

The Potential Of Halang Formation As Hydrocarbon Reservoir

By Bernadeta Subandini Astuti

The Potential Of Halang Formation As Hydrocarbon Reservoir*B S Astuti¹, A F Rizqi¹*¹*Staff of lecturer Departement of geology, Sekolah Tinggi Teknologi Nasional Yogyakarta***ABSTRAK****2**

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, Cikosal and Wanaasih area. The existence of oil and dead oil also its location type in Cikaro area, Cikosal and Geger Halang. The potential rock as source rock is Merawu Formation and the lower part of Pernali. The potential reservoir is Merawu Formation and reef limestone of Sigugur Fomation 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 N 18 (Upper Miocene) to 19 (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.

Key Word : 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, Cikosal 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, Cikosal 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 Bemmelen, 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). 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 rock filled in North Serayu such as Pemali formation which is equivalent to Merawu Formation also Rambat Formation, Halang and Lawak which is equivalent to Penjatan Formation (Astuti, 2012), such as turbidity product from submarine fan. The potential reservoir is Merawu Formation and reef limestone of 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.

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 deadoil 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 deadoil 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 Meong, 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, repeated of carbonate claystone and carbonate sandstone.

The important component from those stratigraphy is pebbly sandstone (Figure 3), it showed us the deadoil 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 sementtation 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 trelatively younger than reservoir rock in North Serayu basin in the eastern part (Early Miocene) which existence of tuffaceous sandstone and quartz arenit 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 be 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 presenced 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 sedimet gliding 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.

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.

References

- Astuti, B. S., 2012, *Stratigrafi dan Sedimentasi Batuan Neogen di Cekungan Serayu Utara, Daerah Kuningan, Jawa Barat – Larangan, Brebes, Jawa Tengah*, Thesis, not published.
- Astuti, B. S., 2016, *Tectonik Influence on Changes in Neogen Sediment Supply, western Part of North Serayu Basin*, International Jurnal of Engineering and science Application, vol. 3 ISSUE 1 May 2016 <http://pasca.unhas.ac.id/ojs/index.php/ijesca/article/view/278>.
- Astuti, B. S., 2016, *Identifikasi Provenance selama Miosen Tengah hingga Pliosen di Cekungan Serayu Utara bagian Barat di daerah Kuningan, Jawa Barat*, Jurnal Teknologi Techoscientia, vol. 8 no 2 Febuari 2016, Akprind Yogyakarta.
- Kastowo, 1975, *Peta Geologi Lembar Majenang, Jawa, Majenang 10/XIV-B*, skala 1: 100.000, Direktorat Geologi, Bandung.
- Kastowo dan Suwarno, N., 1996, *Peta Geologi Lembar Majenang, Jawa, scale 1 : 100.000*, second edition Directorat of Geology, Bandung.
- Koesoemadinata, R. P. and Martodjojo, S., 1974, *Peneitian Turbidit di Pulau Jawa*, report research no. 1295174, Departmentof research Institut Teknologi Bandung, 237 hal.
- Lunt, P., Burgon, G., dan Baky, A., *The Pemali Beds, Central Java and equivalents: indicator of sedimentation on an active plate margin*,

PROCEEDINGS

GEOSEA XIV AND 45TH IAGI ANNUAL CONVENTION 2016 (GIC 2016)
The Trans Luxury Hotel, Bandung, October 10 – 13, 2016

- journal of Asian Earth Sciences,
www.Elsevier.com/locate/jaes.p.14.
- Marks, P, 1957, *Stratigraphy Lexicon of Indonesia*,
Publikasi Indonesia Kementerian
Perekonomian, Pusat Djawatan Geologi
Bandung, p. 233.
- Pettijohn, F. J, 1975, *Sedimentary Rock*, third edition,
Harper & Row, Publishers, New York, p.
628 hal.
- Satyana, A.H., dan Armandita, C., 2004, *Deepwater
plays of Java, Indonesia : Regional
evaluation on opportunities and risks*, IPA
Annual Convention Proceedings, DFE04-
OR-002, p 27.
- Van Bemmelen, 1949, *The Geology of Indonesia*, vol
1, Martinus Nijhoff, The Haque. P. 732.

