Pedaro formation, equivalent of Plover sandstone at Savu Island, Outer Banda Arc

L D Santy¹, A J Widiatama²

¹Centre for Geological Survey, Geological Agency, Diponegoro Street No. 57, B Build. 4th Fl., Bandung, West Java
²Institut Teknologi Sumatera, Room C 110, Terusan Ryacudu Street, Way Hui, Jati Agung Sub District, South Lampung
*E-mail: santylauti@gmail.com

Abstract. Plover Sandstone have been widely known as a good quality of oil and gas reservoir in NW Australia. As the continuity of NW Australia margin, outer Banda Arc become the distribution area of the equivalent of Plover Sandstone units. Therefore, a clear distinction and characterization of equivalent of Plover Sandstones distributed in this area is needed. Thick unit of quartz rich sandstone is scrap out in south Savu Island. Refers to the location where the lithology is found widely distributed, the unit is suggested to be called as Pedaro Formation. The characteristic of the lithology is determined through detailed measured section from two trajectories and laboratory analysis, including fourteen samples of petrography analysis, eight samples of Scanning Electron Microscope (SEM) analysis, and three samples of X-Ray Diffraction (XRD) analysis. The lower part of the unit is initiated by braided fluvial conglomerates which gradually become tidal sand flat association of shale layers, coal seams and sandstone insertion. While the upper part of the unit is consisting of thick bedded quartz sandstone with thin siltstone insertion, deposited in the shoreface environment. Those facies association developed at transgressive conditions in the estuarine environment. The characteristic of the sandstone unit of Pedaro Formation is thickly bedded quartz wacke to quartz arenite, white to light grey in color, moderately to very well sorted, mostly mature sand. Pedaro Formation is identified to be deposited at Early Jurassic in interior craton tectonic setting. The characterization of sandstone unit of Pedaro Formation is showing that the unit can be correlate to the equivalent of Plover Sandstone found in Timor. Sandstone unit of Pedaro Formation can play a role as reservoir candidate in petroleum system of Savu and surrounding area.

1. Introduction
Savu Island lies in the accretionary zone in the northern part of Timor Thrust. Stratigraphically, it is similar to the Timor Island [1,2], suggested the petroleum system of Savu region can be compared to Timor and other regions in the outer Banda Arc (Figures 1 and 2).

As the continuity of NW Australia margin, it has been widely known that the key elements of petroleum system in outer Banda Arc area occur within the Mesozoic succession, particularly in the Late Triassic and Jurassic section [3,4,5,6,7,8,9]. As a main reservoir target in NW Australia Margin is Plover Sandstone, a unit of quartz rich sandstone deposited inside Mesozoic Basin [7]. The unit consist of a series of widespread braided trunk river systems feeding a relatively narrow wave-dominated coastline and beyond, a wide marine shelf [7].
During the exploration of Banli-1 well in southern West Timor, quartz-rich sandstone was encountered, conformably overlaid by Middle Jurassic Wailuli Formation [4]. The workers were determined it as Early Jurassic potential reservoir sequence of “Plover-equivalent”. While, previous studies conducted in Savu Island have recognized the distribution of Late Triassic and Jurassic sequences in Savu Island [2,3,10,11]. However, the existence of equivalent of Plover Sandstone in Savu has not yet clearly described. Audley-Charles [3] and Rosidi et.al. [10], never mentioned the existence of the unit. While, Harris et.al. [2] mentioned about the Late Triassic unit of immature, poorly sorted, massive red sandstone that abundant with iron alteration and sandstone concrete, called as 'Pedaro Beds’. The unit is used as one of the marker layers of Triassic sediment, found in the center part of Savu, because it is “considered” as a repetitive sandstone contain Halobia sp.

![Figure 1. Geological map and profiles of Savu Island [12].](image.png)

Fieldwork carried out by Centre for Geological Survey at 2014 has identified the unit of quartz rich sandstone distributed at south Savu area. The unit consist of thickly bedded quartz wacke to quartz arenite, white to light grey in color, moderately to very well sorted, mostly mature sand. The description of this unit is quite different to the one described by Harris et.al. [2]. Morphological features where the unit is distributed generally undulating hills, with gentle to slightly steep slopes. The unit is exposed in southern part of Savu Island, cropped out at Pedaro, Ledeae, Wadumadi,
Teriwu, Mahona, Waduwela, and Halafaji villages. In the geological map (Figure 1) this unit is marked by yellow colour. Geological reconstruction made by Widiatama [12] at Savu Island shows that the unit is Early Jurassic age, equivalent to the quartz-rich sandstone identified at well Banli-1 [4]. Therefore, this paper is trying to promote the unit as an equivalent of Plover Sandstone, and suggests that the facies succession where the unit is developed can be promote as a new stratigraphy formation called as Pedaro Formation, refers to the location where the unit is found.

