

Stratigraphic position of the Hnget-Taung Formation; evidence from Mega and Microfossils, Goyangyi Kyun and Migyaunggaung Kyun, Ngayoekaung Area, Ngaputaw Township, Ayeyarwady Region

Khin Mar Than¹, May Si Tun², Kyu Kyu Win³, Kaung Sithu⁴

Abstract

The study area is located in the Southwest of Pathein, 114 kilometers (70.8 miles) far from Pathein along the Pathein-Nga Yoke Kaung motor way and its distance is about 4.8 kilometers (3 mile) west of Nga Yoke Kaung. It lies in one inch topographic map No. 85L/2 and 85L/6. It is bounded by the Latitude between 16° 30' to 16° 37' N and Longitude 94° 14' to 94° 22' E. The foraminiferal biostratigraphy of the Hnget-taung Formation, Nga Yoke Kaung Area, Ngaputaw Township has been carried out and it based on a total of 34 limestones, and 25 shales samples collected from the Goyangyi Kyun and Migyaunggaung Kyun, Areas. The faunal assemblage of *Elphidium advena*, *Asterorotalia trispinosa*, *Rotalia koeboeensis*, *Rotalia annectens* are found in the shallow marine, especially near shore environment and Late Miocene in age. Hnget-taung Formation is richly fossiliferous containing *Turritella* sp., *Conus* sp., *Pecten* sp., *Ostrea* sp., and corals. *Turritella* sp. appears to be characteristic of sublittoral (inner neritic) environments. The environmental condition of the lower part of the formation is very shallow marine (littoral) in origin as suggested by the development of cross-bedding, ripple marks, and the occurrence of *Turritella* sp., *Pecten* sp., has been usually used as an indicator of brackish water environment. The development of clay-pebble conglomerates, concretionary sandstones and fossiliferous gritty sandstones suggest an unstable condition indicating a near shore area. Hnget-Taung Formation is Late Miocene in age.

Keywords: Goyangyi Kyun and Migyaunggaung Kyun, near shore environment, Late Miocene

Introduction

Location and size

Nga Yoke Kaung Area (Goyangyi Kyun, Migyaunggaung Kyun, Sabahta Kyun, Thamote Taung and Tite Chi Tauk, Areas) comprises the southwestern coastal region of Rakhine Yoma and Bay of Bengal lies in the west. Regionally, the study area stressed extremely southwest corner of the Ayeyawady Delta Basin. The study area is unducted in the Southwest of Pathein, 114 kilometers (70.8 miles) far from Pathein along the Pathein - Nga Yoke Kaung motor way and its distance is about 4.8 kilometers (3 mile) west of the Nga Yoke Kaung Area (see figure 1). It lies in one inch topographic map No. 85L/2 and 85L/6. It is bounded by the Latitude between 16° 30' to 16° 37' N and Longitude 94° 14' to 94° 22' E.

