

Foraminiferal assemblages of upper cretaceous from the Manipur Ophiolite belt at Naothalung and Mova blocks in Hungpung, Ukhrul district, Manipur state, Northeast India

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Abstract: Fifty nine (59) geological samples were systematically collected from the exotic limestone blocks of the Manipur ophiolite belt at Hungpung village, Ukhrul district, Manipur. The study area lies within 94°20'17" & 94°20'43" East longitudes and 25°02'43" & 25°02'71" North latitude. These limestone block is mainly composed of micritic limestone, chert, sandstone, marl and a matrix of flyschoid rocks and usually hard, calcitic crystalline. 10 genera and 25 species planktic foraminifera are identified and recognised six (6) biozone from the blocks of Naothalung and Mova. Viz., *Globotruncana ventricosa*, *Globotruncanita calcarata*, *Globotruncanella havanensis*, *Globotruncana aegyptiaca*, *Gansserina gansseri*, *Abathomphalus mayaroensis*.

Keywords: Upper cretaceous, Exotic Limestone, Manipur Ophiolite Belt, NE India

1. INTRODUCTION

Manipur is a small state having an area of about 22,327 km². The state is located in the eastern corner of India which is a part of Northeast India, bordering with the Myanmar (Burma) in the eastern and southern part, Nagaland on the north, Assam on the west and Mizoram on the south – western part. It lies between 23°50' N – 25°41' N latitudes and 93°00'E – 94°45'E longitudes. The state are made up of Cretaceous and Tertiary sedimentary rocks and associated with minor igneous and metamorphic rocks with pelagic sediments viz: chert, limestone, shale and sandstone [1]. The eastern part of the state is occupied more by the older group of rocks, i.e. the Metamorphic Complex which encompass the Ophiolite Mélange Zone [2], [3]. The Naga-Manipur Ophiolites (NMO) forms a part of the Tethyan ophiolites in the NNE-SSW trending Indo-Myanmar Orogenic Belt (IMOB) which has been interpreted as an accretion prism resulting from the convergence between the Indian plate and Myanmar plate [4], [5] and these region ophiolites are located within the accretionary prism [6]. Oldham [7] one of the earliest workers gave a broad geological account of Manipur and described the occurrence of cretaceous flysch associated limestone at Ukhrul, Manipur. Clegg [8] reported that similar limestone from the adjoining Burma (Myanmar) part of the Indo-Burmese range and suggested a cretaceous age to these exposures. Some workers investigate and studied on the carbonate rocks associated with Ophiolite in this region including [2], [9], [10], [11].

The pelagic limestones and chert of these region of the exotic blocks in the Melange zone of Ukhrul area provided data on deep oceanic sediments in Late Cretaceous and their subsequent abduction along the eastern margin of the Indian plate [12]. Chungkham and Caron [13] correlate the foraminifers assemblages of Ukhrul Melange zone with the wild flysch zone of Switzerland of the Tethys Sea and studied the preserved assemblages of Foraminifera and Coccoliths from the pelagic limestones of Melange zone of Manipur ophiolite belt of Ukhrul area. So far, many workers including [3], [11], [12], [13], [14] stated that the pelagic limestone of these region are dated as Late Cretaceous (Late Santonian to Late Maastrichtian) The present study is to document the foraminiferal assemblages and age of the pelagic limestone blocks of Naothalung area and Mova at Hungpung, Ukhrul region, Manipur Ophiolite Belt.

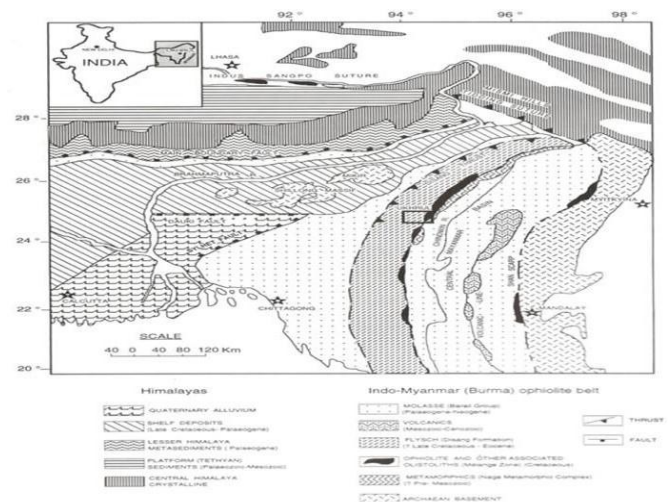


Figure 1. Geotectonic Sketch Map of North-Eastern India and the Adjoining Regions (After Acharyya et al and Mitchel (1993).

