STRATIGRAPHIC ANALYSIS OF RAJAMANDALA FORMATION AND CITARUM FORMATION BASED ON OUTCROPS DATA

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ABSTRACT

The location of study area is in Padalarang, West Java with Rajamandala Formation and Citarum Formation outcrop as observation object. Rajamandala Formation is characterized by shallow marine deposit and carbonate sedimentary rock. Meanwhile, Citarum Formation is identified as deep marine deposit and consists of clastic sedimentary rock. The methods used in this study are fieldwork, laboratory analysis, data interpretation, and stratigraphic analysis. Laboratory analysis consists of petrographic analysis and foraminiferal analysis. The contact between these formations is not identified in study area. Outcrop observation exposes improper data to determine the stratigraphic relation, since covered by debris materials of limestone. Foraminiferal analysis data shows that Rajamandala Formation is formed in Late Oligocene (Lower Te/P20 – P22/N1 – N3) and Citarum Formation is formed in Middle Miocene (N9 – N13). It shows gap of time from N3 until N9. It determines an uncorformity stratigraphic relation between these two formations. The depositional environment changes significantly from shallow marine to deep marine. Study area exposes outcrops data which represent these formations and other additional data needed. It offers a good opportunity to determine the stratigraphic relation between these two formations. Furthermore, it can be used as analogue in determining stratigraphic relation.

Keywords: Formation, Miocene, Oligocene, Stratigraphy, Unconformity.

INTRODUCTION

Study area is situated in Padalarang, West Java where two major formation discovered; Rajamandala Formation (Oml) with limestone composition and Citarum Formation (Mtb, Mts) with Citarum Formation (Mts,Mtb) fine to coarse clastic sedimentary rocks (Figure 1).

During Late Oligocene, Bogor Basin developed and formed Rajamandala Formation in transgression condition. In Miocene time, Bogor Basin filled up with deep marine sediments with considerable turbidites and volcanic debris flows and formed Citarum Formation as lower part of Miocene deposit (deposited in Early Miocene) (Koesoemadinata, 1984).

Most of Rajamandala Formation consists of layered limestone and in some places founded as reef. This formation is generally exposed on highest morphology with steeply slope. The depositional environment of this formation is concluded in shallow marine (Martodjojo, 1984).

Citarum Formation is characterized by clastic sedimentary rock deposit. Lower part of this formation consists of siltsone with sandstone inset and breccia. Sedimentary structure develops as graded bedding, parallel lamination, and cross lamination structures. This formation is believed as deep marine deposit (Wisesa., et.al., 2018, Koesoemadinata, 1984, Martodjojo, 1984).

These formations is bounded by conformity relation (Baumann, 1972 in Martodjojo, 1984). However, the contact is generally covered by debris material of limestone. Therefore, the stratigraphic relation between these formations is not confirmed.

Study area exposes outcrops data which represent these formations and other additional data needed. It offers a good opportunity to determine the stratigraphic relation between these two formations.

METHODS

The methods used in this study are fieldwork, laboratory analysis, data interpretation, and stratigraphic analysis. Fieldwork produces 98 outcrop data and 2 lithological log data which represent Rajamandala Formation and Citarum Formation (Figure 2) (Figure 4). Laboratory analysis is divided into 2 types, those are petrographic analysis and foraminiferal

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analysis. Petrographic analysis is used to describe the outcrop samples in thin section. Foraminiferal analysis can determine relative age dating (planktonic foraminiferal analysis) and bathimetry zone (benthonic foraminiferal analysis). All of the processed data is combined together and analyzed to determine the stratigraphic relation between Rajamandala Formation and Citarum Formation, it is done in stratigraphic analysis.

RESULTS

Rajamandala Formation

Based on outcrop observation, Rajamandala Formation consists of packstone limestone (Dunham, 1962) with white color, grain supported texture (60% - 70% component and 30% - 40% matrix). Foraminifera fossils dominate the limestone composition as component.

Petrographic analysis shows that packstone (Dunham, 1962) as the class of selected sample from this formation. The limestone comes with grayish white color with clay as cement, well sorted, and grain supported fabric in thin section from selected sample (sample SA93) (Figure 5).

Foraminiferal analysis shows that depositional process occurred in Late Oligocene (Lower Te) and situated in Inner Neritic – Middle Neritic bathymetry zone (shallow marine depositional environment). It is obtained by foraminiferal analysis from selected sample (sample SA93) (Table 1).

