

Micro Tectonic at North Serayu Basin Central Java Case Study at Type Locality of Rambatan Formation

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MICRO TECTONIC AT NORTH SERAYU BASIN, CENTRAL JAVA: CASE STUDY AT TYPE LOCALITY OF RAMBATAN FORMATION

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Abstract

Type location of Rambatan Formation at Pamulihan, Larangan, Brebes, Jawa Tengah, Rambatan Formation occupies in North Serayu Basin. Regional character of Rambatan Formation is deep marine flysch or turbidity current as lower fan. Tectonic active controlled lithology of Rambatan Formation that is quick subsidence at Early Miocene to Late Miocene. Tectonic during Middle Miocene to Pliocene caused the change of *sea level* three times. Change of sea level, tectonic and supply sediment is related to dynamic sedimentation in basin. The presence of turbidite in general is always associated with hydrocarbon potential. Potential of hydrocarbon in research area are supported by oil seepage. Analysis of micro tectonic will be part of the sedimentation dynamic that is related play hydrocarbon. Tectonic active in type location of Rambatan Formation take place at early Late Miocene (N15 to N16). That bordered between relative deeper marine and shallow marine. Shallow marine begins with the presence of slump at N17. Indication of tectonic are unconformity, change of environmental (deep water and shallow water), and fault association. The dynamics of sedimentation toward tectonic N15 to N16 will be related to the accommodation space. Accommodation space in research area is decrease. It is marked by the environmental change from deeper to shallow marine that is followed by decrease of sea level and increase sedimentation from south.

Keywords: Rambatan Formation, North Serayu basin, Tectonic, slump.

1. INTRODUCTION

Type location of Rambatan Formation in North Serayu Basin is in Rambatan River at Pamulihan area, Central Java. Regionally, Rambatan Formation has character as turbidity in deeper marine (Suyanto & Sumantri, 1977), or lower fan (Astuti, 2012). Lithology of Rambatan Formation is controlled by active tectonic, that is quick subsidence at Early Miocene to Late Miocene (Koesoemadinata and Martodjojo, 1974). Tectonic during Middle Miocene to Pliocene causes *sea level* change a tree times (Astuti, 2016). Sea level change, tectonic and supply sediment will be associated with dynamic sedimentation at basin.

Tectonic while Mio-Pliocene and Pliocene causes lithology to folded, when sedimentation take place, that sedimentation is quickly deposited through North Serayu. It is called elisional system, and results in *mud vulcano* and *mud diapir* (Satyana dan Asnidar, 2008). The effect of tectonic results in peak of volcanism (Bachrie, 2017). *Provenance* of Rambatan Formation

is magmatic arc, toward of petrographic analysis, change of average lithic is reduced in eastern part of basin (Astuti, 2015).

Presence of mud volcano and turbidity (Stelting, dkk 2000), generally is connected with potential of petroleum. Potential of petroleum in research area is supported by oil seepage (Kastowo & Suwarno, 1976, Satyana, 2007, and Astuti, 2012). Micro tectonic analysis will be a part with dynamic sedimentation and petroleum play.

2. LITERATURE REVIEW

Tectonic in research area is affected by subsidence. The role of tectonic in creating the accommodation for sediment to accumulate is fundamental to sedimentology and stratigraphy (Nichols, 2009). Another factor to control accommodation is volume, type and distribution of sediment. Subsidence in sedimentary basins causes thermal maturation in the progressively buried sedimentary layers (Allen and Allen, 2005). That indicators include organic, geochemical, mineralogical and thermal chronometric parameters. The burial of sedimentary layers in a basin causes porosity loss, mechanical compaction, physicochemical change such as pressure solution, and cementation. The stratigraphy in a sedimentary basin is the result of the interplay of the generation of space or accommodation and the influx of sediment (Allen and Allen, 2005). Explanation of stratigraphic geometries and depositional environments are determined by the tectonic mechanisms causing subsidence, local patterns of faulting, sediment and sea level change. Tectonic setting of the basin is a major factor controlling the changes in the facies distributions and paleo geographical patterns through time (Nichols, G, 2009).

