Seam C1A2 Group coal rank analysis in East Meranti PIT, Katanjung Village, Kapuas Regency based on proximate values

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Abstract. Coal is an organic rock originating from plant matter that undergoes decomposition (diagenesis/biochemical process), increasing carbon (C) content, calorific value, and rank. Kalimantan Island is one of the islands with the largest coal reserves, reaching 19.27 billion tons. The research area is located at the PT Sembilan Tiga Perdana coal mining site in Katanjung Village, Kapuas Regency, Central Kalimantan Province. The research area covers an area of approximately 1.1 hectares and is situated about 38 km east of Kuala Kurun, Gunung Mas Regency, Central Kalimantan. This research aims to analyze the coal rank of the C1A2 seam group at East Meranti Pit, Katanjung Village, Kapuas Regency, based on proximate values. The research methodology consists of direct field surveys and laboratory methods. Field surveys include surface and subsurface surveys, while laboratory methods comprise petrological and proximate analyses. The determination of coal rank refers to the ASTM (American Society for Testing and Materials) classification. The results and discussion of the research indicate the presence of one anthropogenic geomorphological unit. The research stratigraphy consists of two units: laminated sandstone unit and interbedded sandstone-claystone unit. The lineament pattern trends north-south direction. The calculated calorific value of the C1A2 seam group coal is 13,388 btu/lb, categorizing it as high-volatile B bituminous coal.

1 Introduction

Coal is an organic rock from plant matter that undergoes decomposition (diagenesis/biochemical process), increasing carbon (C) content, calorific value, and rank. Additionally, there is a decrease in hydrogen, oxygen, nitrogen, sulfur, and geochemical/metamorphic processes [1,2]. Coal is a deposit of organic carbon compounds that can naturally form from the remains of plants [3].

Kalimantan is one of the islands with the largest coal reserves. According to the latest data from the Geological Agency of the Ministry of Energy and Mineral Resources, Kalimantan is noted as a region with the largest coal reserves. Coal reserves in Kalimantan reach 19.27 billion tons. In the Kalimantan region, the largest reserves are found in East Kalimantan with 13.61 billion tons, South Kalimantan with 3.67 billion tons, and Central Kalimantan with 1.99 billion tons. Based on the above reserves, coal can be utilized as an energy resource [4].

The research area is regionally located within the Barito Basin. The Barito Basin is one of the many sedimentary basins in Southeast Asia that formed during the early Cenozoic period [5,6,7]

The coal object of this research is located within the Tanjung Formation (Tet). During the syn-rift period, the Barito Basin received sedimentary material from the Late Paleocene to Middle Eocene, which constitutes the rift sediments comprising the Tanjung Formation, characterized by lithologies such as sandstone, claystone, shale, conglomerate, and coal seams. During the syn-rift sequence, the collision between the Indian continent, Eurasia, and the western part of the Pacific in the Early Middle Eocene formed the Barito Basin through rift events in the convergent wrenching or back-arc basin extension [8,9,10,11,12,13].

The geological structure of the Barito Basin is caused by the convergent uplift of the Meratus Mountains. This uplift pushed the basin obliquely to the northwest. This can be seen from the threshold to the west of all the structures and imbricate systems approaching the Meratus Mountains. The Barito Basin began its development in the Late Cretaceous, following the micro-continental collision between Paternoster and the SW Borneo microcontinent. Early Tertiary extensional deformation occurred as a tectonic consequence of this oblique convergence. This resulted in a series of NW ± SE trending rifts [13].

Based on this background, this research aims to analyze the coal rank of the C1A2 seam group in the East Meranti Pit, Katanjung Village, Kapuas Regency, based on proximate values.

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2 Research Material and Methods

2.1 Research Material

The research area is located at the PT Sembilan Tiga Perdana coal mining site, in Katanjung Village. The research area covers an area of approximately 1.1 hectares (Figure 1). The operational area of the mining site is one of the operational areas of PT Sembilan Tiga Perdana, located approximately 38 km east of Kuala Kurun, Gunung Mas Regency, Central Kalimantan. Administratively, Katanjung Village falls within the jurisdiction of Kapuas Regency, Central Kalimantan Province.

