03

Skeletons in the Closet: A Zooarchaeological Enterprise in the Prehistoric Archaeology of Middle Ganga Plain and Vindhyas

Prachi Virag Sontakke*

*Email: prachivs@bhu.ac.in

Keywords:

Zooarchaeology
Prehistory
Middle Ganga Plain
Vindhyas

Abstract: Assessment of faunal remains can provide valuable insights into the activities and life of prehistoric people. In the present paper, an attempt has been made to identify certain aspects related to prehistoric human life and habitation with the help of zooarchaeological remains. The area of operation for the current study includes two geographically distinct but interdependent regions with interactive history - the Middle Ganga Plain and the Vindhyas. The present work focuses on the zooarchaeological observations and archaeological sites in this very area right from the Palaeolithic down to the Neolithic times. Zooarchaeological proxies utilized for this study chiefly include fossilized bones, charred bones, antlers and horns, tooth enamel, hoof impressions and rock paintings.

Introduction

"As Cuvier (Father of comparative anatomy) could correctly describe a whole animal by the contemplation of a single bone, the observer who has thoroughly understood one link in the series of incidents, should be able to accurately state all the other ones, both before and after."

Arthur Conan Doyle

One of the humans' chief activities in the past was the exploitation of the animal world. This interaction between humans and the animal world left its visible signatures in the form of zooarchaeological (or archaeozoological) records. Since the sources for prehistoric human occupation and culture are rather limited, these faunal remains offer an extra set of evidence for prehistoric reconstructions. These records hold the key to valuable interpretations regarding the prehistoric way of life. The Middle Ganga Plain and the Vindhya region are the regions where numerous faunal studies have been done by stalwarts of zooarchaeology.

ISBN: 978-93-5786-608-8 (E-book); 978-93-5810-902-3 (Print)

Cite as: Sontakke, Prachi Virag (2023) Skeletons in the closet: A zooarchaeological enterprise in the prehistoric archaeology of Middle Ganga Plain and Vindhyas, in *Animals in Archaeology: Integrating Landscapes, Environment and Humans in South Asia* (*A Festschrift for Prof. P.P. Joglekar*) Volume 1 (Pankaj Goyal, Abhayan G.S., and Sharada Channarayapatna Eds.), pp. 79-97. Thiruvananthapuram: Department of Archaeology, University of Kerala.

Area and Time Frame for the Study

The area of operation for the current study includes two geographically distinct but interdependent regions with interactive history - the Middle Ganga Plain and the Vindhyas (Fig. 1). The researcher chose these two areas rather than a singular area because human-animal relations, both in their ecological and cultural components, can be better comprehended from two different regional perspectives. However, it is imperative to make it clear at the onset that the limits and area of operation of Middle Ganga Plain are taken from I.B. Singh's (2005) classification since it is better suited to the current study on account of the availability of required data. As per Singh (2005: 7), this region marks the middle part of the Ganga plain and can be taken to indicate the area between Kanpur and Patna (Fig. 2). For want of possible connections and disparities in zooarchaeological data, the region of Vindhya has also been considered for the current study. The present work will focus on the zooarchaeological observations in this very area right from the Palaeolithic down to the Neolithic times. Zooarchaeological proxies in the aforesaid timeframe chiefly include fossilized bones, charred bones, antlers and horns, tooth enamel, hoof impressions and rock paintings. They will be referenced as and when required.

Faunal Record from Area of Study

In the beginning, the faunal fossil records from Ganga plains were meager probably due to the dearth of such exploratory works amidst belief in continuous depositary processes

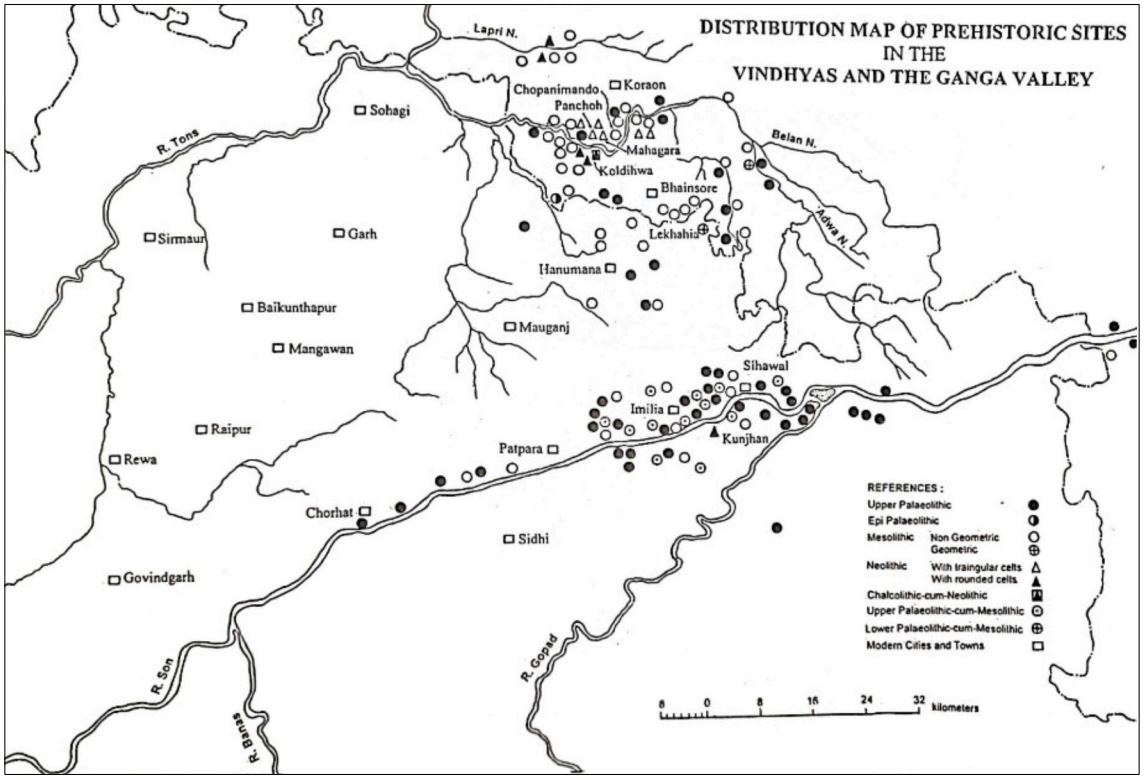

Fig. 1: Prehistoric Sites in the Vindhya and Ganga Valley (after Varma 2010)

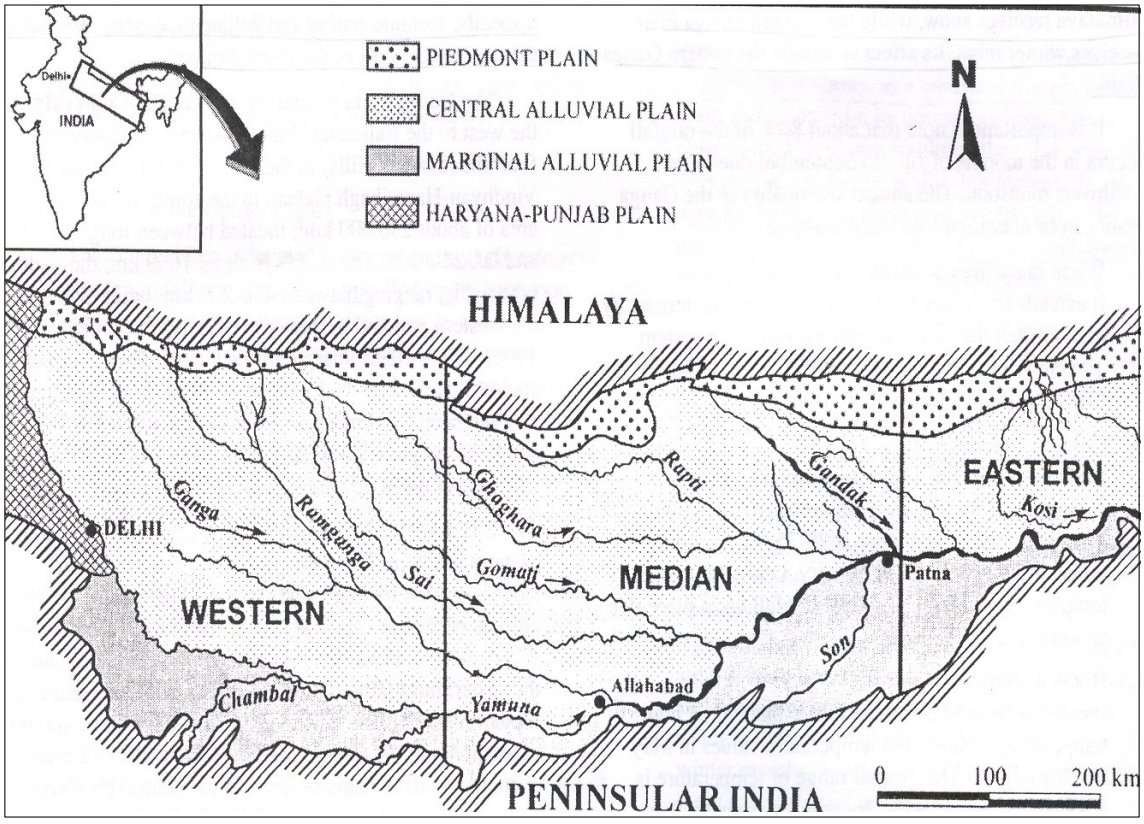

Fig. 2: Middle Ganga Plain (After Singh 2004)

