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A NEW PLEISTOCENE CANID FROM THE UPPER KAREWAS OF KASHMIR BASIN, INDIA

B.S. KOTLIA

PHYSICAL RESEARCH LABORATORY AHMEDABAD 380 009 (INDIA)

ABSTRACT

This paper describes a fossil canid, *Canis vitastensis* sp. nov. from the Upper Karewa Formation of the Kashmir intermontane basin in northwest India. The fossil canid, having a well developed paraconid does not show close similarity with any known species of *Canis*. The fossiliferous horizon, a medium grained sandstone interbedded with silty and mottled mudstone, is exposed at the basement of the Burzahom reference section which is about 12 km NE of Srinagar, and is considered to be younger than .73 Ma in age.

INTRODUCTION

The intermontane Kashmir basin is about 140 km ong and 40 km wide and is bounded in the northeast, southwest, northwest and southeast by Great Himalayan, Pir Panjal, Kaznag and Saribal Mountain Ranges, respectively (Fig. 1). The basin which developed during the Pliocene due to the ponding of the southwardly flowing drainage lines by the uplift of the Pir Panjal Range, preserves a complete record of the late Cenozoic freshwater sediments, collectively known as the "Karewas" or the Karewa Group. Karewa sediments are commonly divided into two lithologic units, the Lower Karewa Formation and the Upper Karewa Formation. Lithologically, the Lower Karewas are characterised by bluish to greenish compact mudstones, laminated greyish claystones, yellowish muddy rhythmites, fine to coarse grained sandstones, channel sandstones, thin but extensive lignite layers and conglomerate horizons with sand, mud and silt lenses. The Upper Karewas are characterised by greyish, brownish and laminated yellowish claystones, greyish