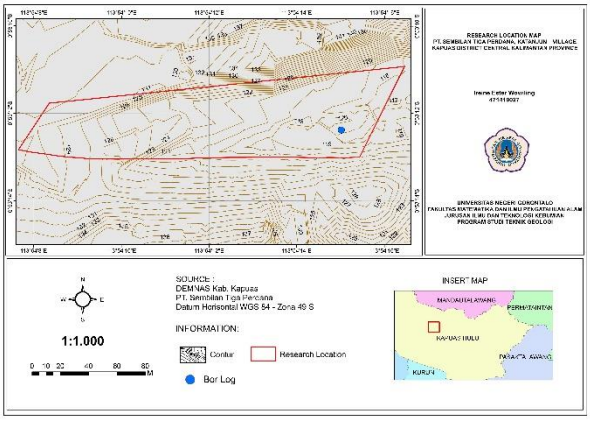

Fig. 1. Research location map

2.2 Research Method

The research methodology employed in this study consists of direct field survey methods and laboratory methods. Field investigation methods include direct surface and subsurface surveys, which involve sampling rock specimens from drilling, collecting coordinate points, obtaining elevations, observing geomorphology, and documenting field observations [14,15,16,17,18,19,20,21].

Meanwhile, the laboratory method comprises petrological and proximate analyses. The petrological analysis involves the analysis of thin section samples using a hand lens and Mohs hardness test kit. The petrological description of the coal in the research area includes colour, streak, lustre, hardness, impurities, fracture, cleavage, and resistance. Proximate analysis is conducted to determine the quality values of coal such as inherent moisture, ash content, volatile matter, fixed carbon, calorific value, and total sulfur. The determination of coal rank refers to the classification [22] (Figure 2).

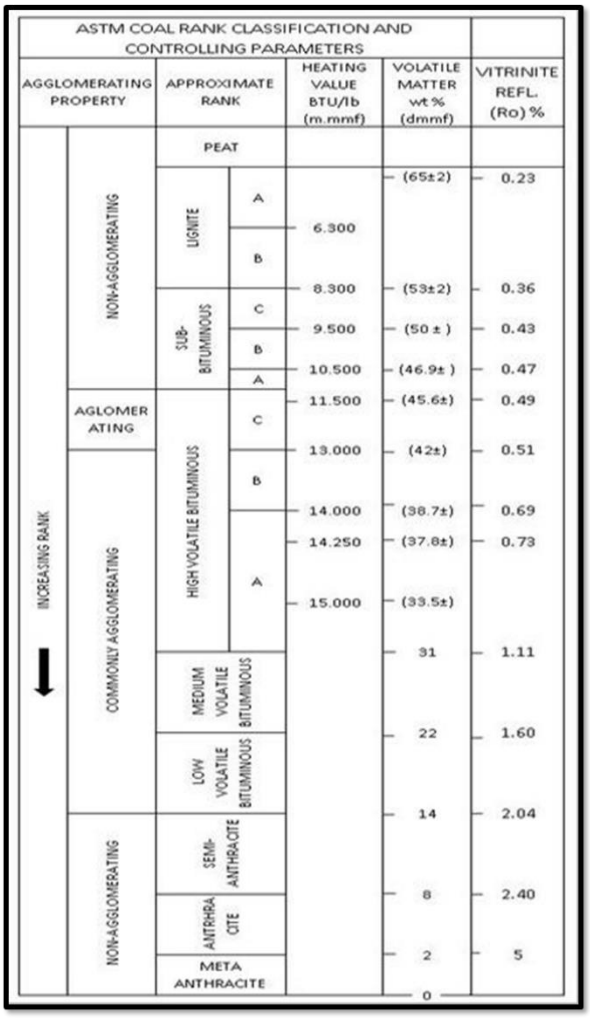

Fig. 2. Coal classification according to [22]

3 Result and Discussion

3.1 Geomorphological

The geomorphology of the research area, according to David (2006), is classified as a Mining Open Unit (A1). The research area located in the eastern part of the Miranti Pit has anthropogenic geomorphological aspects in the open mining area with nearly flat to flat topographic relief. The morphogenesis consists of passive morphostructures of loose materials ranging from sand to clay, and the morphodynamics are influenced by mining activities (Figure 3).

Fig. 3. The geomorphological unit of the research area is characterized as a mining open unit.

This geomorphological unit is formed during mining activities, resulting in mine slopes with longitudinal patterns following the bedding strike, where the rocks trend west-east with rock dip towards the north. The lithology comprising this unit consists of loose materials such as sandstone, claystone, and coal.

3.2 Stratigraphy

The stratigraphy of the research area is within the Tanjung Formation (Tet), which comprises units of laminated sandstone and interbedded sandstone with claystone. The age of the Tanjung Formation, based on regional stratigraphy is Late Eocene.

Laminated Sandstone Unit

With lithological characteristics of clastic sedimentary rocks, fresh rock, light grey, and fine-grained sand-sized particles with good sorting. Closely packed, and the rock structure is laminated (<1 cm) with a strike/dip of N 272°E/22°. The mineral composition includes quartz and feldspar, and the thickness of this unit is 40 meters (Figure 4).

