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AGE OF THE EXOTIC LIMESTONE IN NAOTHALUNG AREA OF HUNGPUNG VILLAGE, UKHRUL DISTRICT, MANIPUR STATE, NORTHEAST INDIA

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ABSTRACT The study of foraminifera and biostratigraphy of the exotic limestone from Naothalung area in Hungpung village shows Early Campanian – Late Maastrichtian age for the mélange zone of Ophiolite Belt, Ukhrul District, Manipur State. Rich associations of planktonic and benthic foraminifera were determined. The present study records six planktonic foraminiferal biozones viz.:
(I) *Gansserina gansseri* zone (ii) *Globotruncana aegyptiaca* zone (iii) *Globotruncanella havanensis* zone (iv) *Globotruncanita calcarata* zone (v) *Globotruncana ventricosa* zone (vi) *Globotruncanita elevate* zone .
In the study area we have recorded first time benthic foraminifera *Bolivina witwickae, Bolivinoides* sp., *Fissurina* sp., *Fissurina orbigyana, Dentalina* sp., *Gaudryina pyramidata, Nodosaria obscura* and *Pseudonodosaria* sp.

KEYWORDS : Exotic limestone, Planktic foraminifera, Benthic foraminifera, Manipur Ophiolite Belt, Manipur, NE India.

INTRODUCTION

Geological studies of the sediments in the North East India and in Manipur region are scanty during the pre-independent period of India. Oldham (1883) was one of the earliest workers to give a broad geological account of Manipur. He has correlated the limestone bearing beds around Ukhrul as "Axials of Arakan Yoma", the southern tectonic equivalent of the Manipur Hill ranges. Clegg (1941) reported similar limestone from the adjoining Burma (now Myanmar) part of the Indo-Burmese range and suggested a Cretaceous age.

Bhattacharya & Bhattacharya (1984) made detail study of the stratigraphy and palaeontology of rocks of eastern parts of Manipur. They reconstructed the stratigraphic succession as follows: Shiroi Formation, Ukhrul Formation and Lamlang Formation. They have recorded a number of Forminifera, Corals, Ostracoda, Pelecypoda and Gastropoda from the fossil bearing limestone blocks. They opined that the limestone of Manipur are part of the Indo-Burma orogeny and are like those of the contiguous Chin hills, Arakan-Yoma and coastal Burma (Myanmar) where such exotic floaters have already been noted within (Palaeocene-Lower Eocene) rock association (Shale-Siltstone geosynclinal flysch facies).

Mishra (1985) reported radiolarians and foraminifers of Maastrichtian age from cherts and limestones associated with the ophiolite suite of rocks. The olistostromal limestone in the west of ophiolite belt contains mainly foraminifers varying in age from Maastrichtian to Palaeocene and Lower to Middle Eocene.

The foraminiferal assemblages from exotic blocks in the melange zone of Ukhrul area providing data on deep oceanic sediments in Late Cretaceous and their subsequent abduction along the eastern margin of the Indian plate by Chungkham Prithiraj et al. (1992). The foraminifer assemblages of Ukhrul Melange zone of Manipur was compared with the wildflysch zone of Switzerland, two distant parts of the Tethys Sea by Chungkham Prithiraj & Caron (1996). Chungkham Prithiraj & Jafar (1998) worked out the preserved assemblages of Foraminifera and Coccoliths from the pelagic limestones of Melange zone of Manipur ophiolite belt of Ukhrul area.

The present paper deals with the age and occurrence of planktic and Benthic foraminifera in the exotic limestone of Naothalung area in Hungpung village, Ukhrul region.

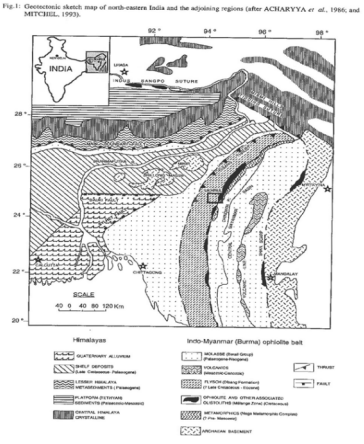


Fig.1: Geotectonic sketch map of north-eastern India and the adjoining regions (after ACHARYYA *et al.*, 1986; and MITCHEL, 1993).

LOCATION AND LITHOLOGY

Manipur is a small state situated in the north-eastern corner of India bordering with the Union Socialist Republic of Myanmar (Burma). It lies approximately between 23°50′ N — 25°41′ N latitudes and 93°00′E — 94°45′E longitudes having an area of about 22,327 km². The hills of Manipur lie between the Naga-Patkai hills on the north and northeast, and the Chin-hills on the South forming an integral part of the Indo-Myanmar (Burma) Ranges (IMR).