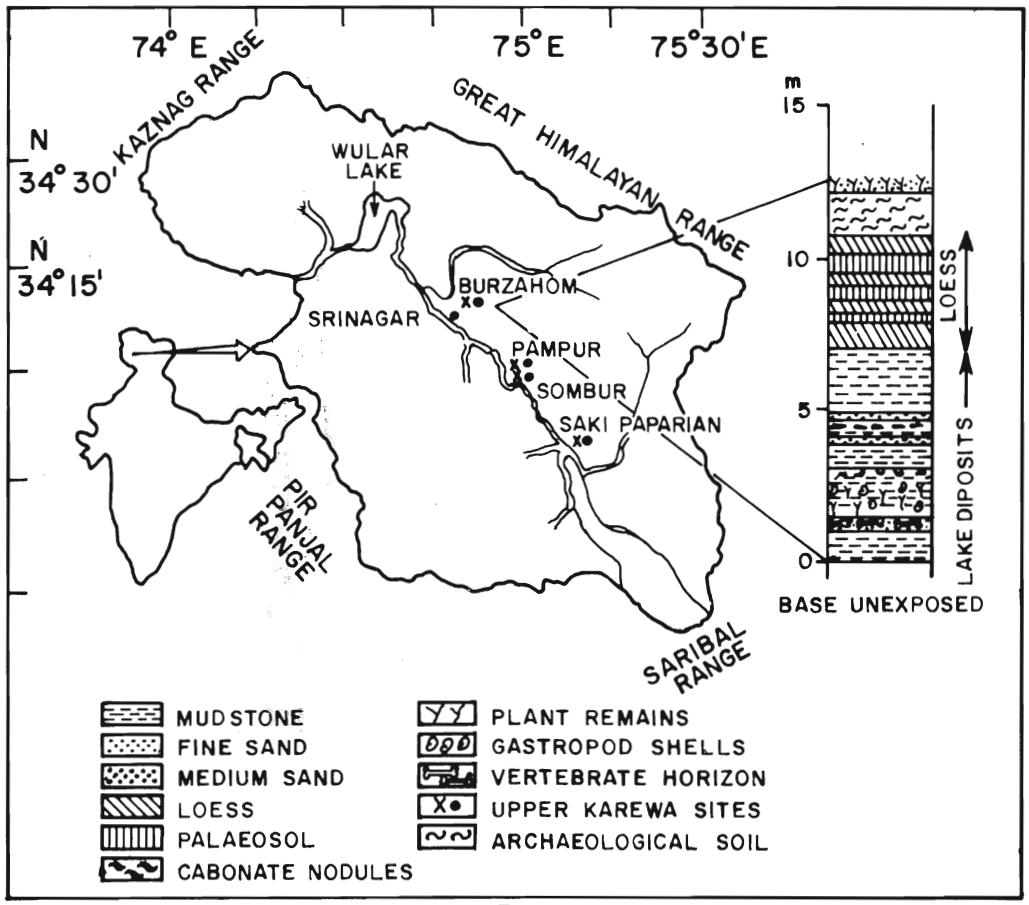

Fig. 1

mottled mudstones and medium grained sandstones. The magnetostratigraphic investigations of the complete Karewa sequence, above a kilometre in thickness, together with fission-track dating of included volcanic ash layers (Agrawal, 1982; Burbank and Johnson, 1982; Kusumgar, Agrawal and Kotlia, 1985a) revealed an age of about 4.0 Ma for the basement of the Karewas in the southern part of the Kashmir Valley. Recently conducted detailed magnetostratigraphic studies (Kusumgar, Kotlia, Agrawal and Sahni, 1986; Agrawal, Kotlia, Kusumgar and Gupta, 1987) suggest that the Karewa sedimentation started in early Gauss Magnetic Chron, about 3.4 Ma ago and continued until the Bruhnes Chron.

The sediments of the Upper Karewa Formation, exposed at Burzahom represent an approximately 7.0 m thick succession of medium to coarse grained channel sandstone, laminated siltstone and mottled mudstone containing rootlets and molluscan shells (Fig. 1). The sequence is capped by the loess, a wind borne deposit in which embedded are the palaeosols (buried soils). Based onthe magnetic stratigraphy, Burzahom deposits fall well within the Brunhes Chron (Kotlia, 1984; Agrawal et al, 1987), therefore are younger than 73 Ma in age.

Various workers (De Terra and Paterson, 1939; Badam, 1968, 1979; Kotila, 1984, 1985a, b; Kotlia, Sahni, Agrawal and Pant, 1982; Sahni, 1982; Sahni and Kotlia, 1985) have worked on the biochronology of vertebrate fossils in both the Lower and the Upper Karewas. More recently, the stratigraphic occurrence of various fossils in magnetic polarity time scale of the Karewas have been worked out by Kotlia (1984; 1985a, b), Kusumgar, Kotila and Agrawal (1985b) and Ksumgar et al (1986). The present canid material is the first report of *Canis* from the Plio-Pleistocene of Karewa basin. The fossil canid is associated with a new unidentifiable vertebrae, broken limb bones and post-cranial fragments together with molluscan shells.

PREVIOUS WORK ON CANIDS

The first record of the subfamily Caninae was made by Baker and Durand (1836, p. 581) by describing a carnivore under the name of *Canis vulpes* (?) which was collected from the Upper Siwaliks between the Markanda Pass and Pinjor. Falconer (1868) discussed another carnivore, *Enhydriodon sivalensis*, originally figured and described as *Canis vulpes* (?) by Baker and Durand (1836). Subsequently, Bose (1880) added significant knowledge of the canids by describing and illustrating *C. curvipalatus*, earlier discussed as *C. vulpes* (?) by Baker and Durand (1836). Bose (1880) also described and figured a mandibular ramus of *C. cautleyi* from the Pinjor Formation of the Upper Siwaliks.

