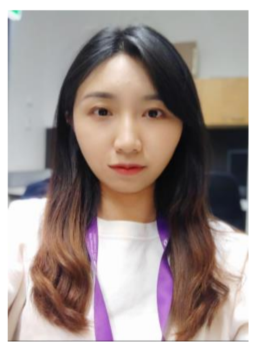
Preliminary study of reservoir properties of the Toolebuc Formation, Eromanga Basin, AU



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1. Introduction

Shales of the Toolebuc Formation, Eromanga Basin, are considered an unconventional petroleum reservoir. To further evaluate its hydrocarbon potential, studies of reservoir properties were carried out on core from one well drilled at the centre of the basin (Figures 1 and 2). Research methods include scanning electron microscope (SEM) analysis, helium (He) pycnometry, mercury (Hg) intrusion porosimetry (MIP), N_2 adsorption and CH_4 adsorption.

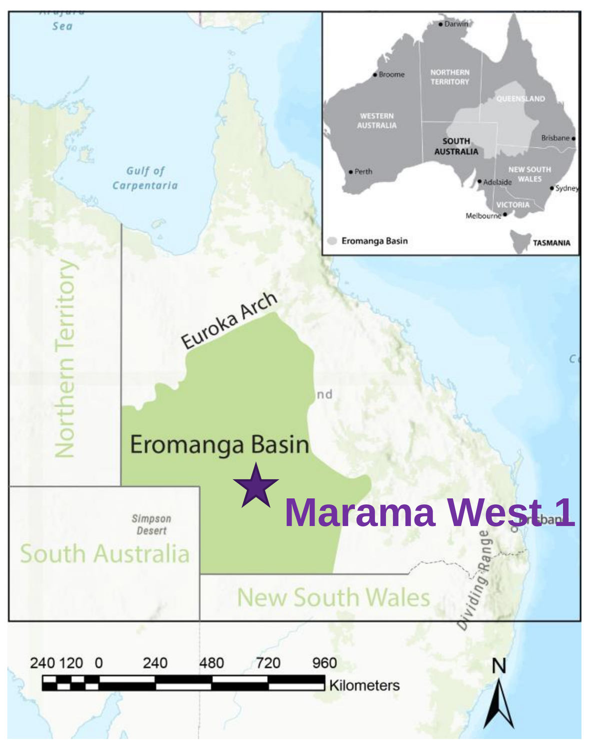

Figure 1: *Location map*

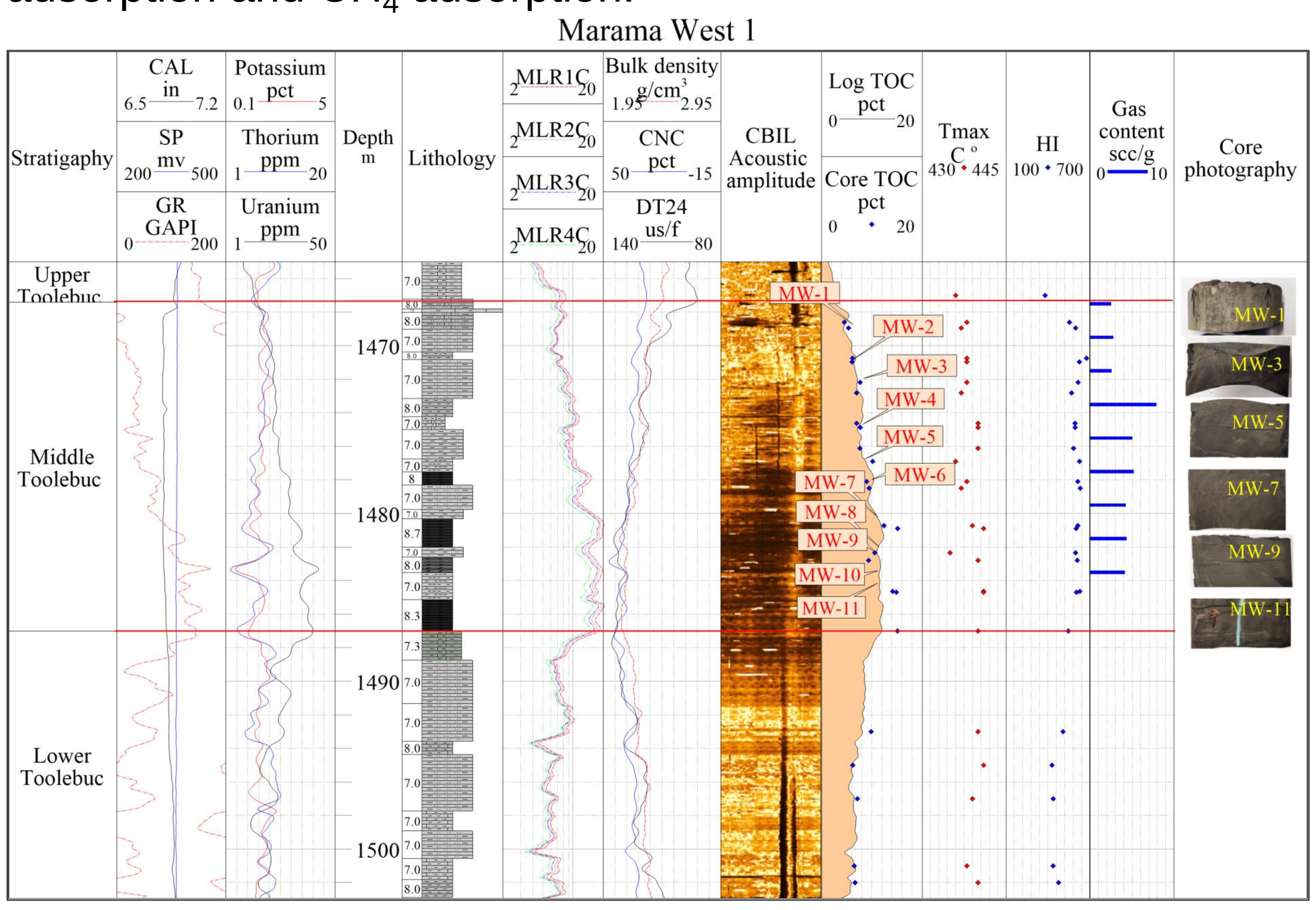

Figure 2: *Wellbore logging data analysis and sample depth selection*

2. Mineral and organic matter distribution

