

TIME EQUIVALENCE OF THE LITHOSTRATIGRAPHIC UNITS OF THE SIWALIK RANGE BETWEEN YAMUNA AND SUTLEJ RIVERS

UMA SHANKER MISRA

Oil and Natural Gas Commission, Dehradun

ABSTRACT—An attempt is made with help of vertebrate fossil assemblages to discuss the status of lithostratigraphic units between Yamuna and Sutlej Rivers, which were mapped by the earlier workers and the present author.

Age fixation of some horizons in the lithostratigraphic units of the Siwaliks is made on the basis of the vertebrate faunal assemblages.

INTRODUCTION

Field mapping of sedimentary lithostratigraphic units involves an examination of gross lithology, the structural elements and establishing the succession of strata and the boundaries of formations. Biostratigraphic studies aim at a more detailed investigation

of the depositional environments of the sediments and fixing the age of the sediments.

In the Siwalik sediments (Upper Miocene to Pleistocene) rapid variations both in the vertical and spatial directions, which are made more complex by tectonics, are noticeable. Unlike some of the type sections of the

EXPLANATION OF PLATE—1

1. *Hexaprotodon sivalensis* X 0.5 Locality—Khol Nepali (30° 46' : 76° 53') Specimen No. ONGC/V/47 Formation. Rupar—1 (Pinjor). 2. *Hydasphtherium megacephalum* X 0.5 Locality—Jamni (30° 27' : 77° 24') Specimen No. Pal/M/17/377 Formation. Bahral—1—(Tatrot). 3. *Equus cautleyi* X 0.5 Locality—Charamwala (30° 28' : 77° 25') Specimen No. Pal/M/374 Formation Bahral—2 (Pinjor).

* Published with the permission of Director, Geology Directorate, Oil & Natural Gas Commission. The views expressed are those of the author and not necessarily those of the organisation to which he belongs.



UMA SHANKER MISRA : TIME EQUIVALANCE OF SIWALIK LITHOSTRATIGRAPHIC UNITS



Siwaliks in West Pakistan, the Siwaliks of the Indian foothills are locally fossiliferous, and therefore their time correlation over large areas is often uncertain. Vertebrate fossils, heavy mineral suites and band tracing along strike with the help of aerial photographs have proved very useful in correlation.

STRATIGRAPHY AND PALAEOLOGY

Area From Yamuna to Markanda Rivers

Bata Formation. The Bata Formation was designated by Agarwal *et al* (1961) based on the section exposed in Bata Nala. Medlicott had earlier mapped this as "Nahan." This formation consists of greenish grey, hard sandstone with alternate bands of shaly clays. No vertebrate fossil was collected in this formation. A few broken dicotyledonous leaf impressions were collected from the shale.

The formation appears to be similar to "Dagshai" in lithology. The heavy mineral suite also suggests that this formation is probably the equivalents of "Dagshai."

Nahan Formation. Medlicott (1864) was the first to designate "Nahan" (Nahun) as a separate formation. Theobald (1921) later suggested that "Nahan" formation may be omitted altogether and that it be renamed as "Murree" series. The suggestion was not followed by Medlicott.

The formation comprises of thick bedded grey compact, medium to fine grained sandstone, with alternate bands of concretionary red clay.

North of Nahan, Cautley (1836) obtained *Anthracotherium* (*Microselenodon*) *silistrense* and *Dinotherium* in the characteristic concretionary clay conglomerate, similar to those in Kalu Wala Rao north of Saharanpur.

Pilgrim (1917) later revisited the area but could not collect any fossils from this formation. Pilgrim correlated the "Nahan" formation with the Lower Siwalik Formation of Sind. He remarked that while the lithological resemblance as a whole is not very close, the concretionary clay conglomerate resembles the beds from the Lower Siwaliks of Punjab.

The fossils collected by Cautley from the Kaluwala Rao north of Saharanpur were identified by Lydekker (1876) as doubtful *Anthracotherium* (*Microselenodon*) *silistrense*. Other fossils like a *Dinotherium* tooth were obtained from the foot of the hills. Another specimen of *Progiraffa sivalensis* was reported to have come from the hills near Roorkee. Similar fossils were discovered by Cautley North of Nahan. Therefore, he correlated Kaulwala Rao section with Nahan Formation.

It is far likely that the supposed Nahan fossils were either of an entirely different age obtained from an outlier or they were

EXPLANATION OF PLATE—2

4. *Hypselphas hysudricus* approx. X 0.5 Locality Masol (30° 48' : 76° 50) Specimen No. ONGC/V/46 Formation, Rugar—II (Pinjor). 5. *Archidiskodon planifrons* X 0.5 Locality, Khera (30° 49' : 77° 5) Specimen No. ONGC/V/315 Formation, Masol (Tatrot). 6. *Stegodon insignis* X 0.5 Locality Masol (30° 29' : 77° 19') Specimen No. ONGC/V/349 Formation, Masol (Tatrot).