Lydekker (1884) discussed the holotype of *C. curvipalatus* and called attention to several features in which *C. curvipalatus* resembles the South African genus, *Otocyon*. Lydekker (1884, p. 259-264) while describing the specimens of *C. cautleyi*, pointed out certain differences between the Indian species and all existing wolves in respect to the angle, condyle and the masseteric fossa. A Cranium of *C. cautleyi* was fully described and figured by Lydekker (1884), originally discussed by Bose (1880). Lydekker's (1884, p. 263) attempt to prove that *C. cautleyi* was more specialised than the existing species of wolves was doubted by Pilgrim (1932, p. 32). Matthew (1929) selected as holotype of *C. cautleyi*, the mandibular ramus, described by Bose (1880, p. 135) and by Lydekker (1884, Fig. 6). Pilgrim (1932) carried out a detailed study of canids and discussed the affinities of *C. cautleyi* and *C. curvipalatus* both of which are reported from the Upper Siwalik period probably the Pinjor Formation.

SYSTEMATIC PALAEONTOLOGY

Class	Mammalia	LINNAEUS, 1758
Order	Carnivora	BOWDICH, 1821
Suborder	Arctoidea	SIMPSON, 1931
Family	Canidae	GRAY, 1821
Subfamily	Caninae	BAKER AND DURAND 1836
Genus	*Canis*	LINNAEUS, 1758

Canis vitastensis n. sp.
(Plate I — 1, 2)

Holotype : VPL/B 3001, a left lower mandibular ramus with M_2, housed at the CAS in Geology, Panjab University, Chandigarh.

Diagnosis : Ramus slender, exhibiting a prominent sigmoid curve on the lingual side; tooth smaller; paraconid weakly developed thereby differing from *C. curvipalatus* and *C. cautleyi*; metaconid the largest cusp; protoconid high; hypoconid poorly developed; entoconid lower than hypoconid; talonid triangular and shallow basined; trigonid smaller than talonid; M_3 present; external and internal cingula well developed; ratio of the anteroposterior diameters of M_1, M_2 and M_3 resemble the other species of Canis, and differ from the members of Amphicyoninae.

Description : Lower left mandibular ramus: VPL/B 3001 with LM_2 (Plate I — 1).

An incomplete left mandibular ramus is broken anteriorly and posteriorly. The ramus consists of the alveoli of P_4, M_1 and M_2 and a well preserved tooth of M_2. The alveoli of P_4 and M_1 are prominent and the alveolus of M_3 is very small and rounded. The anterior part of the ramus is broken at the second alveolus of P_4 and on the posterior side, it is broken just after the junction of mandibular condyle and horizontal ramus.

The alveoli of M_3 and the lower second molar lie

appcoximately in the same plane, whereas the alveoli of M_1 and P_4 are slightly lingual to the second molar. The posterior alveolus pf P_4 is placed more lingually than the incomplete anterior alveolus. The broken and anterior alveolus of P_4 has a transverse diameter of 3.5 mm. The anterior alveolus of P_4 widens lingually and tapers labially The anterior alveolus of M_1 is the largest in the ramus with a transverse diameter of 8.0 mm. It tapers anteriorly and widens posteriorly. The posterior alveolus of M_1 is broad and roughly squarish in shape. M_2 has been described separately elsewhere in this study. The small and rounded alveolus of M_3 shows that the tooth was single rooted, rounded and very small in size.

The ramus exhibits a prominent sigmoid curve on the lingual side with a notch which passes up near the alveolus of M_3 and forms the basal part of the mandibular condyle. The inner ridge of the basal part of the mandibular condyle is particularly observed. There is absence of the mental foramen on the ramus except for a hint of the posterior mandibular foramen.

The ramus is slender and of varying width. It is wider at the anterior alveolus of M_1 and thinner on the posterior side of M_2. The height of the ramus near the alveolus of P_4 is 18.0 mm. The anteroposterior diameter parallel to the longitudinal axis of the ramus is 55.0 mm. The maximum transverse diameter is 10.0 mm and the maximum height that the ramus possesses is 24.0 mm. The depth between the alveoli of M_1 and P_4 is 3.0 mm and 2.5 mm respectively. The distance between the posterior alveolus of P_4 and the anterior alveolus of M_1 is 4.0 mm.