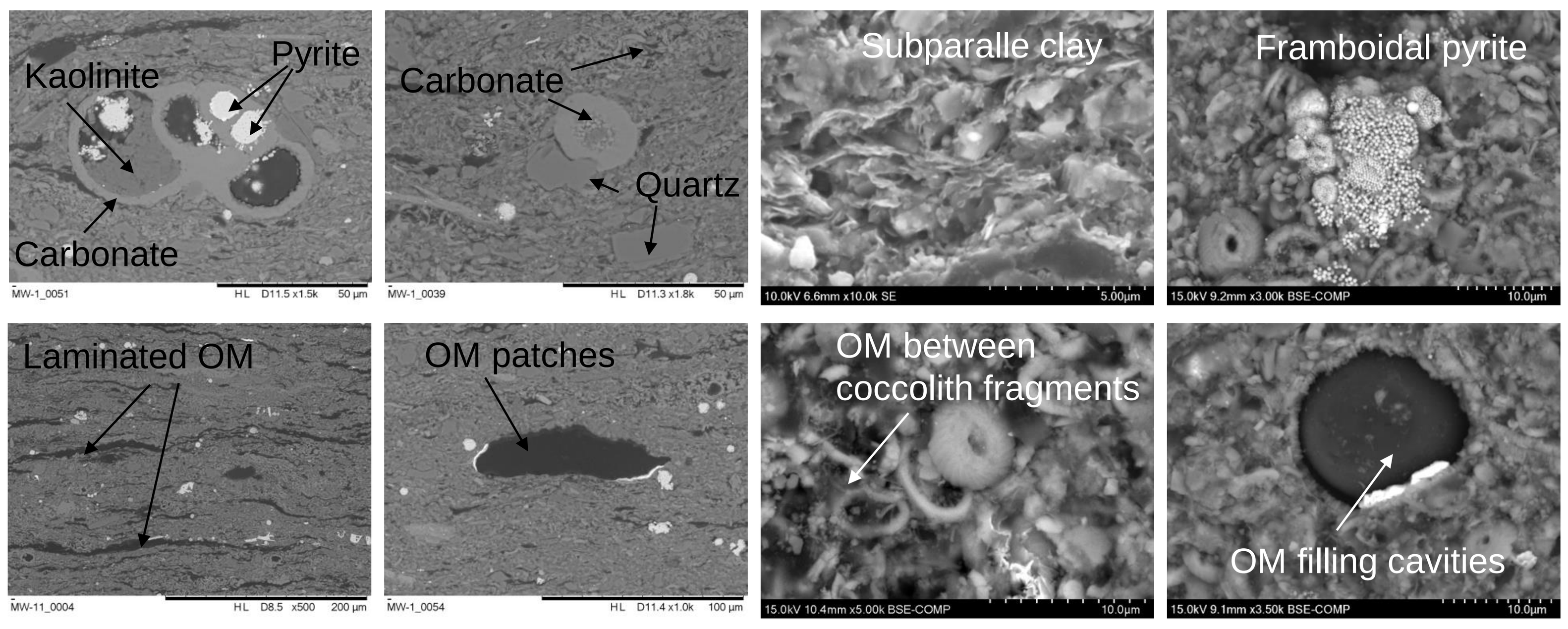

Figure 3: *Minerals and organic matter in Toolebuc Formation*

The middle Toolebuc is made up of laminated, dark grey coloured carbonaceous mudstone, with abundant fossil fragments. Carbonate, quartz, clay and pyrite are common. Organic matter (OM) is abundant and the total organic carbon is higher in the deeper level of the middle Toolebuc (Figure 2). Organic matter is distributed as laminations, patches or filling space between coccolith fragments or within foraminifera cavities.

3. Pore types and structure

The skeletal and bulk density values are 2.21 ~ 2.64 g/cm^3 and 2.05 ~ 2.35 g/cm^3, respectively, and agree with the variation of TOC. The average porosity is 8.47% with higher porosity at the top. Mesopores have the highest intrusion volume (avg. 1.80 cm^3/100g) compared to the micro and macropores (Figure 5).

