FINAL WELL COMPLETION REPORT

NT EP-168 – Tarlee-2

Prepared For:	**NT Department of Mines and Energy**
Date:	**August 2016**
Revision No:	**A**

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REVISIONS				
Revision A		Initial Document	G&G and Engineering	G&G/Ops.
Rev	**Date**	**Reason For Revision**	**Author**	**Initial**

THIS REVISION			
Geology By:		**Engineering By:**	
Name	**Initial/Date**	**Name**	**Initial/Date**
Approved For Submission By:			

APPROVALS			
Name	**Position**	**Signature**	**Date**
Todd Hoffman	Geoscientist		12-09-16
Tim Radburn	Executive Director		12/9/16.

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APPENDICES

ENCLOSURES

1 WELL CARD (DATA SUMMARY SHEET)

GENERAL WELL INFORMATION	
Well Name and Number:	Tarlee-2
Designation:	Petroleum Well
Permit:	EP-168 (Northern Territory)
Basin:	Roper/Beetaloo
Operator and Titleholder:	Pangaea (NT) Pty Ltd (Operator) EMG Northern Territory Holdings Pty Ltd
Graticular Block No:	[3321] (5 minute blocks)
Surveyed Location: (MGA94, Zone 53)	Latitude 15° 53' 24.6387"S (GDA94) Longitude 132° 41' 00.4484"E (GDA94) Easting 251,956.75mE (MGA94,Z53) Northing 8,241,839.08mN (MGA94,Z53)
Pastoral Lease Holder:	Gregory John Saunders "Tarlee" Tarlee Station, Western Creek Road Larrimah, NT
Property Description:	Parcel 3048 "Tarlee Station"
Seismic Reference:	Top Hole: Hidden Valley 2013 2D, Line PB13-07, SP 3550
Offset Reference Well: **(Penetrating Target)**	Tarlee-S3 (2014), TD 1650.6 mRT (33 km NNE)
Surveyed Elevation:	207.77 mAMSL
Well Total Depth (TD):	1180.00 TVDmRT (Driller) 1182.59 TVDmRT (Logger) True Vertical Depth = Measured Depth
Spud Date:	30-Jul-2015
Reach TD Date:	12-Aug-2015
Rig Release Date:	18-Aug-2015
Well Status/Result:	Plugged and abandoned/Hydrocarbon Shows

OPERATOR AND DRILLING CONTRACTOR	
Operator:	Pangaea (NT) Pty Ltd
Operator Postal Address:	Locked Bag 1, 1 Farrer Place Sydney, NSW, 2000
Drilling Contractor:	DDH1 Drilling
Rig Name and Type:	Rig-33 (WEI-DS75)
Height of RT above GL:	4.02 m
RT Elevation:	211.79 mAMSL

FINAL WELL CONSTRUCTION									
Interval	Hole Specifications			Casing Specifications					
	Hole Size	From	To	OD	Weight	Grade	Thread	Casing Top	Shoe Depth
	[in]	[mRT]	[mRT]	[in]	[lb/ft]			[mRT]	[mRT]
Conductor	17-1/2	5.6	28.0	13-3/8	68.0	K-55	BTC	5.6	28.0
Surface	12-1/4	28.0	133.22	9-5/8	36.0	K-55	BTC	5.1	129.68
Intermediate	8.719	133.22	549.48	7	23.0	K-55 / N-80	BTC	4.3	546.48
Production	6-1/8	549.48	1180.0	Open Hole (Cement Plugged)					

DRILLING MEDIUM				
Interval	Hole Size	From	To	Fluid System
	[in]	[mRT]	[mRT]	
Conductor	17-1/2	5.6	28	Water
Surface	12-1/4	28.0	133.22	Dry Air, Mist & Stiff Foam
Intermediate	8.719	133.22	549.48	Dry Air, Mist, Stiff Foam and WBM – KCl / Polymer
Production	6-1/8	549.48	1180.0	WBM – KCl & Polymer

LOGS FOR 8.719" OPEN HOLE SECTION	
Logging Run	Service
Run #1	Gamma Ray (GR) Spontaneous Potential (SP) Laterologs, Micro-resistivity Photo electric / Density / Caliper (Pe-Den-Cal) Neutron Sonic Maximum temperature

LOGS FOR 6-1/8" OPEN HOLE SECTION	
Logging Run	Service
Run #2	Gamma Ray (GR) & Spectral Gamma Ray (HNGS) Spontaneous Potential (SP) Laterologs, Micro-resistivity Photo electric / Density / Caliper (Pe-Den-Cal) Neutron & Pulse Neutron (APS) Maximum temperature
Run #3	Deviation Survey Resistivity Imager (FMI) Dipole Sonic (SonicScanner)
Run #4	Nuclear Magnetic Resonance (CMR) Spectral Lithology (LithoScanner)
Run #5 - #7	MSCT
Run #8	Checkshot Survey

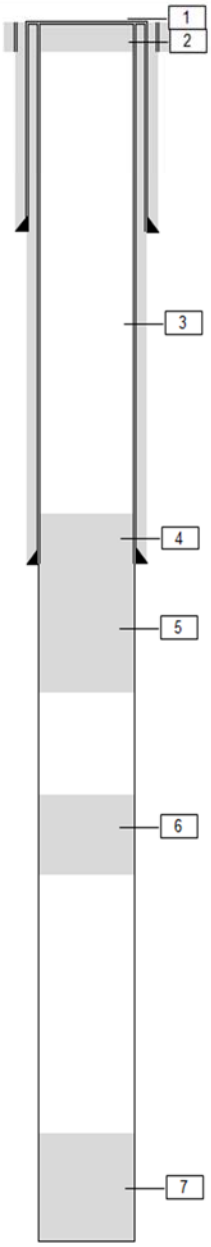
FORMATION TOPS						
Formation	**Predicted Depth**	**Depth**	**Depth**	**Depth**	**Depth**	**Thickness**
	(mRT)	**(mRT)**	**(mGL)**	**(mTVD)**	**(SS)**	**(m)**
Surficial Sediments	-	No samples taken during drilling of conductor hole				
Undifferentiated Cretaceous	-					
Montijinni Limestone	-	41.76	37.74	41.76	-166.01	38.1
Antrim Plateau Volcanics	84.00	79.86	75.84	79.86	-127.91	153.3
Base Cambrian Unconformity	312.00	233.16	229.14	233.16	25.39	-
Hayfield Mudstone	-	233.16	229.14	233.16	25.39	94.13
Jamison Sandstone	-	327.29	323.27	327.29	119.52	102.76
McMinn Formation	312.00	430.05	426.03	430.05	222.28	139.46
Kyalla Shale	583.00	569.51	565.49	569.51	361.74	94.9
Upper Velkerri Shale	714.00	664.41	660.39	664.41	456.64	203
Middle Velkerri	844.00	867.41	863.39	867.41	659.64	217.32
Lower Velkerri	1160.00	1084.73	1080.71	1084.73	876.96	95.27
TD	1210.00	1180.00	1175.98	1180.00	972.23	-

2 WELL SCHEMATIC

PANGAEA RESOURCES PTY Ltd

Plug & Abandon Diagram

Well: TARLEE - 2
Type: Petroleum Appraisal Well



PBTD: 506.4 mRT
Not to Scale

Item No.	Description	Length (m)	Depth Top (mRT)	Depth Bottom (mRT)
1	Steel Cap (Welded)	0.02		
2	Surface Cement Plug	15.00	4.02	19.02
3	Abandonment Fluid (3% KCl, Biocide) - 8.8ppg Density	487.42	19.02	506.44
4	Cement Plug #4	69.36	506.44	575.80
5	Cement Plug #3	167.20	575.8	743.0
6	Cement Plug #2	60.00	795.0	855.0
7	Cement Plug #1	60.00	1059.0	1119.0
	TOC Tagged at 506.4mRT with 6,000lbs weight test			

PERFORATIONS		Gun		Charges			
Formation	Interval (m RT)	Size	Type	SPF	Type	Ph	gm
Well	Not Perforated						

Surface Casing		9-5/8" 36 lbs/ft K-55 SET @ 129.7 mRT
Intermediate Casing		7" 23lbs/ft N-80 SET @ 546.5 mRT
Open Hole		6-1/8" Hole from 546.5 mRT - 1180.0mRT
Cementing Details		Intermediate Casing Cemented to Surface - Lead 12.5ppg, Tail 15.8ppg
Remarks:		TOC Tagged at 506.4mRT - Cement Plug tested with 6000lbs weight
Total Well Depth	1180.0 (mRT)	Status: Plugged & Abandoned

DESIGN		INSTALLATION	
Drafted by:	Steve Miller	Rig Supervisor:	Mark Gregory
Date of Draft:	18/08/15	Date of Installation:	18/08/15

3 DRILLING

The Tarlee-2 well was spudded by DDH1 Rig #33 on July 30, 2015. A 13 3/8" conductor pipe was installed to a depth of 28.0 mRT. Air drilling operations commenced with a 12-1/4" hammer bit. From 42.0 – 53.3 m unconsolidated sand was encountered. A stiff foam was injected and drilling continued to 133.22 m. The well was again circulated with a stiff foam but sand was still coming in from the upper section. The well was displaced with 100 bbls of water and the drill string was POOH while pumping at 200 gpm. A 9-5/8" surface casing string was run and set at a depth of 129.7 mRT and cemented in place.

Air Drilling operations continued with an 8 1/2" hole down to casing point at 549.48 mRT. Prior to running casing wireline logging operations were completed over the intermediate section. A 7" intermediate casing string was run to a depth of 546.5 mRT and cemented in place. Following drilling out the 7" shoe and 3 m of new formation and a LOT (EMW 23.97 ppg) was performed. Drilling operations continued down to TD (1180 mRT) with a 5" fluid hammer and a 6-1/8" PDC bit. Logging operations of the production hole were completed and sidewall cores were cut over the Kyalla & Middle Velkerri formations.

Following the wireline operations the well was plugged and abandoned. Four cement plugs were placed within the open hole section with the top cement plug extending 69.36 m inside the 7" casing plugged back to 506.44 mRT). The well was displaced with a 3% KCl/Biocide brine (Abandonment fluid - 8.8 ppg) and the wellhead removed. A 15 m surface cement plug was spotted and a steel cap was welded across the 9-5/8"casing stub. The well was Plugged and Abandoned as per Section 529 of the Schedule of Onshore Petroleum Exploration and Production Requirements 2012.

