

## Late Quaternary Vertebrate Fossils from the Sagileru Valley, Andhra Pradesh

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**Abstract:** In the course of Quaternary biostratigraphic study in the interior river valleys of Andhra Pradesh, vertebrate fossils belonging to *Antelope cervicapra* and species of *Bos*, *Cervus* and *Equus* have been recorded in the Sagileru valley in Cuddapah district. Fossils were found on the eroded surface of the ossiferous alluvial silts lying above a volcanic ash bed. Palaeolithic side scrapers and blades fashioned out of chert and quartzite were also found in the alluvial silts. Faunal content, nature of sediments and their position above the volcanic ash unit suggest a Late Pleistocene to Early Holocene age for the fossiliferous beds.

**Keywords:** Vertebrate fossils, Late Quaternary, Sagileru valley, Cuddapah district, Andhra Pradesh.

### Introduction

The Sagileru valley is a north-south trending intermontane valley bound by the Nallamalai hill range on the west and by the Velikonda hill range on the east. The valley is drained by the Sagileru river and its tributaries. Originating in the Nallamalais, the River Sagileru flows in a general southerly direction to join the Pennar river. The valley floor is made up of Proterozoic phyllite, slate and quartzite of the Cuddapah Supergroup. In this valley, Quaternary deposits comprising unconsolidated gravel, sandy silt, clayey silt, clay and volcanic ash occur resting unconformably on the Upper Cuddapah Group of rocks. The alluvial fan and palaeochannel gravels occur in the pediplain as erosional remnants and occupy the oldest and the highest depositional surface of the area (Sivaji et al. 1994). The occurrence of Late Quaternary vertebrate fossils previously unknown in this valley, the presence of volcanic ash bed-marker and the mode of distribution of alluvium make it possible to organise the pack of sediments of the valley into Units I, II, III, and IV occurring in that order of superposition (Table 1). Fossils described herein come from highly oxidized and calcretised alluvial sediments of Unit II. This unit is characterized by the presence of a volcanic ash bed marker lying below the fossiliferous sediments.

In the Porumamilla (15°00' 10"N: 78°59'45"E), Kalasapadu (15°06'33"N: 78°56'35"E) and Vankamari (14°56'26"N: 78°56'40"E) areas of Cuddapah district (Fig. 1), fossil specimens were found lying on the exposed surface of the

mammal-bearing alluvial silts of Unit II lying above the volcanic ash bed. Remains of vertebrates are fossilised, disarticulated and commonly fragmentary. The collection contains fragmentary horn cores, maxilla, mandible, isolated molars, tibia, metacarpal and a portion of a humerus of hoofed mammals.

### SYSTEMATIC PALAEONTOLOGY

Class	MAMMALIA
Order	ARTIODACTYLA
Suborder	RUMINANTIA
Infraorder	PECORA
Superfamily	Bovoidea
Family	Bovidae
Subfamily	Bovinae
Tribe	Bovini

Genus *Bos* Linnaeus, 1758

*Bos* sp. (Figs. 3. a, b and c)

**Referred material:** A broken left mandible (SGQ/3) and a fragmentary right tibia (SGQ/1).

**Horizon and locality:** Alluvial silts of Unit II, mandible from Porumamilla and tibia from Vankamari.

**Description:** Mandible (Figs. 3a and b): Posteriorly the mandibular ramus is broken off behind the second molar and hence the coronoid process and the third molar are not available for description. Anteriorly the specimen is chipped

