THE STRATIGRAPHY AND LITHOLOGY OF THE KUMA RIVER AREA BURU ISLAND, MALUKU

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ABSTRACT

The stratigraphy of Kuma River area is divided into six formations, bottom to top, Dalan, Duna, Kuma, Waeken, Wakatin, and Leko Conglomerate. The Dalan Formation is Trassic in age composed of interbedded well-bedded claystone and sandstone with a typical turbidite sequences. The Duna Formation is Jurassic in age, consisting of interbedded pelagic limestone and fossil (ammonites and belemnites) rich beds. The Kuma Formation is Upper Cretaceous to Eocene age comprising well-bedded medium beds pelagic limestone with abundant planktonic forams. The Waeken is Oligocene-Miocene age and comprises micaceous mudstone. The Wakatin Formation consists of light gray massive reefal limestone containing corals, sponge, algae, bivalves and benthonic foraminifers. The Leko Formation has a Pleistocene age consisting of conglomerate. Structural geology of this area comprises anticline, syncline, and normal fault that relats to the block faulting. The presence of reservoir and source rocks and also fold structure may play an important role in hydrocarbon prospective of the area.

Keywords: interbedded pelagic limestone, turbidite sequences, chert layers, hydrocarbon

SARI

Stratigrafi daerah Sungai Kuma terbagi menjadi 6 formasi, dari bawah ke atas adalah Formasi Dalan, Duna, Kuma, Waeken, Wakatin, dan Konglomerat Leko. Tebal keseluruhan runtunan staratigrafi ini berkisar 800m, dengan perincian Dalan: 200 m, Duna: 75 m, Kuma: 300 m, Waeken: 100 m, Wakatin: 100 m, dan Leko: 25 m. Formasi Dalan berumur Trias, dan terdiri atas selang-seling batulempung dan batupasir yang mempunyai tipe sekuen turbidit. Formasi Duna berumur Jura-Kapur, terdiri atas selang-seling batugamping pelagos dan lapisan rijang, dengan lapisan batugamping kaya fosil (ammonit dan belemnit). Formasi Kuma berumur Kapur Atas sampai Eosen, terdiri atas batugamping pelagos berlapis baik dengan ketebalan menengah mengandung foram plangton berlimpah. Formasi Waeken berumur Oligo-Miosen, terdiri atas batulumpur mikaan. Formasi Wakatin berumur Miosen terdiri atas batugamping terumbu pejal, mengandung koral, spons, ganggang, bivalve, dan foram bentos. Formasi Leko berumur Pleistosen terdiri atas konglomerat. Struktur geologi berupa antiklin, sinklin, dan sesar normal yang berasosiasi dengan sesar bongkah. Keberadaan batuan waduk dan batuan penutup, serta adanya struktur lipatan dapat memberikan arti penting terhadap keprospekan akan hidrokarbon di daerah Sungai Kuma.

Kata kunci: perselingan batugamping pelagos, sekuen turbidit, lapisan rijang, hidrokarbon

INTRODUCTION

During October and November 1994, a geological team from the Geological Research and Development Centre Bandung (GRDC) now Geological Survey Institute (GSI) headed by first author carried out a fieldwork in Buru Island, East Indonesia. The project was a joint study between PERTAMINA, Mobil, and GRDC on the East Indonesia islands. The purpose of the investigation is to make an evaluation of the southern Buru for a stratigraphy of a hydrocarbon prospect base on outcrop data.

The Kuma River is located in southwestern part of the Buru Island, approximately 40 km to the northwest of Leksula town, a capital district of the South Buru (Figure 1). The Kuma River, one of the river traverse conducted during the exploration, is approximately 50 km long and flowing to the south and empties at Banda Sea. It is a narrow river with steep and vertical cliffs on both sides. Only during the dry season one can walk along the river upstream. The best time is from October to January. The fieldwork was started from Sekat Village to follow an old timber road and then the Kuma River down stream for four days with a total distance of 22 km.

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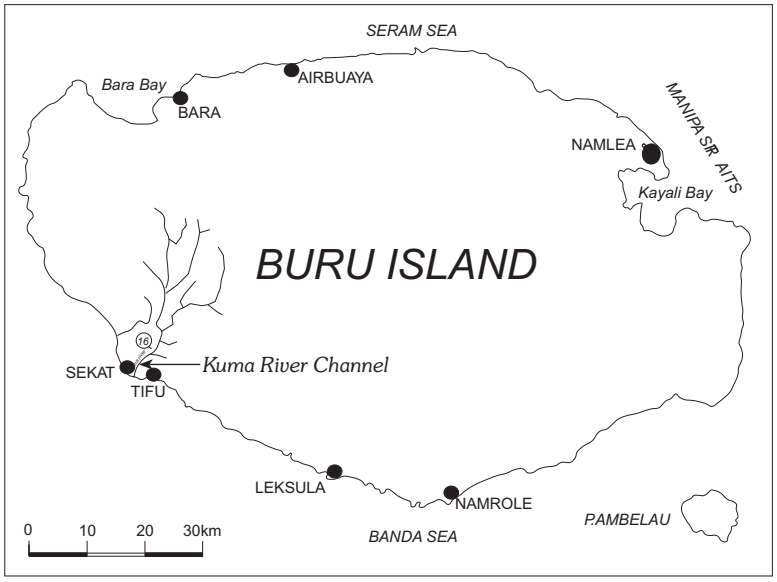

Figure 1. Location Map

The team was supported by eight local people to carry foods, personal equipment, and rocks. The traverses were mapped into 1:10.000 scale bases and compass by using map grade and Global Positioning System (GPS). The distance between GPS point was estimated by stepping and sketching out the river, and finally adjusted with the GPS location points. Every outcrop was plotted directly on the map sheet. The traverse was started at Sekat Village, located 4 km to the NW of the river mouth with GPS point 03°33'96"S and 126°09'99". The traverse passes through the abandoned area of the timber company and followed the old road first to the north and then to the Northeast till finally crosseS the Kuma River at Km 25. The road follows a valley of one kilometer wide and 5 km long. The hills nearby are composed of alluvial terraces which are probably Leko Formation of Pleistocene in age.

