

2. GEOLOGICAL SUMMARY

2.1 Geological Summary

Shea 1 was designed to access the "middle" Velkerri Formation to enable a team from the CSIRO, as part of a joint research project between Pacific Oil and Gas, Resource and Processing Developments and the CSIRO, to conduct a series of tests to determine the insitu rock properties.

The well was spudded in interbedded sandstones and mudstones at the base of the Bukalorkmi Sandstone Member of the McMinn Formation. The formation was moderately weathered to a depth of approximately 10m. The top of the Kyalla Member of the McMinn Formation was intersected at a depth of 20m, 30m higher than expected. The interbedded mudstones and siltstones of the Kyalla Member continued to a depth of 245.42m. The Kyalla Member proved to be significantly thicker than prognosed. The top of the underlying Moroak Sandstone Member of the McMinn Formation, 85.4m deeper than prognosed, is defined by the presence of fine to coarse sandstone interbeds up to several meters thick. The Moroak Sandstone Member here shows an upwards fining cycle. The top of the "upper" Velkerri Formation was intersected 120.9m below the prognosed depth at 284.89m. The "upper" Velkerri Formation is comprised of interbedded mudstones and siltstones. The black, carbonaceous mudstones of the "middle" Velkerri Formation were intersected at a depth of 468.9m. The "lower" Velkerri Formation was intersected at 609m and the hole was terminated in the light bluish gray claystones of the "lower" Velkerri Formation at 616m.

TABLE 3
ACTUAL vs. PROGNOSED FORMATION TOPS

Age	Formation	Actual	Prognosed	Difference
Proterozoic	McMinn Formation			
	-Bukalorkmi Mbr.	Surface	Surface	-
	-Kyalla Mbr.	20.0m	50.0m	+30.0m
	-Moroak Mbr.	245.4m	160.0m	-85.4m
	Upper Velkerri Formation	284.9m	190.0m	-94.9m
	Middle Velkerri Formation	468.9m	345.0m	-120.9m
	Lower Velkerri Formation	609.0m	480.0m	-129.0m
TOTAL DEPTH		616.0m	500.0m	-116.0m

2.2 Well Objectives and Performance

Shea 1 was designed to intersect the "middle" Velkerri Formation between a depth of 345m and 480m to enable the CSIRO team to conduct a testing programme to determine the insitu properties of the "middle" Velkerri Formation. The well was planned to T.D. at 500m. The stratigraphy encountered in Shea 1 was as expected but in general, the sequence had thickened requiring the well to continue past the prognosed T.D. to a depth of 616m. The majority of the thickening of the sequence was within the Kyalla Member. The prognosed thickness of the Kyalla Member was 110m, its actual thickness proved to be 215m. A satisfactory intersection of the "middle" Velkerri Formation was obtained. No evidence of deteriorating well conditions was observed during wireline logging. The well was suspended for several days prior to the commencement of testing by the CSIRO team, who found the well to be in a good condition.

2.3 Stratigraphy

(See Appendix 6 for detailed descriptions)

McMinn Formation - Bukalorkni Sandstone Member.

Surface to 20.0 meters. (20 meters thick)

Medium to thinly interbedded light gray fine to medium sandstone, siltstone and dark purple brown to medium dark gray mudstone. Upwards fining cycles from scour based sandstones at bottom to mudstone. Stratification is broadly planar to wavy planar.

McMinn Formation - Kyalla Member.

20.0 - 245.42 meters. (225 meters thick)

Medium bedded to thinly laminated medium gray carbonaceous, micaceous mudstone and light gray siltstone. Rare silty very fine sandstone. Upwards fining cycles from scour based siltstones to mudstone. Stratification is broadly planar to wavy planar. Synaeresis cracks and load casts common to very abundant.

McMinn Formation - Moroak Sandstone Member.

245.42 - 284.89 meters. (39.47 meters thick)

Generally an upwards fining cycle of interbedded siltstones to coarse sandstone. Mudstone interbeds are common at the top of the cycle but they give way to a dominantly sandstone lithology at the base of the Moroak Member. Cross bedding and oolites beds occur throughout the unit. Styolites are common.

Velkerri Formation.

Note: Pacific informally divides the Velkerri Formation into three intervals largely based on a thick, organic rich section in the middle which has a gradational top and a sharp base.

"Upper" Velkerri Formation.

284.89 - 468.9 meters. (184.01 meters thick)

Medium bedded to thinly laminated carbonaceous, micaceous medium gray mudstone and light gray siltstone. Upwards fining cycles from scour based siltstones to mudstone. Stratification is broadly planar to wavy planar. Synaeresis cracks and load casts common to very abundant.

"Middle" Velkerri Formation.

468.9 - 609.0 meters. (140.1 meters thick)

Dominantly grayish black carbonaceous, micaceous, very finely laminated mudstone. Some light gray fine interbeds. Minor pyrite.

