Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Applied Sciences 6 (1): 127-130, 2006
ISSN 1812-5654

The Oldest Cervid from the Siwalik Hills of Pakistan

[1]Abdul Ghaffar, [1]Muhammad Akbar Khan, [1]Muhammad Akhtar,
[2]Muhammad Anwar Qureshi, [1]Umar Farooq and [1]M. Nazir
[1]Department of Zoology, University of the Punjab, Lahore, Pakistan (54600)
[2]Department of Geology, Azad Jammu and Kashmir University, Muzaffarabad, Pakistan

Abstract: A well-preserved mandibular ramus having M_{2-3} is collected from Chinji formation of the Siwalik Hills of Pakistan. The fossil material is collected from the Chinji formation. The Chinji Formation is a type locality (Lat. 32°41'N: Long. 72°22'E) named after Chinji village situated in Chakwal district. The diagnostic features exhibited by the specimen reveal that it belongs to a large species of family Cervidae that is *Cervus sivalensis*. This dental material of the family Cervidae is reported from late Miocene of the Chinji formation (14.2-11.2 ma). Prior to this, the family Cervidae is reported from Pliocene to Pleistocene (Dhokpathan-Soan formations) only in the Siwaliks of Pakistan. This finding extends the range of the family Cervidae in the Siwaliks of Pakistan from Pleistocene to Miocene times and is a new clue for the evolutionary study of the family Cervidae.

Key words: Family Cervidae, molars, Chinji formation

INTRODUCTION

The rich palaeontological heritage of Pliocene land vertebrates in the Siwaliks indicates that different faunal complexes inhibited in the Cenozoic era. Most of the oldest studies on quaternary vertebrates have focused on evolutionary and taxonomic aspects with the aim of the identifying the continental vertebrate species.

The Siwalik Hills of Pakistan have geochronological, sedimentological and paleontological information for over 5000 m of fluvial deposits spanning the time period between about 18 and 5 Ma[1,2]. The Miocene-Pliocene strata have traditionally been divided into the Kamlial, Chinji, Nagri and Dhok Pathan formations (Fig. 1). In all of these formations, exposures typically consist of gently tilted strata that form shallow strike-valleys and higher ridges as the surface expression of the large structural synclinorium underlying the Potwar Plateau. The ridges are formed by laterally extensive channel sandstones and the valleys by more easily eroded floodplain mudstones and siltstones[3]. Fossils weather out of these strata and accumulate on the outcrop surfaces between the ridges, providing ideal conditions for controlled sampling within well-defined stratigraphic intervals. The Potwar Plateau is capped by late Pleistocene silts and gravels (the Potwar Silts), which buried an erosional unconformity on Mio-Pliocene sediments. In many areas these overlying deposits have been removed by erosion, but in others they cover the older sediments with silts or coarse gravels that limit recovery of the Mio-Pliocene fossils[4].

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 Siwaliks cervids based upon dentitions and antlers have recognized five to six species. Some of these species were though time-successive[5].

There are 6-8 species in South Asia (Indo-Pakistan subcontinent) and are mostly adapted to open woodland habitat[6]. 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.

Siwalik cervids have been studied by Lydekker[7,8], Brown[9], Colbert[10], Azzaroli[11], Akhtar[12] and Akhtar *et al.*[13]. 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[14]. Recently, Barry *et al.*[15] have described indeterminate Cervoid from the upper part of the Chitarwata formation. It is approximately 23 million years old in age. The first appearance of cervids in South America and Africa has been reported from the Pleistocene[16]. The Siwalik rocks are fossiliferous throughout and thus contain an almost continuous record of mammalian evolution spanning 18 million years[17].