REGIONAL GEOLOGICAL SETTING

The island of Buru is supposed to be displaced and deformed fragments from Australian continental margin (Pigram and Panggabean, 1984) as shown in Figure 2. The fragments rifted apart from the main continent in the Early Mesozoic and were re-accreted in the Middle to Late Tertiary during the collision with the Southeast Asian Banda Arc subduction system. This continental fragment has a core of metamorphic rocks, a regional cover of Mesozoic sediments and a fringe around this island of Tertiary deposits. Compared with other islands of the Banda Arc, such as Seram and Timor, the geological structure of Buru Island is less complicated than the others. The island is part of a relatively stable continental crust with block faulting (Wiryosudjono and Tjokrosapoetro, 1978) and is characterized by the absence of thrust faults, imbricated structures, mélange, and peridotite. The oldest rocks in Buru are flysch sediments metamorphosed in the greenschist to lower amphibolite facies (Tjokrosapoetro and Budhitrisna, 1982; Tjokrosapoetro *et al*. 1994) and Linthout et al. (1989). Unconformably overlaying the basement are Triassic flysch-like clastic sediments of Dalan, limestone of Ghegan Formations, and Leksula Limestone (PERTAMINA-Mobil-GRDC, 1994). In Duna River area, during the Jurassic Period volcanic activity resulted in pillow lava of the Mefa Volcanics, which interfingers with the fossiliferous beds of Duna Formation (Harahap, 2000). These formations unconformably overlie the metamorphics and Triassic sediments. The Kuma Formation of Cretaceous to Eocene age, which consists of calcilutite conformably, overlies the Duna Formation. The Kuma Formation is unconformably overlain by the Waeken Formation of Late Oligocene-Early Miocene age. During the Late Miocene, submarine volcanism occurred (Ftau Formation), which interfingered with the Late Miocene Hotong Formation. At this time a reef limestone (Wakatin Formation) was deposited on a high. During Pliocene volcanic activity occurred in places known as Ambelau Volcanics, and simultaneously the Leko Formation of deltaic environment was deposited.

The Dalan and Ghegan Formations of Triassic age were deposited during the early stage of the formation history of the Australian continental margin. The Duna and Mefa Volcanic of Jurassic age were deposited during the breaking up of Gondwana. The Cretaceous and Early Tertiary sediments reflect a period of tectonic stability and subsidence of the margin. In the Middle Tertiary and Early Neogene the sediments were deformed into a foreland thrust and folded and rose above the sea level, forming the present islands.