The most common of depositional processes in deep seas are debris flows and turbidity current (Nichols, G, 2009). That Turbidity currents and mass flow require some form of trigger to start the mixture of sediment and water moving under gravity. The trigger may be provided by an earthquake as the shaking generated by a seismic shock can temporarily liquefy sediment and cause it to move. Debris flow with thick and wide spread will be good as reservoir (Shanmugan and Zimbrick, 1996). Petroleum play covers by reservoir unit, petroleum change system, regional top seal or caprock, petroleum traps and time (Allen and Allen, 2005).

Slump and debris flow are described as the deposition of lithology in slope environment (Shunmuggan, et al, 1994), with slope environment is 1° to 4° (Lewis, 1971 vide Reineck and Singh, 1975). Slope environment in submarine is called Bathyal. Bathyal has a depth between 200m up to 2000m (Friedman and Sanders, 1978). Mud flow is indicated increase of fluid, and especially those associated with Flysch deposits and rapid sedimentation (Reineck and Singh, 1975). Such regions may be stable because of greater slope, type of sediment deposited or other reasons. In large scale, slump during slumping there is compression near the toe of a slump-sheet and tension near the head (Reineck and Singh, 1975). That compression results in thrusting and folding, while tension causes faulting and downslope gliding. In the central part the slump-sheet is un deformed, and sometimes show rotational movements. Small scale gravity slumps are also common in the lower continental margin, it is called olisthonites and mass flow deposit (Klemene, 1958 vide Reineck and Singh, 1975).

3. METHODOLOGY

General lithology of Rambatan Formation is needed to identify tectonic indication required for measuring stratigraphy. Result of measuring stratigraphy is used to order bottom to upper lithology, especially tectonic association, that is debris flow. Measuring stratigraphy is supported by fossil and sediment structure. Regionally, unconformity is an indication of tectonic. Unconformity is marked by gap time. Paleo current is needed to know source rock.

4. RESULT AND DISCUSSION

Results

Result of measuring stratigraphy in type locality of Rambatan Formation are indication of tectonic phenomenon. That phenomenon is slump (Fig. 1) and debris flow (Fig 2). The bigger dimension of slump in research area is 1 kilometer, and thickness is 5 meters, it is associated with fault. The list in thickness of slump in research area is 1 meter to 5 centimeters. Another phenomenon of tectonic are fault and environment change (deeper to shallow marine).

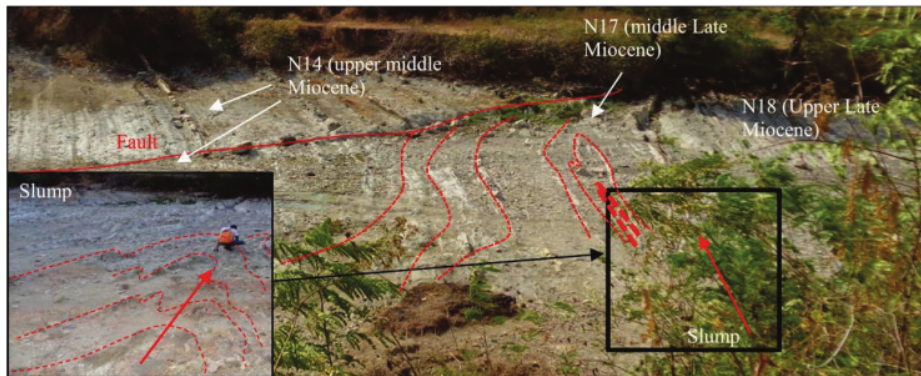


Fig. 1. Slump and association with fault at Pamulihan, Brebes.