PROCEEDINGS

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

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

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)	
MIOSEN	N21	F. Ligung	F. Kaliglagah F. Kalibuk	Endapan Kuarter F. Linggopodo F. Gintung F. Kaliglagah	F. Tapak	F. Pemat	Tektonik	
	N20	F. Bodas (fasies neritik mioase)	F. Tapak			F. Halang	(penurunan cekungan)	
	N19							
	N18	F. Bodas (fasies vulkanik)	F. Kumbang	F. Halang	F. Kumbang			
	N17							
	N16							
	N15			F. Lawak				
	N14							
	N13	Basal limestone horizon (fasies vulkanik)	F. Halang	F. Rambatan	F. Halang	F. Halang		
	N12							
MIOSEN TENGAH	N11							
	N10	F. Perlatan						
	N9							
	N8		F. Lawak					
	N7			F. Pemat				
	N6		F. Rambatan			F. Rambatan		
	N5	F. Merawaj	F. Pemat Atas		F. Pemat		Tidak tersingkap	
	N4	F. Sigugur						
	MIOSEN AWAL							
PALEOGEN	P22							
	N3		F. Pemat Bawah					
	P20							
	N2							
OLIGOSEN	P19		Tidak tersingkap					
	P18							
ED	"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.

PROCEEDINGS

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

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

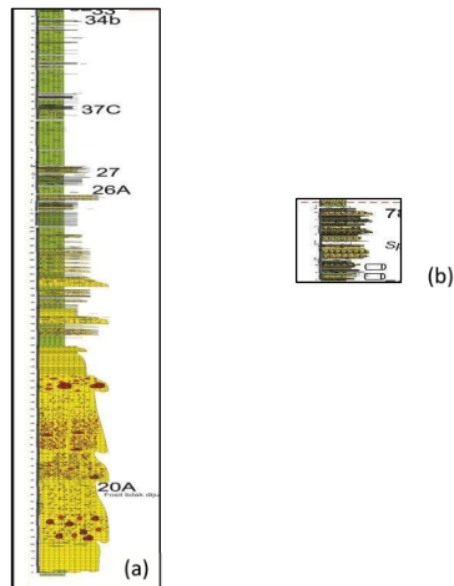


Figure 2. The measurement of stratigraphy in Cikaro, Wanaasih (a) and Cikesal (b), based on analysis of paleontological age of rock of Halang Formation in Cikaro areain N 18 (Upper Miocene), but in Cikesal area in N19 (Pliocene), based on astuti's analysis pebbly sandstone on both of measurement are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

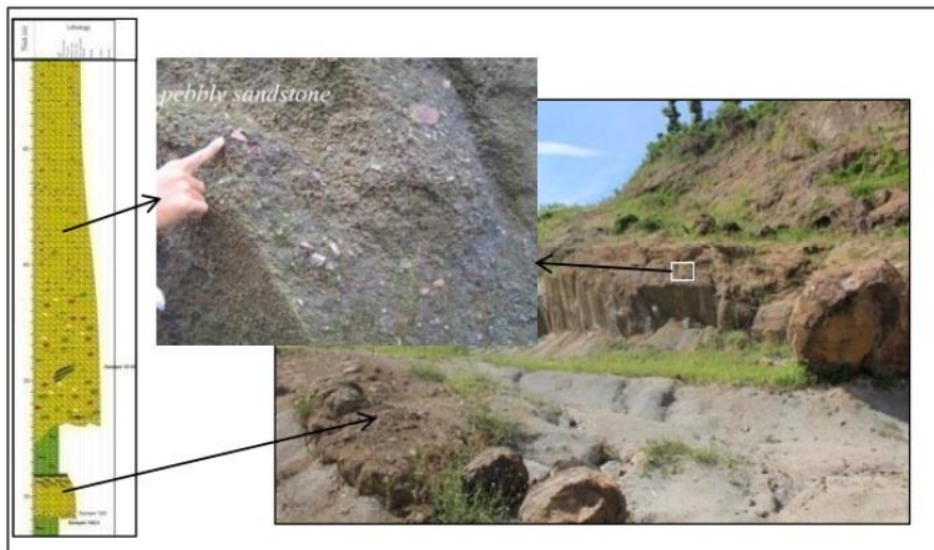


Figure 3. The stratigraphy in Geger Halang, the northeast of Malahayu Lake (location 10) coordinate 0259810, 9222023, and the visual looking of pebbly sandtone, based on Astuti's analysis (2012) it's achannel fill (new supra fan lobe)

