Coal Facies of Coal Deposit, Tekorejo-Buay Madang Area, OKU Timur Districs, South Sumatra, Indonesia.

Basuki RAHMAD[1], Yody RIZKIANTO[1] Mochamad Ocky Bayu NUGROHO[1], Sugeng RAHARJO[1], EDIYANTO[1], Rozi Kurnia RUSANDI [1]
[1]Department of Geological Engineering, Faculty of Technology
Mineral, Universitas Pembangunan Nasional "Veteran" Yogyakarta,
Indonesia Corresponding author: basukirahmad@upnyk.ac.id

ABSTRACT

Lithology of coal bearing deposit Tekorejo Area consist of claystone interbedded carbonaceous claystone and channel sandstone fine sand to very coarse sand, cross bedding, normal reverse graded bedding included Kasai Formation. Result of pollen analysis from carbonaceous claystone samples there are florschuetzia levipoli (Plio- Pleistocene) and florschuetzia meridionalis fossils (Plio-Pleistocene) shows deltaic plain environment at marsh facies controlled by meandering river system. The trending of development structure geology is anticline-syncline WNW-ESE toward. Calorivic value coal deposit in Tekorejo area between 4441- 5494 cal/gr (adb) subbituminous rank.

Maceral composition of coal deposit Tekorejo Buay Madang Area from 9 samples are vitrinite between 56.2 - 95.4

% vol.; liptinite between 1.6 -6 % vol. and inertinite between 2 - 35.6 % vol. Mineral Matter between 2.6 - 27.2 % vol. The condition shows degraded of vitrinite is lower at limnic condition, whereas the most inertinite maceral content at sample number-9 (35.6 % vol.), it shows oxic condition at tropical climate. Reflectance vitrinite value between 0.43-0.45 subbituminous rank.

Keywords: limnic, marsh, vitrinite, inertinite, limnic, oxic, tropical climate, subbituminous

INTRODUCTION

The research location, which is located in Tekorejo-Buay Madang, Ogan Komering Ulu Timur, South Sumatra, is mostly a rubber and oil palm plantation area, below which are coal deposits including the Kasai Formation of Late Miocene-Pliocene age in the South Sumatra Basin (Gafoer et al. ., 1994).

The Ogan Komering Ulu Timur area is located in the northernmost part of the Lampung Highlands, the appearance of bedrock with a north-south trend on which is deposited Tertiary sediments from the South Sumatra Basin covering east/southeast and west (Pulunggono et al., 1992). The purpose of this study was to determine the depositional environment and coal facies.