Middle Siwaliks as suggested by Medlicott. These fossils are similar to those obtained from the Lower Siwaliks of Chinji in the Salt Range. For these reasons Pilgrim disagreed with Oldham, who considered these beds as "Middle Siwalik," and the occurrence north of Nahan, as an Middle Siwalik outlier. Pilgrim considered it as equivalent to Lower Siwaliks and forming a part of Nahan Formation.

The heavy mineral suite of the Nahan Formation suggests Lower Siwalik age. The polospore assemblage shows a dominance of Pteridophytic flora during deposition of Nahans and supports a Lower Siwalik age.

Area South of Paonta

Bahral Formation. This area was mapped by Agarwal *et. al* (1960-61) between Yamuna and Markanda Rivers as the oldest formation in the Siwalik belt immediately to the north of the plains. They considered this formation as of Middle Siwalik age.

This formation yielded the following characteristic fauna which suggests an Upper Siwalik age:—

Stegodon insignis; *Hypselephas hysudricus* (Plate 3, Figs. 8, 9) *Equus cautleyi* Plate I, Fig. 3) *Hydaspitherium megacephalum* (Plate I, Fig. 2) *Merycopotamus* sp.

The heavy mineral suite of the samples collected by them from Chikan Kishan Khol

traverse also suggests an Upper Siwalik affinity.

It is possible that a part of Baharal-I Formation, exposed in the core of Dhanaura anticline east of Dhanaura is of Middle Siwalik age, because the fossil which is found in that area, *Hydaspitherium megacephalum*, ranges in age from Dhok Pathan to Tatrot. The heavy mineral suite in Baharal-I in Katgarh Setiwala traverse suggests Middle Siwalik affinity.

Area from Pinjaur to Rupar

Masol Formation. This formation was named by Rao *et. al* (1960-61). It has highly fossiliferous horizons which can be used as a datum for time correlation. The most common fossils are as follows—

Stegodon insignis (Plate 2, Fig. 6) *Archidiskodon planifrons* (Plate 12, Fig. 5) *Proamphibos kashmiricus*, *Hemibos acuticornis*, *Bubalus proamphibos*, *Hexaprotodon sivalensis*, *Merycopotamus* sp.

Archidiskodon planifrons and *Bubalus proamphibos* are representative fossils of Tatrot. Hence the age of this formation is Tatrot, i.e. Astian.

Rupar-I II and III Formations. These formations were designated by Rao *et. al* (1960—61) They differ in lithological appearance but their fossil content is similar to that

EXPLANATION OF PLATE—3

7. *Stegodon ganesa* 0.5 X Locality Rupar (30° 41' : 76° 50') Specimen. ONGC/V/279 Formation, Rupar—II (Pinjor). 8. *Hypselephas hysudricus* X 0.5 Locality Behral (30° 29' : 77° 48') Specimen No.—ONGC/V/24 Formation, Behral—(Pinjor). 9. *Hypselephas hysudricus* X 0.5 Locality Prempura (30° 47' : 76° 41') Specimen No. ONGC/V/50 Formation, Rupar—III (Pinjor).



