

PROCEEDINGS

GEOSEA XIV AND 45TH IAGI ANNUAL CONVENTION 2016 (GIC2016)

The Trans Luxury Hotel, Bandung, October 10 – 13, 2016



**PROCEEDINGS OF GEOSEA XIV AND 45th IAGI ANNUAL
CONVENTION 2016**

"ASEAN Earth Resources and Geoscientist Role in AEC Era".

10-13 October 2016, Bandung, Indonesia



IKATAN AHLI GEOLOGI INDONESIA (IAGI)

Indonesia Association of Geologist

Ikatan Ahli Geologi Indonesia (IAGI)

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PREFACE

The 45th Annual Scientific Convention of the Indonesian Association of Geologists (IAGI) this year has been held in conjunction with the GEOSEA Congress XIV (abbreviated as GIC-2016). The GEOSEA is a communication forum for the geologists in Southeast Asia countries.

The main theme of the event which is the ASEAN Earth Resources and Geoscientist Role in AEC (ASEAN Economic Community) Era has made the papers submitted and presented in the event covering a wide range of variety. The main theme covering two main topics, i.e. earth resources and geoscientist development in ASEAN countries has also been represented by the papers presented in this event.

Although since several years ago, the earth resource industry situation has not been that bright, triggered by the declining of commodity prices, regulation uncertainty, and also other issues related to the local stakeholders; this GIC 2016 event has attracted significant numbers of participants including industry geologists, faculty staff from the universities, government agencies, contractor companies, and other experts. It is the IAGI's pride to present this GIC 2016 event for the benefit of geological society in both Indonesia and ASEAN countries.

The proceedings contain all papers presented in the GIC 2016, covering various topics including

1. Engineering Geology, Hydrogeology, Mitigation and Applied Geology
2. Geology and Geophysics Method and Application
3. Geotourism
4. Mineral And Energy Resources Management
5. Mineralogy, Petrology, Geochemistry
6. Sedimentology, Stratigraphy, and Petroleum Geology
7. Tectonic, Structural Geology and Geodynamic
8. Volcanology and Geothermal

They are written by experts from various geology background including industry, government institutions, and universities.

On behalf of IAGI, we would like to thank all authors, paper reviewers, editorial team, and also to all sponsors from industry and government for their contributions and involvements. Without all of them the GIC 2016 event and the publication of this proceeding will not happened.

Bandung, October 2016

Sukmandaru Prihatmoko

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The Potential Of Halang Formation As Hidrocarbon Reservoir

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Abstract

Regionally, research area included in the western part of North Serayu basin which filled by the product of submarine fan turbidite composed by Pemali, Halang, and Rambatan Formation. Based on the stratigraphy sequence approach, the stratigraphy relationship is interfingering. On those basin, there are oilseeps and gas also dead oil in Pamedaran area, Cikesal and Wanaasih area. The existence of oil and dead oil also its location type in Cikaro area, Cikesal, and Geger Halang. The potential rock as source rock is Merawu Formation and the lower part of Pemali. The potential reservoir is Merawu Formation and reef limestone of Sigugur Formation and Halang Formation. This research is purposed for taking the geology data which area related to Halang Formation which is used to determine the hydrocarbon potential reservoir rock of Halang Formation. Halang Formation has age at N18 (Upper Miocene) to N19 (Pliocene), with the lithology such as andesite breccias, pebbly sandstone, and the repeated of carbonate claystone and the carbonate sandstone. The pebbly sandstone which is specific to mid fan facies has good porosity and permeability, it also would be proved by the presence of dead oil on field.

Keywords : Serayu Utara, reservoir, Halang, dead oil, pebbly sandstone

Introduction

The North Serayu basin was formed in Oligo-Miocene due to the north – south orientation of subduction. On those basin there are the oilseeps and gases (Kastowo, 1975, Kastowo & Suwarno, 1976 and Satyana, 2007), especially in Ciseuti area, Randusari village, in addition there is dead oil in Wanaasih area, Pamedaran village, Cikesal area in Babakan river, and Wanaasih Cikaro. The existence of oilseep and dead oil are indicated that those basin is prospect for oil (Koesoemadinata and Martodjojo, 1974). The research area included in Halang Formation which has the seepage and dead oil also its location type, Cikaro area, Cikesal, and Geger Halang.