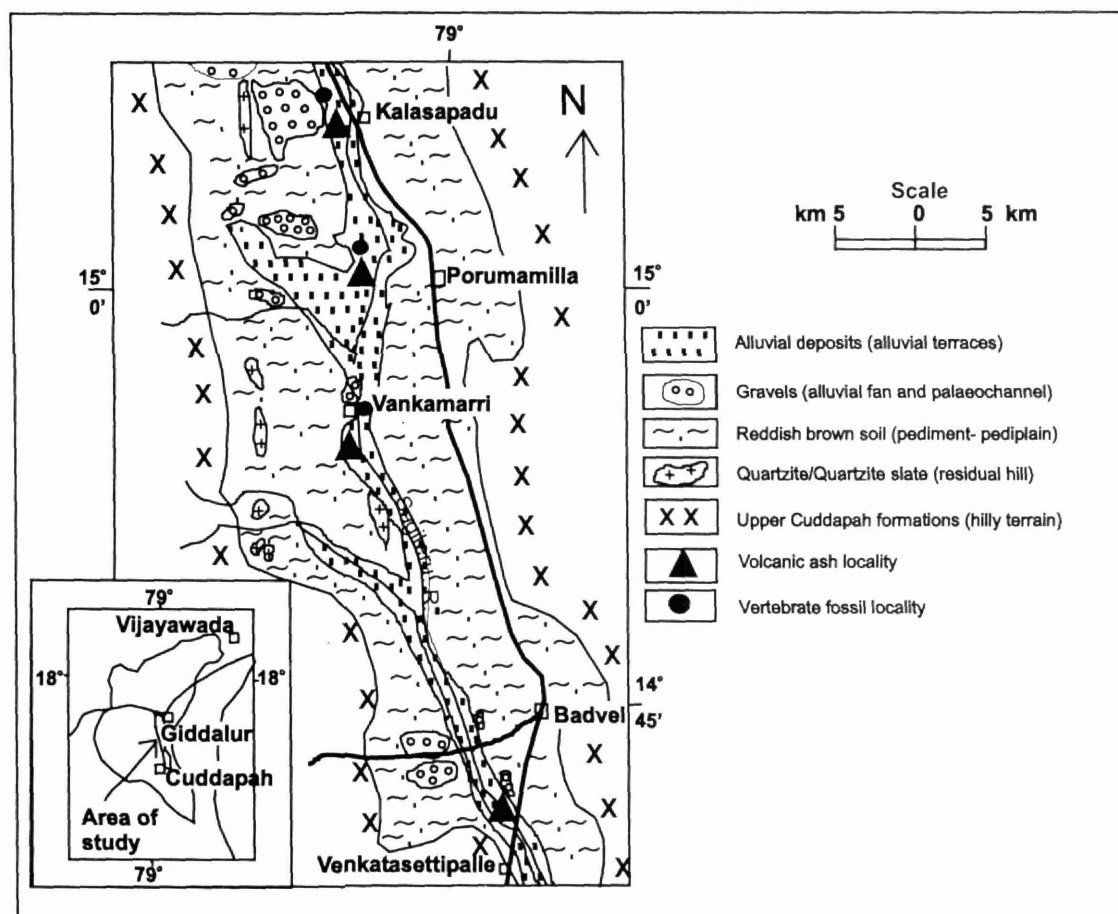


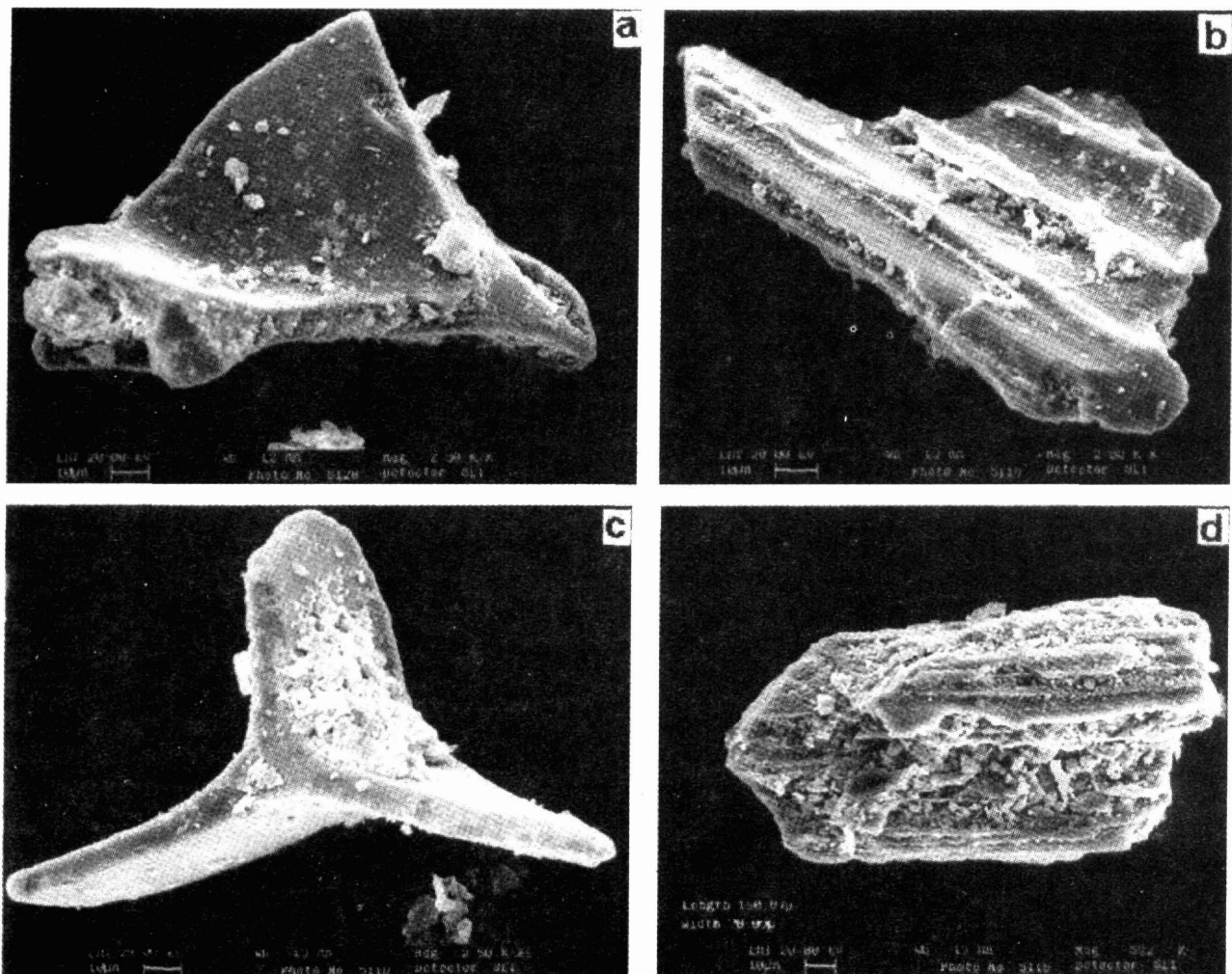
Fig.1. Geological map of the Sagileru valley showing volcanic ash and fossil localities (after C.V.N.K. Rao and others in Sivaji et al. 1994).

off in advance of the second premolar. The ramus is robust with the first and the second molars, and the alveolus of the fourth and third premolar. The roots of the second premolar are preserved. The depth of the ramus is not uniform throughout and therefore is not straight ventrally. The depth

of the mandible below  $M_2$  is 60 mm. The teeth are worn and the caliche cover obscures the cusp pattern. Measurements of the teeth are given below. The nature of the mandible and the size of the teeth are in tune with the known size ranges of the species of *Bos*.

Table 1. Lithological sequence of the Quaternary deposits of the Sagileru valley, Cuddapah district, A.P.

QUATERNARY	Recent	Unit IV	Active river channel sand and gravels ----- Unconformity----- (break in sedimentation; soil formation)
	Early to Late Holocene	Unit III	Massive, pale khaki and earthy brown silty clay to clayey silt. Small nodules of caliche and ferruginous pellets are present ----- Unconformity----- (break in sedimentation; pedogenic pedocaliche formation)
	Late Pleistocene- Early Holocene	Unit II	Massive pale grayish brown and yellowish brown to reddish brown silts and clayey silts, volcanic ash, and unconsolidated gravels. Vertebrate fossils and lithic implements present ----- Unconformity----- (Valley deepening and formation of Sagileru drainage)
	Middle Pleistocene	Unit I	Palaeochannel and alluvial fan gravel ----- Unconformity-----
	Proterozoic		Cumbum slate, phyllite with bands of quartzite.