The Age for the Hnget-taung Formation

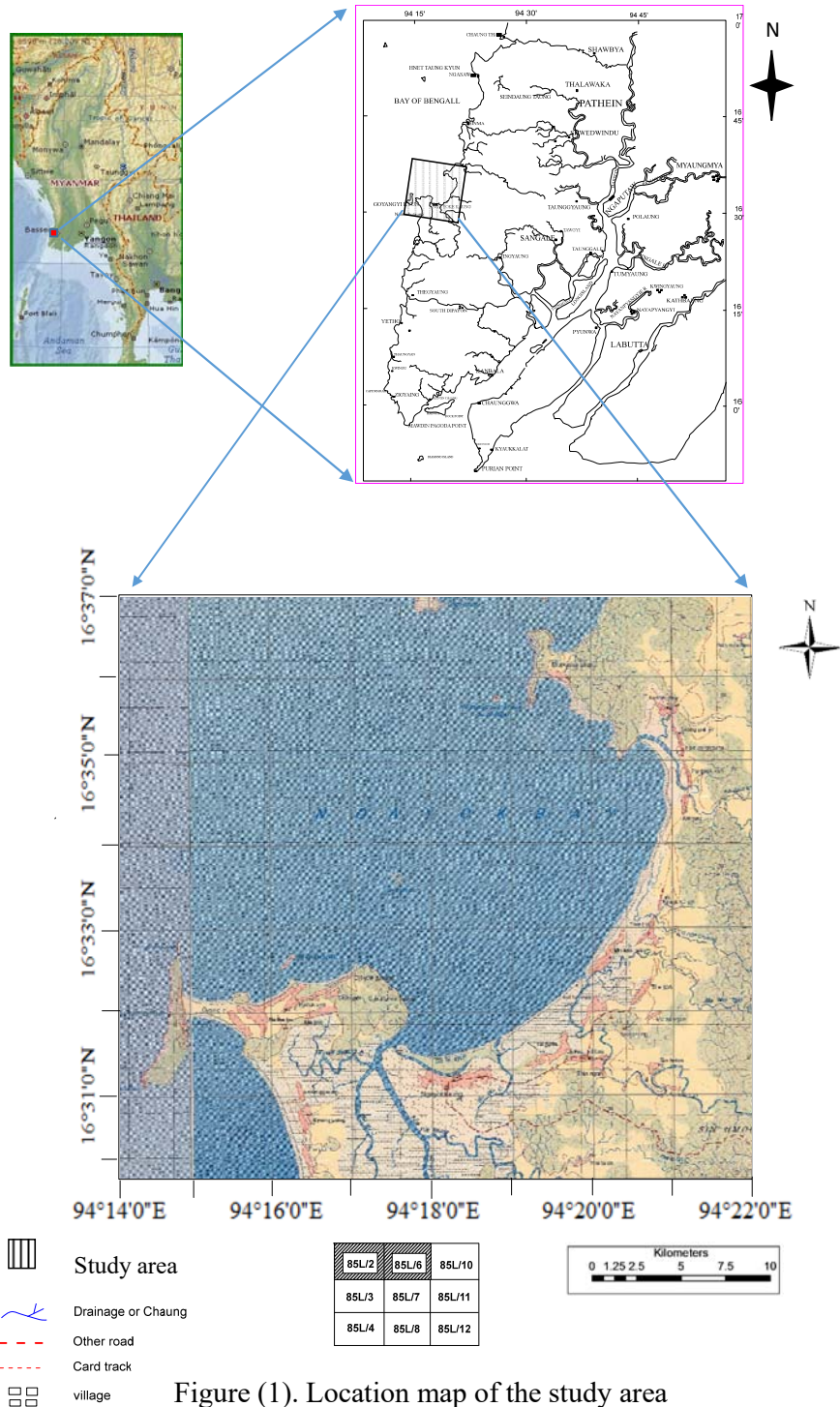
The flooded to abundant occurrence of *Globorotalia menardii* has been recorded in the Hnget-taung Formation, especially in the Migyaunggaung area (Samples 5a – 5f). The *Globorotalia menardii* is a distinct zonal species established by Bolli (1957, 1966). The *Globorotalia menardii* Zone is definitely assigned to Neogene Zone 15, which can be recognized the lower most horizon of the Hnget-taung Formation. Besides this, the upper limit of the formation is marked by the last appearance of *Globorotalia mayari* and first appearance of *Globorotalia acostaensis*. Both the species are present in the uppermost part of Hnget-taung Formation, in association with *Globorotalia menardii* B. According to this part

^{1, 4} Assistant Lecturer, Department of Geology, Pathein University

² Associated Professor, Department of Geology, Pathein University

³ Assistant Lecturer, Department of Geology, Yenanchaung Degree College

of formation, that it defined as the *Globorotalia acostaensis* zone, which coincides with the Neogene zone 16 of Boli (1970) see in Table (1). Therefore, the age of Hngettaung Formation ranges from Neogene Zone 15 to Neogene Zone 16 which is placed to upper part of Middle Miocene to early Late Miocene. According to chronological determination by Berggren and others (1985), the Hnget-taung Formation is assigned to upper part of Middle Miocene to early Late Miocene, i.e, Serravallian and Lower Part of Tortonium.