Citarum Formation

Citarum Formation in outcrop observation is mainly exposed as sandstone with breccia and siltstone inset. It has gray color, very fine – medium sand grain size, rounded – sub angular roundness, well – medium sorted, and exposed with graded bedding and parallel lamination structure. Breccia with andesitic rock component and silstone show up as an inset in some outcrop locations.

Petrographic analysis shows that feldspathic wacke (Pettijohn, 1975) as the class of selected sample from this formation. The sandstone comes with grayish white color, medium sorted, and grain supported fabric. Lithic fragment and some minerals such as quartz, plagioclase, opaque, carbonate, pyroxene, and chlorite can be found in thin section from selected sample (sample SA19) (Figure 5).

Foraminiferal analysis shows that depositional process occurred in Middle Miocene (N9 – N13) and situated in Outer Neritic - Upper Bathyal bathymetry zone (deep marine depositional environment). It is obtained by foraminiferal analysis from selected samples (sample SA17, SA30, SA42, and SA71) (Table 1).

Stratigraphic Relation

The contact between these formations is not identified in study area. Outcrop observation exposes improper data to determine the stratigraphic relation, since covered by debris material of limestone. Thrust fault appears as structural boundary between these formations. This geological structure thrusts Rajamandala Formation toward Citarum Formation (Figure 3).

This study is continued with focus on foraminiferal analysis. Foraminiferal analysis data shows that Rajamandala Formation formed in Late Oligocene (Lower Te/P20 – P22/N1 – N3) and Citarum Formation formed in Middle Miocene (N9 – N13) (Table 1). It shows gap of time from N3 until N9. It determines an uncorformity stratigraphic relation between these two formations and it may caused by non-depositional event. The depositional environment changes significantly from shallow marine to deep marine. It may represents the geological event that occur in gap of time.

CONCLUSION AND DISCUSSION

All the data have processed and analyzed to determine the stratigraphic relation between Rajamandala Formation and Citarum Formation. Outcrop observation is unable to determine the stratigraphic relation, because it is difficult to find the proper outcrop in study area.

The unconformity between Rajamandala Formation and Citarum Formation occurs in local scale, because some studies also show that Citarum Formation is deposited conformable with Rajamandala Formation. Data also shows the change in depostional environment from shallow marine to deep marine. Comprehensive and further study is needed to determine the stratigraphic relation clearly.

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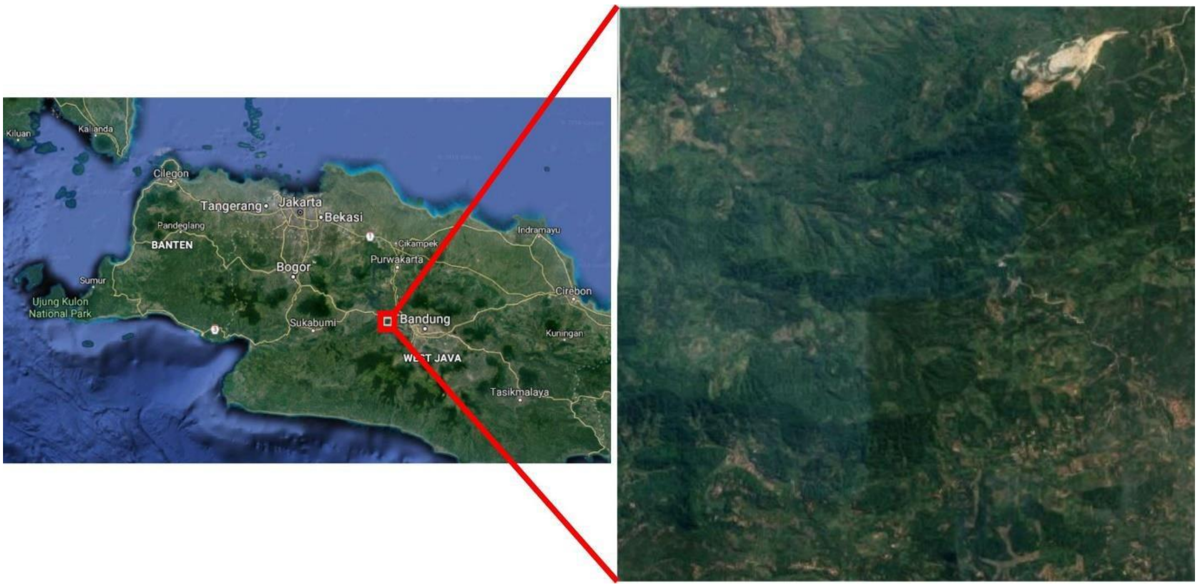

Figure 1 – Study area in Padalarang, West Java.