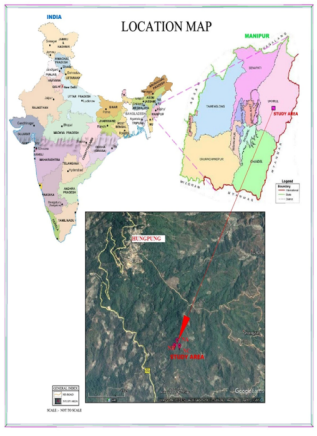


Fig.2. study area

NA – NAOTHALUNG A BLOCK, NB – NAOTHALUNG B BLOCK, NC- NAOTHALUNG C BLOCK

The study area is located in a hilly region which is (1750 meters above the MSL) and part a of the "Mélange zone" in the Naothalung area of Hungpung (erstwhile Hundung) village in Ukhrul District, Manipur where the limestones are exposed along with great thickness of Upper Disang shales on the eastern and western ridges. The study area lies within 94º20′17″ and 94º20′43″ East longitudes and 25º02′43″ and 25º02′71″ North latitudes. The regional trend of the beds is NNW-SSE with a westerly dip between 20° and 25°. The study area of Naothalung is situated 4 km from the Hungpung village and 76 kms from the east of Imphal city. In this area, it has three blocks and denote as NA which is in the North, NB in the South west (middle) and NC in the south. The limestone is fine-grained, varying shades of grey, whitish, and brown, generally massive, and highly jointed at places. The microfossils recovered from these three limestone blocks comprise of planktic foraminifera and benthic foraminifera.

The mélange zone is characterised by the occurrence of exotic blocks of varying size (a few centimetres to tens of meters) composed of micritic limestone, marl, sandstone, basic rocks and conglomerate embedded in matrix of flyschoid rocks. The olistolithic blocks of pelagic limestone and chert could be hitherto dated as Late Cretaceous (Late Santonian to Late Maastrichtian) (Acharyya et Al.1986; Mitra et al.1986, Chungkham 1996 and Chungkham and Caron 1996).

MATERIALAND METHODS

The samples were collected from three blocks in Naothalung area of Hungpung village. The relevant exposures are marked in the field and the samples are collected in the field in a systematic manner. Before obtaining a sample the surface of the exposure needs to be cleared of weathered material and packed in a sample bag. Usually 500 gm of each sample is taken for micropaleontological analysis.

The samples were processed using the modified version maceration technique developed by Zolnaj (1979). The Limestone sample is broken into small pieces of 1 cm and slightly lesser sizes with the hammer. The Limestone sample are mixed with copper sulphate crystals and put inside a glass beaker. The quantity of copper sulphate crystals is approximately half of that limestone sample processed. Concentrated acetic acid is poured up to the level to cover the mixture. This treatment is kept for 3 to 4 days till the whole mixture turns into a paste. Then the paste is washed and sieved. The undigested samples can be dried and treated again by the same procedure. After the samples were washed in ASTM 230 sieves, the washed samples were then dried in the Hot Air Oven (HAO). Further, the dry sieving was carried out in ASTM mesh nos.20, 40, 60, 80,100 and 120 for picking up the microfossils from the matrix.

The basic reaction in this treatment is that the concentrated acetic acid attacks the rocks rapidly but it starts digesting the matrix of microcrystalline calcite (micrites) first and only later the calcified skeletal grains. If diluted acetic acid of any strength is used the reaction is much slower and the matrix and the skeletal grains are digested simultaneously. The copper sulphate acts as an anti-reactant to stop the complete digestion of the skeletal grains. However, if the treatment is kept for a long time, i.e. more than 6 days then the whole of the rock is digested.

The dry sample which was separate through ASTM mesh nos.20, 40, 60, 80,100 and 120, is poured into a tray in a single layer of grains. The fossils are picked with moistened brush by using Stereo Zoom Microscope. The brush should make pointed and place it in a hovering position over the field of the microscope. The moistened brush is lowered over the specimen desired and allowed to touch the surface, to which the specimen will adhere. Transferred to the slide, micropaleontological slides (24 squares) made up of cardboard, which is divided into compartments by white lines. Further, the specimens are process for identification and SEM photograph.