PROCEEDINGS

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

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

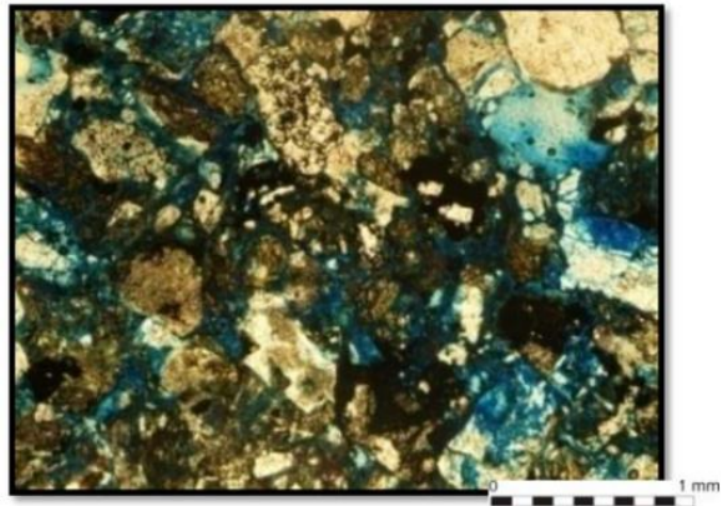


Figure 4. The visual view of pebbly sandstone founded in Wanaasih area, cikaro track, coordinate 0946900, 9219407 petrographically it's Lithic Arenite (Pettijohn, 1973), it has the blue pores.

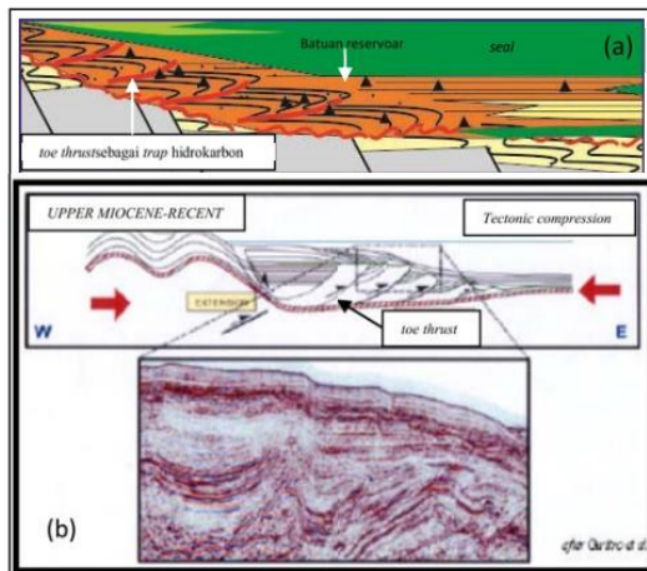


Figure 5. The illustration of gliding tectonic in research area (a) it' form a toe thrust which also founded in the lower part of Kutai basin (b) in the North Makassar basin (Guritno, et al., 2000, in Satyana & Armandita, 2004) as hydrocarbon trap (Astuti, 2012).

The Potential Of Halang Formation As Hidrocarbon Reservoir

ORIGINALITY REPORT

3%

SIMILARITY INDEX

PRIMARY SOURCES

- | | | |
|---|--|----------------|
| 1 | link.springer.com
Internet | 30 words — 2% |
| 2 | www.vangorselslist.com
Internet | 16 words — 1% |
| 3 | Hidayat Hidayat, Andri Dian Nugraha, Awali Priyono, Marjiyono Marjiyono et al. "Travel Time Tomography to Delineate 3-D Regional Seismic Velocity Structure in the Banyumas Basin, Central Java, Indonesia, Using Dense Borehole Seismographic Stations", <i>Frontiers in Earth Science</i> , 2021
Crossref | 8 words — < 1% |
-

EXCLUDE QUOTES ON

EXCLUDE MATCHES OFF

EXCLUDE BIBLIOGRAPHY ON