The north serayu basin in Neogene is filled by the rock from turbidity rocks of submarine fan, such as rock from Pemali, Halang, and Rambatan Formation (Astuti, 2012). The Pemali Formation is equivalent with the Merawu Formation, the Rambatan, Halang, and Lawak Formation are equivalent with Penjatan Formation (Astuti, 2012). Based on stratigraphy sequence relationship is interfingering (Astuti, 2012). The deposit rocks on those time is influenced by active tectonic and has made the sea level rise and drop for three times (Astuti, 2016).

The provenance of rock came from the south direction (van Bemmlen, 1949, Astuti, 2016), The potential source rock is Merawu Formation and the lower part of Pemali. The potential reservoir is Merawu Formation and reef limestone of Sigugur Formation (Satyana & Armandita, 2004) and Halang Formation (Astuti, 2012). The cap rock are shale of Penjatan Formation, Merawu (Satyana & Armandita, 2004), and the upper part of Pemali Formation (Astuti, 2012). The hydrocarbon trap in north Serayu basin such as structural trap e.g toe thrust due to the gliding sediment in Middle Miocene (Astuti, 2012). Halang formation is estimated as potential reservoir rock, its generally in Oligo-Mio volcanic product which is active till Pliocene (Astuti, 2012).

This research is purposed for taking the geology data which area related to Halang Formation which is used to determine the hydrocarbon potential rock of Halang Formation.

The rocks filled in North Serayu such as Pemali formation which is equivalent to Merawu Formation also Rambatan Formation, Halang, and Lawak which is equivalent to Penjatan Formation (Astuti, 2012), such as turbidity products from submarine fan. The potential reservoir is Merawu Formation and reef limestone of

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Sigugur Formation (Satyana & Armandita, 2004) and Halang Formation (Astuti, 2012).

The stratigraphy of north Serayu has been researched by Mark (1957), Kastowo (1975), Kastowo & Suwarno (1996), Lunt, *et al* (2008), Astuti (2012). The result of those research shows us the age of rocks inter basin which filled by the different formations (Table 1) (Mark, 1957; Kastowo, 1975; Kastowo & Suwarno, 1996, Lunt, *et al*, 2008), but based on the analysis of stratigraphy sequence shows us the interfingering relationship (Astuti, 2012). Halang Formation layered on Pemali and Rambatan Formation unconformably (ter Haar, 1934, in Mark, 1957), and layered on Lawak Formation conformably, also interfingering to Gununghurip Member (Kastowo & Suwarno, 1996). According to Kastowo & Suwarno (1996) in sequence of stratigraphy from the oldest and the youngest among three formation is Pemali, Rambatan, and unconformably layered by Halang formation. According to Astuti (2012) the rocks of Halang Formation was emerged in middle of N 10 to N19 (Pliocene) which is interfingering to Rambatan and Pemali Formation where are the rocks of Pemali Formation based on some authors (figure 1) shows the position in the lower part of Halang Formation and also there are assumptions its located in the upper part of Halang Formation. According to van Bemmelen, 1949 in Mark, 1957, the rock of Pemali Formation is considered as the oldest sediment unit which has age in Oligocene-Miocene, layered under the Rambatan Formation. In addition, according to Lunt, *et al*. (2008), based on result of foraminifera analysis which is taken in Cisadap area near to Sahang (Figure 2) shows us the age of rock is about Late Miocene to Pleistocene, layered upper part of Halang Formation Lunt, *et al*. (2008), from deepwater facies.

Based on its location type, the lower part of Halang Formation is volcanic, the thickness is about 500 metres such green andesite sandstone and tuffaceous conglomerate which its repeat with the dark green marine marl. The thickness of upper part is about 300 metres such as the repeated between marl and andesite sandstone (Mark, 1957). Based on Penjatan Formation,

the rocks rich in large foraminifera shows us the middle Miocene, but based on sample from Bantarkawung area showed us in Upper Miocene. This formation is generally a volcanic rock (ter Haar, 1934, in Mark, 1957, Koesoemadinata & Martodjojo, 1974, and Kastowo & Suwarno, 1996, Astuti, 2012), which were each others mentioned as the repetition, the intermediate volcanic rock, and the volcanic breccias also pebbly sandstone.

