

DISCOVERY OF EARLY QUATERNARY VERTEBRATE FOSSILS BENEATH THE GANGA RIVER BED AT BHAGALPUR, BIHAR; THEIR AGE AND BIOSTRATIGRAPHIC IMPLICATIONS

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ABSTRACT

A major breakthrough has been made in unravelling the prehistoric biotic life and its age in the Gangetic plain with the discovery of a large number of vertebrate fossils in excavations for a bridge over the Ganga river at Bhagalpur in Bihar. The fossil material was recovered from a depth of 33 to 52 m below the present river bed and represents an extinct fauna which inhabited the area before the advent of the Great Ice Age. The faunal assemblage consisting forms like *Elephas hysudricus*, *Stegodon insignis*, *Equus* sp. cf. *E. sivalensis*, *Hexaprotodon* sp. cf. *H. sivalensis*, etc. has Pinjorian affinity and indicate Lower Pleistocene age.

Key words : Quaternary, vertebrate fossils, Gangetic Plain, Bhagalpur (Bihar).

INTRODUCTION

A large number of vertebrate fossils evidently of Lower Pleistocene age have been discovered at Bhagalpur, Bihar in excavations laid for well foundations of a bridge over the Ganga river (fig. 1). The fossils have been recovered from a presumably highly fossiliferous zone lying at a depth between 33 and 52m below the river bed. The excavated material indicates the source beds to be made up of sandstone and silty sand which are overlain by a nearly 30 m thick sequence of fluvial and wind blown sediments (fig. 2) apparently poor or barren of fossils.

The fossils material was collected by two of us (AM and UK) and other associates of Mandar Nature Club (MNC), Bhagalpur. The recovery operation involved scanning of large quantities of muddy material excavated from the systematically logged foundation wells at 63 points across the vast span of the Ganga River with each well dug up to a depth of 70-80m from the present river bed. The fossil-bearing horizon was encountered in almost all the wells at the same level indicating its persistence over a wide region. These come from a stratigraphic horizon lying between 33 and 52m below the bed of the Ganga River (fig. 2)

The Ganga plain covering about 0.3 million sq km of the Indian subcontinent is made up of an enormous pile of terrestrial sediments (at places up to 3000m thick) ranging in age from Lower Miocene to Sub Recent (Kumar *et al.*, 1996). It has revealed very scanty record of past life because of the unfossiliferous cover consisting dominantly of aeolian sediments throughout its extension.

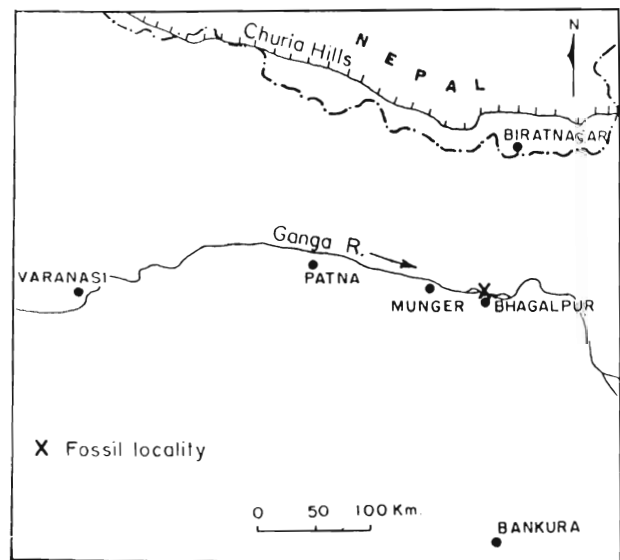


Fig. 1. Map showing location of the Bhagalpur fossil locality.

* Retired from GSI; Present address: Village & Post Office Chetru, district Kangra- 176 209 (H.P.).

