Pliocene-Pleistocene Calcareous Nannoplankton Biostratigraphy, Section Banyuurip, Rembang Zone, East Java Basin, Indonesia

By

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Presentation Outline

1. Introduction
2. Methode
3. Result & Discussion
4. Conclusion
5. Reference

Introduction

Pliocene to Pleistocene

The Pliocene-Plistocene was the most important moment in the geological history of Java. At this time, an orogenic process occurs causing the formation of mountains, folds, and faults in a relatively short time and covers a narrow area in the form of fold-thrust belt of Kendeng Mountain and the Rembang Anticlinorium, etc.

Introduction

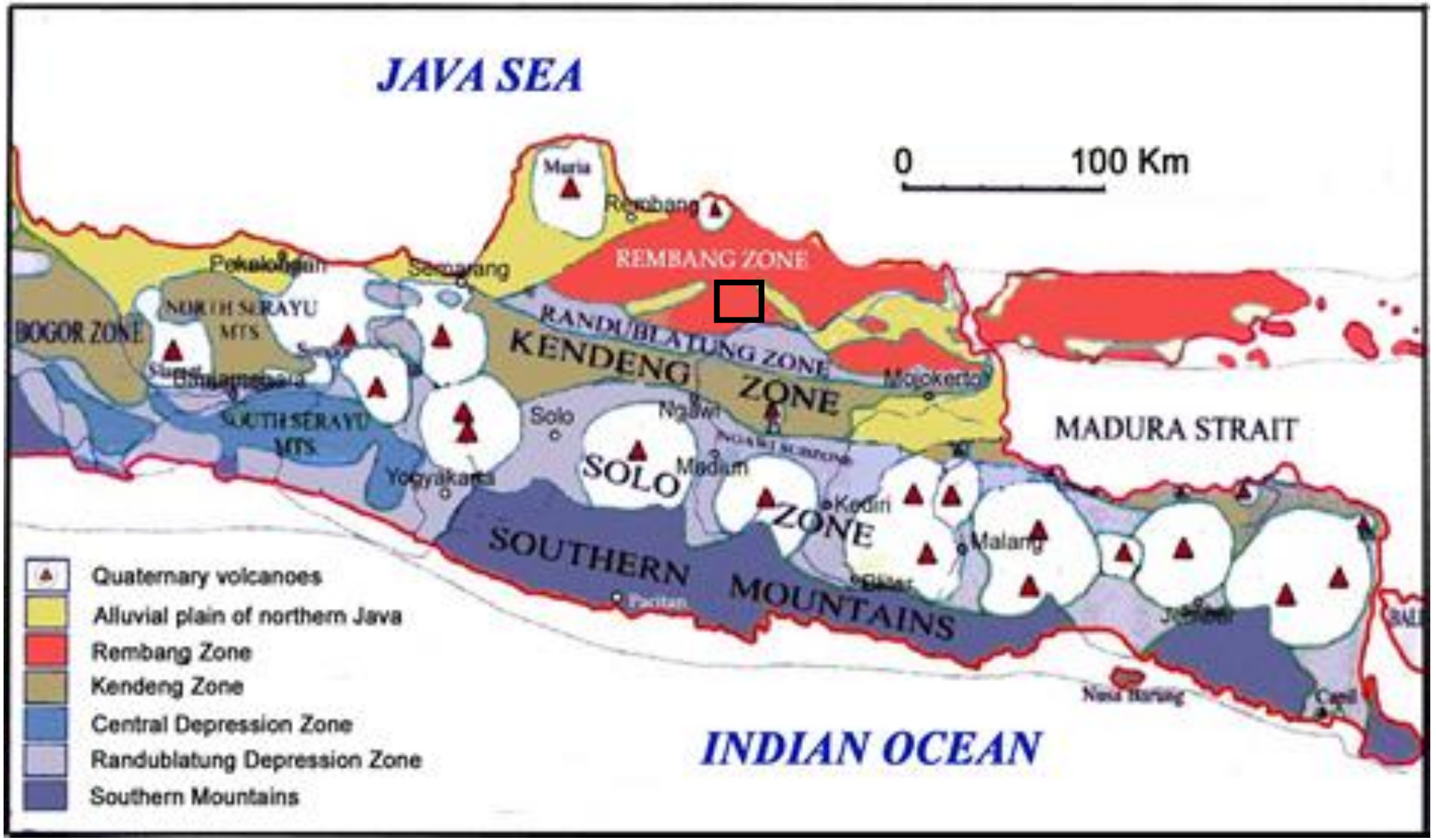

FIGURE 1. Physiography of East Java Basin [1]

Pliocene: At this time the North East Java Basin experienced a transgression where the the limestone of Paciran Formation was deposited that was not aligned above the Tuban Formation. This formation is quite widespread and is dominated by limestone with shallow marine environment [2].

Pleistocene: a regression phase occurs with the deposition of Kabuh Formation (terrestrial environment) and unconformable with the above Paciran Formation [2]. In some places the Kabuh Formation was deposited in a transitional environment. At this time there was also an extreme climate change (glaciation), a drastic fall in the temperature of the earth which hit most of the world, including Indonesia and resulted in the formation of the configuration of the Indonesian archipelago as it is today [3].

