic origin from the Dhok Pathan Formation of the Middle Siwaliks.

SUMMARY

The collected fossils show similarity with the established diagnostic features of the genus *Tragoportax* and the species *Tragoportax punjabicus* s including description of theupper molars which arequadrate, moderately hypsodont, outer folds and ribs rather strong, median rib in posterior lobe is weaker than in anterior lobe, entostyles present in all the molars. In *Tragoportax punjabicusMetaconid* of p3-p4 is larger than in *Miotragocerus*, splayed lingually and T-shaped on p4, with an open anterior valley. Premolar series is short, upper molars are hypsodont with divergent styles and median ribs are prominent.The p4 has a strong paraconid, metaconid and entoconid. The entoconid is fused with the endostylid. The anterior valley of p4 is open in *Tragoportax punjabicus.* All the above mentioned characters were compared and the specimen was classified up to specie level.

CONCLUSION

Tragoportax pnjabicus and other species of this genus that discovered from the Dhok Pathan from Chakwal district of northern Pakistan. *Tragoportax punjabicus* fossils are studied completely. The Dhok

Pathan bovid fauna suggests a much higher diversity during late Miocene of the Siwaliks [2,3,20,25,26].

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