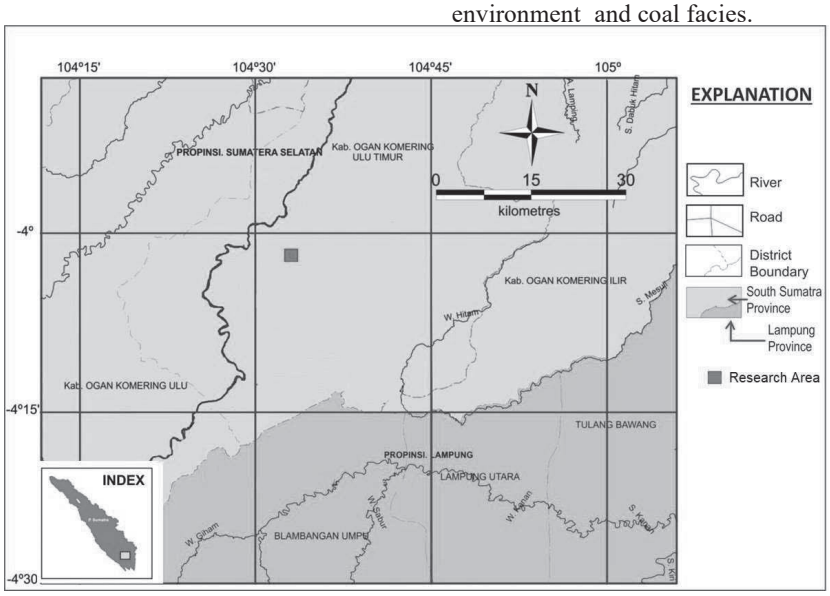

Figure 1. Research Area

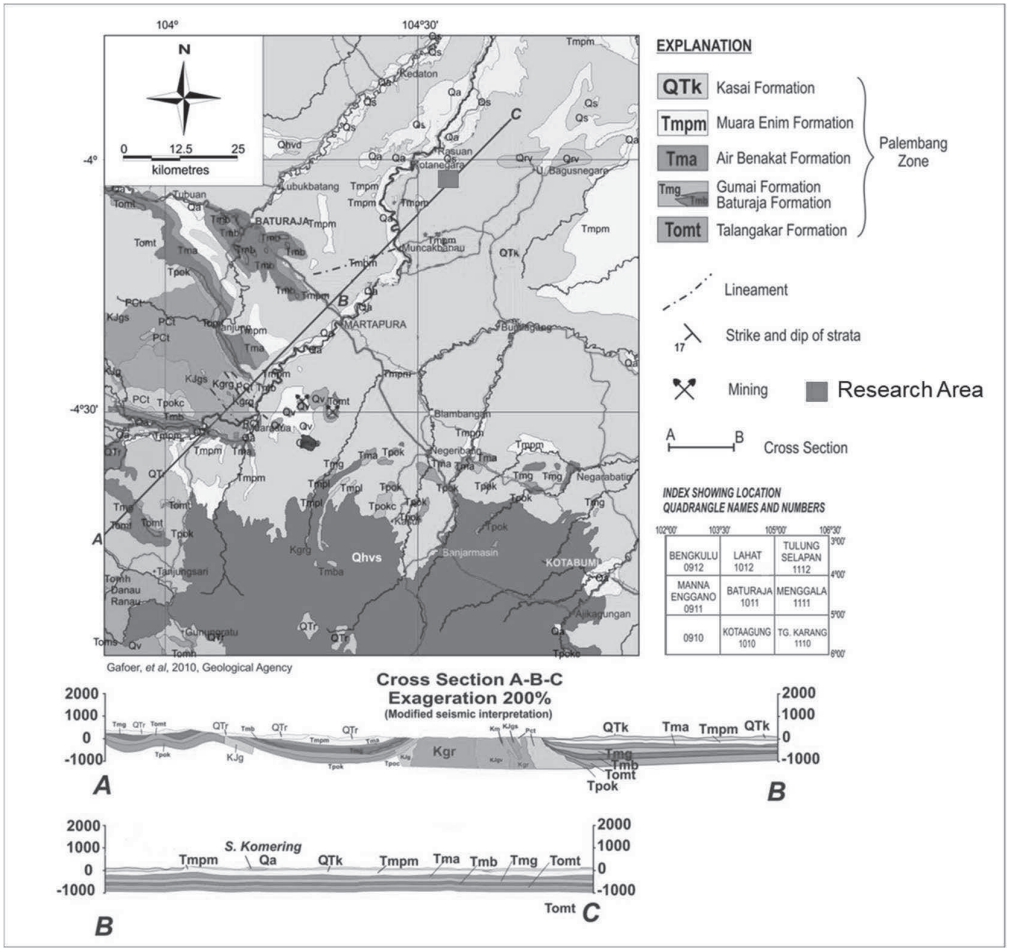

Figure 2. Geology of research area (Gafoer et al., 1994)

METHOD OF RESEARCH

The research methods used are field observation of coal outcrops, profiling and laboratory analysis. Laboratory analysis includes proximate and maceral analysis of coal. Coal maceral analysis was carried out by means of coal samples obtained from the field and then made into polished briquette pellets with a diameter of 2.5 cm and a thickness of 2 cm. Coal petrographic analysis is divided into 2 types, namely reflectance analysis and maceral analysis using a reflected light microscope Leitz Orthoplan POL Polarizing Research Microscope equipped with a vertical illuminator, using an oil immersion objective. Reflectance analysis to determine the amount of reflected light reflected by the maceral, in this case the vitrinite maceral with the consideration that vitrinite maceral is most commonly found in coal deposits. The increase in the amount of reflected light from the vitrinite maceral corresponds to the increase in the coal seam level of coalescence, so that the vitrinite reflectance analysis can be used to determine vitrinite reflectance analysis can be used to determine the coal seam rank.