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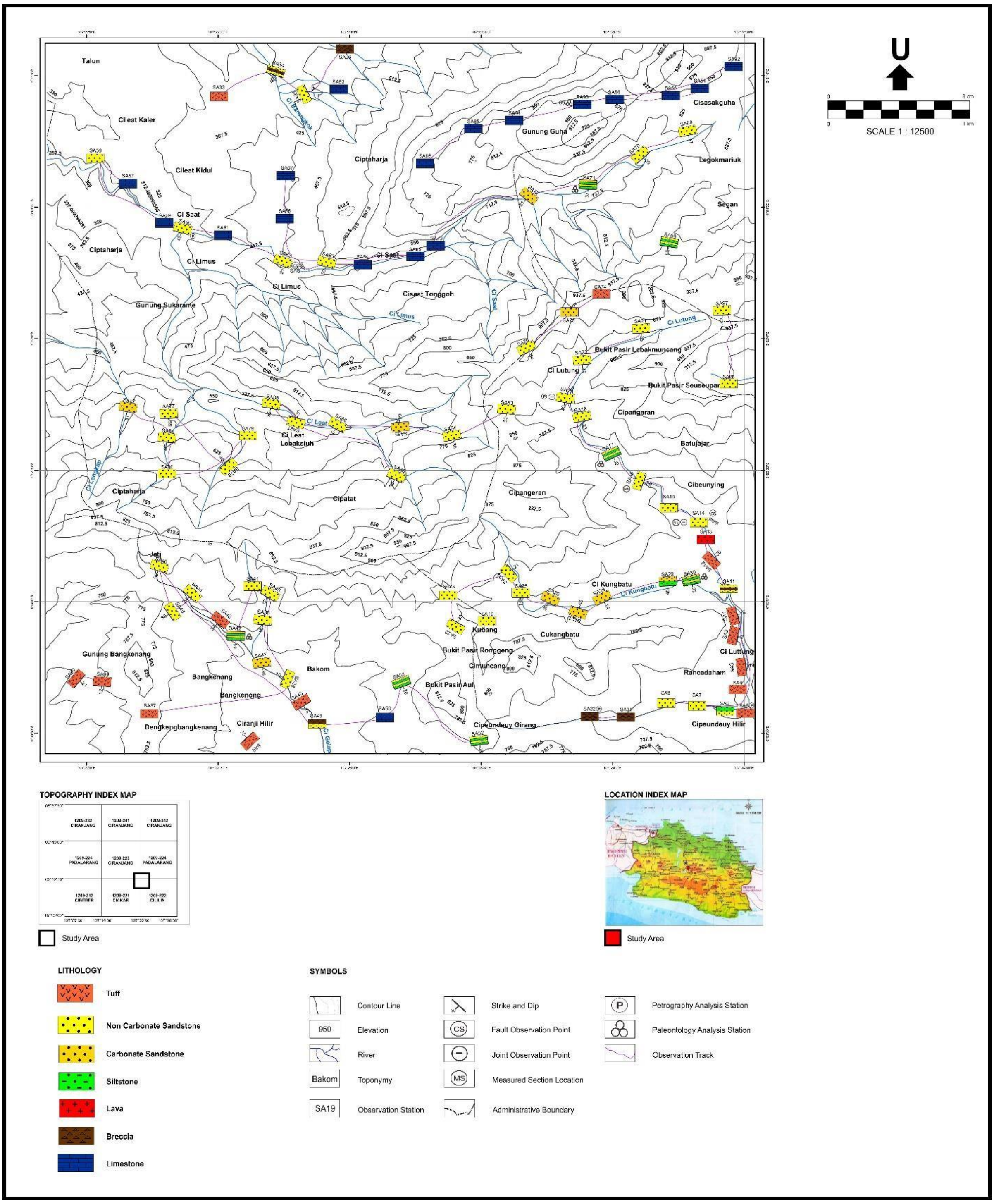

Figure 2 – Base map of study area showing 98 observed oucrops.