Based on result of revision on sheet in Geological Map of Majenang, especially is related to Halang Formation (Kastowo & Suwarno, 1996), the rock of Halang Formation has 2 members, such as Gununghurip and Lebakwangi. The Gununghurip member is in the lower part are composed by volcanic breccia with andesite composition, inserted by sandstone, shale, sandy-claystone and conglomerate of many materials. Halang formation is interfingering to Gununghurip member, but the Lebakwangi member is outcropped by one place which layered above the Halang Formation

Based on the research on its location type, Halang Formation has a thickness of 730 metres, it has age in Upper Miocene (Koesoemadinata & Martodjojo, 1974). The lower part is composed by the thick layers which repeated of the clay marl and sandstone as thick of 277 metres. In the middle it has thickness of 285 metres, composed by repeated the sediment layer of fine grained such as clay, clay marl, and the thin layer of sand layer. The upper part has thickness about 190 metres, composed by clay layer, clay marl, grey coloured with red weathering sandy clay. It has nodule and molusca printed from carbonate also the porous tuffaceous sandstone.

Data and Method

Data are used in this research are data from stratigraphy measuring taken in area around the dead oil. Data also included paleontology and petrography. Paleontology data will be used in age of rock, also the petrography data to determine the composition of rock and its texture.

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Methods are used in this research by taking the field data related to analysis of Halang Formation as a reservoir. The taking data such as the stratigraphy detail measurement especially in Halang Formation, to determine the thickness of rock, the development of Halang Formation rock vertically.

The taking data is helped by the geological tools such as geological hammer, compass, the jacob stick and GPS. The steps of the stratigraphy measuring are doing the measurement of rock in area close to seepage and dead oil e.g Cikaro and Cikesal, also its location of rock. The taking of sample done by sorting the rock which has made the measurement of rock so that it will get the sort of the age of rock and its composition vertically.

Result and Discussion

The research area is located in the southern part of North Western of Java basin, there are many manifestation oil and seepage and dead oil which spread out in some places. Seepage presence in Ciseuti area, randusari village. Dead oil were emerge in Cikaro track area especially in Wanaasih (Figure 1) and in Babakan river track especially in Cikeusal Pasar area, Cikeusal Kidul and North of Pasir Meongf, Pamedaran village. In those Dead oil composed by the rocks filling the channel such as pebbly sandstone from Halang Formation. Based on paleontology analysis the rock of Halang Formation in Wanaasih area showed the age in N18 but the Geger Halang and Cikesal showed the age in N 19. Based on stratigraphy measuring in Cikaro area (figure 2) the presence of rock are sorted in gradational stratigraphy by fining upward looking, started from andesite breccias, pebbly sandstone till the

repeated of carbonate claystone and carbonate sandstone.

The important component from those stratigraphy is pebbly sandstone (Figure 3), it showed us the dead oil on this rock. Based on Astuti (2012), pebbly sandstone in Cikaro and Cikesal are mid fan facies, but in Geger Halang is a channel fill and the dead oil related to mid fan facies.

Based on the visual on the field the pebbly sandstone is easy to loosening the compaction. It shows us the cementation on this rock is very poor and easy to absorb the water so that the permeability is very good.

Based on the petrography analysis (figure 4), pebbly sandstone shows us that there are pores. Based on the visual on the field and laboratory, the pebbly sandstone is good for reservoir because it has good porosity and permeability so that it could be reservoir. Stratigraphically the reservoir rock of Halang formation is located in the western part of those basin, it's relatively younger than reservoir rock in North Serayu basin in the eastern part (Early Miocene) which existence of tuffaceous sandstone and quartz arenite from Merawu Formation (equivalent to Pemali Formation) and reef of limestone of Sigugur formation (Satyana & Armandita, 2004). The reservoir rock in north of west Java basin which is proved by production. The research area is equivalent to Parigi Formation which has age in Upper Miocene, although in the northern part of west Java basin the rocks has presented the older rock on Jatibarang Formation (Paleogene) and the rock of Baturaja Formation, Cibulakan (lower Neogene-and middle Neogene).

Based on Astuti (2012), for the potential of source rock in research area has not been sure, but the potential trap such as stratigraphy and structure trap. Stratigraphy trap such as massive marl from Upper part of Pemali Formation, but in the eastern part of basin such as shale from Penjatan Formation (equivalent to Halang Formation). Structural trap such as toe thrust due to sediment sliding in the middle Miocene e.g Kutai basin (figure 5) so that the potential may be happened in hydrocarbon migration at research area in Middle Miocene.