RESULTS AND DISCUSSION

Coal quality test to determine coal rank is based on coal proximate analysis. The results of the proximate analysis (coal quality) based on outcrop samples for each formation are shown in (Table 1). Kasai Formation : CV 4441 -5494 kcal/kg (adb), sulfur 0.31 – 5.26% (adb); ash 1.37 – 19.33% (adb); inherent moisture 8.3 -11.21% (adb); volatile matter
35.51 - 45.54% (adb); fixed carbon 34.42 – 44.17% (adb), Total Moisture 30.16 – 59.35 % (ar); relative density 1.34 -1.46, the avarage of reflectance vitrinite
0.44-0.48, coal grade classification: sub-bituminous coal. (Table 2). The results of the petrographic analysis of 9 coal samples of the Kasai Formation, all of these samples were taken from surface outcrops. The mean vitrinite-maceral group percentage of the Kasai Formation was 74.67%.

Table 1. Result of Tekorejo-Buay Madang coal Kasai Formation proximate analysis

No.	Lab.Number	Sample Marks	Formation	Total Moisture % (ar)	Inherent Moisture % (adb)	Ash % (adb)	Volatile Matter % (adb)	Fixed Carbon % (adb)	Calorivic Value cal/gr (adb)	Total Sulfur % (adb)	Relative Density	Rv (max)	Coal Rank
1	7363/2011	OKUT-1/S-1/S-IJAN	Muara Enim	56.33	9.68	6.65	43.82	39.85	5397	2	1.4	0.44	SubBituminus
2	7364/2011	OKUT-1/S-2/S-IJAN	Muara Enim	49.47	8.3	19.33	37.95	34.42	4441	5.26	1.5	0.44	
3	7365/2011	OKUT-1/S-3/S-IJAN	Muara Enim	57	11.21	3.69	42.92	42.18	5390	0.31	1.35	0.46	
4	7366/2011	OKUT-2/IRIGASI	Muara Enim	45.33	10.07	9.43	45.54	34.96	4834	0.63	1.41	0.46	
5	7367/2011	OKUT-4/TEST PIT	Muara Enim	57.85	10.21	2.45	43.47	43.87	5351	1.68	1.37	0.48	
6	7368/2011	OKUT-5/WAY-KANAN/TBL	Muara Enim	43.91	10.95	20.26	35.51	33.28	4389	0.57	1.46	0.46	
7	7369/2011	OKUT-6/SEAM-E/HANSEN	Muara Enim	44.59	10.57	4.69	42.91	41.83	5228	2.36	1.4	0.46	
8	7370/2011	OKUT-6/SEAM-G/HANSEN	Muara Enim	30.16	10.43	1.37	44.03	44.17	5494	0.7	1.34	0.46	
9	7371/2011	OKUT-7/KALIREJO	Muara Enim	59.35	10.92	5.76	43.78	39.54	5394	0.51	1.38	0.46	

Table 2. Maceral Composition of the Tekorejo-Buay Madang Area, Muara Enim Formation