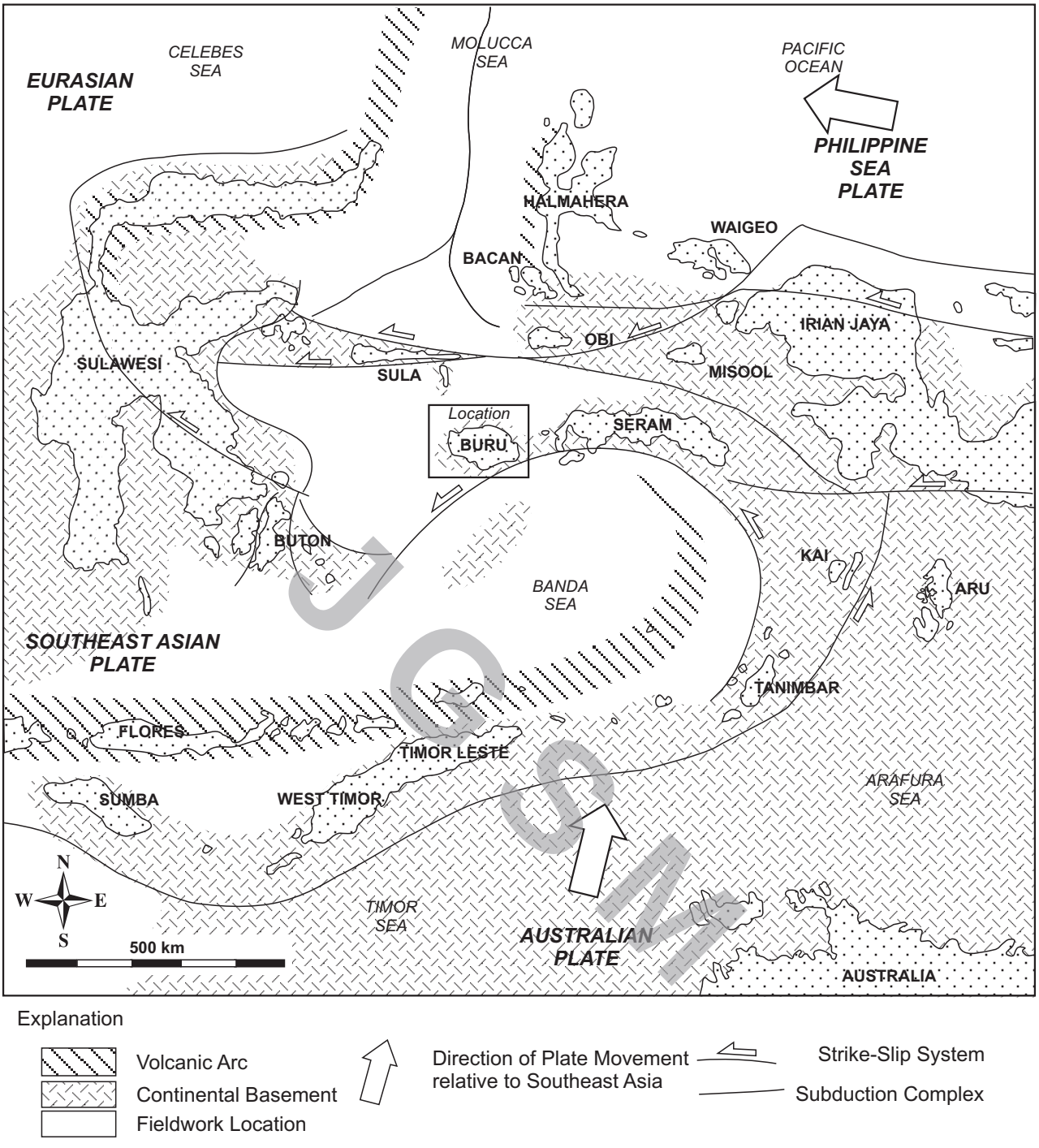

Figure 2. Tectonic sketch map of eastern Indonesia and location map of Buru Island (After Hamilton, 1979).

LOCAL GEOLOGY

The geology along the Kuma River is shown on Figure 3. The original plan on this traverse was to start from the mouth of Kuma River and to follow this river upstream, to see the complete section of the Kuma Formation. However, the sea was too rough for us to be dropped at the river mouth.

The first exposures in the valley are in a hill which altitude of about 60 m. The outcrops consist of an interbedded mudstone and sandstone of probably Tertiary age that is similar to the Waeken Formation reported elsewhere by Tjokrosapoetro *et al*. (1993). The beds dip 15° to the southeast. Some isolated hills further to the north are completely composed of well-bedded calcilutites with smaller foraminifera.

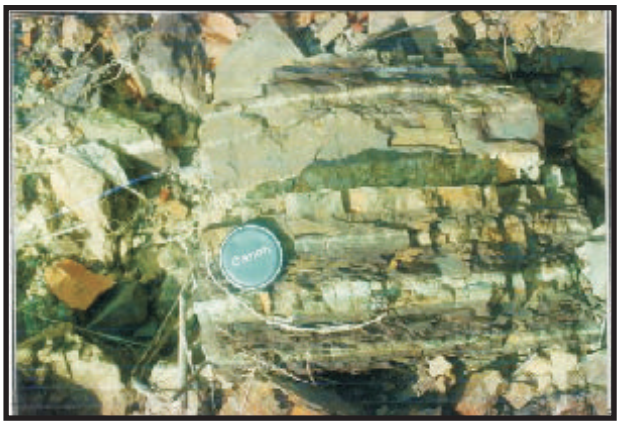

Photo 1. Intercalation of well bedded reddish brown shale and greenish grey shale of Triassic Dalan Formation. Exposed in the Sekat timber road, at location Bu-94-016-15

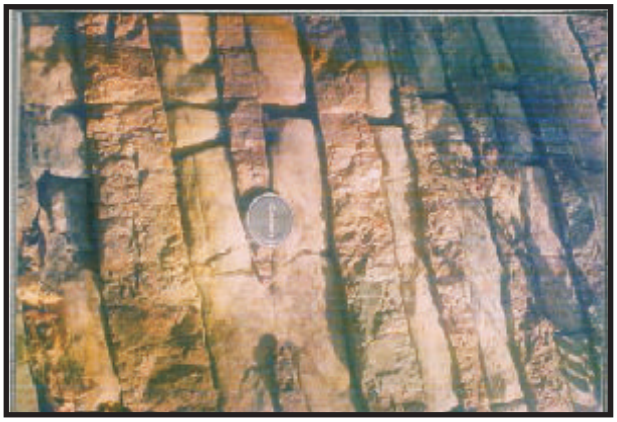

Photo 2. Close-up well bedded calcilutite with longitudinal beds of chert of Jurassic-Cretaceous Duna Formation. Exposed in the Kuma River, at location Bu-94-016-23.

The outcrops have a thickness of up to 20 m. The beds are gently dipping and undul ing. They belong to the Kuma Formation. Most of the hills in the area further to the north consist of thick soil with gravel and blocks of calcilutite. They are mapped as Leko Formation by Tjokrosapoetro *et al*. (1993) but may be the weathered Kuma Formation.

The lithology of all highest parts along the road is dominated by turbidities sediments (photo 1 and 3) that consist of well-bedded sandstone, mudstone, and conglomerate. It is interpreted to be the Dalan Formation as described by Tjokrosapoetro *et al*, (1994) elsewhere in Buru. The turbiditys sediments are typically micaceous with brown and red colours and with rock fragments. The lithology is a typical of Triassic sediments in the Australian continent of Papua as had been observed also by the first author in many places in Papua that is for the time being it is assumed to be Triassic in age. Some parts of the succession show graded bedding, sole markings, and laminations. The sandstone seems to have a good porosity. These rocks are widely distributed further toward the north. They are often tightly folded and faulted. It seems that the upper part becomes thinly bedded with an increasing amount of intercalated shale. In general the sequence is thinning upward. A massive unit of calcilutites, more than 30 m wide, overlies unconformably the turbidity sequence.

