2.0 GEOLOGICAL INFORMATION

2.1 Drilling Rationale:

Shenandoah-1A is the deepened section of the Shenandoah-1 well located in the Beetaloo Basin, Northern Territory, Australia, approximately 500km southeast of Darwin and 45km SE of Daly Waters (figure 1, Location Map). Shenandoah-1 was drilled by Sweetpea Petroleum in September 2007 as a twin of the nearby Balmain-1 well located 200m to the north-east. Balmain-1 was drilled to a depth of 1050m and terminated in the Kyalla Formation.

Shenandoah-1 was to test a structure that was previously thought to have been drilled by the 1992 Pacific Oil and Gas Balmain-1 well but, following evaluation of reprocessed seismic data acquired over the Jamison-1 and Balmain-1 wells, Balmain-1 was subsequently found to have been drilled off-structure. Shenandoah-1 was programmed to reach a total depth of 2900m in the Bessie Creek Sandstone but was suspended with a view to later deepening after drilling to 1555m. The well was cased with 9.625" (9 5/8") casing to 1553m.

Shenandoah-1 recorded oil fluorescence shows in the Hayfield Sandstone and upper Kyalla Formation and may have intersected unconventional Basin Centered Gas at 1500m. Gas shows were recorded in the Kyalla Formation and middle Kyalla Sandstone unit.

Shenandoah-1A commenced drilling from 1555m in late August 2009 and reached a total depth of 2714m in early October 2009. The main objectives were to evaluate the gas bearing and production potential of the Proterozoic Kyalla Formation, Moroak Sandstone, Velkerri Formation and Bessie Creek Sandstone of the Maiwok Subgroup lying within a potential basin-centered gas accumulation (BCGA).

The Kyalla and Velkerri formations (comprising claystones, siltstones and shales) have sections of high total organic content (TOC) derived from ancient (1400Ma) oil prone (Type I and II) algae, cyanobacteria and bacterial sources. These were particularly noticeable in the Velkerri Formation in the Altree-2 well and were associated with elevated resistivity values and gas readings.

High TOC values within the Kyalla Formation of 2%-3% (with a peak of 9%) had been recorded in Jamison-1. In Mcmanus-1, 4%-7% TOC (with a peak of 12%) was measured in the middle Velkerri Formation.

The Kyalla and Velkerri targets were potential fracture-stimulation objectives to enhance gas production. These zones were to be cored to provide gas-desorption data and essential rock-property characteristics for gas recovery programs. Upper Kyalla Formation gas shows were recorded in the Shenandoah-1 well section below 1500m.

Three thick sandstone formations were present in adjacent wells. These sandstones are interbedded with the rich source rocks and produced good shows in several of wells. The Bessie Creek Sandstone underlies the Velkerri Formation and was only penetrated in one well on the margin of the basin on the Walton High. Wells north of the basin and on the Walton High have encountered shows in this sandstone.

The Moroak Sandstone (figure 5) is regionally up to 100m thick and contained oil shows in Elliott-1 (Beetaloo Basin) and Alexander-1 (McArthur Basin). The Moroak Sandstone lies between the Velkerri and Kyalla formations. Core porosities within the Moroak Sandstone range from about 6% to 15% and up to 19% from depths near 700m in McManus-1 (drilled in the northern McArthur Basin 80kms north

north-east from Shenandoah-1A). In Elliott-1, located 88kms to the south south-east, core porosity measurements from 1340m to 1400m ranged from almost 0% to 10% porosity.

Drill-stem tests had produced water in the Moroak, confirming productivity potential. In Elliott-1, DST-5 at 1330m recovered 5200 litres of water, but no hydrocarbons. Porosity seems to decrease significantly with increasing burial depth and the sandstone targets were expected to comprise relatively low deliverability grade sandstones.

2.2 Stratigraphic and Structural Summary (partly from Well Proposal)

The Beetaloo Basin has an areal extent of 28,000km^2 and is defined is a broad intracratonic feature that contains Late to possibly Middle Proterozoic (Pre-Cambrian) sediments. The older rocks date from approximately 1400Ma. The Proterozoic section is overlain by Cambrian volcanics and sedimentary rocks and in turn by Cretaceous sediments. These basal rocks and overlying younger sediments have only undergone subtle structural modification. Refer to figures 2 and 3 below.