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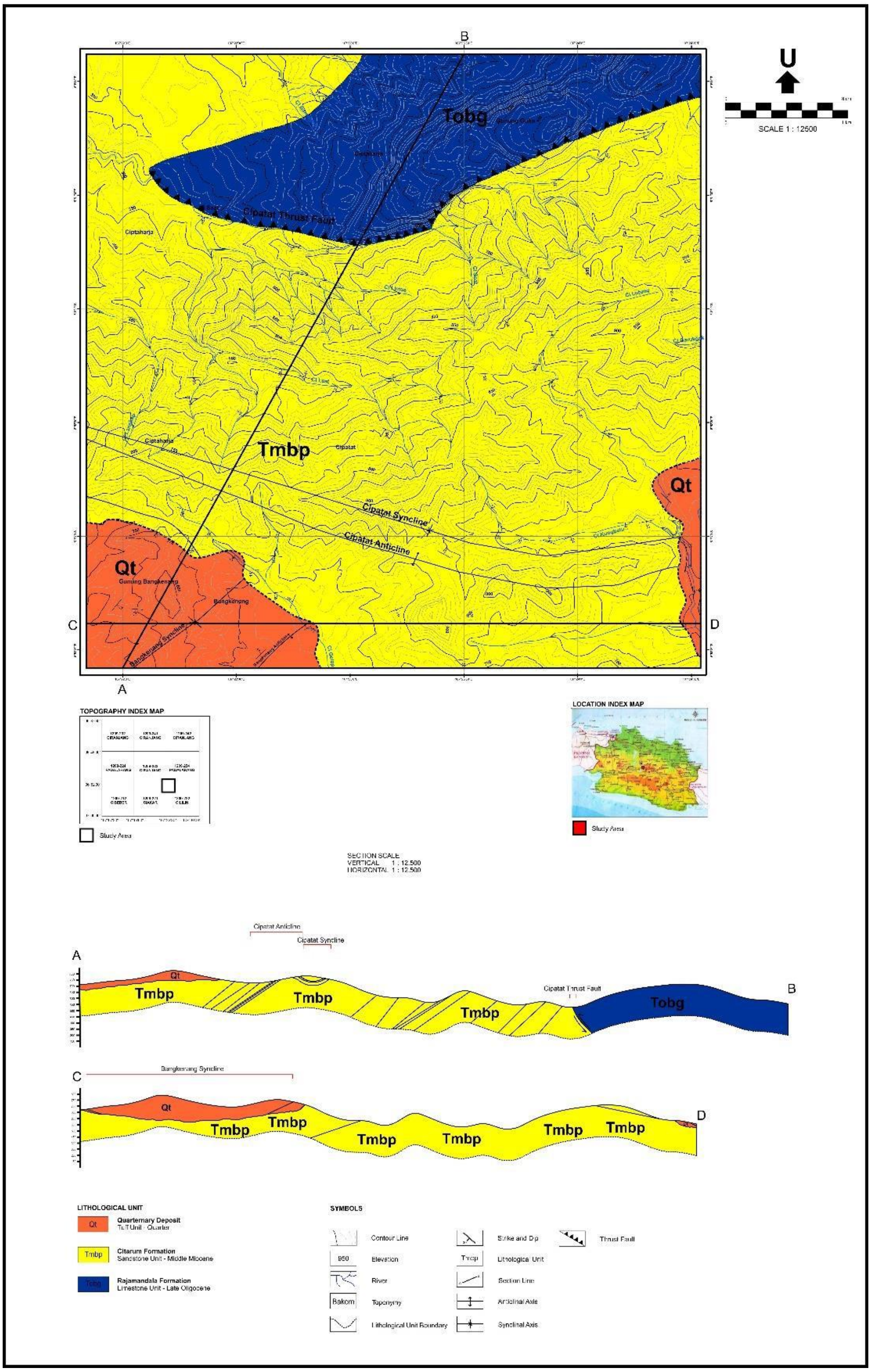

Figure 3 – Geological map of study area showing Tuff Unit (Quarternary Deposit), Sandstone Unit (Citarum Formation), and Limestone Unit (Rajamandala Formation).