BIOSTRATIGRAPHY

The biostratigraphy of Cretaceous planktonic foraminifera became widely important after the papers of Viennot (1930), Thalmann (1934), Pessagno (1962) and Caron (1985). The Middle and Late Cretaceous biostratigraphic zonations were revised by the European Working Group on Cretaceous Planktonic Foraminifera (Robaszynski & Caron, coordinators, 1979; Robaszynski and others, 1984 and by Caron (1985) to reduce the intricateness caused by the multitude of previously established taxa. Robaszynski & Caron (1995) and Robaszynski (coordinator, 1998) make with the planktonic foraminiferal biozones with the time scale of Gradstein and others (1994).

Occurrences of Cretaceous flysch containing limestone was first reported by Oldham (1883.see Pascoe, 1959) from Ukhrul in Manipur, Northeast India. Most of the Limestone is whitish and grey micritic limestones, the matrix and skeletal grains are dominantly calcitic.

Four exotic limestone blocks of Hungpung have been discussed previously by Chungkham Prithiraj and Syed A.Jafar (1998) ranges from Early Campanian to Late Maastrichtian whereas the present study focus on three exotic limestone blocks and are established Early Campanian to Late Maastrichtian.

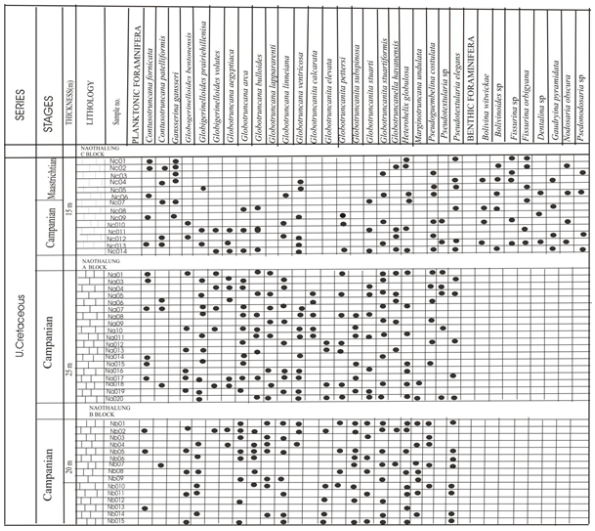


Fig.3. Distribution chart of the planktic foraminifera and benthic foraminifera from the three exotic limestone blocks.

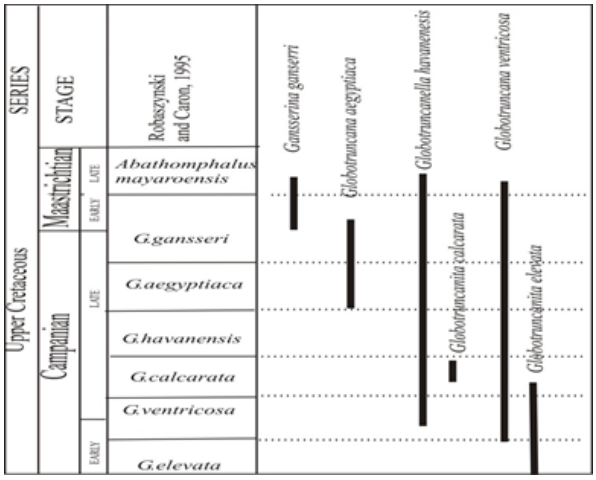


Fig.4. Stratigraphic ranges of the marker planktonic foraminifera species with the planktonic foraminiferal zonation.

PLANKTONIC FORAMINIFERA

The foraminifers are taxonomically classified using the "Foraminiferal Genera and Their Classification" by Loeblich and Tappan (1988) and Biostratigraphic classification followed by Robaszynski and Caron (1985).

Gansserina Gansseri Interval zone

The zone of *Gansserina Gansseri* Interval zone was defined by Bronnimann (1952). It defined that the zone marks the interval from first occurrence of *Gansserina gansseri* to first occurrence of *Abathomphalus mayaroensis,* this zone marks due to the occurrence of marker planktonic foraminiferal species *Gansserina gansseri* as *Abathomphalus mayaroensis* is not found in this blocks.The species found in the sample NC01, 02, 03, 04, 07 and 09. It ranges from Late Campanian to Late Maastrichtian.The associated planktonic foraminifera are *Contusotruncana contusa, Globotruncana*

aegyptiaca, *G. arca,G.lapparenti, G.Linneiana, G.ventricosa, Globotruncanita Stuarti, G. stuartiformis,Heterohelix globulosa, Pseudoguembelina costulata, Pseudotextularia elegans.*

