LITHOSTRATIGRAPHY, AGE AND PALAEOGEOGRAPHY OF THE NEWLY DISCOVERED FOSSILIFEROUS INFRATRAPPEANS, LALITPUR DISTRICT, UTTAR PRADESH

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ABSTRACT

Designated as Papro Formation, the newly discovered fossiliferous infratrappeans are divisible into three lithostratigraphic members, namely the Conglomerate Member, the Silicified Tuff Member and the Pitchstone Member. The Papro Formation unconformably overlies the Kaimur Sandstone and shows a gradational contact with the overlying Deccan Traps. It has yielded a well preserved charophyte assemblage, ostracodes and gastropods and on this basis the age of the Papro Formation is discussed. It is suggested that these rocks were deposited in small pools formed by blocking of the river valley by basaltic flows during the dying phase of the Deccan Trap volcanic activity. A comparative table of the fauna and flora of the important localities of infratrappeans and intertrappeans of India is also given.

INTRODUCTION

The fossiliferous Deccan intertrappean and infratrappean beds, though sparingly recorded, have a wide geographical distribution in Central India (Fig. 1). These beds have yielded a wealth of information on the faunal and floral distribution at the time of Deccan Trap volcanic activity and thus are of much help in solving the age controversy associated with the outpouring of the stupendous volume of basic and other types of volcanic lavas which cover large areas of Cutch, Kathiawar, Maharashtra, Gujarat, Madhya Pradesh, Bihar, Karnatak, Andhra Pradesh and Uttar Pradesh (see GUPTA, 1976). The intertrappean beds generally occur as thin intercalations in different volcanic flows and represent quiescent period in which lacustrine or fluvial sediments accumulated. These sediments have yielded remains of wood, charophytes, gastropods, pelecypods, insects, bones, fish scales and teeth, frogs and tortoise (GUPTA, 1976). In contrast to the intertrappeans, the infratrappeans are much more varied both in lithology as well as lithologic setting. These include the marine Bagh Beds, the coastal deposits of Lameta Formation (KUMAR & TANDON, 1978, 1979), the fresh water sediments of Jabalpur Formation and older sedimentary and metamorphic rocks. Thus, the infratrappeans have also been of much value in establishing the time of the beginning of the Deccan volcanic activity.

Recently, a new fossiliferous infratrappean bed has been discovered from the Bundelkhand region of Uttar Pradesh (Ravi Prakash and Prem Swaroop, Directorate of Geology and Mining, Uttar Pradesh, personal communication). It is the first record of fresh water deposits of Eocene age from Uttar Pradesh. The present paper deals with the stratigraphy, age and the palaeogeographic implications of the newly discovered fossiliferous infratrappean beds.

The area of investigation falls in the toposheet No. 54 L/15 and L/16 of the Survey of India. It is approachable by the Solda-Papro Forest Road and is about 3 kms NNE of Papro, Lalitpur District, Uttar Pradesh.

