CHAPTER–7

# Evolutionary Trends in Narmada Fossil Fauna

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## INTRODUCTION

### Lithostratigraphy

The Narmada Valley is probably one of the most researched and talked about river valleys in India because of its anthropological, archaeological, geological, historical palaeontological, and religious significance. The river flows across the middle of the Indian subcontinent through a rift (known as Narmada rift) formed between the Vindhya and Satpura mountains and marks a traditional dividing line between the north and south of India. Originating in the Maikala Range in the eastern Madhya Pradesh, the river flows for a distance of around 1300 km through mainly Madhya Pradesh and Gujarat before emptying in the Gulf of Cambay, near Baruch, in Gujarat. At Bhedaghat, near Jabalpur, the Narmada flows over a fall of 10 m at what is known as Dhuandhar water falls and thereafter flows in the form of a saucer shaped basin unto Handia, near Hoshangabad. This basin has attracted the attention of numerous scholars from India and abroad for various reasons for the last 150 years or more, e.g., Princep (1832, 1833 a,b, 1834), Spillsbury (1833, 1837, 1841), followed by De Terra and Paterson (1939), and subsequently by several Indian scholars. Scholars have discovered numerous fossils belonging to mammals, reptiles, fish and amphibians (the last two in negligible percentage), molluscan shells and thousands of Stone Age tools, from Lower Palaeolithic right unto Mesolithic, manufactured by Early Man.

The previous works on different aspects of the valley are too numerous to be referred to here. These have already been given in detail by Badam (1979 a,b, 1984, 1996, 2001 and 2007a,b) and several authors (see Tiwari

and Bhai, 1997; Tiwari and Mohabey,1999, and references therein). However, a word about the stratigraphy can be said here, which has been variously interpreted by various scholars. Different names have been used for different or sometimes the same horizon which has created some confusion about the schemes of classification being adopted. To avoid unwanted confusion the Geological Survey of India came up with a scheme of lithostratigraphic classification wherein age old terms like Older Alluvium and Younger Alluvium have been replaced by a new set of terms generally acceptable as a result of recent new bio and chrono stratigraphic data collected over the years by various scholars including the present authors. The new scheme of classification is given below in Table 1 with brief comments on the lithounits of the various formations.

**Table 1**
**The Recent Nomenclature of the Lithounit Formations of Narmada Quaternary (Adapted from Tiwari & Bhai, 1997)**

| | |
|---|---|
| Recent / Holocene | Ramnagar Formation<br>Bauras Formation |
| Upper Pleistocene | Hirdepur Formation<br>Baneta Formation |
| Middle Pleistocene | Surajkund Formation<br>Dhansi Formation |
| Lower Pleistocene | Pililkarar Formation |

The Pililkarar Formation is recognised as the basal unit of the Quaternary sequence in the Narmada Valley, which is comprised of lateritic gravels with ferricrete at the top, and the lithomarge red clay at the bottom. It is devoid of vertebrate remains. Overlying this is the Dhansi Formation, exposed near village Dhansi, comprising grey sand, brown silt, yellow and orange sand and red silty clay. It contains fossils, but less in frequency as compared to the overlying Surajkund Formation, exposed extensively as calcareous conglomerates, grey silty sands, brown to steel grey and yellow clays. It is the most richly fossiliferous lithounit of the Narmada Valley. The overlying Baneta Formation is comprised of calcareous conglomerate, grit, gravels, brown calcareous silts, sandy silt, carbonaceous clays towards the top, and volcanic ash at some places, having yielded a date of about 75,000 years B.P. This formation covers much of the Narmada alluvial plain and yields fossils of Upper Pleistocene affinity. Followed in succession comes another later Pleistocene lithounit, named as Hirdepur Formation, which comprises calcareous conglomerate, sand, sandstone, calcareous light grey silts and sands. It is relatively poor in fossil content. All the above Pleistocene formations have distinctive soils. The Baneta and the Hirdepur formations change from coarser lithofacies (near the Satpura fault) to finer lithofacies (away from the fault). The Holocene period is covered by two lithounits, the older of these is known

as Baurus Formation consisting of calcareous gravels, sands and silts. The youngest or the topmost lithounit known as Ramnagar Formation comprises sands, silts and clays. These are largely devoid of fossils or contain sub-fossilised bones.