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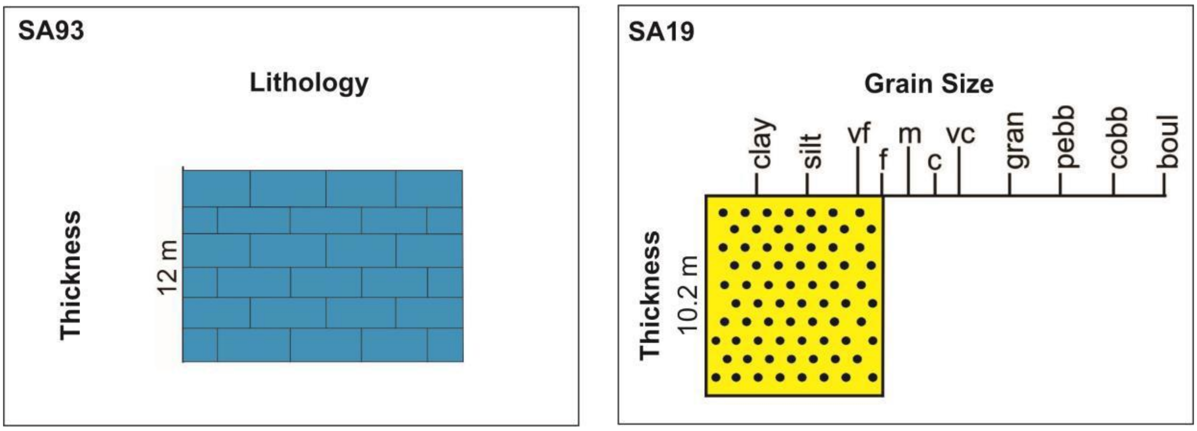
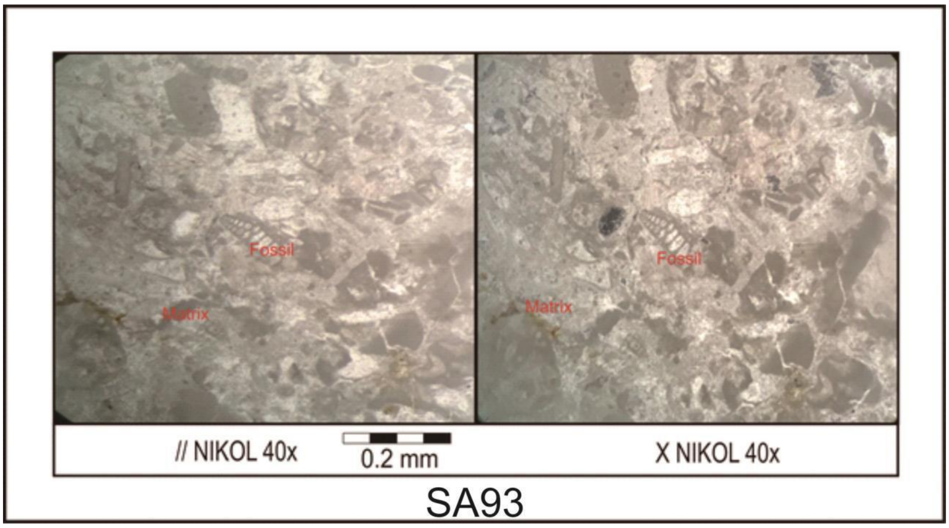


Figure 4 – Lithological log of selected outcrops; SA93 (Limestone – Rajamandala Formation); SA19 (Sandstone – Citarum



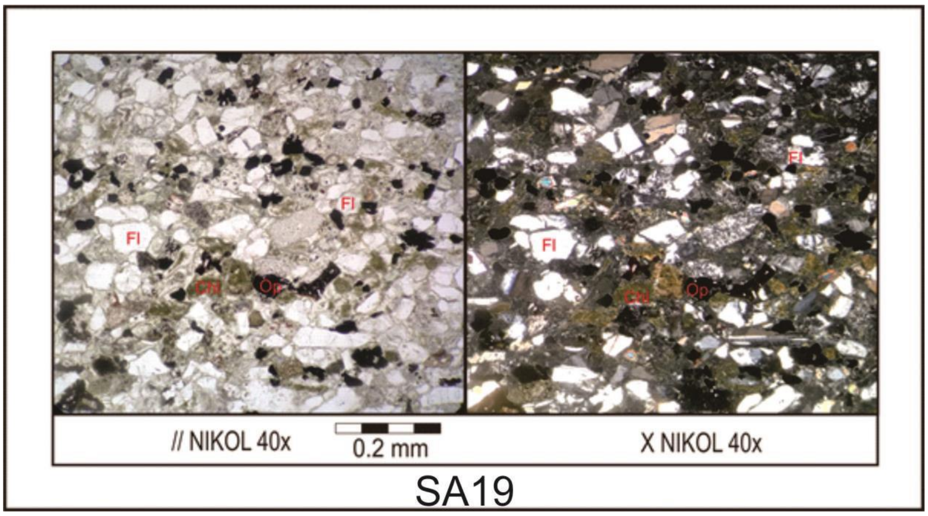


Figure 5 – Petrographic analysis of selected samples; Packstone (Dunham, 1962) – SA93; Feldspathic Wacke Sandstone (– SA19