"Lower" Velkerri Formation.

609.0 - 616.0 meters. (7 meters thick)

Light bluish gray massive to very finely laminated claystone.

2.4 Geophysical Logging

2.4.1 Wireline Logging

A full suite of wireline logs, comprising Spontaneous Potential, Dual Resistivity, Gamma Ray, Neutron Porosity, and Sonic were run at total depth. Copies of the logs are provided in Plan PetNTcw4417, 4418, 4419, 4420, 4421, 4422 and 4423.

2.4.2 Spectral Gamma Ray

Spectral Gamma Ray readings were taken (using a hand-held spectrometer) over 5m intervals for the first 72m; ie that part of the hole that was rotary drilled. Measurements were taken every meter over the entire length of the core. Total Count, Uranium, Potassium and Thorium counts were all sampled four times over a ten second sample window. An average of the four readings was then calculated. These results are included in PetNTcw4424.

2.5 Formation Sampling

2.5.1 Rotary Cuttings

Rotary cuttings were sampled at 5 metre intervals from the ditch. Three samples from each interval were obtained and described. The first sample was submitted for TOC analysis, the second was despatched to the MIDME and the third was retained by Pacific.

2.5.2 Continuous Core

Upon recovery the core was pieced together and cleaned with a damp rag. The core was then indelibly marked with a blue line and a red line (red to the right when looking up the core) and the depth marked on the core every twenty centimetres (annotated every metre). A core block with the drillers depth was placed at the end of every run, and the core was placed in a Samplex tray. The core was then photographed, both wet and dry, under white light. The core was also examined under ultraviolet light for fluorescence, and if present, the core was photographed under ultraviolet light. After logging, core chip samples were taken at approximately five metre intervals.

The entire Middle Velkerri Formation was sealed using aluminium foil, plastic cling wrap and shrink wrap before being despatched to the CRA core storage facility in Melbourne. A core tally summarising amounts of core cut and recovered is provided in Appendix 7.

Note : Except for intervals where the core was obviously lost from one run and recovered subsequently, each core interval is marked using the driller's depth (marked on the previous block) as the next datum to avoid compounding minor discrepancies from each core run.

2.6 Hydrocarbon Shows

Weak to moderate petroliferous odour was apparent of most of the Kyalla and Moroak Members of the McMinn Formation. Weak to moderate odour was apparent over the entire "upper" and "middle" Velkerri Formation. Occasional pin point oil bleeds and dull to bright yellow fluorescence in occasional siltstone interbeds occur throughout the Kyalla Member. Trace to abundant pin point oil bleeds, abundant dull yellow fluorescence and minor bright yellow fluorescence throughout the sandstones and siltstones of the Moroak Member. Occasional pin point oil bleeds and dull to bright yellow fluorescence within siltstones and on rare joint/fault surfaces throughout the "upper" Velkerri Formation. Occasional pin point oil bleeds throughout the "middle" Velkerri Formation. Interval 578.33 to 582.15m abundant live oil bleeds, minor oil and gas exsolving from several bedding plane partings. Dull white to bright white fluorescence occurred over interval.

2.7 Analyses

2.7.1 Source Rock Geochemistry

One hundred and nineteen small (30-50 grams) samples were taken at frequent intervals throughout the core (with emphasis on the darkest and finest-grained units) to assess the source rock and maturity levels. All samples were submitted to Geotech (Perth) and following determinations of Total organic Carbon (TOC) content, those reporting greater than 0.5% TOC were subjected to Rock-Eval Pyrolysis. Results of these analysis are given in Appendix 4. A geochemical log is provided in PetNICw4425.

2.7.2 Reservoir Analysis

Eleven core samples from Shea 1 were submitted to Geotech (Perth) for reservoir analysis. All samples are from the Moroak Sandstone Member. Samples were taken to test what appeared to be the most promising reservoir potential. A one inch plug was cut for each and ambient analysis was conducted for horizontal permeability, helium-injection porosity and grain density. A thin section of each was cut and a brief description was provided. Results of these analyses are given in Appendix 5.

2.8 Contributions to Geological Knowledge

Shea 1 confirmed surface geological mapping and revealed the thickening of the Kyalla Member towards the west of the permit area. The well has further added data on the maturation history of the upper Roper Group and reservoir characteristics of the Moroak Sandstone Member. It has provided further evidence of live oil within the Roper Group. The test programme conducted by the CSIRO under guidance from Resource and Processing Developments will further expand our knowledge gained from Shea 1.

KEYWORDS

Petroleum, Proterozoic, Hydrocarbons, Source Rock.

LOCATION

Shea 1, MIAS 5667 1:100,000, Hodgson Downs SD53-14, 1:250,00.
EP5, McArthur Basin, Northern Territory.

LIST OF DPO'S

68153 and 77701