

Megascolides-1

COAL BED METHANE LOG ANALYSIS

Objectives:

To process the intervals 700-1100m with the purpose of identifying coal seams and their properties.

Summary:

A standard log interpretation of the interval was run initially to identify the coals followed by the PETROLOG CBM module which attempts to identify the coal types and to compute potential gas content using the Mavor et.al. equation.

A full description of the procedures followed is in this report.

Conclusion:

Most of the beds are relatively thin and the logs were not fully developed to clearly identify the coals. Since the density logs does not measure the true Coal density, the coal types and Vash measured suffer accordingly.

The total thickness of all coals identified = 12.2m and each bed is listed in Table 2 at the end of this report.

See Figure 1 for the final results.

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Petrophysicist

Since well log interpretations are opinions based upon inferences from well logs, we cannot guarantee the correctness or accuracy of any interpretation. Therefore we shall not be liable or responsible for any loss, damage, cost or expense incurred or sustained by anyone resulting from any interpretation.

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1. General information

Company:	Karoon Gas Pty Ltd
Well Name	Megascolides-1
Country	Australia
State	Vic
Location	Permit/Licence PEP162/EL4537
Permanent Datum	MSL
Elevation of DF	105.27m
Elevation of GL	101.0m
Logging Company	Schlumberger
Logging date:	18 December 2005
Open Hole Logs:	HALS Sonic TLD MCFL Hi Res
Bottom log reading	695.29m
Top log reading	1105.05m
Casing shoe	497.09m
Bit size:	8. 5 inches
Fluid type:	KCL base mud
Fluid Density:	1.14 g/cc
RM	4.3 @ 20.6 DegC

2. Log Quality Control

- Generally good hole conditions over the interval processed with only minor noticeable washouts.
- All logs were of good quality.

3. Environmental corrections

- No environmental corrections have been applied.