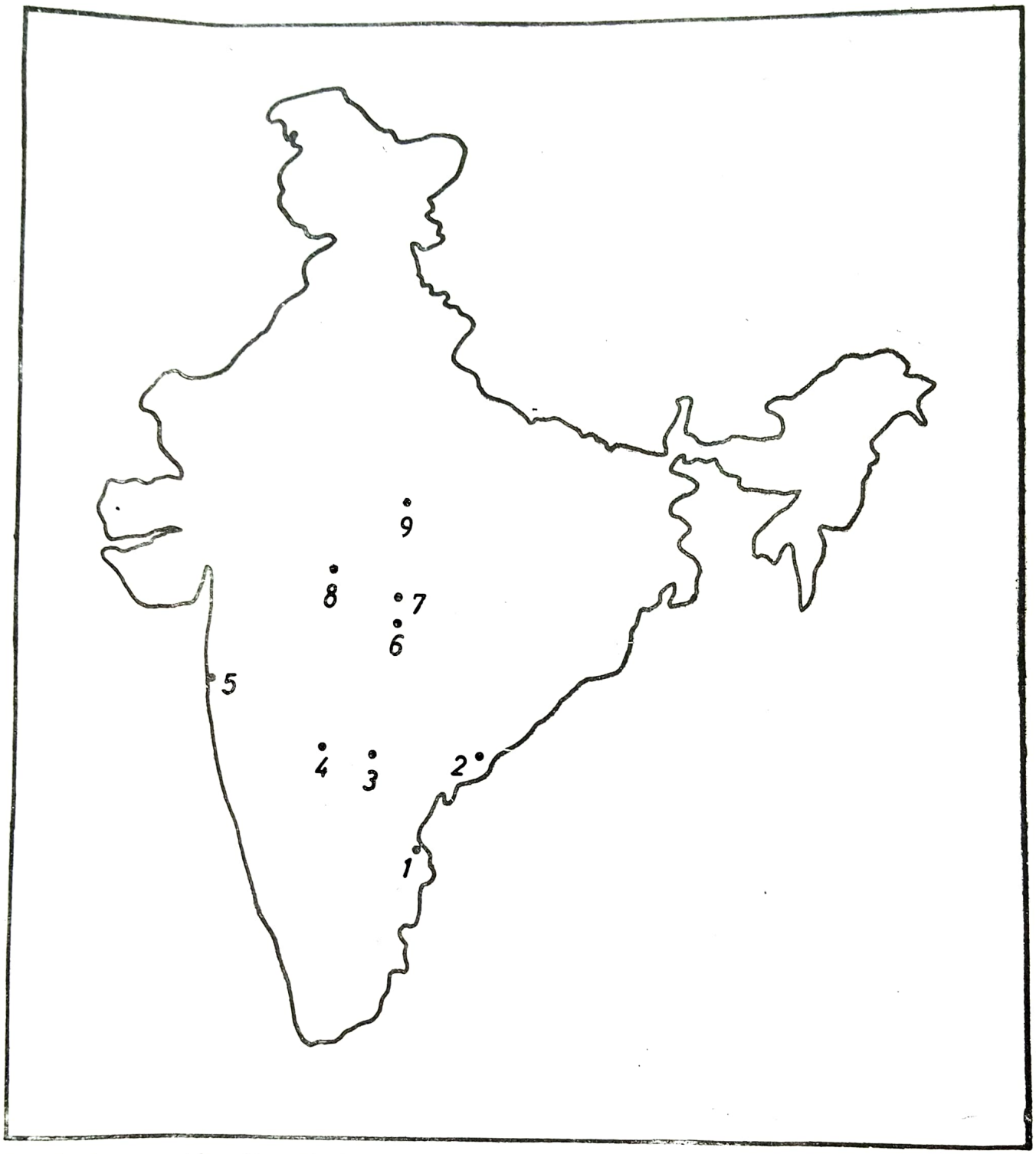

Fig. 1. Important locailties of infra-and intertrappeans.
1. Pangadi, 2. Kateru, 3. Vicarabad, 4. Gulbarga, 5. Bombay, 6. Nagpur, 7. Chindwara, 8. Narmada Valley and 9. Lalitpur.

GEOLOGICAL SETTING

The area under study is marked by an undulating topography characterised by well developed scarps and plateau of Kaimur Sandstone in the southern and of the Deccan Traps in the northern and northeastern parts. Near Papro, unconformably overlying the Kaimur sandstones, the fossiliferous succession of Eocene age is seen in two nala cuttings in a hillock trending SSE-NNW (Fig. 2). Both the exposures are separated from each other by about a km wide ridge trending ENE-WSW made up of Kaimur sandstones.