There are four pore types: interparticle pores between grains, intraparticle pores within clay aggregates and pyrite framboids, pores within fossils and fractures (Figure 4). Few organic matter pores have been identified.

Table 1 He density and MIP parameters

Sample No.	He density (g/cm^3)	Bulk density (g/cm^3)	Porosity (%)	Total intrusion volume (cm^3/100g)	Macro pore volume (cm^3/100g)	Meso pore volume (cm^3/100g)
MW-1	2.64	2.35	11.17	2.25	0.50	1.75
MW-2	2.43	2.28	6.14	2.09	0.28	1.80
MW-3	2.49	2.22	11.00	2.17	0.50	1.67
MW-4	2.31	2.15	6.94	2.29	0.49	1.81
MW-5	2.44	2.12	12.88	2.46	0.54	1.92
MW-6	2.34	2.15	8.13	2.47	0.48	1.98
MW-7	2.26	2.09	7.49	2.75	0.96	1.79
MW-8	2.23	2.10	5.76	2.30	0.61	1.68
MW-9	2.31	2.09	9.50	2.57	0.79	1.78
MW-10	2.26	2.10	6.91	2.02	0.33	1.69
MW-11	2.21	2.05	7.22	2.88	0.94	1.94
average	**2.36**	**2.12**	**8.47**	**2.34**	**0.59**	**1.80**