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2. GEOLOGICAL SETTINGS

This ophiolite complex is haphazardly juxtaposed along faults or they consist of lensoid slices interbedded with Disang group of rocks. The lower Disang sediments were intermixed with pelagic cherts and limestone [15]. The ophiolites and the associated suite of rocks are exposed in Manipur which is in the eastern border between India and Burma (Figure.1), along these a part of northerly extension Sunda Arch –Trench System linking the Alpine - Himalayan and the Andaman – Nicobar Islands [5], [14], [16], [17]. Olistolith blocks trending NE-SW and NNE-SSW in the area has been referred middle Eocene to Palaeocene age [3], [18]. The microfacies in carbonate rocks as fossiliferous micrite, sparse biomicrite and packed biomicrite. Close association of carbonates with the pelagic sediments suggests deposition above carbonate compensation-depth [5]. The eastern part of India plate collided with the Eurasia and the ophiolites of Naga – Andaman belt are attributed to the ongoing Andaman – Java subduction activity which began since Cretaceous in time and extends northward in space [19], [20], [21]. Mukhopadhyay and Dasgupta [22], [6], [11] stated that these ophiolites are located within the accretionary prism. The state is mainly made up of Tertiary and Cretaceous along with the minor igneous and metamorphic rocks associate with sediments such as limestone, chert, shale and sandstone [1]. Based on the faunal assemblages (radiolarian, nannocoliths and planktonic foraminifera), the Naga-Manipur ophiolites has been assigned as Cretaceous to Paleocene [14], [11]. The presence of rare arenaceous and benthic foraminifera, plant fragments and Ophiomorpha-type burrow structures in the Disang and Barail sediments indicate that these rocks were deposited in a shallow marine to deltaic setting [17].

3. STUDY AREA

The study area of Naothermal blocks and Mova block are located at Hungpung village, which is in a hilly region (1750 meters above the MSL) and a part of the -Mélange zonell in Ukhrul District, Manipur. The outcrops of the limestones are exposed alongside incredible thickness of Upper Disang shales on the eastern and western ridges. Highly fossiliferous limestone deposits on the upper part of Disang Group with an olistostromal deposits varying in dimensions from a few meters to 1 km. The present study area lies within 94°20'17" and 94°20'43" East longitudes and 25°02'43" and 25°02'71" North latitude at the distance of 4 km from the Hungpung Kazipphung village and 76 kms from the east of Imphal (capital of Manipur). Three blocks recognised in this area of Naothermal and represent as Naothermal North (NA), Naothermal South West (NB) and Naothermal South (NC). The limestone are generally massive, fine-grained, cream white in colors, varying shades of grey, and brown, and highly jointed at places and the study area are well covered by vegetation (Figure 2). And further down towards the south another block at Mova block (M) which is 1 km away (Figure.3). These limestone are hard, fine-grained, massive compact and creamy white in colors. The microfossils of foraminiferal from these study area are comprise of planktic foraminifera. These exotic limestone blocks

compiled of micritic limestone, sandstone, marl, basic rocks were recognised. so far, the foraminiferal assemblage of limestone suggests Upper Cretaceous (Maastrichtian) to Oligocene age supporting a range by their exotic nature in the mélange zone [18]. And it has been reported that the olistolith limestone deposit of pelagic limestones and chert could be hitherto dated as Late Cretaceous (Late Santonian to Late Maastrichtian) [3], [5], [11], [12], [13], [14].



Figure 2. (1) Sample collection from Naothermal blocks. (2) Sample Collection from Mova Blocks.