4 CEMENTING

4.1 Surface Casing Cement

The 12-1/4" surface hole was drilled to 133.22 mRT and 9-5/8" casing was run to 129.68 mRT. The casing was cemented by pumping 47.5 bbl slurry of 15.8 ppg Class G cement with 1% BWOC Calcium Chloride additives and displaced with 30.4 bbl water. Bump plug; held 2005 psi for 5 min. No cement returns were seen at surface. A top up cement job was performed by pumping 13 bbl slurry of 15.3 ppg Class G cement.

Surface Casing Cement	
Parameters	
Casing Section:	Surface
Hole Details	12-1/4”
Casing Details:	9-5/8” 36 lb/ft K-55 BTC
Casing Shoe Depth:	129.68 mRT
Cement Type/Additives:	Class G / 1% BWOC Calcium Chloride
Cement Weight:	15.8 ppg
Cement Excess Pumped:	100%
Top of Cement Depth:	Top-up cement job at surface.
Bump Plug:	580psi, Pressure Casing up to 2005psi/5min-OK

4.2 Intermediate Casing Cement

The 8.719” intermediate hole was drilled to 549.48 mRT and 7” casing was run to 546.48 mRT. A 22.2 bbl spacer was pumped followed by pumping 41.3 bbl of 12.5 ppg Lead slurry and 18.2 bbl 15.8 ppg Tail slurry. The plug was dropped and cement displaced with 70.8 bbl of fluid. Bump plug; held 1550 psi for 15 min. Cement returns were seen at surface.

Intermediate Casing Cement	
Parameters	
Casing Section:	Intermediate
Hole Details:	8.719”
Casing Details:	7” 23 lb/ft N-80 BTC
Casing Shoe Depth:	546.48 mRT
Cement Type:	Class G
Cement Weight:	Lead: 12.5 ppg, Tail: 15.8ppg
Cement Excess Pumped:	Lead: 10%, Tail: 10%
Top of Cement Depth:	Lead: Surface, Tail: 400m
Bump Plug:	550psi, Pressure casing up to 1550psi/15min -OK

4.3 Cement Plug P&A

Cementing Stages					
N°	Bottom	Top	Length	Density	Cement Type
	[mRT]	[mRT]	[m]	ppg	Class
1	1119.0	1059.0	60.0	15.8	G
2	855.0	795.0	60.0	15.8	G
3	743.0	575.8	167.2	15.8	G
4	575.8	506.44*	69.36	15.8	G
506.44 – 19.02mRT (Abandonment Fluid)				**8.8**	**N/A**
5	19.02	4.02	15.0	15.8	G

**Top of cement tagged at 506.44 mRT with a 6,000 lb weight test*

Drilling operations and log data interpretations indicate that all the formations in the production hole (Kyalla Shale, Upper Velkerri, Middle Velkerri, and Lower Velkerri) have very low permeability, therefore no lost circulation intervals were identified. The hydrocarbon bearing formations are the Kyalla Shale and Middle Velkerri, which have been completely isolated by setting cement plugs across their tops and bases depths.

5 CORES AND SAMPLING

Please see **Appendix 1** for details of sidewall cores and samples taken.

6 WELL TRAJECTORY

Please see **Appendix 2** for deviation survey results.

7 LABORATORY ANALYSES

SECONDARY ANALYSES		
Analyses Type	Laboratory	Status
Desorption	Weatherford Australia	Complete
Rock-Eval Pyrolysis	Weatherford Australia	Complete
LECO TOC	Weatherford Australia	Complete

8 LABORATORY RESULTS

Please see **Enclosure 1** for laboratory results.

9 PETROPHYSICAL ANALYSIS

Please see **Enclosure 2** for petrophysical interpretation.

10 HYDROCARBON SHOWS

HYDROCARBON SHOWS		
Top Depth (mRT)	**Base Depth (mRT)**	**Show Details**
482.4	514.0	**Show in Sandstone**: 10% to 15% of cuttings with very pale yellow-gold fluorescence, solvent cuts only obtained on crushed samples- pale yellow residual rings, no odor. Shows rated as trace.
514.0	523.0	**Show in Sandstone**: 5% of cuttings with uniform moderate to bright yellow fluorescence, solvent addition produced very slow developing bluish white cuts, medium bluish white residual rings. Oil stain is spotty to very faint and uniform. Show rated as poor to fair.
553.0	579.0	**Show in sandstone**: 3% to 5% of grains with medium yellow spotty fluorescence, very slow developing cuts- some only display residual rings after soaking. Solvent cuts that did develop and residual rings were pale bluish-white to straw yellow. Traces of very fine spotty – pin point light brownish stain. Show rated as trace.
579.0	587.0	**Show in sandstone**: 10% to 15% of grains with medium to bright yellowish-white uniform fluorescence, very slow streaming bluish-white solvent cuts with bluish-white residual rings. Some very light brownish uniform oil staining or stain simply not apparent. No odor apparent. Show rated as fair.
645.0	655.0	**Show in sandstone**: 5% of grains with faint to dull yellow spotty fluorescence, very slow developing milky yellowish-white solvent cuts, very pale bluish-white residual rings, light brown stain ranges from somewhat uniform to pin point, no odor. Show rated as trace to poor.
663.0	713.3	**Shows in thin interbedded sandstones in Moroak**: Several percent of grains in each cuttings interval with pale yellow to dull yellow gold uniform fluorescence, solvent cuts range from extremely slow pale yellow streaming to simply pale yellow residual ring cuts (evidence of hydrocarbons only after solvent evaporation), spotty medium brown intergranular stain to some dark brown heavier stain/residue, no odor. Shows rated as trace.
724.0	745.0	**Shows in thin interbedded sandstones in Upper Velkerri**: Several percent of sand grains with dull gold fluorescence, solvent cuts were only of the residual variety with pale yellowish rings – most samples had to be crushed to produce any solvent reaction. Spotty medium brown to black-brown intergranular stain / residue. Shows rated as trace.
749.0	785.0	**Very marginal shows in thin interbedded sandstones:** Traces of dull gold fluorescing sand cuttings in this interval, only pale yellow residual rings evolved on solvent addition, spotty brown oil stain / residue. Show quality diminishes with depth through the Upper Velkerri. Shows rated as trace.

11 GEOLOGY

11.1 Summary

The Tarlee-2 petroleum well is located in the northern portion of EP-168 in central Northern Territory, approximately 164 km south-southeast of Katherine (**Figure 1**). The landscape is dominated by low-lying savanna with the predominant land use being broad acre cattle grazing. The nearest exploration wells are Tarlee-S3 (2014), approximately 33 km to the north-northeast and Tarlee-1 (2016), approximately 18 km to the southeast of the Tarlee-2 location.

The primary objective of Tarlee-2 was the carbonaceous shale reservoirs within the middle Velkerri Formation. The secondary objective was the organic-rich shale within the Kyalla Formation.

Tarlee-2 was successful in both confirming the presence of favourable stratigraphy in the Western Beetaloo Sub-Basin, and identifying thick organic rich shales within the middle Velkerri Formation and the Kyalla Formation. Excellent gas shows in the form of desorption from side-wall cores, elevated mud-gas and micro-bleeding from cuttings was observed in multiple formations throughout the well.

Tarlee-2 was plugged and abandoned on August 17th, 2015.

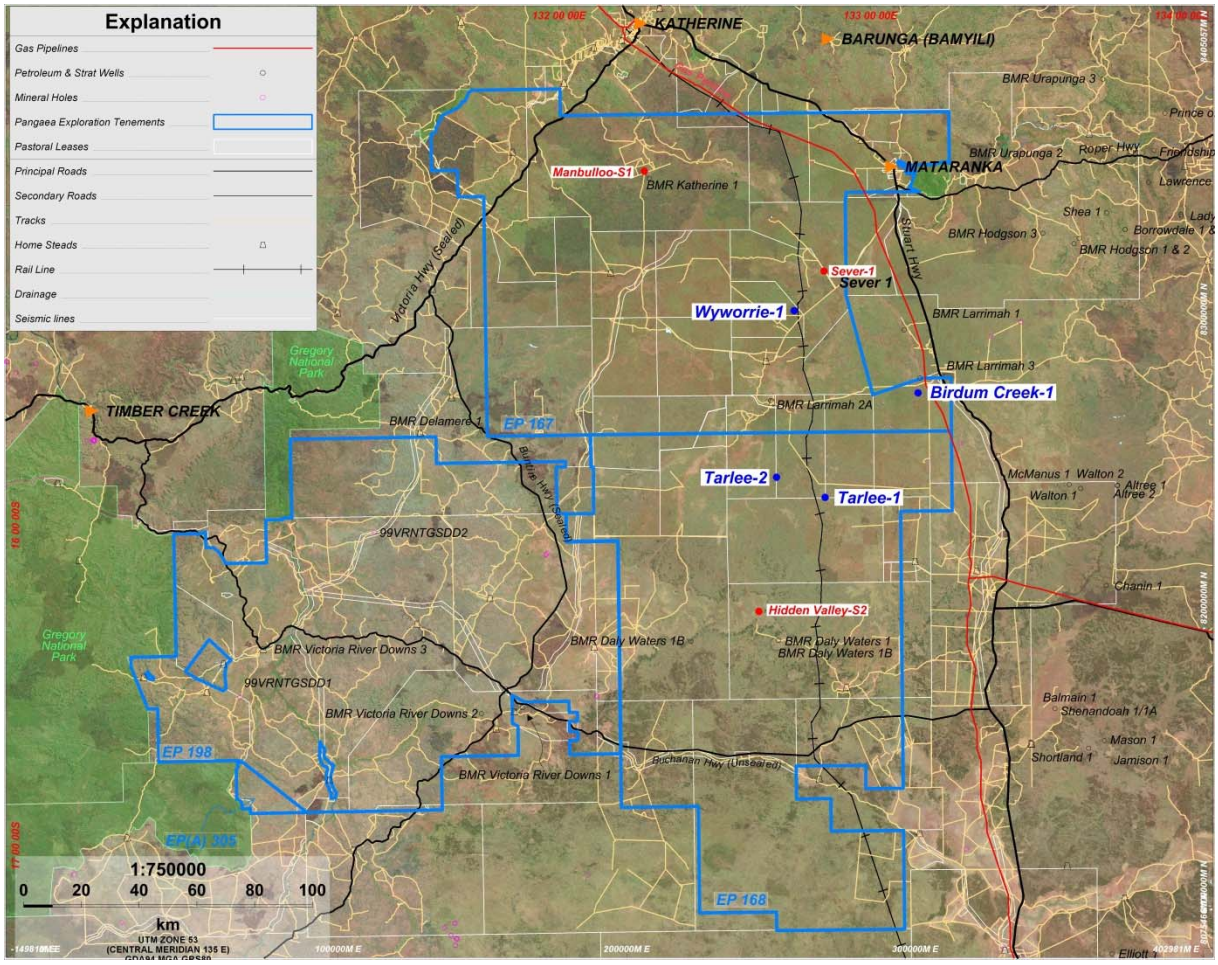


Figure 1: Tarlee-2 Location Map with Cultural Features

11.2 Lithology

See **Appendix 3** for lithology descriptions.

