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Additional Quaternary faunal remains from the Middle–Late Pleistocene deposits of Purna Alluvial Basin, Maharashtra, Central India

One of the important fossiliferous localities being surveyed in recent years is the less known Purna Valley in Central India (Figure 1). However, the adjoining regions like the Central Narmada Valley have yielded numerous faunal remains in the past and these have been reported from time to time. In this context the Purna Valley assumes significant importance in the region. In fact, this area had remained less explored for a long time (Tables 1 and 2). Renewed efforts in this area have brought to light fossils from Bovidae, Equidae, Cervidae, Elephantidae and other groups like reptiles (turtles) and invertebrate fossils (molluscan shells) which are under study (Figure 2). In this study, the genus *Elephas* is reported from the Purna Basin. On the whole the material is well preserved and similar to that of the Narmada Valley. It throws enough light on the distribution pattern of these animals in Central and peninsular river valleys of India.

Geology of the area is characterized by silty clay, sandstone, gravels and calcretes. However, the most characteristic feature of the stratigraphy is the presence of tephra beds, palaeomagnetic and Ar–Ar dating. This has thrown light on the correlation of geological units with those of other Central Indian basins. Geologically, there are four formations in the valley – Vaghoi, Kodori, Kural and Purna, mostly comprising grey, silty clay, brown clay, calcretes and pockets of silty sand. Geochemistry of Gandhigram tephra relates the Purna Valley tephra to the Youngest Toba Tephra (YTT). Fission track date of the Gandhigram tephra is about 75,000 years BP. The Kodori Formation, *in situ* tephra, is early Upper Pleistocene in age[1–6]. Palaeomagnetic studies carried out by Gaonkar[7] show that the Vaghoi Formation has reverse magnetic polarity of Matuyama epoch (older than 0.7 Ma), whereas the Kodori and Kural formations are both in the normal magnetic polarity of Brunhes Normal (less than 0.7 Ma). Using the litho-stratigraphic and magnetic polarity criteria, the Vaghoi Formation is correlated with the Dhansi Formation of Narmada Valley[5,8]. Similarly, based on the fossil assemblage, the Kodori Formation and the overlying Kural Formation may belong to Upper Pleistocene. In fact, there appears to be a long erosional gap between the Vaghoi and Kodori formations, dating from Lower Pleistocene to early Upper Pleistocene respectively, and this is being examined. We are of the opinion that Middle Pleistocene should definitely be represented in the area, especially in parts of the Kural and Kodori formations pending its confirmation. The Kural Formation has yielded fossils of *Bos* sp., *Bos namadicus*, *Bubalus namadicus*, *Equus hemionus khur*, *Equus* sp. and *Antilope cervicapra* of Upper Pleistocene affinity. A few Palaeolithic implements were also discovered from this formation[9,10]. Recently, a rich and diverse assemblage of Quaternary fossils from Kapileshwar and adjoining localities of the Purna Basin has been discovered[11,12] and these collections are under study (Figure 3 *a* and *b*). The geomorphological and mineralogical data that are being studied may throw further light on the chronology and also on the depositional environment, fluvial geomorphology and types of palaeosols in the basin.

It is important to note that the alluvial fan deposits in the area form an important part of the geological formations and have an indirect bearing on the taphonomy of the fossils discovered in the region. The fans of the Upper Pleistocene occur as transverse depositional systems in northern region of the Purna Alluvial Basin. According to Chakrabarti and Roy[13], fans were formed by three main sedimentary processes – debris flow, sheet flood and stream flood.

More than 200 fossils have been retrieved so far during exploration and excavation in the area; most of them are well preserved and can be identified up to the species level. However, with more faunal materials being reported, it will be possible to identify the remaining materials up to the species levels. The materials are represented by parts of skulls, lower and upper jaws, isolated teeth, limb bones (complete and partial), vertebrae, girdles, digits, lamellibranchs, turtle shells and other parts. These were