Mega and Micropaleontology

Fauna Distribution of the Nga Yoke Kaung Area (Goyangyi Kyun Area, Migyaunggaung Kyun, Sabahta Kyun, Thamote Taung and Tite Chi Tauk)

The fauna from the Nga Yoke Kaung Area (Goyangyi Kyun, Migyaunggaung Kyun, Sabagta Kyun, Thamote Taung and Tite Chi Tauk) sections is a typical assemblage, consisting of (36) foraminiferal species, and (6) larger fossils. The Hnget-taung Formation is characterized by the richness of foraminiferal species. The Goyangyi Kyun is quite distinct by the scarcity of fauna, as compared to the Migyaunggaung Kyun, where the species occur fairly common to abundant as shown in (Table 2). Among them, abundance species are *Asterorotalia multispinosa*, *Asterorotalia trispinosa*, *Calcarina calcar* var.4&5, *Rarotalia ozawai*, and common species are *Valvulineria* sp. and *Quinqueloculina* sp. are occurred. The foraminiferal species of larger foraminifera is 6, and abundance species are *Amphistegina* sp., *Rotalia* sp. and *Cycloclypeus* sp. According to Admans, (1970), the Range of some larger Foraminifera in the Indo-west Pacific Region see (Table 3), *Amphistegina* sp., *Cycloclypeus* sp., *Rotalia* sp. from the prominent outcrops of Goyangyi Kyun, Thamote Taung, Sabatar Kyun and Migyaunggaung Kyun Areas and Megafossils of *Turritella*, *Pecten*, *Conus* indicating the Late Miocene in age see in figure (a-z). There are 18 genus and 39 species are occurred in the planktonic and benthonic species see (Table 3). Hnget-taung Formation is richly fossiliferous containing *Turritella* sp., *Conus* sp., *Pecten* sp., *Ostrea* sp., and corals.

An assemblage of foraminiferal species in the study area is as follows.

Larger Foraminiferas

1. *Amphistegina radiate*
2. *Cycloclypeus* sp.
3. *Lepidocyclina* sp.
4. *Discocyclina* spp.
5. *Amphistegina* sp.
6. *Miliolid* sp.

Benthonic Species

1. *Rotalia annecten*
2. *Elphidium crispum*
3. *Rotalia sumatrana*
4. *Spiroloculina dentate*
6. *Cibicides wuellerstorfi*
7. *Bolivina sumatrensis*
8. *Asterorotalia multispinosa*
9. *Elphidium advenum*
10. *Cibicides koeboeensis*
11. *Cibicides foxi*
12. *Quinqueloculina seminulum*
13. *Streblus beccarri* var.1
14. *Reussella simplex*,
15. *Valvulineria demonti*
16. *Asterorotalia trispinosa*
17. *Calcarina calcar* var 2
18. *Rotalia calcar*
19. *Rotalia ozawai*
20. *Quinqueloculina* sp.2
21. *Calcarina calcar* var 4&5
22. *Elphidium incertum*
23. *Bolivina bilaensis*
24. *Rotalia murrayi*
25. *Planorbilina acervalis*
26. *Textularia candeiana*
27. *Rotalia beccarii* (linne) var.2 ssw
28. *Nodosaria* sp.
29. *Spiroloculina* sp.
30. *Cymbaloporetta squamosa*
31. *Spiroloculina exima*
32. *Pararotalia ozawi*
33. *Quinqueloculina lamaricicna*
34. *Milionella* sp.

Planktonic Species

1. *Globorotalia menadii*
2. *Globorotalia mayeri*
3. *Globorotalia menadii* B

Table (1). Showing the stratigraphic range of planktonic species within Neogene Zone 15 and Neogene Zone 16 Bolli and Saunders: (1985) Oligocene to Holocene low latitude planktic foraminifera

AGE	PLANKTIC FORAMINIFERAL ZONES and SUBZONE	N/P ZONES	Species
Eocene	L	N21	<i>Globorotalia tozaniensis tozaniensis</i>
	M	N20	<i>Globorotalia miocenica</i> <i>Gr. trilob. fistulosus</i>
	E	N19	<i>Globorotalia margaritae</i>
	E	N18	<i>Gr. marg. evoluta</i> <i>Gr. marg. margaritae</i>
Miocene	L	N17	<i>Globorotalia humerosa</i>
	L	N16	<i>Globorotalia acostasensis</i>
	L	N15	<i>Globorotalia menardii</i>
	L	N14	<i>Globorotalia mayeri</i>
	M	N13	<i>Globigerinoides ruber</i>
	M	N12	<i>Globorotalia foksi robusta</i>
	M	N11	<i>Globorotalia foksi lobata</i>
	M	N10	<i>Globorotalia foksi foksi</i>
	M	N9	<i>Globorotalia foksi peripheroronda</i>
	E	N8	<i>Praeorbulina glomerata</i>
	E	N7	<i>Globigerinotella insueta</i>
	E	N6	<i>Catapsydrax stainforthi</i>
E	N5	<i>Catapsydrax dissimilariis</i>	
E	N4	<i>Globigerinoides primordius</i>	
Oligocene	L	P22/N3	<i>Globorotalia huqisi</i> <i>Globigerina ciperoensis ciperoensis</i>
	M	P21/N2	<i>Globorotalia opima opima</i>
	E	P20/N1	<i>Globigerina ampliapertura</i>
		P18/N3	<i>Cassig. Chlipoensis/Pseudohast. AN</i>