At Km 15, where the timber road crosses the Kuma River, the geology in the upstream area is dominated by clastic sediments of the Triassic Dalan Formation as shown by the abundant sandstone and siltstone blocks in the river like the one described above. While at the down stream the outcrops of carbonates of the Duna and Kuma Formations are predominant. Some

Photo 3. Conglomeratic quartz sandstone of Triassic Dalan Formation (?). Exposed in Sekat Timber road, at location Bu-94-016-19.

Photo 4. Close up of Ammonite in well bedded white calcilutite. Exposed in the Kuma river, at location Bu-94-016-19.

excellent exposures occur along this river to the south. In a steep gorge, very well bedded calcilutites are exposed containing chert layers (photo 2 and 4). It is red in the lower part and becomes gray in the upper part. The calcilutites contain some fossil rich layers. One bed in the higher part of the succession contains

abundant bivalves, ammonites and belemnites as well as chert nodules and layers (photo 5). The stratigraphy shows very thick beds in the lower part of the unit and thin beds in the upper part. In the middle of the sequence there is a 5 m thick interval of greenish gray calcilutites with stylolites, chert, and abundant belemnites. There is also a 7 m thick interval of green and gray shale.

Further down stream, there is a clear geologic contact where the Kuma Formation overlies clastic sediments of presumably the Triassic Dalan Formation (photo 6). In the lower part, the Kuma Formation is commonly made up of reddish grey calcilutites with chert nodules. The formation is gently folded and has some normal faulting. In places, especially at the lower part, beds are contorted with possible slumps. There are small hills occupied by terrace deposits.

STRUCTURE

Figure 3 and 4 show the general geological structure occurred in the Kuma River and Kuma Timber Road area. The structures are anticline, syncline, and normal fault. Dip of bedding is in the range of five to fifty degrees. In general, the fold axis is trending NW-SE and in places E-W and NE-SW. The anticline and syncline are generally in symmetrical form, gentle, and open. Field data do not show a brecciated part in the rock, which is commonly found on the thrust belt area like Lengguru Fold Belt in Papua (Visser and Hermes, 1962, Dow *et al*, 1985). This evidence may indicate that the Kuma River and Sekat Timber Road area are block faulting in relatively stable part of a continent rather than a zone of thrust belt. Field data on the cross section (Figure 3) show that transport direction of the main stress was slightly derived from southwest where the Banda sea is located.

STRATIGRAPHY

The basement in Buru Island is suggested to be pre-Cambrian metamorphic rock (Tjokrosapoetro and Budhitrisna, 1982 and Tjokrosapoetro *et al*, 1993). The Triassic Dalan Formation in the western part of the Buru Island overlies this basement. Based on geological fieldwork conducted in the Kuma River and Kuma Timber road, six formations have been mapped (old to young) (Figure 5): Triassic Dalan Formation, Late Jurassic Duna Formation, Late Cretaceous Kuma Formation, Oligocene-Miocene Waeken Formation, Miocene Wakatin Formation, and Pleistocene Leko Formation. The Duna Formation is introduced for the rich fossils limestone with chert beds, similar to the succession found in the type locality in the Duna River in North Buru (Harahap, 2000).

Photo 5. Well bedded calcilutite with thin bedded and nodular reddish brown chert of Cretaceous-Eocene Kuma Formation. Exposed in Kuma River, at location BU-94-016-19

Photo 6. Landscape showing the relationship between sandstone ridges on the left side and limestone Questa on the right side. Location: Bu-94-016-29 (Kuma River).