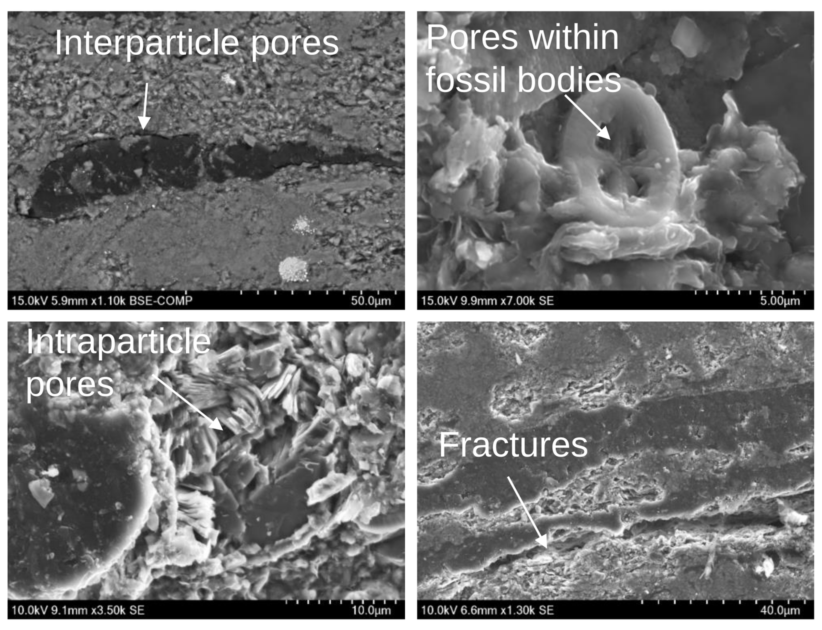

Figure 4: *Pore types*

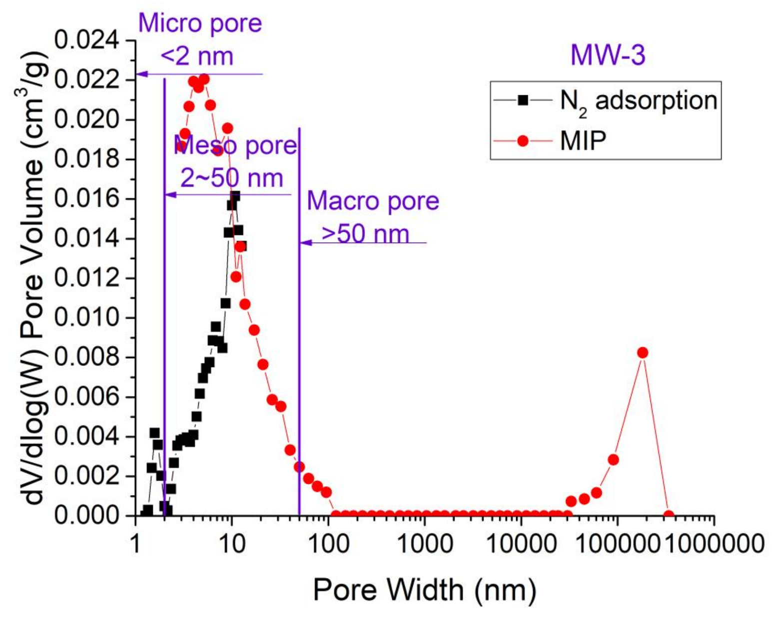

Figure 5: *Pore size distribution*

4. CH_4 adsorption properties

The CH_4 adsorption measurement was performed on powdered samples (75~106 μm) at 30 ℃ and pressure up to 8 MPa. The amount of CH_4 absorbed increases with pressure but there is no typical adsorption curve (Figure 6). With the highest of 6.95 cm^3/g at 8 MPa, samples exhibit quite high adsorption volume.

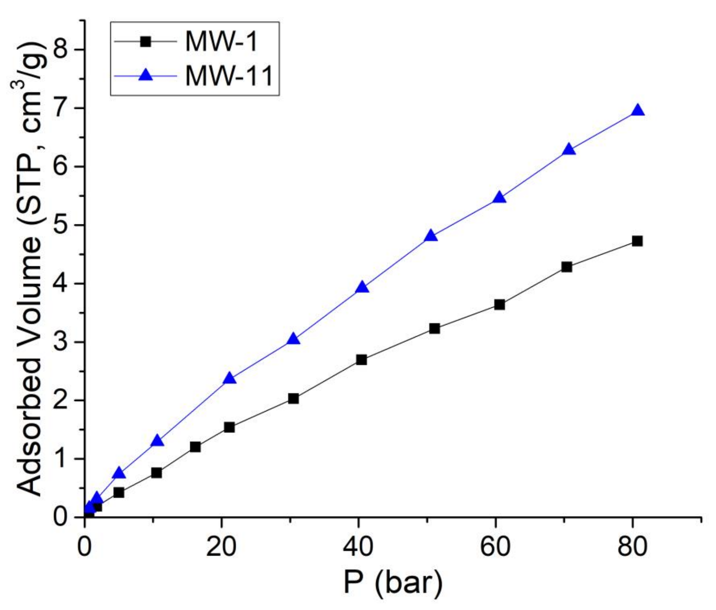

Figure 6: *CH_4 adsorption isotherms*

5. Conclusions

- The reservoir has high organic matter abundance and a certain amount of brittle minerals.
- Four typical pore types are identified and mesopore takes up the most pore space.
- The CH_4 adsorption capacity is high. The deeper part of the middle Toolebuc has higher gas potential.

Acknowledgements

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