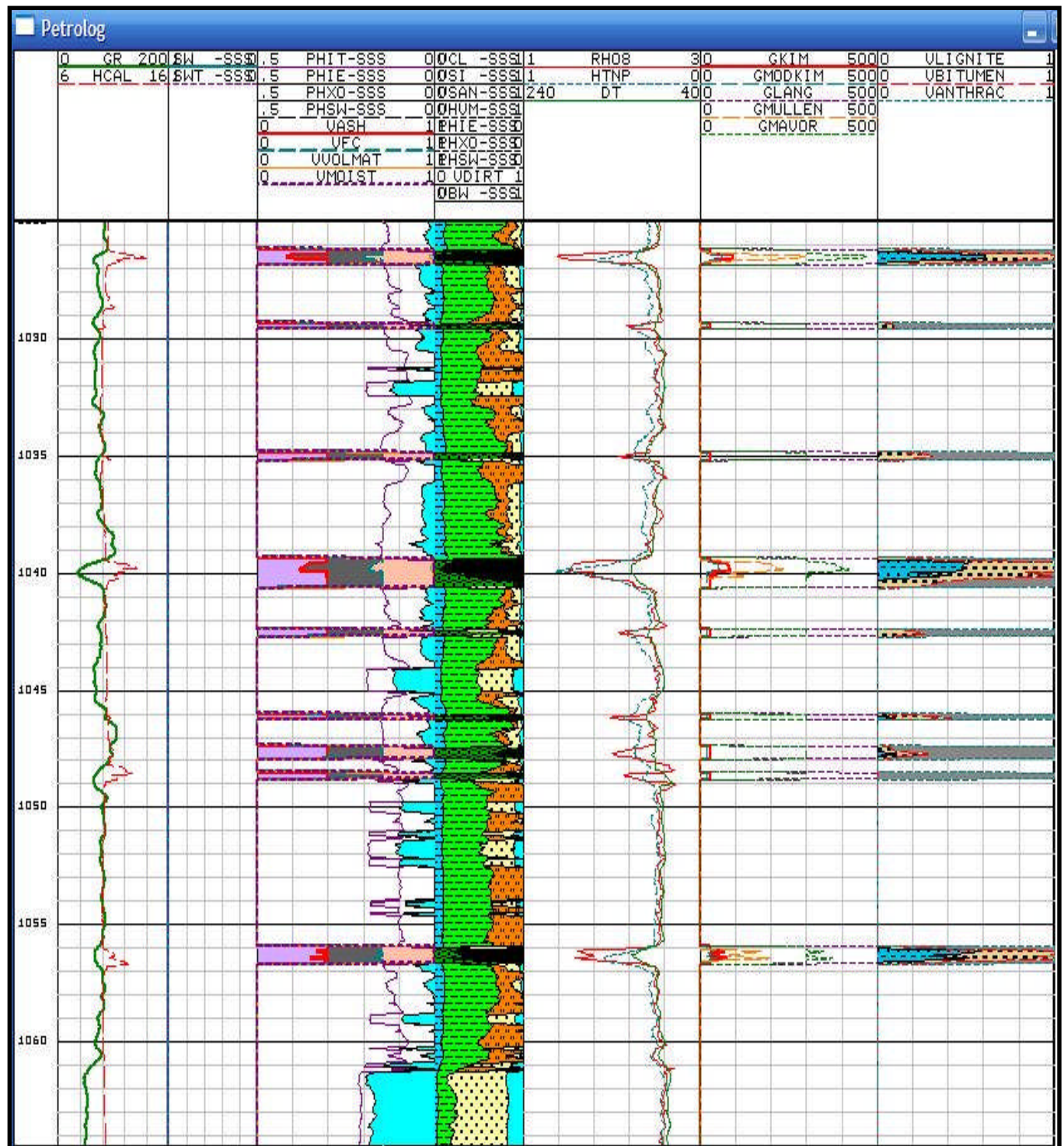


FIGURE 1 Megascolides-1 Final Processed Results.

- Track 1: Depth in M
- Track 2: GR.
- Track 3: SW and SWT computed
- Track 4: PHIT, PHE, Vash, Vfc, Vmoist, V volatile matter.
- Track 5: V bound water, Vclay, Vsand, V water, V coal and V debris in coal.
- Track 6: RHOB, DT and NPHI logs. Note the poor log response in thinner beds.
- Track 7: Gas volume in cuft/ton using the Mavor & All equation.
- Track 8: Coal type as identified by the RHOB-DT-NPHI logs.

4. RT determination

RT has been computed from the LLD-LLS-RXO combination.

5. Vclay determination

The following clay indicators are available

- Gamma Ray
- Sonic
- NPHI
- D-N X-plot
- S-D X-Plot

All clay indicators were in close agreement,

6. Porosity determination

The density Neutron combination was used to compute the matrix density and then PHIE using the density log.

7. RW Determination

Method used:

- *SSP*
- *RWA method*
RWA is calculated using the Archie equation and assuming that
SW = 100% and Vclay = 0%
 $SW = 1.0 = F * RW / RT$ *Archie*
This equation is then converted to:
 $RWA = RT / F$

8. SW Determination

The Indonesia equation to compensate for Vclay has been used as follows:

$$S_w = \left(\frac{1.0}{Y \sqrt{RT}} \right)^{2/n}$$

$$Y = \frac{Vcl^{(1-0.5Vcl)}}{\sqrt{RT}} + \frac{PHIe^{m/2}}{\sqrt{aRw}}$$

$$S_w = \left(\frac{1.0}{Y \sqrt{RT}} \right)^{2/n}$$

S_w = Water saturation

$a = 1.00$

Rw = Formation water resistivity

RT = True formation resistivity

$PHIe$ = Effective Porosity

$m = 2.00$ (Cementation factor)

$n = 2.0$

9. Coal bed identification.

The following logs and conditions were used to identify the coal beds

RHOB < 2.34 g/cc
NPHI > 0.35 v/v
DT > 70.0 us/f
RT > 20.0 ohmm

All coals should have a density reading below 2.0 g/cc however. In very thin beds with adjacent formation having high density readings, the log response is limited and the density does not read the true value.

In this particular well many thin coal stringers are too thin to allow the logs to be fully developed and the coal cut-off values have been modified accordingly to allow the detection of those thin coal beds

10. Coal types

Table 1 shows typical ranges of log values for different coal types.

Coal type	RHMAcoal	RHOB	DT	NPHI	RHOMAA
Lignite	1.10	0.5 - 1.22	80 - 90	0.45 - 0.55	1.3
Young Bituminous coal	1.25	1.22 – 2.00	110 - 140	0.55 – 0.60	2.0
Mature Bituminous coal	1.35	1.22 – 2.00	95 - 110	> 0.60	2.0
Anthracite	1.50	1.3 – 1.9	80 – 90	0.35 - 0.45	2.1

Table 1

Taking the middle values for each type we can plot these as a RHOMAA-DT X-Plot and Figure 3 shows the clear distinction between various coal types.