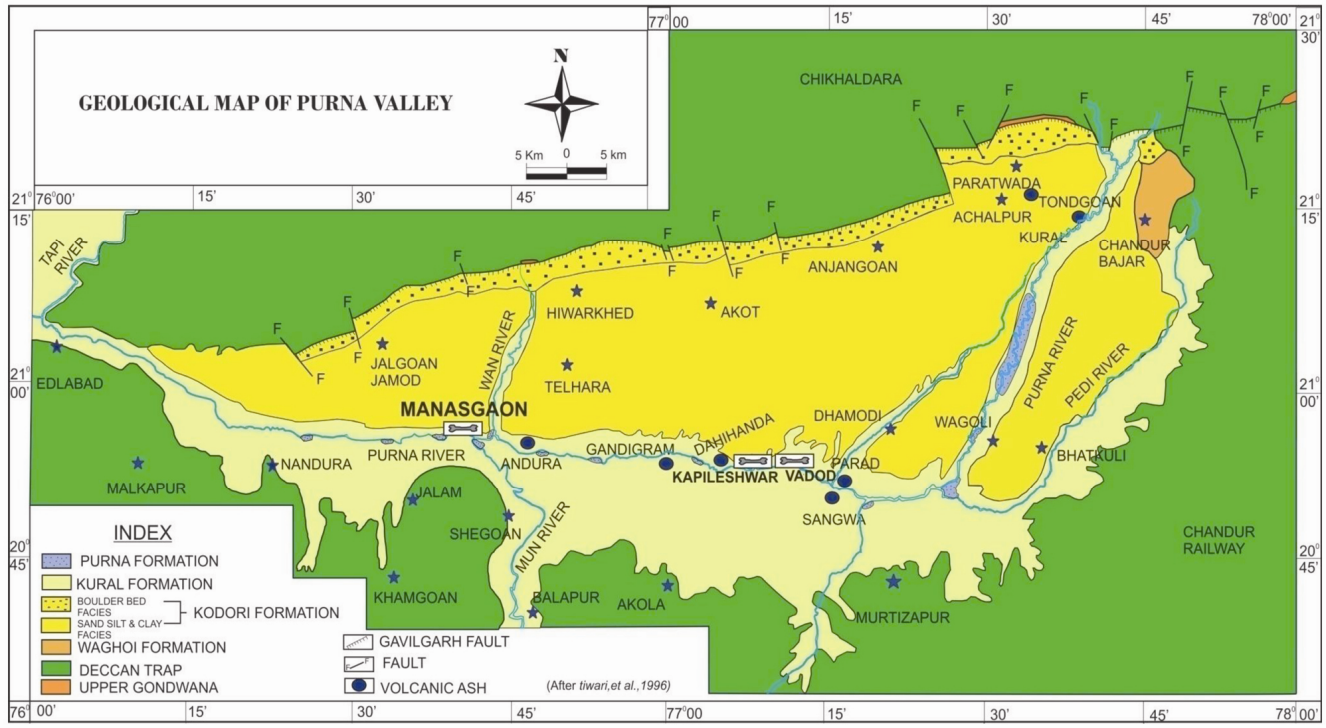

Figure 1. Geological map of Purna Valley, Maharashtra, India[5,8].

Table 1. Faunal occurrences in various localities of Purna Valley, Maharashtra, India

District/locality	Fossil/species	Type of fossil material	Age	Formation	Reference	Work based on
Akola district	Fossil Ruminantia	Fossils of bones and teeth of ruminants	Late Tertiary or Pleistocene to Recent	–	18	–
Sangavi, Mungsi and Yelki localities	*Bos* sp.	Fossil fragments	Early to Late Stone Age	–	10	Stone Age stratigraphy
Akola/Amravati (Kapileshwar locality)	*Antelope* cf. *cervicapra*	A skull	Upper Pleistocene	Gravel of unit-3	9	Vertebrate Palaeontology
	Bos sp./ *Bubalus* sp.	Fragmentary left mandible with M3 and part of M2				
	Bos sp.	Tip of horn core, vertebra				
	Bos namadicus	Fragmentary skull with left horn core and part of right horn core				
Amravati (Amla locality)	*Equus heminous khur*	Right molar 2				
	Bovid	Right upper premolar 2				
Amravati (Lakhpuri locality)	*Equus* sp.	Distal end of tibia				
Amravati (Thugaon locality)	*Equus heminous khur*	Right molar 2				
		Upper left milk molar				
Akola (Kapileshwar locality)	*Equus namadicus*	*Equus namadicus*, *Equus* sp., *Bos namadicus*, *Trionyx gangeticus* Lamellibranchs	Upper Pleistocene	Gravelly bed having lenses of cross-bedded sandstone	11, 12	Vertebrate Palaeontology

Table 2. Vertebrate collection from Purna Basin during the past and present study

Species	Sites									
Perissodactyla	Sangavi	Mungsi	Yelki	Kapileshwar	Amla	Lakhpuri	Thugaon	Manasgaon	Vadod	Probable age
E. namadicus				O ▲					√	Upper Pleistocene
E. hemionus khur					+		+			
Equus sp.						+				
Proboscidea										
Elephas sp.									√	
Elephas namadicus								√		
Artiodactyla										
Bubalus sp.				+						
B. namadicus				+ O ▲√						
Bos sp.	×		×	×	+					
Antilope cervicapra				+						

×, Bopardikar[10]; +, Sonakia[9]; O, Badam *et al.*[11]; ▲, Varade *et al.*[12]; √, Present collection.