LM_2 (Plate I — 2)

The left lower second molar is small in size, comprising effectively of three prominent and definite cusps, viz. protoconid, metaconid and entoconid. Metaconid is the largest cusp on the tooth. Besides these three cusps, the molar has a small paraconid and a low hypoconid. Paraconid is situated directly in the front of metaconid on the anterolabial side. The entoconid lies directly on the posterior side, thus all three cusps, i.e., paraconid, metacoind and entoconid lie approximately in the same plane, parallel to the anteroposterior axis of the tooth. Paraconid is joined to the protoconid by an oblique trending ridge and to the metaconid by a low ridge. Paraconid lies close to the metaconid than to the protoconid. The trigonid comproses less than half of the crown and forms almost a flat surface without any basin or valley.

Entoconid is better developed than the protoconid and hypoconid but is lower than the metaconid and protoconid. Entoconid is a rounded cusp which is joined to the metaconid by a broad notch and to the hypoconid by an oblique and sharp ridge. Hypoconid is placed more labial to midline of the tooth and is separated from the base of the paraconid by a notch. Hypoconid is not crested and is joined to the entoconid by a distinct ridge which runs along the posterior margin of the tooth. The posterior end of the tooth is pointed in the midline. A triangular and shallow basined talonid comprises over half of the crown. The molar is two rooted. The anterolingual and the posterolingual margins of the tooth are slightly curved inwards. Tooth is slender and tapers more anteriorly than posteriorly. It is wider in the centre and pointed on the anterior and the posterior ends along the midline.

COMPARISON AND DISCUSSION

Canis cautleyi, described by Pilgrim (1932, p. 30-31) has a M_2 without paraconid, thus can be easily differentiated from *C. vitastensis* n. sp. in which the anterior cingulum in the position of the paraconid is better developed on M_2. The talonid of M_2 of *C. cautleyi* consists of a trenchant hypoconid and a small entoconid whereas the talonid of M_2 of *C. vitastensis* n. sp. is triangular in outline, having an entoconid which is better developed than the hypoconid. *C. curvipalatus*, discussed by Pilgrim (1932, p. 33) from the Upper Siwaliks has no trace of the paraconid, thus can be easily distinguished from *C. vitastensis* n. sp. which has a M_2 with a pronounced anterior cingulum in the form of the paraconid.

Observations based on the study of an incomplete ramus and LM_21, suggest that the present specimen cannot be assigned to the subfamily Amphicyoninae due to the following characters that have been recorded in *Canis vitastensis* n. sp.

1. The LM_2 consists of a well developed paraconid, a character that has been present in primitive canids.
2. The tooth has a basined talonid, slightly bigger than the trigonid.
3. The talonid has better developed but low cusps, entoconid and hypoconid; entoconid being larger than the hypoconid.
4. The molar does not taper more posteriorly than anteriorly.
5. M_3 is single rooted.
6. The ratio of the anteroposterior diameters of M_1, M_2 and M_3 of the present specimen is far from the ratio of the molars of any member of the subfamily Amphicyoninae.

The present specimen is easily distinguished from *C. cautlevi* and *C. curvipalatus* in having a better developed anterior cingulum (in the position of paraconid) and a definite entoconid. The M_2 of other species of *Canis* has a trenchant hypoconid whereas *C. vitastensis* n. sp. consists of a hypoconid more labially placed which is neither trenchant nor crested but somewhat ridged in the appearance. Though the present specimen differs from approximately all species of *Amphicyon* in many ways and also from other species of *Canis* to some extent but it is difficult to describe it under a new genus only on the basis of the study of M_21. In this study, the author ranks the present canid as a distinct species, *Canis vitastensis* n. sp., as it is more closely allied to the members of

Canis than to the members of Amphicyoninae but it can be easily distinguished from other species of *Canis* is having a better developed anterior cingulum (in from of the paraconid) and possessing a rounded entoconid, higher than the ridge shaped hypoconid.