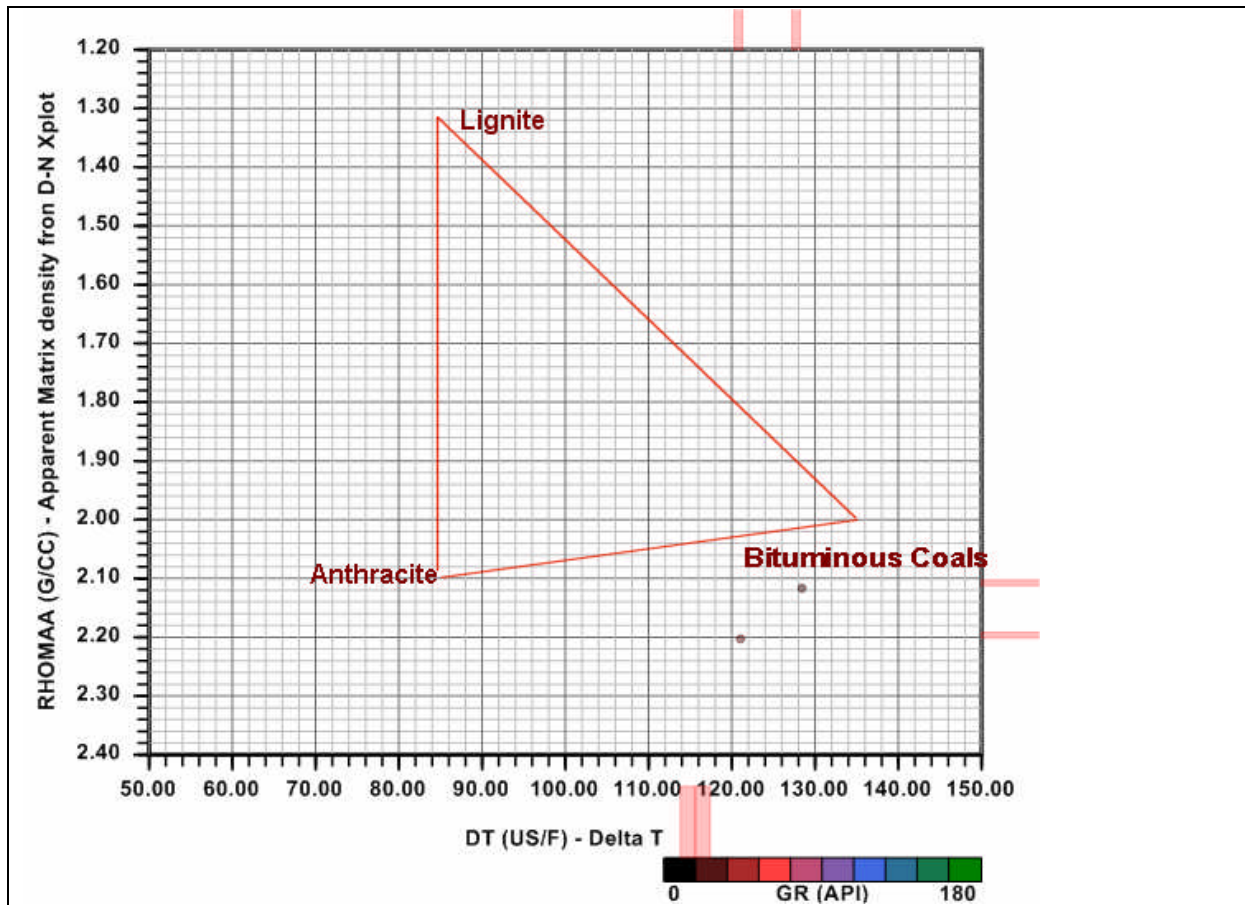


FIGURE-3 Display of the clear distinction between various coal types.

11. Vash, Vmoist, V volatile matter and V Fixed Carbon

The following equations have been used:

- $VASH = (RHOB - RHMA_{coal}) / (2.5 - RHMA_{coal})$ (V/V)
- $VFC = 0.512 - 0.512 * VASH$ (V/V)
- $VMOIST = 0.0461 - 0.1 * VASH$ (V/V)
- $VVOLMAT = 1.0 - VASH - VFC - VMOIST$ (V/V)

Since RHOB is restricted due to thin bed effect, Vash has been limited to 0.4 or less in this interpretation.

Results are plotted in Figure 1 above.

12. Gas volumes calculations

Mavor, Close, McBaner equation:

$$gMAVOR = 601.4 - 751.8 * Vash / (1.0 - Vmoist) \quad (\text{cuft/Ton})$$

13. Total Gas volumes estimations

From table 2 below: Total coal thickness = 12.19m

14. Coal bed report.

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Karoon Gas Pty. Ltd.