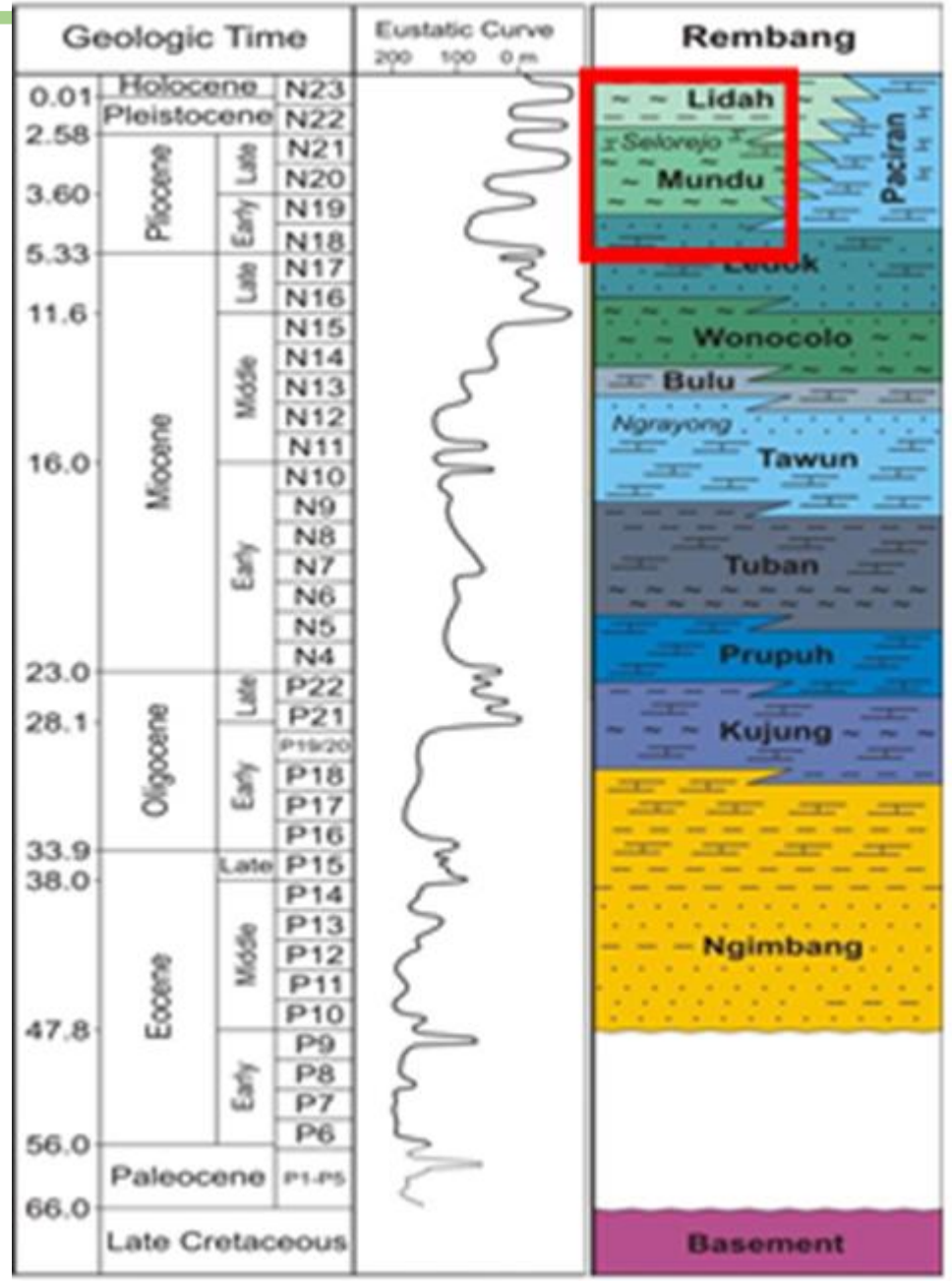

FIGURE 2. Regional Stratigraphy of Rembang Zone [2]

Methods

This research method uses two-steps

1. Mapping:
   - Observation of lithology
   - Measurement Section (2 lines sections), of the Mundu and Lidah Formation.
   - The rock sampling are systematic and the total sample are 41 samples.
2. Laboratorium analysis: from selected sample: fine-grain, contain of calcareous (marl, shale, limestone)

Methods

Preparation method:

- Smear slide method.
- This method uses of objective glass, and determined by a polarizing microscope at 1000 x magnification (parallel and cross Nicol) and SEM (Scannig Electrone Microscope) at 10.000 x magnification .
- Species identified using taxonomic remarks by

  Martini (1971), Okada and Bukry (1980), Perch and Nielsen (1985), Aubry (1985) and Nannotax3 website.

- Biostratigraphy Zone determination uses Martini (1971). This zone is still in use today

Result & Discussion

Pliosen to Plistosen Stratigraphy
of the study area composed of :
3 units, in the older to younger are
- Ledok Formation (upper Ledok),
- Mundu Formation,
- Lidah Formation.