11.3 Stratigraphy

Tarlee-2 was drilled into the upper Roper Basin west of the Daly Waters Arch. Tarlee-2 intersected the Cambrian Daly Basin, Neoproterozoic (Centralian Supersequence I) and Meosproterozoic Roper Basin (**Figures 2 and 3**). The Daly Basin consisted of the Tindall Limestone and Antrim Plateau Volcanics. A Cambrian unconformity separates the underlying Hayfield Mudstone and Jamison Sandstone, interpreted to be Neoproterozoic Centralian Supersequence I (Hoffman 2016, Munson 2016). A late Mesoproterozoic unconformity separates the Mesoproterozoic Roper Basin sequence and the Centralian Supersequence I.

A silty interval and a sandstone below the Antrim Plateau Volcanics is interpreted as the Neoproterozic Hayfield Mudstone and Jamison Sandstone (**Figure 3**). The stratigraphy below the Jamison Sandstone consist of the upper Roper Basin sequence and includes the McMinn Formation, Kyalla Shale, Moroak Sandstone and Velkerri Formation.

Regionally, the middle Velkerri Formation can be subdivided into three organically rich units separated by two clay-rich, organically lean shales and siltstones, however, in the Tarlee-2 region the lower organically lean siltstone is not present (**Figure 3**). These organic-rich shales have been termed Shale A, B and C (oldest to youngest). Regionally, the Upper C shale appears to be the least consistent facies within the middle Velkerri Formation. In Tarlee-2, the C shale contains more extra-basinal siltstone which dilutes the organic material. This dilution of the organic-rich shale appears to increase to the south and southwest and can also be seen in Shenandoah-1A. The B and A Shales facies are regionally more consistent and predictable than the C shale, with the B shale typically having the thickest and most consistent zone of elevated TOC.

Both the Kyalla and Derim Derim sills obersved in Tarlee-S3 were not present in Tarlee-2 (**Figure 3**).

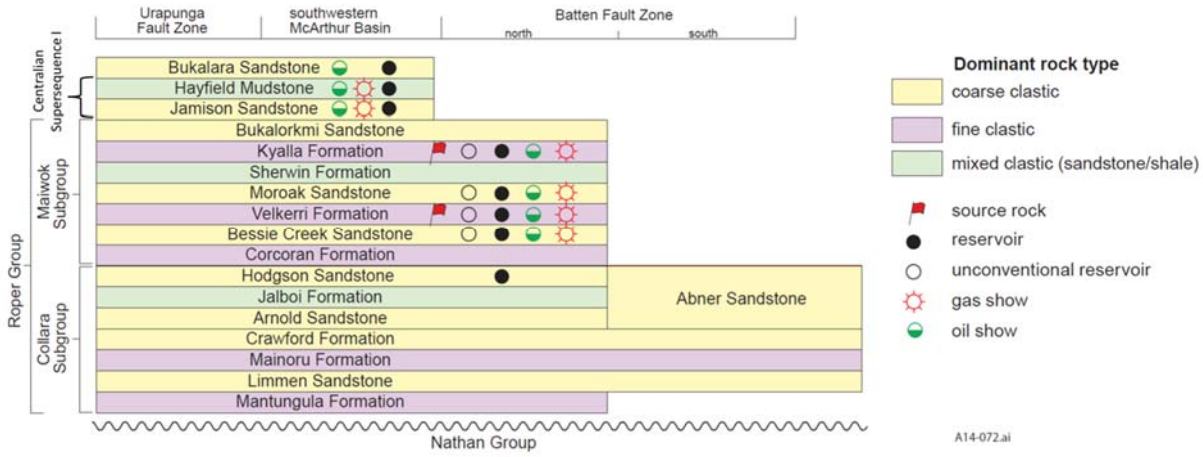


Figure 2. Stratigraphic Column Showing the Roper Basin Units and Source Reservoir and Hydrocarbon Shows (Munson TJ, 2014) and the interpreted Neoproterozoic Supersequence I.

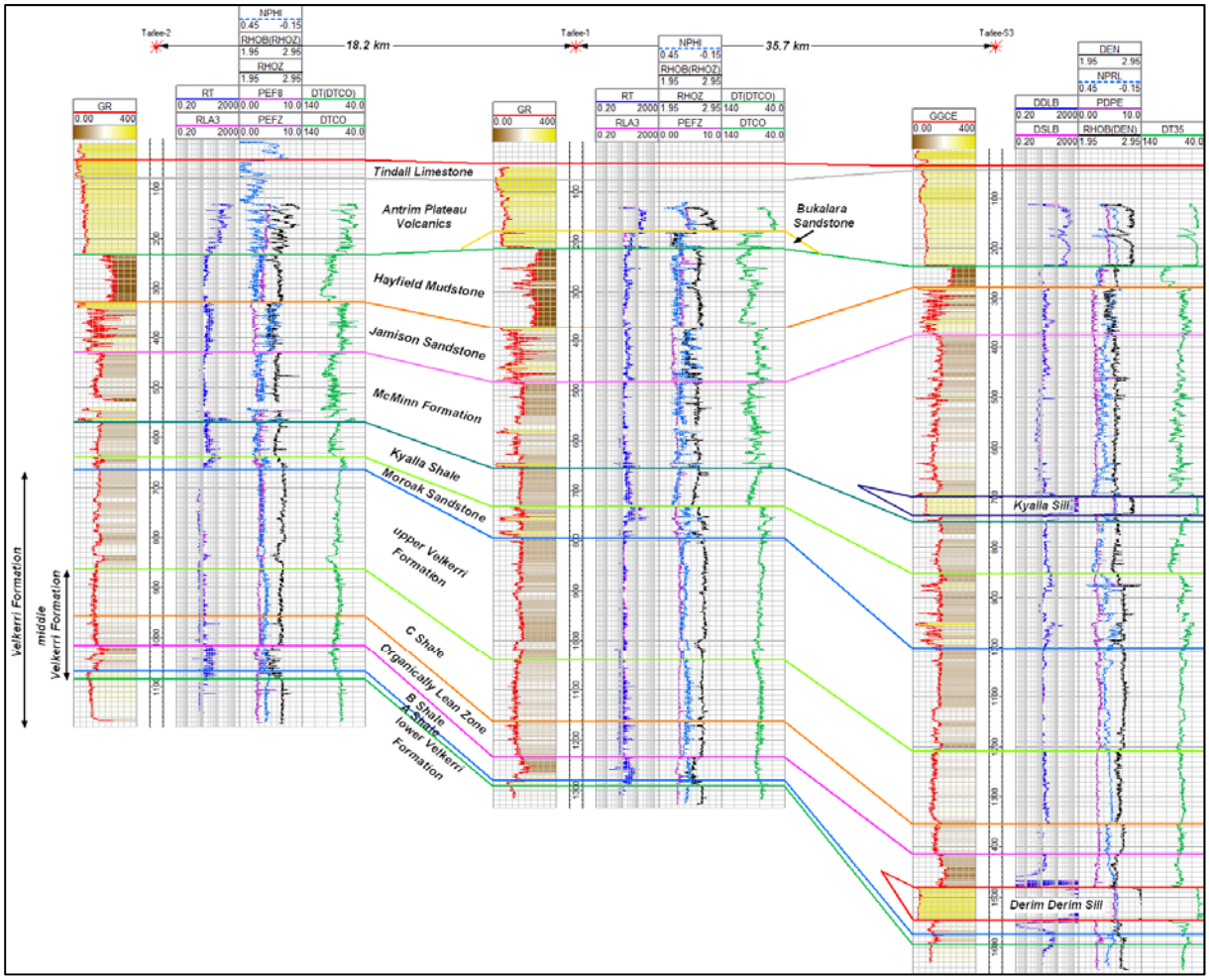


Figure 3. Tarlee-2 middle Velkerri correlation to nearby wells

11.4 Well-to-Seismic Tie

The seismic data quality around the Tarlee-2 well location is of reasonable quality and a good well-to-seismic tie using the acquired checkshot data can be produced (**Figure 4**). Based on the well-tie, a number of key seismic markers can be mapped regionally across the area to other existing wells.

