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GAS IN PLACE PREDICTION OF COAL BED METHANE EXPLORATION WITH PROXIMATE DATA, PIT "HMG", WEST BANKO, SOUTH SUMATRA

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ABSTRACT

The energy demand are increase everyday, but the supply insufficiently if only depends on conventional energy. Coal bed methane exploration are one of the unconventional energy that can fulfill energy demand. The main aspect of coal bed methane exploration are the reserve of gas in place. In this research are use conventional data to approach a prediction and calculation of gas in place at PIT "HMG", West Banko, Tanjung Enim, South Sumatra. Based on the analysis shows that the gas content are increase as the deeper of seam, and the total gas in place are 235.30 MMcf, with Seam C has the highest value72.47 MMcf.
Keywords: *Coal bed methane, Gas in place, Unconventional energy, Exploration, Tanjung Enim*

INTRODUCTION

Coal bed methane is becoming a new trend in the unconventional energy industry. By conduct coal bed methane exploration, can fulfill the supply of energy demand that increasing every day, and also optimize the coal reserves. One of important aspect of coal bed methane exploration is the gas in place, the accumulation of gas content in every seam in the field study. The existing of coal basically always formed a gas or desorbed gas into the coal (Yee, 1993).

This research was carried out at conventional coal mines, within that the integration of conventional data was carried out to predict gas content and gas in place.The data are from as dry receive of proximate analysis, and being calculate to predict the accumulation gas of coal bed methane in PIT "HMG", Banko Barat, TanjungEnim, South Sumatera. The rock formation of research area are formed when stable phase on Oligocene-Pliocene (Pulunggono & Cameron, 1984) and also on regression sea level (Jackson, 1961), that made the seam are thick and relatively continous

LITERATURES STUDY

The proximate analysis is principally a measurement of the weight difference (gravimetric) after the coal sample is heated by a certain temperature. This analysis aims to determine the value of coal rank based on the results of the value of water content in coal (moisture). This moisture content includes the value of ash, total water content, fixed carbon and volatile matters. The heating temperature for water content analysis was carried out at 105° - 110°C, for volatile matters at 950°C for the proximate analysis with instrument, and 900°C for the manual proximate. The temperature for ash (ash) is 750°C for the instrument proximate and 815°C for manual proximate, (Prahesthi & Zamani, 2011). With the proximate analysis data, it can be intragrate to calculate and predict gas content. One gram of coal can contain as much surface area as several football fields and therefore is capable of sorbing large quantities of methane. One short ton (2000 pounds mass) of coal can store about 1,300 m3 of methane. Depending on reservoir pressure, not all the storage capacity is filled with gas (Crain, 2006). Analysis of gas content in coal are the main aspect of coal bed methane reservoir. The main seam of this research are on member M2 of Muara Enim Formation, that consist of 4-8 seam (Gafoer, 1986).

METHOD

One of important factor of energy industry, especially coal bed methane exploration is the prediction of gas in place, the accumulation of gas content in research area. In this research, using an approach of proximate analysis data as the basic calculation to predict the gas content, based on Kim (1977) :

$$V = \frac{(100 - \%\ moisture - \%\ ash)}{100}\,(0{,}75)\,.\,\left[ko\,(0{,}096\,.\,h)^{no} - 0.14\,\frac{(1.8h + 11)}{100}\right]\,.\,1{,}7 \qquad \ldots (3.1)$$

V : total gas coal volume (cm^3/g)
ko : 0,79 . (Fixed Carbon / Volatile Matter) + 5.62 ($cm^3/g/atm$)
no : (0.39 – 0.013) . ko
h : seam depth

However the kim equation refers to the field condition in United States, such as San Juan Basin, River Down Basin, etc. That makes the equation are empirical, therefore in this research used the modification of Kim Equation, by Sobarin., et al (2013), the equation already calibrated with the field condition in South Sumatra Basin.

$$V = \frac{(100 - \%\ moisture - \%\ ash)}{100}\,(0.30)\,.\,\left[ko\,(0.096\,.\,h)^{no} - 0{,}14\,\frac{(4.97h + 22)}{100}\right]\,.\,1{,}7 \qquad \ldots (3.2)$$

From the result of the equation (3.2), then it can calculate the gas in place, in this research refers to the equation of Mavor & Nelson (1977).