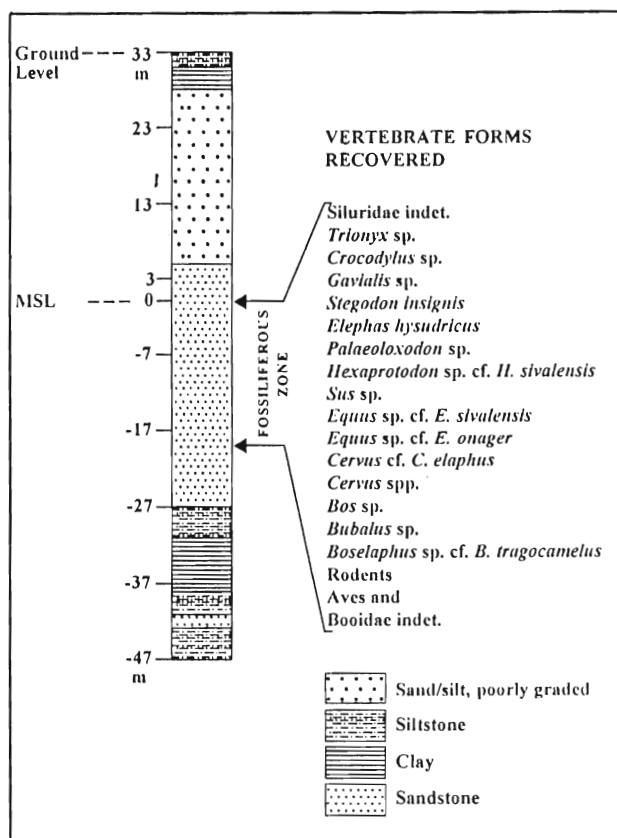


Fig. 2. Stratigraphic position of the fossiliferous horizon and vertebrate taxa present in the collection.

FOSSIL MATERIAL

The Bhagalpur fossil material, despite its fragmentary nature contains perfectly preserved isolated teeth, horn cores, antlers, broken jaws, limb bones and other skeletal parts. The unworn condition of the petrified bones indicated *in situ* nature of the material. However, their fragmentary nature is attributable to taphonomic factors such as crushing and disarticulation of skeletal carcass into parts by predators, scavengers and short distance transport by flooding streams, etc. which generally affect the dead terrestrial animals.

The present fossil collection assumes significance in view of the fact that there is no similar record of prolific prehistoric biotic life in the Gangetic Alluvium. The only stray fossil occurrences in the alluvial sections are those of Paimar Valley, Gaya (Badam, 1976), Prahaladpur in Varanasi District, about 380 km in the west (Chakravary, 1932) and near Bankura in the alluvial deposits of

peninsular India about 220 km to the south (Dassarma, Biswas and Nandi, 1982). Earlier records of vertebrate fossil finds in the Older Alluvium in areas further west of Varanasi are those at Karimkhan (Smith, 1833), Banda (Lydekker, 1882) and around Allahabad (Pilgrim, 1904; Mukherjee, 1949, Dassarma and Biswas, 1976).

CHECK LIST OF FAUNA

A systematic study of the Bhagalpur fossil material has shown presence of the following vertebrate taxa :

- | | |
|----------------|---|
| Fish | : Siluridae indet |
| Chelonia | : <i>Trionyx</i> sp.
(larger and smaller individuals) |
| Crocodylidae | : <i>Crocodylus</i> sp.
<i>Gavialis</i> sp. |
| Stegodontidae | : <i>Stegodon insignis</i> F & C |
| Elephantidae | : <i>Elephas</i> sp. cf. <i>E. hysudricus</i> F & C |
| Loxodontidae | : <i>Palaeoloxodon</i> sp. |
| Hippopotamidae | : <i>Hexaprotodon</i> sp. cf. <i>H. sivalensis</i> F & C
<i>Hippopotamus</i> sp. |
| Suidae | : <i>Sus</i> sp. |
| Equidae | : <i>Equus</i> sp. cf. <i>E. sivalensis</i> F & C
<i>E. onager</i> (?) |
| Cervidae | : <i>Cervus</i> sp. cf. <i>C. elaphus</i> Linn.
<i>Cervus</i> sp. |
| Bovidae | : <i>Bos</i> sp.
<i>Bubalus</i> sp.
<i>Boselaphus</i> sp. cf. <i>B. tragocamelus</i> (Pallas) |
| Caprinae | : Caprinae indet. |
| Antilopinae | : <i>Antilope</i> sp. |