Interbedded Sandstone-Claystone Unit

With lithological characteristics of clastic sedimentary rocks, ranging in colour from white to greyish, coarse-grained sand-sized particles, rounded grain shapes with a closed texture, and good sorting. This sandstone is interbedded with claystone and composed of quartz and feldspar minerals, with a thickness of 60 meters (Figure 5).

Fig. 4. The appearance of laminated structures in sandstone

Fig. 5. The appearance of interbedded sandstone-claystone unit

3.3. Geological Structure of Research Area

Climate change has led to high levels of weathering in this research area. This condition results in soil accumulation, causing secondary structural features in outcrops to be less easily identifiable. Therefore, the analysis refers to drawing lineament patterns on river valleys from SRTM maps. Based on the pattern of drawing river valleys, which is then analyzed using a rose diagram, the obtained general direction of the lineament pattern relative to north-south (N-S).

3.4 Coal Rank

The determination of the coal rank of the C1A2 seam group in the research area is based on the ASTM (American Society for Testing and Materials) classification (Figure 6). For coal rank analysis, it relies on petrological descriptions and proximate analysis.

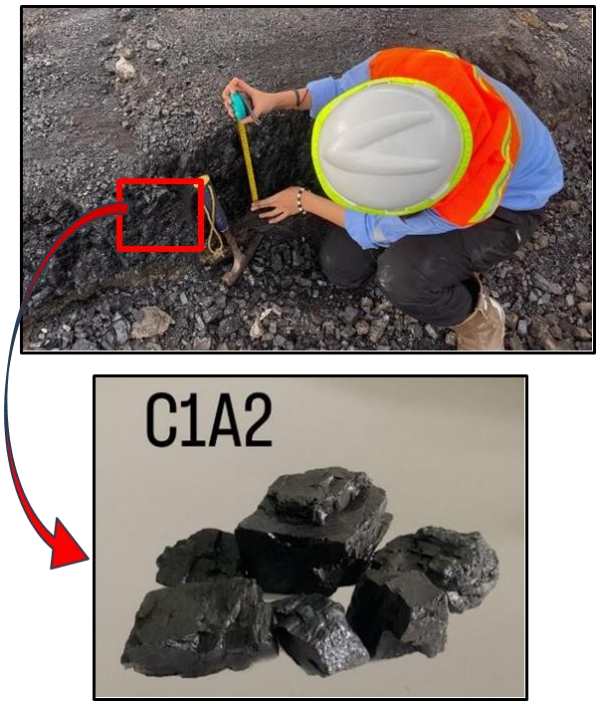

Fig. 6. Physical appearance of coal seam group C1A2

The petrological description of coal in the research area includes colour, streak, lustre, hardness, impurities, fracture, cleavage, and resistance. The results of the coal description can be seen in Table 1.

Table 1. Coal seam group C1A2 descriptions

Sample Code	Seam thickness (cm)	Description	Coal rank
C1A2	31	1. Colour: black 2. Streak: Dark brown to blackish 3. Lustre: Glassy - pearly 4. Hardness: 5 5. Impurities: pyrite 6. Cleavage: one direction 7. Fracture: Irregular 8. Resistance: brittle	Subbituminus – Bituminus

The coal rank is based on ASTM (American Society for Testing and Materials) at the East Meranti Pit, PT. STP (Sembilan Tiga Perdana), Katanjung Village, Kapuas Regency, Central Kalimantan Province, can be seen in Table 2.

Table 2. The results of the coal analysis based on ASTM for the C1A2 seam group

Sample Code	Gross Calori	Gross Calori Result (x 1.8 btu/lb)	Coal Rank
C1A2	7.438	13.388 btu/lb	High-volatile B Bituminous coal

The results of the coal rank calculation for the C1A2 seam group can be seen in the data below:

- 1 kcal = 3,96 btu
- 1 kg = 2.20 lb
- 1kcal/kg = (3.96 btu)/(2.20 lb)=1.8 btu/lb
- 1 kcal/kg = 1.8 btu/lb
- 7.438 kcal/kg x 1.8 btu/lb = 13.388 btu/lb
- Rank High-Volatile B Bituminous Coal

4 Conclusion

Based on the research results, the coal rank of the C1A2 seam group at the location of PT Sembilan Tiga Perdana, East Meranti Pit, indicates the presence of one anthropogenic geomorphological unit. The research stratigraphy consists of two units: laminated sandstone unit and interbedded sandstone-claystone unit. The lineament pattern trends north-south direction. The calculated calorific value of the C1A2 seam group coal is 13,388 btu/lb, categorizing it as high-volatile B bituminous coal.

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