Table 2. Showing the distribution of Foraminiferal species present in the shale exposed along the Migyaunggaung Area

Planktonic species	Formation
1 <i>Globorotalia mayeri</i>	VR
2 <i>Globorotalia menardi B</i>	VR
3 <i>Globorotalia menardi</i>	R
Benthonic species	
4 <i>Praeorbulina acornuta</i>	
5 <i>Asterorotalia multiplicata</i>	
6 <i>Asterorotalia triplicata</i>	R
7 <i>Bolivina bilazensis</i>	
8 <i>Bolivina sumatrensis</i>	
9 <i>Rosella simplex</i>	
10 <i>Calcarina calcar var. 2</i>	A
11 <i>Calcarina calcar var. 4&5</i>	VR
12 <i>Cymbaloporeta squamosa</i>	VR
13 <i>Chilides foxi</i>	VR
14 <i>Chilides koebenensis</i>	R
15 <i>Chilides wuellerstorfi</i>	VR
16 <i>Ephelium crispum</i>	R
17 <i>Ephelium incertum</i>	C
18 <i>Ephelium advenum</i>	VR
19 <i>Milondella sp. 1</i>	R
20 <i>Quinqueoculina seminulum</i>	VR
21 <i>Quinqueoculina lamarkiana</i>	VR
22 <i>Nodosaria sp.</i>	R
23 <i>Quinqueoculina sp. 2</i>	VR
24 <i>Rotalia beccarii</i>	R
25 <i>Rotalia calca</i>	R
26 <i>Rotalia ozawa</i>	R
27 <i>Rotalia sumatrana</i>	R
28 <i>Rotalia murroyi</i>	C
29 <i>Rotalia amictos</i>	R
30 <i>Streba beccarii var. 1</i>	VR
31 <i>Spiraloculina sp.</i>	VR
32 <i>Spiraloculina dentata</i>	VR
33 <i>Spiraloculina esima</i>	VR
34 <i>Pararotalia ezawi</i>	VR
35 <i>Testularia candana</i>	VR
36 <i>Valvulineria demontii</i>	VR

ENCY EXPLANATION

V RARE (1 SPECIES), R=RARE (2-5 SPECIES), C=COMMON (6-8 SPECIES), A= ABUNDANT (9-15 SPECIES)

Table (3). Showing the Range of some larger Foraminifera in the Indo-west Pacific Region (Adams, 1970)