operating here which may have hidden such remains in deep Gangetic sediments. The first documented find of animal fossils in this area was made as early as 1830 by Falconer in Jumna alluvium which was reported in the *Manual of the Geology of India* (cited in Pilgrim 1904: 177). In 1904, G.E. Pilgrim (1904: 176) reported the fossil finds of *Bos namadicus, Bubalus* sp., *Elephas* sp., *Cervus* sp. and Hippopotamus from Allahabad. Chakravarty (1931: 115) reported a Stegodon molar from the Upper Pleistocene bed of Ganga near Varanasi in 1931. However, it was the search for human occupational remains in the Vindhya-Ganga Valley that led to the discovery of a great number of faunal fossils from the Terminal Pleistocene context. A total of 57 fossil bones were recovered from Gravel I near Dahiya representing *Bos, Equus, Bubalus, Cervus, Chelonia,* etc. (IAR 1968-69: 34). With the realisation of the archaeological importance of the Vindhya-Ganga Valley, G.R. Sharma and his team took up this region for further explorations and excavations during the 1970s and made significant faunal finds (Sharma 1973: 143, 1975: 18). The excavation reports of these sites give due credit to the faunal remains encountered during the course of excavations. Furthermore, Sharma tried to explain the human dispersal with the help of faunal remains and thus brought human-animal relationships under scrutiny. Insights of Sharma about human-animal interactions were discussed further in the works of Varma (2010: 175), Mandal (1980: 163), Pal (2002: 289), Blumenschine and Chattopadhyaya (1983: 281), Thomas and Joglekar (1995: 496), Thomas et al. (1995:29), Thomas et al. (2002: 366), Sathe (2017: 1) and Joglekar (2006: 309) over the stretch of time.

Material and Methods

Zooarchaeological parameters for palaeoenvironmental reconstruction may be divided into proxy data and direct data. Proxy data is the data that can inform about the antecedent conditions not directly accessible for observation (Dinacauze 1987: 259). In contrast, direct data implies those sources which are directly available for knowing the past environments. These may also be addressed as macro and micro faunal data. In the area under current research, the use of various techniques utilised for extracting proxy data is seen such as organic residue analysis, tooth enamel studies, Fluorine-Phosphorous ratio analysis, Magnesium and Strontium analysis in shells, isotopic compositions of carbonates to name a few. Besides proxy and direct data, visual indirect data in form of rock art has also been utilised for the present study. However, it must be made clear at this juncture that the researcher has merely utilised the results of zooarchaeological studies conducted by experts and has not done any faunal study on her own. Furthermore, for the current study, faunal remains from various prehistoric sites distributed in the Middle Ganga Plain and neighboring Vindhyan region are considered only.

Inferences

As noted above, the assessment of faunal remains can provide valuable insights into the activities and lifeways of prehistoric people. Here, an attempt is made to identify certain aspects regarding prehistoric human life and habitation which can be better understood with the help of zooarchaeological remains.

a) Seasonal occupation of archaeological sites

G.R. Sharma (1975: 14) tried to establish the seasonal nature of the Mesolithic site of Sarai Nahar Rai based on his hypothesis of the seasonal movement of animals. Sharma believed that human entry from Vindhyas to Gangetic plain was the result of humans following the animal migration to the same region. He postulated that Vindhyas on account of aridity must have comparatively denuded vegetation during Terminal Pleistocene. Scarcity of fodder and water must have driven the animals to more hospitable regions of the Ganga alluvium. This was not the first migration of animals from Vindhyas to the Ganga valley (Sharma 1975: 13). As noted above, the fossil remains of the mid-Pleistocene fauna discovered at Allahabad include *Bos namadicus*, *Elephas namadicus*, Hippopotamus, *Bos or Bubalus* sp., and *Cervus* sp. (Pilgrim 1904: 176), in addition to a Stegodon molar from the Upper Pleistocene bed of Ganga near Varanasi (Chakravarty 1931: 115). These beds yielding the fossils belong to the mid-upper Pleistocene. There is, however, no evidence in this period, of the arrival of Stone Age humans following these animals. The second wave of animal migration into the Ganga Valley is significant as it was also followed by the arrival of humans in the area. The question is why were these bands of hunters-fishermen moving across the Ganga and Yamuna into unknown lands? As Graham Clark has remarked in a different context, it was an unwitting process having more in common with the spread of animals or even plant species than with the planned exploration (Clark and Piggott 1970: 92). The hunter-

fisherman way of life depended on the intensive and often difficult quest for food and was conducive to movement. The occasion was a fluctuation in climate which may have provided the decisive impulse (Sharma 1975: 14).

Thus we see that excavations at Sarai Nahar Rai led Sharma (1973: 19) to hypothesise a summer migration of Vindhyan groups into the Ganges Valley in search of food and water caused by seasonal drought and local resource depletion in Vindhyas. Sharma believed that Gangetic sites were seasonal sites occupied under climatic duress by the Vindhyan population. However, Varma (2010: 187) argued in favour of a semi-permanent occupation at Mahadaha and Damdama based on the number of grinding stones at these sites. On the other hand, Chattopadhyaya (1996: 468) opined that both arguments by Sharma and Varma were too general to be conclusive. He argued that the faunal evidence provides an important clue to the settlement pattern, particularly in respect to whether the Ganga Valley populations were sedentary at some sites or were residentially mobile as hypothesised by Sharma (Chattopadhyaya 1996: 468). He based his argument on the isolated teeth and ageable mandible of hog deer and swamp deer from faunal assemblages at Mahadaha and Damdama (Fig. 3). The ages at which wear commences for different molars of hog deer and swamp deer are roughly known and they indicate a wide range of killing seasons. For example, taking April and July as the months of the birth of hog deer and swamp deer respectively, the unworn and slightly worn lower permanent molars indicate a wide range of months for human occupation. Furthermore, the presence of fully erupted but unworn teeth of hog deer indicates August, April and December as the period of occupation at Mahadaha. Likewise, July and January are indicated by the molars of swamp deer. This evidence of site occupation in both summer and winter is sufficient to challenge Sharma's hypothesis of summer visits by Vindhyan groups and the nature of habitation as seasonal.

In this connection, the presence of the bandicoot rat, a commensal species, at Mahadaha and Damdama is also significant. As the existence of small rodents is consistently associated with agricultural fields and storage areas, the presence of these rodents at an archaeological site also warrants the presence of such activities in and around the settlement (Sathe 2017: 8). It has been argued that commensal animals cannot colonise a habitation site unless food is available throughout the year. The fact that the proportion of bandicoot remains increases from the early to late phases both at

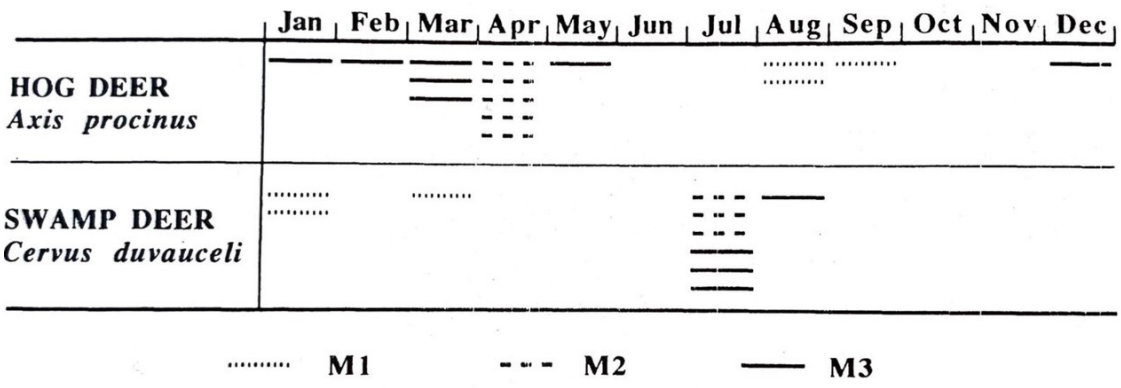

Fig. 3: Seasons of death of Hog deer and swamp deer at Mahadaha based on fully erupted but unworn and slightly worn lower permanent molars (After Chattopadhyaya 1996)