Figure 2. Stratigraphy of Savu compared to Timor Island [2]. Note that Pedaro sandstone is described as Triassic immature, poorly sorted massive red sandstone abundant iron alteration, and sandstone concretions of all sizes.

2. Methodology
Field data were obtained by conducting two geological trajectories, at East and West Savu. Field data was collected to obtain the description of lithologies, included sedimentary structures, measurement of geological structural elements, documentation, and rock sampling for laboratory analysis. All laboratory analysis are taken at GeoLabs of Centre for Geological Survey. Measurement of the stratigraphic section is carried out to determine the vertical and lateral distribution of each rock unit. Rock sampling was carried out systematically for thin section petrography and SEM-EDX analysis. Sixteen outcrop points has been observed.

Data processing includes sedimentological and stratigraphic analysis as well as laboratory analysis. Facies identification has been determined by observing the pattern of rock vertical section at the stratigraphic measurement column, correlation between lithological units, and correlation between West and East Savu trajectories.
Fourteen samples of sandstone unit of Pedaro Formation are taken for petrography analysis, represented lower, center and upper part of the formation. Eight samples have been taken for Scanning Electron Microscope (SEM) Analysis, using JEOL JSM-6360LA, equipped with the JEOL JED-2300 energy dispersive spectrometer (EDS) system. This tool can magnify objects up to 300,000 times and determine the levels of chemical elements semi-quantitatively. Three samples are taken for X-Ray Diffraction (XRD) Analysis for knowing the composition of clay mineral intercalated between the sandstone layer. XRD Analysis is taken by equipment of X-ray Diffraction PANalytical X’Pert PRO PW3040/0.

3. Result

3.1. Facies Succession of Pedaro Formation

Two measure sections have been carried out in Savu (Figure 3). In the East Savu trajectory, the 27 meters thick stratigraphy succession can be divided into three parts, the lower part which has a thickness of 9 meters consists of conglomerates which gradually become shale layers with coal seams at the bottom, and sandstone insertion. The sandstone layers tend to thickening and coarsening upwards. The middle part has a thickness of 9.25 meters consists of layers of quartz sandstone and siltstone. The sandstone layers tend to fining upward and thinning upward, while the silt layers tend to thicken upwards. The upper part has a thickness of 8.75 meters consists of layers of quartz sandstones, the sandstone layers tend to fining and thinning upwards.

On the West Savu trajectory, the measured stratigraphy of 39 meters can be divided into three parts, the lower part which has a thickness of 12 meters consists of shale with sandstone insertion. The sandstone layer tends to thickening and coarsening upwards turns into quartz sandstone with thin siltstone insertion. The middle part has a thickness of 19 meters consists of layers of quartz sandstone with an insertion of siltstone, the sandstone layer tends to thinning and fining upwards. The upper part has a thickness of 8 meters consists of quartz sandstone layers, the sandstone layer tends to thinning the and the fining upwards.

The oldest outcrop of Pedaro succession consist of grain-supported conglomerates (Figure 4a). To the upper part can be found coal layer with a thickness of 30 cm (Figure 4b), which turns into an intersection of shale and sandstone. Shale with a fissile structure, light gray in color, layering of 3-10 cm alternating with fine-grained-very fine sandstones (Figure 4c).

In a younger direction, it will be found yellowish brown sandstones, fine sand to medium sand, 10-20 cm thick, parallel sedimentary structures, with abundant trace fossils. The uppermost part can be observed as light white to yellowish white sandstones, good to very well sorted, grain size medium to coarse sand, 20-60 cm thickness, parallel bed, tabular cross bed sedimentary structure, with trace fossils of Skolitos (Figure 4d).
Figure 3. Measure section carried out in Savu Island to determine the succession of Pedaro Formation.
Figure 4. Outcrop of Pedaro Formation; (a) Conglomerate; (b) Coal layer; (c) Sand – shale intercalation; (d) quartz sandstone.