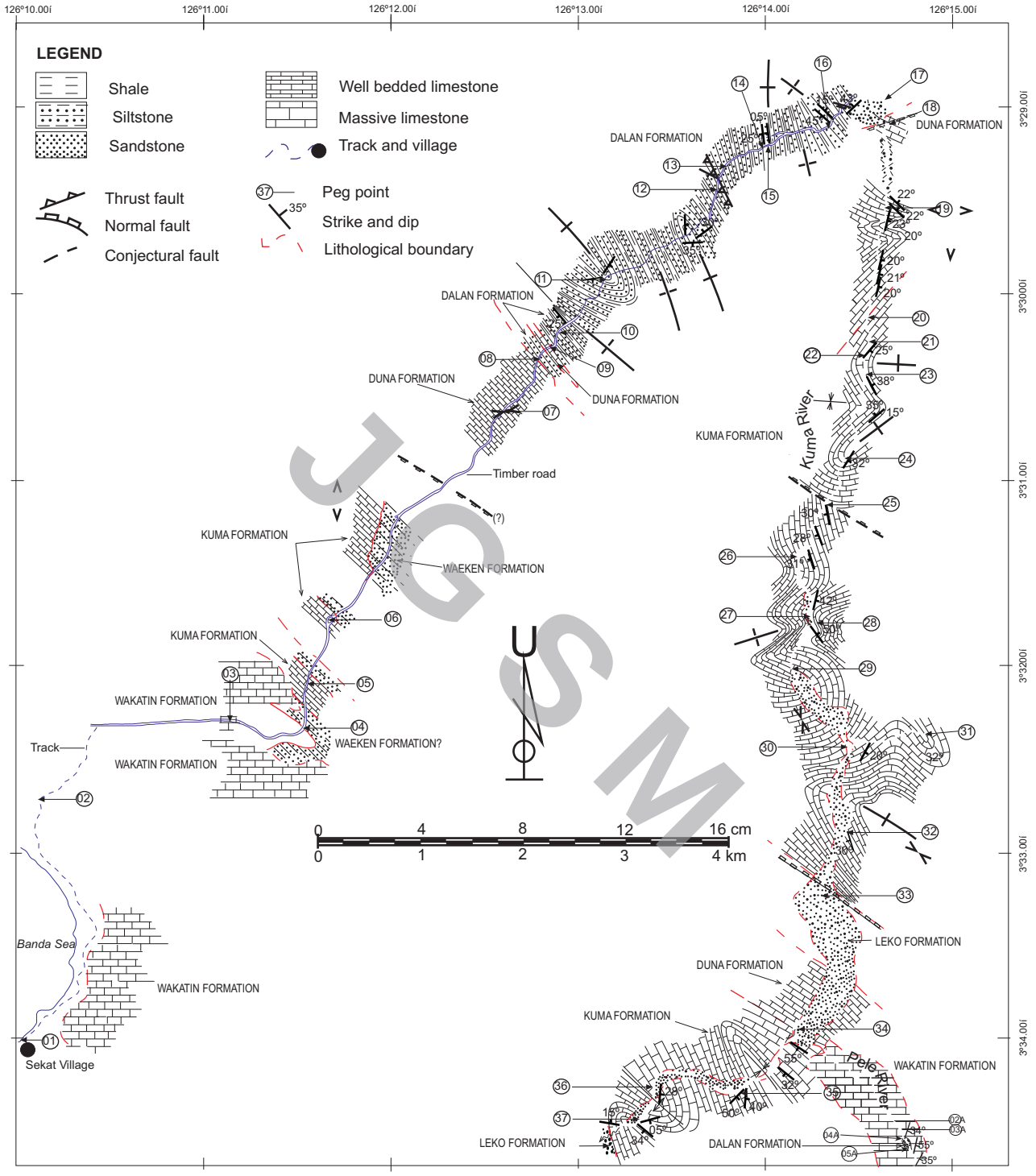

Figure 3. Kuma River Geological Traverse, Buru Island - Eastern Indonesia.

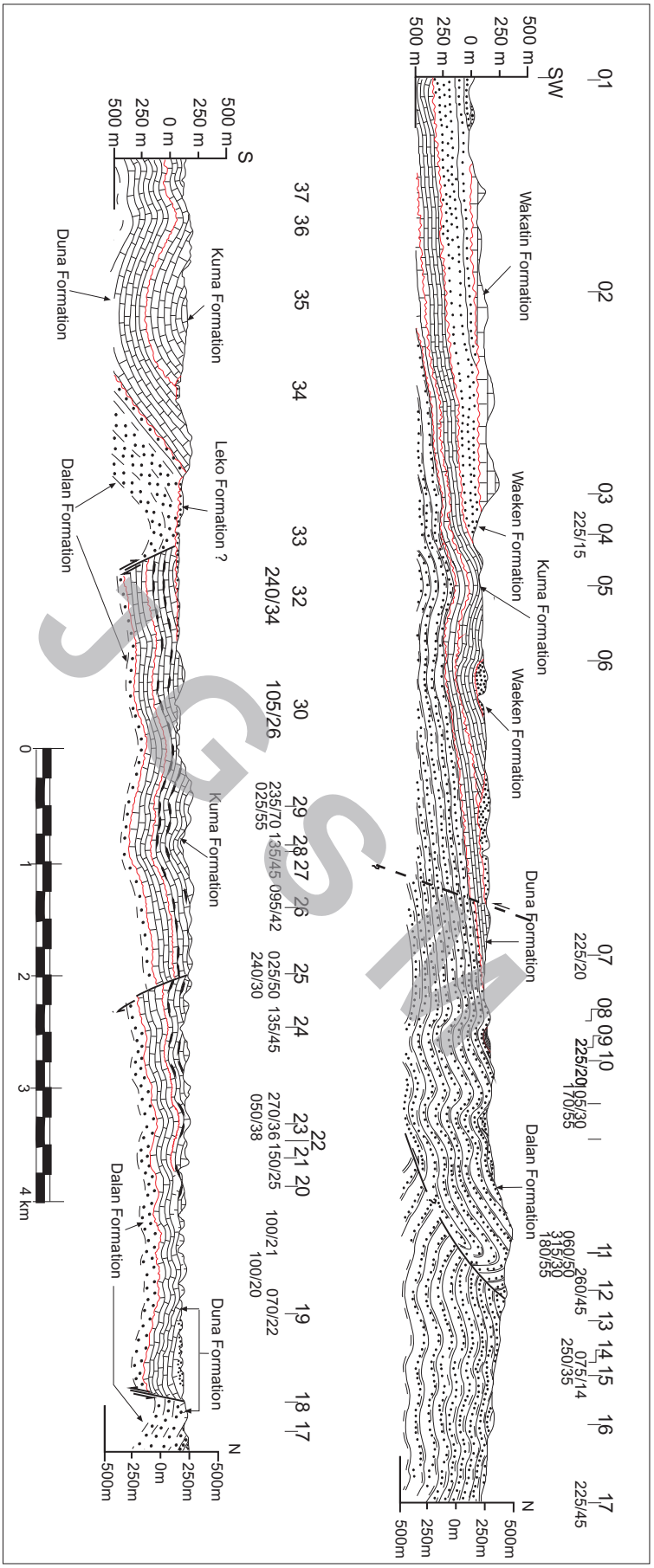

Figure 4. Geological Cross Section of Kuma River and Sekat Tiber Road.