Mahadaha and Damdama may suggest increasingly year-round rather than seasonal occupation at these sites (Chattopadhyaya 1996*:* 468).

b) Identification of activity locales at the site

The presence of faunal remains may also offer insight into the purpose for which an area was being used. Excavations at Mahadaha revealed three distinct activity areas - the cemetery-cum-habitation complex, the butchering complex and the lake complex. Animal bones were recovered from all three areas. Interestingly, the character of the animal bones recovered from these three different areas and the species represented by them was identical. Analysis of bones from the butchering complex indicated that the Mesolithic hunters used to bring the carcass of small game and the dismembered parts of big animals and cut them into small pieces in this area. This area was also used for fabricating bone tools and ornaments. The occurrence of thousands of animal bones in the lake area indicated that the Mesolithic people at the site, after consuming the flesh, had dumped the refuge from the hearth and habitation area in the lake (Sharma et al. 1980: 101). The sheer volume of the refuge suggests deliberate human action and precludes the role of any natural agency (Sahu 1998: 99).

Furthermore, a large cattle pen, irregular rectangle on plan, was exposed at the eastern fringe of the south-eastern sector of the settlement at Mahagara. Identification of this enclosure as a cattle pen was evident since a large number of hoof impressions belonging to different age groups were located in clusters. Furthermore, the debris within the enclosure was completely devoid of pottery and other artefacts. Its location is at one end of the village particularly at the eastern one, which provides the shortest approach to the riverbank, which is significant in respect of the mechanism of cattle herding. This pen was surrounded by huts. Remains of as many as eight floors constituting four house units on four sides were found around the pen (Sharma et al. 1980: 146). The placement of this pen in the centre with houses around speaks volumes about its importance.

Faunal remains from Damdama once again helped in identifying activity locales within the site. The horizontal distribution of bones at Damdama showed the concentration of meat-bearing and non-meat-bearing parts of skeletons in different parts of the excavated area. Possibly the bones were cut off from the original carcass and dumped at one place near the settlement for further use. They form various clusters in each unit which could be identified as different activity areas such as butchering areas and refuse dumping areas. It is also interesting to note that some of the bones of large mammals were concentrated on the south-eastern part of the site (trenches SA-SD). These bones were well preserved, without much charring or fragmentation. Probably these were intentionally kept as raw material for the preparation of bone tools and objects (Thomas et al. 2002: 368).

c) Palaeoenvironment

Studies researching the palaeo-ecological implications of presence or absence of fauna are far and few in the Middle Ganga Plain. Amidst the dearth of such studies, some singular studies have proved helpful in deciphering the microenvironments of the

human habitats in the study area. Analysis of dispersed sedimentary sections of two lakes, Mesa Tal and Sanai Tal in particular, constitute one of such studies where micro faunal studies have been carried out with the aforesaid objective (Figs. 4 and 5). The patterns and responses of lake level fluctuations, ecological changes, variation in sedimentation rates and lithological changes are very well reflected in the specific associations of ostracod and gastropod assemblages of these lakes. In Mesa Tal, the lower 1.5 m horizon has yielded rich and diversified micro faunal assemblage, whereas in Sanai Tal the fauna is recorded from the upper 1.05 m sequence. The inferred palaeo-ecology of gastropod and ostracod fauna in Mesa Tal sediments suggests that it was a relatively large lake during the early Holocene times. During the mid-late Holocene period, the lake shrank with an increased supply of terrigenous sediments. In Sanai Tal, ostracod and gastropod faunal assemblages suggest shallow but permanent water bodies since the onset of Holocene. The richness of the fauna further indicates enriched vegetation and climatic amelioration during early-mid Holocene (10,120-7600 yrs BP) followed by a gradual decline in the lake size and water column during late Holocene (Saxena et al. 2011: 149).

Besides ostracod and gastropod proxies, studies on oxygen isotopic fingerprints of bovid tooth enamel from Ganga plain have also been carried out for understanding its palaeoenvironmental record. Oxygen isotope analysis of teeth enamel was done at Kalli Pachchhim, Dadupur and Charda in the area under study. Third molars of *Bos indicus* collected from these sites show that the bulk ^{18}O values of these teeth from different archaeological horizons reflect climatic shifts over large time scales. Samples from around 3600 cal yr BP indicate humid conditions, which change to drier conditions around 2800 cal yr BP. From 2500 to 1500 cal yr BP there is a trend of increasing humidity. Around 1300 cal yr BP, climatic conditions again became less humid or dry. The bulk ^{18}O

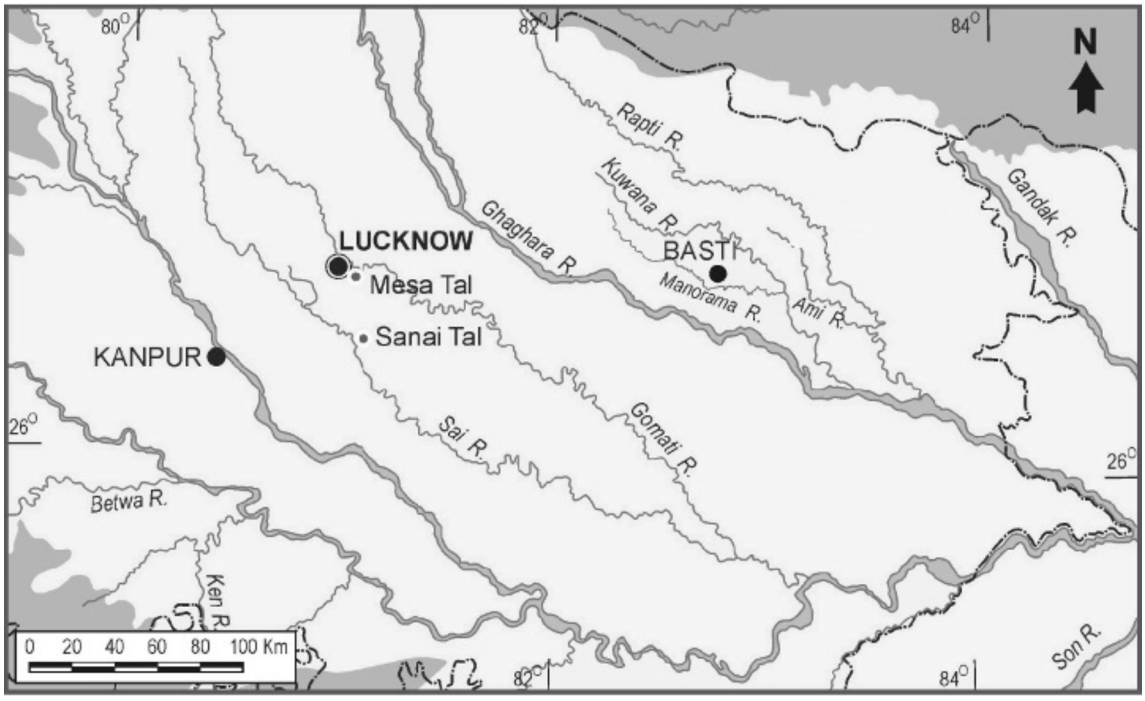

Fig. 4: Mesa Tal and Sanai Tal in Ganga Plain (After Saxena et al. 2011)