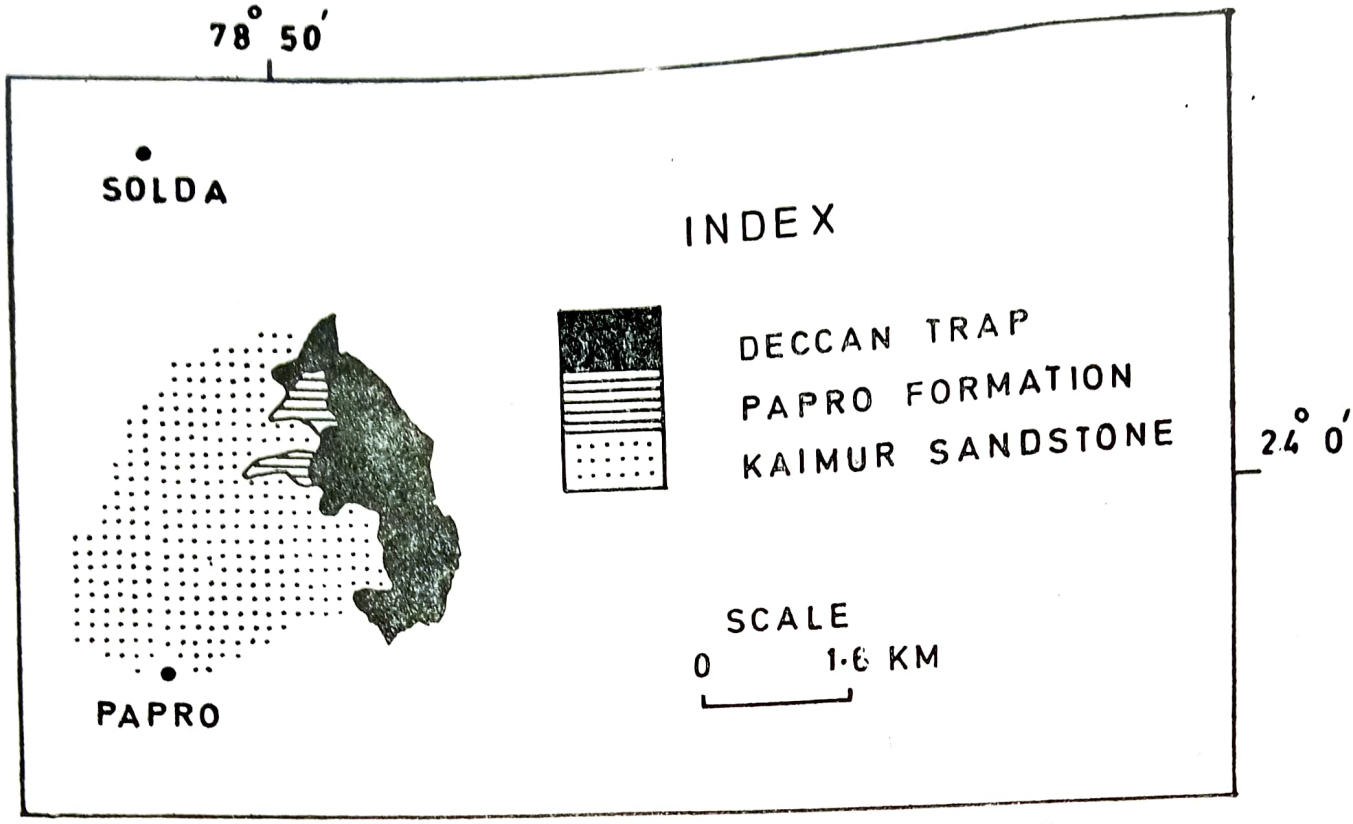

Fig. 2. Geological map of Papro area, district Lalitpur, U. P.

Both the exposures are approximately at the same height. There is no evidence of any tectonic disturbance effecting the Kaimur Sandstone, fossiliferous infratrappeans and the Deccan Traps and, thus, the original palaeogeographic setting is still discernible.

LITHOSTRATIGRAPHY OF THE FOSSILIFEROUS INFRATRAPPEAN BEDS

The fossiliferous infratrappean succession is represented by Conglomerate, Silicified Tuffs and Pitchstone, and has been designated as Papro Formation (Plate 1, Fig. 1). The name is derived from the nearest village Papro. The Papro Formation shows lower unconformable contact with the Kaimur Sandstone and upper gradational contact with the Deccan Traps (Fig. 3). The total thickness of the formation is about 6 m.

The Papro Formation has been subdivided into three lithostratigraphic members (Table 1).

Conglomerate Member—It shows an unconformable lower contact with the Kaimur Sandstone and more or less sharp contact with the overlying Silicified Tuff Member. It is represented by light brown coloured conglomerate made up of pebbles, cobbles and boulders of the Kaimur sandstones seen in a sandy matrix (Plate 1, Fig. 3). The maximum size of the boulders recorded is about 60 cms. These are generally angular to subrounded. The cementing material is hematitic. Bedding features and imbrication structures are not seen and, thus, the rock appears as massive. Due to absence of exposures, the bed is not traceable for long distances. No fossil has been recorded in the conglomerate. It appears that the conglomerate represents lag behind deposit of a small river valley. The boulders etc. must have been accumulated in the river valley under the influence of rain water as most of them show almost no evidence of long transportation. The geomorphological setting at the time of deposition of these beds must have been much similar in