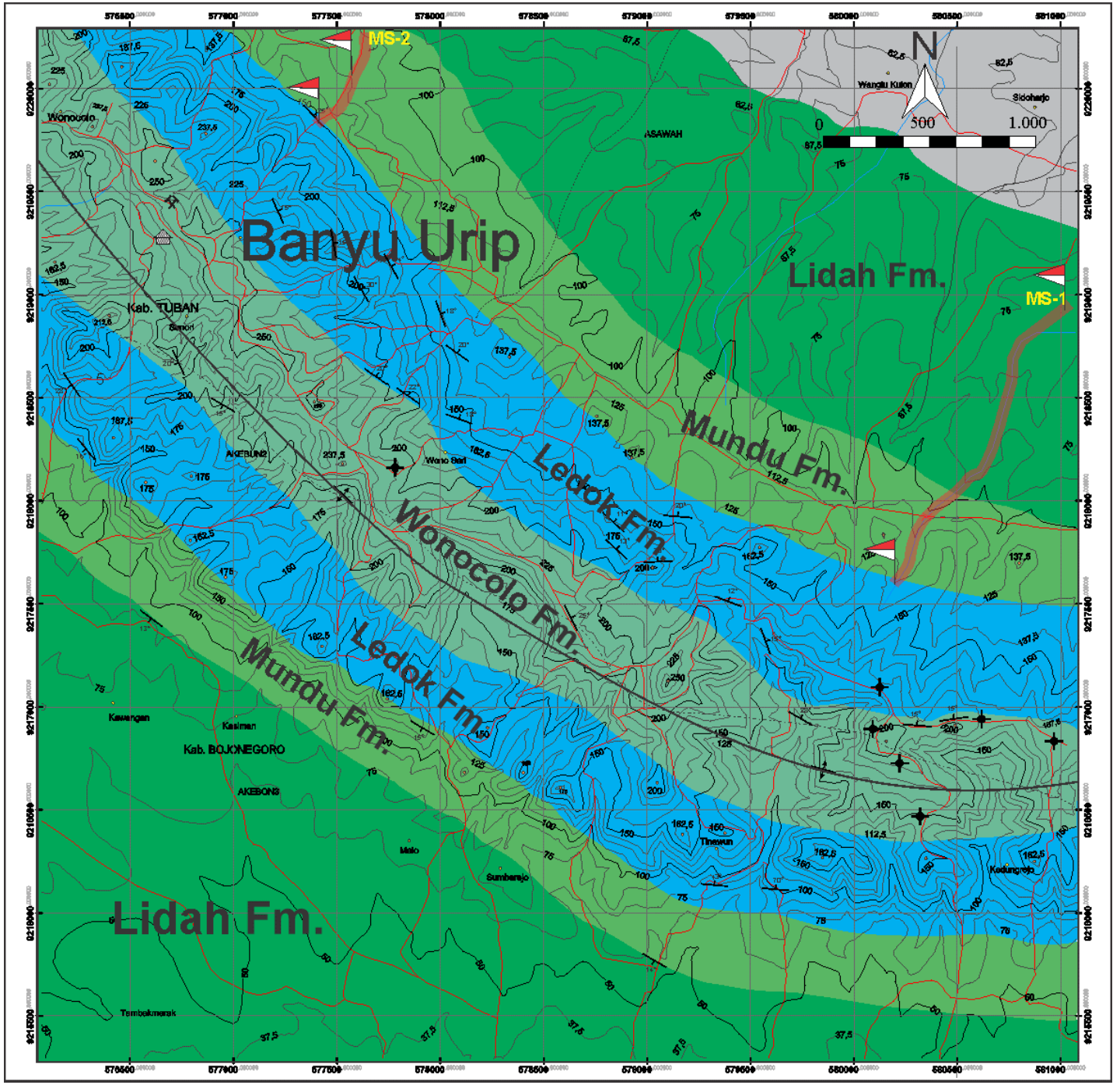

FIGURE 3. Geological Map and Measurement Section

Calcarenite Unit of Ledok Formation

The unit is dominated by calcarenite, with intercalation of limestone, calcarenite, marl and and sandy limestone and also contains a lot of the glauconite.

Age of this unit is NN11-NN13 (Late Miocene to Middle Pliocene), while based on foraminifera in regional stratigraphy is N16 to N17/Late Miocene [3].

Bathymetry environment of 100m to 200m or outer neritic and thickness of the unit around 150-200 meters [7, 8].

FIGURE 4. The sedimentary structures are massive, lamination, parallel bedding and cross bedding

Marl Unit of Mundu Formation

This unit is dominated by marl, very thick, massive structure, containing many foraminifera, so it is known as Mundu Marl. Characteristic color of this lithology is bluish-gray and brownish-white “Fig. 5”. Stratigraphically it is conformable with calcarenite unit of Ledok Formation. Age of this unit is NN13 to NN16 (Early Pliocene to Middle Pliocene) on the basis of First Occurrence (FO) *Discoaster asymmetricus* and Last Occurrence (LO) *Reticulofenestra pseudoumbilicus* and *Discoaster surculus* [7, 8, 9, 10, 11]. The bathymetry of the unit is upper bathyal to lower bathyal (200-2000) meters [12, 13] while the thickness is (150-200) meters.