FIGURE 2. SCHEMATIC STRUCTURAL CROSS SECTION – WEST TO EAST

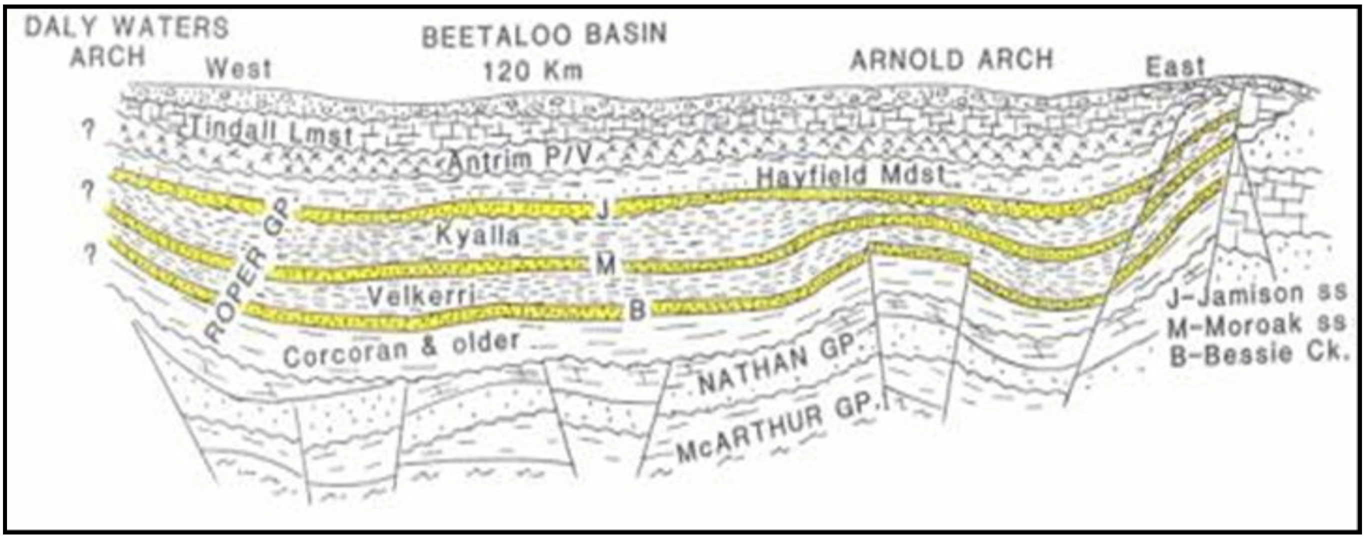
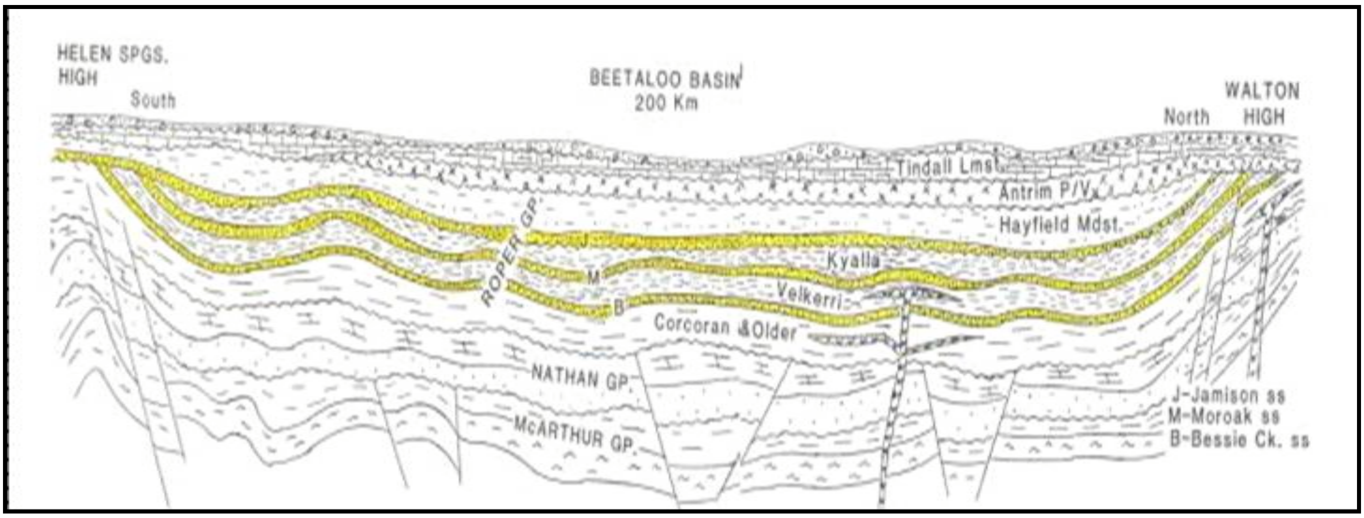


FIGURE 3. SCHEMATIC STRUCTURAL CROSS SECTION – SOUTH TO NORTH



The Beetaloo Basin is in part superimposed upon to the east and north by an older sediment-filled rift basin, the McArthur Basin. Early compression and strike-slip movements have created a large axial arch with basin-margin highs. Figure 4 presents a Bouguer Gravity map showing the structural features adjacent to the Beetaloo Basin as well as regional hydrocarbon show information.