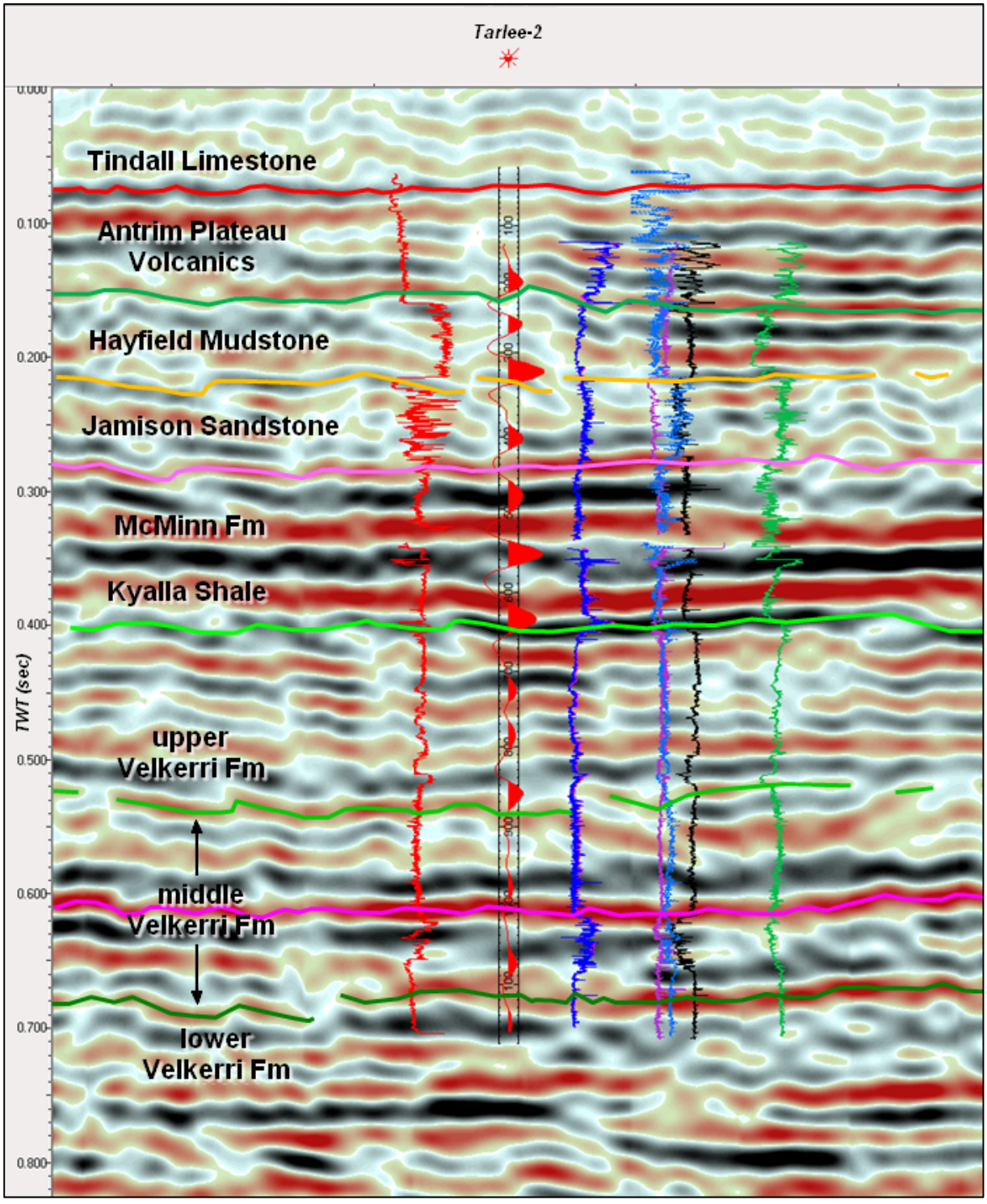


Figure 4. Tarlee-2 well-to-seismic tie.

11.5 Reservoir Properties

The middle Velkerri shale is gas saturated, organically rich, and has a gross thickness of approximately 221 m. Gas was observed to be bleeding from virtually all carbonaceous intervals

within the middle Velkerri Formation. Log derived porosity is calculated to be approximately 5% across the Kyalla Shale and 6.5% across the middle Velkerri shales (see **Enclosure 2**).

Regionally, there are three distinct organic-rich zones identified within the middle Velkerri Shale termed the A, B and C shale (deepest to shallowest). In Tarlee-2 the C Shale is approximately 94 m thick and the Total Organic Carbon content (TOC) is typically low <1 wt%. The middle organically rich zone, the B Shale is separated from the C Shale by an approximately 60 m thick clay-rich organically lean zone. The B Shale is 53 m thick. The TOC ranges from approximately 2 - 6 wt% and averages 5.16 wt% (**Enclosure 1 and 2**). The lower organically rich zone, the A Shale, is approximately 16 m thick and has a TOC content ranging from approximately 1 – 3 wt%. The A Shale in this Tarlee-2 is continuous with the B Shale.

11.6 Trap Integrity

Tarlee-2 was drilled to investigate a shale resource play and was therefore not located on a mappable structure/trap.

11.7 Geochemistry of Source Rocks

Elevated TOC was observed in the Kyalla Shale and the Middle Velkerri Shale in Tarlee-2. Rock-Eval pyrolysis and Leco TOC data is contained in **Enclosure 1**.

11.8 Environment of Deposition

Tarlee-2 appears to have been located in a marine environment during the deposition of the middle Velkerri Formation. As such, the deep water euxinic conditions present were conducive towards the deposition and preservation of the thick sequences of organic rich shale observed in the A and B Shales. The increase in clastic sediment in the C Shale and the thinning of the A and B Shales at this location indicates that this well is more proximal to the sediment source than other wells to the northeast (e.g. McManus-1). The sediment source is likely from a southerly direction. This is based on the increase in sand content in the middle Velkerri C Shale in Shenandoah-1A and Tarlee-2.

11.9 Contributions to Geological Knowledge/Hydrocarbon Potential

Tarlee-2 was drilled in the south-eastern portion of EP 168 to the west of the Daly Waters Arch and is the third well to be drilled into the Velkerri Formation west of the Daly Waters Arch.

Tarlee-2 confirms the lateral consistency of a number of the regional markers within the Velkerri Formation which have been identified across the Roper basin (**Figure 3)**. The increase in extra-basinal material in the C Shale is consistent with the greater variability of this unit compared to the B and A shales. It is also consistent with the increase in sand and silt observed in Shenandoah-1A.

Excellent gas shows in the form of gas bleeds from the cuttings, elevated mud gas readings (**Enclosure 4**) and gas in desorption samples (**Enclosure 1**) in the middle Velkerri Shale and the Kyalla Shale confirm the presence of gas in the Mesoproterozoic basin. The petrophysical interpretation confirms the unconventional shale reservoir potential of the middle Velkerri shales.

12 EVALUATION LOGS

Please see **Enclosure 3** for digital wireline log data.

Please see **Enclosure 4** for graphical mud log.

No measurement, logging or pressure while drilling logs were performed.

13 WELL TESTING

No formation fluid samples or productions tests were performed.

14 CORE PHOTOGRAPHY

No whole core was acquired in Tarlee-2.

15 BIT RECORD

Please see **Appendix 3** for bit record.

16 MUD RECORD

Please see **Appendix 4** for mud record.

17 ESTIMATED RESERVOIR TEMPERATURE

Horner's correction was applied to maximum temperature data acquired from thermometers installed in the logging head of the wireline runs over the 6-1/8" open hole interval.

Time Driller to TD (1180 mRT)		**12-Aug-2015 11:13**	
Circulation Stopped		**12-Aug-2015 12:00**	
Wireline Run	**Time WL at Bottom**	**Max. Temp.**	**Temp. Sensor Depth**
		[°C]	**[mRT]**
Run#2 (APS-Pex-HNGS)	13-Aug-2015 09:56	79.86	1167.02
Run#3 (FMI-SonicScanner)	13-Aug-2015 17:53	77.73	1156.48
Run#4 (LithoScanner-CMR)	14-Aug-2015 06:00	79.01	1163.68
Run#5 (MSCT-1)	15-Aug-2015 02:52	83.33	1043.54
Run#6 (MSCT-2)	15-Aug-2015 16:33	93.33	1037.04
Run#7 (MSCT-3)	16-Aug-2015 04:40	85.00	1016.30
Run#8 (Checkshot)	16-Aug-2015 09:43	85.00	1170.00

The bottom hole static temperature of 97.9°C @ 1180mRT was estimated (**Figure 5**).

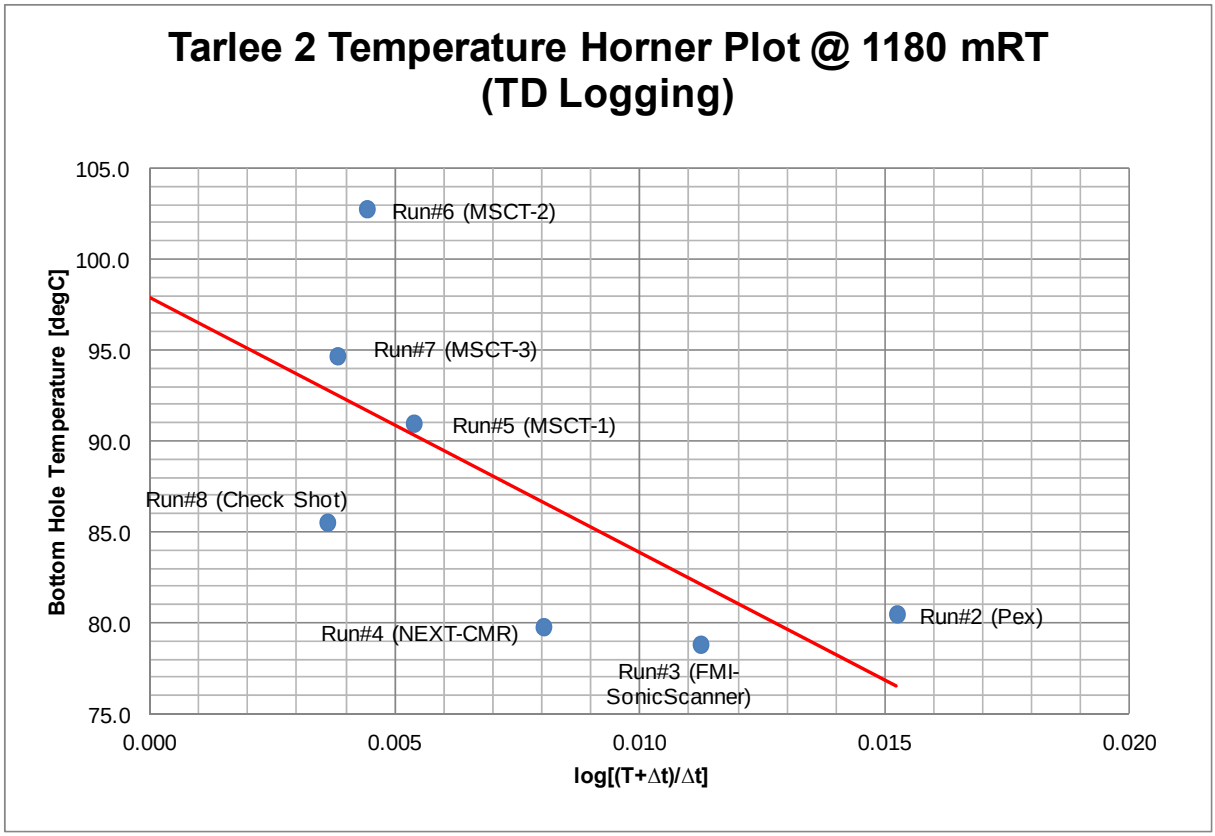


Figure 5. Tarlee-2 Temperature Horner Plot

References:

