



SOME FOSSILS OF DEER FROM THE QUATERNARY DEPOSITS OF MADHYA PRADESH, INDIA

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GEOLOGICAL SURVEY OF INDIA, NAGPUR - 440 006

ABSTRACT

The authors during their research on the Quaternary mammals of central India have collected some fossils of deer from the alluvial deposits ranging in age from middle Pleistocene to lower Holocene. The fossils are of antlers, mandible and teeth belonging to *Cervus* cf. *unicolor*, *C. cf. duvauceli* and *Muntiacus* cf. *muntjak*. An ecology of humid climate can be reconstructed for the occurrence of these deer. Species of deer preferring much of humidity were restricted to the Indian subcontinent and those preferring humidity in a lesser degree were extended up to south and southeast Asia.

Key words : Fossil deer, (Cervidae), Quaternary, Systematics, Madhya Pradesh.

INTRODUCTION

Deer make the most widespread wild life in the present-day Indian subcontinent. But fossils of deer are less abundant as compared to some other mammalian genera. However, the comparatively scanty fossils of deer are quite significant in the reconstruction of palaeoclimate, evolutionary pattern, mammalian province, etc.

Some fossils of deer along with other mammalian fossils have been collected from the Quaternary deposits exposed in the riverine sections in the valleys of Narmada, Son and Ken in Madhya Pradesh (fig.1). Litho- and bio-stratigraphy of the Son and Narmada deposits have been worked out in detail (Sonakia *et al.*, 1996) and are adopted here (fig. 2). A reconnaissance study has been carried out on the Ken valley deposits (Sonakia, 1998); a correlation of these deposits with the Son-Narmada deposits has been suggested based on the nature of sedimentary cycles and fossilisation.

SYSTEMATIC DESCRIPTION

Family Cervidae

Genus *Cervus* Linnaeus, 1758

Cervus cf. *C. unicolor* Bechsten

(Pl. I, figs. 1-2)

Material, Locality, Horizon : GSI CR A 1115: RM₂; Son valley near the village Patpara in Sindhi distt. of Madhya Pradesh; Sand bed of the Baghor Formation, Upper Pleistocene (Pl. 1, figs. 1A-B).

GSI CR A 580 : RM₂; Narmada Valley near the village Dhansi in Hoshangabad distt. of Madhya Pradesh; Sand bed of Surajkund Formation, Middle Pleistocene (Pl. I, figs. 2A-B).

Description : Teeth are hypsodont, enamel is rugose, ectostylid (basal pillar) prominent but not reaching the apex, bifid in specimen no. 580 and simple in specimen no. 1115. Parastylid and entostylid are strong. Goat fold (after Gentry, 1992) prominent in specimen no. 1115. Teeth are narrow towards apex bucco-lingually. Cingulum is prominent.

Remarks : Cheek teeth of the Cervidae family are distinguished from other ruminants by presence of marked broad cingulum and the sloping side of their crown (Hillson, 1986). Amongst these, the dentition of *Cervus unicolor*, a common extant form, has certain unique characters which readily distinguish it from other members of the Cervidae family. The large size and hypsodonty of molars are diagnostic for *C. unicolor* (Colbert and Hooijer, 1953). The fossil specimens under discussion agree