FIGURE 4. GRAVITY MAP OF BEETALLO BASIN

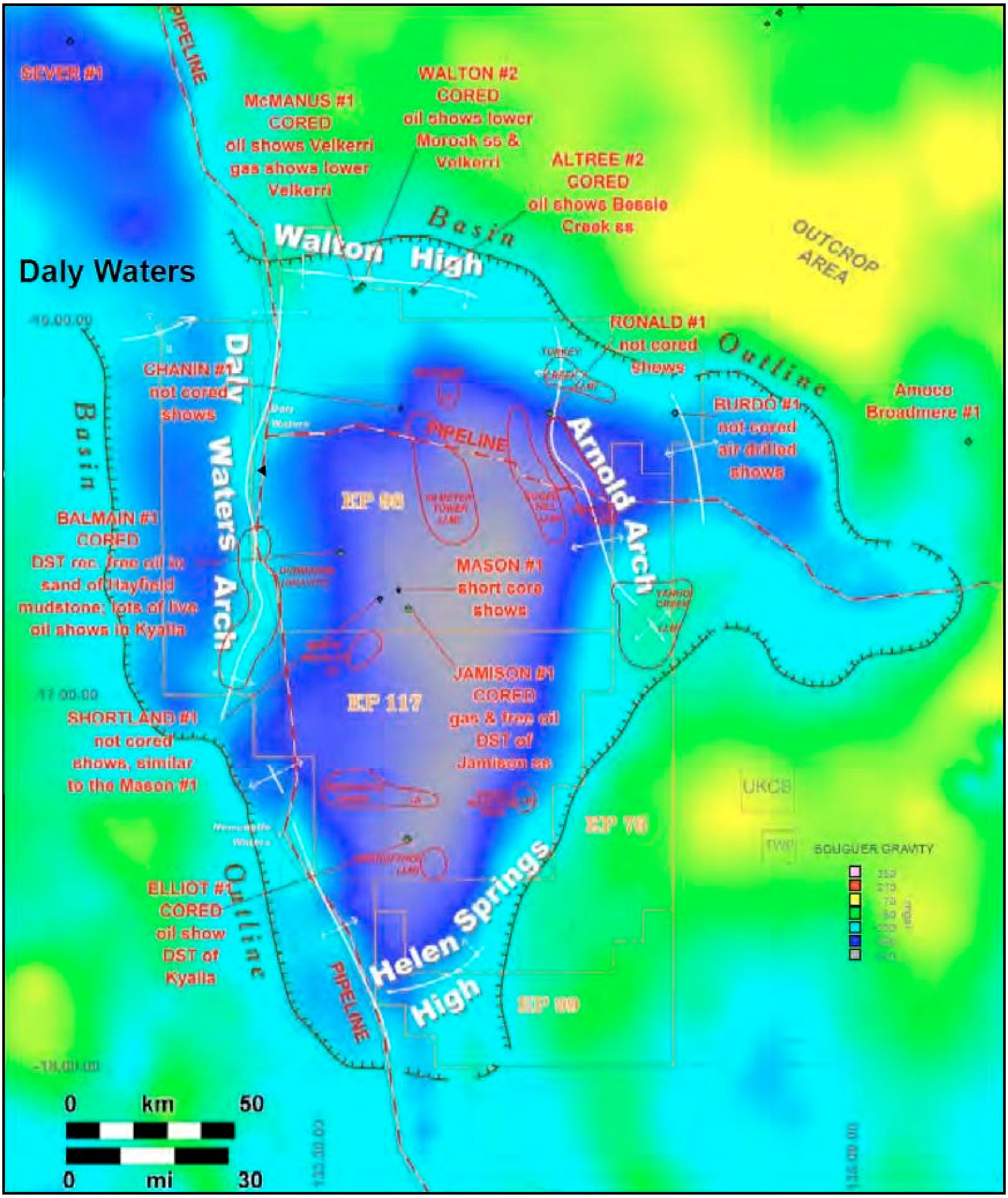


FIGURE 5. MOROAK SANDSTONE STRUCTURE MAP (pre-drilling).