Table 1. The compilation of stratigraphy coloumn in research area based on some authors. (Astuti, 2012)

UMUR	Serayu Utara timur (van Bemmelen, 1949)	Jawa Tengah (van Bemmelen, 1949)	Majenang (Kastowo, 1975)	Bumiayu (Sujanto, dkk, 1977)	Jawa Tengah (Lunt, 1999)	Malahayu (Astuti, 2012)	TEKTONIK (Astuti, 2012)
N21	F.Ligung	F. Kaliglagah F. Kalibiuk	Endapan Kuarter F. Linggopodo F. Gintung F. Kaliglagah	F. Tapak	F. Pemali	F. Tapak F. Pemali	Tektonik
N20	F.Bodas (fasies neritik molase)	F. Tapak	F. Halang	F. Kumbang	F. Halang	F. Halang	(penurunan cekungan)
N18	F.Bodas (fasies vulkanik)	F. Kumbang	F. Lawak	F. Halang	F. Halang	F. Rambatan	(penurunan cekungan)
N17							
N16							
N15							
N14							
N13	Basal limestone horizon (fasies vulkanik)	F. Halang	F. Rambatan	F. Halang	F. Halang		
N12							
N11							
N10							
N9	F. Penjatan						
N8		F. Lawak	F. Pemali				
N7		F. Rambatan					
N6							
N5	F. Merawu	F. Pemali Atas		F. Pemali	F. Rambatan	Tidak tersingkap	
N4	F. Sigugur	F. Pemali Bawah					
P22/ N3							
P20/ N2			Tidak tersingkap				
P19							
P18							
Eo	"Eosen"	Tidak tersingkap					



Figure 1. The outcrop of pebbly sandstone with the compositioning dead oil, showing by oil film (directed in arrow), founded in Wanaasih area, Cikaro track, koordinat 0946900, 9219407.

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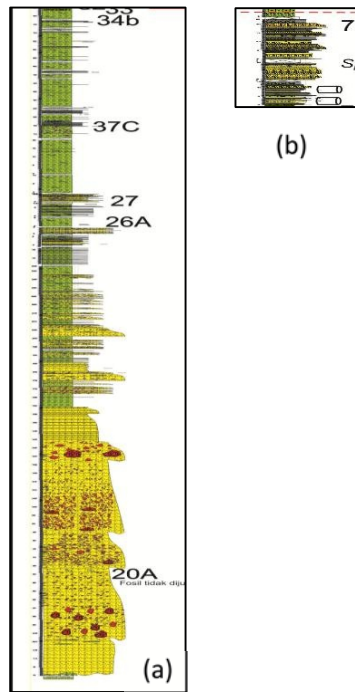


Figure 2. The measurement of stratigraphy in Cikaro, Wanaasih (a) and Cikasal (b), based on analysis of paleontological age of rock of Halang Formation in Cikaro areain N 18 (Upper Miocene), but in Cikasal area in N19 (Pliocene), based on astuti's analysis pebbly sandstone on both of measurement are mid fan facies.