3.2. Origin of the Pedaro Sandstone

Fourteen petrographic analyses were carried out representing the lower, middle, and upper parts of the formation, summarized in Table 1. It can be seen that the composition of the sandstone is dominated by quartz arenite to quartz wacke (figure 5), while the shale is mudrock. Based on fourteen sandstone samples, provenance analysis of the Pedaro Sandstone shows that it is originated from an interior craton (Table 2).

Eight samples were carried out by SEM observations to determine more detailed microscopic characters, and three samples of XRD analysis which are summarized in Table 3. The Pedaro Formation shows illite as dominant of clay minerals, and in small amounts it can be identified smectite and illite-smectite that fill the pores (pore-filling) and cover the pores (pore-lining). The detritus quartz granules show secondary (autigenic) quartz growth and there are micro-fractures. XRD analysis showed that the illite clay minerals were of the nacrite type, while the smectite was of the nontronite, saponite, and montmorillonite types. The domination of illite and existing of nacrite can be interpreted as the result of metagenetic of the sediment in this area [13]. In addition, there are also faujasite sulfide minerals. The presence of iron sulfide (FeS$_2$) indicates a reducing environment.
Figure 5. Fourteen thin section and eight SEM Analysis has been conducted for knowing the Pedaro characteristics; (a) thin section of quartz wacke with carbonate semen (Ca); (b) thin section of quartz arenite; (c) thin section of quartz arenite; (d) thin section of mudrock; (e) SEM of quartz mineral covered by growth quartz (Qzo); (f) Micro fracture formed at sandstone.

Table 1. Result of petrography analysis carried out at Pedaro Formation [12].

| No | Samples  | Name          | Qm (%) | Qp (%) | KF (%) | PF (%) | Lv (%) | Ls (%) | Lithic (%) | Cement | Matrix | Smt | Opaque minerals | Carbonate | Fm | Other Grains |
|----|----------|---------------|--------|--------|--------|--------|--------|--------|------------|--------|--------|----|----------------|-----------|-----|-------------|
| 1  | 14LS115D | Quartz wacke  | 69.4   | 1.5    | 0.6    | 0      | 0      | 0      | 0          | 10.3   | 2      | 3.6| 12.6          | 0         | 0   |             |
| 2  | 14LS116  | Quartz arenite| 69.9   | 12.1   | 2.7    | 0      | 0      | 1      | 0          | 10.2   | 2      | 5  | 0             | 0         | 0   |             |
| 3  | 14LS119  | Quartz arenite| 79.2   | 4.6    | 4.3    | 0      | 0      | 0      | 0          | 4.3    | 3      | 3.3| 0             | 0         | 13  |             |
| 4  | 14LS121A | Quartz wacke  | 69.3   | 2.6    | 1.3    | 0      | 0      | 0      | 0          | 12.9   | 4      | 4.9| 0             | 0         | 0   |             |
| 5  | 14LS122  | Quartz wacke  | 66.2   | 2.6    | 1.3    | 0      | 0      | 0      | 0          | 18.5   | 2      | 7.6| 0             | 0         | 1   |             |
| 6  | 14LS123  | Quartz arenite| 78.6   | 8.3    | 3.6    | 0      | 0      | 0      | 0          | 6.6    | 2      | 9  | 0             | 0         | 0   |             |
| 7  | 14SH119B | Quartz arenite| 78.3   | 2.6    | 0      | 0      | 0      | 0      | 3          | 12.5   | 3      | 0.6| 0             | 0         | 0   |             |
| 8  | 14SH122  | Quartz arenite| 80.3   | 4.3    | 0      | 0      | 0      | 0      | 5          | 7.3    | 2      | 1.1| 0             | 0         | 0   |             |
| 9  | 14SH123  | Quartz arenite| 77.3   | 4.8    | 2.3    | 0      | 0      | 0      | 2          | 8.3    | 2      | 3.5| 0             | 0         | 0   |             |
| 10 | 14SH124  | Quartz arenite| 75.3   | 4.3    | 0      | 0      | 0      | 0      | 1          | 11.8   | 2      | 4.6| 0             | 0         | 1   |             |
| 11 | 14SH125  | Quartz arenite| 70.3   | 5.3    | 2      | 0      | 0      | 0      | 0          | 17.3   | 3      | 2.1| 0             | 0         | 0   |             |
| 12 | 14SH129  | Quartz wacke  | 75.8   | 1.8    | 2      | 0      | 0      | 0      | 0          | 15.3   | 2      | 1.1| 0             | 0         | 1   |             |
| 13 | 14SH127C | Quartz arenite| 76.7   | 1.6    | 1      | 0      | 0      | 0      | 0          | 9.9    | 2      | 1.8| 0             | 0         | 1   |             |
| 14 | 14SH129  | Quartz arenite| 87.3   | 1.3    | 1      | 0      | 0      | 0      | 0          | 6.3    | 1.6    | 1.4| 0             | 0         | 1.1 |             |
Table 2. Recapitulation of Provenance Analysis for Babulu and Pedaro Formation. It can be summarized that Pedaro Formation is originated from Craton interior [12].