Hoffman TW, 2016. Roper Basin burial history modelling: Inferences for the timing of hydrocarbon generation: in *'Annual Geoscience Exploration Seminar (AGES) 2016. Record of abstracts'. Northern Territory Geological Survey, Record 2016-001*

Munson TJ, 2016. Sedimentary characterisation of the Winto package, greater McArthur Basin: in *'Annual Geoscience Exploration Seminar (AGES) 2016. Record of abstracts'. Northern Territory Geological Survey, Record 2016-001*

APPENDIX 1. CORES AND SAMPLES DETAILS

SAMPLE DETAILS

SIDEWALL CORE DETAILS

Tarlee-2 Sidewall Cores					
MSCT Run	**No**	**Depth (mRT)**	**Formation**	**Remarks**	**Recovered**
5 (MSCT-1)	1	585.0	Kyalla Shale		Yes
	2	587.0	Kyalla Shale		Yes
	3	597.0	Kyalla Shale		Yes
	4	602.0	Kyalla Shale		Yes
	5	607.0	Kyalla Shale		Yes
	6	610.0	Kyalla Shale		Yes
	7	612.0	Kyalla Shale		Yes
	8	617.0	Kyalla Shale		Yes
	9	622.0	Kyalla Shale		Yes
	10	627.0	Kyalla Shale		Yes
	11	591.5	Kyalla Shale	Off depth	Yes
	12	608.5	Kyalla Shale	Off depth	Yes
	13	618.5	Kyalla Shale	Off depth	Yes
	14	623.5	Kyalla Shale	Off depth	Yes
	15	633.5	Kyalla Shale		Yes
	16	638.5	Kyalla Shale	Off depth	Yes
	17	639.5	Kyalla Shale		Yes
	18	643.5	Kyalla Shale		Yes
	19	648.5	Kyalla Shale		Yes
	20	648.5	Kyalla Shale		Yes
	21	653.5	Kyalla Shale		Yes
	22	655.5	Kyalla Shale	Off depth	Yes
	23	658.5	Kyalla Shale	Off depth	Yes
	24	773.5	U. Velkerri		Yes
	25	818.5	U. Velkerri	Off depth	Yes
	26	819.0	U. Velkerri	Off depth	Yes
	27	826.5	U. Velkerri		Yes
	28	831.5	U. Velkerri		Yes
	29	836.5	U. Velkerri		Yes
	30	842.0	U. Velkerri	Off depth	Yes
	31	843.0	U. Velkerri		Yes
	32	843.5	U. Velkerri	Off depth	Yes
	33	1055.8	M. Velkerri	Desorption	Yes
	34	1056.0	M. Velkerri	Desorption	Yes
	35	1056.2	M. Velkerri	Desorption	Yes
6 (MSCT-2)	36	840.0	U. Velkerri		Yes
	37	844.0	M. Velkerri		Yes
	38	846.0	M. Velkerri		Yes
	39	849.0	M. Velkerri		Yes
	40	924.0	M. Velkerri		Yes
	41	954.5	M. Velkerri		Yes
	42	969.0	M. Velkerri		Yes

	43	976.0	M. Velkerri		Yes
	44	980.0	M. Velkerri		Yes
	45	1010.0	M. Velkerri		Yes
	46	1019.0	M. Velkerri		Yes
	47	1020.0	M. Velkerri		Yes
	48	1021.0	M. Velkerri		Yes
	49	1023.0	M. Velkerri		Yes
	50	1025.0	M. Velkerri		Yes
	51	1027.0	M. Velkerri		Yes
	52	1029.0	M. Velkerri		Yes
	53	1031.0	M. Velkerri		Yes
	54	1033.0	M. Velkerri		Yes
	55	1035.0	M. Velkerri		Yes
	56	1037.0	M. Velkerri		Yes
	57	1039.0	M. Velkerri		Yes
	58	1041.0	M. Velkerri		Yes
	59	1042.0	M. Velkerri		Yes
	60	1043.0	M. Velkerri		Yes
	61	1045.0	M. Velkerri		Yes
	62	812.0	U. Velkerri	Retake Run#5 (MSCT-1)	Yes
	63	812.5	U. Velkerri	Retake Run#5 (MSCT-1)	Yes
	64	820.0	U. Velkerri	Retake Run#5 (MSCT-1)	Yes
	65	835.5	U. Velkerri	Retake Run#5 (MSCT-1)	Yes
	66	1049.3	M. Velkerri	Desorption	Yes
	67	1049.5	M. Velkerri	Desorption	Yes
	68	1049.7	M. Velkerri	Desorption	Yes
7 (MSCT-3)	69	632.0	Kyalla Shale	Retake Run#5 (MSCT-1)	Yes
	70	637.0	Kyalla Shale	Retake Run#5 (MSCT-1)	Yes
	71	642.0	Kyalla Shale	Retake Run#5 (MSCT-1)	Yes
	72	647.0	Kyalla Shale	Retake Run#5 (MSCT-1)	Yes
	73	837.0	U. Velkerri	Retake Run#5 (MSCT-1)	Yes
	74	1047.0	M. Velkerri		Yes
	75	1049.0	M. Velkerri		Yes
	76	1051.0	M. Velkerri		Yes
	77	1053.0	M. Velkerri		Yes
	78	1055.0	M. Velkerri		Yes
	79	1057.0	M. Velkerri		Yes
	80	1058.0	M. Velkerri		Yes
	81	1059.0	M. Velkerri		Yes
	82	1061.0	M. Velkerri		Yes
	83	1063.0	M. Velkerri		Yes
	84	1065.0	M. Velkerri		Yes
	85	1067.0	M. Velkerri		Yes
	86	1068.0	M. Velkerri		Yes
	87	1069.0	M. Velkerri		Yes
	88	1071.0	M. Velkerri		Yes
	89	1073.0	M. Velkerri		Yes
	90	1075.0	M. Velkerri		Yes
	91	1077.0	M. Velkerri		Yes

	92	1079.0	M. Velkerri		Yes
	93	1081.0	M. Velkerri		Yes
	94	1082.0	M. Velkerri		Yes
	95	1083.0	M. Velkerri		Yes
	96	1085.0	M. Velkerri		Yes
	97	1117.0	M. Velkerri		Yes
	98	1149.0	M. Velkerri		Yes
	99	1028.5	M. Velkerri	Desorption	Yes
	100	1028.7	M. Velkerri	Desorption	Yes
	101	1028.9	M. Velkerri	Desorption	Yes

*NOTE: Because of incorrect correlation pass in run # 5 (MSCT–1), off depth cores from the planned MSCT were taken. Depths of off depth cores listed above have been corrected. Missing cores were collected in the subsequent MSCT runs.

CUTTINGS SAMPLE DETAILS

Washed and Dried Cuttings for Pangaea (Set A) and NTGS (Set B)			
Box Number	**Type**	**Depth (mRT)**	**Remarks**
1	Cloth Bag	5.62 –133.22	Sample collected at every connection
2	Cloth Bag	133.22 – 269.00	Sample collected at every connection
3	Cloth Bag	269.00 – 409.00	Sample collected at every connection
4	Cloth Bag	409.00 – 549.48	Sample collected at every connection
5	Cloth Bag	549.48 – 700.00	10m intervals (Set A)
6	Cloth Bag	700.00 – 860.00	10m intervals (Set A)
7	Cloth Bag	860.00 – 1020.00	10m intervals (Set A)
8	Cloth Bag	1020.00 – 1180.00	10m intervals (Set A)
9	Cloth Bag	549.48 – 700.00	10m intervals (Set B)
10	Cloth Bag	700.00 – 860.00	10m intervals (Set B)
11	Cloth Bag	860.00 – 1020.00	10m intervals (Set B)
12	Cloth Bag	1020.00 – 1180.00	10m intervals (Set B)

Washed and Dried Cuttings Set C (for Pangaea Records)			
Box Number	**Type**	**Depth (mRT)**	**Remarks**
1	Samplex Tray	5.62 –1180	Mixed Intervals 26 Trays (126 Samples)

ISOTUBE SAMPLE DETAILS

Tarlee-2 Isotube Samples			
Sample Number	**Depth (mMDRT)**	**Total Gas Unit**	**Date & Time**
TL-2 GS-1	558	558	09 Aug 2015 / 16:59
TL-2 GS-2	575	575	09 Aug 2015 / 18:16
TL-2 GS-3	593	593	09 Aug 2015 / 19:30
TL-2 GS-4	596	596	09 Aug 2015 / 21:05
TL-2 GS-5	623	623	09 Aug 2015 / 21:10
TL-2 GS-6	816	816	10 Aug 2015 / 17:21
TL-2 GS-7	835	835	10 Aug 2015 / 18:52
TL-2 GS-8	865	865	11 Aug 2015 / 01:00
TL-2 GS-9	895	895	11 Aug 2015 / 03:45
TL-2 GS-10	925	925	11 Aug 2015 / 06:40
TL-2 GS-11	955	955	11 Aug 2015 / 09:06
TL-2 GS-12	971	971	11 Aug 2015 / 13:03
TL-2 GS-13	1019	1019	12 Aug 2015 / 00:01
TL-2 GS-14	1035	1035	12 Aug 2015 / 01:17
TL-2 GS-15	1035	1035	12 Aug 2015 / 01:18
TL-2 GS-16	1047	1047	12 Aug 2015 / 02:00
TL-2 GS-17	1061	1061	12 Aug 2015 / 03:26
TL-2 GS-18	1061	1061	12 Aug 2015 / 03:27

APPENDIX 2. DEVIATION SURVEY

Tarlee-2 Deviation Survey Results			
Depth	**Date/Time**	**Deviation**	**Azimuth**
[mRT]		[deg]	[deg]
151.0	05-Aug-15 - 03:30	0.2	289.3
344.0	05-Aug-15 - 23:00	0.0	45.0
539.0	07-Aug-15 - 02:30	0.2	355.2
758.5	10-Aug-15 - 10:30	0.8	209.6
949.0	11-Aug-15 - 11:00	3.3	164.6
1158.4	12-Aug-15 - 13:45	5.7	168.0

A Wireline Logging Deviation Survey using the Schlumberger's General Purpose Inclinometry Tool (GPIT) was performed. Data can be found in **Enclosure 3**. From this survey at the Wireline Total Depth (TD) of 1180.74 m (MD) and 1178.64 m (TVD) the Axial Coordinates (N/-S, E/-W) are (-11.18, -29.95) from the target origin at (0, 0).