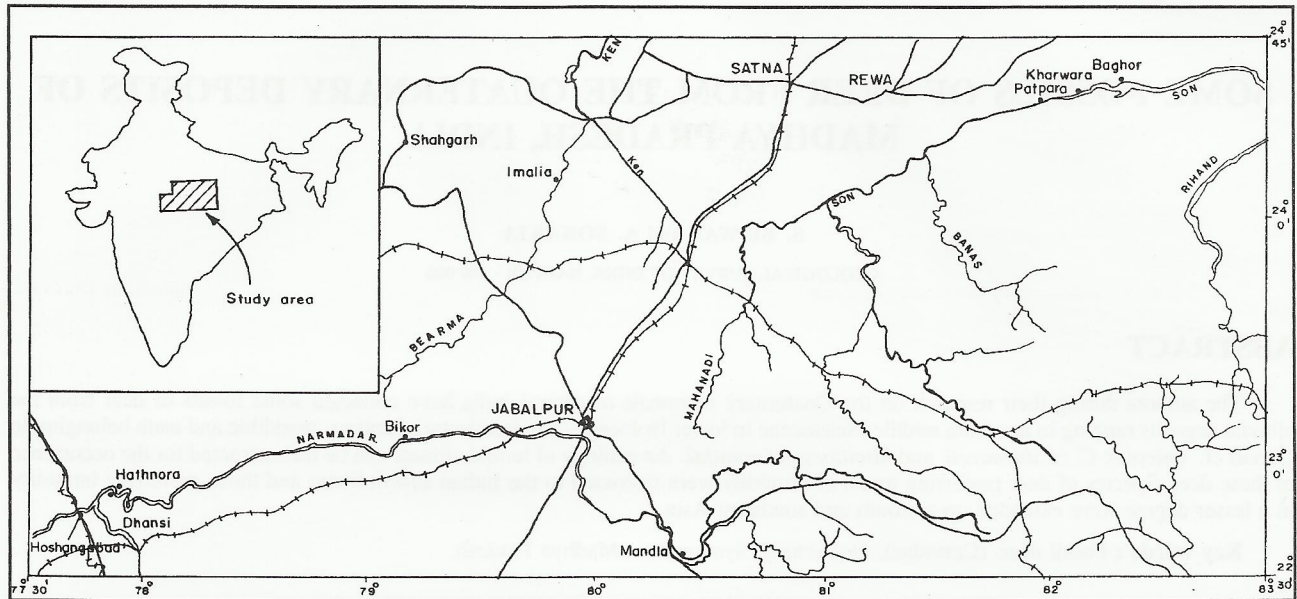


Fig. 1. Localities of fossil Deer along the Narmada, Son and Ken valleys in Madhya Pradesh.