	EOCENE		OLIGOCENE			MIOCENE			PLIOCENE	PLEISTOCENE	RECENT
	MID	UPPER	Lr	MID	UPPER	Lr	MID	UPPER			
	Ta3	Tb	Tc	Td	Lower Te	Upper Te	Lower Tf	Upper Tf	Tg		
1 <i>Spiroclypeus</i> spp.	?	■	■	■	■	■					
2 <i>Borasis pygmaeva</i>		■	■	■	■	■					
3 <i>Austrorillina asmariensis</i>			■	■	■	■					
4 <i>Lepidocyclina (Eulipedina) spp.</i>			■	■	■	■					
5 <i>Lepidocyclina (Nephrolepidina) spp.</i>			■	■	■	■		?			
6 <i>Lepidocyclina (N) carva</i>				■	■	■	?				
7 <i>Austrorillina striata</i>				■	■	■					
8 <i>Miogypsinoides</i> spp.				■	■	■	■				
9 <i>Cycloclypeus eidae</i>				■	■	■	■				
10 <i>Archaias venderviarke</i>				■	■	■	■				
11 <i>Lepidocyclina (N) sumatransis</i>				■	■	■	■				
12 <i>Miogypsina</i> sp.					■	■	■	?			
13 <i>Mandropsina anahensis</i>					■	■	■				
14 <i>Miogypsinoides dehaart</i>					■	■	■				
15 <i>Flosculinella raicheli</i>					■	■	■				
16 <i>Flosculinella globulosa</i>					■	■	■	?			
17 <i>Miogypsina tarcideselarmis</i>					■	■	■				
18 <i>Lepidocyclina flesuosa</i>					■	■	■				
19 <i>Lepidocyclina (N) inflata/acula</i>					■	■	■				
20 <i>Lepidocyclina (N) japonica</i>					■	■	■	?			
21 <i>Gypsina marigoensis</i>					■	■	■				
22 <i>Miogypsinoides cupulaelarmis</i>					■	■	■				
23 <i>Cycloclypeus posteidae</i>					■	■	■				
24 <i>Austrorillina howchini</i>					■	■	■				
25 <i>Marginogora vertebralla</i>							■	■	■	■	■
26 <i>Lepidocyclina (N) Martini</i>							■	■	■	■	■
27 <i>Cycloclypeus indepeticicus</i>							■	■	■	■	■
28 <i>Orbulina</i> spp.							■	■	■	■	■
29 <i>Flosculinella banlangensis</i>							■	■	■	■	■
30 <i>Barella male male</i>							■	■	■	■	■
31 <i>Lepidocyclina (N) terreroi</i>							■	■	■	■	■
32 <i>Cycloclypeus (k) annulatus</i>							■	■	■	■	■
33 <i>Barelis malo curdica</i>							■	■	■	■	■
34 <i>Tabarina malabarica</i>							■	■	■	■	■
35 <i>Peneroplia targensis</i>							■	■	■	■	■
36 <i>Lepidocyclina (T) radiata</i>							■	■	■	■	■
37 <i>Alveolinella tennemai</i>							■	■	■	■	■
38 <i>Lepidocyclina (T) rudiens</i>							■	■	■	■	■
39 <i>Cycloclypeus radialus/stellatua</i>							■	■	■	■	■
40 <i>Lepidocyclina (T) orientalis</i>							■	■	■	■	■
41 <i>Lepidocyclina (T) talahabensis</i>							■	■	■	■	■
42 <i>Cycloclypeus cargenteri/guembathanus</i>							■	■	■	■	■
43 <i>Alveolinella quayi</i>							■	■	■	■	■
44 <i>Boralis sehlumbergeri</i>							■	■	■	■	■
45 <i>Asterorotalina pulchalla</i> group							■	■	■	■	■

Legend	
■	range proven
■	range uncertain
?	doubtful record (s)



Figure (a and b) *Pectens*



Figure (c and d) *Conus*

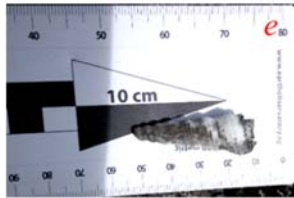


Figure (e and f) *Archimediella*



Figure (g) *Cirsotrema*



Figure (h and i) *Crassatella*



Figure (j and k) *Clavilithes*



Figure (l and m) *Polymesoda*



Figure (n) *Colpophyllia*



Figure (o) *Septastraea*

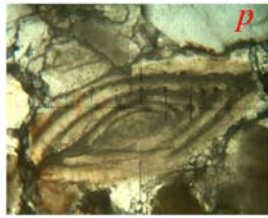


Figure (p) *Amphistegina radiate*

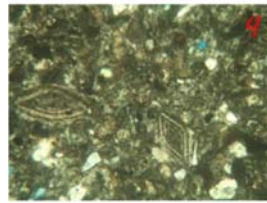


Figure (q and r) *Amphistegina* sp.

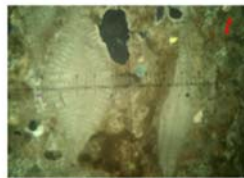
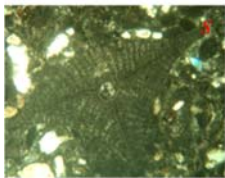
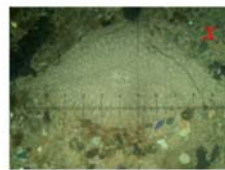
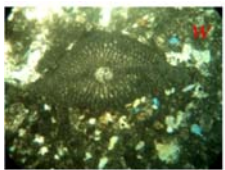


Figure (s and t) *Discocyclina dispansa*

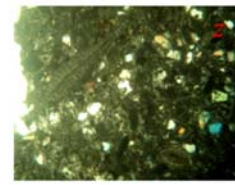
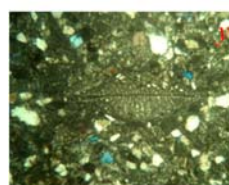


Figure (u and v) *Miliolids* sp.