APPENDIX 3. LITHOLOGY DESCRIPTIONS

Lithology		
Interval		Description
From	To	
[mRT]	[mRT]	
5.6	18.0	Sandy Claystone- medium reddish orange to brick red, soft and rounded cuttings, earthy, non-calcareous, approximately half of returned cuttings are loose, sub-rounded to sub-angular, fine to coarse grained quartz grains, most are translucent with adhering orange-colored (Fe stained) clay. Also several percent of cuttings are medium grey, fine grained lithic fragments.
18.0	23.0	Claystone- reddish orange sandy claystone as above, new component is off-white to yellowish tan claystone with fine grained, disseminated quartz grains throughout. This claystone is firm with sub-blocky profiles. Rare calcareous grains observed.
23.0	28.0	Sandstone and claystone- claystones as above. New sandstone component is off-white to yellowish-white, very fine to fine grained, moderately well sorted, sub rounded, firm – siliceous and argillaceous cement, poor visible porosity, NSOFC. Note – no true limestone cuttings (Tindall) observed to depth.
28.0	34.0	Claystone and sandstone- reddish orange sandy claystone and off-white to yellowish tan claystone with fine grained, disseminated quartz grains throughout. This claystone is firm with sub-blocky profiles. Sandstone is off-white to yellowish-white, very fine to fine grained, moderately well sorted, sub rounded, firm – siliceous and argillaceous cement, poor visible porosity, NSOFC.
34.0	42.0	Sandstone- quartzose, clear to semi-translucent, most with very pale tints of yellow and orange, most lightly frosted, very well rounded to sub rounded – predominately all loose and disaggregated quartz grains, trace friable aggregates, most coarse to some very coarse grained, fairly poor sorting, good to excellent inferred porosity due to lack of visible cement and roundness of grains, NSOFC.
42.0	46.0	Limestone- Inferred top of Tindall Limestone, no limestone in returned cuttings, cavernous porosity encountered as bit fell through this section unimpeded. Cuttings that were coming to surface during this time were unconsolidated sandstone (above). Circulation lost at 46 metres, tight hole situation encountered at that point.
46.0	53.3	Sandstone- minimal returns over this interval, mainly as discontinuous surges. Quartzose sand that was recovered is mostly semi-translucent with less yellowish tinge than above, better sorting and less very coarse grains – mostly fine to medium grained, sub rounded to rounded with some sub angular, all grains loose and disaggregated, good inferred porosity, NSOFC.
53.3	58.5	Basalt- weathered flow top, mottled dark brownish to greyish brown, also some with mustard yellow surface coloration, also reddish-ocher colored, fine grained, with visible vesicles (scoria-like), hard, irregular to jagged-edge cuttings profiles.
58.5	61.8	Sandstone- similar to sand seen in 34.0 to 42.0 metre interval (sand

		probably running into hole from that location) quartzose, medium to very coarse grained, semi-translucent with slight tints of yellow and orange, sub rounded to rounded, good inferred porosity.
61.8	62.8	Basalt- similar to above basalt, vesicular (flow top).
62.8	70.5	Limestone- first returned limestone cuttings to depth, coloration ranges from flesh-colored to light salmon pink, amorphous and chalky at top of interval becoming microcrystalline to finely crystalline to base, hints of sucrosic texture, some pin point vugs, relatively soft at top to firm at base, poor to fair visible porosity, NSOFC.
70.5	71.5	Basalt- similar to above basalt, vesicular (flow top).
71.5	74.0	Limestone- as above.
74.0	74.9	Basalt- similar to above basalt, vesicular (flow top).
74.9	79.5	Limestone- as above.
79.5	133.22	Basalt and sandstone- distinct change in basalt appearance, dark mottled grey to olive grey with dark reddish-orange splotches, most with medium crystalline groundmass and coarse grained pyroxene phenocrysts, weathered (?) reaction rims around most phenocrysts, hard, irregular-shaped cuttings, trace amygdaloidal-related mineral occurrences. Associated sandstones are quartzose, semi-translucent and lightly frosted with some slight yellowish tints, poor to fair sorting, fine to occasionally very coarse grained, all loose and disaggregated- very little evidence of cementation, some well-rounded to sub rounded, good inferred porosity, NSOFC. These sands are interbedded with basalt and some contribution possibly from uphole sands running into hole. Much more sand returned to surface than can be accounted for in drilled material alone.
133.22	136.22	Basalt- mottled dull reddish-orange and grey, ground mass is medium grained, non-vesicular and composed of plagioclase laths, quartz and some ilmenite-magnetite, dull and opaque olive green pyroxene phenocrysts of variable size, some dull greenish-grey chlorite-altered grains loose in samples, very firm to hard coarse blocky cuttings, trace crystalline calcite fracture fill, rare amygdaloidal-related mineral occurrences. First sample also contained loose, sub rounded quartz grains similar to that observed in overlying section.
136.22	180.0	Basalt- variably-colored through this interval - mottled dull reddish-orange and grey, mottled greenish-grey and orange, dark grey, some ocher, ground mass texture ranges from fine to medium grained, matrix composed of plagioclase laths, quartz and some ilmenite-magnetite, dull and opaque olive grey to pale blue-green pyroxene phenocrysts of variable and irregular size. Some amygdales display interiors with concentrically layered mineral fill (geode-like), some dull greenish-grey chlorite-altered grains loose in samples. Basalt hardness ranges from somewhat easily crushed to very firm to hard, coarse blocky cuttings, trace crystalline calcite fracture fill. Variable ROP through interval does not appear to be due to non-basalt interbeds as sandstone aggregates constitute much less than 1% of returned cuttings. Differences in lithologic properties of individual basalt flows could be the cause.

180.0	211.0	Basalt- basalt with interbedded sandstone- less mottled grey coloration, more mottled reddish-orange to ocher coloration, ocher-colored variety (Fe-stained) becomes more weathered-looking through interval- also basalt with pin-point vesicles (un-filled) present (flow tops), mineralogy remains basically the same as above. Hardness of weathered basalt less than non-weathered basalt as cuttings size has noticeably decreased and becomes somewhat friable. Quartzose sands are clear-translucent to very lightly frosted, Large majority are as loose disaggregated quartz grains with only minor aggregated sand. Grains are sub-rounded and medium to coarse grained, no visible evidence of any cementing material adhering to grains, good inferred porosity, NSOFC.
211.0	233.0	Basalt- mottled medium orange-greenish-grey, mottled brownish grey, medium grained groundmass of plagioclase, quartz, ilmenite-magnetite, phenocrysts of medium bluish-green pyroxene appear larger than overlying basalts, amygdaloidal mineral-filled cavities also appear larger sized, crystalline calcite fracture fill, first appearance of small pyrite nodules near base of interval.
233.0	250.0	Top of McMinn Formation: Siltstone and sandstone interbedded- siltstone is dull brick red to greyish-orange to some dark salmon-colored, sub-blocky to sub-platy, very firm, non-calcareous, earthy to some sub-resinous luster- luster due to disseminated bronze micromica, very finely sandy in part. Quartzose sandstones are off white to pale orange-tinted, mostly fine grained-some medium grained, sub angular, generally poor sorting, somewhat friable to firm, cemented with silica and reddish argillaceous material, non-calcareous, bronze mica flakes in some sand aggregates, generally no loose quartz grains, pale green chloritized grains (possibly glauconite), rare small mafic grains, poor visible porosity, NSOFC.
250.0	269.0	Siltstone (predominately) and mudstone- change in coloration – greyish orange siltstone coloration above giving way to medium grey with slight bluish grey tints, also very light grey to light brownish-grey, grades to same-colored mudstone in part, very finely micromicaceous- mica appears more clear and less-bronze colored, siltstone also contains less coarse clastic material (fine grained quartz grains) than above, all non-calcareous, no carbonaceous material observed in mudstones.
269.0	280.0	Interbedded and gradational sandstone and siltstone- sandstone is very light greyish-tan, very fine grained and grades to siltstone in large part, firm, slightly calcareous, finely micromicaceous, no visible porosity, NSOFC. Siltstones are similarly-colored and also light grey, sub blocky firm, non-calcareous, micromicaceous.
280.0	306.0	Mudstone (predominately) and minor siltstone- mudstones are various shades of greenish-grey to bluish-grey, also light grey, sub-platy to sub blocky, generally firm, non-calcareous, earthy to very slight resinous luster due to finely disseminated micromica, no carbonaceous material noted, occasionally silty in part, trace loose pyritic grains, rare deep green glauconite grains, rare buff microcrystalline limestone fragments. Siltstones are as above.
306.0	328.0	Mudstone and siltstone- greyish-colored mudstones are as above. Siltstones (new component) are brick red to ocher to brownish-orange,