Sampel			7363/OKUT 1	7364/OKUT 1	7365/OKUT 1	7366/ OKUT 2	7367/ OKUT 4	7368/OKUT 5	7369/OKUT 6	7370/OKUT 6	7371/OKUT 7
Kelompok Maseral	Sub Kelompok Maseral	Maseral	% Volume Per Nomor Contoh								
			1	2	3	4	5	6	7	8	9
VITRINITE			69.0	65.0	77.2	78.4	84.4	70.0	76.4	95.4	56.2
	Telovitrinite		5.0	0.4	9.0	5.4	6.4	3.6	9.4	16.4	2.0
		Textinite									
		Texto-ulminite									
		E-ulminite									
		Telocollinite	5.0	0.4	9.0	5.4	6.4	3.6	9.4	16.4	2.0
	Detrovitrinite		56.0	44.0	62.8	59.6	64.4	58.4	61.0	53.0	51.6
		Attrinite									
		Densinite	1.0	8.4	8.0	20.0	4.4	5.0	4.6	1.4	2.6
		Desmocolinite	55.0	35.6	54.8	39.6	60.0	53.4	56.4	51.6	49.0
	Gelovitrinite		8.0	20.6	5.4	13.4	13.6	8.0	6.0	26.0	2.6
		Corpogelinite	8.0	20.6	5.4	13.4	13.6	8.0	6.0	26.0	2.6
		Porigelinite									
		Eugelinite									
LIPTINITE			5.6	6.0	4.8	2.4	1.6	2.2	4.6		1.6
		Sporinite			1.8				0.6		
		Cutinite		0.6					0.4		
		Resinite	5.6	5.4	3	2.4	1.6	0.4	3		1.6
		Liptodetrinite						1.4			
		Alginite									
		Suberinite						0.4	0.6		
		Flourinite									
		Exsudatinite									
		Bituminite									
INERTINITE			13.8	1.8	11.8	8.2	7.6	7.4	11.4	2.0	35.6
	Telo-inertinite										
		Fusinite							1.4		3.6
		Semifusinite	0.4		0.4	1.4	0.6	0.4	5		12.4
		Sclerotinite	8.0	1.4	11	4.4	5	6.4	2.6	1.6	9.0
	Detro-inertinite										
		Inertodetrinite	5.4	0.4	0.4	2.4	2	0.6	2.4	0.4	10.6
		Micrinite									
	Gelo-inertinite										
		Macrinite									
MINERALS MATTER			11.6	27.2	6.2	11.0	6.4	20.4	7.6	2.6	6.6
		Oksida				9.0	0.4		1.4		
		Pyrite	5.0	7.6	2.6	1.4	3.0	1.0	3.2	1.0	1.0
		Clay	6.6	19.6	3.6	0.6	3.0	19.4	3.0	1.6	5.6
TOTAL (%)			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Rv. Minimum			0.42	0.42	0.42	0.42	0.44	0.42	0.44	0.44	0.42
Rv. Maksimum			0.44	0.44	0.46	0.46	0.48	0.46	0.46	0.46	0.46
Rv. Rata-rata			0.43	0.43	0.44	0.44	0.46	0.44	0.45	0.45	0.44
Standar Deviasi			0.02	0.02	0.03	0.02	0.03	0.03	0.02	0.22	0.03
Peringkat Batubara			SubBit	SubBit	SubBit	SubBit	SubBit	SubBit	SubBit	SubBit	SubBit

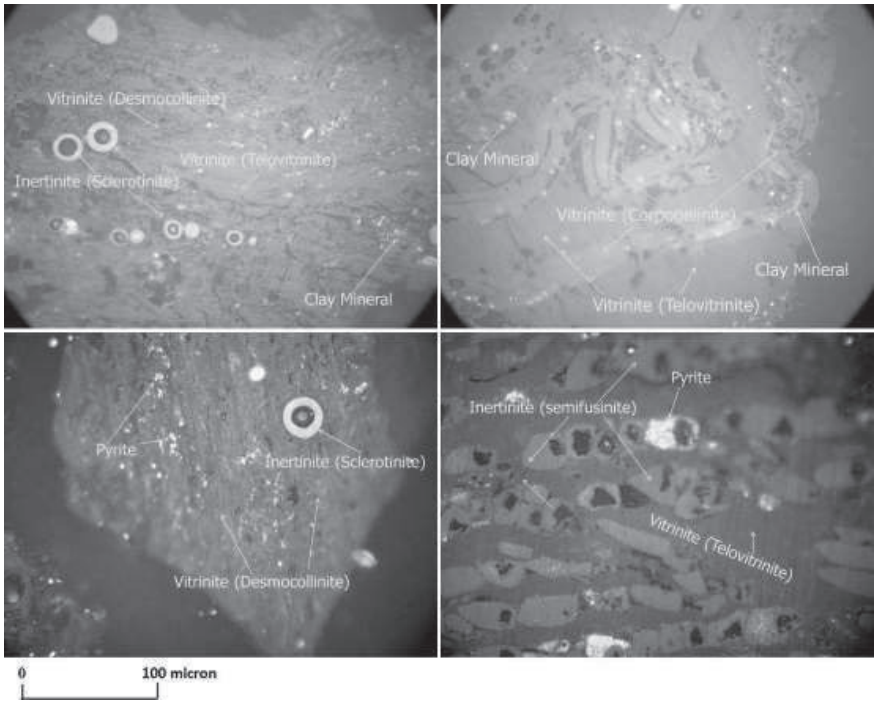

Figure 3. Characteristics of Coal Microscopic of Tekorejo-Buay Madang Kasai Formation