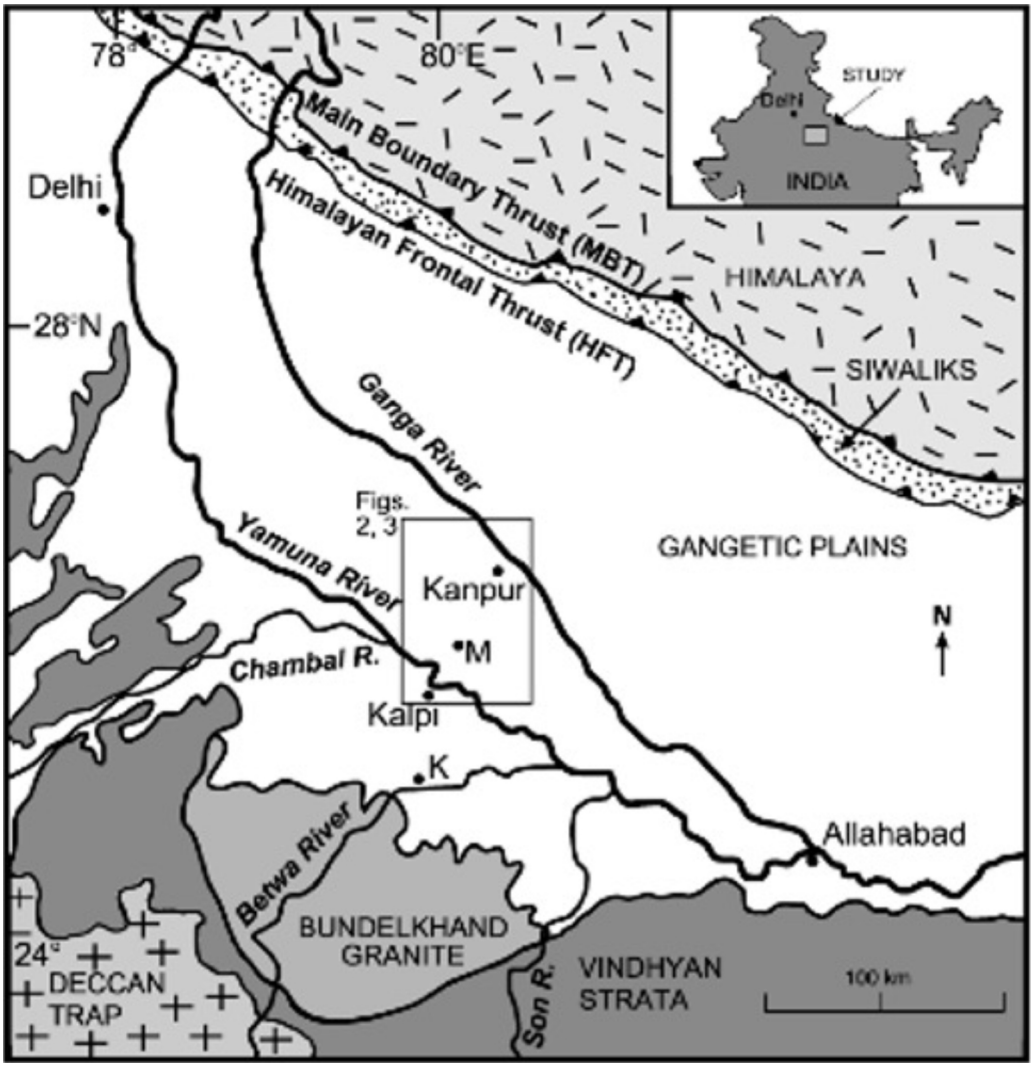

Fig. 5: Kalpi in Ganga Plain (After Gibling et al. 2005)

values of M3 teeth from different archaeological horizons also reflect climatic shifts over large time scales. The ^{18}O values of tooth samples from Charda (high annual rainfall area) are lower in comparison to ^{18}O values of samples from Kalli Pachchhim (lower annual rainfall area). However, ^{18}O values of samples from the same archaeological period from the two sites show a similar seasonal variation. It appears that although the amount of annual rainfall varied significantly in different parts of the Ganga plain, the seasonal pattern remained the same everywhere (Sharma et al. 2004: 27).

As against faunal proxy data, the macrofauna record from Middle Ganga Plain and Vindhyas is abundant. Sathe (2017: 5) holds the view that reconstruction of the palaeoenvironment based on macrofaunal remains can be best attained when the assemblage is having a variety of species, reflecting the existence of a wider range of habitats. This is true as thousands of fossils representing a diverse range of faunal species have been recovered from the Pleistocene alluvial contexts at numerous localities in the Son and Belan river valley and Gangetic horseshoe-lake sites. These remains have lent a helping hand in recording the palaeoenvironment of Ganga and Vindhyas (Pal 2013: 1). The coarse member of Baghor formation was highly fossiliferous and revealed

a corpus of faunal remains in the form of skeletal evidence of *Bos, Equus*, hippopotamus, crocodile, antelope, elephant, tortoise, stag, deer, etc. in the well-preserved conditions (Misra 2007: 5). The taxonomic composition of the assemblage is consistent with the geological evidence for the arid conditions during the terminal Pleistocene. A large proportion of bones of bovid, equid and rhino indicates substantial tracts of relatively open grassland, while the good representation of Cervidae indicates the presence of sufficient woodland and bushes. Swampy areas with plenty of water bodies are indicated by the presence of hippo, crocodiles and molluscs (Blumenschine and Chattopadhyaya 1983: 283). These faunal remains are indicative of a humid climate in and around Baghor. Investigations of the depositional sequence and the associated faunal remains at Belan valley also have helped to understand the prehistoric environments of the region, and based on artifacts obtained from these deposits, the reconstructed climatic phases have been correlated with those of prehistoric cultures (Pal 2013). From cemented gravel III (Upper Palaeolithic Period) of Belan Valley, remains of different animals were documented. The occurrence of bison with cattle having wild affinity indicates that the terrain was having a thick forest cover along with grass. The presence of the elephant and the hippo indicate wetter climatic conditions (Alur 1990: 240).

Another macrofaunal study of Pleistocene times was done at the site of Kalpi, located in Uttar Pradesh. Scattered in the succession of Event II at Kalpi are remains of many vertebrates, namely, *Bos, Equus, Elephas,* hippopotamus, crocodiles and turtles. The rich fauna of Event II would demand a swampy region with a humid climate. Though the present climate of Kalpi is semi-arid, the fluorine-phosphorus ratio of animal bones indicates that Event II was deposited during a humid climate event of 28-33 ka (Singh et al. 1999: 1024). In addition, some ideas about the palaeoenvironment can be envisioned by the rock art of the Mesolithic period. The pictorial content of rock paintings by Vindhyan Mesolithic hunters indicates that the climatic conditions were quite similar to the present. All the animals depicted are still to be found in India. They document a fauna that could only exist in a climatic condition very similar to the current one (Neumayer 1993: 20). Rock paintings at Gochara, Kerwa, Kauva Koh, Ghormanagar, Panchmukhi and Soraho in Mirzapur document the presence of one-horned rhino in the paintings of earlier phases (Tewari 1990: 13). This provides evidence that initially the environment in this area was suitable for rhino. Tewari also documented 55 depictions of elephants too from Mirzapur rock-painted shelters. This once again attests to the humid conditions in the area.

It is important to note here that most of the palaeoenvironmental reconstruction in the area of study is done based on fossil remains of big vertebrate animals like *Bos, Elephas*, Hippo, etc which represent macro vertebrates. Sathe (2007) opines that since the mobility of micro vertebrates like rats and lizards is generally confined to restricted areas during their entire life span and some of them are highly sensitive to climatic changes, their occurrence provides higher resolution in interpretations of palaeoenvironment and formation of palaeocommunities. In this light, rodents present the potential to provide palaeoenvironmental information not attainable from other animal groups. The usefulness of rodents as a source of such information appears to have been overlooked in the context of Indian Archaeology in general and in the area of study in particular (Sathe 2017: 3).

d) Subsistence

Due to several faunal studies done in the last few decades, the evidence of the animal-based economy in the Ganga Valley is growing (Joglekar 2006: 309). During the early Holocene times, many horseshoe lakes in Middle Ganga Plain were formed. These lakes abounded in the aquatic and avian fauna and the area around them must have been full of vegetal food which attracted humans and animals alike. Consequently, a definite change in animal resource exploitation was seen in the form of a change in subsistence from Palaeolithic hunting-gathering of large animals to fishing and fowling, besides hunting-foraging in the Mesolithic period. This shift is evident in the faunal remains recovered from Mesolithic sites in Middle Ganga Plain. One notices the inclusion of aquatic and avian remains in the bone assemblages of Mesolithic sites in the Middle Ganga Plain. Faunal remains from Damdama showed these changes in the animal resource exploitation by humans (see Table 1).

It appears that the inhabitants of Damdama exploited one class of mammalian resources for a longer period of time; thereby depleting it to such an extent that other alternatives had to be chosen. If one hypothesises that a sufficient time period was allowed for regeneration, possibly the threatened species might have been naturally regenerated. Further, it was postulated that the paucity of wild mammals perhaps forced the people at Damdama to look for other animal resources to fulfill their meat requirements which they did by relying on the exploitation of avian fauna and at times aquatic fauna (after Thomas et al. 1995: 35).