		sub platy to platy in part, firm, non-calcareous, very finely disseminated micromica.
328.0	368.0	Sandstone-quartzose, clear & translucent to very light off-white, coarse to very coarse grained in upper part of interval becoming medium grained with depth, sub-rounded (generally) to sub angular- some well-rounded in upper part, non-to –very slight frosting, moderately friable- Large percentage of grains are loose in sample- aggregated clusters are calcite and weakly silica cemented, some small pyrite grains noted, fair to good visible porosity, NSOFC, small background gas increases noted through sand interval.
368.0	380.0	Ongoing from 328 mRT (DGR7): Sandstone-quartzose, clear & translucent to very light off-white, coarse to very coarse grained in upper part of interval becoming medium grained with depth, sub-rounded (generally) to sub angular- some well-rounded in upper part, non-to –very slight frosting, moderately friable- Large percentage of grains are loose in sample- aggregated clusters are calcite and weakly silica cemented, some small pyrite grains noted, fair to good visible porosity, NSOFC, small background gas increases noted through sand interval.
380.0	400.5	Sandstone with some interbedded siltstone- change in sandstone character, quartzose, mostly off white with some speckled light greenish-grey. As opposed to the above very friable and loose sands, sandstones in this interval are predominately well aggregated and cemented with silica and traces of calcite- very little loose quartz grains present. Quartz grains are sub-angular to some sub-rounded, fair sorting, fine to medium grained, firm, lightly peppered with light greenish chloritic micas, rare to trace pyritic grains but become more common to base of interval. Visible porosity is poor, NSOFC. Minor amounts of speckled light greenish-grey sandstone, this sand is heavily micaceous with chloritic mica and unaltered dark bronze micas, medium grained quartz, friable, weakly silica cemented, no visible porosity, NSOFC. Interbedded siltstones are medium greenish-grey and very chloritic, sub blocky profiles, firm, non-calcareous, very micaceous with all mica displaying chlorite alteration. Rare sulphide mineralization on 0.5 mm wide fractures.
400.5	429.5	Sandstone and minor interbedded siltstone- off-white quartzose, similar to above but less large aggregated sandstone cuttings- most cuttings are 5 to 10 grain aggregates, more friable with less silica cement and more calcite cement than overlying sand. Mostly medium grained, sub angular, fairly well sorted, less chloritic mica grains, increase in small pyritic grains- some larger clusters, poor visible porosity, NSOFC. Siltstones ate light greenish-grey, sub blocky to sub platy, firm, non-calcareous, much less micaceous than above.
429.5	433.3	Sandstone and shale- interbedded sequence, off white quartzose sandstones as above, fine to medium grained, sub-angular, sand is mostly aggregated and fairly cemented with silica. Pyritic grains and larger loose pyrite nodules noted. Very rare traces of dark brown oil residue (dead), most occurrences found when sand/carb shale observed in contact, traces of dull yellowish spotty

		fluorescence but no solvent cuts could be obtained. First visible indication of liquid hydrocarbon to depth. Dead residue found only on small number of grains in sample. Shale- ranges from medium grey to light brownish-grey to medium brown, brown part (5% of cuttings) is slightly carbonaceous (first carbonaceous material to depth in well). Carbonaceous material occurs as small dark brown flakes/ patches and short discontinuous streaks. This shale has poorly developed fissility, firm, silty in part. Associated greyish shales are lightly flecked with similar carbonaceous material as in brown part, sub platy, non-calcareous, silty and micromicaceous in part.
433.3	449.0	Interbedded mudstone and siltstone- mudstones are various shades of grey and very light brownish grey, sub blocky to sub platy, trace brownish carbonaceous flecks noted, very little micromica observed, non-calcareous, slightly silty in part. Interbedded siltstones are also grey, slightly micaceous, trace carbonaceous flecks noted.
449.0	482.4	Interbedded sandstone, siltstone, minor mudstone- sandstones are quartzose, off-white to very light greyish –white, very fine grained, sub-angular, fair sorting, fairly well cemented with silica-some calcite cement noted, some small brownish carbonaceous streaks and discontinuous laminae, very poor to nil visible porosity, NSOFC. Siltstones and mudstones display various greyish to olive grey to light brownish grey hues, sub blocky, generally firm, non-calcareous, small to fair percentage flecked with carbonaceous material, also small discontinuous laminae, amount of carbonaceous material increases to base of interval, silts are micromicaceous, siltstones and mudstones gradationally related, several large loose pyritic nodules in samples.
482.4	514.0	Top of Kyalla Sandstone: Sandstone- quartzose sandstone, off-white, fine to very fine grained, fair to poor sorting, sub-angular, fairly firm, cemented with silica and some calcite cement, medium to very deep blue-green glauconite grains common- some chlorite altered, some bronze micromica flakes, poor visible porosity, see show description. Interbeds of siltstones and mudstones as above, mostly light brownish grey to medium grey, light to medium brown small carbonaceous patches and discontinuous laminae are fairly common in both lithologies. Traces of pale olive greenish-grey siltstone, splintery profiles.
514.0	523.0	Sandstone- predominately as above, quartzose, off white, very fine to some fine grained, fairly well sorted, sub angular, moderately firm, silica cement with matrix plugging white argillaceous material, medium green glauconite grains common, some black unidentified grains- possibly very heavily altered glauconite, poor visible porosity, see show description.
523.0	536.0	Interbedded shale, siltstone and only trace sandstone. Shales are very light to medium brownish grey, only rarely flecked with medium brown carbonaceous material, sub platy, silty in part and grading to siltstone, micromicaceous in part, rare glauconite grains. New component is distinctive light greenish-grey to light bluish grey to pale lime green argillaceous siltstone, splintery to rough tabular cuttings-some sharp edged, sub-resinous luster, finely micromicaceous, some micropyrite.

536.0	549.48	Top of Kyalla Shale- Carbonaceous shale- medium greyish brown to dark olive brown, sub blocky to sub platy, non-fissile, non-calcareous, non to slightly micaceous, slightly to fairly carbonaceous (a range of brownish hued shale in sample), traces of disseminated micropyrite. Some light greenish-grey to light bluish grey to pale lime green argillaceous siltstone as above, some brownish grey argillaceous siltstone, trace glauconite. Faint but noticeable light petroliferous odor coming from blooie line sample tap area and also while processing cuttings. Steady production of small gas bubbles breaking out of cuttings chips when immersed in water. Effect noted for several hours after first immersion. Small Total Gas show through top of Kyalla Shale interval (5 units maximum) due to dilution of liberated gas stream by compressed drilling air. However gas signature is heavy ended (presence of pentanes detected).
549.48	579.0	Carbonaceous shale, sandstone and some mudstone- First 3 metres drilled before LOT test consisted of medium brownish grey and lighter hued and less carbonaceous shale than the carbonaceous shale directly overlying (before setting 7" casing). Deeper in the interval the shale became progressively darker hued (medium greyish brown) and slightly more carbonaceous, sub blocky, moderately firm, non-calcareous, non-to-slightly micaceous. Small gas bubbles breaking out of immersed chips common (similar to activity noticed in overlying air-drilled portion before setting casing). Mudstones are light to medium grey, sub platy, non-calcareous, flecked with small carbonaceous grains / laminae. Sandstones are off white, mostly fine, but ranging from very fine to medium grained, sub angular, fair to poor sorting, weakly silica cemented with traces of calcite, poor visible porosity, see show description above. Overall sample quality through this interval was poor- cement cavings contaminated the upper portion and shaker screens had to eventually be changed out to a larger size due to plugging. This resulted in mud streaming over shakers and samples not falling into catchment trays. Poor sample quality eventually resolved.
579.0	587.0	Sandstone- quartzose, off-white, fine to medium grained, sub angular, moderate to poor sorting, aggregates are fairly well silica cemented, micaceous, some chloritic grains, traces of pyrite, poor visible porosity, see show description. Interbedded with medium brownish grey shale and some grey-brown slightly carbonaceous shale. Shales are silty and micaceous.
587.0	645.0	Top of Kyalla Shale – 587.0 mRT Note: This top revised downward from previous report- sandstones encountered after drilling out from under 7" casing belong to the Kyalla Sandstone Formation. Gas curve from air drilled portion of well not definitive enough to assist with lithologic pick. Carbonaceous shale – medium to dark greyish brown to deep chocolate brown to some olive black, fairly to very carbonaceous, sub platy to some sub blocky- darkest hued parts with poorly developed sub-fissile texture, non-calcareous, finely disseminated micropyrite common and becomes

		more prominent to base, steady production of small gas bubbles breaking out from immersed chips. Possible very thin sandy-silty interbeds due to small background amounts (1% to 2%) of very fine grained sand displaying very light brownish oil stain occurring in samples through this interval.
645.0	663.0	Top of Moroak Sandstone- 645.0 mRT Sandstone- quartzose, light greyish-white to some off-white, generally fine grained, sub-angular to sub-rounded, poor to fair sorting, slightly frosted, firm, silica cemented with some argillaceous material in matrix, trace mica, traces of chloritic glauconite, silty in part, poor visible porosity, see show description. Interbedded with light brownish grey shale and argillaceous siltstone, sub blocky to sub platy, firm, non-calcareous, upper part flecked with minor carbonaceous material, finely micaceous in part.
663.0	713.3	Moroak Sandstone (cont. from DGR #11) Sandstone- quartzose, light greyish-white to some off-white, generally fine grained- becomes more varied grain size through interval, sub-angular to sub-rounded, poor to fair sorting, slightly frosted, firm, silica cemented with some argillaceous material in matrix, some iridescent quartz overgrowths on some cuttings scattered through interval – not consistent, trace to moderately micaceous, traces of medium green glauconite, silty in part and grades to very finely sandstone, poor visible porosity, see show description. Interbedded with light brownish grey shale and argillaceous siltstone, sub blocky to sub platy, firm, non-calcareous, upper part flecked with minor carbonaceous material, traces of glauconite, traces of pyrite, finely micaceous in part. Traces of brownish black carbonaceous shale near base of interval.
713.3	749.0	Top of Upper Velkerri – 713.3 mRT Shale- new shale component- very light grey to light greenish grey and some very light grey with slight bluish tinge, platy to flaky profiles, moderately soft, non-calcareous, smooth texture and very slightly sub-resinous, with extremely fine bronze mica flakes, occasionally silty in part, rare medium green glauconite grains. Interbedded with light to medium brownish grey shale, sub platy to sub blocky, firm, non-calcareous, lightly flecked with carbonaceous grains- however overall a non-carbonaceous shale, variably micaceous and silty, rare traces glauconite. Rare grey-black carbonaceous cuttings. Some thin interbedded sandstones from 724 to 745 mRT, quartzose, off white with some brownish-grey tinge, predominately fine to very fine grained- grades to fine sandy and micaceous siltstone in part, sub angular, firm, moderately-well silica cemented- some argillaceous material in matrix, light greenish glauconite grains common, very poor visible porosity, see show description.
749.0	785.0	Interbedded shale, siltstone, minor sandstone- shales are similarly colored as above, very light grey with occasional slight greenish hues, however cuttings size is much reduced from above- cuttings are very flaky, soft, becoming more silty to very finely sandy in part. Some medium greyish brown slightly carbonaceous shale, platy with poorly developed sub-fissile texture, soft, disseminated micropyrite