| For. No. | Sample Code | Quartz (%) | Plagioclase (%) | Lithic (%) | Qt (%) | F (%) | L (%) | Q (%) | F (%) | Lt (%) | Lm (%) | Lv (%) | Ls (%) | Tectonic          |
|---------|-------------|------------|-----------------|------------|--------|-------|-------|-------|-------|--------|--------|--------|--------|-------------------|
| Babulu Formation |             |            |                 |            |        |       |       |       |       |        |        |        |        |                   |
| 1       | 14LS105A    | 41.6       | 13.0            | 0.3        | 0.0    | 8.1   | 0.0   | 67.6  | 20.2  | 12.3   | 63.0   | 19.2   | 7.1    | 53.5              |回收氧代       |
| 2       | 14LS105F    | 43.0       | 12.6            | 0.3        | 0.0    | 2.0   | 0.0   | 75.2  | 21.4  | 3.3    | 71.4   | 21.4   | 7.1    | 53.5              |Craton interior |
| 3       | 14LS106B    | 11.6       | 5.0             | 0.0        | 0.0    | 28.4  | 0.0   | 40.8  | 9.4   | 19.8   | 21.9   | 9.4    | 68.7   | 27.5              |回收氧代       |
| 4       | 14LS106C    | 38.8       | 17.6            | 0.0        | 0.0    | 4.0   | 0.0   | 63.8  | 29.5  | 0.7    | 0.61   | 29.3   | 8.9    | 24.5              |Craton interior |
| 5       | 14LS106D    | 20.6       | 6.6             | 0.0        | 0.6    | 15.9  | 0.0   | 51.2  | 14.3  | 34.5   | 44.7   | 14.3   | 41.0   | 15.9              |回收氧代       |
| 6       | 14LS107B    | 8.0        | 5.0             | 2.0        | 11.4   | 20.0  | 0.0   | 57.1  | 34.4  | 64.5   | 16.4   | 14.4   | 69.2   | 6.0               |过渡弧       |
| 7       | 14LS121A    | 20.7       | 5.3             | 13.1       | 0.0    | 1.3   | 0.0   | 79.5  | 18.6  | 1.8    | 72.0   | 18.6   | 9.4    | 80.3              |Craton interior |
| 8       | 14SH101A    | 40.5       | 10.6            | 0.0        | 0.0    | 2.0   | 0.0   | 78.0  | 18.5  | 3.5    | 79.5   | 18.5   | 11.0   | 68.3              |Craton interior |
| 9       | 14SH109A    | 38.9       | 20.0            | 0.0        | 0.0    | 1.0   | 0.0   | 66.9  | 31.5  | 1.6    | 0.61   | 31.5   | 7.1    | 77.8              |Craton interior |
| Pedaro Formation |             |            |                 |            |        |       |       |       |       |        |        |        |        |                   |
| 1       | 14LS115D    | 69.4       | 0.6             | 0.0        | 0.0    | 0.0   | 0.0   | 92.2  | 0.8   | 0.0    | 97.1   | 0.8    | 2.1    | 100.0             |回收氧代       |
| 2       | 14LS116    | 69.9       | 12.1            | 7.7        | 0.0    | 1.0   | 0.0   | 95.7  | 3.2   | 1.2    | 81.6   | 3.2    | 15.3   | 92.4              |Craton interior |
| 3       | 14LS119    | 79.2       | 4.6             | 4.3        | 0.0    | 0.0   | 0.0   | 95.1  | 4.9   | 0.0    | 89.5   | 4.9    | 2.2    | 100.0             |Craton interior |
| 4       | 14LS121A    | 69.3       | 2.5             | 13.1       | 0.0    | 0.0   | 0.0   | 98.2  | 1.8   | 0.0    | 94.7   | 1.8    | 3.6    | 100.0             |Craton interior |
| 5       | 14LS121B    | 68.0       | 2.6             | 1.3        | 0.0    | 0.0   | 0.0   | 98.1  | 1.9   | 0.0    | 94.4   | 1.9    | 3.7    | 100.0             |Craton interior |
| 6       | 14LS125    | 78.6       | 8.3             | 3.6        | 0.0    | 0.0   | 0.0   | 90.0  | 4.0   | 0.0    | 86.9   | 4.0    | 9.2    | 100.0             |Craton interior |
| 7       | 14SH119B    | 78.3       | 2.0             | 0.0        | 0.0    | 3.0   | 0.0   | 96.4  | 0.0   | 3.6    | 95.3   | 0.0    | 6.7    | 100.0             |Craton interior |
| 8       | 14SH121    | 80.3       | 4.3             | 0.0        | 0.0    | 5.0   | 0.0   | 94.8  | 0.0   | 5.6    | 89.6   | 0.0    | 10.4   | 100.0             |Craton interior |
| 9       | 14SH123    | 77.3       | 4.8             | 2.3        | 0.0    | 0.0   | 0.0   | 95.0  | 2.7   | 2.3    | 89.5   | 2.7    | 2.9    | 100.0             |Craton interior |
| 10      | 14SH124    | 75.3       | 4.3             | 0.0        | 0.0    | 0.0   | 0.0   | 98.8  | 0.0   | 1.2    | 93.4   | 0.0    | 6.6    | 100.0             |Craton interior |
| 11      | 14SH125    | 79.3       | 5.3             | 2.0        | 0.0    | 0.0   | 0.0   | 97.4  | 2.6   | 0.0    | 90.8   | 2.6    | 6.8    | 100.0             |Craton interior |
| 12      | 14SH126    | 75.8       | 1.8             | 2.0        | 0.0    | 0.0   | 0.0   | 97.5  | 2.5   | 0.0    | 95.2   | 2.5    | 2.3    | 100.0             |Craton interior |
| 13      | 14SH127C    | 76.3       | 1.6             | 1.0        | 0.0    | 0.0   | 0.0   | 98.7  | 1.3   | 0.0    | 98.7   | 1.3    | 2.0    | 100.0             |Craton interior |
| 14      | 14SH129    | 87.3       | 1.3             | 1.0        | 0.0    | 0.0   | 0.0   | 98.9  | 1.1   | 0.0    | 97.4   | 1.1    | 1.5    | 100.0             |Craton interior |
### Table 3. Recapitulation of SEM and XRD Analysis carried out at Pedaro Formation [12].