An interesting observation relating to some sort of exchange activity in sites in the Middle Ganga Plain was made by Chattopadhyaya (1996) based on the faunal remains excavated at these sites. He noted that the animal skeletal remains, more directly associated with meat, were heavily underrepresented at Mesolithic sites of Ganga Plain. He suggests that meat was perhaps produced more than the direct requirements of the community and could be used as an item of exchange to acquire the much-needed stones for implements (as cited in Chakrabarty 2000: 109).

The Neolithic period at Chirand threw light on an amazing variety of bone tools. The type and nature of these bone tools indicate not only mastery in their making but also imply a fairly long tradition of bone working behind them. Different parts of animal

Table 1: Changes in animal resource management at Damdama (After Thomas et al. 1995: 36)

Changes in mammal %	**Layers**	**Changes in other resources**
Decrease	10-8	Reduction in mammals is mainly compensated by an increase in birds.
Increase	7-5	An increase in mammals is mainly compensated by a decrease in aquatic resources in layer 7 and by birds in layers 6 and 5.
Decrease	4-3	Reduction in mammals is mainly compensated by an increase in birds.
Increase	2-Surface	An increase in mammals is mainly compensated by aquatic resources.

bones were used for making different types of bone tools. A reconstruction of their probable uses as attempted by L.A. Narain (1974) throws an interesting light on the different vocations practiced by the Neolithic community. The needle probably was meant for leather sewing. This is also substantiated by the find of leather cutting bone tools. Spear points were possibly used for fishing and arrowheads for hunting small games. Bone discs may have served as spindle whorls and implied weaving. Tortoise shells served as an excellent raw material for fabricating bangles and as a knife for skinning animals. A single specimen of bodkin with eyes probably represents a net sinking tool, once again used for fishing. Some of the tools such as drills, a divider and a pencil-like tool were possibly used for making other tools and artefacts. Tools like weeders and adze are suggestive of planned agriculture (Narain 1974: 14-23; Narayan 1996: 504). Thus faunal remains at Chirand offered evidence for the varied nature of crafts based on wood, leather working, net making, weaponry, textiles or weaving during the Neolithic period.

The bio-molecular components of organic residues can also be used as a tool to identify the source of the residue and to glean information on economic and subsistence practices associated with prehistoric cultural and technological tradition (Das and Ghosh 2018: 1456). Lipid biomarkers in the organic residue extracted from the ceramics excavated from the site at Lake Lahuradewa revealed the presence of human skin lipids which implied that organic residue extracted from the ceramics was not suitable for archaeological interpretations due to sample contamination (Das and Ghosh 2018: 1457). As a result, no idea about prehistoric subsistence practices at Lahuradewa could be made from the organic residue analysis of ceramics.

e) Domestication

Faunal evidence from sites in the area under study demonstrates the gradual transition to domestication from Mesolithic to Neolithic. Skeletal bones from Sarai Nahar Rai reveal the occurrence of *Bos indicus, Bos/Bubalus*, sheep, goat, *Elephas indicus*, tortoise and fish. Alur's report on the faunal remains excavated at Sarai Nahar Rai clearly shows that a majority of these were all grazing animals and were still in a wild condition and that domestication was not in vogue (Sharma 1975: 18). Nevertheless, Singh (2010: 50) believes that there is a suggestion in Alur's report that some of the cattle and sheep/goats may not have been wild. The prevalence of wild sheep, goats and cattle is also recorded from Gravel III and IV and from Chopani Mando in the late Mesolithic Phase. The analysis of bones from Damdama revealed only a single bone of a goat and one of domestic cattle among thousands of bone fragments (both were certainly later intrusions). At Damdama, therefore, there is neither any evidence of fully domesticated animals nor of probable domesticates (Thomas et al. 1995: 32; Thomas et al. 2002: 374). At Mahadaha, Alur observed that the size and nature of wearing on a molar of a pig indicate domestic origin (Alur 1980: 215). In Alur's observation, there seems to be some suggestion for the appearance of the herding of pigs in some stage of Mesolithic Mahadaha (as cited in Sahu 1998: 100). However, this needs to be further corroborated by additional evidence from more sites in the region. Therefore, based on evidence from these Mesolithic sites, it can be postulated that the domestication of animals had not yet started in the Mesolithic period.

In contrast to the high percentage of wild cattle in Mesolithic, their share receded to a meager 6.5% in the Neolithic period. This, along with the considerable reduction in the size of the cattle indicates its domestication. There are ample indications for marked evolutionary changes pointing towards domestication which conclusively demonstrates that these animals were domesticated from their wild prototypes available in the area during the Mesolithic and were not brought as readymade breeds from outside (Misra 2010: 246). Cattle bones from Neolithic Koldihwa, Tokwa and Mahagara are mostly of domesticated variety though some specimens of wild cattle were also present. Thus, the presence of both wild and domesticated cattle and sheep/goats presents a fascinating picture of the transition from wild variety to domesticated animals. The change in size and bone structure of animals not only indicates their natural selection and domestication but also suggests that this area was a nuclear region that experienced independent local domestication of animals (Sahu 1998: 180).

f) Selective hunting

It is interesting to see that early humans displayed certain selective preferences with regard to their food choices. This becomes apparent from the study of faunal remains from the Mesolithic and Neolithic sites in the Middle Ganga Plain and Vindhyas (Figs. 6 and 7). The high values of resource diversity and niche width at Mesolithic Ganga sites of Mahadaha, Damdama and Sarai Nahar Rai suggest a generalized economy with specialized hunting of swamp deer and hog dear (Chattopadhyaya 1996: 468). At Neolithic Mahadaha, this trend for selective choice continued as amongst bones of wild fauna; mainly two species- deer and boar are represented there (Mandal 1980: 168). This once again demonstrates a selective preference by the Neolithic population at Mahadaha with regard to available food resources. Nevertheless, exceptions to this specialized approach are also seen. The presence of bones of Indian gaur in the Damdama collection is one such instance. This animal lives in high altitudes and hilly areas and is not native to Ganga valley. Hence it is possible that during the winter season some of these animals may have migrated to the plains where they were hunted by the inhabitants of Damdama (Singh 2010: 55). This indicates that humans left their selective food choice of swamp and hog deer and laid their hands on whatever meat they could get.

g) Diet and food processing

Meat from hunted animals was a major item in the diet of Mesolithic people and was generally consumed after roasting it in the pit hearths (Pal 2002: 302). A charred bison's skull found in a hearth of Mahadaha is noteworthy in this context (Pal 2002: 300). Alur reported the presence of black soot on some of the bones from cemented Gravel III of Belan and Son valley indicating evidence of roasting. Signs of roasting were also seen on the antlers (Alur 1980: 201). Chopping and roasting marks were identified in some cattle, barasingha, hippo and tortoise remains from Sarai Nahar Rai (Alur 1980: 209). Analysis of animal bones from hearths at Sarai Nahar Rai also revealed a careful selection of parts of the body in terms of their food yield (Sharma 1973:140). The companions of the Neolithic people of Jhusi were cattle, sheep/goats, boar, barasingha, etc. Fish, turtles and birds also constituted an important item of their diet (Pal 2008: 273). However, it is