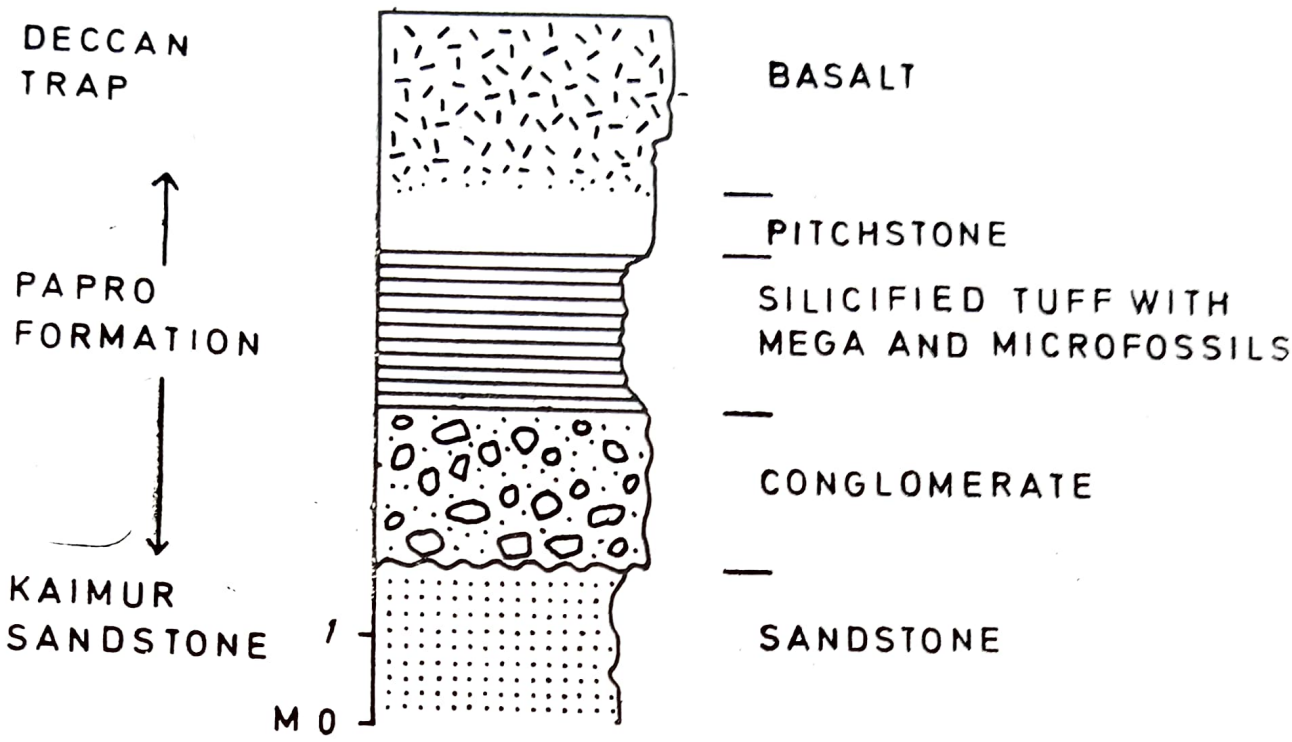

Fig. 3. Lithology of the Papro Formation.

Table 1

Deccan Traps	Basalts
	Pitchstone Member (3 m)
Papro Formation	Silicified Tuff Member (2 m)
	Conglomerate Member (2 m)
— — — — — — — — — — — —	Unconformity — — — — — — — — —
Kaimur Sandstone	Sandstones and siltstones
— — — — — — — — — — — —	Unconformity — — — — — — — — —
Bijawar Formation	Phyllites and schists

comparison with the present day Vindhyan topography. The provenance for these conglomerate was the Kaimur Sandstones as all the boulders etc., are made up of them.

Silicified Tuff Member—Having more or less sharp contact with the underlying Conglomerate Member, it is represented by ash gray to grayish black tuff made up of chert, argillaceous matter and shells of gastropods (Plate 1, Fig. 2). It has also yielded well preserved microfossils. The rocks of this member are completely silicified which resulted in replacement of gastropod shells and microfossils by chert. In megafossils only gastropods are recorded which attain maximum size of about 12 cms. No sorting is noticed in the gastropod shells. Thus, largest sized shell is seen along with the smallest of the same species. Bedding features are poorly preserved. Faint development of parallel bedding, however, is recorded. There is no evidence of any current or wave activity. A few

poorly preserved burrow structures are also recorded which suggest that this sequence is bioturbated. Perhaps bioturbation is responsible for distruction of the bedding features and it also indicates a very slow rate of sedimentation.