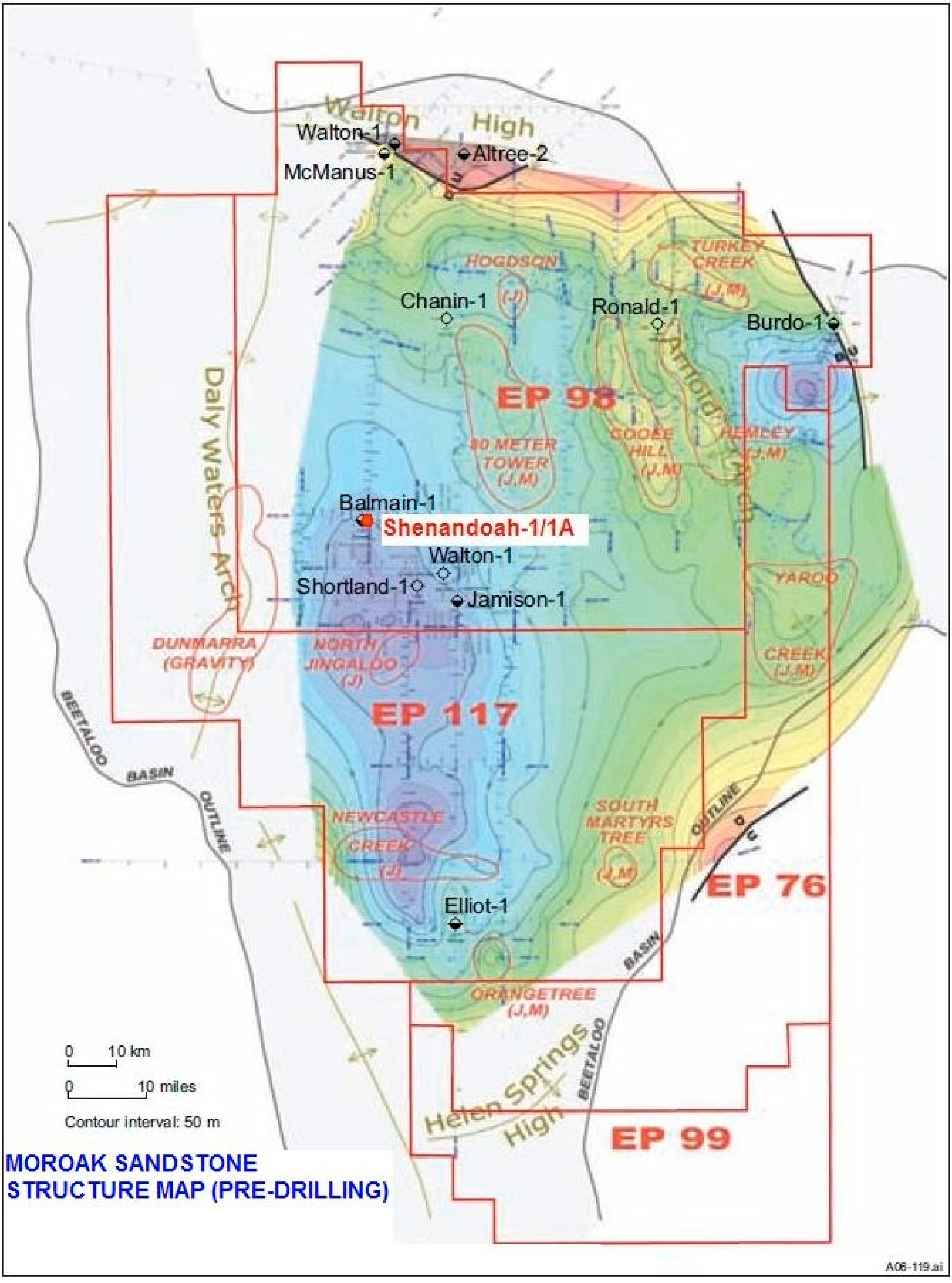
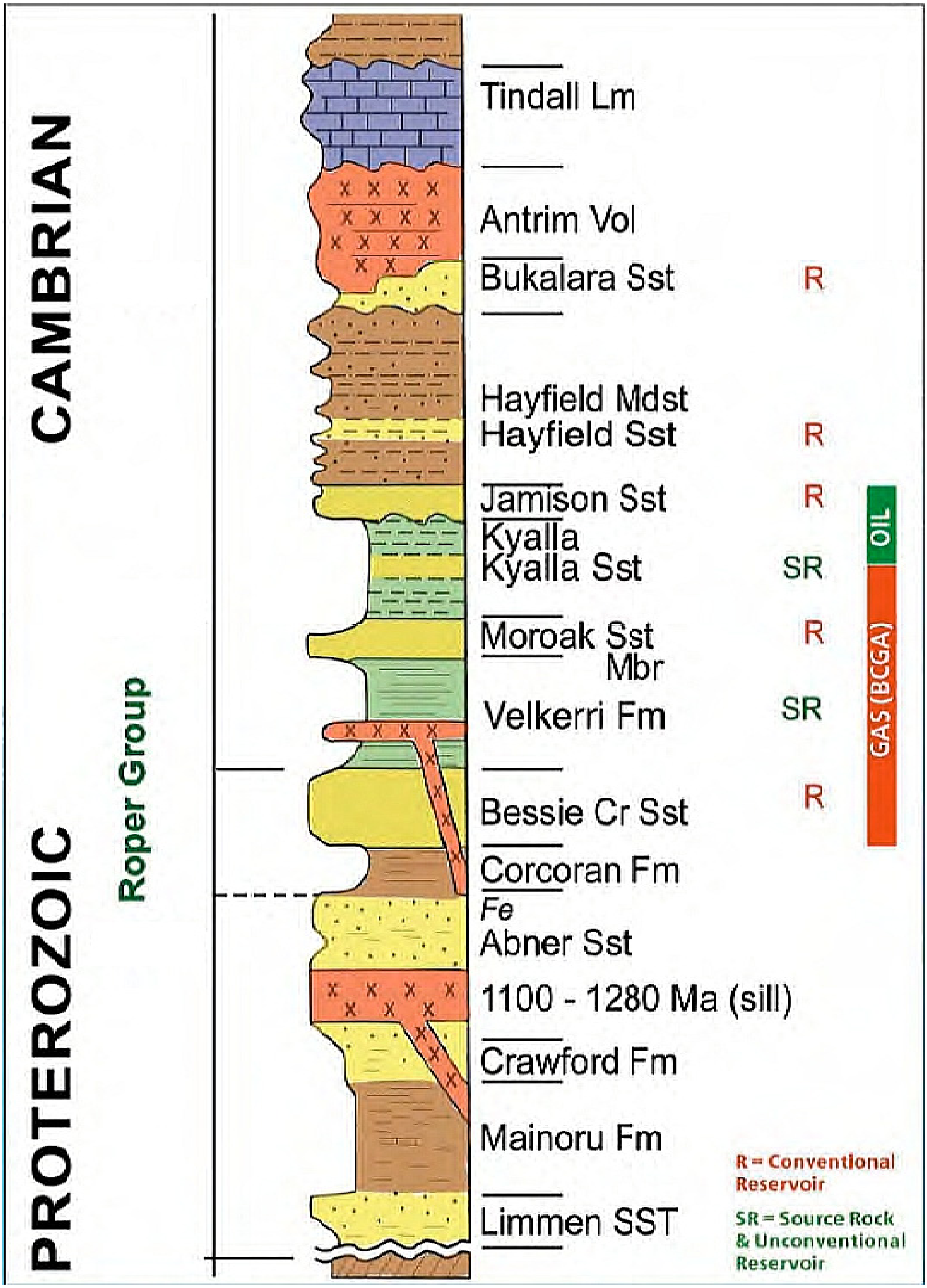