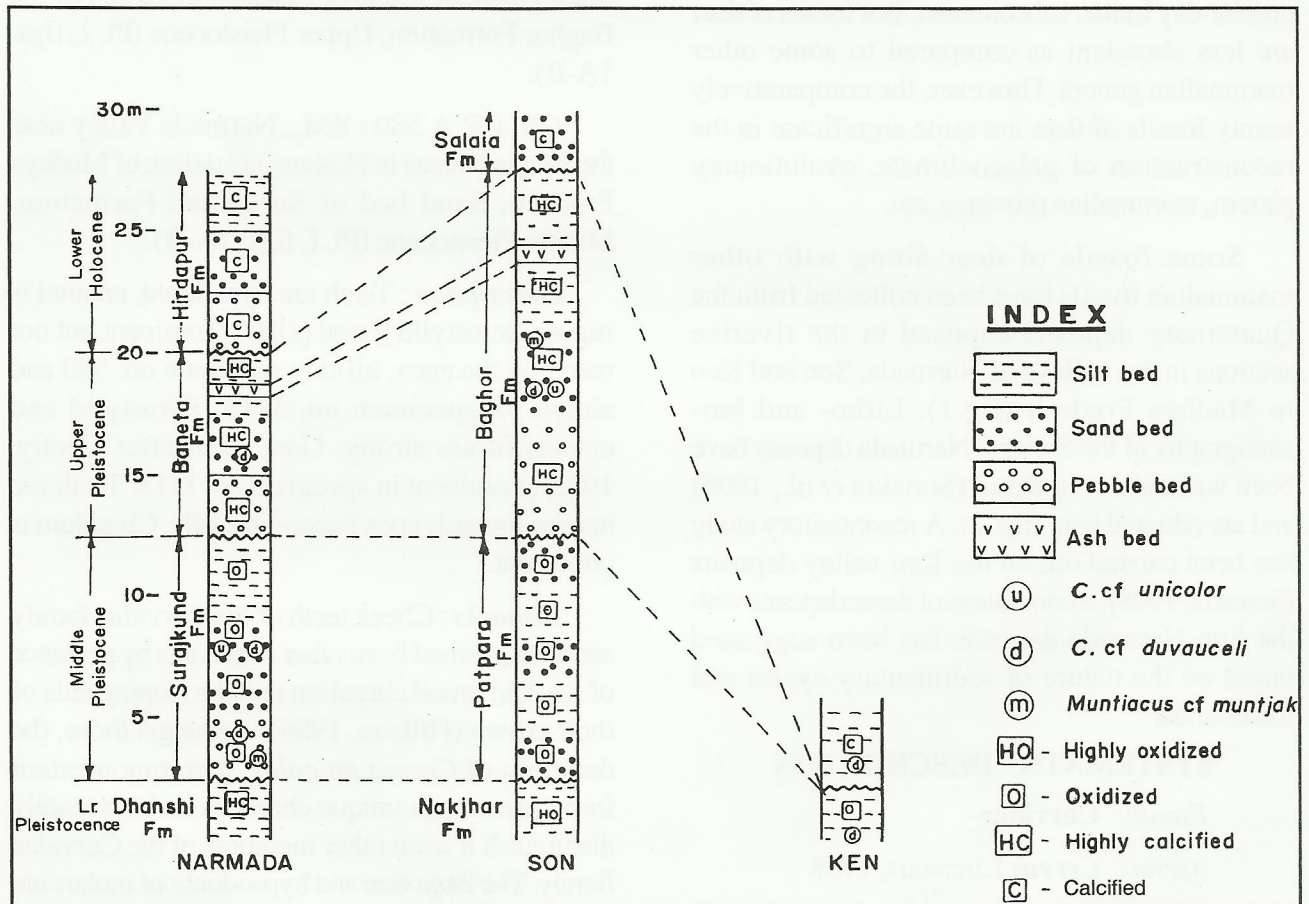


Fig. 2. Fossil occurrences in the Quaternary deposits in the sections in Narmada, Son and Ken valleys.

with these diagnostic characters, but some differences are here noted. Labial walls of protoconid and hypoconid in occlusal view are broadly rounded in fossil specimens, but sharp and V-shaped in extant forms. Fossil specimens are larger mesiodistally and smaller labio-lingually as compared to extant forms.

Measurements (mm) :

Specimen no.	Length	Maximum breadth	Height
A 1115 (RM ₂)	26	13.5	33
A 580 (RM ₂)	25	13	32.5
19089 (RM ₂)	21	17	

(Specimen collected from Quaternary deposits of Bankura (Dassarma *et al.*, 1982) and preserved as Type specimen no. in the GSI repository).

LM ₂	23	17	22+
RM ₂	24	18	22+

(Unnumbered specimen of *C. unicolor* in the Veterinary College, Nagpur)

Cervus cf duvauceli Cuvier

(Pl. I, figs. 3-11)

Material, Locality, Horizon : A 1320 : Right shed antler with burr, part of browline and beam. Narmada valley near village Hathnora, Sehore distt. of Madhya Pradesh. Pebble bed of the Surajkund Formation, Middle Pleistocene (Pl. I, fig. 3).

A 1281 : Left shed antler with burr part of browline and beam. Son valley near the village Baghor in Sindhi distt. of Madhya Pradesh. Sand bed of the Baghor Formation, upper Pleistocene. (Pl. I, fig. 4).

A 992 : Right shed antler with burr part of browline and beam. Narmada Valley near the village Dhansi in Hoshangabad distt. of Madhya Pradesh. Sand bed of the Baneta Formation, upper Pleistocene. (Pl. I, fig. 5).