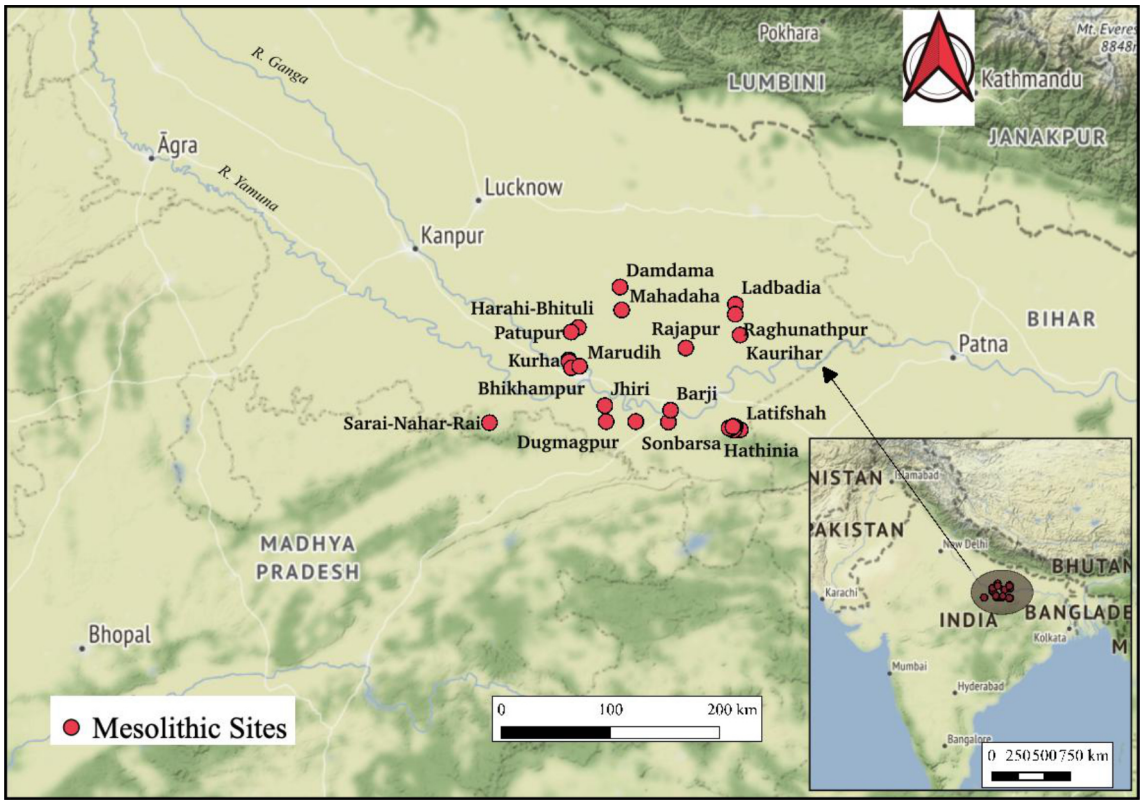

Fig. 6: Mesolithic sites in Middle Ganga Plains and Vindhyas

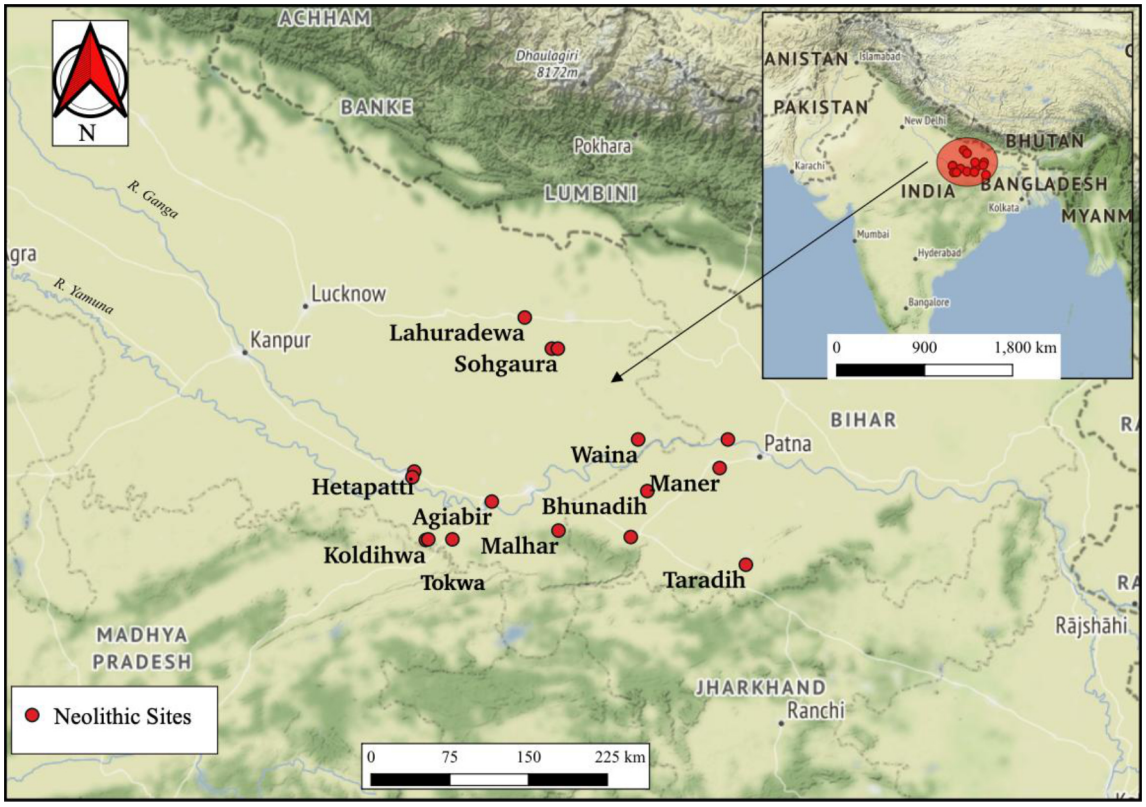

Fig. 7: Neolithic sites in Middle Ganga Plain and Vindhyas

significant to note that fish and bird bones are a rare find in any archaeological collection primarily because they are very small and fragile and are apt to decomposition and disintegration (Alur 1990: 229). Therefore, one must not overlook their contribution to the diet on account of the low percentage of their bones in the total bone counts. Furthermore, the skeletal material of rats and mice from archaeological sites in India does not bear any signs of charring or butchering. This has led to conclude that humans did not consume the small rodents. However, the prehistoric rock paintings provide positive evidence of its being hunted and collected along with the larger game, which includes rats as a regular part of the diet of prehistoric humans. One of the paintings reported by Neumayer in 1983 and dated to the Mesolithic period shows a series of three different episodes of rat hunting at rock shelter site Jaora near Bhimbetka (Sathe 2017:11). An interesting case of diet selection was noticed at Neolithic Chirand. The bulk of refuse of animal bones, birds and fish at the site seemed to indicate that animal food and fish probably constituted lion's share in subsistence and, in turn, daily diet. Hunting and fishing, therefore, seem to occupy the primary position and served as a balancing factor in relation to a diet based on agricultural produce (Narain 1974: 21; Narayan 1996: 517).

Besides faunal remains, an idea about the diet of Mesolithic people is made by the study of dental attributes of humans and microwear study of microliths. Dental traits of the Mesolithic population as studied from Damdama sample revealed large tooth size, low frequency of dental abscesses, low dental caries rate and high levels of dental attrition consistent with a coarse diet and a hunting and foraging subsistence base (Lukacs and Pal 2003: 333). At Sarai Nahar Rai, skeletal remains of *Bos indicus*, *Bos/bubalus*, sheep, goat, *Elephas indicus*, tortoise and fish were found. At Sarai Nahar Rai, the Mesolithic people primarily lived on these animals and their meat was the principal diet of humans as indicated by human dental attributes. Almost in each case, on account of munching of bones, the right side of the teeth, in both the jaws, is considerably grounded and worn out (Sharma 1975: 18). Microwear study of microliths from Ganga plain also indicated that they were used for cutting bones and antlers (Pal 2002: 321).

h) Beliefs and rituals

Insight into the rituals and beliefs of prehistoric communities can be gleaned especially in their burials besides other material finds. Communities of the past have laid special emphasis on making elaborate arrangements for burials which can be related to their rituals and belief system. From Lekhaiya, there is evidence of special burial goods in form of a buffalo rib, two horns of a deer and a molluscan shell (Misra 1977: 95). At Sarai Nahar Rai, the presence of a particular type of shell in the graves was noticed. It casts a light on some sort of burial ritual (Sharma et al. 1980: 18). At the site of Damdama, in grave VII, a pendant made of ivory with eyes on either end along with two bones was discovered. At Mahadaha, two males were buried adorned with necklaces of bone rings. These were not seen in the case of other burials at the site. It appears that the form of these items is *sociotechnic*, indicative of social status (Pandey 1990: 315). Bone arrowheads were offered to members of both the sexes at Mahadaha refuting any sexual disparity with regard to grave goods.