## OBSERVATIONS

### The Fauna

The updated faunal list of Siwaliks (Pinjor Formation) and Central Narmada Valley compiled from previous (Gentry, 1997) and recent

**Table 2**
**Upper Siwalik (Pinjor) and Narmada Valley Fauna**

| *Order/Family* | *Pinjor (Upper Siwaliks)* | *Narmada Valley* |
|---|---|---|
| Hominidae | ? | Homo erectus or "archaic"Homo sapiens |
| Carnivora | *Mellivora sivalensis* | *Ursus namadicus* |
| | *Panthera* cf. *P. cristata* | *Panthera* sp.. |
| | *Canis pinjorensis* | *Canis* sp. |
| | *Crocuta felina* | *Cuon alpinus* |
| | *Crocuta colivini* | *Holarctos namadicus* |
| Bovidae | *Bubalus palaeindicus* | *Bubalus palaeindicus* |
| | *Bubalus platyceros* | *Bubalus bubalis* = modern Indian buffalo |
| | *Bos acutifrons* (Pilgrim, 1939) | *Bos namadicus* |
| | – | *Bibos gaurus* |
| | *Bison sivalensis* | *Bison sp.* |
| | *Leptobos falconeri* | *Leptobos frazeri* (Pilgrim, 1905) = *Bos* |
| | - | *namadicus* (De Terra & Chardin, 1936; |
| | - | De Terra & Paterson, 1939). |
| | | *Boselephus tragocamelus,* |
| | | *Antilope cervicapra* |
| Elephantidae | Elephas hysudricus | Palaeoloxodon namadicus |
| | Stegolophodon stegodontoides | Elephas namadicus |
| | | Elephas hysudricus |
| | | Elephas maximus |
| | | Stegodon insignis ganesa |
| Cervidae | Cervus punjabiensis | *Cervus unicolor* [=sambar] |
| | | *Cervus duvauceli* [=barasingha] |
| | | *Axis axis* |
| Hippopotamidae | Hexaprotodon sivalensis | Hexaprotodon namadicus |
| | Pentaprotodon sivalensis | Hexaprotodon palaeindicus |
| Suidae | Sus falconeri | Sus namadicus, |
| | Sus hysudricus | Sus palaeindicus |
| Rhinocerotidae | Rhinoceros palaeindicus | *Rhinoceros unicornis* [=living species] |
| | Rhinoceros sivalensis | |
| Equidae | Equus sivalensis | *Equus namadicus* [zebrine] |
| | [caballine] | *Equus hemionus khur* [ zebrine] |
| | | *Equus asinus* [zebrine] |
| Rodentia | *Hystrix leucurus* | |
| | *Mus linnaeusi* | |
| | *Hadromysloujacobsi* | |
| | *Rhizomys pinjoricus* | *Rhizomys* sp.*?* |

published sources (e.g., Badam, 2007 a,b; Nanda & Sehgal, 2007; and other scholars) is given in *Table 2*.

In recent years several genera of micro-vertebrates have been collected for the first time from the Narmada Valley and also molluscan shells which are listed below in Table 3 As said above some amphibian and fish fossils have also been reported from the valley.

**Table 3**
**Aquatic Fauna from Narmada Valley**

| | |
|---|---|
| Crocodilidae & Gavialidae | *Crocodylus palaeindicus, Gavialis gangeticus* |
| Emydidae (Turtles / Tortoises) | *Pangsura tectum, Trionyx gangeticus, Emys sp., Clemmyx sp* |
| Mollusca by R. Patnaik (2007): *Millardia meltada, Bandicota bengalensis,Tatera indica [?= Tatera pinjoricus* (Siwaliks)], *Gerbillus* sp. | Mollusca by A. Deshpande - Mukerjee (2007): *Lamellidens* sp. , *Corbicula* sp., *Parreysia* sp., *Melania* sp., *Bellamya* sp. |

## Likely Faunal Evolutionary Linkages

In view of the recent multidisciplinary research in the Narmada Valley and surrounding areas the understanding of the fauna in proper perspective calls for some comments. The initial nomenclature of the species listed above has undergone some revisions over a period of time. As mentioned earlier some of the genera do exist at present. *Rhinoceros unicornis* is identical with the living species. Recently, and for the first time in India, three fossilized horn cores of *Rhinoceros unicornis* have been identified by Badam (in press) in a collection from the Narmada Valley made by late Dr. V. S. Wakankar about thirty years ago and now housed in the Archaeology Museum of the Vikram University, Ujjain, Madhya Pradesh.