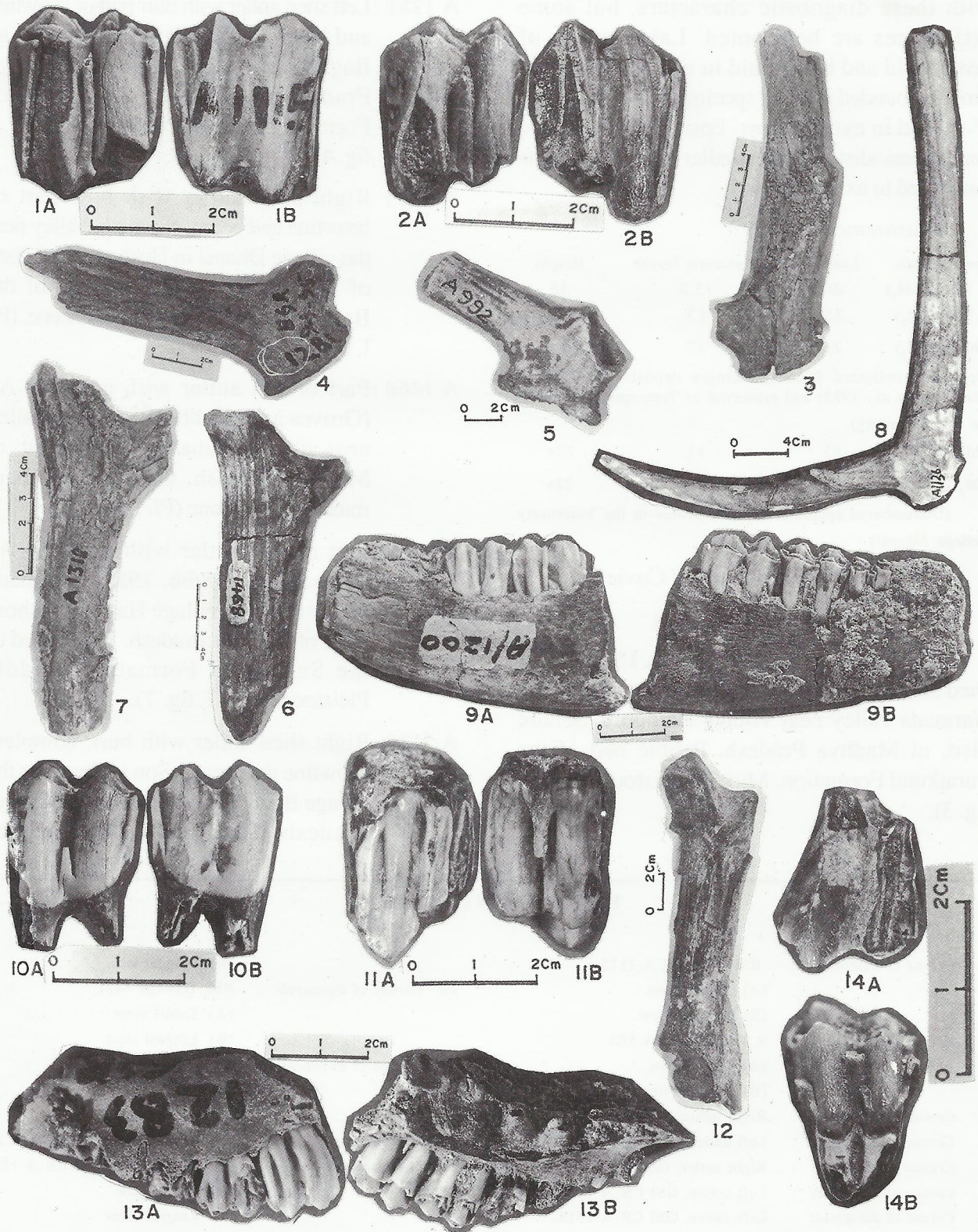
A 1468 : Part of left antler with possibly A2 (Groves and Grubb, 1987). Ken valley near village Imalia in Domoh distt. of Madhya Pradesh. Oxidized silt bed, middle Pleistocene (Pl. I, fig. 6).

A 1318 : Part of left antler with possibly A3 (Groves and Grubb, 1987), Narmada valley near the village Hathnora, Sehore distt. of Madhya Pradesh. Pebble bed of the Surajkund Formation, middle Pleistocene (Pl. I, fig. 7).