**Fig.2.** SEM of glass shards of Sagileru ash. (a) broken glass shard showing vesicles remnant with minute shards adhering to the surface. (b) a broken pumice fragment with elongate parallel pipe vesicles. (c) trijunctional vesicular wall remnants with loosely adhering glass fragments on the surface. (d) a fragmentary pumice with pipe vesicles. Small particles loosely adhering to the grain surface are small angular shards. (Scale bar = 10  $\mu$ m).

	M <sub>1</sub>	M <sub>2</sub>
Antero-posterior length	20mm	29mm
Transverse width	14mm	—

*Right tibia* (Fig.3c): The distal portion of the bone is preserved. The distal articulation for the astragalus is in the rather two shallow groves, set parallel with a sagittal plane and to the axis of the shaft, which is normally the case in bovids (Sisson and Grossman, 1977). The upper layer of the mediolateral surface is chipped off due to which the medial malleolus is not preserved. The greatest distal width of the shaft measures 74 mm. The characteristics of this specimen are comparable with that of tibia of *Bos*.

Subfamily	Antilopinae
Tribe	Antilopini

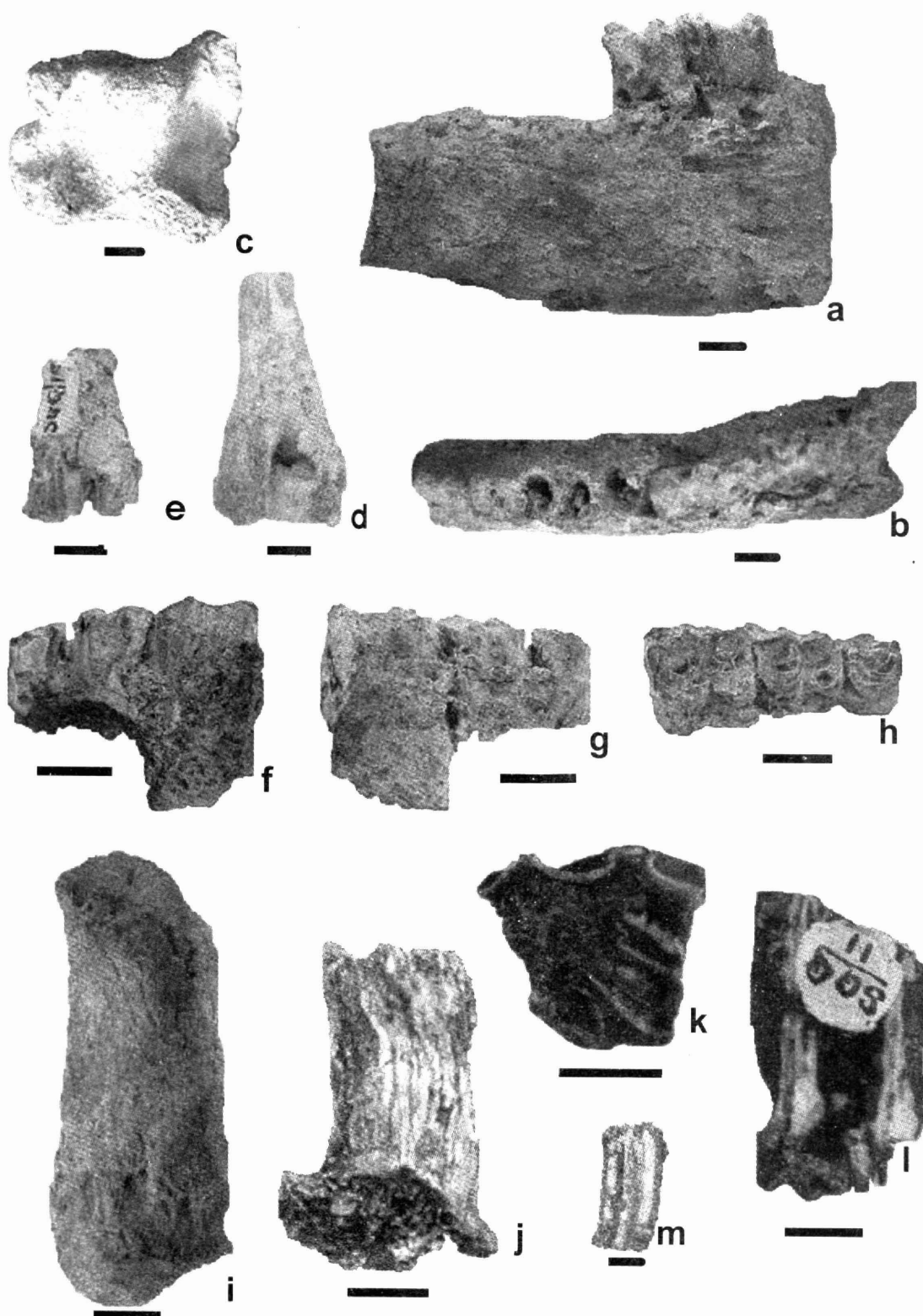
Genus *Antilope* Pallas, 1766

*Antilope cervicapra* (LINN) (Figs.3. f, g, h, i and j)

*Referred material:* Two fragmentary horncores and maxilla. One of the horncores (SGQ/13) (Fig.3j) is too fragmentary for description.

*Horizon and locality:* Alluvial silts of Unit II, Porumamilla