FIGURE 5. Characteristic color of this lithology is bluish-gray and brownish-white, structures are massive of the Marl of Mundu Formation

Calcareous claystone Unit of Lidah Formation

This unit is dominated by calcareous claystone and claystone, massive structure and there are fragments of mollusc shells “Fig. 6”. This unit is NN16 to NN18 (Middle Pliocene-Late Pliocene) based on last occurrence of *Reticulofenestra pseudoumbilicus, Discoaster surculus, Discoaster pentaradiatus, Discoaster brouweri* [7, 8, 9, 10, 11]. This unit was deposited of the inner bathyal to upper bathyal (200-500) meters [12, 13], and the thickness of 170-200 meters.

FIGURE 6. Calcareous claystone and claystone, massive structure and there are fragments of mollusc shells the Calcareous claystone Unit of Lidah Formation

TABLE 1. Nanofossil analysis results of study area

No	Species\ Sample code	Wonocolo Formation						LEDOK FORMATION																	MUNDU FORMATION																			LIDAH FORMATION						
		Marl						Limestone																	Marl																			Calcareous Claystone						
		Late Miocene						Late Miocene																	Pliocene																			Pleistocene						
		NN 9		NN 10							NN11											NN 12			NN 13		NN14					NN 15			NN 16		NN 17					NN 18		NN 19						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1	*Cd. leptoporus*	R		R	R				R		R						R	R		R	R	R		R	R		R	R				R			R	R	R	R	R	F	R		F			F	R	R	R	R
2	*Cd. macintyrei*				R											R	R			R	C	R								R											R		F		R	R	R	R	R	R
3	*C. cristatus*																																											R			R			
4	***C rugosus *)***																								> **R**														R						R					
5	*Cc. pelagicus*	R		R	F						F		F		R		R	R				R	R	R		R		R	R	R			R	R							F	F	R	R	R	R	R	F	F	F
6	*Cy. nitescens*													R	F	R	R	R		R	R	R		R		R	R	F	F	R	R			F	R															
7	***D. asymmetricus *)***																										> **R**	R	R		R	R	R	R	R				R		**R** <									
8	*D. bellus*			R	R		R		R		R								R																															
9	*D. braarudii*	R							R					R																																				
10	***D. brouweri *)***		R		R		R		R		R	R				R						R	R		R	R	R	R	8	R	R		R	R	R	R		8	R	R	R	R	**R** <							
11	***D. hamatus *)***		**R** <																																															