Corresponding Author: Abdul Ghaffar, Department of Zoology, Punjab University, Lahore, Pakistan

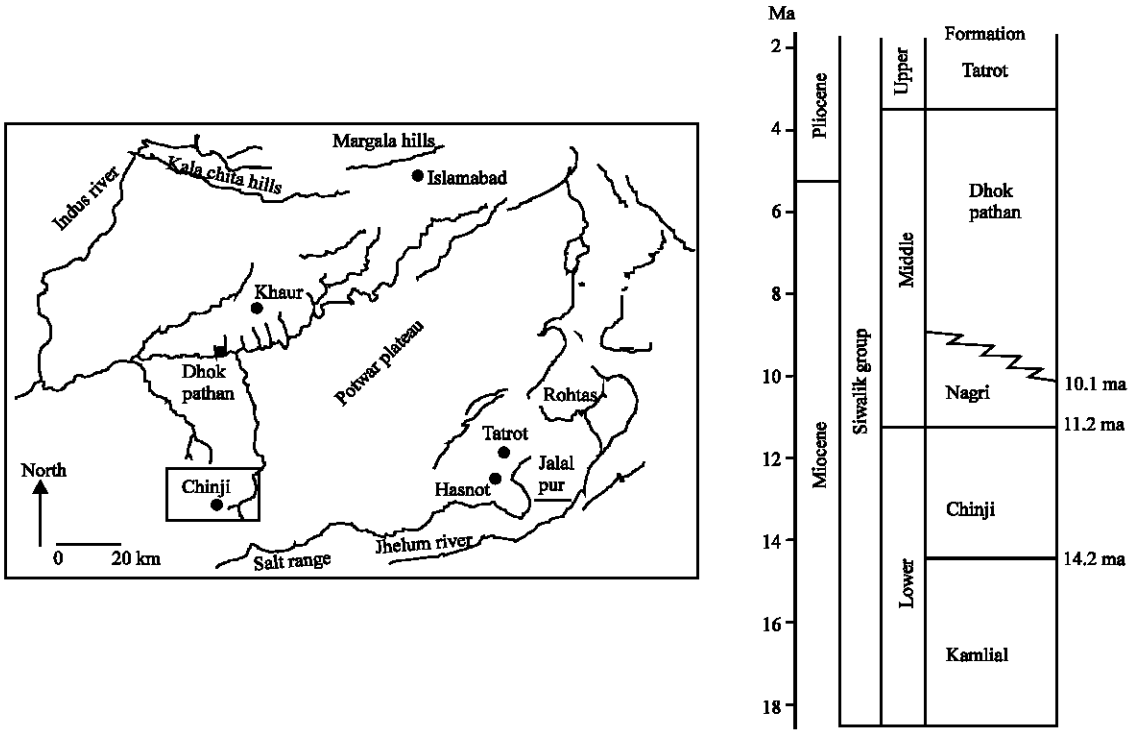

Fig. 1: Map of the Potwar Plateau; inset showing the locality and a generalized stratigraphic section with chronstratigraphy for the major Siwalik formations. Boundary dates are from Barry *et al.*[2]

The Miocene faunal turnover 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[18].

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.

Abbreviations

P.U.P.C: Punjab University palaeontological collection, stored in the Department of Zoology, Lahore, Pakistan.
G. S. I: Geological Survey of India, Calcutta.
L: Maximum preserved anteroposterior crown length of the tooth.
W: Maximum preserved crown width of the tooth.
CI: Crown shape index (W/L*100).
M_2: Second left lower molar.
M_3: Third left lower molar.
mm: Millimeter.

Systematic Palaeontology

Class Mammalia, Linnaeus
Order Artiodactyla, Owen
Family Cervidae, Gray
Genus Cervus, Linnaeus
Species *Cervus sivalensis*

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

Type locality: Maili, Punjab.

Horizon: Upper Siwalik.

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 arises immediately above the burr and forms an obtuse angle with the beam.

Material studied: P. U. P. C. NO. 2004/50, a left mandibular ramus bearing M_{2-3}.