*Bubalus palaeindicus*, *Cervus unicolor* and *Cervus duvauceli* are related to the modern Indian buffalo, sambar and the barasingha respectively. *Bos namadicus* is profusely represented in the Narmada Valley and had a possible ancestor in the *Bos acutifrons* of the Siwaliks (Pilgrim, 1939). *Bos namadicus* is supposed to have given rise to the present day Indian cattle *Bos indicus* (Badam, 1984).

The skull claimed to be of *Leptobos frazeri* (Pilgrim, 1905) may be nothing but a damaged skull of *Bos namadicus* (De Terra and Chardin, 1936; De Terra and Paterson, 1939). The latter authors opined that the tusk fragments assigned to *Stegodon* are too imperfect for precise identification. A few years back the author was tempted to assign one of the skulls he excavated from a Late Pleistocene horizon in the Ghod Valley near Inamgaon, in Maharashtra, as *Leptobos* but it was re-identified by Dr Caroline Grigson as that of *Bos namadicus*. Further, *Bos gaurus* is now named as *Bibos gaurus* (Badam and Grigson, 1990).

*Bubalus arnee* is a transitional form between *Bubalus palaeindicus* and *Bubalus bubalis*. It may have certain characters reflected in the process of domestication which are yet not very clear and thus the species is hard to identify unless the sample is large. Besides, at present we do not have any statistical or osteological data to support it.

Some of the elephant species like *Stegodon* spp. and *Elephas hysudricus* are survivals from the Siwaliks of NW India. *Elephas namadicus* (sometimes named as *Palaeoxodon namadicus*) is identical with *Elephas antiquus* of Europe and in some earlier publications it has been mentioned as *Elephas antiquus*. Similarly, *Elephas hysudricus* and *Hypelephas hysudricus* represent one and the same species and the first one gets the priority in usage.

It is possible that *Hexaprotodon namadicus* was also derived from a Siwalik ancestor, *Hexaprotodon sivalensis*. *Hexaprotodon namadicus* and *Hexaprotodon palaeindicus* are identified on the basis of shallow depth in the latter. Both the species have six incisors each and it is not correct to name the species as *Hippopotamus palaeindicus* as some scholars have been doing. It may be mentioned here that evolution in the genus is indicated by the gradual elimination of second incisors, one by one, and one of the specimens in this category has been described by Sahni and Khan (1961) from Siwaliks with five incisors instead of six, which may represent an evolutionary stage leading to the four- incisored Hippopotamus. This was named as *Pentaprotodon sivalensis*. The present day hippopotamus is the *Hippopotamus amphibius* which is not indigenous to India.

*Equus caballus* as identified by Supekar (1968) has been re-identified as *Equus namadicus* (Badam, 1979 a,b) which is regarded as ancestral to modern *Equus hemionus* (Hooijer, 1963).

*Cuon alpinus tripathii*, a new subspecies reported from the Narmada Valley may not warrant a separate status at present. *Cuon alpinus* is presently reported from South India but its fossil forms are not well established.

There appears some doubt about the identification of *Holarctus namadicus* as Colbert (1942) is the only scholar who has mentioned it. In fact, it has been listed without any diagnostic characters on which the species was established. This species is included in Notoungulates which has been divided into several Orders by Darwin while he was on the Beagle. However, what Darwin created was on the basis of living forms and not the fossilized ones. Sometimes the species is referred as Holarctic ungulate which makes its specific identification rather doubtful.

The reptiles like *Pangsura tectum* and *Gavialis gangeticus* are identical with the reptiles living in the Indian rivers today. In view of their long time span and slow evolutionary process their impact on chronology is not as pronounced as their use in palaeoecology.

The above remarks suggest that many species have been created on account of minor morphological variations without taking any account

differences due to the genetic factors, sex, age, abnormalities, individual and geographical variations and animal's response to them.

Summing up the problem of nomenclature the authors suggest that changes in it are bound to occur as more and new fossil discoveries are made and hence it is necessary to follow the guidelines of the Commission for International Code of Zoological nomenclature, which meets periodically, to get acquainted with the latest information in this regard and the possibility of synonymizing of various genera / species.

As per our current understanding, the various Narmada Quaternary mammalian fauna can be assigned to the following genera and species as they appeared temporally (see Table 4).