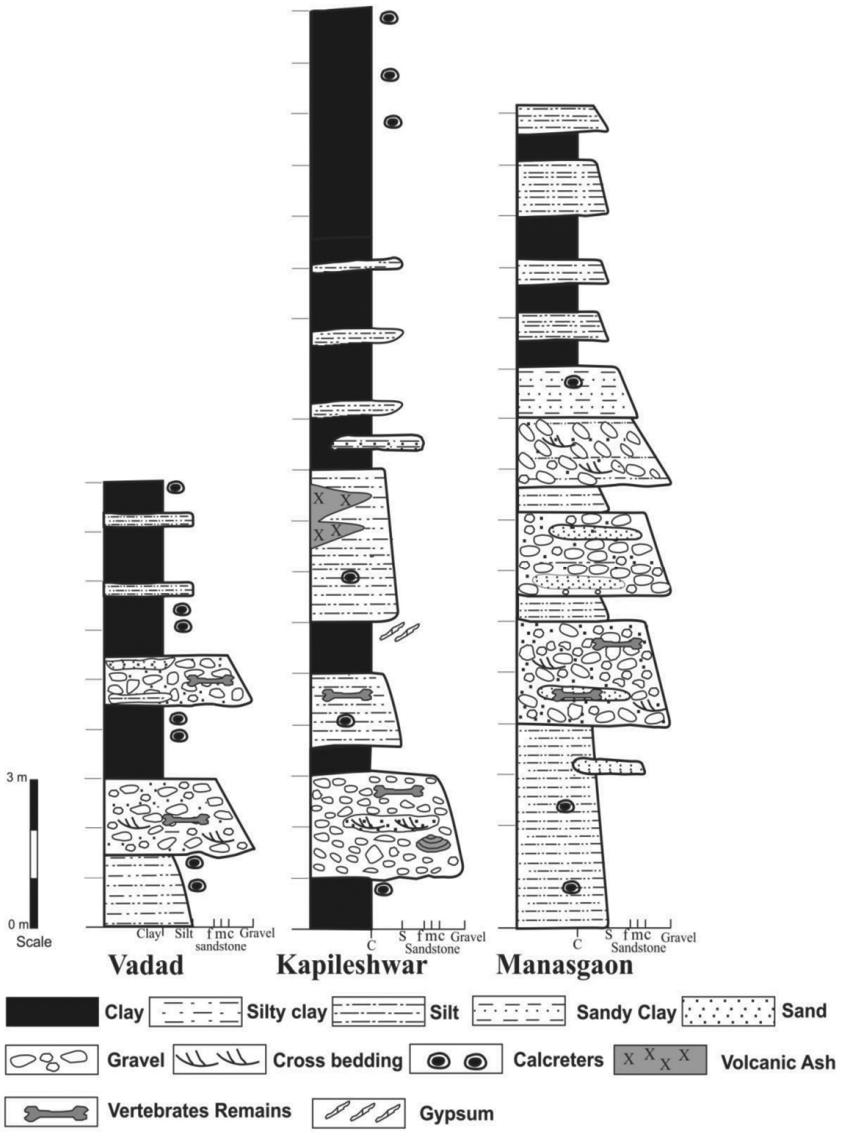

Figure 2. Lithologs of various sites in the Purna Basin.

processed in a solution of acetic acid and water in the ratio 1 : 3, cleaned with brush and dental machine (wherever necessary) and reconstructed using adhesives.

Some of the materials have already been reported[11,12] and others await results of morphological study. Photographs and remarks of some of the new collections are provided here Figure 3 *c–f*.

1. Skull of *Equus namadicus* (Figure 3 *c*): Almost complete with the exception of the pre-maxillary portion. It is elongated and the dorsal profile is flat. Most of the parts are well preserved and on the left side all the six teeth, viz. M^3, M^2, M^1, P^4, P^3 and P^2 can be clearly seen. Features of anterior and posterior fossettes of dentition with paracone, metacone and protocone, interstylar faces, etc. are well preserved. On the right side, M^3 is broken whereas M^2 and M^1 are well preserved; part of P^4 is also present. Palate is deep, orbits are of moderate size in proportion to the skull.