| No. | Sample Code | Clay Mineral | Formation | Another Fitur | Behaviour | Clay Type (XRD) |
|-----|-------------|--------------|-----------|---------------|-----------|-----------------|
| 1   | 14LS115     | Illite, with minor clorite | Mat; hexagonal plate | –          | Pore-filling | –               |
| 2   | 14LS115A    | –            | –         | Pyrite       | –         | Nontronite; Faujasite |
| 3   | 14LS115B    | Smectite     | Crenulated to flaky | Micro fractures | Pore-filling | Saponite and Monmorillonite |
| 4   | 14LS119     | Illite, with minor clorite | Mat; hexagonal plate | –          | Pore-filling and pore lining | – |
| 5   | 14LS121A    | Illite       | Mat       | –            | Pore-filling and pore lining | – |
| 6   | 14LS122B    | Smectite     | Crenulated to flaky | Quartz growth and micro fracture | Pore-filling and pore lining | – |
| 7   | 14LS125     | Smectite with minor kaolinite | Crenulated to flaky; with segmented plate | Quartz growth | Pore-filling and pore lining | – |
| 8   | 14SH126A    | Illite - Smectite | Crenulated-wetby with filamentous | Quartz growth from muscovite | Pore-filling and pore lining | Naclrite |
| 9   | 14SH135B    | Illite       | Mat       | Quartz growth | Pore lining | –               |

#### 3.3. Age Determination

There were no fossils can be used to determine the age of Pedaro Formation. Based on the stratigraphic position, Pedaro Formation is conformably overlies by Wailuli Shales. While, the age of Wailuli has been determined using radiolarian fossils, showing Middle Jurassic age (Bajocian-Callovian) [12]. Therefore, it can be estimated that the age of Pedaro Formation is not younger than Middle Jurassic.