**Table 4**
**Chronological Occurrences and Ranges of Fossil Mammals in Narmada Valley**

| *Temporal Span* | *Genera and Species* |
|---|---|
| Lower to Upper Pleistocene | *Elephas hysudricus, Stegodon insignis ganesa.* |
| Middle Pleistocene | *Elephas namadicus, Sus namadicus, Hexaprotodon namadicus* |
| Middle to Upper Pleistocene | *Elephas namadicus, Sus namadicus, Equus namadicus, Bos namadicus* |
| Upper Pleistocene | *Sus palaeindicus, Hexaprotodon palaeindicus* |
| Upper Pleistocene to Holocene | *Antilope cervicapra, Cervus unicolor, Cervus duvauceli, Axis axis, Boselaphus tragocamelus,Equus asinus, Elephas maximus* |

## Hominin Fossils

Hathnora stands unique in South Asia for having yielded the unequivocal Middle Pleistocene hominins crucial for understanding *Homo erectus* / *Homo sapiens* transition. The first discovery of the hominin partial skullcap (Sonakia, 1984) has filled up the gap in our knowledge of the hominin evolution in this part of the world and in South Asia as a whole, though there has been a difference of opinion about its nomenclature. On the basis of archaeological associations, this species fits in the description of "archaic" *Homo sapiens* (Badam *et al.*,1986), which was later also claimed by Kennedy *et al.* (1991) on the basis of craniometric and non-mensural characters. This was followed by important postcranial discoveries of hominin fossils from the same locality, e.g., two clavicles and one left 9$^{th}$ rib by Sankhyan (1997a, b, 1999, 2005).

The hominid discoveries have given Narmada Valley recognition worldwide. Work on the Narmada Valley is going on in right earnest from a multidisciplinary point of view and it is hoped that with patience and luck many more discoveries of the hominin fossils from the valley or other parts of the country would come to light one day. While the absolute dates for the hominin fossils remain unsettled, recently under the Narmada Project launched by the Anthropological Survey of India in June 2005, in

*situ* collections of important fossil fauna have been made from the hominin bearing bed and from sections immediately below it (Sankhyan *et al.*, 2007). The fossil findings speak proxy for the age, ecology and the process of humanization in South Asia, further attested by the *in situ* collections of the lithic cultural artefacts, dealt with separately.

## DISCUSSION

The wide distribution in time and space of some fossils is on account of similar ecological niches, climatic conditions and geographical history prevalent in most parts of Central and South Indian regions. The animals seem to have had zonal distribution pattern in these parts without any definite ecological barriers between them. Most of the forms appear to be the late survivals from the Siwaliks, having migrated to other suitable areas in India (especially the Narmada–Godavari complex) when the conditions in northwest became unfavourable an account of glaciations.

The ice sheet as a result of Pleistocene glaciations pushed out repeatedly from the northwest. It acted as a physical and climate barrier to the

