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REPORT ON *CERVUS SIVALENSIS* FROM THE UPPER SIWALIKS OF PAKISTAN

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Abstract: A well preserved right mandibular ramus with P_3-M_3 from Sardhok (Upper Siwaliks), Gujrat district, the Punjab province, Pakistan is being described for the first time. A comparison of the specimen under study with known material of the genus *Cervus* has shown that it is referable to the species *Cervus sivalensis*. This description gives additional information about the palaeozoogeography of cervids in the Siwaliks.

Key words: Premolars, molars, *Cervus*, Sardhok, Palaeozoogeography.

INTRODUCTION

The cervids are characterized by the presence of antlers and prominent lacrymal depressions anterior to the eyes that are occupied by the pre-orbital glands in the living animals. They appeared in the Siwalik sequence of Indo-Pakistan during Plio-Pliestocene times. Earlier studies of the Siwalik cervids based upon dentitions and antlers have recognized five to six species. Some of these species were though time-successive (Arif and Raza, 1991).

There are 6-8 species in South Asia (Indo-Pakistan subcontinent) and are mostly adapted to open woodland habitat (Roberts, 1977). The cervids show similar species diversity in the fossil record too. Their fossils are known from the Upper Siwalik sequence of the Kohat-Potwar basin and the adjoining basins of Jammu-Kashmir and the Indian-Punjab. The Siwalik cervids have been studied by Lydekker (1876, 1884), Brown (1926), Colbert (1935), Azzaroli (1954), Akhtar (1998) and Akhtar *et al.* (1999).

The cervids appeared in Oligocene with small size and lack of antlers. Early small cervids, e.g., *Eumeryx* and *Iberomeryx*, appeared in the Middle Oligocene sediments of Central Asia from where they dispersed to Europe and North America, most probably, in the early Miocene. The first appearance of cervids in South America and Africa has been reported from the Pliestocene (Romer, 1974).

The Siwalik rocks are fossiliferous throughout and thus contain an almost continuous record of mammalian evolution spanning 18 million years (Barry *et al.*, 1982). The Miocene faunal turn-over events introduced immigrants into South Asia mainly from Africa whereas the Pliocene events record mammalian faunas closely similar to contemporary ones in Northern and Western Eurasia (Barry and Flynn, 1990).

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Several species of the family Cervidae have been described mainly from the Upper Siwalik rocks of the Western Himalayas including the Siwalik Hills and adjoining ranges in India and southern Kashmir, Potwar and Trans-Indus Hill ranges of Pakistan. The earlier identifications were based on a few fragmentary specimens and their holotypes designations include maxillary fragments. The taxonomic details of Siwalik cervids given by Lydekker (1876, 1884), Brown (1926), Colbert (1935), Azzaroli (1954) and Arif and Shah (1991), have been critically reviewed and the following species are considered valid.

C. simplicidense Lydekker
C. triplidense Lydekker
C. sivalensis Lydekker
C. punjabiensis Brown
C. rewati Arif and Shah

The latest faunal turn-over events during the last Pliocene around 2.9 Ma introduced many Eurasian mammalian genera in the Siwalik faunal province including *Cervus, Equus, Elephas, Sivatherium, Sus* and *Sivachoeras*. This faunal change, termed as *Elephas Planifrons* interval zone. (Barry *et al.*, 1982).

This faunal zone is characterized by dominance of herbivore community of woodland habitat with a few adapted for riverine galley forests. The principal feature of this community is continuing into the modern South Asian wildlife assemblages.

ABBREVIATIONS

G.S.I.:	Geological Survey of India, Calcutta.
P.U.P.C.:	Punjab University Paleontological Collection, stored in the Department of Zoology, Lahore, Pakistan.
L:	Maximum preserved anteroposterior crown length of tooth.
W:	Maximum preserved crown width of tooth.
CI:	Crown shape index (W/L x 100) a ratio between width and length of crown.
mm:	Millimeter.
P_3:	Third right lower premolar.
P_4:	Fourth right lower premolar.
M_1:	First right lower molar.
M_2:	Second right lower molar.
M_3:	Third right lower molar.

SYSTEMATICS

Class	Mammalia, Linnaeus
Order	Artiodactyla Owen
Family	Cervidae Gray

Genus	*Cervus* Linnaeus
Species	*Cervus sivalensis* Lydekker

Holotype

G.S.I. No. B215, a right ramus with M_{2-3}.