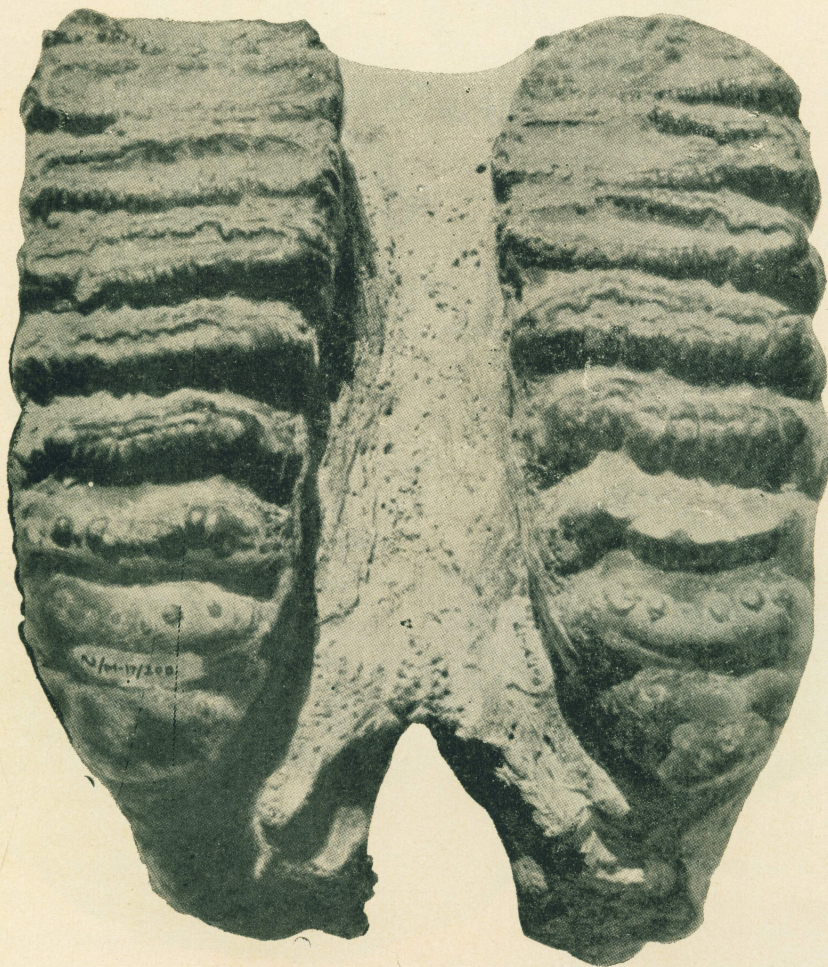
7



8



9



10

of Masol formation. The most common fossil genus of all three formation is *Elephas* which is generally represented by *E. hysudricus*, the molars of which are less complex in structure than those of *E. indicus*. The most common fossils are—

Elephas planifrons; *Hypselephas hysudricus* (Plate 2, Fig. 4 and Plate 3 Fig. 9) *Stegodon ganesa* (Plate 3, Fig. 7 and Plate 4, Fig. 10) *Bubalus platyceras*, *Equus cautleyi*, *Rhinoceros platyrhinus*, *Hexaprotodon sivalensis* (Plate 1 Fig, 1), *Hippopotamus sp.*

Hypselephas hysudricus, *Elephas planifrons* and *Equus cautleyi* are representative of fossil assemblage of Pinjaur. Hence the Rupar Formation is probably of Pinjaur age. The abundance of *Elephas planifrons* in the Rupar formation in Pinjaur also supports this contention.

The Masol and Rupar Formations can be distinguished as follows:—

(i) Certain species are abundant in Masol Formation but not common in Rupar formation viz. *Bubaline promphibos*.

(e) *Rupar IV Formation*. This formation is designated by Rao *et al* (1960-61). As no fossil was recorded from this formation, no age determination on faunal basis can be made. The assemblage of the heavy mineral

suite indicates that it may be of Middle Pleistocene (Cromerian) age.

CONCLUSIONS

The rocks of the Himalyan foot hills between Yamuna and Sutlej rivers have so far been mapped on the basis of their gross lithologies, heavy mineral suites and field relations. Vertebrate fossils have proved useful in fixing the time plane in some of these sediments.

ACKNOWLEDGEMENT

The writer is grateful to late Shri G. Kohli of ONGC., who initiated the systematic collection of vertebrate fossils from the Neogene sediments of the foot hills of the Himalayas; to Shri S N. Talukadar, Director, of Geology, ONGC, for permission for publication and encouragement, to Shri P.V. Dehadrai acting C.G. & A.D., Geology Directorate, ONGC., for going through the manuscript and Shri Harpal Singh for helping in preparation of references.

REFERENCES

- AGARWAL, G.C. MITRA, R.N. and Sikka, S.N., 1961, Progress report on the Geology of Kala Amb Badshahbagh and Nahan—Rampur, in Ambala (Punjab) Sirmur (H.P.) Saharanpur, Dehra Dun (U.P.). (*Unpublished report*, ONGC).
- CAUTLEY, P.T. 1836, Note on the teeth of the Mastodon adents étroites of the Siwalik Hills. *J. As. Soc. Beng.*, 5, 294-296.

EXPLANATION OF PLATE—4

10. *Stegodon ganesa* X 0.5 Locality Mandpa (30° 36' : 77° 4') Specimen No. ONGC/V/260 Formation. Rupar—III (Pinjor)

LYDEKKER, R., 1876, Fossil Mammalian fauna of India and Burma. *Geol. Surv. Ind.* **9**.

PILGRIM, G.E., 1908, The Tertiary and Post Tertiary fresh water deposits of Baluchistan and Sind. *Rec. Geol. Surv. Ind.* **37** (2).

RAO, V.S. SHRIVASTAVA J.P., MISRA, U.S. 1961, Progress report on the geology of the outermost Siwalik range between Sutlej and Markanda rivers, District Ambala, Punjab. (*Unpublished report, ONGC*).