Figure 6 shows the general stratigraphy of the Beetaloo Basin. Shenandoah-1A commenced drilling in the Lower Kyalla Formation at 1555m.

FIGURE 6: BEETALOO BASIN STRATIGRAPHIC COLUMN



Whereas the adjacent Balmain-1 well provided the best offset data point for Shenandoah-1, the stratigraphic prognosis for Shenandoah-1A was based wells drilled further afield by Pacific Oil and Gas, both in the Beetaloo and adjacent northern McArthur basins. Many of the wells were stratigraphic tests drilled and cored without the benefit of the knowledge of defined structural closure or seismic data.

Pacific Oil and Gas drilled eleven wells in the Beetaloo Basin between 1984 and 1993. The prognosed stratigraphy of Shenandoah-1A (Kyalla Formation to total depth) was based upon two of these Beetaloo basin wells, Elliott-1 and Jamison-1.

Elliott-1 was drilled in 1991 and was located 88kms to the south-southeast of Shenandoah-1A. Elliott-1 reached a total depth of 1729m in the Moroak Sandstone (possibly a thin section of underlying Velkerri Formation) and provided good offset data for the Kyalla Formation and Moroak Sandstone.

The deepest well drilled by Pacific Oil and Gas in the Beetaloo Basin was Jamison-1 in 1991. Jamison-1 was located 26kms southeast of Shenandoah-1A and was drilled to 1765m, terminating in the Moroak Sandstone. Jamison-1 was also a good offset well for the Kyalla Formation section and located closer to Shenandoah-1A.

For the prognosed stratigraphy lying below the upper Moroak Sandstone intersected in Jamison-1, the relatively distant Altree-2 well section was used.

Altree-2 was spudded in 1988 on the 'Walton High' on the northern margin of the Beetaloo Basin in the adjacent and superimposed McArthur Basin. The well was 80kms north-northeast from Shenandoah-1A. This well drilled through 830m of Velkerri Formation reaching a total depth of 1700m in dolerite lying below the Corcoran Formation.

Of paramount importance were the predicted locations of the three Velkerri Formation high TOC zones seen in several wells, particularly Altree-2, and containing potential tight gas pay. These high TOC zones, be cored in Shenandoah-1A, had characteristically higher resistivity values and higher gas readings than adjacent low TOC shales and claystones.

Table 1 presents the proposed and actual formation tops (logger's depths) for Shenandoah-1A. The rotary table (RT) height was 231m and ground level was 226.8m above the Australian Height Datum (AHD).