Ornaments too sometimes may be related to the belief system. In the area under study, bone, antler, horn core and shell constituted an important source of raw material

for manufacturing a variety of ornaments during the Mesolithic period. Nevertheless, all the ornaments, finished and unfinished at Sarai Nahar Rai, were made from antlers only (Sharma et al. 1980: 108). It is not clear though if this restricted choice of material for making ornaments had some special significance. Last but not the least, there are few antiquities, made out of animal bones, which specifically relate to some special purpose. Of interest is the distal extremity of the tibia of wild cattle from Mahadaha whose medullary cavity has been scraped to provide the necessary volume to the thus formed container. Its bottom has been ground flat to make it rest properly when used (Alur 1980: 210). Alur notes that the gloss and smoothness that it has developed at the labial margin of contact indicate its use as a drinking vessel (Alur 1980: 216). There is also a similar solitary bone specimen from the Advance Mesolithic phase at Chopani Mando. But unlike its Mahadahan counterpart, it bears incised decoration or carving (Sharma et al. 1980: 69). The presence of these special utensils shows their probable utility. On account of their being solitary unique finds, it appears that they served some special purpose.

i) Adaptation

Adaptation is a human's way to cope up with a given environmental situation. During prehistoric times, this adaptation was also witnessed in the form of the choice of raw material for tool making. The Mesolithic period is typologically defined by the presence and dominance of microliths made on fine semi-precious stones. Nevertheless, the tool kit of the Mesolithic period at some sites displays a glaring non-adherence to this typological constraint. An abundance of bone tools rather than stone at Mahadaha is one such instance. Unlike elsewhere, bone tools form one-third of the total number of artefacts here. It reflects the adaptability of humans to their habitat and ecology. It appears that since the Vindhyan region, the source of stone, was distant from Mahadaha, humans took the bone to meet their tool requirements. The depleted nature of the lithic industry and the high percentage of bone tools seem to lend strength to this inference (Sahu 1998: 101). Like Mahadaha, bone tools also formed an important part of the artefactual repertoire of the people at Damdama. Every second or third excavated animal bone at Damdama was a worked bone; if not a well-made tool. It seems that people had attained high proficiency in the manufacture of bone tools. Split bones and horn cores were used for making sharp and effective arrowheads. This also perhaps explains the large quantity of small unidentifiable chips that were by-products of the bone tool industry at Damdama. Since stone was scarce, bone was the easiest alternative raw material for tool manufacture (Thomas et al. 1995: 32). From Sarai Nahar Rai, there are scrapers fashioned from fragments of long bones of cattle. There is a point made of antler tip (Alur 1980: 210). The ecological and geographical resource distribution seems to have played a dominant role in determining the choice of raw material for tool making at Neolithic Chirand. The ground stone tools belonging to the Neolithic period at Chirand consist of fewer specimens probably on account of the non-availability of raw material in the area. However, a bewildering variety of more than 30 types was noticed with regard to the bone tool industry at Chirand. They consisted of chisel, celt, hammer, wedge, scraper, shaft straightener, puncher, borer, awl, needles, divider, arrowheads, drills, spear, pencil, socketed handle, adze, comb and pendant to name a few (Narayan 1996: 502). Many of these tools are mainly replica of stone prototypes. This could be

explained as an adaptation by the Neolithic community at Chirand with regard to the absence of lithic raw material near the settlement and the availability of animal bones at the site which proved to be handy for converting into different types of tools and weapons.

j) Dating

From Palaeolithic times through Mesolithic and down to the Neolithic period, faunal remains provide valuable dating evidence and also facilitate clear stratigraphical determinations. Extinctions of species and the emergence of new ones are also in some cases a good chronological indicator. However, even in a publication dated as late as 1995, dating based on zooarchaeological evidence does not find mention in the list of conventional methods of dating (Agarwal and Yadava 1995: 77). The beginning of the Pleistocene epoch is also defined in terms of the first appearance of some marker fossils which as a group are called *Villafranchian* flora and fauna. The Plio-Pleistocene boundary is determined on the basis of the break of *Villafranchian* fauna. It is defined as the first appearance of any species of *Bos, Equus* and *Elephas* in territorial context and *Hyalinthica baltica* in the marine context (Bhattacharya 2005: 26). The Tatrot zone at Potwar and Karewas at Malshahibagh in Srinagar was dated on the basis of *Villafranchian* fauna break, specifically *Equus* (Bhattacharya 2005: 84). Pilgrim (1904: 177) ascribed the Pleistocene age to his reporting of *Bos, Elephas, Cervus, Bubalus* and hippo fossil finds from Allahabad on the basis of similarity of deposit with ancient Narbada alluvium from which typical *Bos namadicus* was found. In the area under study, remains of *Bos namadicus* and *Elephas namadicus* were found from Belan cemented gravel II roughly dated to 55 ka and Baghor, Khunteli and Patpara formation in Son valley dated approximately to 75 to 45 ka (Pal 2013: 5). So despite being the first appearance of the right species for *Villafranchian* break, scholars have not used this term for relative dating. This was probably because these species do not represent *Villafranchian* fauna per se on account of their late occurrence. This however does not seem logical since the definition of *Villafranchian* break nowhere mentions the probable time of occurrence.

Nevertheless, zooarchaeological evidence is utilised at many sites for both absolute and relative dating. Over three hundred fossil bones were recovered from explorations near Belan and Seoti rivers, of which as many as fifty-seven were found from Gravel I, near Daiya on the left bank of the Belan. The species represented in the collection were *Bos, Equus, Elephas, Bubalus, Cervus, Chelonia, Tragulid,* etc. These fossils were studied by Shri M. V. A. Sastry, Palaeontologist-in-charge of the Geological Survey of India. He observed that the fossils of the lower conglomerate (Cemented Gravel I) of the Belan and Seoti system can be equated with those at the lower zone of the Narmada (Mid-Pleistocene) on faunistic and lithological considerations. The fauna from Cemented Gravel II and other younger beds is similar, and more or less related to living members of the same groups, and indicates a younger age than the Narmada alluvium (IAR 1968-69: 33-35). Event II at Kalpi relating to the Middle Palaeolithic period has been relatively dated to 28-33 ka on the basis of faunal evidence (Singh et al. 1999: 1024). Upper Palaeolithic tool-bearing deposits in the Belan and Son valleys have been placed, on the basis of zooarchaeological evidence, in the Terminal Pleistocene and the beginning of the Holocene (Varma 2010: 180). Chattopadhyaya (2010: 466) questioned the late Holocene

dates at Sarai Nahar Rai on the basis of the presence of *Bos namadicus* remains at the sites since this species becomes extinct around the mid-Holocene. Fluorine to phosphorus ratio in bones from archaeological sites is useful in obtaining approximate ages (Joshi and Kshirsagar 1986: 7). Three dates, derived from bioapatite of bovid enamel at Damdama, suggest a younger age between 5550±60 B.P. and 5250±70 B.P. Two AMS dates derived from human bone samples from Stratum 1 (earliest) and Stratum 6 (middle) at Damdama have yielded dates of 8865 and 8640±65 B.P. By contrast, three dates derived from bioapatite of bovid enamel suggest a younger age, between 5550±60 B.P. Two AMS dates derived from Damdama on the other hand have yielded dates of 8865 and 8640±65 B.P which were derived from human bone samples from Stratum 1 (earliest) and Stratum 6 (middle). By contrast, three dates derived from bioapatite of bovid enamel suggest a younger age, between 5550±60 B.P. (Lukacs and Pal 2003: 331 (Lukacs and Pal 2003: 331).

Conclusion

This survey of the utility of zooarchaeological remains in decoding the life and ways of prehistoric humans in the Middle Ganga Plain and Vindhyas has aptly demonstrated their importance in drawing fruitful correlations and interpretations. It appears that having equipped the hunter with bourgeois impulses and prehistoric tools, we simply judge his/her situation hopeless in advance (Sahlins 1968: 86). It seems that prehistoric humans through learned and innovative behaviour became capable enough to formulate well-designed and well-adapted strategies to achieve not only an adequate food supply but other survival appendages too from their environment. And faunal remains, both macro and micro, from the area of study, offer an apt testimony to the same. Future endeavours in this direction are bound to enrich our understandings of prehistoric cultures.

Acknowledgements

The author sincerely acknowledges the help of Dr. Virag Sontakke for going through the draft of the paper and for offering valuable insights. Thanks are due to Dr. Manoj Kumar for his guidance in contemplating the theme of this paper. The author is also grateful to the editors for their help in soliciting a difficult reference.

REFERENCES

Agarwal, D.P. and M.G. Yadava (1995) *Dating the Human Past*, ISPQS Monograph Series No.1. Pune: Indian Society for Prehistoric and Quaternary Studies.

Alur, K.R. (1990) *Studies in Indian Archaeology and Palaeontology*. Dharwad: Srihari Prakashan on behalf of Alur Venkatarao Pratishthana.

Bhattacharya, D.K. (2005 reprint) *An outline of Indian Prehistory*. Delhi: Palaka Prakashan. (First published in 1991).

