PANGAEA
RESOURCES PTY Ltd.

Petrophysical Report
NT EP-167 – Manbulloo-S2

Prepared For: NT Department of Mines and Energy
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1 INTRODUCTION AND OBJECTIVE

Manbulloo-S1 was the second of three stratigraphic core holes designed to assess the stratigraphy and hydrocarbon potential of the Western McArthur Basin.

Manbulloo-S1 reached a total depth (TD) of 1236.22 (mRT) at 13:30 on the 14th of August 2014. Open hole wireline data was acquired by Weatherford. Due to borehole condition, Gamma Ray (GR) was logging inside the drill pipe from TD to surface. The open hole tool was hung up at around 930 mRT, and wireline data was acquire from the Hang Up Depth (HUD) to the casing shoe.

Petrophysical analysis of wireline data was performed over the Barney Creek equivalent in the Manbulloo-S1. The main desired outputs are:

- Porosity
- Water Saturation

2 LOGGING DATA

Wireline data was acquired by Weatherford over the HQ (3.78 in.) open hole interval from hung up depth (~ 930.0 mRT) to 4-1/2 in. casing shoe (420.3 mRT). Table 1 presented available wireline data.

Table 1. Wireline Logs

Logging Run	Logging Suite
Run #1 (Inside the Drill Pipe)	Compact Gamma Ray/Temp (MCG)
Run #2 (Logged from Hang Up Depth)	Compact Gamma Ray/Temp (MCG)
	Compact Dual Neutron (MDN)
	Compact Photo Density (MPD)
	Compact Dual Laterlog (MDL)
	Compact Micro Resistivity (MMR)
	Compact Micro Imager (CMI) – for calipers only
	Compact Sonic (MSS)
Run #3 (Logged from Hang Up Depth)	Velocity Check Shots (VCS)

CMI was run as the calipers tool only. The resistivity imager data was not acquired.

2.1 Log Quality Control

All tool calibrations were within tolerance.

All tool repeatability were within tolerance.

The following mud data was reported in the log header:

Table 2. Mud Properties in HQ (3.78 in.) Open Hole

Mud Type:	KCL
Mud Weight:	1.04 g/c³ (8.68 ppg)
Funnel Viscosity:	55 s
pH:	Not reported
Fluid Loss:	Not reported
Date/Time Circulation Stopped:	14-Aug-2014 19:00
Resistivity of Mud:	0.17 Ωm @ 25.0 °C
Resistivity of Mud Filtrate:	0.16 Ωm @ 25.0 °C
Resistivity of Mud Cake:	0.25 Ωm @ 25.0 °C

2.2 Borehole Temperature

Table 3. Bottom Hole Temperature

Time Reached TD	14-Aug-2014 13:30	Circulation Time	5.50 [hrs]	
Circulation Stopped	14-Aug-2014 19:00			
Services	**Time @ TD**	**Time since Circ. [hrs]**	**Temperature [°C]**	**Depth [mRT]**
Run # 1	14-Aug-2014 19:30	00.50	69.0	1236.00
Run # 2	15-Aug-2014 06:00	11.00	59.0	900.60
Run # 3	15-Aug-2014 14:00	19.00	65.0	930.70

The bottom hole static temperature (BHST) was not estimated because the bottom hole temperature was not measured at the same depth.

3 METHODOLOGY

3.1 Total Organic Carbon

Figure 1 presented the complete Wireline data over the Fraynes Formation (Barney Creek Formation). Resistivity (DDLB) and Sonic (DT35) was plotted together on track # 6. DDLB and DT35 were overlain; Sonic – Resistivity cross-over indicated the presence of the Total Organic Carbon (TOC). Rock-Eval/TOC results agreed with the Wireline data.

TOC was estimated with the Schmoker method:

$$TOC = \frac{156.956}{\rho_b} - 58.271$$

Where ρ_b was the Bulk Density (DEN) in g/cc and TOC was reported in wt%.