*Description:* Horncore (SGQ/5) (Fig.3i): The preserved horncore's length is 85 mm. It is twisted into an open spiral making one half revolution in 85 mm. Cross section of the horncore is circular. Keels are absent. The diameter at the base is 33 mm and is larger than the diameters of the horncores of the extant individuals. In the extinct *A. subtorta*



**Fig.3.** (a) Buccal view of the left mandible of *Bos* sp. (b) Occlusal view of the same. (c) End view of the distal extremity of right tibia of *Bos* sp. (d) Posterior view of the distal portion of humerus of *Cervus* sp. (e) Anterior view of the distal portion of the metacarpal of *Cervus* sp. (f) Buccal view of a portion of the right maxilla of *Antilope cervicapra*. (g) Lingual view of the same. (h) Occlusal view of the same. (i) Fragmentary horncore of *Antilope cervicapra*. (j) Fragmentary horncore of *Antilope cervicapra*. (k) Occlusal view of an upper molar of *Equus* sp. (l) Buccal view of the same. (m) Buccal view of the lower molar of *Equus* sp. (Bar scale 1 cm).

Pilgrim, the horncores are much less twisted, the torsion being about one third of a revolution as against a whole revolution in a length of about 105 mm in living *A. cervicapra* (Pilgrim, 1939, Dassarma et al. 1982). It is evident that in the degree of torsion the present specimen stands in between the extinct and the extant forms.

**Maxilla (SGQ/8)** (Figs 3f, g and h) Right maxilla with  $Pm^4$ ,  $M^1$  and  $M^2$ . The hypsodont dentition, strong external folds, absence of basal median pillar and the size of the molars go in favour of ascribing the specimens to *A. cervicapra*.