***Globotruncana Aegyptiaca* Interval range zone**

The zone of *Globotruncana aegyptiaca* Interval range zone was defined by Caron (1985). It defined that the zone marks the interval from the first occurrence of *Globotruncana aegyptiaca* to first occurrence of *Gansserina gansseri* in the study area . This zone marks the presence of the marker foraminifera species *Globotruncana Aegyptiaca.* The associated planktonic foraminifera are *Contusotruncana contusa, Globotruncana arca, G.bulloides, G.lapparenti, G.linneiana, G.ventricosa, Globotruncanita Stuarti, G. stuartiformis, Heterohelix globulosa, Pseudoguembelina costulata, Pseudotextularia elegans.*

***Globotruncanella Havanensis* Partial range zone**

The zone of *Globotruncanella Havanensis* Partial range zone was defined by Caron (1978) as the range was nominate taxon between the last occurrence of *Globotruncanita calcarata* to first occurrence of *Globotruncana aegyptiaca.* Important planktonic foraminifera recognized in this zone are: *Gansserina gansseri ,Globotruncana arca, G.bulloides,G.lapparenti, G.Linneiana, G.ventricosa, Globotruncanita Stuarti, G. stuartiformis, Globotruncanella Havanensis,Heterohelix globulosa, Pseudotextularia elegans.*

***Globotruncanita calcarata* Total range zone**

The *Globotruncanita calcarata* Total range zone was defined by Herm (1962).This zone marks the interval of total range of *Globotruncanita calcarata.* It assigned as Late Campanian in the NA block which is total range occurrence of marker foraminifera species are found in the sample NA04, 05, 07, 09, and 10 (see Fig.3).Which represents first appearance NA04 and last appearance NA10. The important planktonic foraminifera recognized in this zone are: *Globigerinelloides Prairiehillenis, Globotruncana arca, G.bulloides, G.lapparenti, G.Linneiana, G.ventricosa, Globotruncanella Havanensis, Globotruncanita Elevata, G.Subspinosa,G.Stuarti, G. stuartiformis, Heterohelix globulosa, Pseudoguembelina costulata, Pseudotextularia elegans.* This zone assigned as the Late Campanian.

***Globotruncana ventricosa* Interval Zone**

The zone of *Globotruncana ventricosa* Interval Zone was defined by Dalbiez (1955). It ranges from the *G.ventricosa* zone to *G.Gansseri* zone that is Early Campanian to Late Maastrichtian. The associated planktonic foraminifera are: *Globigerinelloides Prairiehillenis, Globotruncana arca, G.bulloides,G.lapparenti, G.Linneiana, G.ventricosa, Globotruncanella Havanensis, Globotruncanita Elevata, G.Subspinosa, G. stuartiformis, Heterohelix globulosa, Pseudoguembelina costulata, Pseudotextularia elegans.*

***Globotruncanita elevata* Partial range zone**

The zone marks the interval from the first occurrence of *Globotruncanita elevata* at the base and the first occurrence of *Globotruncanita ventricosa* at the top of the biozone.The zone of *Globotruncanita elevata* Partial range zone was defined by Postuma (1971). The important associated planktic foraminifera are: *Globotruncana arca, G.bulloides, G.lapparenti, G.Linneiana, G. stuartiformis, Heterohelix globulosa, Pseudoguembelina costulata.*This zone assigned as Early Campanian.

RESULT AND CONCLUSION

Foraminiferals are yield in good result of all the sample collected, 19 genera and 32 species planktic and benthic foraminifera are found in this study area. The study of Naothalung blocks reveals the age from the Early Campanian to Late Maastrichtian. Topmost Naothalung A Block found the oldest age (Late Campanian), Naothalung B block found the Early Campanian whereas Naothalung C Block found the youngest age (Late Maastrichtian). Presence of the marker planktonic foraminifera species established six biozone, (i) *Gansserina gansseri* Interval zone (ii) *Globotruncana aegyptiaca* Interval range zone (iii) *Globotruncanella havanensis* Partial range zone (iv) *Globotruncanita calcarata* Total range zone (v) *Globotruncana ventricosa* Interval Zone (vi) *Globotruncanita elevata* Partial range zone .