Blumenschine, R.J. and U.C. Chattopadhyaya (1983) A preliminary report on the terminal Pleistocene fauna of the Middle Son Valley, in *Palaeoenvironments and Prehistory in the Middle Son Valley* (G.R. Sharma and J.D. Clark Eds.), pp. 281-284. Allahabad: Abinash Prakashan.

Chakrabarty, Dilip K. (2000) *India: An Archaeological History -Palaeolithic Beginnings to Early Historic Foundations*. New Delhi: Oxford University Press.

Chakravarty, D.K. (1931) On a Stegodon Molars from the Older Gangetic Alluvium near Benaras, *The Quarterly Journal of the Geological, Mining, and Metallurgical Society of India* 3: 115-124.

Chattopadhyaya, Umesh C. (1996) Settlement pattern and the Spatial Organisation of Subsistence and Mortuary Practices in the Mesolithic Ganges Valley, North-Central India, *World Archaeology* 27(3): 461-476.

Chattopadhyaya, Umesh C. (2010) Settlement pattern and the spatial organization of subsistence and mortuary practices in the Mesolithic Ganges valley, north-central India, *World Archaeology* 27(3): 461-476.

Clark, Graham and Stuart Piggott (1970) *Prehistoric Societies*. U.K: Penguin.

Das, Supriyo Kumar and Santanu Ghosh (2018) Organic residue analysis in archaeological ceramics from Lahuradewa, India: role of contaminants, *Current Science* 115(8): 1456-1458.

Dincauze, Ferran Dena (2000) *Environmental Archaeology Principles and Practice*. Cambridge University Press. Cambridge.

IAR - I*ndian Archaeology: A Review*. New Delhi: Archaeological Survey of India.

Joglekar, P.P. (2006) A fresh Appraisal of the Animal-based Subsistence and Domestic Animals in The Ganga Valley, *Pragdhara* 18: 309-321.

Joshi, R.V. and A. Kshirsagar (1986) *Chemical Studies of Archaeological Bones from India: Fluorine and Fossilization Process*. Pune: Deccan College, Post Graduate Research Institute.

Lukacs, John R. and J.N. Pal (2003) Skeletal variation among Mesolithic People of the Ganga Plains: New Evidence of Habitual Activity and Adaptation to Climate, *Asian Perspectives* 42(2): 329-351.

Mandal, D. (1980) Neolithic culture of the Vindhyas: Excavations at Mahagara in the Belan valley, *Indian Prehistory 1980*: 163-174.

Misra, V.D. (2007) Stone Age Cultures, their Chronology and Beginning of Agriculture in North-Central India, *Man and Environment* XXXII (1): 1-14.

Misra, V.D. (2010 reprint) Agriculture, Domestication of Animals, Ceramic and Other industries in Prehistoric India: Mesolithic and Neolithic, in *The Dawn of Indian Civilization (upto c.600 B.C.) History of Science, Philosophy and Culture in Indian Civilization*, Vol. I Part I (G.C. Pande Ed.), pp. 233-266. New Delhi: Centre for Studies in Civilizations. (First published in 1999).

Narain, L.A. (1974) A Study in the Techniques of Neolithic Bone tool Making at Chirand and their Probable Uses, *The Journal of Burma Research Society* LIV(I-IV)(1970): 1-24.

Narayan, Basudev (1996) *Prehistoric Archaeology of Bihar (A Survey of Stone-Age Industries in Environmental context from the Palaeolithic to the Neolithic times)*. Patna: Kashi Prasad Jayaswal Research Institute.

Neumayer, Erwin (1983) *Prehistoric Indian Rock Paintings*. New Delhi: Oxford University Press.

Neumayer, Erwin (1993) *Lines on Stone The Prehistoric Rock Art of India*. New Delhi: Munshi Manoharlal Publications.

Pal, J.N (1994) Mesolithic settlements in the Ganga Plain, North India, *Man and Environment* XIX: 91-101.

Pal. J.N. (2002) Mesolithic Gangetic Plain, in *Mesolithic India* (V.D. Misra and J.N. Pal Eds.), pp. 289-305. Allahabad: Department of Ancient History, Culture and Archaeology, University of Allahabad.

Pal, J.N. (2008) The Early Farming Culture of the Middle Ganga Plain with Special Reference to the Excavations at Jhusi and Hetapatti, *Pragdhara* 18: 263-281.

Pal, J.N. (2013) New Researches in the Prehistoric Archaeology of the Vindhyas, *Puratattva* 43: 1-10.

Pandey, J.N. (1990) Mesolithic in Ganga Valley, *Bulletin of Deccan College Post-Graduate and Research Institute* 46: 311-316.

Pilgrim, Guy Ellcock (1904) Pleistocene Fossils from the Ganges alluvium, *Records of Geological Survey of India* Vol. XXXI: 176.

Sahlins, Marshall (1968) Notes on the Original Affluent Society, in *Man The Hunter* (R.B. Lee and J. DeVore Eds.), pp. 85-89. Chicago: Aldine.

Sahu, B.P. (1998) *From Hunters to Breeders (Faunal Background of early India)*. Delhi: Anamika Prakashan.

Sathe, Vijay (2017) Smaller but not Secondary: Evidence of Rodents in Archaeological Context in India, *Ancient Asia* 8: 1-20.

Saxena, A., I.B. Singh and P.N. Agarwal (2011) Palaeoecological implication of ostracod and gastropod assemblages of the Holocene lake records from the Ganga Plain, *Journal of the Palaeontological Society of India* 56 (2): 23-37.

Sharma, G.R. (1973) Mesolithic lake cultures in the Ganga valley, India, *Proceedings of the Prehistoric Society* 39: 129-146.

Sharma, G.R. (1975) *Seasonal Migrations and Mesolithic Lake Cultures of the Ganga Valley*, Presidential Address. Delhi: Indian Prehistoric Society.

Sharma, G.R., V.D. Misra, D. Mandal, B.B. Misra and J.N. Pal (1980) *From Hunting and Food Gathering to Domestication of Plants and Animals Beginnings of Agriculture (Epi Paleolithic to Neolithic: Excavations at Chopani Mando, Mahadaha and Mahagara.* Allahabad: Abinash Prakashan and The University of Allahabad.

Singh, B.P. (2004) *Early farming Communities of the Kaimur (Excavations at Senuwar) [1986-87, 1989-90]*, Vol. II. Jaipur: Publication Scheme.

Singh, Indra Bir (2005) Quaternary Palaeoenvironments of the Ganga Plain and Anthropogenic Activity, *Man and Environment* XXX(1): 1-35.

Singh, Indra Bir, Shikah Sharma, Maneesh Sharma, Pradeep Srivastava and Govindaraja Rajagopalan (1999) Evidence of human occupation and humid climate of 30 ka in the alluvium of south Ganga Plain, *Current Science* 76(7): 1022-1026.

Singh, Purushottam (2005) *Archaeology of the Ganga Plain Cultural- Historical Dimensions*. New Delhi: Indian Institute of Advance Studies, Shimla and Aryan Books International.

Tewari, Rakesh (1990) *Rock Paintings of Mirzapur*. Lucknow: U.P. State Archaeology and Eureka Printers.

Thomas, P.K. and P.P. Joglekar (1995) Faunal Studies in Archaeology, *Memoirs of Geological Society of India* 32: 496-514.

Thomas, P.K., P.P. Joglekar, V.D. Mishra, J.N. Pandey and J.N. Pal (1995) A Preliminary Report of the Faunal Remains from Damdama, *Man and Environment* 20(1): 29–36.

Thomas, P.K., P.P. Joglekar, V.D. Misra, J.N. Pandey and J.N. Pal (2002) Faunal Remains from Damdama: Evidence for the Mesolithic food economy of the Gangetic Plain, in *Mesolithic India* (V.N. Misra and J.N. Pal Eds.), pp. 366-380. Allahabad: University of Allahabad.

Varma, R.K. (1981-82) The Mesolithic cultures of India, *Puratattva* 13-14: 27-36.

Varma, Radha Kant (1986) *The Mesolithic Lake-Cultures of the Ganga-Valley*, Paper Presented in First South Asian Archaeological Congress, Delhi.

Varma, Radha Kant (2010 reprint) The Emergence of Culture in the Vindhya-Ganga Region with Special Reference to Old Stone Age, in *The Dawn of Indian Civilization (upto c.600 B.C.) History of Science, Philosophy and Culture in Indian Civilization*, Vol. I Part I (G.C. Pande Ed.), pp. 175-204. New Delhi: Centre for Studies in Civilizations. (First published in 1999).