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Table 1 – Foraaminiferal analysis of selected samples for determining relative age and bathymetry zone; SA93 (Limestone Unit - Rajamandala Formation); SA17, SA30, SA42, and SA71 (Sandstone Unit - Citarum Formation)

SA93

Foraminifera Fossil	Large Benthic Tertiary Foraminifera Biozonation (Adam, 1970)												
	Paleocene		Eocene			Oligocene			Miocene			Pliocene	
	Early	Late	Early	Middle	Late	Early		Late	Early	Middle	Late	Early	Late
	Ta1		Ta2	Ta3	Tb	Tc	Td	Lower Te	Upper Te	Lower Tf	Upper Tf	Th	
Lepidocyclina sp.													
Heterostegina borneensis													
Cycloclypeus sp.													
Operculina sp.													

SA93

Bathymetry Zone	Littoral	Neritic			Bathyal			Abyssal	
		Inner	Middle	Outer	Upper	Middle		Lower	
Foraminifera Fossil	0	-20	-50	-100	-200	-600	-1000	-2000	
Spiroclypeus sp.									
Hetrastegina borneensis									
Cyclocypeus sp.									
Lepidocyclina sp.									

SA17

Age / Foraminifera Fossil	Oligocene			Miocene															Pliocene			Quarter	
				Early					Middle						Late								
Foraminifera Fossil	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23
Globigerinoides immaturus																							
Globigerina nepenthes																							
Globigerina praebulloides																							
Globigerina venezuelana																							
Globigerinoides trilobus																							
Orbulina bilobata																							
Orbulina universa																							
Globorotalia obesa																							
Globigerinoides subquadratus																							

SA17

Foraminifera Fossil	Littoral	Neritic			Bathyal			Abyssal	
		Inner	Middle	Outer	Upper	Middle	Lower		
	0	-20	-50	-100	-200	-600	-1000	-2000	
Pyrgo sarsi									
Prygo comata									
Nuttallides bradyi									

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SA30

Age	Oligocene			Miocene															Pliocene			Quarter	
				Early					Middle						Late								
Foraminifera Fossil	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23
Globorotalia mayeri																							
Globigerinoides trilobus																							
Globigerinoides bolli																							
Orbulina universa																							
Globigerina nepenthes																							
Globorotalia praemenardii																							
Globigerina venezuelana																							
Globigerinoides obliquus																							

SA30

Foraminifera Fossil	Littoral	Neritic			Bathyal			Abyssal	
		Inner	Middle	Outer	Upper	Middle	Lower		
	0	-20	-50	-100	-200	-600		-1000	-2000
Numoloculina contraria									
Sigmoilena obesa									
Mississippina pacifica									

SA42

Age	Oligocene			Miocene															Pliocene			Quarter	
				Early					Middle						Late								
Foraminifera Fossil	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23
Orbulina universa																							
Globigerinoides immaturus																							
Globigerinoides subquadratus																							
Globigerina venezuelana																							
Globorotalia siakensis																							
Globorotalia praemenardii																							
Globigerina seminulina																							
Globigerinoides diminutus																							

SA42

Foraminifera Fossil	Littoral	Neritic			Bathyal			Abyssal
		Inner	Middle	Outer	Upper	Middle	Lower	
	0	-20	-50	-100	-200	-600		-1000
Anomalinoides globulosus								
Cibicides mabahethi								
Hyperammina novaezealandiae								

SA71

Age	Oligocene			Miocene															Pliocene			Quarter	
				Early					Middle						Late								
Foraminifera Fossil	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23
Globorotalia mayeri																							
Orbulina bilobata																							
Orbulina universa																							
Globigerinoides subquadratus																							
Globorotalia obesa																							
Globigerinoides trilobus																							

SA71

Foraminifera Fossil	Littoral	Neritic			Bathyal			Abyssal	
		Inner	Middle	Outer	Upper	Middle	Lower		
	0	-20	-50	-100	-200	-600		-1000	-2000
Hoeglundina elegans									
Discorbinella bertheloti									

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