The vitrinite maceral group of the Kasai Formation is divided into sub-maceral groups (Table 2; Figure 3).

a. Telovitrinite averages 6.4% for the Muara Enim Formation. Telovitrinite maceral consists of telocolinite. Telocolinite under a microscope shows a gray to dark gray color, forming light layers.
b. Detrovitrinite averaged 56.75% (Muara Enim Formation), consisting of densinite and desmocolinite macerals. Desmocolinite in the form of fragments surrounded in inertinite, liptinite or in other mineral materials. Densinite maceral is the result of gelification of attrinite maceral with a low level of gelification. The detrovitrinite maceral group is a component formed by detritals from vitrinite macerals (Stach, 1982).
c. Gelovitrinite averaged 11.51 % for the Muara Enim Formation, consisting of corpo-gelinite maceral. Microscopically, the corpogelinite maceral appears homogeneous, round to oval in shape, usually isolated in desmocolinite.

The average percentage of liptinite maceral groups for the Muara Enim Formation was 3.6%, consisting of the following macerals: sporinite, resinite, cutinite, alginite and suberinite. The average percentage of inertinite maceral groups for the Kasai Formation is 11.0%, consisting of maceral subgroups: fusinite, semifusinite, sclerotinite and inertodetrinite.

The indicators used to analyze the coal facies of the Kasai Formation are based on the tissue preservation index (TPI) and the gelification index (GI); (Diessel, 1986).

Diesel uses the equation from the comparison of several macerals to get the GI (Gelification Index) and TPI (Tissue Preservation Index). To determine the depositional environment of coal, the values of GI and TPI were plotted on a diagram of the depositional environment of Diesel (1986). The equation is as follows:

$$GI = \frac{\text{Vitrinite} + \text{Geloinertinite}}{\text{Teloinertinite} + \text{Detroinertinite}}$$

$$TPI = \frac{\text{Telo} - \text{vitrinite} + \text{Telo} - \text{inertinite}}{(\text{Detro} + \text{Gelovitrinite}) + (\text{Detro} + \text{Geloinertinite})}$$

The advanced humification process will cause tissue destruction, which is expressed in the level of tissue preservation of plant structures (Tissue Preservation Index/TPI) with quantitative calculations.

While the gelification index (Gelification Index / GI) is related to the continuity of moisture. The result of slow (intermittent) subsidence in marginal peat- forming conditions, such as in dry conditions of peatlands, will cause oxidation and other changes in the humified plant tissue in either small or large

amounts, so this can expressed in the gelification index (Gelification Index / GI).

The plotting results on the facies diagram based on the gelification index (GI)and preservation index (TPI); (Diessel, 1986 & Lamberson, 1991) and in general the depositional facies of Muara Enim coal GI > 1 and TPI < 1 were deposited in limnic conditions of delta plain – back barrier environment (Figure 4 & 5). This condition is reinforced from the results of the outcrop profile (Figure 6). The sedimentary structures that develop in the sandstone are normal graded bedding and reverse graded bedding as channel deposits and overbank deposits as coal bearing sediments in delta plain environments (Allen et al., 1998)

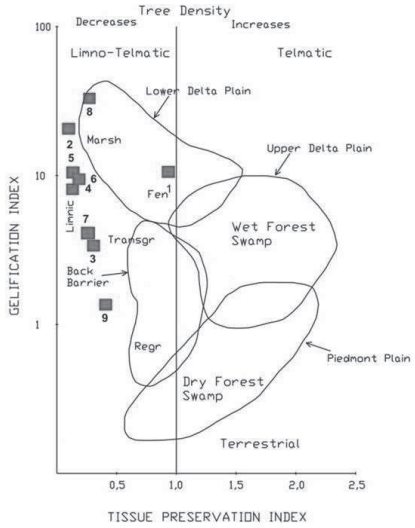

Figure 4. Coal Facies Indicator of Tekorejo-Buay Madang Kasai Formation (Diessel, 1986)