In microfossil assemblage only charophytes (Plate 2, Figs. 1—6) and ostracodes have been observed. Following is the list of the fossils recorded :

Megafossils

Lymnaea sp.
Physa sp. (Both dextral and sinistral forms)

Microfossils

Chara lalitpurensis Singh, 1978
Chara bitruncata (Reid & Groves)
Grambastichara tornata (Reid & Groves)
Microchara sp.
Gyrogona bundelkhandensis Singh, 1978
Gyrogona coelata (Reid & Groves)
and some ostracodes.

A significant feature in the megafossil assemblage is that it is represented by only gastropods of both adult and young forms. This can be explained by suggesting a very short span of time for the deposits in which varied fauna could not develop due to lack of time. Since all the fossils recorded are of fresh water origin and are autochthonous, they confirm a fresh water origin to the rocks of the Papro Formation. The sharp contact with the underlying conglomerates, faintly preserved parallel bedding, bioturbation structures, lithology and absence of sorting in the megafossil content suggest an environment in which the current activity was almost absent. This leads to the conclusion that this member must have been deposited in a small pool.

Pitchstone Member—The Silicified Tuff Member grades into Pitchstone Member. It is represented by black to light green pitchstones. No lamination is recorded. These lavas ultimately grade into typical Deccan tholeiitic basalts. It is suggested these rocks represent early volcanic flows which due to sudden cooling in contact with the water/sediments in the area of sedimentation, solidified as pitchstones.

PALAEOGEOGRAPHIC IMPLICATIONS

As previously described, the Pre-Deccan Trap geomorphological setting in the two nala cuttings in which the rocks of the Papro Formation is exposed, is still discernible and appears to be much similar in comparison to the present day Vindhyan topography. Thus, it appears that these nala cuttings represent superimposed drainage. It is suggested that due to outpouring of Deccan basalts near the area of investigation, the small river valleys got filled with lava which resulted in blocking of the valleys. Due to this blocking, small pools developed in the upstream area of the blocked river valleys. Thus, the Conglomerate Member represents the sediments of the pre-blocking stage of the river valleys. It appears that the volcanic dust, formed by the outpouring of volcanic lavas, settled in these pools. The subsequent volcanic flows ultimately inundated the upstream region of the valleys also and the small pools developed as the result of the blocking of the valleys in which the volcanic dust was settling, got filled up with the lavas. The flows which were in direct contact with the water/sediments formed the pitchstones and the rest formed the basalts.

The Bundelkhand region is a shield area and has remained uplifted since the Vindhyan times. The Deccan Traps also cover a part of the fringe of the Bundelkhand granites, though the thickness of the flows is quite thin in comparison to the vast thickness of the Deccan Traps in Western and Central India. It appears that the Deccan Traps in the Bundelkhand region represent the dying phase of the volcanic activity during Eocene Period and these volcanic flows could reach the higher ground, i.e., the Bundelkhand region, only when whole of the western India was already inundated by the volcanic flows.

AGE

In the present work, the charophyte assemblage is quite helpful in assigning the age to the rocks of the Papro Formation vis-a-vis the age of the Deccan Traps. The *Chara bitruncata* (Reid & Groves) has been widely reported from the Eocene rocks of Hampshire, England. The *Grambastichara* Horn af Rantzien (1959) ranges from the Upper Bartonian to Tartonian (Miocene). The *Microchara* Grambast (1959) has been reported from the Lower Maestrichtian up to Eocene and *Gyrogona* Lamarck (1804) ex Lamarck (1822) emend. GRAMBAST (1956) has been recorded from the Palaeocene—Eocene rocks. Thus, the charophyte flora of the Papro Formation indicates lower age limit as Maestrichtian, though the present authors are inclined to suggest Eocene age as the present flora closely resembles with the flora described from the Eocene of Hampshire, England. A comparative account of the inter-and infratrappean flora and fauna of the different localities of India (excluding Bagh and Lameta beds) is given in Table 2.

