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Organic Petrological analysis results for a suite of shale samples from Marmbulligan-1, Tarlee-S3 and Altree-2, the Beetaloo sub-basin, Northern Territory

For Northern Territory Geological Survey

Zhongsheng Li and Mohinudeen Faiz

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Enquiries should be address to:

Zhongsheng Li
CSIRO Energy
11 Julius Avenus, North Ryde, NSW 2113, Australia
Telephone: +61 2 9490 8645
E-mail: Zhongsheng.Li@csiro.au

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Contents

Acknowledgments 3

1 Introduction 4

2 Results 5

Tables

Table 1 Summary of reflectance values of alginite and bitumen measured at the CSIRO North Ryde laboratory for samples from Tarlee S3, Beetaloo Sub-basin, Northern Territory. 5

Table 2 Summary of reflectance values of alginite and bitumen measured at the CSIRO North Ryde laboratory for samples from Marmbulligan-1, Beetaloo Sub-basin, Northern Territory. 7

Table 3 Summary of reflectance values of alginite and bitumen measured at the CSIRO North Ryde laboratory for samples from Altree-2, Beetaloo Sub-basin, Northern Territory 8

Table 4 Summary of reflectance values of thucolite and bituminite measured at the CSIRO North Ryde laboratory for samples from Marmbulligan-1, Altree2 and Tarlee S3, Beetaloo Sub-basin, Northern Territory. 9

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1 Introduction

The “Energy Resources Program” of CSIRO Energy conducted organic petrological analysis, as part of a research project to evaluate unconventional reservoirs within Mesoproterozoic shales of the Beetaloo Sub-basin (BSB). The analyses of samples collected from three exploration wells (Marmbulligan 1, Tarlee S3, and Altree-2) from the Northern Territory Geological Survey (NTGS) Core Store. were done at the CSIRO Energy’s organic petrology lab at North Ryde, NSW.

The reflectance analyses on a suite of shale samples from three wells Marmbulligan-1, Tarlee-S3, and Altree-2, were done on bitumen and alginite (Table 1 to 3) which are the main macerals present in the samples studied, along with some measurements from thucolite and bituminite (Table 4) if applicable in samples.

2 Results

Table 1 Summary of reflectance values of alginite and bitumen measured at the CSIRO North Ryde laboratory for samples from Tarlee S3, Beetaloo Sub-basin, Northern Territory.

				Bitumen Reflectance					Alginite Reflectance				
Well Name	**Sample #**	**Depth (m)**	**Formation**	**Rm_{ran}%**	Min	Max	N	σ	**Rm_{ran}%**	Min	Max	N	σ
Tarlee -S3	**19158**	1102.16	Upper Velkerri	**1.82**	1.12	2.30	31	0.29					
	19159	1139.20	Upper Velkerri	**1.92**	1.47	2.35	23	0.24					
	19160	1172.05	Upper Velkerri	**1.35**	0.98	2.13	39	0.30					
	19163	1237.70	Middle Velkerri	**1.99**	1.62	3.91	58	0.42					
	19165	1275.21	Middle Velkerri	**1.90**	1.73	2.18	6	0.17					
	19168	1360.56	Middle Velkerri	**2.55**	1.96	5.02	41	0.59					
	19169	1405.76	Middle Velkerri	**2.56**	1.91	3.28	61	0.34					
	19172	1469.15	Middle Velkerri	**3.05**	1.96	4.46	52	0.53					
	19173	1477.10	Velkerri	**3.39**	2.61	4.65	47	0.47					

19174	1478.50	Middle Velkerri	**2.13**	1.52	2.97	25	0.33	
19175	1479.08	Middle Velkerri	**5.49**	4.16	7.61	51	0.70	
19176A	1480.80	Middle Velkerri	**4.95**	4.01	7.27	52	0.64	**19167A - Adjacent to intrusion**
19176B	1480.80	Middle Velkerri	**4.58**	1.85	8.56	11	2.58	**19176B - Adjacent to intrusion**
19177	1545.99	Middle Velkerri	**2.65**	2.00	3.90	33	0.42	
19178	1559.88	Middle Velkerri	**5.90**	2.30	9.10	72	2.04	
19181	1589.96	Middle Velkerri	**2.94**	2.48	3.33	44	0.24	
19183	1618.80	Lower Velkerri	**2.35**	1.93	2.97	39	0.19	
19185	1645.52	Lower Velkerri	**2.14**	1.84	2.37	16	0.16	**2.21** 2.12 2.34 11 0.08

Rm_{ran}% = Mean random reflectance of bitumen and alginite, measured in unpolarised light and under oil immersion.
Min = minimum value; Max = maximum value; N = Number of reflectance readings; σ = standard deviation.

Table 2 Summary of reflectance values of alginite and bitumen measured at the CSIRO North Ryde laboratory for samples from Marmbulligan-1, Beetaloo Sub-basin, Northern Territory.