A 1136 : Right shed antler with burr, complete browline and beam, Son valley near the village Baghor in Sindhi distt. of Madhya Pradesh. Sand bed of the Baghor

EXPLANATION OF PLATE I

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|-----------------------------------|---------------------------------|-------------------|
| 1. <i>Cervus cf unicolor</i> : | RM ₂ , GSI CR A 1115 | (B) Lingual view. |
| | (A) Labial view. | |
| | (B) Lingual view. | |
| 2. <i>Cervus cf unicolor</i> : | RM ₂ , GSI CR A 580 | |
| | (A) Labial view. | |
| | (B) Lingual view. | |
| 3. <i>Cervus cf duvauceli</i> : | Right antler, GSI CR A 1320. | |
| 4. <i>Cervus cf duvauceli</i> : | Left antler, GSI CR A 1281. | |
| 5. <i>Cervus cf duvauceli</i> : | Right antler, GSI CR A 992. | |
| 6. <i>Cervus cf duvauceli</i> : | Left antler, GSI CR A 1468. | |
| 7. <i>Cervus cf duvauceli</i> : | Left antler, GSI CR A 1318. | |
| 8. <i>Cervus cf duvauceli</i> : | Right antler, GSI CR A 1136 | |
| 9. <i>Cervus cf duvauceli</i> : | Right mandible, GSI CR 1200 | |
| | (A) Labial view | |
| 10. <i>Cervus cf duvauceli</i> : | RM ₁ , GSI CR 1474. | (B) Lingual view. |
| | (A) Labial view. | |
| | (B) Lingual view. | |
| 11. <i>Cervus cf duvauceli</i> : | LM ₁ , GSI CR 302, | |
| | (A) Labial view. | |
| | (B) Lingual view. | |
| 12. <i>Muntiacus cf muntjak</i> : | Right antler, GSI CR A 1120. | |
| 13. <i>Muntiacus cf muntjak</i> : | Left maxilla GSI CR A 1283 | |
| | (A) Labial view. | |
| | (B) Lingual view | |
| 14. <i>Muntiacus cf muntjak</i> : | RM ₂ , GSI CR A 575 | |
| | (A) Labial view. | |
| | (B) Lingual view. | |



Formation, upper Pleistocene. (Pl. 1, fig-8).

A 1200 : Right mandible with M_1 , M_2 and P_4 , Son valley near the village Baghor in Sidhi distt. of Madhya Pradesh. Sand bed of the Baghor Formation, upper Pleistocene (Pl. I, figs. 9A & B).

A 1474 : RM_1 , Ken valley near the village Imalia in Damoh distt. of Madhya Pradesh. Calcareous silt bed, lower Holocene. (Pl. I, figs. 10A & B).

A 302 : LM^1 Narmada valley near the village Bikor in Narsinghpur distt. of Madhya Pradesh. Sand bed of the Surajkund Formation, middle Pleistocene (Pl. I, figs. 11A & B).

Description : Antlers are rugged with numerous longitudinal channels. But the surface is somewhat smooth in specimen no. A 1320 and A 1136. Browtine and the beam do not have a sharp angle and are with a smooth curve. However, the axes of the beam and the browtine form and angle varying from 110° to 120° . In Sp. no. A 1136, a small accessory tine has been developed on browtine posteriorly and a little above the base; possibly, this may be initiation of the bez tine. In specimen no. 1468, the beam and A2 form a smooth curve and the angle between their axes is about 115° . In specimen no. A 1318, the angle between the axes of the beam and A3 is about 90° .

Teeth are brachydont. Enamel is rugose. In M^1 , a small entostyle (basal pillar) is present; it is continuous with the cingulum. Parastyle, rib and mesostyle are prominent. Metastyle broken. Paracone is sharp. The crown is narrow towards the apex bucco-lingually with a lingual slope. In M_1 , ectostylid (basal pillar) is small. Parastylid is strong. Metastylid is strong in specimen no. A 1200 and weak in specimen no. A 1474. Goat fold is present. In M_2 , parastylid and metastylid area prominent. A

small goat fold is present. Metaconid and entoconid are sharp.

Remarks : The swamp deer, *Cervus duvauceli* is a common species of deer in present-day India. Study of tens of skulls from various places of India, mounted in Zoological Gallery of the Indian Museum, Calcutta shows that the browtine and the main beam of the antler of *C. duvauceli* are in obtuse angle. Browtine and the main beam of *C. eldi* are in a smooth curve as an arc of circle (Prater, 1971). Browtine and the main beam of *C. elaphus* of Kashmir are also in obtuse angle, but a major difference is that the branching of the main beam is close to pedicel of *C. elaphus* and away from it in case of *C. duvauceli*. The fossilized specimens of the antlers described above compare well with antlers of *C. duvauceli* in the those essential characters.