The lithology at the bottom of slump is associated with classical turbidity. That lithology toward of paleontology has age N14, that appearance of *Globigerina nepenthes*, Tood. The lithology at the upper of slump is associated with shallow marine environment (Table 1). Indication of shallow marine are hummocky (Fig 2), large foram (Fig 2) and clast mud (Fig 2), that age is N17, with appearance *Globorotalia miocenica*, Palmer. Sedimentary process of Rambatan Formation has a gap time N15-N16 (early Late Miocene). Indication of the gap sedimentation processes is unconformity, related with tectonic.

Table. 1. Association of sediment toward tectonic

Age	Association	Description and environmental
N19 (Pliocene)	clast mud, debris flow	traction current and Shallow
N18 (Upper Miocene)	large foram, debris flow, slump	shallow marine
N17 (Upper Miocene)	hummocky, debris flow, slump	shallow marine
N14 (Late Middle Miocene)	Turbidity	deeper marine

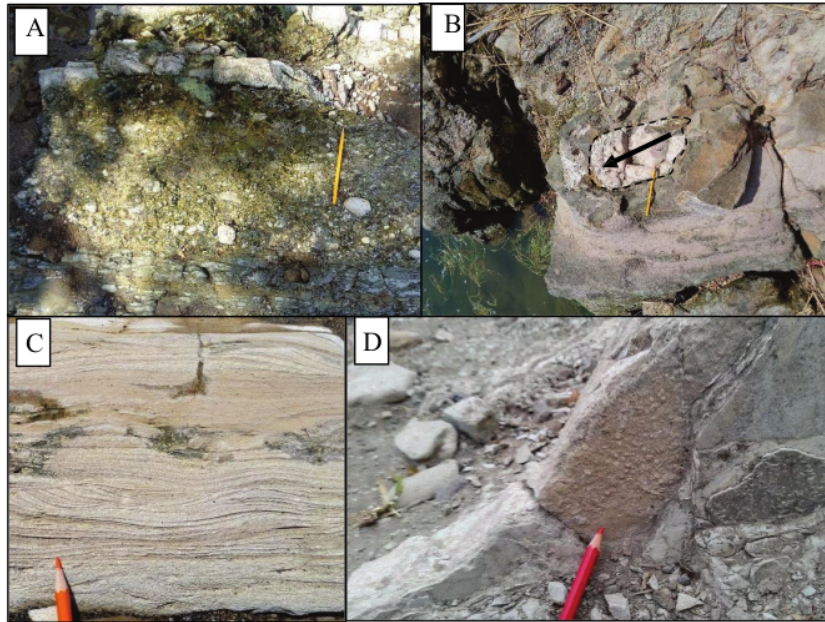


Fig. 2. Mud flow (A), clast mud (B), *hummocky* (C) and large foram (D).

Slump and debris flow in tape locality Rambatan Formation began from N17 (Middle Upper Miocene) up to N19. Slump while N17 up to N18 associated with hummocky sedimentary structure. Hummocky is used as an indication of shallow marine environment. Debris flow while N19 associated with clast mud, that is indication as traction current. Paleo current of slump is relatively from South East and South West.

Environment change in research area toward of slump, turbidity currents and clast mud or traction current (shunmuggan et al, 1994) is deeper marine to shallow marine. Mud clast is indicated of increase sediment concentration (Talling, et al, 2012). Generally, slump N17 is indicated of tectonic border.

Regionally, tectonic active happened since Early Miocene up to Late Miocene. Specific tectonic active in research area is in Early late Miocene (N15 to N16), that bordered of deeper to shallow marine environment. Shallow marine began with slump while N17. Toward of dynamic sedimentation, tectonic N15 to N16 cause decrease of accommodation space. Decrease of accommodation space cause environment change, sea level drop and increase of sediment from south.

5. CONCLUSION

Tectonic active in type location of Rambatan Formation occur at early Late Miocene (N15 to N16). Indication of tectonic are unconformity, change of environmental (deep water and shallow water), and fault association. Presence of slump plays the role as characteristic of early sedimentation of shallow marine, with material from south.

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