0 0.5 mm

Figure (w and x) *Lepidocyclus* sp.



0 0.5 mm

Figure (y and z) *Cycloclypeus* sp.

Results and finding

The foraminiferal biostratigraphy of the Hnget-taung Formation, Nga Yoke Kaung Area, Ngaputaw Township has been carried out and it based on a total of 34 limestones, and 25 shales samples collected from the Nga Yoke Kaung Area (Goyangyi Kyun, Migyaunggaung Kyun, Sabahta Kyun, Thamote Taung and Tite Chi Tauk Areas). The general consensus is that the sandy limestone unit (Hnget-taung Formation by U Tin Aung Han 1976) exposed to the near-shore and offshore islands along the western coast of Southern Arekan are Miocene rather than Eocene in age. A typical assemblage, consisting of (36) foraminiferal species, and (6) larger fossils. All of them are recognized with bear a large number of foraminiferas. This consensus is reached on the basis of Miocene microfossils (e.g., *Cycloclypeus* sp.) and typical Miocene megafossils (e.g., *Turretella* sp., *Pecten* sp., and *Conus* sp) were collected during the trip.

The Miocene sandy limestone unit is molassic in lithologic character and is probably a fore reef facies. It has gentle westerly and northerly dips. Paw Tun (1977) assigned the age of Hnget-taung Formation to Miocene by the species. *Amphistegina* sp., and *Cycloclypeus* sp. with some megafossils of *Turretella* sp., *Pecten* sp., and *Conus* sp.

Discussion and Conclusion

Abundant occurrence of *Amphistegina* sp., *Cycloclypeus* sp., *Rotalia* sp. from the prominent outcrops of Goyangyi Kyun, Migyaunggaung Kyun, Sabahta Kyun, Thamote Taung and Tite Chi Tauk Areas. The Goyangyi Kyun is quite distinct by the scarcity of fauna, as compared to the Migyaunggaung Kyun, where the species occur fairly common to abundant. Hnget-taung Formation is richly fossiliferous containing *Turritella* sp., *Conus* sp., *Pecten* sp., *Ostrea* sp., and corals. *Turritella* sp. appears to be characteristic of sub-littoral (inner neritic) environments. The environmental condition of the lower part of the formation is very shallow marine (littoral) in origin as suggested by the development of cross-bedding, ripple marks, and the occurrence of *Turritella* sp., *Pecten* sp., has been usually used as an indicator of brackish water environment. Hnget-Taung Formation is Late Miocene in age.

Acknowledgements

We would like to express our special gratitude to Dr. Si Si Hla Bu, Rector of Patheingyi University and Dr. Nilar Myint and Dr. Than Tun, Prorectors of Patheingyi University, for their kind helps during this research works. Special thanks are also due to Dr. Thein Naing, Professor and Head and Dr. Khin Mar Phyu, Professor of Department of Geology, Patheingyi University, for letting me to do this research. The authors kindly express their thanks to Dr. May Si Tun, Associated Professor, Patheingyi University, for continuous guidance and supervision during this research works. We are also indebted to the editors of the Research Journal, for their critical reading that greatly helped in improving the draft manuscript.

References

- Adams, C.G, 1970. A reconsideration of the East Indian Letter Classification of the Tertiary. Bull British Museum (Natural History) 19:3, pp. 87-131 (Paleontology).
- Bolli, H.M and Saunders, J.B., 1985. Oligocene to Holocene Low Latitude Planktonic Foraminifera. Planktonic Stratigraphy, Chapter 6, pp. 255-262. Cambridge University press.
- Bolli, H.M., 1957. "Planktonic Foraminifera from the Oligocene-Miocene Cipero Formation and Lengua Formation of Trinidad, British West India", U. S. Nat. Mus. Bull. 215, pp. 97-123, pl. 22-29, text figs. 17-21.
- Tin Aung Han, 1976. Geology of the country between Padaung-Taunggup, Sandoway and Ngapali area. Department Report (Unpublished).