In addition to above groups, rodents, snakes and birds are also represented in the collection. We figure here some of the important taxa (Pl. I) which have a bearing on the age and biostratigraphy of the

source beds. The detailed systematic descriptions are intended to be published later.

AGE AND BIOSTRATIGRAPHIC IMPLICATIONS

Pilgrim (1904) suggested Pleistocene age to the fossils collected at Allahabad which were excavated from a depth of 25-30 m below the Ganga River bed, i.e. approximately from the same depth as the Bhagalpur specimens. Chakravarty (1932) and Mukherjee (1949) assigned Upper Pleistocene age to the fossil occurrences at Guraini (Prahaldpur) and Naini (near Allahabad) respectively. These conclusions are evidently unrealistic as the fossil material was too inadequate to make any age estimate. Furthermore, our concept about the duration and biotic life of the Pleistocene have undergone considerable revision since the second half of this century. As such with the generation of new data a revision of the age estimate of the fossils of the Older Alluvium sediments seems inevitable.

In content, the faunal assemblage recovered at Bhagalpur is correlatable with the Pinjorian fauna of the Upper Siwalik Subgroup of NW India (Sahni and Khan, 1964) and upper part of Churia Group in Nepal (Corvinus and Nanda, 1994). The two basic parameters generally utilised in age determination of the Upper Siwalik subunits are (i) the prolific vertebrate fauna of Pinjor and its Villafranchian affinity and (ii) complete annihilation of the fauna with the advent of cold, arid and windy climate which prevailed during deposition of the Kalar Formation (Verma, 1996a) lying conformably over the Pinjor. These criterion are applicable to the Bhagalpur area as well, as the Siwaliks and the Gangetic plain exhibit similar biostratigraphic setups (Verma, 1996b). The faunal assemblage recovered from the fossiliferous horizon at Bhagalpur is correlatable with the Pinjor whereas uppermost unfossiliferous part of the Gangetic alluvium stands equivalent to the Kalar Formation (Lower Boulder Conglomerate) of the Upper Siwalik Subgroup. Indeed, it is a long held belief amongst the Siwalik biostratigraphers that the Siwalik hills are "an upheaved portion of the plains of India" (Falconer in Medlicott, 1873). The Siwalik part was subjected to thrusting, folding and faulting during the Middle Pleistocene Himalayan orogeny, while the Gangetic

plain remained unaffected. In global perspective, the Quaternary events of the Northern Hemisphere such as (i) the proliferation of the Villafranchian fauna (3.3 to about 1.0 m.y.), (ii) advent of cold climate and consequent glaciation, (iii) deposition of wind blown sediments (between 0.6 to 0.1 m.y.) and (iv) dwindling of the Villafranchian fauna with the beginning of the cold phase are clearly reflected in the Siwalik and Gangetic plain as well. Thus in our contention the fossiliferous beds of Bhagalpur most probably are the subsurface southern extension of the fossiliferous Upper Churia Subgroup (=Pinjor) of Nepal which lie about 150 km to the North. At least they are homotaxial.

The presence of extinct forms such as *Equus* sp. cf. *E. sivalensis*, *Stegodon insignis*, *Elephas hysudricus*, *Hexaprotodon sivalensis*, *Palaexoloxodon* sp., *Bos* sp., *Bubalus* sp., *Boselaphus* sp. cf. *B. tragocamelus* affiliates the Bhagalpur assemblage to the Pinjorian fauna of Upper Siwalik which has temporal range from 3 m.y. to about 1 m.y. B.P. We conjecture the age of the Bhagalpur fossils to be between 1.5 and 1.0 m.y. as *Elephas hysudricus*, *Stegodon insignis* and *Equus* are important Pleistocene elements in this assemblage and have since been extinct.