		common. Some thinly interbedded off-white, very fine grained quartzose sands, similar to above, very poor visible porosity, see show description.
785.0	804.0	Shale- light grey component has dropped out and shale is mostly medium brownish grey, sub blocky to sub platy, firm, non-calcareous, lightly flecked with brownish carbonaceous material, interbedded and grades to argillaceous siltstone, micaceous. Interbedded with thin off-greyish white, fine grained micaceous sandstones.
804.0	825.0	Shale- generally as above but taking on slightly darker brownish grey hues, sub platy to platy, silty and finely micaceous in part, traces of light greyish black carbonaceous shale,- micropyritic, poor sub fissile texture. Traces of very light grey shale, traces of off-white, very fine to fine grained sandstones.
825.0	855.0	Top of Middle Velkerri – 825.0 mRT Carbonaceous shale- distinct change in shale lithology, mostly light to medium greyish black, mostly platy cuttings – some with poorly developed sub-fissile texture, earthy luster, moderately soft to approaching firm, non-calcareous, disseminated micropyrite common, no gas observed to be breaking out when cuttings submerged, some thin interbeds of light brownish grey non-carbonaceous shale grading to siltstone in part.
855.0	863.7	Shale- interbedded shale with minor carbonaceous shale and sandstone-shale is medium to dark grey with some brownish hues, sub platy, generally firm, non-calcareous, flecked with some carbonaceous material but classified as a non-carbonaceous shale. Some thin interbeds of carbonaceous shale as above. Some off-white fine grained sandy lenses, silica cemented, poor visible porosity, NSOFC.
863.7	871.5	Continued from DGR #12: Shale- interbedded shale with minor carbonaceous shale and sandstone-shale is medium to dark grey with some brownish hues, sub platy, generally firm, non-calcareous, flecked with some carbonaceous material but classified as a non-carbonaceous shale. Some thin interbeds of carbonaceous shale as above. Some off-white fine grained sandy lenses, silica cemented, poor visible porosity, medium brown dead oil stain noted on some grains, NOFC. Some medium grey siltstone interbeds.
871.5	892.0	Interbedded sandstone, siltstone and shale- quartzose sands are off-white to medium brownish- white, mostly fine grained, sub angular, fair to poorly sorted, weakly silica cemented, also some with calcite cement, medium to dark brown intergranular stain common and imparts the brownish coloration to these sands. Siltstones are very light grey to tan, sub blocky to sub platy, firm, slightly calcareous in part, micaceous. Grades to similar colored shales, shales are non-carbonaceous and micaceous.
892.0	922.5	Sandstone with interbedded siltstone, minor shale- predominately brownish-grey, fine grained, moderately well sorted, sub angular, fairly friable, calcite and silica cement, poor visible porosity, majority of cuttings with rather uniform medium brown dead oil stain, NOFC. Interbedded with siltstones as above.
922.5	948.0	Shale and sandstone- shales are light to medium grey and some brownish-grey, sub platy, soft, non-calcareous, some lightly flecked with carbonaceous grains, grades to micaceous and argillaceous siltstone.

		Interbedded sandstones as above, most with dead intergranular oil residue, poor to some visible porosity, NOFC.
948.0	978.0	Shale with interbedded sandstone- shales are very dark grey to medium brownish grey, minor amounts of light greyish-black, sub platy, firm to soft, non-calcareous, silty in part, occasionally micromicaceous, black part is moderately carbonaceous with disseminated micropyrite, sandstones are as above, with dead oil residue, NOFC, sand percentage decreasing to base.
978.0	984.0	Dolerite Sill: Dolerite appears as dark charcoal grey cuttings, extremely fine grained-aphanitic- no identifiable minerals in groundmass, structureless, firm. Dolerite is very poorly represented in samples-cuttings are all extremely fine and easily washed through the sample processing 100 mesh sieve. Drilling characteristics of this interval: ROP dropped to <2.0 m/hr, down from 15 to 18 m/hr in the overlying 5 metre interval (973 to 978 m). Fluid hammer not engaged. Background gas dropped from 600 to 650 units in overlying 5 metre interval to about 250 units. At 984.0 mRT, rig down for 3 hours to repair wash pipe.
984.0	997.0	Shale with minor interbedded sandstone and siltstone, shales are very dark grey to brownish grey to some very light greyish-black, sub platy, non-calcareous, sands are off-white, very fine grained, poor visible porosity, much less dead oil residue in matrix noted, siltstones are thin and grade to silty shale. No dolerite cuttings observed. Note: Pump number 1 fixed (changed out liner) during down time to repair wash pipe. This pump now able to pump sufficient volume to engage fluid hammer full time, as opposed to only sporadic firing before. Drilling characteristics of this interval (hammer engaged): ROP averaged 18 to 19 m/hr, background gas averaged 190 to 210 units. Due to introduction of the hammer action at 984 metres, vertical extent of dolerite sill is somewhat uncertain).
997.0	1018.0	Shale and minor carbonaceous shale- shales taking on progressively darker hues, some micaceous content, coarse clastics not in evidence, some medium greyish-black carbonaceous shale, micropyritic. No dolerite cuttings observed. Drilling characteristics of this interval (hammer engaged): ROP averaged 29 to 33 m/hr, background gas averaged 390 to 580 units.
1018.0	1026.0	Top of Middle Velkerri "B" Shale – 1018 mRT Carbonaceous shale- shale lithology change- medium greyish-black, earthy luster, sub platy to sub blocky, firm, shale is non-calcareous but associated with clear crystalline to opaque calcite fracture fill grains scattered throughout, moderately to fairly carbonaceous, micropyrite widely scattered through shale matrix, some tiny gas bubbles breaking out from shale cuttings when immersed in water, but not abundant or vigorous. Background gas almost tripled in this interval compared to overlying interval.
1026.0	1066.0	Top of Middle Velkerri "B" Shale – 1018 mRT (cont from DGR #13) Carbonaceous shale- medium to dark greyish-black- this coloration very consistent through the interval, earthy luster, sub platy to sub blocky, firm, shale is predominately non-calcareous but a small percentage of cuttings

		display extremely small and widely dispersed pin points where effervescence in HCl occurs from the shale matrix, fairly to very carbonaceous, micropyrite is ubiquitous throughout the interval with some uptick in concentration near the middle of the unit, some tiny gas bubbles breaking out from shale cuttings when immersed in water, but not abundant or vigorous. Semi-crystalline clear to white amorphous calcite fracture fill occurs through the interval. Near the base, some off-white limy cuttings occur that do not look like typical fracture fill, microcrystalline. Not clear if this represents some type of carbonate deposition. There was a more or less steady drop off of liberated gas from the "B" Shale to "A" Shale transition, so the gas curve alone is not definitive enough to pick the "B" Shale base. However, the ROP curve is more-or-less uniform through the lower "B" Shale until a reverse break was encountered at 1066 mRT. Base of the "B" Shale was picked at this point. It is also marked by the appearance of dark brownish grey shales in the returned cuttings. Total thickness of Middle Velkerri "B" shale – 1018 m to 1066 m = 48 metres.
1066.0	1089.0	Carbonaceous shale and shale- progressive lightening in the carbonaceous shale hues (i.e., becoming less carbonaceous) – light greyish black predominates, disseminated micropyrite in matrix still noted. Interbedded with shales that range in color from dark brownish grey to tan-grey, mostly platy, somewhat soft, most are generally non-carbonaceous but darker hued varieties with some carbonaceous content. Shales beginning to display some very fine clastic content. Rare off-white very fine grained sandy stringers. Calcite fracture fill still observed through interval.
1089.0	1180.0 Well TD	Top of Lower Velkerri – 1,089.0 mRT Shale-predominately a uniform-looking shale lithology through interval, coloration is mostly light grey with some whitish-grey to minor medium grey to traces of light bluish-grey tints near base, platy to flaky grain profiles- smooth textured, non-calcareous, rare medium green glauconite near top of interval, very rare carbonaceous grains noted scattered throughout interval. Traces of very fine grained calcareous sandy lenses near top of interval.

APPENDIX 4. BIT RECORD

Bit Information																	
Bit Number:		1			2			3			4		
Size:	[in]	17.500			12.250			8.720			6.125		
Make:		Carbide			Halco			Halco			Tercel		
Type:		Mill Tooth			Mach 132			Mach 132			PDC		
IADC Code:		117			N/A			N/A			M432		
Serial Number:		H24459			64193 X44						S5D3673		
Nozzles:	No. x 1/32 [in]	3	x	20/32	3	x	32/32	3	x	30/32	6	x	14/32
		1	x	32/32									
TFA:	[in^2]	1.706			2.356			2.071			0.902		
Depth In:	[m] MD	0.0			28.0			133.2			549.5		
Depth Out:	[m] MD	28.0			133.2			549.5			1180.0		
Total Drilled:	[m]	28.0			105.2			416.3			630.5		
Total Time:	[hrs]	4.25			9.70			21.58			44.38		
Condition Out:		Good			Good			Good - 1 x chip button.			2-1-WT-C-X-I-NO-TD		

APPENDIX 5. FLUID RECORD

TARLEE-2 FLUID PROPERTIES SUMMARY							
DATE	DEPTH (M)	WEIGHT (PPG)	Vis (sec/qt)	pH	Fluid Loss (mls)	OPERATION	MUD USED
30/07/15	28.0	8.33	28	n/a	n/a	WBM Drilling	Water
31/07/15	28.0	8.33	n/a	n/a	n/a	Cementing	Water
01/08/15	28.0	n/a	n/a	n/a	n/a	WOP*	Water
02/08/15	133.2	n/a	n/a	n/a	n/a	Air Drilling	Air and Foam
03/08/15	133.2	n/a	n/a	n/a	n/a	Cementing	Water
04/08/15	136.2	8.40	28	n/a	n/a	WBM Drilling	Water
05/08/15	260.0	8.55	43	10	9.4	Drilling	Air and Foam KCl / Polymer WBM
06/08/15	482.0	8.65	42	10	9.2	WBM Drilling	KCl / Polymer WBM
07/08/15	549.8	8.55	40	9.5	10.0	WBM Drilling	KCl / Polymer WBM
08/08/15	549.8	8.50	37	10	11.4	Cementing	KCl / Polymer WBM
09/08/15	569.0	8.55	36	9.5	8.0	WBM Drilling	KCl / Polymer WBM
10/08/15	818.0	8.90	36	9.2	7.0	WBM Drilling	KCl / Polymer WBM
11/08/15	984.0	8.90	37	9.0	6.2	WBM Drilling	KCl / Polymer WBM
12/08/15	1180.0	9.30	37	8.5	7.8	WBM Drilling	KCl / Polymer WBM

*WOP: Waiting on Part