12	*D. neohamatus*	R	R	R														R																																
13	*D. neorectus*			R					R																																									
14	*D. pansus*																																	R																
15	*D. pentaradiatus*								R								R	R		R	R	R		R						R	R	R	R	R	R				R											
16	***D. quinqueramus *)***										> **R**					R	R	R			**R** <																													
17	***D. surculus *)***																			R					R	R	R		R							**R** <														
18	*D. triradiatus*																															R											R						R	R
19	*D. variabilis*																			R	R	R		R		R						R	R				R		R											
20	***G. caribbeanica *)***																																											> **R**	R	R	R	R	R	R
21	*G. small*																																R		R	R		R		R		F	R	R	R	R	R	C		R
22	*Hy. perplexus*								R											R	R	R		R	R	R		R	R		R		R	R	R	R		R	R	R	R	R	R							
23	*H. carteri*		R	R			R		R					R			R	R			R	R	R	R	R	R		R				R						R	R				R				R	R	R	R
24	*H. sellii*																					R	R		R	R	R	R	R	R	R	R		F	R	R	R	R	F	R	F		R							
25	*H. wallichii*			R	R								R	R	R	R	R			R	R	R			R				R	R		R								R	R	R			R	R	R			
26	*Oo. fragilis*																															R		F	R	R	7		R		R	R		R	R	R	R	R		
27	*P. discopora*			R				R														R	R		R	R	R	R	R	R	R	R		R	R			R	R	R			R				R	R	R	
28	*P. japonica*																R			R	R	R			R										R		R		R											R
29	***Ps. lacunosa *)***																															> **R**	R	C	R	R	F	R	F	R	F		R	R	R	R	R		R	**R**
30	*R. minuta*	C	R	C	A	C	F	F	R	R	C	F	F	C	A	F	C	F	F	A	A	A	C	A	A	A	A	A	A	A	A	A	C	A	C	A	A	A	A	A	A	C	C	F	R	R	F	C	C	C
31	*R. minutula*	R			R	R			R	R					F	R	R		R	C	C	A	F	C	C	F	F	F	C	C		R	R	F	R	C	C	C	C	F	F	R	F	R		R	R	R	R	R
32	*R. pseudoumbilicus*														R						F	F	R	F	C	C	R	R	R	C	R	R	R	**R** <																
33	*Scy. globulata*																R				R	R	R	R		R	R		R	R			R	R																
34	*Scy.lagena*																	R																R		R														
35	*Scy. pulcherrima*																																							R	R			R	R			R	R	R
36	*S. abies*	R		R	F				R		F	C	F	C	C	R	F	R	R	C	C	C	F	C	C	C	C	C	C	F	F	R	C		C	F	R		R	R	R		R	R	R	R	R			R
37	*S. neoabies*								R	R	C	F	F	R	F	R	F	F	R	C	C	C	C	A	F	C	R	F	F	R	R		A	R	A	C														