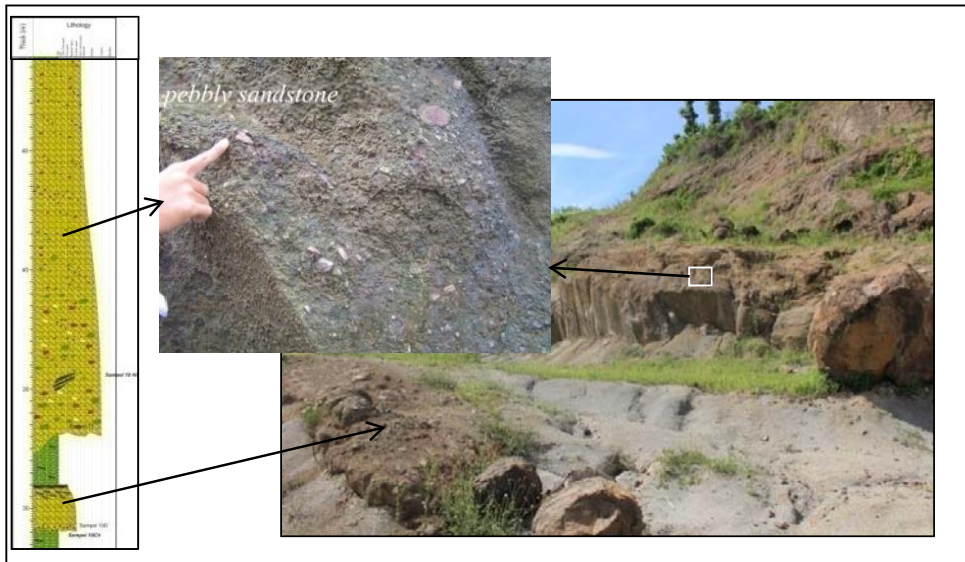


Figure 3. The stratigraphy in Geger Halang, the northeast of Malahayu Lake (location 10) coordinate 0259810, 9222023, and the visual looking of pebbly sandstone, based on Astuti's analysis (2012) it's *achannel fill (new supra fan lobe)*

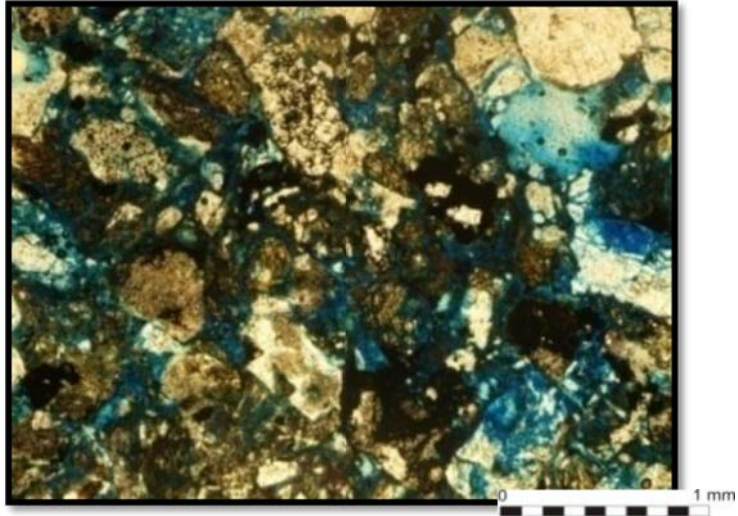


Figure 4. The visual view of pebbly sandstone founded in Wanaasih area, cikaro track, coordinate 0946900, 9219407 petrographically it's *Lithic Arenite* (Pettijohn, 1973), it has the blue pores.

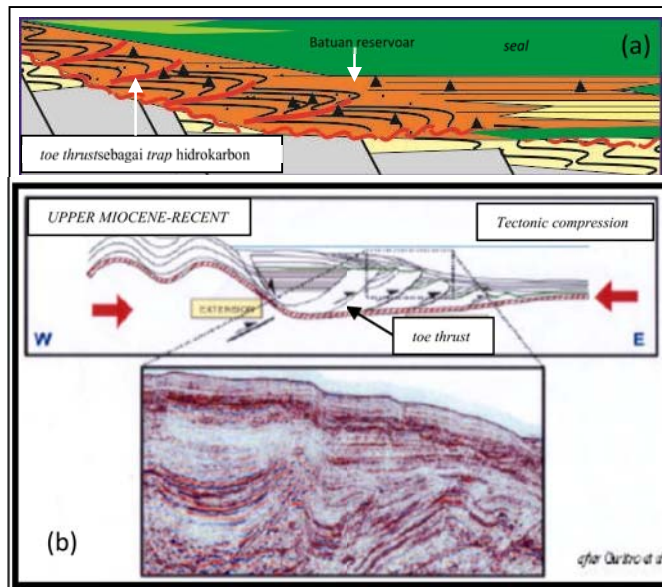


Figure 5. The illustration of gliding tectonic in research area (a) it' form a toe thrust which also founded in rthe lower part of Kutai basin (b) in the North Makassar basin (Guritno, et al., 2000, in Satyana & Armandita, 2004) as hydrocarbon trap (Astuti, 2012).

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Conclusions

Halang Formation has age in N18 to N19, it has the gradationally stratigraphy started from andesite breccias, pebbly sandstone and repeated of carbonate clay and sandstone sandstone. The good porosity in the pebbly sandstone on mid fan facies. Pebbly sandstone has a good porosity and permeability. It would be proved by the presence of dead oil on field.

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