Table 2—Intertrappean and Infratrappean localities of India

INFRATRAPPEANS

Name of Localities	Fauna/Flora	Thickness	Age	References
PANGADI (marine) Loc. (a) About 0.85 km. Southeast of Devarapalle village.	*Quinqueloculina* sp., *Vaginulina* sp., *Guttulina*, *Pseudopolymorphina devarapalleensis*, *Cibicides* sp., *Palmulina bhatia*, *Turritella*	1 m	Palaeocene	Bhalla (1968)
PAPRO Lalitpur District (U.P.)	*Chara lalitpurensis*, *C. bitruncata*, *Lymnaea*, *Physa*, *Grambastichara tornata*, *Gyrogona bundelkhandensis*, *G. coelata*, *Microchara*, *Physa* sp., *Lymnaea* sp., Ostracodes.	4 m	Early Eocene	Singh (1978)
KATERU (2 miles north of Rajamundry, exposed in a quarry, 500 yards North of Saratorium hills & 200 yards west of Koraikonda Road.	*Chara wrightii*, *C. helieteres*, *C. medicaginula*, *C. coelata*, *C. vasiformis*, *C. turbinata*, *C. strobilocarpa*, *C. subglobosa*, *C. oehlerti*, *C. rajamundrica*, *C. sampathi*, *C. sahnii*, *C. indica*, *Quinqueloculina* sp., *Lagena* sp., *Bathysiphon eocinicus*, *Discorbistoddae*, *D. subvilardiboana*, *Protelphidium adansi*, *Nonionkingi*.	5 m	Palaeocene to Early Eocene	Bhalla & Khan (1969)

(*Contd.*)

Name of Localities	Fuana/Flora	Thickness	Age	References
PANGADI	*Bathysiphon eocenicus*, *Quinqueloculina* sp., *Virgulina* sp., *Rosalina* sp., *Triloculina decopieus*, *Discorbis toddae*, *Globorotalia* sp., *Cibici des reinholdi.*, *Globulina inacqualis*, *Protelphidium adamsi P. duddukuruense*, *Nonionkingi*, *Vaginulina icenii*, *Fissurina laevigata*, *Eotrigodon jonesi* (ostracod by Bhalla).	1.2 m	Lower Eocene	Bhalla (1967, 1968)
BOMBAY (Malabar hills & Worli hills)	Plant impressions, remains of frogs & rarely bitumin or coaly materials. They also contain fresh water tortoise *Isydrapsis* (*Platemys*) *leithi*, the frog *Rana pusella*, *Indobatrachus pusillus* & 3 species of *Cyprides* (crustacea) the common form being *Cypris submarginate.*	30 m		Blandford (1920)
	Plant remains (Paleus) e.g., *Nepadites*, *Perishoriacites varians*, *Massulites coelatus*, Plant and animal fossils and *Palaeosordaria eagena.*	40 m	Eocene	Hora (1939)
NAGPUR	*Physa*, *Paludina* (both fresh water gastropods), *Chara malcolmsonii*, *Chara elliptica.*		Late Cretaceous	Sowerby (1837), Blanford (1920)
	Platychara raoi, *Platychara sahnii*, *Microchara* sp.		Mid.-Up. Palaeocene	Sahni & Rao (1943), Bhatia & Manikery (1976) Bhatia (1976)
CHHINDWARA	Aquatic flora, water ferns. *Azolla intertrappea*, *Gyrogonites*, spores and tissues of Pteridophyta, *Chara* fruits, *Palaeosordaria lagena*, tissues of angeosperm, *Massulites coelatus*, *Perishoriccites various.*		Early Tertiary	Sahni & Narayan Rao (1943)
VICARABAD near Hyderabad	Specimens comparable to *Chara malcolmsonii.* *Gyrogonites* sp.		Tertiary	Mahadevan & Sharma (1947)
GULBARGA (Gurmalkal area, Mysore)	*Chara wrighti*, *C. vasiformis*, *C. strobilicarpa*, *C. foetida*, *C. microceras*, *Chara* sp., *Gyrogona medicaginula*	3-14 m	Tertiary	Shivarudrappa (1972)