	$M^2$	$M^1$	$Pm^4$
Antero-posterior length	15mm	13mm	8.5mm
Transverse width	10mm	8mm	7.0mm

Superfamily	Cervoidea
Family	Cervidae
Subfamily	Cervinae

Genus *Cervus* Linnaeus, 1758

*Cervus* sp. (Figs 3 d and e)

**Referred material** A portion of humerus (SGQ/4) and metacarpal (SGQ/15)

**Horizon and locality** Alluvial silts of Unit II, Porumamilla

**Description** **Humerus** (Fig. 3d) The specimen under description is a portion of a right humerus with the distal articulation. Capitulum is absent, thereby suggesting that the radius is not a separately movable one. The trochlea is laterally displaced relative to the line of the shaft. The proximal edge of the trochlea is moderately descending laterally. The greatest distal width of the shaft is 20 mm. The width of the trochlea is 33 mm and its height is 23.5 mm. On its medial side the distal part of the shaft is flat without any marked medial epicondyl. The olecranon fossa is considerably deep. Judging from the preserved length of the shaft, the humerus appears to be short and slender. The size of the trochlea and its profile in distal aspect are comparable with those of the species of *Cervus*.

**Metacarpal** (Fig. 3e) The specimen is a fragmentary left metacarpal. The bone is not stocky but lightly built. A vertical septum divides the medullary cavity into two parts. The dorsal surface is rounded marked by a vertical furrow. The volar surface (posterior) is flat but the nature of vascular groove is obscured by the caliche. The distal end is divided into two articular surfaces by a medial/sagittal notch. Each division is made up of two condyles separated by a sagittal ridge. The sagittal ridge extends to the shaft. The length of the distal articular surface is 28 mm of which 3.5 mm is the width of the sagittal notch. The height of the articular surface

is 17 mm. The size and nature (Cornwall, 1968) of the articular surface facilitate in assigning the specimen to *Cervus*.

Order	PERISSODACTYLA
Suborder	HIPPOMORPHA
Superfamily	Equoidea
Family	Equidae
Subfamily	Equinae

Genus *Equus* Linnaeus, 1758

*Equus* sp. (Figs 3 k, l and m)

**Referred material** An isolated lower molar (SGQ/9), (Fig. 3 m) too fragmentary for description and an upper left molar (SGQ/11)

**Horizon and locality** Alluvial silts of Unit II, Kalasapadu

**Description** **Upper left molar** (Figs 3 k and l) On its anterior and posterior side near the pre- and post-fossette the enamel is chipped off and hence the tooth is incomplete along its antero-posterior length. Otherwise the tooth is nearly well preserved. The tooth is high and prismatic. The anterior half of the ectoloph is more concave inward than the posterior half of the ectoloph. Metastyle and parastyle are prominent. Protocone is elongate. The median indentation in its inner wall gives a bilobate appearance. Its connection with protocone is broad and anterior. The mediavallum is deep and well developed. The enamel in the fossettes does not show much crimping. The hypoglyph is not preserved. The preserved transverse width of the tooth is 23 mm and that of the antero-posterior length is 27 mm. The preserved length of the protocone is 9 mm. The enamel fold pattern and the size parameters of the tooth are comparable with those of *Equus*.

#### Volcanic Ash

Kalasapadu, Porumamilla, Vankamarri and Venkatesettipalle (14°39'20"N 79°02'40"E) (Fig. 1) are tephra sites located along the river bank sections and in the gullied topography adjacent to them. Volcanic ash in the sequence is found to occur in the form of discontinuous but isochronous lensoid bodies/pods of varying dimensions and in thin layers and beds of thickness up to 2 m. It occurs either within flood basin sediments or directly on the basement rocks. Ash is un lithified, white, brownish white, dull white to light grey, non-plastic, dusty and very fine-grained. The study of morphology of glass shards (Figs 2a-d) under scanning electron microscope revealed the presence of transparent, unaltered bubble wall shards and small pumice fragments. Broken vesicle walls are broadly triangular or quadrangular in shape. Y-shaped shards are common. Pumice fragments contain parallel or sub-parallel elongate pipe vesicles.

Vesicularity is the main character of the glass shards of the Sagileru ash as indicated by the presence of predominantly bubble wall shards. The glass shard morphology of ash from the Sagileru valley compares well with the shard morphology of those from comparable stratigraphic positions in other river valleys of India. Ash from these localities is compared and correlated with the Youngest Toba Tuff of 75000 yr old (Acharyya and Basu, 1993). Therefore the same age is provisionally considered for the ash from the Sagileru valley.