Contact between the Pedaro (Plover-equivalent) and the Babulu Formations can’t be observed in the study area. Regionally, Charlton [6] describes that the Plover Formation is deposited in harmony above the Babulu Formation. Referring to Charlton [6] it is interpreted that in the research area, the Pedaro Formation is conformably overlain the Babulu Formation. Based on the reconstruction of the geological section it can be estimated that the thickness of this unit exposed in the study area at least 400 meters. This is suitable with the thickness of the Plover Formation equivalent in the Banli-1 well drilling, which shows a thickness of more than 100 meters.

#### 3.4. Facies Association

Based on the measured stratigraphic section (Figure 3), the lower part of Pedaro Formation shows that it consists of conglomerates and shales. The conglomerate at the bottom has well-sorted grain-supported characteristics indicating it is deposited at a high energy environment. The rounded shape of the fragments shows intensive abrasion, the dominance of sedimentary rock fragments as fragments indicates that the sediment source comes from older sedimentary rocks that are exposed as a result of accumulation in the expansion tectonics or due to the exposing of land during lowering of sea level. The conglomerate corresponds to the Gm facies in Miall's classification [14], which is a feature of channel lag deposits. The association of channel lag deposited without material from the ocean is a characteristic of braided fluvial deposits [14]. Shale with coal seams overlapping conglomerates, showing parallel bed, parallel lamination, slurry cross-bedding, ripple, wavy layer, flaser layer and mud drapes indicates traction currents with different orientations controlled by tides, shedding of carbon material on shale. Shale is thought to be deposited in a tidal sand flat environment [15].

The middle section shows a sandstone deposition pattern with a thinning upward and fining upward layer, well sorted, and the matrix on the sediment indicates a little wave control in the deposition process. The sedimentary structure of parallel layers and laminations with coarse to fine sand-grain sized sediments is characteristic of the shoreface deposit [16]. The insertion of siltstone between the quartz sandstone layers contains Skolithos ichnofacies association indicates that the depositional environment is less influenced by waves, in the middle to lower shoreface environment.
The upper part shows repeated layers of quartz sandstone with a fining upward and thinning upward pattern. The sedimentary structure of parallel layers and laminations with coarse to fine sand-grain sized sediments is characteristic of the shoreface deposit [16]. The association of braided fluvial facies, tidal flat facies, and shoreface facies is characteristic of transgressive conditions in the estuarine environment [16]. The precipitation model for the quartz sandstone unit is depicted in Figure 6.

*Figure 6.* Depositional model of Facies Association of Pedaro Formation at braided fluvial, tidal flat, and shoreface environment.

4. Discussion
Early Jurassic sandstone has been described from the Banli-1 exploration well as the Plover equivalent Formation [4,6]. The Plover Formation is deposited in the passive margin of Gondwana in a delta environment with dominant sedimentation of quartz sand which is influenced by tidal currents [17]. On Tanimbar Island [18] there are Triassic to Early Jurassic-aged sandstones and Early Jurassic coal (outcrops in the form of boulders in poton) which are deposited in a fluviodic environment to tidal areas.

Physically and from age determination, thickly bedded quartz wacke to quartz arenite unit of Pedaro Formation can be compared to those of the Plover Formation in Australia and the Triassic-Jurassic Sandstone of Tanimbar Island with variations in depositional facies more towards the basin. Provenance analysis of quartz sandstones shows the origin of sediments from interior cratons [12].

The Pedaro Formation has some distinctive characteristic and facies succession, mapable in the south Savu area. It can be separated from the sandstone unit of Triassic Babulu Formation. The separation of Pedaro Formation from the rest of Babulu Formation sequence will help facilitate the mapping of hydrocarbon reservoir targets in Savu and its surrounding area.
5. Conclusion
Geological observation and laboratory analysis have been carried out to determine the characterization of quartz-rich sandstone unit cropped out at the south part of Savu Island as Plover equivalent. The facies unit consist of quartz sandstone, shale, conglomerate, and siltstone, deposited at fluvial and tidal environment in the lower part, gradationally changing to the upper part, becoming estuarine sediment deposit with the influence of marine wave, during transgressive event at Early Jurassic. The analysis of provenance suggested sediment origin from craton interior. Hereinafter, we suggested that the lithologic succession carried out sandstone unit of “Plover equivalent” in Savu Island can be named as Pedaro Formation. Furthermore, we expected that the study of Pedaro as reservoir candidate and study of Savu petroleum system can be continued comprehensively in order to understand the petroleum play in the outer Banda Arc region.