Type locality

Maili, Punjab.

Horizon

Upper Siwaliks.

Diagnosis

A large cervid with relatively hypsodont molars. The skull and antlers resemble these portions in *Cervus duvaucelli*. The skull by virtue of the frontal concavity at the orbits, and the forward swell at the pedicles. The lacrymal vacuity is smaller than in *C. duvaucelli*. The browtine of the antler arise immediately above the burr, and form an obtuse angle with the beam.

Material Studied

P.U.P.C. No. 66/9: A fragment of right mandibular ramus having P_3-M_3.

Locality

Sardhok, Gujrat district, the Punjab province, Pakistan.

Horizon

Upper Siwaliks.

Description (Fig.1)

The specimen under study includes P_3-M_3 of right mandibular ramus. A portion of mandibular ramus with diastema is also well preserved with these teeth. The length of preserved mandibular ramus is 202 mm while its depth below M_2 is 62 mm. The depth of diastema is 33 mm. It is in an excellent state of preservation and at middle stage of wear. A very thin layer of cement is present on all sides of the teeth and is more prominent at the base of the crown. The teeth are narrow crowned and hypsodont except P_3 that is extremely hypsodont. The enamel is rugose and this rugosity is more prominent and evident on buccal side. The median basal pillar is prominent in M_{1-3} while absent in P_{3-4}. In M_{2-3} this is touching the summit of the crown and broken in M_1. These are also covered with thick layer of cement.

The principal conids are well preserved and prominent. In P_{3-4} the centre of the tooth is higher than that of anterior and posterior part. In M_{2-3}, the inner side of the tooth is higher than that of outer side, while in M_1 the inner conids are badly damaged at the summit of the crown. In molars the conids are broad while in premolars these are narrower. In molars the buccal conids are roughly U-shaped and broad.

The metastylid is more prominent in premolars than that of molars. In P_{3-4} it is the anterior extension of protoconid and metaconid. It is roughly V-shaped, narrow anteriorly while broad posteriorly. In M_{2-3} it is not clear because of thick layer of cement. In M_3 it is a fold like structure and also broken anteriorly. The entostylid is also prominent in premolars while not clear in M_{1-2}. In M_3 it is slightly developed.