G = A . p . H . Gc................ (3.3)

G : Gas In Place (m^3)
A : Area (m^2)
p : coal density (g/cc)
H : seam thickness (m)
Gc : Gas Content (m^3/ton)

RESULT AND DISCUSSION

Basically the proximate analysis aims to determine the fluid content (moisture) in coal which includes the total moisture value when as received, namely the overall value of fluid in coal when taking and calculating external influences. Meanwhile, the form as dry base is the determination of moisture content in coal and other substances by burning coal first to eliminate external factors, which consist of inherent moisture, volatile matter, fixed carbon and ash expressed in percentages (Table 1). With the rank of coal in Seam A1, A2 and B1 that is sub-bituminous B, the Seam B2 and C are sub-bituminous C based on the comparison of calorific values (Arbi, 2018).

Table 1. Proximate Analysis

Sumur	Seam	Prospek	Collar Y	Collar X	Dari Kedalaman	Sampai Kedalaman	Ketebalan	RD	Total Moisture	PROXIMATE (% ADB)				DAF
									TM	IM	VM	FC	A	
								Densitas	(%, ar)	Inherent Moisture	Volatile Matter	Fixed Carbon	Ash	
BKGT_18	A1	BKP1_BARAT	369802	9582103	8.66	20.5	11.84	1.3	21.70	8.80	43.80	44.30	3.10	11.90
BKGT_16	A2	BKP1_BARAT	369783	9581920	16.8	25.4	8.6	1.3	20.30	7.20	43.10	46.10	3.60	10.80
BKGT_17	A2	BKP1_BARAT	369780	9582005	20.4	31.86	11.46	1.3	23.60	6.50	45.60	46.50	1.40	7.90
BKGT_18	A2	BKP1_BARAT	369802	9582103	35.8	47.36	11.56	1.3	23.30	9.00	43.50	44.50	3.00	12.00
BK_197	A2	BKP1_BARAT	369991	9582017	8.34	19.22	10.88	1.3	29.00	14.10	40.80	41.50	3.60	17.70
BK_198	A2	BKP1_BARAT	369962	9582355	19.3	30	10.7	1.3	27.40	17.10	40.30	40.80	1.80	18.90
BKGT_16	B1	BKP1_BARAT	369783	9581920	37.4	50.2	12.8	1.3	22.30	8.30	42.20	46.20	3.30	11.60
BKGT_17	B1	BKP1_BARAT	369780	9582005	43.74	56.58	12.84	1.3	18.60	6.90	43.60	45.50	4.00	10.90
BKGT_18	B1	BKP1_BARAT	369802	9582103	58.86	72.42	13.56	1.3	25.30	10.80	39.60	44.90	4.70	15.50
BK_197	B1	BKP1_BARAT	369991	9582017	31.3	43.64	12.34	1.3	27.30	15.40	39.70	40.70	4.20	19.60
BK_198	B1	BKP1_BARAT	369962	9582355	44.2	56.2	12	1.3	26.60	16.80	39.00	40.80	3.40	20.20
BKGT_16	B2	BKP1_BARAT	369783	9581920	58.6	63.15	4.55	1.3	25.00	8.40	40.80	46.10	4.70	13.10
BKGT_17	B2	BKP1_BARAT	369780	9582005	64.4	69.06	4.66	1.3	24.00	9.80	39.30	47.40	3.50	13.30
BKGT_18	B2	BKP1_BARAT	369802	9582103	79.46	84.36	4.9	1.3	23.70	12.00	40.10	43.60	4.30	16.30
BK_197	B2	BKP1_BARAT	369991	9582017	53.7	57.78	4.08	1.3	31.70	17.10	37.60	42.80	2.50	19.60
BK_198	B2	BKP1_BARAT	369962	9582355	64.6	69.02	4.42	1.3	26.60	12.20	40.10	41.50	6.20	18.40
BKGT_16	C	BKP1_BARAT	369783	9581920	102.05	113.5	11.45	1.3	23.60	7.40	40.20	47.60	4.80	12.20
BKGT_17	C	BKP1_BARAT	369780	9582005	109.38	120.44	11.06	1.3	24.00	9.30	40.50	46.50	3.70	13.00
BKGT_18	C	BKP1_BARAT	369802	9582103	124.08	135.88	11.8	1.3	19.30	8.60	42.90	43.80	4.70	13.30
BK_197	C	BKP1_BARAT	369991	9582017	95.16	106.34	11.18	1.3	28.80	16.10	36.60	44.30	3.00	19.10
BK_198	C	BKP1_BARAT	369962	9582355	108.46	118.68	10.22	1.3	24.20	12.30	40.20	44.90	2.60	14.90