TABLE 1: STRATIGRAPHIC SUMMARY, SHENANDOAH-1A

		DEPTH, m SSTVD			TRUE THICKNESS, m		
AGE	**FORMATION**	**Prognosed**	**Actual**	**Difference to progn. High/Low**	**Prog.**	**Actual**	**Difference**
L. PROTEROZOIC	LOWER KYALLA FM (1)	-1262.5	-1257.4	5.1 H	230.0	227.9	-2.1
M. PROTEROZOIC	MOROAK SANDSTONE (1)	-1492.5	-1485.3	7.2 H	405.0	482.9	77.9
M. PROTEROZOIC	UPPER VELKERRI FM (1)	-1897.5	-1968.2	70.7 L	820.0	514.4	-305.6
M. PROTEROZOIC	VELKERRI 'A' BED	-2177.5	-2168.1	9.4 H	120.0	51.0	-69.0
M. PROTEROZOIC	(LWR VELKERRI 'A' BED)	NP	-2219.1	N/P	NA	N/A	N/A
M. PROTEROZOIC	VELKERRI 'B' BED	-2297.5	-2238.1	59.4 H	120.0	33.0	-87.0
M. PROTEROZOIC	(LWR VELKERRI 'B' BED)	NP	-2271.1	N/P	NA	N/A	N/A
M. PROTEROZOIC	VELKERRI 'C' BED	-2417.5	Absent	N/A	300.0	N/A	N/A
M. PROTEROZOIC	LOWER VELKERRI FM (1)	NP	-2326.1	N/P	NA	156.5+	N/A
M. PROTEROZOIC	BESSIE CREEK SST (1)	-2717.5	not penetrated	not penetrated	300.0	N/A	N/A
	TOTAL DEPTH	-3017.5	-2482.6	534.9 H	N/A	N/A	N/A

N/A = not applicable. N/P = not prognosed. (1) Primary gas objective.

As can be seen on table 1, all horizons for Shenandoah-1A were intersected high to prognosis. The well did not reach the Bessie Creek Sandstone but may be deepened in 2010 as the Bessie Creek Sandstone is now considered a promising gas objective following evaluation of the Velkerri Formation.

There were major lithological changes in the Velkerri Formation with more sandstone than predicted based on the distant offset wells.

A review of the Shenandoah-1A stratigraphic sequence from total depth to the surface-casing shoe follows. All depths mentioned are logger's:
Shenandoah-1A reached a measured total depth of 2714.5mMD (2713.6mTVD, -2482.6mSSTVD), 156.5m into the lower **VELKERRI FORMATION** of the **MAIWOK SUBGROUP (Proterozoic)**. The lithology of this sequence comprised predominantly interbedded and intergradational claystone and siltstone beds from 2714-2684m from where traces of very fine sandstone occurred up to 2654m. Wireline logs show mainly homogenous resistivity and sonic responses and a relatively muted, cleaning-upwards cyclic gamma-ray profile. The claystone was described *as mid to dark grey, rarely very dark grey, moderately to abundantly micromicaceous, occasional micaceous laminae, trace disseminated pyrite, rare calcite vein deposit, hard, sub-fissile to fissile, commonly splintery* and could be further defined as shaley.
The siltstone was generally *light to mid grey, occasionally dark to very dark grey, moderately argillaceous in part, slightly to abundantly micromicaceous, trace disseminated pyrite, hard to rarely very hard, sub-fissile to fissile, commonly splintery, rarely sub-blocky.* Carbonaceous matter was lacking.
A general description for the minor sandstone was *off-white, rarely light brown-grey to light grey, very fine to medium, occasionally very fine, moderately well to very well sorted, angular to subangular, moderate to abundant quartz overgrowths, siliceous cement, generally moderate to abundant argillaceous and occasionally silty matrix, siliceous matrix in part, common argillaceous inclusions in part, rare to common lithic grains, rare carbonaceous grains, trace disseminated pyrite, moderately hard to very hard, tight to very poor visual porosity, no fluorescence.* As noticed, some traces of carbonaceous matter were seen in some sandstone samples.

Above 2654m, where sandstone reached 40% of the gross sample over a thin 3m interval, siltstone dominated the sequence with subordinate intergradational and interbedded claystone. The siltstone was *mid to dark brown-grey and mid to dark grey, argillaceous, very finely arenaceous in part, common to abundant disseminated pyrite, very micromicaceous, laminated, hard, sub-fissile* and the claystone was described as *mid to dark, occasionally very dark grey, abundantly micromicaceous, common to abundant mica flakes in part, common to abundant disseminated pyrite, hard, sub-fissile to fissile, commonly splintery.*

Above 2590m, claystone again dominated (maximum 80% with 20% siltstone). Claystone comprised 100% of the formation from 2573m. The GR curve shows higher values above 2570m suggesting deeper water deposition.