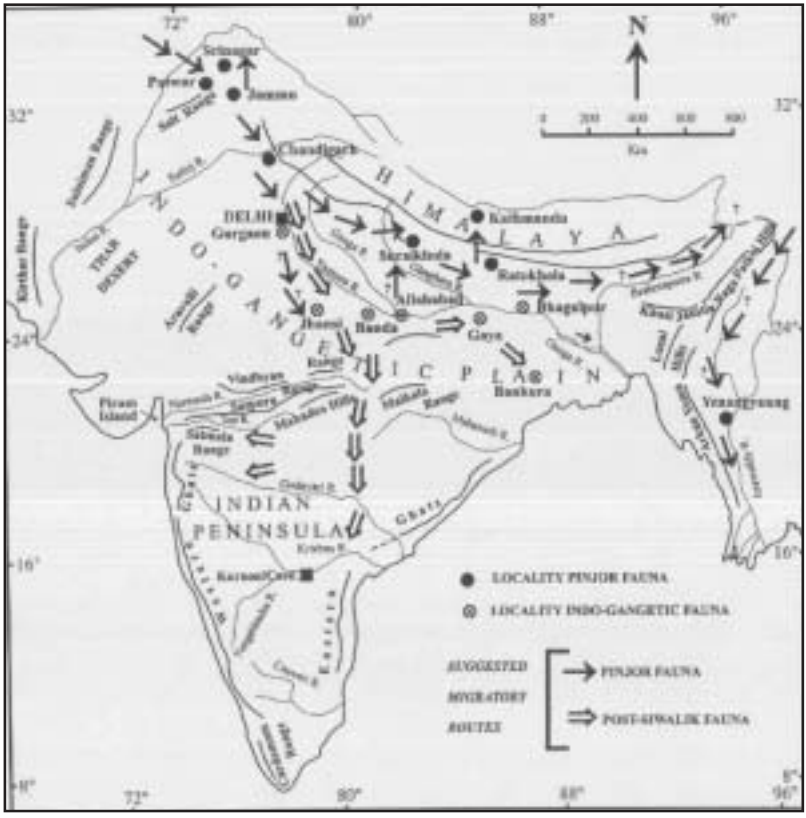


**Figure 1:** Probable Routes of Migration of the Quaternary Fauna in South Asia

movement of animals northwards and made the southward migration of most of the animals possible. Many of the species became extinct in course of such migrations due to adverse climatic conditions and allied factors like non-adaptability and hence are not represented in these deposits in such profusion or are totally absent. A few evolved into advanced forms in the Holocene.

The variability of the climatic conditions during the Pleistocene (at times more warm and humid and at other times much drier and cooler than today) gave rise to profusion of large and varied fauna. Nevertheless, this magnificent assemblage of animals was not totally indigenous to India. Progressive groups possibly of local origin were the primates, many giraffe-like forms, musk-deer, goats, buffaloes, bovids and pigs. The mammals which were shared by the contemporary fauna of Europe were the sabre-toothed cats, the hyena, wolves, rhinoceroses, horses of the genus *Equus*, various deer, antelopes and hippopotamii. The migratory routes lay east and west of the Himalayas (Pilgrim, 1925) and most of the larger animals migrated from Egypt, Arabia, Central Asia and North America through passes across Alaska, Siberia and Mongolia. Hippopotamii and elephants had their early origin in Central Africa from where they radiated out and entered India during the Tertiary period through Arabia and Iran. Rhinoceros, horse and camel, all originating in North America, evolved in some countries of central and western Asia before migrating to India. The elephant and horse have been a world traveller and reached to almost every country of the world.

It is well known that the migration of mammals chiefly occurred in the Tertiary, starting vigorously in the Lower Eocene and continuing with gaps till the Pleistocene. The Himalayan range began to be elevated as early as Eocene. In the Miocene it must have acted as a formidable barrier to the free migration of mammals between India and Central Asia. However, the migratory routes lay between Burma and China and through Baluchistan into Persia. Intercommunication also took place between India and North America and Mongolia.

Between India and Africa, interchange of faunas probably took place more easily. There is sufficient evidence for the existence of land-bridge across the straits at the entrance of the Persian Gulf. A corresponding bridge across Red Sea would have opened up ready means of communication between India and Africa through Arabia. Many species of European and Central Asian origin migrated to India during glacial periods and survived, directly or indirectly, until the modern times or became extinct.

Thus, based on the above discussion, the linkages of the Middle Pleistocene mega fauna of Narmada Valley *vis-à-vis* that of the Lower Pleistocene of the Siwaliks, and the Holocene India may be delineated as follows:

(1) *Stegodon insigns ganesa '! Elephas namadicus '! Elephas hysudricus*

(2) *Hexaprodaon namadicus '! Hexaprotodan palaeindicus*

(3) *Sus namadicus'!Sus palaeindicus*

(4) *Equus namadicus'!Equus asinus*

(5) *Bos acutifrons'! Bos namadicus*

(6) *Bubalus platyceros'! Bubalus palaeindicus*

(7) *Rhinoceros sivalensis'!Rhinoceros unicornis*

Three Narmada species clearly appear to have their predecessors among the *Bos acutifrons, Bubalus platyceros* and *Rhinoceros sivalensis,* respectively that inhabited the Pinjor Formation of the Upper Siwaliks of India.

## CONCLUSIONS

The Narmada Valley is one of the richest areas for fossils and cultural materials manufactured by Stone Age Man. This valley has yielded innumerable animal fossils and also a few hominin fossils, which have a direct bearing on the evolution of Man in South Asia. Besides, being a unique mid-continental place in the Old World, Narmada Valley has formed a traditional north and south dividing line. This has been an important path for transmission of the monsoons from southeast to northwest as well as for the faunal migrations from north to the south. That is why the Narmada Valley houses an admixture of Old and New World elements, initially migrated from outside. Thus, the Narmada fauna brings forth the evidence of endemic and immigrant species crucial for the study of linkages and evolution through the understanding of the dispersal of species within India and in- and out-migration from other geographical regions in time and place.

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