4.1 Gas Content

According to Kim (1973), from the result of proximate analysis as dry basic, it can calculate the gas content of coal with the modification of Kim equation by Sobarin., et al (2013).From the volume of gas content (Table 2) obtained a graph that shows the relation between depth and gas content are directly proportional, as the deeper of seam, the gas content are increase, with the value of coefficient correlation approaching almost 1, R^2 = 0.9371, so the result data are valid and have a correlation (Fig. 1).

Table 4.2 Well Gas Content

Sumur	*Seam*	Volume Kandungan Gas (cm3/gr)
BKGT_18	A1	2.10
BKGT_16	A2	2.38
BKGT_17	A2	2.70
BKGT_18	A2	3.06
BK_197	A2	1.90
BK_198	A2	2.31
BKGT_16	B1	3.18
BKGT_17	B1	3.34
BKGT_18	B1	3.53
BK_197	B1	2.70
BK_198	B1	2.98
BKGT_16	B2	3.44
BKGT_17	B2	3.60
BKGT_18	B2	3.68
BK_197	B2	3.08
BK_198	B2	3.30
BKGT_16	C	4.35
BKGT_17	C	4.37
BKGT_18	C	4.46
BK_197	C	3.93
BK_198	C	4.24

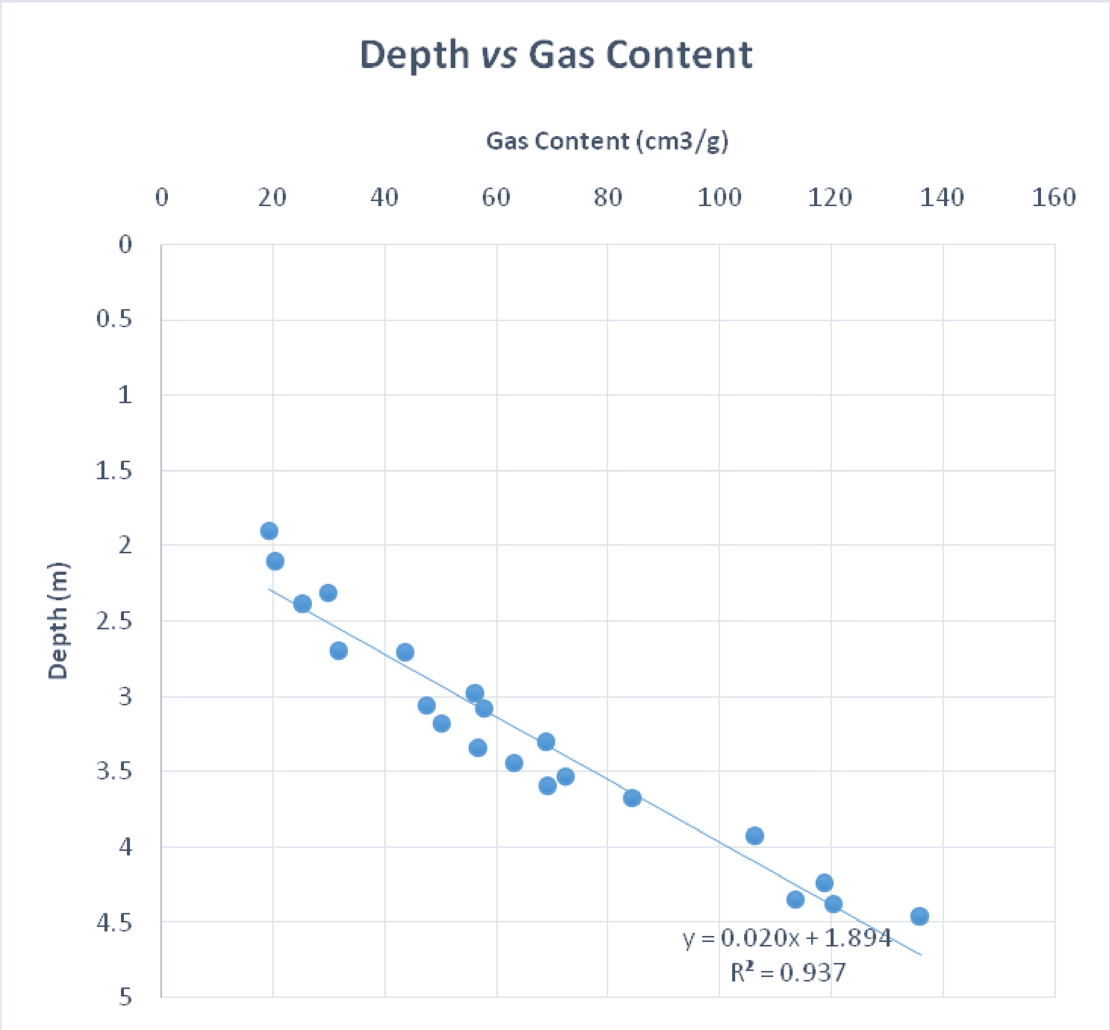

Figure 1. Depth vs Gas Content PIT "HMG", West Banko

4.2 Gas In Place