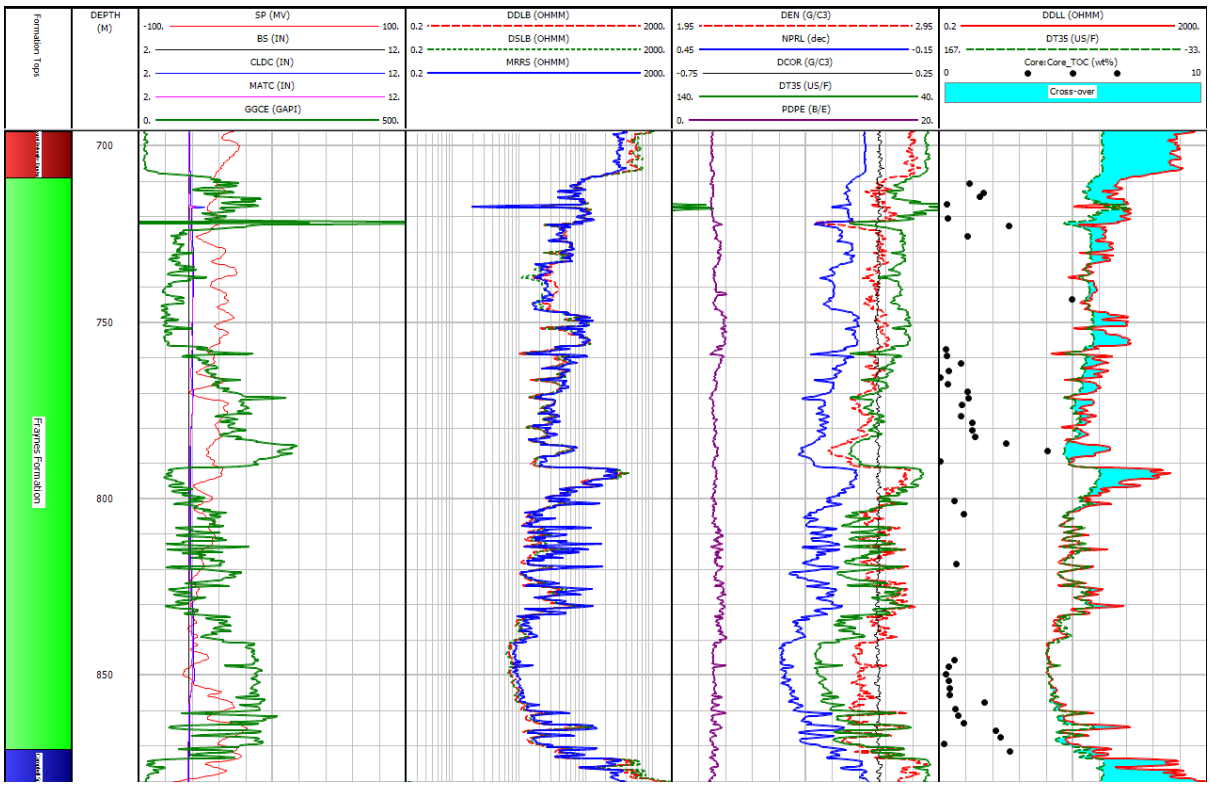

Figure 1. Resistivity – Sonic Overlaid Fraynes Formation

3.2 Volume of Clay

Gamma Ray and Neutron – Density were used to estimate volume of clay. Data was calibrated with the XRD data. The Clay Volume was the smallest one from two methods.

3.3 Bulk Volume and Porosity

Base on XRD data and lithology description, multi-minerals models (probabilistic method) were used to solve for bulk volume and porosity.

3.4 Water Saturation

Water Saturation was computed using the Simandoux equation with default parameters (a = 1, m = n = 2).

Apparent Water Resistivity (Rwa) was used to estimate the Formation Water Resisitivy (Rw).

3.5 Cut-offs Summary

Table 4 presented the cut-offs value used to determine reservoir and pay thickness.

Table 4. Cut-offs Used

	Min. Thickness	PHIE	Sw	VClay
Reservoir	≥ 1.00	≥ 0.02		≤ 0.5
Pay	≥ 1.00	≥ 0.02	≤ 0.5	≤ 0.5