A mandible and some isolated molars of *C. duvauceli* have earlier been reported from the Quaternary deposits at several localities of peninsular India (Tripathi, 1964; Dassarma and Biswas, 1977; Dasarma *et al.*, 1982). These teeth are described as having basal pillars developed, but smaller than those of *C. unicolor*. A comparative study shows the basal pillars of the present specimens are similar in nature to the specimens of *C. duvauceli* described earlier and preserved as GSI Types (Type nos. 19086, 19087). Brachydont characters but with slightly high crown of the teeth are also similar to those types.

Diameter of antler above the burr (mm) :

Specimen no.	maximum	minimum
A 1320	52.5	40
A 1281	55	37
A 992	58	33
A 1136	64	52
GSI 19084	37	32

(Specimen from Bankura, Dasarma *et al.*, 1982)

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(*C. sivalensis*, Colbert, 1935)

Dimension of teeth (mm) (measured at the base) :

Specimen no.		mesio-distal	bucco-lingual	height
A 1200	M ₁	16.5	12.5	19
	M ₂	22	13	19
A 1474	M ₁	17	12	21
A 302	M ₁	20	20.5	27
GSI 19087	LM ₁	19	15	-
	LM ₂	20	15	-

(Specimen from Bankura, Dassarma *et al.*, 1982)*Genus Muntiacus* Rafinesque, 1815*Muntiacus cf muntjak* Zimm

(Pl. I, figs. 12-14)

Material, Locality, Horizon : GSI CR A 1120 : fragmentary right antler with part of the orbit and browline. Son valley near the village Kharwar in Sidhi distt. of Madhya Pradesh. Sand bed of the Baghor Formation, upper Pleistocene (Pl. I, fig. 12).

GSI CR 1283 : Fragmentary left maxilla with M², M¹ and P⁴, Son Valley near the village Baghor in Sidhi distt. of Madhya Pradesh. Sand bed of the Baghor Formation, upper Pleistocene (Pl. I, figs. 13A & B).

GSI CR A 575 : RM² Narmada valley near the village Hathnora in Sehore distt. of Madhya Pradesh Pebble bed of the Surajkund Formation, middle Pleistocene (Pl. I, figs. 14 A & B).

Description : Antler is fitted on pedicel of about 82 mm long. Surface of antler is smooth. From the preserved portion, it can be conjectured that the angle between the beam and browline is acute; both the browline and the beam is thin.

Teeth are brachydont. Enamel is rugose. In M² parastyle is strong. Anterior rib is prominent. Paracone and metacone are very sharp. Protocone and metaconule are also prominent. Entostyle (median pillar) incipient. In M¹ all the styles and ribs are prominent. Paracone and metacone are sharp. Entostyle (median pillar) weak. Cingulum present. P⁴ is molariformed.

Remark : Diagnostic characters of *Muntiacus* vis-a-vis *M. muntjak* are noted as small deer with antlers borne on long pedicles, browline short and close to burr (Colbert and Hooijer, 1953). The antler specimen under discussion (GSI, CRA 1120) possesses these diagnostic characters. The teeth (GSI CR 1283 - LM²-P¹ and GSI CR 575 RM²) possess the characters of deer (Hillson, 1986) in having cingulum and bucco-lingual narrowness and of *M. muntjak* in having small size.

Measurement (in mm, measured at the base) :

Specimen no.		Mesio-distal	bucco-lingual	height
1283	M ²	15	14	17
	M ¹	11.5	13	12
A 575	M ²	13	11	12

DISCUSSION

Deer thrive in varied climate ranging from warm to cold. They prefer humid climate and do not live in desert condition (Prater, 1971). As fossils of deer do not differ very much from the corresponding extant forms in structure, it is assumed that their ecology, too, was not widely different from their present-day ecology (Biswas, 1999).