Notes: *): Index of nannofossil (■ for determine of zonation biostratigraphy), > First Occurrence (FO) /First Appearance (FO), < Last Occurrence (LO) /Last Appearance (LO)

Abundance of Nannofossils species: A (Abundant), C (Commond), F (Few), R (Rare)

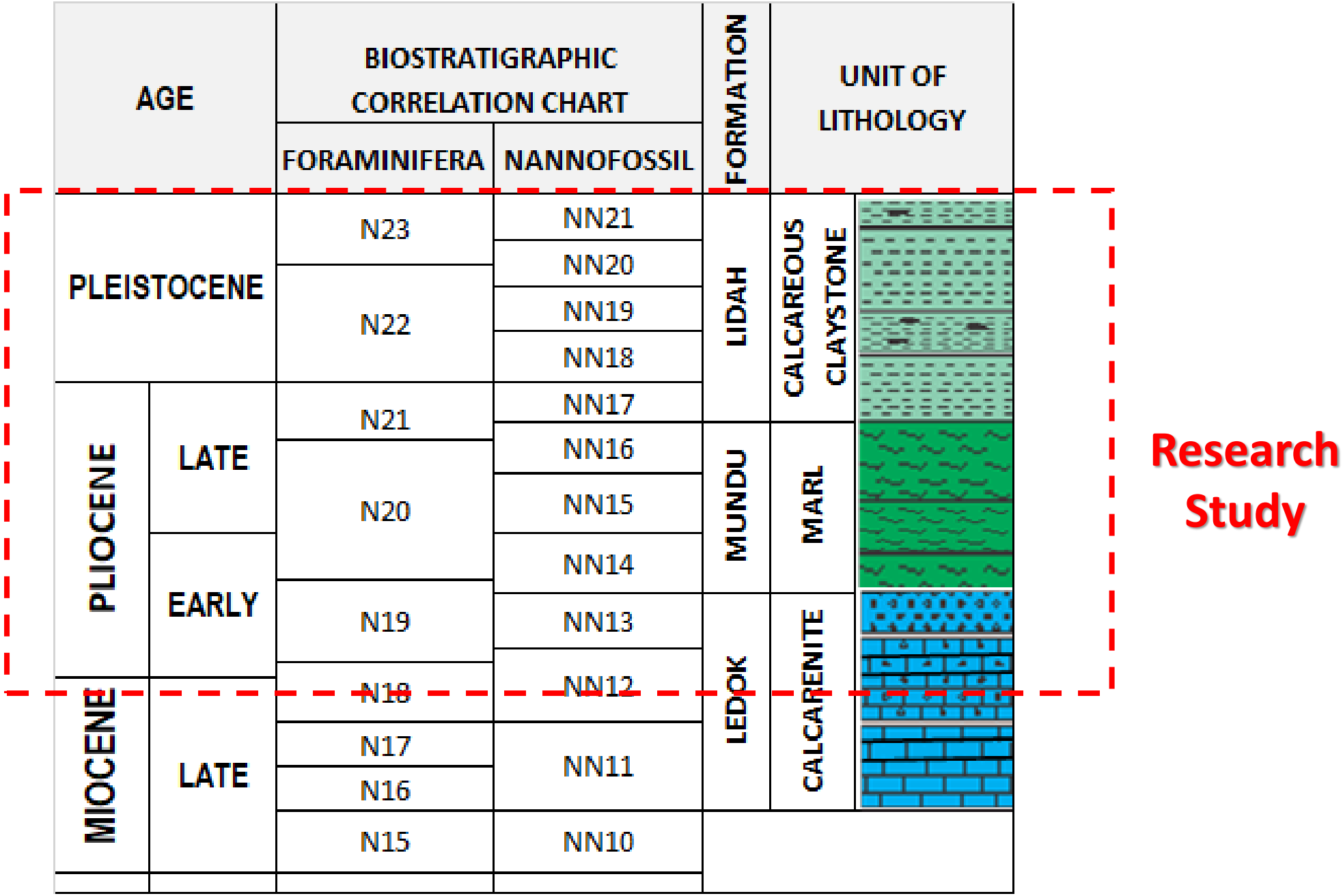

FIGURE 7. Local Stratigraphy (2019)

Biostratigraphy

1. The relative age based on FA and LA of certain species.
2. Biostratigraphic analysis using Martini, 1971
3. Fossil range and datum plane.
4. Based on sampling on the MS section (70 samples)
5. The results of nannoplankton analysis are in table 2.
6. Biostratigraphy Zone : 10 zones