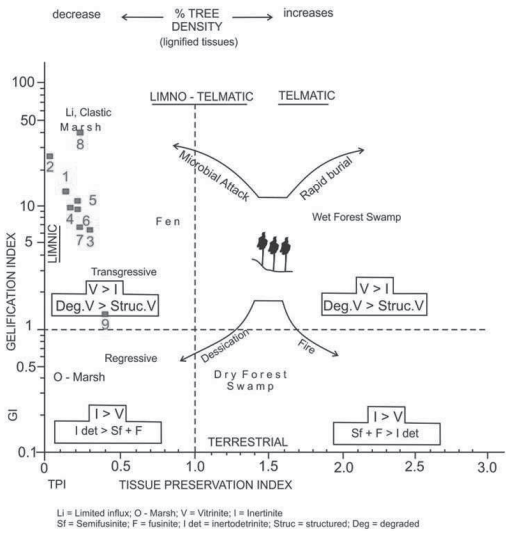

Figure 5. Coal Facies Indicator of Tekorejo-Buay Madang Kasai Formation (Diessel, 1986)

Basically, the delta plain facies have a poor drainage pattern and is always in a limnic condition. This will form an extensive coal seam in the marsh area. Maceral composition of coal deposit Tekorejo Area from 9 samples are vitrinite between 56.2 - 95.4 % vol.; liptinite between 1.6 -6 % vol. and inertinite between 2 - 35.6 % vol. Mineral Matter between 2.6 - 27.2 % vol. The condition show degraded of vitrinite is lower at limnic condition, whereas the most inertinite maceral content at sample number-9 (35.6 % vol.), it shows oxic condition at tropical climate (Laberson, 1991); (Figure 5). Reflectance vitrinite value of the Coal Tekorejo-Buay Madang between 0.43-0.45 subbituminous rank.

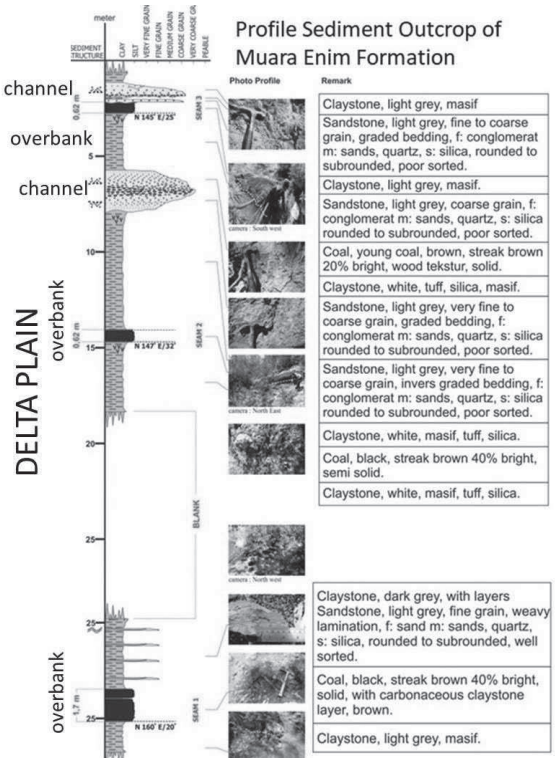

Figure 6. Profile outcrop of coal bearing sediment

CONCLUSION

1. Coal rank of Tekorejo Buay Madang Kasai Formation is subbituminous
2. Coal facies of coal Tekorejo Buay Madang Kasai Formation deposited at limnic-marsh condition in lower delta plain-back barrier
3. Degraded of vitrinite is lower at limnic condition,
4. Abundant inertinite maceral content at sample number-9 (35.6 % vol.), it shows oxic condition at tropical climate.

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