### Discussion

The occurrence of Quaternary vertebrate fossils previously unknown in the Sagileru valley, the presence of volcanic ash bed marker and the mode of distribution of alluvium provide a basis for grouping of sediments of the valley into Units I, II, III and IV occurring in that order of stratigraphic sequence. SEM study of glass shard morphology of volcanic ash from Venkatesettipalle in the Sagileru valley supports the consistent view (Acharyya and Basu, 1993, Westgate et al 1998) that the late Quaternary ash from the interior river valleys of India can be correlated with the ash from the Youngest Toba Tuff of 75000 yr old. Among the lithounits in the Quaternary sequence, the oxidized and calcretised fluvial silts lying above the volcanic ash unit are ossiferous. Fossil fauna from the valley includes *Antelope cervicapra* and *Bos* sp., *Cervus* sp. and *Equus* sp. The nature of oxidation and calcretization of the sediments together with the dissected nature of the terrace suggests an antiquity to the sediments and therefore to the fossils

contained in them. However, the fossils are not older than the Youngest Toba Tuff (75000 yr BP), because, in the sequence, they occur in sediments lying above the ash bed. Faunal content, nature of sediments and their position above the volcanic ash unit suggest a late Pleistocene to early Holocene age for the vertebrate fossil-bearing deposits of the river valley. The faunal record from this valley confirms the earlier observation (Biswas, 2003) that the Upper Pleistocene to Lower Holocene fossils are known from deposits distributed throughout peninsular India. Upper Palaeolithic side scrapers and blades fashioned out of chert and quartzite also occur in the ossiferous alluvial silts. The faunal record from the Sagileru valley gives an idea that in the interior river valleys of Andhra Pradesh, the alluvial silts and clayey silts lying above the ash bed are potential formations for the search of vertebrate fossils.

**Repository** The specimens, SGQ (the abbreviated form of Sagileru Quaternary)/1, 3-5, 8-9, 11, 13 and 15 described are deposited at Regional Palaeontology laboratory, Geological Survey of India, Hyderabad.

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### References

- ACHARYYA, S K and BASU, P K (1993) Toba ash on the Indian subcontinent and its implications for correlation of Late Pleistocene Alluvium. *Quaternary Res*, v 40, pp10-19.
- BISWAS, S (2003) Some observations on the Quaternary mammals of the Indian Sub-continent. In *Proceedings of the Fourth South Asia Geological Congress, New Delhi, India (GEOSAS-IV)* pp 297-301.
- CORNWALL, I W (1968) *Bones for the archeologist*. Phoenix House Limited, London, 154p.
- 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 India N S*, Vol XLIV.
- PILGRIM, G E (1939) The fossil Bovidae of India. *Pal India N S*, v 26, pp 39-40.
- SHANKAR, K, RAO, C V N K and SITARAMAIAH, Y (1998) Palaeontological and biostratigraphic studies of vertebrate fossil bearing Quaternary formations of the interior river valleys of Andhra Pradesh. Unpublished Report, Geol Surv India (FS 1995-96 and 1996-97).
- SISSON, S and GROSSMAN, J D (1977) *The anatomy of the domestic animals*. The Macmillan Company of India Limited, pp 153-154.
- SIVAJI K, SINGARAJU, V, RAO, A K and SATYANARAYANA, S V (1994) Preliminary assessment of gravels for diamonds in Sagileru river basin in Prakasam and Cuddapah districts, Andhra Pradesh. Unpublished Report, Geol Surv India (FS 1988-89 and 1989-90 and 1991-92).
- WESTGATE, J A, SHANE, P A R, PEARCE, N J G, PERKINS, T W, KORISSETTER, R, CHESNER, C A, WILLIAMS, M A J and ACHARYYA, S K (1998) All Toba Tephra occurrences across Peninsular India belong to the 75000 yr B P eruption. *Quaternary Res*, v 50, pp 107-112.

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