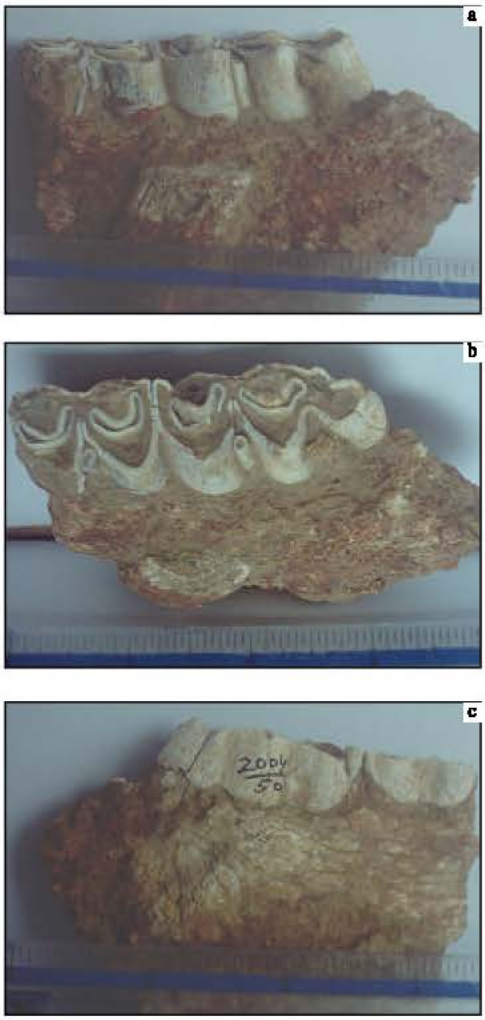

Fig. 2: P. U. P. C. NO. 2004/50, a left mandibular ramus bearing M_{2-3}. a. Outer view; b. Crown view; c. Inner view

Locality and age: Known from the Chinji formation. It is approximately 14.2 to 11.2 million years ago in age.

Horizon: Lower Siwalik.

Description (Fig. 2): The specimen is well preserved only the protoconid in M_2 and metaconid in M_3 are slightly broken. While all other structures including conids, stylids and cavities are very well preserved. The median ribs are also well preserved nearly touching the summit of the crown. The talonid in M_3 is also very well preserved. The anterior central cavity in M_3 is also slightly damaged. The mandibular ramus beneath these teeth is also well preserved (Table 1).

Table 1: Comparative dental measurements (mm) of left mandibular having M_{2-3} (P. U. P. C. NO. 2004/50) referred to *Cervus sivalensis* Lydekker

	P. U. P. C. 2004/50		G. S. I. B215	
	M_2	M_3	M_2	M_3
L	25	33	25	35
W	17	18	17.5	--
CI	68	54.5	70	--

DISCUSSION

The different species of family Cervidae are known from the Plio-Pleistocene of the Siwalik continental deposits[5]. The specimen described here indicates that the range of the Siwalik cervid goes to late Miocene (Fig. 1). There are 5 species described from the Siwalik Hills of Pakistan that are *Cervus punjabiensis, Cervus rewati, Cervus sivalensis, Cervus simplicidense, Cervus triplidense*. For *C. simplicidense,* Pilgrim[19] mentioned the horizon as Middle Siwalik while Brown[9] mentioned the horizon as upper Siwalik. For *Cervus triplidense* similar horizon like *C. simplicidense* is mentioned by Pilgrim and Brown. For *Cervus sivalensis* and *Cervus punjabiensis,* the Lydekker and Brown mentioned the horizon as upper Siwalik, while Arif and Shah [20] also mentioned the same horizon for *Cervus rewati*.

Recently, Ghaffar[21] has studied all the specimens placed in Abu Bakr Fossil Display and Research Center, Punjab University, Lahore and found that the specimens of *Cervus sivalensis*, *Cervus punjabiensis* and *Cervus rewati* are also come from Middle Siwalik, supporting the idea that the range of the siwalik cervid is from the Middle to upper Siwaliks.

The specimen under study has a unique presence as compare to other specimens of the cervid found in the Siwaliks. The described specimen is collected from the Chinji formation that indicates the range of the *Cervus sivalensis* is from the lower to upper Siwaliks and probably this is the first immigrant cervid in the Siwaliks of Pakistan. If this hypothesis is true then we are the first to prove that the arrival of the cervid in the Siwaliks was occurred in 12-11 million years ago. This finding extends the range of the family Cervidae from Plio-Pleistocene to Miocene. The specimen also provides the links between different species of the Plio-Pleistocene to Oligocene cervid. This paper also provides the additional information about the dispersal of the family Cervidae from Central Asia to Europe and North America during the Miocene but however more dental material of *Cervus sivalensis* as well as the additional fossils of family Cervidae are necessary to shed new light to check the paleozoogeography and stratigraphic ranges of the

different species in the different formations of the Siwalik continental deposits.