The species of deer mentioned here have been widely distributed in peninsular India from the middle Pleistocene to the present-day (Lydekkar, 1886; Tripathi, 1968; Dassarma and Biswas, 1977; Dassarma *et al.*, 1982; Prater, 1971; Gentry, 1997). Amongst these, *Cervus duvauceli*, possibly originated from *C. sivalensis* in the lower Pleistocene of extra-peninsular India (Colbert, 1935). Though *Cervus duvauceli* has been prolific from the Pleistocene to the present day, it has remained confined to the Indian subcontinent throughout its history. *C. duvauceli*, the swamp deer prefers much of humidity. Other two species discussed here namely, *Cervus unicolor* and *Muntiacus muntjak* are tolerant to lesser degree of humidity and are reported from the middle Pleistocene to the present day in south and south-

east Asia as well (Colbert and Hooijer, 1953, Groves and Grubb, 1987). Obviously, the Pleistocene Epoch witnessed a widespread climatic belt of intense humidity in India. It was connected to climatic province of south and south-eastern Asia where humidity was of lesser degree.

All these species, like other members of the Cervidae family have retained the primitive characters of Artiodactyla such as rugosity of tooth enamel, presence of cingulum on teeth and overall brachydonty of teeth for quite a long time. Their evolutionarily trait during the Pleistocene does not show a major structural change other than the change in size. However, in the present day, isolation of gene pools has created certain intra-specific variations. In the process, Indian species of *C. duvauceli* has formed varieties (Prater, 1971) and the cosmopolitan species of *C. unicolor* and *M. muntjak* have developed several sub-species (Groves and Grubb, 1987).

REFERENCES

- Colbert E.H., 1935. Siwalik mammals in the American Museum of Natural History. *Trans. Amer. Mus. Soc. Philadelphia NS.* 26: 1-315.
- Colbert E.H. and Hooijer D.A. 1953. Pleistocene mammals from the Limestone fissures of Szechwan, China. *Bull. Amer. Mus. Nat. Hist.* : 105-108, 110-113.
- Dassarma D.C. and Biswas S. 1977. Newly discovered Late Quaternary vertebrates from the alluvial fill of Son Valley. *Ind. Jour. Earth Sci.* 4(2) : 127, 128, 135.
- Dassarma D.C. Biswas S. and Nandi A. 1982. Fossil vertebrates from the late Quaternary deposits of Bankura, Burdwan and Purulia districts, West Bengal. *Pal. Ind. NS* 44:14-16, 35-36, 44.
- Gentry A.W. 1992. The sub-families and tribes of the family Bovidae. *Mammal Rev.* 22 (1) : 6.
- Gentry A.W., 1997. The London collection of Narmada fossil mammals. *Spl. Pub. Geol. Surv. India.* 46 : 105-115.
- Groves Collin P. and Grubb Peter 1987. Relationship of living deer in Biology and Management of Cervidae. Research Symposia of the National Zoological Park, Smithsonian Institution, pp 21-59.
- Hillson S. 1986. *Teeth Mammals in Archaeology*. Cambridge University Press.
- Lydekker R. 1886. The fauna of the Kurnool Caves. *Pal. Ind.* 10 (4) : 19-58.
- Prater S. H. 1971. *The Book of Indian Animals*. Bombay Natural History Society.
- Sonakia A. 1998. Reconnaissance from fossiliferous horizons in Tapi, Chambal and Ken Valley Quaternary alluvial belts of Madhya Pradesh. *Geol. Surv. India.* 131 (6) : 134.
- Sonakia A., Biswas, S. and Sitarmaiah Y. 1996. Quaternary History of the Alluvial Strip along the Vindhyan Range in Sehore, Raisen, Jabalpur and Sidhi districts with emphasis on Hominid, its Culture and Environment. *Rec. Geol. Surv. India.* 129 (6): 217-18.
- Tripathi C. 1964. A note on geology and vertebrate fossils of Syamalai area, Tirunelveli district, Madras. *Rec. Geol. Surv. India.* 93 (2) : 257-262.
- Tripathi, C. 1968. The Pleistocene alluvial deposits around Nevasa, Ahmadnagar distt., Maharashtra. *Rec. Geol. Surv. India.* 95 (2) :355-366.

Manuscript Accepted April 2001