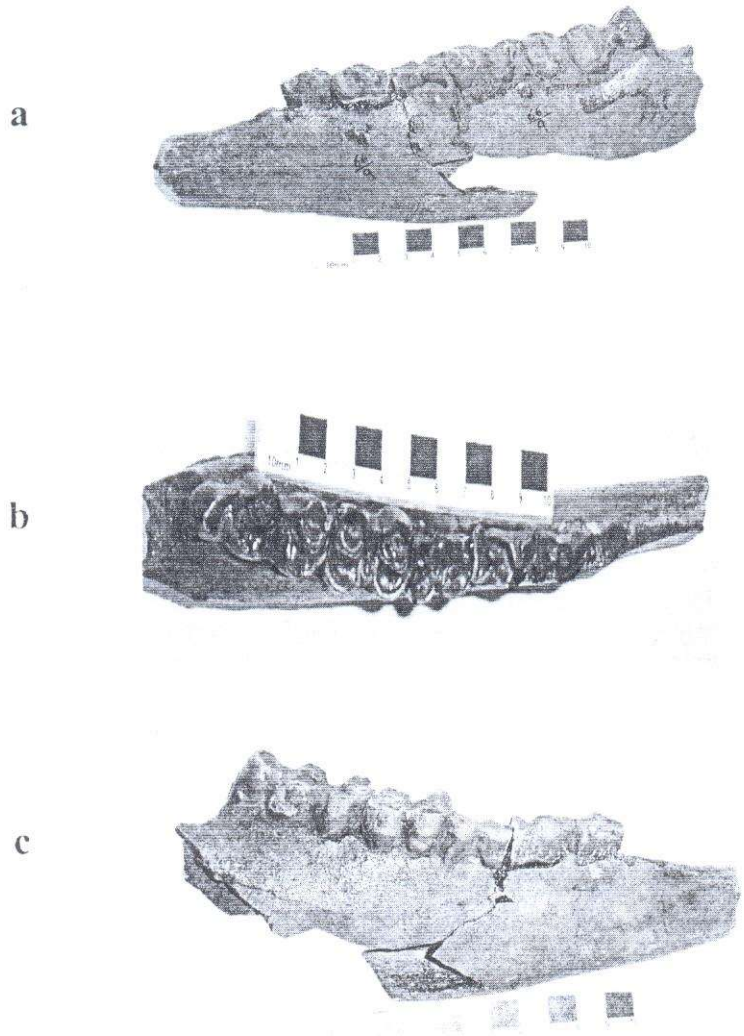

Fig. 1: *Cervus sivalensis* Lydekker, a fragment of right mandibular ramus having P_3-M_3 (P.U.P.C. No. 66/9), collected from Sardhok, Gujrat district, the Punjab province, Pakistan.
a) Lingual view, b) Occlusal view, c) Buccal view.

The anterior central cavities are absent in P_3-M_1 while in M_{2-3} these are narrow in the middle and broad anteroposteriorly. The posterior central cavity is poorly developed in P_3-M_1. These are small circular structures in P_3-M_1. In M_{2-3}, these are well developed and like anterior cavities, narrow in the middle and broad anteroposteriorly.

The median ribs are also well developed and preserved. In P_3 the posterior rib is strong than that of anterior rib while in P_4 the anterior rib is strong than that of posterior rib. In M_1 ribs are missing. In M_{2-3} anterior ribs are more strong than that of posterior ribs. The posterior ribs in M_{2-3} are slightly broken at the tips.

In M_3 the talonid is excellently preserved. It is V-shaped in its outline. It is broad in the middle while narrow anteroposteriorly. It is the postero-external extension of hypoconid and entoconid. It is also very similar to other lingual conids of molars in its general appearance.

DISCUSSION

The name *C. sivalensis* was introduced by Lydekker (1884) and then after by Pilgrim (1910), Brown (1926), Matthew (1929) and Colbert (1935). Lydekker has pointed out the resemblance of this species to *C. duvaucelli* both in the characters of the skull and of the antlers. He also mentioned that the brain case of *C. sivalensis* is large and the face is deep. The teeth of *C. sivalensis* are large and quadrate in shape. The folds are open and the enamel is rugose.

Lydekker (1880) referred the type G.S.I. No. B215 to *C. triplidense* but later Lydekker (1884) stated that this conjectural reference was incorrect, and the name *C. sivalensis* was proposed for this species to which the lower teeth belonged.

Pilgrim (1913) mentioned the name *C. sivalensis* in his list saying that it was from the Upper Siwaliks of Pinjor or Tatrot zone. Similarly Brown (1926) and Matthew (1929) mentioned this species in their account. Later, Colbert (1935) described a skull and antler under this name. According to Colbert (1935) the teeth are large and quadrate in shape. The folds are open and the enamel is rugose. The internal pillars are very small. The rugosity of the teeth was also pointed by Lydekker (1884). According to Lydekker (1884) the present teeth are also distinguished by the more rugose character of the enamel. Matthew (1929) only mentioned the name of this species in his faunal list. The material under study is well worn and maximum height in M_{2-3} is 14 mm and 13 mm, respectively. Lydekker (1883) also stated that in *C. sivalensis* the molars are very low crowned. Median basal pillars are very prominent between main cusps in M_{2-3}. M_2 is very similar to M_3 except that of talonid. In G.S.I. No. B215 the length x width of M_2 is 25 mm x 17.5 mm while in P.U.P.C. No. 66/9 it is 29 mm x 20 mm that is slightly more than that of type specimen, while the length of M_3 is exactly same as in G.S.I. No. 215. The material under study the enamel is also rugose, and this rugosity is also mentioned by Lydekker in type specimen. Similarly the crown index of M_2 under study and G.S.I. M_2 have the nearest values as 68.96 mm and 70 mm, respectively.

Table I: Comparative dental measurements (mm) of a fragment of right mandibular ramus having P_3-M_3 (P.U.P.C. No. 66/9) referred to *C. sivalensis* Lydekker.

	P.U.P.C. No. 66/9					G.S.I. No. B215				
	P_3	P_4	M_1	M_2	M_3	P_3	P_4	M_1	M_2	M_3
L	20	21.5	22	29	43	-	-	-	25	35
W	11.5	14	16	20	21	-	-	-	17.5	-
CI	57.50	65.11	72.72	68.96	48.83	-	-	-	70	-

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