Acknowledgement
The authors are grateful to all members of the 2014 Savu Basin Team who have helped in data collection, the GeoLab Laboratory of the Geological Survey Center, the Geological Agency Ministry of Energy and Mineral Resources Republic Indonesia that carried out G&G Survey at 2014 in Savu and Rote area, and also to Dr. Dardji Noeradi for his discussion and suggestions during draft writing.

References
[1] Tampubolon B T, Sameena Y 2009 Savu basin: a case of frontier basin area in eastern Indonesia Proc. 33rd Indonesia Petroleum Association Annual Convention (Jakarta, Indonesia)
[2] Harris R A, Vorkink M W, Prasetyadi C, Zobell E, Roosmawati N, and Apthorpe M 2009 Transition from subduction to arc-continent collision: Geologic and neotectonic evolution of Savu island, Indonesia. Geosphere. 5(3) 152 – 71
[3] Audley-Charles M G 1987 Evolution of southern margin of tethys (north Australian region) from early Permian to late Cretaceous (Tethys and Gondwana, Geol. Soc. Spec. Publ. 37) ed M G Audley-Charles and A Hallam pp 79 – 100
[4] Sani K, Jacobson M I, and Sigit R 1995 The thin-skinned thrust structures of Timor Proc. 24th Indonesian Petroleum Association Annual Convention (Jakarta, Indonesia) 277 – 93
[5] Milsom J 2000 Stratigraphic constraints on suture models for eastern Indonesia J. of Asian Earth Sci. 18 761 – 79
[6] Charlton T R 2001 The petroleum potential of West Timor Proc. 28th Indonesian Petroleum Association Annual Convention (Jakarta, Indonesia) 301 – 17
[7] Barber P, Carter P, Fraser T, Bailie P, Myers K 2003 Paleozoic and Mesozoic petroleum systems in the Timor and Arafura seas, eastern Indonesia Proc. 29th Indonesian Petroleum Association Annual Convention (Jakarta, Indonesia)
[8] Matsui R, Shinbo E, Omokawa,M, Zushi T 2009 Quartz cementation and reservoir quality of the plover sandstone in the Abadi gas field Proc.33rd . Indonesia Petroleum Association Annual Convention (Jakarta, Indonesia)
[9] Zimmermann S, Hall R 2014 Provenience of Mesozoic sandstones in the Banda arc, Indonesia.Proc. 33rd Indonesia Petroleum Association Annual Convention (Jakarta, Indonesia)
[10] Rosidi H M D, Tjokrosaporo S, and Gafoer S 1979 Peta geologi lembar Kupang, Timor Pusat penelitian dan pengembangan Geologi (Bandung, Indonesia)
[11] Roosmawati N and Harris R 2009 Surface uplift history of the incipient Banda arc-continent collision: geology and synorogenic foraminifera of Rote and Savu islands, Indonesia. Tectonophysics 479 95 – 110
[12] Widiatama A J 2019 Sedimentasi batuan Mesozoikum pulau Sawu Thesis Program Master Institut Teknologi Bandung (Unpublished)
[13] De Segonzac, G D. 1970. The Transformation of clay minerals during diagenesis and low grade metamorphism: A review. *Sedimentology* **15**, Issue 3-4 pp 281 – 346

[14] Miall A D 1992 Alluvial deposits pp 119 – 142 *Facies model: Response to sea level change* ed Walker R G and James N p 409 (Geological Association of Canada, Ontario-Canada)

[15] Dalrymple R W 1992 Tidal depositional systems pp 195-218 *Facies model: Response to sea level change* ed Walker R G and James N p 409 (Geological Association of Canada, Ontario-Canada)

[16] Reinson G E 1992 Transgressive barrier island and estuarine systems pp 179-194 *Facies model: Response to sea level change* ed Walker R G and James N p 409 (Geological Association of Canada, Ontario-Canada)

[17] Tovaglieri F. and George A D 2014 Stratigraphic architecture of an early middle Jurassic tidally influenced deltaic system (Plover formation), Browse basin, Australian northwest shelf, *Marine and Petroleum Geology* **49** pp 59 – 83

[18] Charlton T R, de Smet M E M, Samodra H, and Kaye S J 1991 The stratigraphic and structural evolution of the Tanimbar islands, eastern Indonesia *J. of Southeast Asian Earth Sci* **6** pp 343 – 58