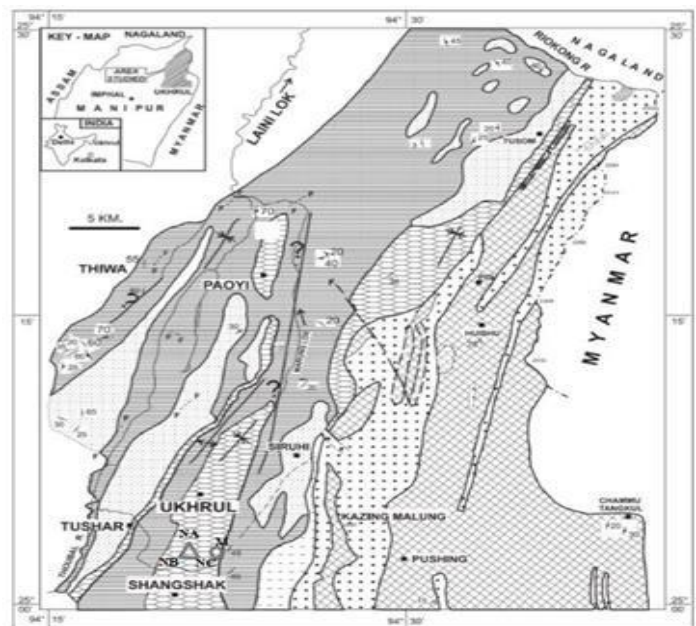


Figure 3. Geological Sketch Map of the Study Area, After Joshi and Vidyadharan, (2008)

4. METHODS

Fifty nine (59) geological samples were systematically collected and processed for the study of foraminiferal assemblages from the four limestone blocks at Naothermal area and Mova block in Hungpung Village. In the field, the samples are collected in a systematic manner where the limestones are exposed. Before obtaining a sample, the surface of the exposure needs to be cleared of weathered material and packed in a sample bag. The samples were collected from various litho-units and 500 gm of each sample is taken for Micro paleontological analysis. Due to hard and crystalline, they do not break down easily under the process of normal treatment of Hydrogen Peroxide. After treatment various

methods and trials, finally the limestone could be break down with the help of a modified version of a maceration technique developed by Zolnaj [23].

5. DESCRIPTION OF PLANKTONIC FORAMINIFERAL ZONES

The foraminifers are taxonomically classified using the -Foraminiferal Genera and Their Classification by Loeblich and Tappan [24] and Biostratigraphic classification followed by Robaszynski and Caron [25].

5.1 *Abathomphalus mayaroensis*

Category: Total range zone

Definition: The zone of *Abathomphalus mayaroensis* was defined by Bronnimann [26]. It was defined that the interval of total range of *Abathomphalus mayaroensis*.

Remarks: This zone marks the presence of the marker foraminiferal species *Abathomphalus mayaroensis*, where the *Abathomphalus mayaroensis* appear from the base Nc block of samples Nc04 till the top of M Block M01. The associated planktonic foraminifera are: *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanita angulata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Gansserina gansseri*, *Abathomphalus mayaroensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P. intermedia*.

5.2 *Gansserina gansseri*

Category: Interval zone

Definition: The zone of *Gansserina Gansseri* Interval zone was defined by Bronnimann [26]. It defined that the zone marks the interval from first occurrence of *Gansserina gansseri* to first occurrence of *Abathomphalus mayaroensis*.

Remarks: The zone marks due to the occurrence of marker planktonic foraminiferal species *Gansserina gansseri*. where the *Gansserina gansseri* appear the first in the Nc04 and marks at the top M01. It ranges from Late Campanian to Early Maastrichtian. The associated planktonic foraminifera are *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanita angulata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Gansserina gansseri*, *Abathomphalus mayaroensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P. intermedia*.

5.3 *Globotruncana aegyptiaca*

Category: Interval range zone

Definition: The zone of *Globotruncana aegyptiaca* Interval range zone was defined by Caron [27]. It defined that the zone marks the interval from the first

occurrence of *Globotruncana aegyptiaca* to first occurrence of *Gansserina gansseri*.

Remarks: This zone marks the presence of the marker foraminiferal species *Globotruncana aegyptiaca*. The associated planktonic foraminifera are *Globogerinelloides ultramicra*, *G. prairiehillensis*, *G. volutus*, *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanita angulata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P. intermedia*.

5.4 *Globotruncanella havanensis*

Category: Partial range zone

Definition: The zone of *Globotruncanella havanensis* Partial range zone was defined by Caron [27] as the range was nominate taxon between the last occurrence of *Globotruncanita calcarata* to first occurrence of *Globotruncana aegyptiaca*.