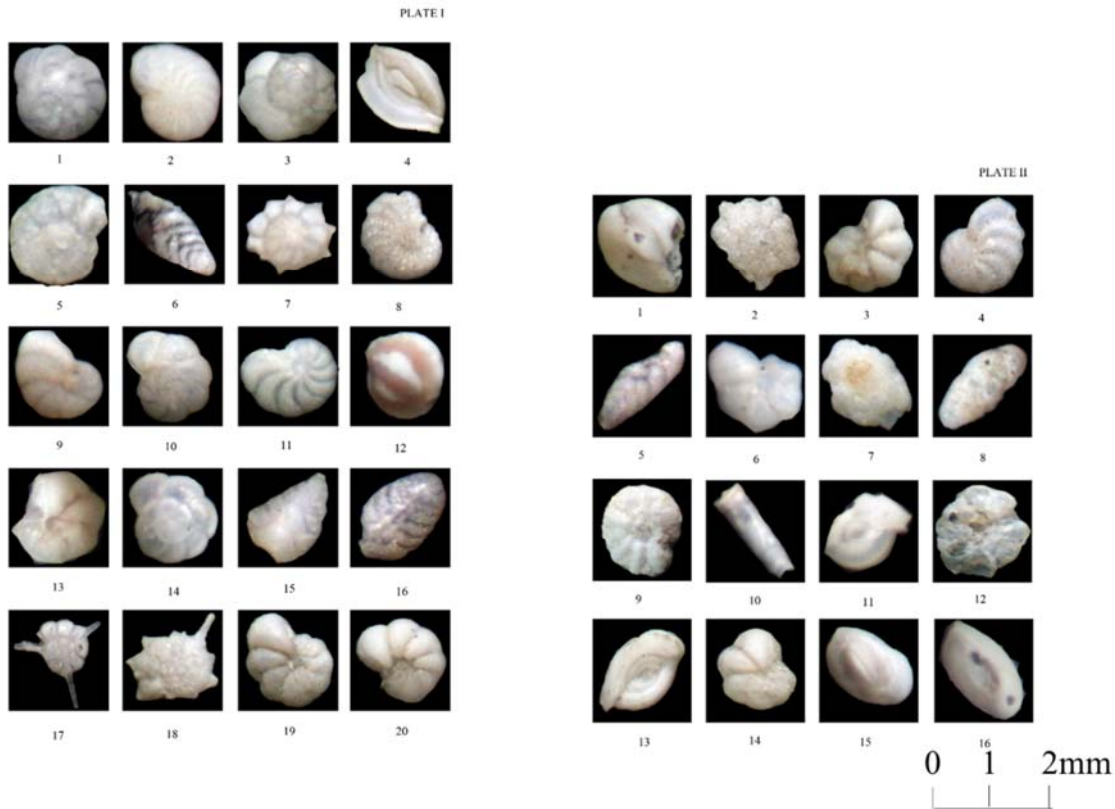


PLATE. I EXPLANATION

1. *Rotalia annecten*
2. *Elphidium crispum*
3. *Rotalia sumatrana*
4. *Spiroloculina dentate*
5. *Cibicides wuellerstorfi*
6. *Bolivina sumatrensis*
7. *Asterorotalia multispinosa*
8. *Elphidium advenum*
9. *Cibicides koeboeensis*
10. *Globorotalia mayeri*
11. *Cibicides foxi*
12. *Quinqueloculina seminulum*
13. *Globorotalia menardii*
14. *Streblus beccarii* var.1
15. *Reussella simplex*,
16. *Valvulineria demonti*
17. *Asterorotalia trispinosa*
18. *Calcarina calcar* var 2
19. *Rotalia calcar*
20. *Rotalia ozawai*

PLATE. II EXPLANATION

1. *Quinqueloculina* sp.2
2. *Calcarina calcar* var 4&5
3. *Globolotalia menardii* B
4. *Elphidium incertum*
5. *Bolivina bilaensis*
6. *Rotalia murrayi*
7. *Planorbililina acervalis*
8. *Textularia candeiana*
9. *Rotalia beccarii* (linne) var.2 ssw
10. *Nodosaria* sp.
11. *Spiroloculina* sp.
12. *Cymbaloporetta squamosa*
13. *Spiroloculina exima*
14. *Pararotalia ozawi*
15. *Quinqueloculina lamaricicna*
16. *Milionella* sp.1