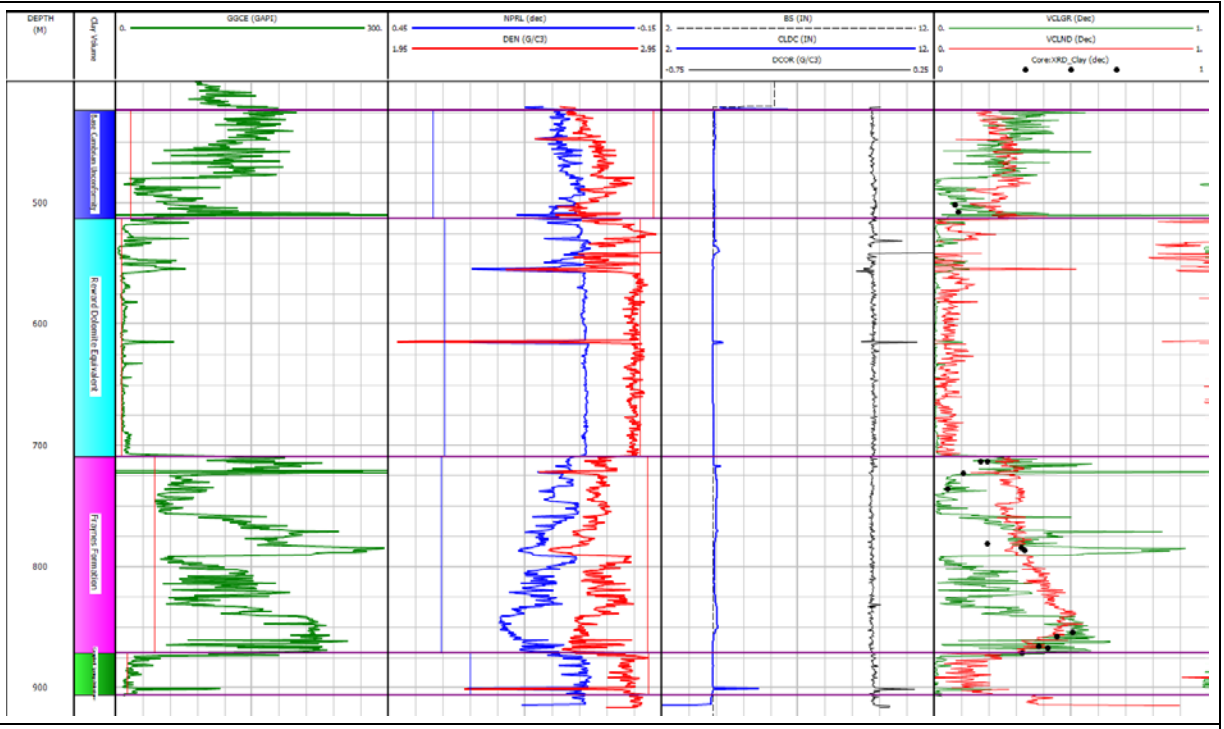

Figure 2. Estimate Volume of Clay

4 INTERPRETED RESULT

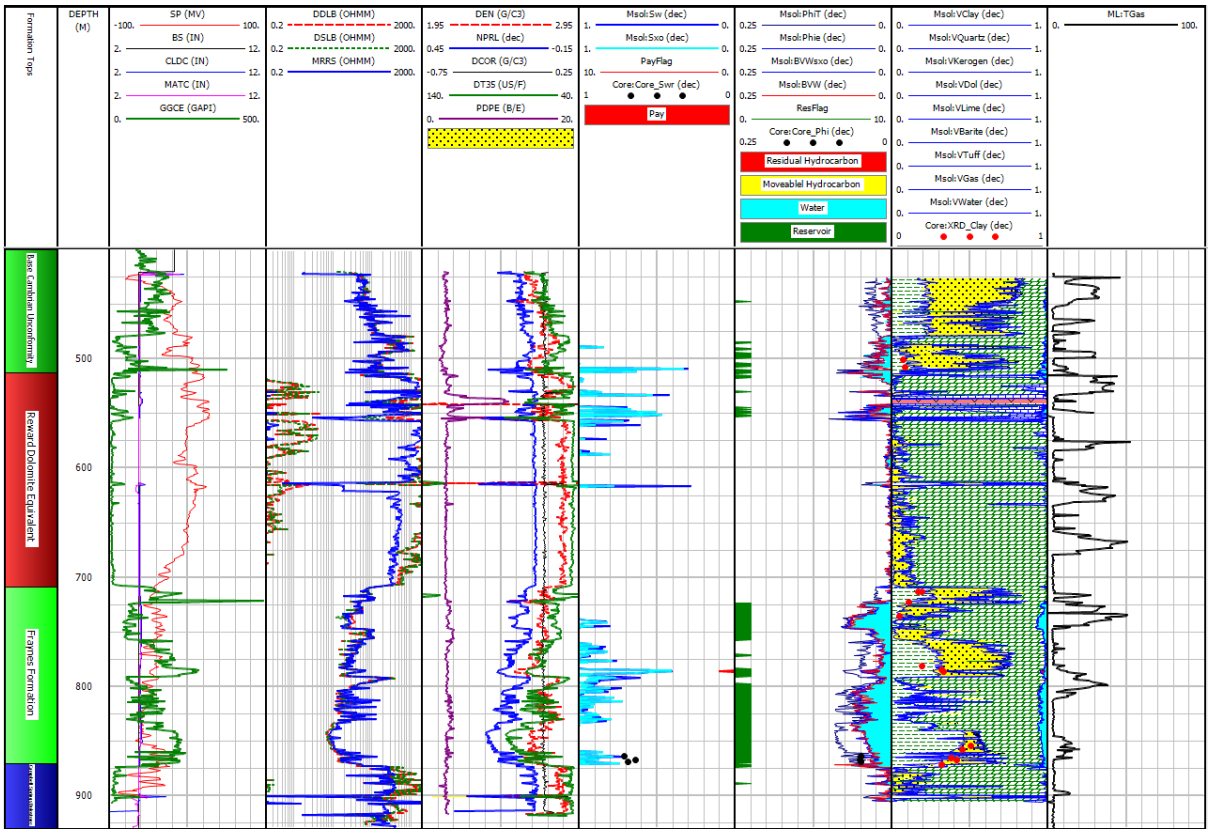

Figure 3. Interpreted Result

Zone Name	Top	Bottom	Gross	Net	N/G	Av. Phi	Av. Sw	Av. VCl	Phi*H	PhiSo*H
Reservoir										
Fraynes Formation	709.00	871.00	162.00	113.65	0.702	0.044	0.945	0.200	4.96	0.270
Pay										
Fraynes Formation	709.00	871.00	162.00	1.60	0.01	0.048	0.413	0.266	0.08	0.05

Table 5. Reservoir and Pay Summary

5 DISCUSSION

Wireline data and TOC lab results conform with each other and indicated that the penetrated formations have low TOC content.