Remarks: The zone are mark where the *Globotruncanella havanensis* appear at the first in the NA16 of last occurrence of *Globotruncanita calcarata* and first appear in the NC04 of *Globotruncana aegyptiaca*. The important planktonic foraminifera recognized in this zone are: *Globogerinelloides ultramicra*, *G. prairiehillensis*, *G. volutus*, *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanita angulata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P. intermedia*.

5.5 *Globotruncanita calcarata*

Category: Total range zone

Definition: The *Globotruncanita calcarata* Total range zone was defined by Herm [28].

Remarks: This zone marks the interval of total range of *Globotruncanita calcarata*. This zone assigned as Late Campanian which is a total range due to occurrence of marker foraminifera species *Globotruncanita calcarata*, where the first appear in the Na07 and the last occurrence in the Nb16. The important planktonic foraminifera recognized in this zone are: *Globogerinelloides ultramicra*, *G. prairiehillensis*, *G. volutus*, *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanita angulata*, *G.calcarata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P. intermedia*.

5.6 *Globotruncana ventricosa*

Category: Interval Zone

Definition: The zone of *Globotruncana ventricosa* Interval Zone was defined by Dalbiez [29].

Remarks: This zone marks due to the occurrence of marker planktonic foraminiferal species *Globotruncana ventricosa*. It ranges from the *G.ventricosa* zone to *G.Gansseri* zone that is Early Campanian to Late Maastrichtian. The associated planktonic foraminifera are: *Globogerinelloides ultramicra*, *G. prairiehillensis*, *G. volutus*, *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanella angulata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P.intermedia*.

SERIES	STAGES	THICKNESS (m)	LITHOLOGY	SAMPLE NO	PLANKTONIC FORAMINIFERA																						
					<i>Globogerinelloides ultramicra</i>																						
					<i>Globogerinelloides ultramicra</i>	<i>Heterohelix globulosa</i>	<i>Contusotruncana fornicata</i>	<i>C.patelliformis</i>	<i>Globotruncana aegyptiaca</i>	<i>G.arca</i>	<i>G.bulloides</i>	<i>G.linneiana</i>	<i>G.orientalis</i>	<i>G.ventricosa</i>	<i>Globotruncanella angulata</i>	<i>G.conica</i>	<i>G.pettersi</i>	<i>G.stuarti</i>	<i>G.stuartiformis</i>	<i>G.subspinosa</i>	<i>Globotruncanella havanensis</i>	<i>Gansserina gansseri</i>	<i>Abathomphalus mayaroensis</i>	<i>Pseudoguembelina costulata</i>	<i>Pseudotextularia elegans</i>	<i>P.intermedia</i>	
Upper Cretaceous	Maastrichtian	10m	MOVA BLOCK	V01																							
				V02																							
				V03																							
				V04																							
				V05																							
				V06																							
				V07																							
				V08																							
				V09																							
				V10																							
	Maasichian	15m	NAO THALUNG C BLOCK	N01																							
				N02																							
				N03																							
				N04																							
				N05																							
				N06																							
				N07																							
				N08																							
				N09																							
				N10																							
	Campanian	30m	NAO THALUNG B BLOCK	NC1																							
				NC2																							
				NC3																							
				NC4																							
				NC5																							
Campanian	30m	NAO THALUNG A BLOCK	NA01																								
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Table.1. Distribution chart of the planktic foraminifera from the four limestone blocks.

6. RESULT AND CONCLUSION

A wide distribution of planktic foraminifers are found to be vary from rare to high and well preserved. Foraminiferal are yield in good result of all the sample collected, 10 genera and 25 species of planktic foraminifera are found in this study area. The study of Naothalung blocks and mova block recognized the age from the Late Campanian to Late Maastrichtian. Presence of the marker planktonic foraminifera species established six biozone, (i) *Abathomphalus mayaroensis* Total range zone (ii) *Gansserina gansseri* Interval zone (iii) *Globotruncana*

aegyptiaca Interval range zone (iv) *Globotruncanella havanensis* Partial range zone (v) *Globotruncanita calcarata* Total range zone (vi) *Globotruncana ventricosa* Interval Zone. The planktic foraminifera obtained in the present study are as follows: *Globogerinelloides ultramicra*, *G. prairiehillensis*, *G. volutus*, *Heterohelix globulosa*, *Contusotruncana fornicata*, *C.patelliformis*, *Globotruncana aegyptiaca*, *G.arca*, *G.bulloides*, *G.linneiana*, *G.orientalis*, *G.ventricosa*, *Globotruncanita angulata*, *G.calcarata*, *G.conica*, *G.pettersi*, *G.stuarti*, *G.stuartiformis*, *G.subspinosa*, *Globotruncanella havanensis*, *Gansserina gansseri*, *Abathomphalus mayaroensis*, *Pseudoguembelina costulata*, *Pseudotextularia elegans*, *P.intermedia*.