Claystone also dominated the Core-2 lithology from 2511-2517.4m. *CLAYSTONE: very dark grey with mid grey laminae, abundantly micromicaceous, common mica flakes, common to abundant disseminated to very finely crystalline pyrite, hard, fissile. Shows near-vertical planar fracture with "rosettes" of pyrite and calcite crystals formed on the surfaces.* Although carbonaceous matter was not described in the claystones, minor thin sandstones did contains some, possibly alganites - *SANDSTONE: protoquartzitic, light brownish grey to mid grey, very fine, very well sorted, angular, abundant quartz overgrowths, generally sutured grain boundaries and transverse grain fractures, siliceous cement, siliceous matrix, rare to common black carbonaceous(?) irregular to sub-spherical grains, very hard, sub-conchoidal fracture, tight to very poor visual porosity, no fluorescence.*

Above 2515m thin sandstones occurred within massive siltstone. The sandstone was *dark grey to dark brown-grey, occasionally very light to light grey, very fine, occasionally very fine to fine, well to very well sorted, angular to subangular, moderate quartz overgrowths, abundant sutured grain boundaries and transverse grain fractures in part, siliceous cement, generally moderate to abundant argillaceous and silty matrix, siliceous matrix in part, occasional to abundant mica flakes, common argillaceous inclusions in part, rare to common lithic grains, trace disseminated pyrite, rare pyrite nodules, rare glauconite grains, moderately hard to very hard, protoquartzitic in part, tight to very poor visual porosity, no fluorescence.* Siltstone was described as *mid to predominantly dark grey, rarely light grey, moderately to very micromicaceous and micaceous, common to locally abundant disseminated pyrite, generally argillaceous, rare micaceous laminae, rare to locally common carbonaceous(?) specks, moderately hard to hard, sub-fissile to fissile, splintery in part, rarely sub-blocky.*

As shown both on the logs and in the cuttings descriptions, a 30m thick sandstone comprising multiple stacked thin cleaning upwards sandstone units and subordinate intervening siltstones was intersected from 2503-2470m. These sandstones and siltstones were described similar to those lying below. Although no carbonaceous matter was seen in the sandstone, the siltstone did contain carbonaceous specks. The sandstone units may be interpreted as nearshore, relatively shallow marine sheet sands.

A period of deeper water prevailed from 2470-2451m where the wireline and LWD logs and cuttings identify a dominant arenaceous siltstone with subordinate intergradational very fine to fine grained sandstone as seen below.

From 2451-2400m finely interbedded sandstones and siltstones were penetrated. The sandstone was generally sharp based and cleaning/coarsening-upwards suggesting foreslope or deltaic-front deposits in relatively shallow water. Typically the sandstone was described as *SANDSTONE: very light to light grey, occasionally dark brown-grey, very fine, occasionally very fine to fine, rarely very fine to medium, moderately to very well sorted, angular to subangular, abundant quartz overgrowths, abundant sutured grain boundaries and transverse grain fractures in part, siliceous cement, siliceous matrix, occasionally moderate to abundant argillaceous and silty matrix, occasional to abundant mica flakes, common argillaceous inclusions in part, rare to common lithic grains, rare trace disseminated pyrite, rare pyrite nodules, rare glauconite grains, moderately hard to very hard, protoquartzitic in part, tight to very poor visual porosity, no fluorescence* and the interbedded siltstone as *SILTSTONE: light to mid, rarely dark grey and dark brown-grey, commonly light grey and quartzose grading to very fine Sandstone, moderately to very micromicaceous, sub-phyllitic in part, trace to locally abundant disseminated pyrite, generally argillaceous, very finely arenaceous in part, occasional micaceous laminae, rare to locally, moderately hard to hard, sub-fissile to fissile, splintery, rarely sub-blocky.*

From 2400-2370m sandstones gradually thinned, were dominantly fine to very fine and graded into arenaceous siltstones. Porosity was described as tight to very poor.

Above 2370m the GR showed an increase in radioactive response suggesting that the lithology was generally argillaceous. However, cuttings showed a dominance of arenaceous (quartzose) siltstones grading into silty sandstones and very fine sandstones. In parts, the siltstones were highly micaceous.

Siltstones dominated the sequence up to 2310m above which sandstones were intersected with percentages ranging from 10% to 40%. These sandstones were *off-white to light grey, occasionally mid brown-grey, very fine, very well sorted, angular to subangular, abundant quartz overgrowths, abundant sutured grain boundaries and transverse grain fractures, siliceous cement, siliceous matrix, occasionally moderate argillaceous matrix, rare very fine glauconite grains, rare to common lithic grains, rare trace pyrite cement, hard to very hard, tight to very poor visual porosity, no fluorescence.*

Above 2280m sandstones became the predominant lithology in cuttings though on logs they appeared to be finely intercalated with siltstones. This may have been due to the finer clastics being ground up and lost in the mud during the drilling process.