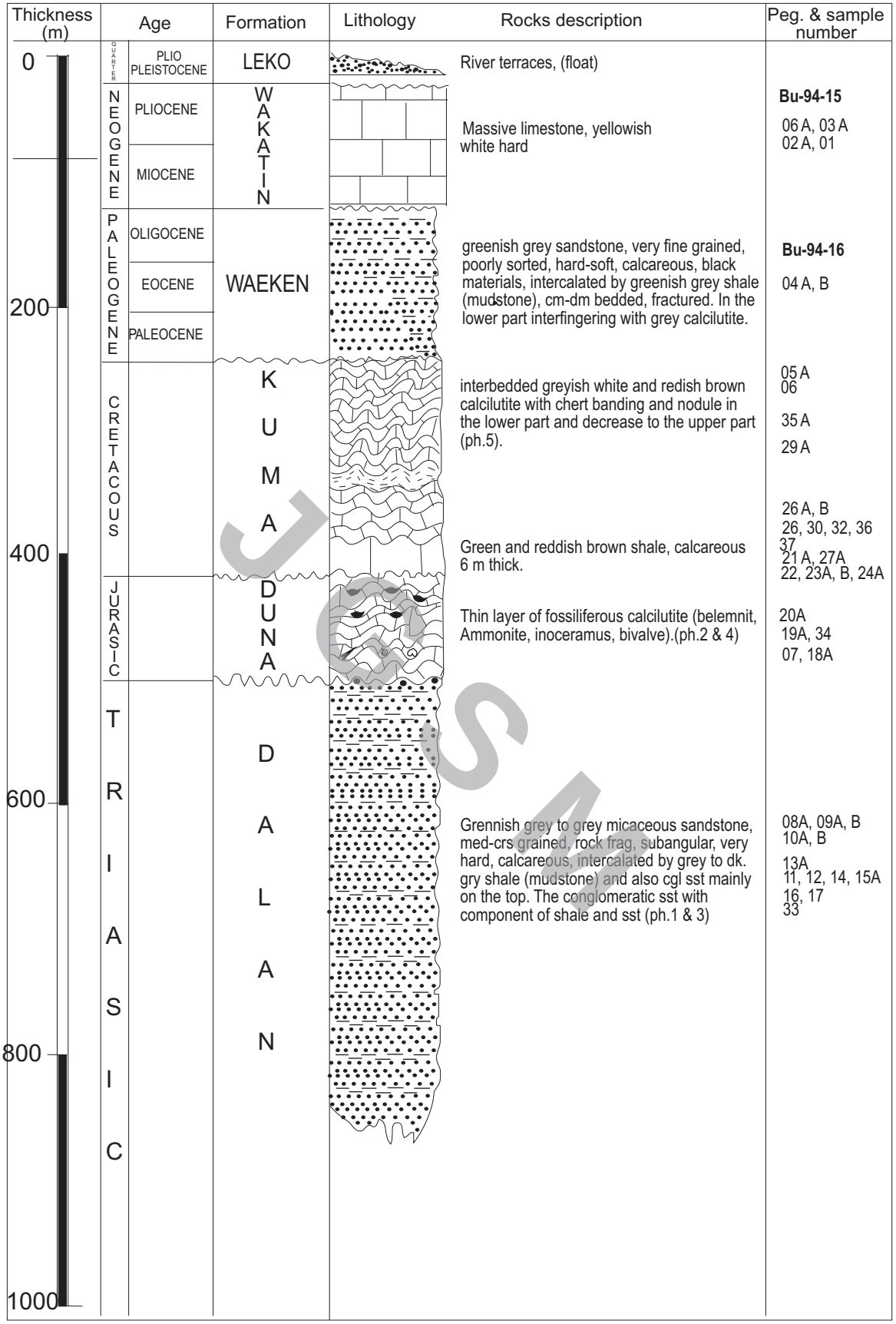

Figure 5. Stratigraphic column of Kuma River traverse.

Triassic Shale and Sandstone (Dalan Formation)

In the Dalan River at Buru Island, the type locality proposed by Tjokrosapoetro *et al*. (1993), the unit is characterized by well bedded sandstone, shale, siltstone, and conglomerate. Beds range in thickness from several cm to about 1 m. Graded bedding, cross-bedding, flow ripples, load structures, and flute marks are present. The formation contains the Triassic trace fossil Halobia (PERTAMINA-Mobil-GRDC, 1994). Wanner (1922) concluded a Triassic age based on more complete bivalve content. A thickness of 1000 to 2000 meters is estimated, based on the regional distribution of the formation. A much greater thickness of the original Dalan Basin may have existed because the base of the formation disappears where it is a gradual transition to its metamorphosed equivalent, the Rana Metamorphic Complex (Tjokrosapoetro *et al*, 1993).

In Kuma River and Sekat Timber Road areas the unit is about 250 m thick. The lithology consists of light to dark grey shale with common sandstone and siltstone, and rare conglomeratic beds. The sandstone are grey to brown, typically fine to medium grained, micaceous, and poorly sorted, composed of quartz, brown and green minerals, feldspar, muscovite, and black material. Plant materials are common in this formation but the kind of coaly beds as observed in some sections in Seram is not present. Metamorphic rock fragments can sometimes be recognized in the sediments. Apart from common lamination, the beds show occasional graded bedding and sole marks.

Based on primary sedimentary structure such as graded bedding, lamination and pelitic rocks, which is a typical of turbidite sediments of Bouma sequences, the Dalan Formation was deposited on a slope at bathyal depths in a restricted environment. The environmental conditions remain basically unchanged during the deposition of the entire sequences. Mica flakes and poor sorting of the sediments show that the source of the rocks was nearby. Small scale folding in the formation is caused by slumping of the sediments and must be the result of tectonic instability of the developing slope. The monotonous, fine-grained composition of the formation is indicative of a relatively stable hinterland (Gondwana), delivering the sediments to the Dalan Basin. Probably the hinterland was peneplained. Some red and green coloured sand-stone are reported to occur in the Dalan Formation (Tjokrosapoetro *et al*., 1993). These sandstones reflect an oxidizing environment and may represent short periods of aerial exposure of the basin sediments. Such red and green colours are much more common in the Triassic of Papua (Pieters *et al.* 1983).