REFERENCES

1. Johnson, N.M., J. Stix, L. Tauxe, P.F. Cerveny and R.A.K. Tahirkheli, 1985. Paleomagnetic chronology, fluvial processes and tectonic implications of the Siwalik deposits near Chinji Village, Pakistan. J. Geol., 93: 27-40.
2. Barry, J., M. Morgan, L. Flynn, D. Pilbeam, A.K. Behrensmeyer, S. Raza, I. Khan, C. Badgely, J. Hicks and J. Kelley, 2002. Faunal and Environmental changes in the late miocene siwaliks of northern Pakistan. Paleobiology, 28: 1-72.
3. Willis, B.J. and A.K. Behrensmeyer, 1995. Fluvial systems in the Siwalik Neogene and Wyoming Paleogene. Palaeogeogr. Palaeoclimatol. Palaeoecol., 114: 13-35.
4. Behrensmeyer, K.A. and J.C. Barry, 2005. Biostratigraphic surveys in the siwaliks of Pakistan: A method for standardized surface sampling of the vertebrate fossil record. Palaeontologia Electronica, 8: 24.
5. Arif, M. and S. Raza, 1991. New findings of Cervidae (Mammalia) from the upper siwaliks of Potwar-Mirpur areas, Pakistan. Proc. Pakistan Congr. Zool., 11: 275-281.
6. Roberts, T.J., 1977. The Mammals of Pakistan. Ernest Benn limited, London, pp: 361.
7. Lydekker, R., 1876. Molar teeth and other remains of mammalia from the India Tertiaries. Pal. Ind., 10: 19-87.
8. Lydekker, R., 1884. Siwalik and Narbada carnivora. Pal. Indica (X), II Pt.6; 178-363; Pls. XXVI-XLV.
9. Brown, B., 1926. A new deer from the Siwalik. Am. Mus. Novitates, 242: 6.
10. Colbert, E.H., 1935. The correlation of the siwaliks of India as inferred by the migrations of *Hipparion* and *Equus*. Am. Mus. Novitates, 797: 1-15.
11. Azzaroli, A., 1954. Critical Observations upon Siwalik Deer. Proc. Linnean Soc. London, pp: 75-83.
12. Akhtar, M., 1998. *Cervus triplidens* Lydekker from type locality Dhok Pathan, Chakwal district, Punjab, Pakistan. Punjab Univ. J. Zool., 13: 27-31.
13. Akhtar, M., A. Ghaffar and M.A. Qureshi, 1999. On *Cervus punjabiensis* Brown from the Siwalik Hills of Pakistan and Azad Kashmir. Punjab Univ. J. Zool., 14: 93-96.
14. Sarage, D.E. and D.E. Russell, 1983. Mammalian Paleofaunas of the World, London.
15. Barry, J.C., C.S. Maclatchy, L. Lindsay, H. Everett, R. Kityo and A. Rajpar, Rahim, 2005. Oligocene and early Miocene ruminants (Mammalia, Artiodactyla) from Pakistan and Uganda, Palaeontologia Electronica, 8: 29.
16. Romer, A.S., 1974. Vertebrate Palaeontology, Vol. III. The University of Chicago Press, Chicago Illinois, pp: 1-687.
17. Barry, J.C., E.H. Lindsay and L.L. Jacobs, 1982. A biostratigraphic zonation of the middle and upper Siwaliks of the Potwar Plateau of northern Pakistan. Palaeogeogr. Palaeoclimatol. Palaeoecol., 37: 95-130.
18. Barry, J.C. and L.J. Flynn, 1990. Key biostratigraphic events in the siwalik sequence. In: European Neogene Mammal Chronology (Ed. Lindsay, E.H. *et al.*). New York, pp: 557-571.
19. Pilgrim, G.E., 1910. Notices of New Mammalian Genera and Species from the Tertiary of India. Rec. Geol. Surv. India, XL: 63-71, pt.1.
20. Arif, M. and S.M.I. Shah, 1991. *Cervus rewati* sp. nov. (Mammalia, Cervidae) from the upper siwaliks of Pakistan. Pak. Geol. Surv. Mem., 17: 11.
21. Ghaffar, A., 2005. Studies on Equid, Cervids and Carnivora from the Siwalik Hills of Pakistan. Ph.D. Thesis, University of the Punjab, Pakistan.