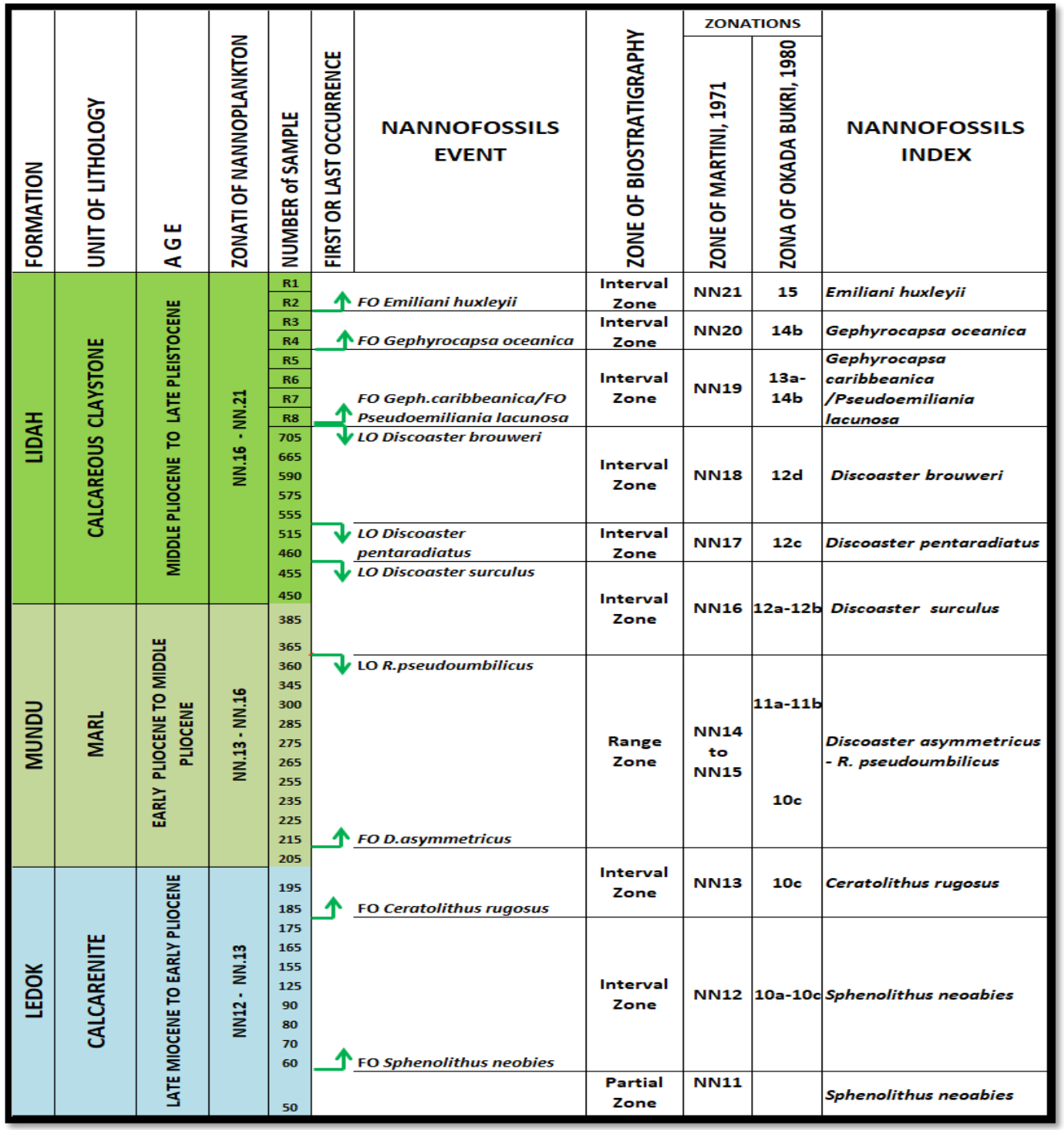

TABLE 2. NANNOFOSSIL ZONATION SCHEME MODIFIED WITH MARTINI (1971) AND OKADA BUKRY (1980)

Conclusion

Stratigraphy of this study based on nannofosils is Late Miocene (Early Pliocene) to Late Pleistocene (NN12 to NN21).

The stratigraphic sequence from older to younger are:

1. Calcarenite Unit of Ledok Formation (upper part of Ledok) is Late Miocene to Early Pliocene/NN12 to NN13), was deposited in the outer Neritic (100-200) meters.
2. Marl Unit of Mundu Formation is Early Pliocene-Middle Pliocene (NN13 to NN16) in the upper bathyal to lower bathyal (200-2000) meters.
3. Calcareous claystone Unit of Lidah Formation is Middle Pliocene to Late Pleistocene (NN16 to NN21), was deposited in the Inner Neritic to upper bathyal (200-500) meters.

Conclusion

The Biostratigraphic of the study area consists of 9 zones, from Pliocene to Early Pleistocene.
These Zone are :

1. Interval Zone of *Sphenolithus neoabies* Zone (NN12)
2. Interval Zone of *Ceratolithus rugosus* Zone (NN13)
3. Range Zone of *Discoaster asymmetricus* to *Reticulofenestra pseudoumbilicus* Zone (NN14 to NN15)
4. Interval Zone of *Discoaster surculus* Zone (NN16)
5. Interval Zone of *Discoaster pentaradiatus* Zone (NN17)
6. Interval Zone of *Discoaster brouweri* Zone (NN18)
7. Interval Zone of *Gephyrocapsa caribbeanica* Zone or *Pseudoemiliania lacunose* Zone (NN19)
8. Interval Zone of *Gephyrocapsa oceanica* Zone (NN20)
9. Interval Zone of *Emiliania huxleyi* Zone (NN21).

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THANK YOU

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