Sample #	Depth (m)	Formation	Bitumen Reflectance					Alginite Reflectance				
			Rm_{ran}%	Min	Max	N	σ	Rm_{ran}%	Min	Max	N	σ
19134	109.6	Upper Velkerri	**0.56**	0.46	0.71	9	0.09	**0.39**	0.19	0.66	46	0.11
19137	191.3	Middle Velkerri						**0.32**	0.15	0.58	29	0.11
19139	254.99	Middle Velkerri	**0.46**	0.36	0.56	7	0.08	**0.30**	0.18	0.46	27	0.09
19141	311.11	Middle Velkerri	**0.60**	0.35	0.98	42	0.11	**0.45**	0.22	0.76	50	0.15
19144	363.7	Middle Velkerri	**0.62**	0.40	0.80	25	0.10	**0.49**	0.34	0.72	14	0.11
19146	432.61	Middle Velkerri	**0.59**	0.32	0.82	62	0.11	**0.49**	0.22	0.71	53	0.13
19147	467.83	Middle Velkerri	**0.82**	0.58	1.02	14	0.13	**0.71**	0.36	0.97	14	0.16
19148	506.03	Middle Velkerri	**0.87**	0.42	1.16	46	0.15	**0.76**	0.42	1.05	41	0.14
19149	544	Lower Velkerri	**1.30**	1.02	1.69	12	0.21	**1.19**	1.15	1.22	2	0.06
19150	596	Lower Velkerri	**1.32**	1.08	1.66	29	0.15	**1.44**	1.02	1.63	6	0.22
19151	635.33	Lower Velkerri	**1.44**	1.23	1.84	33	0.13	**1.50**	1.19	1.87	21	0.14

Rm_{ran}% = Mean random reflectance of bitumen and alginite, measured in unpolarised light and under oil immersion.
Min = minimum value; Max = maximum value; N = Number of reflectance readings; σ = standard deviation.

Table 3 Summary of reflectance values of alginite and bitumen measured at the CSIRO North Ryde laboratory for samples from Altree-2, Beetaloo Sub-basin, Northern Territory.

Sample #	Depth (m)	Formation	Bitumen Reflectance					Alginite Reflectance				
			Rm_{ran}%	Min	Max	N	σ	**Rm_{ran}%**	Min	Max	N	σ
19186	573.60	Upper Velkerri	**0.48**	0.35	0.65	4	0.15	**0.44**	0.20	1.03	32	0.19
19189	681.60	Middle Velkerri	**0.46**	0.33	0.56	9	0.07	**0.38**	0.24	0.62	66	0.09
19198	1060.00	Lower Velkerri	**1.33**	1.04	1.81	24	0.18	**1.39**	1.15	1.66	16	0.16
19200	1126.20	Lower Velkerri	**1.19**	0.72	3.07	33	0.50	**1.15**	0.84	1.63	20	0.20

Rm_{ran}% = Mean random reflectance of bitumen and alginite, measured in unpolarised light and under oil immersion.
Min = minimum value; Max = maximum value; N = Number of reflectance readings; σ = standard deviation.

Table 4 Summary of reflectance values of thucolite and bituminite measured at the CSIRO North Ryde laboratory for samples from Marmbulligan-1, Altree2 and Tarlee S3, Beetaloo Sub-basin, Northern Territory.

Sample #	Depth (m)	Formation	Thucolite Reflectance					Bituminite Reflectance				
			Rm_{ran}%	Min	Max	N	σ	**Rm_{ran}%**	Min	Max	N	σ
19134	109.6	Upper Velkerri	**0.69**	0.50	1.18	14	0.19					
19137	191.3	Middle Velkerri						**0.16**	0.14	0.17	2	0.02
19139	254.99	Middle Velkerri	**0.79**	0.79	0.79	1						
19141	311.11	Middle Velkerri						**0.32**	0.25	0.43	20	0.05
19144	363.7	Middle Velkerri	**0.61**	0.61	0.61	1						
19146	432.61	Middle Velkerri										
19147	467.83	Middle Velkerri										
19148	506.03	Middle Velkerri	**0.99**	0.99	0.99	1						
19159	1139.20	Upper Velkerri	**1.59**	1.13	2.23	16	0.34					

19186	573.60	Upper Velkerri	**0.70**	0.46	1.28	14	0.23
19189	681.60	Middle Velkerri	**0.61**	0.37	0.92	5	0.21

Rm_{ran}% = Mean random reflectance of thucolite and bituminite measured in unpolarised light and under oil immersion.
Min = minimum value; Max = maximum value; N = Number of reflectance readings; σ = standard deviation.

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Contact us

1300 363 400
+61 3 9545 2176
csiroenquiries@csiro.au
www.csiro.au

For further information

C**SIRO Energy**
Zhongsheng Li
+61 2 **9490 8645**
Z**hongsheng.Li**@csiro.au
csiro.au/E**nergy**