CBM Gas Results
21-04-2005

From M	To M	Thickness M	Vash %	VFC %	Vvolmat %	Vmoist %	gKIM FT3/TON	gmodKIM FT3/TON	gLANGMUIR FT3/TON	gMULLEN FT3/TON	gMAVOR FT3/TON
716.48	716.53	.05	40.0	30.7	.6	28.7	31.3	18.5	4031.7	.0	298.8
717.30	717.85	.56	40.0	30.7	.6	28.7	31.3	18.5	4031.7	13.1	298.8
740.56	740.71	.15	40.0	30.7	.6	28.7	31.3	18.4	4031.7	.0	298.8
762.05	762.25	.20	40.0	30.7	.6	28.7	31.3	18.3	4031.7	.0	298.8
771.65	771.86	.20	40.0	30.7	.6	28.7	31.3	18.3	4031.7	.0	298.8
816.15	816.91	.76	37.6	31.9	.8	29.6	42.1	24.5	3325.8	68.2	316.2
823.72	823.82	.10	40.0	30.7	.6	28.7	31.3	18.1	4031.7	.0	298.8
830.33	830.63	.30	40.0	30.7	.6	28.7	31.3	18.1	4031.7	28.1	298.8
831.44	831.55	.10	40.0	30.7	.6	28.7	31.3	18.0	4031.7	.0	298.8
836.27	836.42	.15	40.0	30.7	.6	28.7	31.3	18.0	4031.7	.0	298.8
838.66	838.76	.10	40.0	30.7	.6	28.7	31.3	18.0	4031.7	.0	298.8
842.47	842.52	.05	40.0	30.7	.6	28.7	31.3	18.0	4031.7	.0	298.8
851.36	851.61	.25	40.0	30.7	.6	28.7	31.3	18.0	4031.7	20.8	298.8
911.40	911.45	.05	40.0	30.7	.6	28.7	31.3	17.8	4031.7	.0	298.8
915.11	915.42	.30	39.5	31.0	.7	28.9	34.7	19.4	3772.9	51.9	302.3
930.25	930.76	.51	40.0	30.7	.6	28.7	31.3	17.7	4031.7	30.2	298.8
934.67	935.28	.61	36.1	32.7	1.0	30.2	48.9	28.3	2851.9	102.1	327.4
938.38	938.78	.41	37.2	32.1	.9	29.7	44.3	25.5	3167.6	84.8	319.2
940.77	940.92	.15	40.0	30.7	.6	28.7	31.3	17.6	4031.7	.0	298.8
941.63	941.78	.15	40.0	30.7	.6	28.7	31.3	17.6	4031.7	.0	298.8
943.00	943.20	.20	40.0	30.7	.6	28.7	31.3	17.6	4031.7	.0	298.8
998.42	998.83	.41	29.4	36.2	1.7	32.8	60.3	38.4	2412.3	152.6	378.0
1002.08	1002.13	.05	40.0	30.7	.6	28.7	29.4	17.4	5224.8	.0	298.8
1002.59	1003.30	.71	39.0	31.2	.7	29.1	34.9	20.4	4769.5	49.0	306.1
1005.13	1005.64	.51	33.6	34.0	1.2	31.1	51.4	31.3	3655.4	105.5	346.0
1007.77	1007.97	.20	40.0	30.7	.6	28.7	29.4	17.4	5224.8	.0	298.8
1022.50	1022.65	.15	40.0	30.7	.6	28.7	29.4	17.4	5224.8	.0	298.8
1026.31	1026.82	.51	31.3	35.2	1.5	32.1	59.4	36.6	3102.5	144.0	363.4
1029.46	1029.56	.10	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1034.95	1035.15	.20	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1039.42	1040.43	1.02	34.7	33.4	1.1	30.7	52.1	30.9	3469.3	114.0	337.5
1040.49	1040.59	.10	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1042.47	1042.67	.20	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1046.07	1046.28	.20	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1047.55	1047.90	.36	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1048.56	1048.77	.20	40.0	30.7	.6	28.7	29.4	17.3	5224.8	.0	298.8
1056.03	1056.64	.61	37.7	31.9	.8	29.5	42.6	24.3	4083.0	98.9	315.4
1065.94	1066.04	.10	40.0	30.7	.6	28.7	29.4	17.2	5224.8	.0	298.8
1078.69	1079.09	.41	39.3	31.1	.7	28.9	34.1	19.4	4765.0	49.0	303.6
1085.44	1085.65	.20	40.0	30.7	.6	28.7	29.4	17.1	5224.8	.0	298.8
1093.67	1093.72	.05	40.0	30.7	.6	28.7	29.4	17.1	5224.8	.0	298.8
1095.86	1096.11	.25	40.0	30.7	.6	28.7	29.4	17.1	5224.8	.0	298.8
1098.55	1098.80	.25	40.0	30.7	.6	28.7	29.4	17.1	5224.8	32.8	298.8
TOTAL THICKNESS		12.19m									

Table 2 List of all coal beds in the interval processed.