The ratio of the transverse and the anteroposterior diameters of the morals of the known species and the present specimens has been shown in Tables 1.1-1.3. The ratio of the transverse and anteroposterior diameters of M_1, M_2 and M_3 in *Canis* vary from .417 to .600 (LM_1), from .667-.706 (LM_2) and from .700 to .737 (LM_3) which fall which fall within the limit of *C. vitstensis* n. sp. with a ratio of .460 (LM_1); of .667 (LM_2) and of .700 (LM_3).

The comparative mesurements of the anteroposterior diameters of P_4 and M_1 of the different species of *Canis* are shown in Table 1.4.

Table 1.1

Measurements (in mm) of LM_1 of *Canis*. present specimen and modern dog (*Canis familiaris*)

Name of the species	Anteroposterior diameter (L)	Transverse diameter (W)	W/L
C. cautleyi	24.0	10.0	.417
C. vitastensis n. sp.	18.5 (Approx.)	8.5 (Approx.)	.460
C. familiaris	20.0	12.0	.600

Table 1.2

Measurements (in mm) of LM_2 of *Canis* present specimen and *C. familiaris*

Name of the species	Anteroposterior diameter (L)	Transverse diameter (W)	W/L
C. cautleyi	10.0	7.0	.700
C. vitastensis n. sp.	9.5	6.0	.667
C. familiaris	8.5	6.0	.706

Table 1.3

Measurements (in mm) of LM_3 of *Canis* present specimen and *C. familiaris*

Name of the species	Anteroposterior diameter (L)	Transverse diameter (W)	W/L
C. cautleyi	4.8	3.5	.729
C. vitastensis n. sp.	4.0 (Approx.)	2.8	.700
C. familiaris	3.8	2.8	.737

Table 1.4

Comparative measurements (in mm) of P_4 and LM_1 of *Canis* present specimen and *C. familiaris*

Name of the species	Anteroposterior diameter (L) of P_4	Transverse diameter (L) of LM_1	Ratio
C. curvipalatus	9.0	8.8	1:.98
C. vitastensis n. sp.	12.0 (Approx.)	18.5 (Approx.)	1:1.5
C. familiaris	12.0	20.0	1:1.7

Table 1.5

Comparative measurements (in mm) of M_1, M_2 and M_3 of *Canis* present specimen and *C. familiaris*

Name of the Species	Antero-posterior diameter (L) of LM_1	Antero-posterior diameter (L) of LM_2	Anteroposterior diameter (L) Ratio of LM_3
C. cautleyi	24.0	10.0	4.8 1:42:.20
C. vitastensis n. sp.	18.5	9.0	4.0 1:.49:.22
C. familiaris	20.0	8.5	3.8 1:.43:.20

The comparative measurements of the anteroposterior diameters of LM_1, LM_2 and LM_3 of the different species of *Canis* have been indicated inTable 1.5. It is interesting to note that the ratio of 1:.49:.22 in *C. vitastensis* n. sp. shows close similarity with other species of *Canis*.

Horizon and locality : A channel sandstone bed of Upper Karewa Formation exposed at Burzahom, 12 km NE of Srinagar, Jammu and Kashmir.

Age : Brunhes magnetic chron (younger than 0.73 Ma).

Etymology : For the River Vitasta (now River Jhelum) which flows in the entire Kashmir Valley.