PLATE I

- 1. *Globogerinelloides ultramicra*
- 2. *Globogerinelloides prairiehillensis*
- 3. *Globigerinelloides volutus*
- 4. *Heterohelix globulosa*
- 5. *Contusotruncana fornicata*
- 6. *Contusotruncana patelliformis*
- 7. *Globotruncana aegyptiaca*
- 8. *Globotruncana arca*
- 9. *Globotruncana bulloides*
- 10. *Globotruncana linneiana*
- 11. *Globotruncana orientalis*
- 12. *Globotruncana ventricosa*

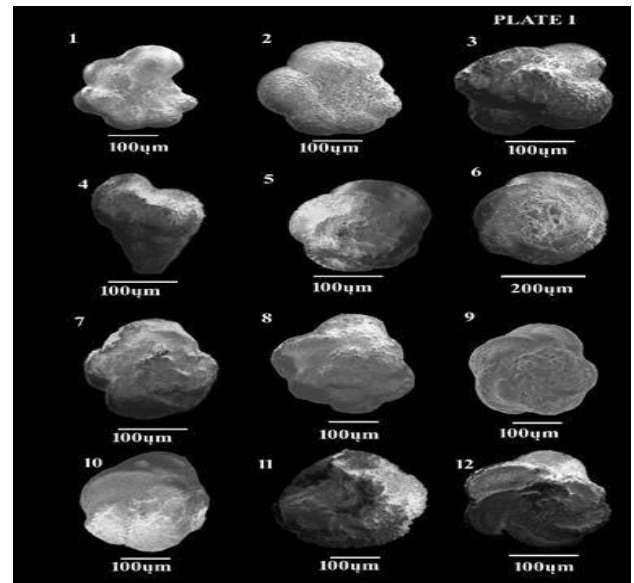
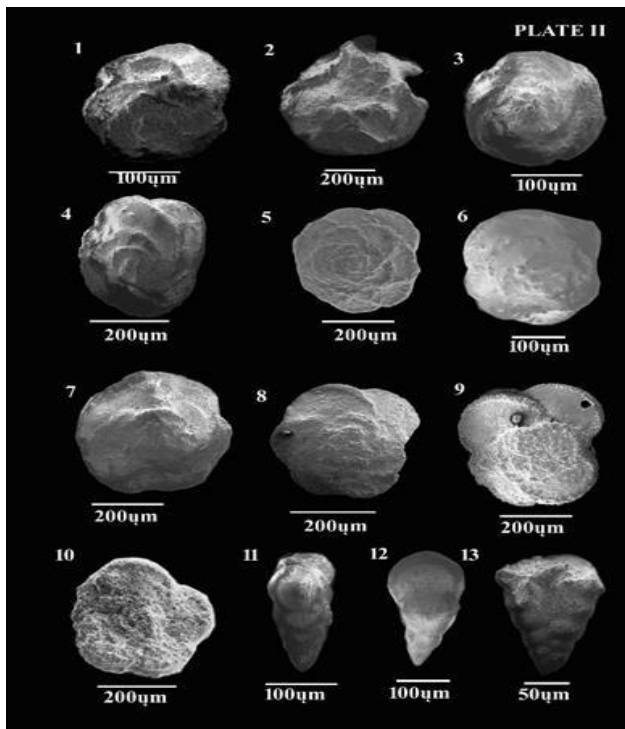


PLATE II

- 1. *Globotruncanita angulata*
- 2. *Globotruncanita calcarata*
- 3. *Globotruncanita conica*
- 4. *Globotruncanita pettersi*
- 5. *Globotruncanita stuarti*
- 6. *Globotruncanita stuartiformis*
- 7. *Globotruncanita subspinosa*
- 8. *Globotruncanella havanensis*
- 9. *Gansserina gansseri*
- 10. *Abathomphalus mayaroensis*
- 11. *Pseudoguembelina costulata*
- 12. *Pseudotextularia elegans*
- 13. *P.intermedia*



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