The result of gas content value from each seam in PIT "HMG", West Banko, are use to calculate and predict the gas in place on the research area, refers to the equation of Mavor & Nelson (1977).

Based on cumulative results, the average value of gas in place on PIT "HMG", West Banko (Fig 2), it shows that Seam C has the highest gas in place, with value 72.47 MMcf, the second are Seam B1 with the value 61.08 MMcf, then Seam A2 with value 40.26 MMcf, Seam A1 with value 37.87 MMcf and the last are Seam B2 with value 26.63 MMcf. Total value of gas in place in the research area are around 235.30 MMcf.

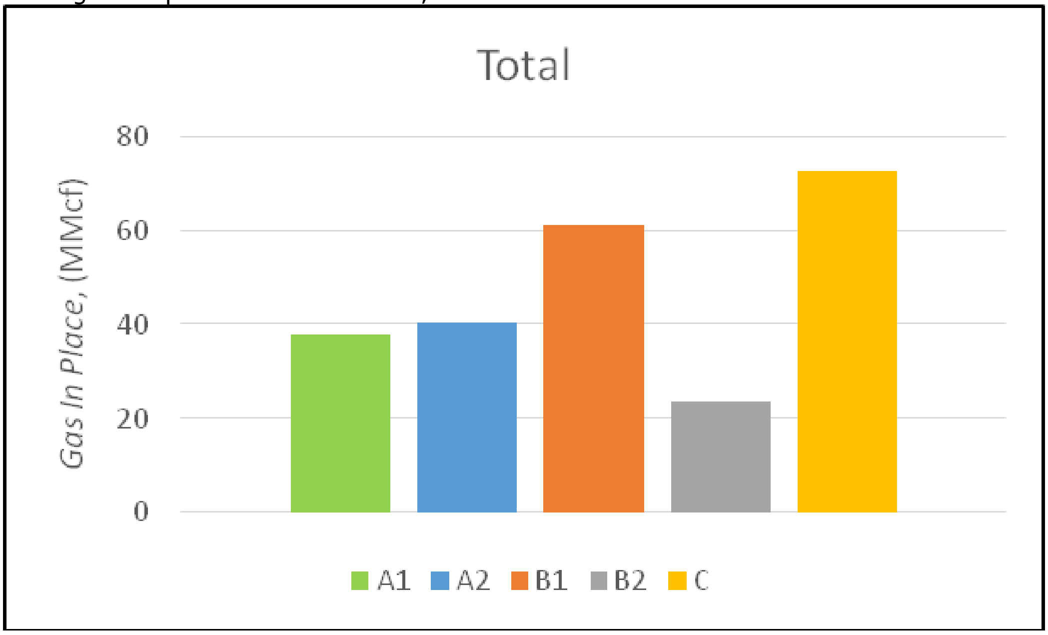

Figure 2. Total Gas In Place per Seam, PIT "HMG", West Banko

CONCLUSION

The gas content are increase as the deeper of the seam, with the value of coefficient correlation approaching almost 1, R^2 = 0.9371. From the calculation and prediction of cumulative gas in place in research area, shows that Seam C has the value 72.47 MMcf, B1 with 61.08 MMcf, then Seam A2 has the value 40.26 MMcf, Seam A1 with value 37.87 MMcf, and Seam B2 with value 26.63 MMcf. Total value of gas in place are around 235.30 MMcf.

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