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EXPLANATION OF PLATES

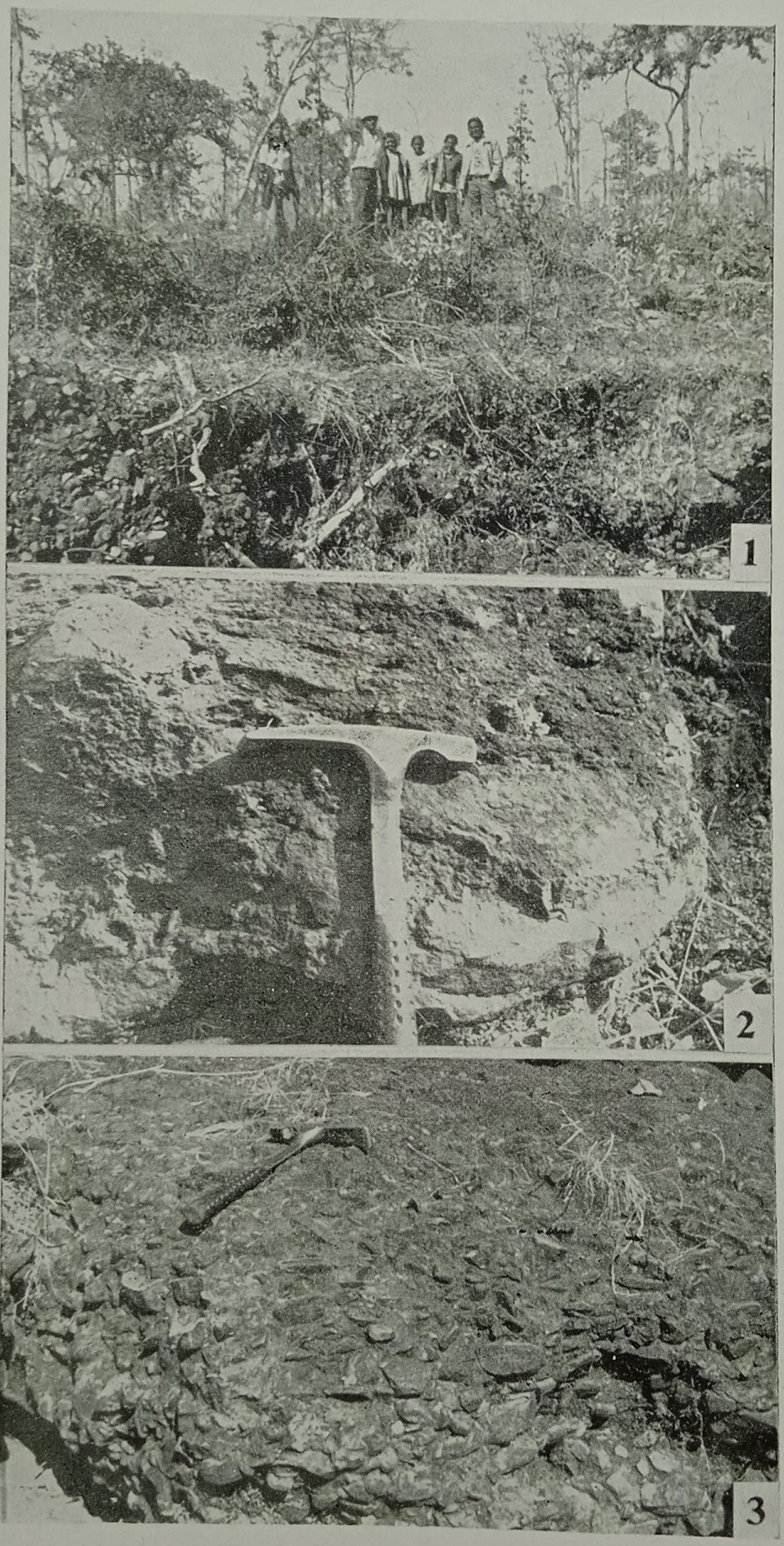
PLATE 1

1. Exposure of the Papro Formation in the nala cutting, northeast of Papro village, Lalitpur District, Uttar Pradesh. Lower part shows the Conglomerate Member and overlying it is the fossiliferous Silicified Tuff Member.
2. Silicified Tuff showing gastropod shells, same locality as above.
3. Conglomerate made up of boulders, cobbles and pebbles of Kaimur sandstones seen in a sandy matrix.

PLATE 2

The charophyte assemblage of the Papro Formation.