A gradual change from metamorphosed to non-metamorphosed sediments at the base of the Dalan Formation had been observed in Watina River (by the first author), approximately 75 km to the southeast of Kuma River. The metamorphic fragments found in the sandstones and in the rare conglomerates of the formations represent a Triassic unconformity somewhere at the margins of the Dalan Basins but not visible in the studied sections. It is futher reported`that the top of the formation has an interfingering contact with the limestone of the Geghan Formation (Tjokrosaputro *et al.*, 1993), that is exposed approximately 30 kms north of Kuma River.

Jurassic-Cretaceous Belemnite and Bivalves (Duna Formation)

Harahap (2000) introduced the Duna Formation for the fossilferous carbonate beds in the Duna River, northern Buru Island. It is a unit of only some tens meters thick, but with very typical fauna and lithology; where it consists of alternating beds of belemnite-rich limestone, lumachelles (bivalve boundstones) and chert-rich beds. The colours are red, green, and grey. The Duna Formation comprises beds of grey, chert- rich limestone and it interfingers with the volcanics of the Mefa Formations. The number of the chert-rich beds increases towards the top of the unit and finally they replace the bioclastic limestone completely. Wanner (1922) named this fossil rich limestone of Buru as the Kartina Limestone, and Tjokrosapoetro *et al*. (1993) included the unit in the basal part of the Kuma Formation. The Duna Limestone is the equivalent of the belemnite and bivalve-rich “Fatjeh Shales” of Misool (Wanner, 1931), which is now called the Demu Formation (Pigram *et al*., 1982).

In the Kuma River area, the Duna Formation is very well bedded consisting of calcilutite with rare beds of green and grey shale. The calcilutite contains some fossil-rich layers. The lower part of the unit is thickly bedded, while the upper part of the sequence is thinly bedded. Here the calcilutite contains abundant bivalves, ammonite, and belemnites as well as

cherts. In the middle part of the sequence, there is an interval of 5 m thick greenish grey calcilutite with stylolite, chert and abundant belemnite. The Duna Formation is thought to be deposited in the shallow water environment (Harahap, 2000). The unit is probably conformably overlain by the Kuma Formation. The basal contact of the Duna is assumed to be an unconformity. The thickness of the formation is estimated to be 100 m.

Wanner (1922) dated the Duna Formation in Buru as Late Jurassic, based on the assemblage of belemnite Taliabuticus (Boehm), bivalve *Inoceramus* sp., the coral Lovcenipora Vanassai (Giattini), *Auxella* sp. and Aptychus. For the equivalent unit in Misool, Pigram *et al*. (1982) dated the rocks as Late Jurassic, based on ammonite content.

Late Cretaceous to Eocene Calcilutites (Kuma Formation)

Tjokrosapoetro and Budhitrisna (1982) defined the Kuma Formation. In the definition they included the shallow marine, Late Jurassic Duna Formation as described above. The Kuma Formation in the present definition consists only of pelagic limestone and does not include any shallow water deposits. It is the equivalent of the Miting Limestone of Wanner's (1922).

In the Kuma River area, the Kuma Formation consists of well-bedded reddish gray calcilutites with chert bands and nodules, and contains abundant planktonic foraminifers. The formation is gently folded and has some normal faulting. In places, beds are contorted with possibly slumps. Based on these foraminifers, the age of Kuma Formation is Late Cretaceous to Eocene (Harahap, 2000 and Tjokrosapoetro *et al.*, 1993). The environment of deposition of the unit is interpreted as bathyal. The thickness of this formation is estimated to be 300 m. The Kuma is unconformably overlain by the Waeken Formation.

Oligo-Miocene Sandstone (Waeken Formation)

The first occurrence of clastic rocks in Buru during the Tertiary was defined Waeken Formation by Tjokrosapoetro and Budhitrisna (1982). The Waeken Formation is composed of light coloured shale, siltstone, sandstone, and conglomerate. The rocks are in general poorly consolidated and have a variety of light yellow and green colors. The sandstone beds are fining grained and micaceous and often contain reworked plant debris. They were observed as turbidites inside the shale as well as in thickly and irregularly bedded units with large scale fore-sets, probably representing channels. Tjokrosapoetro *et al*. (1993) considered the age of this formation to be Late Oligocene-Middle Miocene. Based on samples collected in this area that contain abundant planktonic foraminifers, the age of this unit is Early to Late Miocene. The environment of deposition is open marine, sublittoral to neritic, and bathyal. The presence of quartz and metamorphic detritus in the formation indicates that the Paleozoic basement of Buru was already eroded in the Oligocene-Miocene. The formation has a thickness of 100 meters.

Miocene platform limestone (Wakatin Formation)

The Wakatin Formation was defined by Tjokrosapoetro *et al*. (1993) to describe Miocene reefal limestone in Buru. It consists of light grey massive reefal limestone containing corals, sponge, algae, bivalves, and benthonic foraminifera. The rocks are commonly hard, and occasionally recrystallised and brecciated.