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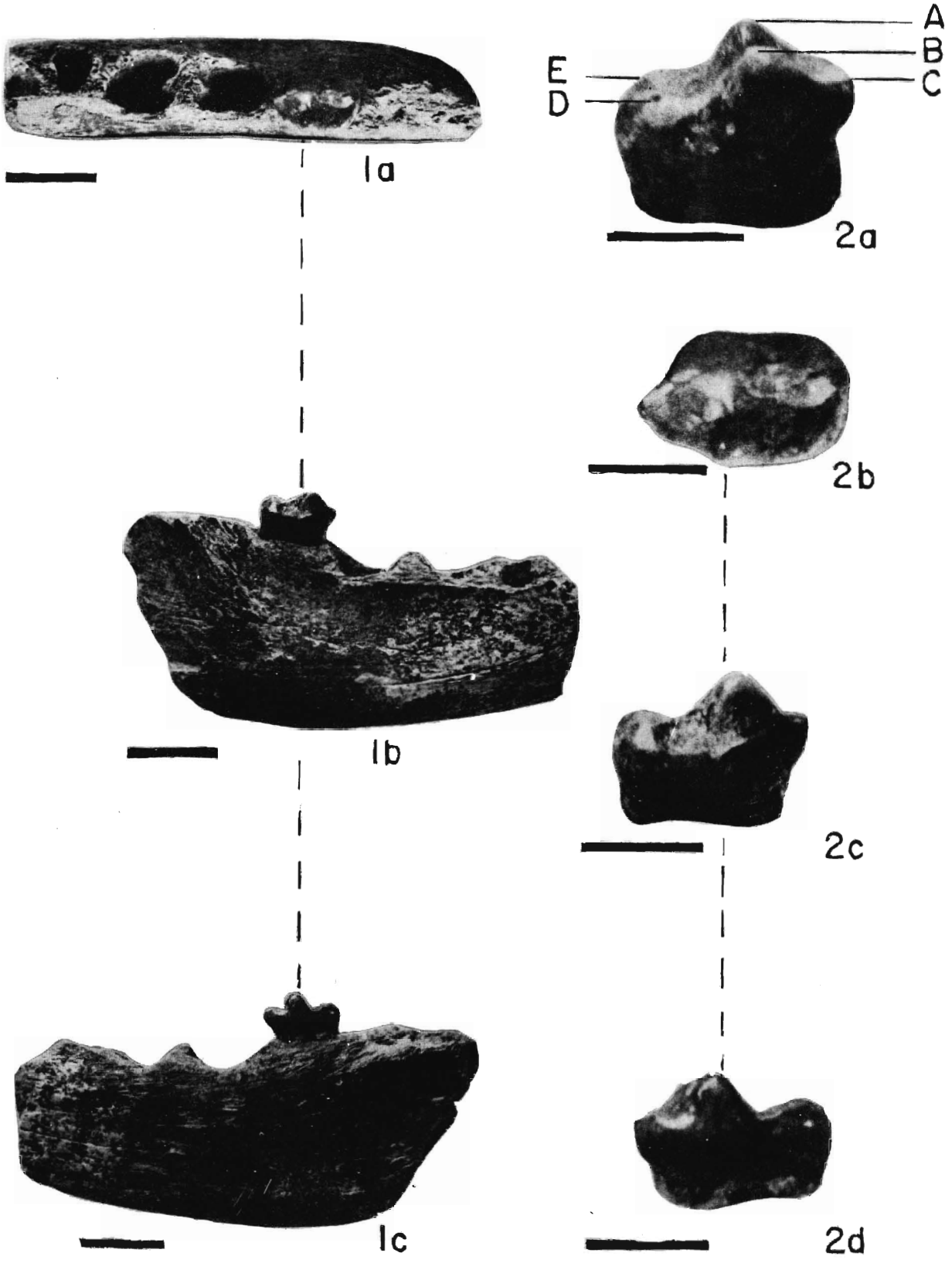
EXPLANATIONS OF PLATE

PLATE I

(Bar represents 1 cm for Fig. 1 and 1/2 cm for Fig. 2)

Canis vitastensis n. sp.

1a. VPL/B 3001, left lower ramus with M_2, occlusal view
1b. VPL/B 3001, left lower ramus with M_2, lingual view
1c. VPL/B 3001, left lower ramus with M_2, labial view
2a. VPL/B 3001, left lower second molar, LM_2, lingual view (A = Protoconid, B = Metaconid, C = Paraconid, D = Entoconid, E = Hypoconid)
2b. VPL/B 3001, left lower second molar, LM_2, occlusal view
2c. VPL/B 3001, left lower second molar, LM_2, lingual view
2d. VPL/B 3001, left lower second molar, LM_2, labia, view.


A
B
C
E
D
1a
2a
2b
1b
2c
1c
2d