The planktic foraminifera obtained in the present study are as follows: *Contusotruncana fornicata, Contusotruncana patelliformis, Gansserina ganseri, Globogerinelloides bentonensis, Globigerinelloides prairiehillenis, Globigerinelloides volutes, Globotruncana aegyptiaca, G.arca, G.bulloides, G.lappararenti, G.linneiana, G.ventricosa, Globotruncanita calcarata, G.elevata, G.pettersi, G.subspinosa, G.stuarti, G.stuartiformis, Globotruncanella havanensis, Heterohelix globulosa, Marginotruncana undulata, Pseudoguembelina costulata, Pseudotextularia* sp., *Pseudotextularia elegans,*

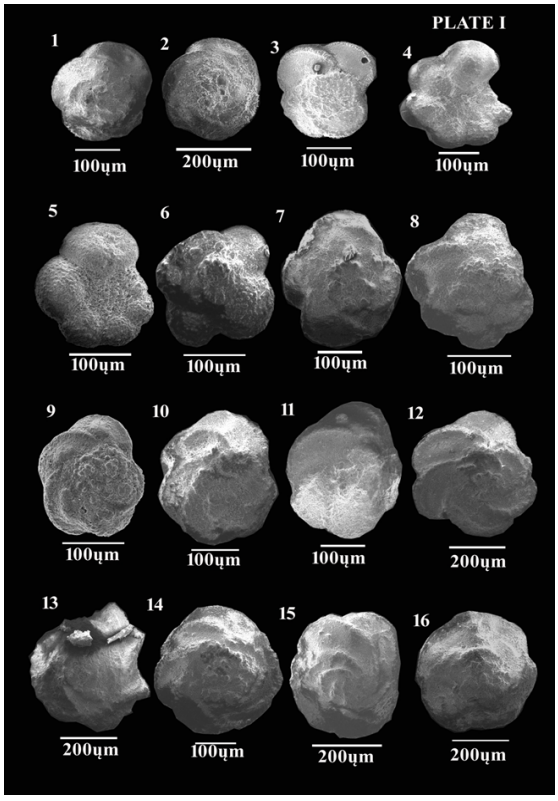
And the first time recorded benthic foraminifera obtained in the present study are as follows: *Bolivina witwickae, Bolivinoides* sp, *Fissurina* sp., *Fissurina orbigyana, Dentalina* sp., *Gaudryina pyramidata, Nodosaria obscura, Pseudonodosaria* sp.

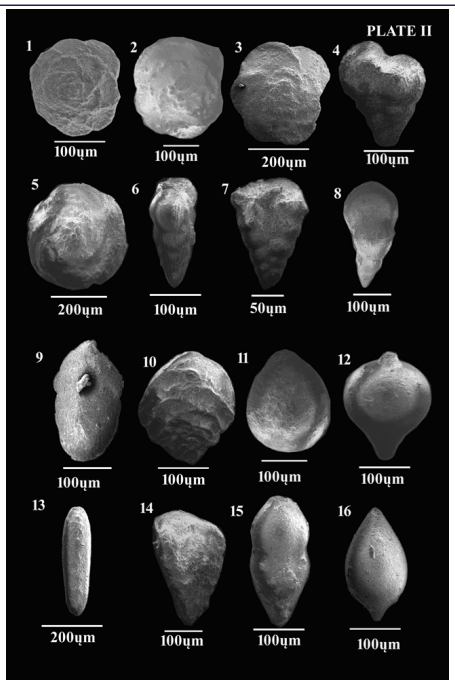
PLATE I

1. *Contusotruncana fornicata* (Plummer)
2. *Contusotruncana patelliformis* (Gandolfi)
3. *Gansserina ganseri* (Bolli)
4. *Globogerinelloides bentonensis* (Morrow)
5. *Globigerinelloides prairiehillenis* (Pessagno)
6. *Globigerinelloides volutes* (White)
7. *Globotruncana aegyptiaca* (Nakkady)
8. *Globotruncana arca* (Cushman)
9. *Globotruncana bulloides* (Vogler)
10. *Globotruncana lappararenti* (Brotzen)
11. *Globotruncana linneiana* (d'Orbigny)
12. *Globotruncana ventricosa* (white)
13. *Globotruncanita calcarata* (Cushman)
14. *Globotruncanita elevate* (Brotzen)
15. *Globotruncanita pettersi* (Gandolfi)
16. *Globotruncanita subspinosa* (Pessagno)

PLATE II

1. *Globotruncanita stuarti* (de Lapparent)
2. *Globotruncanita stuartiformis* (Dalbiez)
3. *Globotruncanella havanensis* (Voorwijk)
4. *Heterohelix globulosa* (Ehrenberg)
5. *Marginotruncana undulata* (Lehmann)
6. *Pseudoguembelina costulata* (Cushman)
7. *Pseudotextularia* sp.
8. *Pseudotextularia elegans* (Rzehak)
9. *Bolivina witwickae* (Gawor-Biedowa)
10. *Bolivinoides* sp
11. *Fissurina* sp.
12. *Fissurina orbigyana* (Seguenza)
13. *Dentalina* sp.
14. *Gaudryina pyramidata* (Cushman)
15. *Nodosaria obscura* (Reuss)
16. *Pseudonodosaria* sp.





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