The Bhagalpur fossil material represents a diverse and prolific vertebrate fauna established in an ecological niche which was probably not much different from the one prevailing at present in the region. Fresh water loving forms, i.e. common inhabitants of stream/lake proximal and distal areas, forests and open grass lands such as fish, chelonians, elephants, hippopotamids, suids, equids, bovids, cervids, etc. comprised the assemblage.

The subsurface position of the Bhagalpur fossiliferous beds in relation to the present mean sea level is highly interesting and is a significant indicator of the sea level changes during the Quaternary. Since the faunal assemblage in question is essentially of fresh water character and the lower part of the fossiliferous horizon presently rests about 19m below the present sea level (fig. 2); it means sea level would have stood at least another 20-30m lower than the fossil-bearing zone. This gives an

idea of the extent to which the Gangetic Alluvium has sunk or the sea level has risen since Early Pleistocene. It seems the sea level stood at least 50m below the present m.s.l. during Lower Pleistocene/Bhagalpur fauna time. This is in concordance with the generally believed lower sea levels in Northern Hemisphere during Lower Pleistocene (Bjorn, 1968). However, to what extent the subsidence has occurred due to Late Quaternary neotectonism in the area is not clear as yet.

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EXPLANATION OF PLATE

Plate I

1. *Gavialis* sp., isolated tooth (MNC 58 x 1).
2. *Gavialis* sp., isolated tooth (MNC 126 x 1).
3. *Gavialis* sp., isolated tooth (MNC 125 x 0.7).
4. *Crocodylus* sp., isolated tooth (MNC 60 x 0.7).
5. *Crocodylus* sp., isolated tooth (MNC 115 x 0.7).
6. *Stegodon insignis* Falc & Caut., crown view of the ridge plate of molar fragment (MNC 169 x 0.7).
7. *Stegodon insignis* Falc & Caut., anterior view of the detached unworn molar plate (MNC 167 x 0.6).

8. *Palaeoloxodon* sp., crown view of the third lower milk molar (MNC 172 x 0.5).
9. *Elephas (Hypselephas) hysudricus* Falc & Caut., crown view of last lower molar, M_3 (MNC 171 x 0.3).
10. *Equus* sp. cf. *E. sivalensis* Falc & Caut., crown view of right upper molar, M^1 or M^2 (MNC 91 x 1).
11. *Equus* sp. cf. *E. sivalensis* Falc & Caut., occlusal view of left mandibular ramus with M_1 and M_2 (MNC 24A x 0.85).
12. *Equus* sp., crown view of isolated upper incisor tooth (MNC 131 x 0.8).
13. *Equus* sp., lateral view of isolated upper incisor tooth (MNC 131 x 1).
14. *Hexaprotodon* sp. cf. *H. sivalensis* Falc & Caut., lateral view of canine fragment (MNC 22 x 0.6).
15. *Hippopotamus (?Hexaprotodon)* sp. cf. *H. sivalensis* Falc & Caut., crown view of unworn lower last molar, M_3 (MNC 168 x 0.8).
16. *Hippopotamus (?Hexaprotodon)* sp. cf. *H. sivalensis* Falc & Caut., crown view of right last upper molar, M^3 (MNC 23 x 0.85).
17. *Bubalus* sp., crown view of second upper molar, M^2 (MNC 85 x 1).
18. (?)*Boselaphus* sp., buccal view of isolated right lower milk molar, MM_1 (MNC 117 x 1).
19. *Cervus* sp., antler fragment (MNC 73 x 0.65).
20. *Cervus elaphus* Linn., antler fragment (MNC 14 x 0.5).