In Pele River, the unit is dominated by massive limestone. In some places there the unit is composed of brecciated fine crystalline limestone containing foraminifers and gastropods. The environment of deposition of this unit is a coast, open marine. The thickness of this formation is 100 meters. Wanner (1922) and Tjokrosapoetro *et al*. (1993) determined a Late Miocene age for the formation based on larger foraminifers.

Plio-Pleistocene Deltaic Deposits (Leko Formation)

The Leko Formation was defined by Tjokrosapoetro *et al.* (1993) for the terrace deposits in Buru. The unit varies in composition from place to place dependent upon the hinterland lithologies as the source of the rocks. In Kuma River area, the unit consists of coarse and poorly sorted conglomerates of calcilutites coming from the Kuma Formations exposed upstream. The conglomerates form very large fore sets. No fossils were found, but it is obvious that the age is Pliocene or Quaternary. The formation consists of the raised apexes of deltas in the southern part of Buru. The thickness of the formation is estimated to be about 25 m. The Leko has an unconformable relation to all older units.

PETROLEUM GEOLOGY

Source Rocks

The main period of source rock deposition in Buru is in the Triassic to Early Jurassic succession. The sediments succession consists of a turbidite and shale sequences with a high content of plant remains (Dalan Fm). The upper section of the Dalan Formation is interfingering and equivalent with the Ghegan Formation where it has a TOC of 2.6% (PERTAMINA-Mobil-GRDC, 1994) considered to be good source rock. Organic rich shale is indicated from that part of the stratigraphic sequence of Dalan Formation. Therefore, there is a possibility that the Dalan Formation may have potential source rocks which has similar value of TOC with the Ghegan Formation.

The Dalan has a total stratigraphic thickness of 1000 - 2000 meters. It was deposited in subsiding graben structures that developed during the breakin-up stage of the Gondwana craton (Tjokrosapoetro and Budhitrisna, 1982). PERTAMINA-Mobil-GRDC (1994) further reported that about 5% of the observed limestone blocks derived from the Ghegan Formation contain solid oil filling cracks. The solid oil is expelled from the limestone blocks by sun heated.

This research confirms that the main source rock in this area is the unit of Triassic equivalent to Ghegan Formation found in NW Buru. Its thickness is up to 1000 m although it became thinning into less than 200 m in SW Buru which is believed to be an upper part of the Dalan Formation. Minor source potential may also be present in dark shales of Paleogene age (Waeken Formation), but it is assumed to be immature.

Reservoir Rocks

The Triassic Limestone which is interfingering with the Triassic shales act as a fractured reservoir in NW Buru (Harahap, 2000). In the Kuma River and Sekat Timber road area, the conglomerate and sandstone of Dalan Formation may act as reservoir rocks. These clastic rocks are clean and consist mainly of quartz and rock fragments. The porosity of sandstone within the Dalan Formation is estimated to be about 5-10%. Fine grained sandstone in the Paleogene may act as a reservoir but the porosity is low. The thickness of these sandstones is up to 500 m. No oil stain is observed in these rocks. Reefal limestone of Oligocene-Miocene age is up to 300 m thick and has a fair porosity. They are not covered by a seal and no oil stains were observed in these rocks.

Seal

Dense limestone in the top of the Triassic acts as a seal. Mud rock of Paleogene age has a sealing capacity but these do not have a regional distribution.

Traps

The problem in Buru is a lack of trap. The 1:250.000 scale geological map of Buru shows that Triassic reservoir is obviously breaching and eroding in the most elevated parts of the island, here along the shoreline that Mesozoic strata dip seawards at angle of 20 to 45 degrees, indicating that there is very little hope for structural traps in the nearby offshore areas. In Kuma River and Sekat Timber Road areas, the structure consists of low angle fold (anticline and syncline) and normal fault. These folds are generally open and without closure.

CONCLUSIONS

The geological investigation in Kuma River and Sekat Timber Road areas have resulted a more detailed illustration of the geology in the area, including a production of a total length of the geological traverse for 20 km with excellent exposures especially in Kuma River area. The area comprises sandstone, limestone and conglomerate that is divided into six formations, base to top part, Dalan, Duna, Kuma, Waeken, Wakatin and Leko Conglomerate. The important additional information of the geology is that the presence of Duna Formation that is an additional new unit in this area. The stratigraphy of the Kuma River area can be correlated with the stratigraphy of Duna River area in the north, at least since Jurassic which supports the idea that the Buru Island is an anticline having east-west axis. The Dalan Formation in this area can be the flank of Buru anticline. The Dalan Formation changed in facies to be limestone of the Ghegan Formation towards north. Total thickness of the stratigraphy in Kuma River is about 800 m where Dalan is 200 m, Duna is 75 m, Kuma is 300m, Waeken is 100 m, Wakatin is 100 m and Leko 25 m.

The structure geology along the traverse section is in the form of anticline, syncline, and normal fault associated with block faulting. Forces direction of tectonics was thought to be derived from the south (Banda Arc). From the petroleum point of view, based on field observation, it can be said that the area posses several criteria of prospective, such as the present of sandstone as reservoir rocks within the Dalan Formation. While the cap rocks of the Kuma and Duna Formations, have a trap of fold structure. Some parts of the succession of formation found in this area have a significant source rock potential. Evidently, the petroleum system occurs in this area by the presence of dripped oil at the limestone block in Duna River area (PERTAMINA-Mobil-GRDC, 1994 and Harahap, 2000) and in Leksula area (Dr. Munarsi pers. Com, 1988). Here the Triassic Dalan Formation containing plant remain, although it is not really significant compared to the Permian Aifam Group in Papua (Pieters *et al.*, 1983). However, the geochemistry of the source rocks and reservoir analyses of sandstone rocks need a further study.

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