2. Lamellae/plates of *Elephas* molar (Figure 3 *d*): This is a well-preserved partial molar of *Elephas* sp. consisting of three almost straight plates of dentine. The plates are quite deep; absence of bend/curve in the plates makes it difficult to identify the specimen up to the species level. However, in all probability it may belong to *E. namadicus*, till further confirmation. Gravelly matrix attached to the specimen is reddish in colour.

3. Humerus of *Elephas* (Figure 3 *e*): This is the proximal part of humerus of *Elephas* sp. with well-preserved head, medial and lateral tuberosities, deltoid

Figure 3. ***a***, Position of *in situ* large fossil in basal hard gravelly strata (Kapileshwar). ***b***, Volcanic ash (Tephra) in the Kural Formation (Kapileshwar). It may be noted that most of the faunal material comes from levels below the tephra exposure. ***c***, Skull of *Equus namadicus* (palatal view) showing well-preserved features (Vadod). ***d***, Plates of *Elephas* (Manasgaon). ***e***, Proximal humerus of *Elephas* (Vadod). ***f***, Tibia of a bovid (Kapileshwar).

tubercle, and part of shaft which appears straight beyond deltoid tubercle.

4. Tibia of a bovid (Figure 3 *f*): This is a well-preserved tibia of *B. namadicus* with triangular outline at the proximal end. The slight twist on the shaft at about one-third of the length from the proximal end is prominent and distal groove for the attachment of tarsal bone is well marked and straight.

It may be mentioned here that, on the whole, some species like *B. namadicus*, *E. namadicus*, *Bubalus palaeindicus* and a host of other animals continue from Central India to Peninsular river valleys without undergoing micro-morphological changes. Some species extend even into the Holocene[14] (up to the genus or species levels) like *A. cervicapra*, *Cervus* sp., *Boselephas tagocamelus*, etc. A few pass through domestication and modification processes and have an impact on the Quaternary fauna of India as far as ecology, food economy and migration pattern is concerned. It may also be mentioned here that it takes around 20 generations for the characteristic features of a large-sized animal to be manifested in its progeny through mutation, considering the factors of climate and time[15]. However, some micro-morphological changes are reflected in their progeny given the long time gap involved in the Lower/Middle Pleistocene transition. The species hitherto considered as index fossil for Middle Pleistocene, e.g. *B. namadicus* no longer stands valid. At present, *E. namadicus* is reliably considered as index fossil for the Middle Pleistocene (along with *Sus namadicus* and *Hexaprotodon namadicus*), which have so far not been found in the Purna Basin but in the adjoining areas of Central India[16]. Also, the Late Pleistocene fossils cannot be differentiated from those of the Holocene, as there are no major osteological changes occurring due to domestication unless we deal with completely preserved skull and parts of skeleton bone by bone. The time lag between the two periods as also the degree of mineralization need to be considered.

The present collection is interesting from a taphonomic point of view. Most of the fossils come from channel lag deposits, except a few like the *E. namadicus* skull which is from the primary context. As mentioned elsewhere[11,12], the basin represents the death assemblage of large vertebrates which were disarticulated and fragmented both before and after burial. Evidences of trampling, subaerial erosion and bacterial activity are present in some fossils. The taphonomic signatures on the fossils also hint at the dominance of the fluvial system which might have been responsible for transporting and even scattering the skeletal elements. With respect to local channels some fossils are considered *in situ*, while these may be considered as autochthonous when taken as a whole unit of the entire Purna Valley. On the whole, the conditions occurring in the Purna Valley with respect to preservation and disarticulation of the fossils also apply to the adjoining Narmada and other valleys though the density of the fossil elements is far less in the river valley under consideration.

It may be mentioned that the sum total of fossil-forming processes occurs as a result of many inter-related geological, biological and chemical phenomena. The different events in such phenomena

generally provide insights into the causes of death, decomposition and disarticulation, weathering and transport, diagenetic factors, etc. All details regarding this aspect will be dealt with in a future publication on taphonomy. However, sufficient research has been conducted on different taxa from various localities in the country regarding diverse taphonomical aspects, some of which also apply to the collection of the Purna Valley[17].

Efforts to study the recently recovered faunal materials and to excavate and collect more fossils from the general region are presently on for a better understanding of faunal distribution pattern and evolutionary trends in the Indian Middle to Late Pleistocene time bracket, the migration patterns and minor ecological changes accompanied with the migration patterns of the faunal resources.

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