1. *Chara bitruncata* (Reid & Groves). Lateral view. X 32.
2. *Grambastichara tornata* (Reid & Groves). Lateral view. X 50.
3. *Microchara* sp. Lateral view. X 32.
4. *Gyrogona bundelkhandensis* Singh. Lateral view. X 32.
5. *Chara lalitpurensis* Singh. Lateral view. X 32.
6. *Gyrogona coelata* (Reid & Groves). Lateral view. X 32.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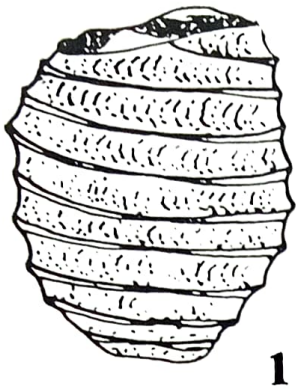

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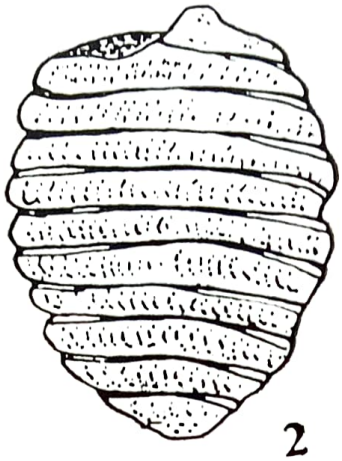

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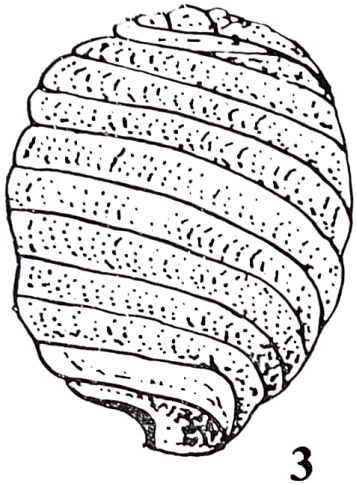

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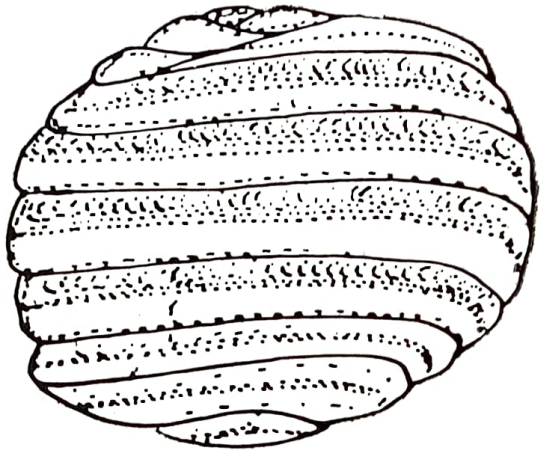

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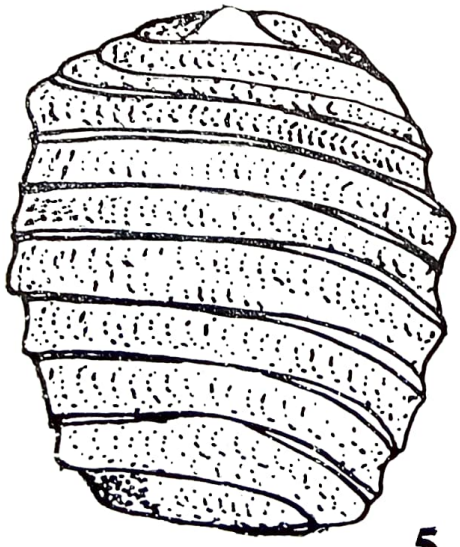

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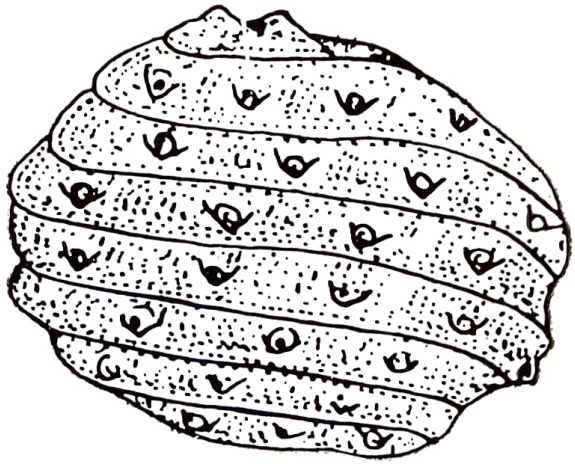

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