Between 2240-2200m, thinly stacked, generally coarsening-upward sandstones, possibly deltaic-front, were logged. These were described as *SANDSTONE 1): off-white to very light brown-grey, very fine to fine, occasionally fine to medium, well to moderately sorted, angular, abundant quartz overgrowths, siliceous cement, siliceous matrix in part, rare kaolinite matrix, rare to occasional kaolin grains, rare carbonaceous grains, rare lithic grains, rare pyrite crystals, moderately hard to very hard, tight to very poor visual porosity, no fluorescence.* Subordinate siltier sandstone was logged as *SANDSTONE 2): light to mid grey-brown, very fine to fine, occasionally very fine to medium, well to moderately sorted, angular, abundant quartz overgrowths, siliceous cement, argillaceous, micaceous and silty matrix, common carbonaceous grains, common carbonaceous grain coatings, common to abundant very fine to fine mica flakes, rare very fine to fine glauconite grains, moderately hard to hard, tight to very poor visual porosity, no fluorescence.* Subordinate interbedded and intergradational siltstones were recorded as *SILTSTONE: mid brown-grey to very dark grey-brown, moderately to very argillaceous, moderately micromicaceous, very finely arenaceous in part, occasional to common carbonaceous specks, trace disseminated pyrite, moderately hard to rarely very hard, sub-blocky to sub-fissile.* As can be seen, some sands contained carbonaceous grain-coatings and carbonaceous specks were seen in the siltstones.

The top of the Velkerri Formation had been picked at 2200m. In the base of the overlying **MOROAK SANDSTONE (Mid Proterozoic)**, from 2200-2168m, well-developed fine grained but clean sandstones were logged. These beds also had gradual cleaning and/or coarsening-upward bases and flat tops and were likely to be deltaic beaches or distributary channel deposits. These beds were described as *SANDSTONE: off-white to very light brown-grey, very fine to fine, well sorted, rare to occasional sub-rounded to rounded frosted quartz grains, predominantly angular, abundant quartz overgrowths, siliceous cement, siliceous matrix in part, rare kaolinite matrix, rare to occasional kaolin grains, rare to occasional carbonaceous grains, rare lithic grains, rare pyrite crystals, moderately hard to very hard, tight to very poor visual porosity, no fluorescence.* The siltstone was similar to the older beds.

In the overlying 100m up to 2066m, thinly interbedded sandstones, silty sandstones and siltstones were deposited, probably in a nearshore, relatively shallow-water marine environment. The siltstones were similar to the older beds below. As the basin filled with sediments, the grain sizes became larger. The sandstones were fine to medium and coarse in parts and contained abundant carbonaceous matter (possibly gilsonite) in part - *SANDSTONE: very light grey to off-white and light brownish grey, dark grey to very dark brown-grey in part, very fine to fine, very fine to medium with common coarse grains in part, well to poorly sorted, angular, abundant quartz overgrowths, siliceous cement, occasional pyrite cement and matrix, siliceous matrix in part, rare to occasional kaolin matrix, abundant dark brown-grey argillaceous matrix in part, abundant carbonaceous matrix (gilsonite?) in part, rare fine to medium pale green to black glauconite grains, occasional to locally abundant kaolin grains (after orthoclase?), moderately hard to very hard, tight to very poor visual porosity, no fluorescence.* A subordinate sandstone type was finer grained and generally very hard - *SANDSTONE 2): light brown-grey, very fine to fine, well sorted, angular, abundant quartz overgrowths, common transverse grain fractures, sutured grain boundaries, siliceous cement, rare very fine glauconite grains, hard to very hard, tight to very poor visual porosity, no fluorescence.*

Well-developed sandstones with gradual cleaning upward profiles and moderately thick intervening siltstones (from 5 to 15m) were deposited from 2066-1918m. Log profiles, morphology and cutting descriptions suggest these were delta front sandstones subjected to submergence and periodic flooding. Sandstone descriptions were similar up to 2040m with common coarse to occasional very coarse quartz grains in the cleaner sandstone sections and carbonaceous 'gilsonite' still relatively common in the matrix of the finer grained beds. Rare to minor ferro (haematitic) grain coatings were seen from above 2040m suggesting a near terrestrial source and a marginal marine to deltaic front or plain environment. Glauconite was seen throughout the sequence.

From 1918-1815m log profiles (gamma-ray) show a dominance of stacked coarsening and cleaning-upward sandstones with minor interbedded claystone, siltstone and silty sandstone units. The general sandstone description was *SANDSTONE: clear to translucent, occasional opaque white quartz, 5-10% red brown-greyish red stained quartz, local pale yellow quartz, very fine to very coarse - generally fine and medium, angular (common broken grains) to subrounded, poorly sorted, mainly strong siliceous cement, abundant fractured grains and quartzite shards (strongly cemented aggregate fragments), 80% disaggregated, moderately hard, very poor inferred porosity, tight visual porosity, no fluorescence.* The minor claystone was described as *CLAYSTONE: very dark grey to very dark brownish grey, rarely greyish pink, occasional to abundant fine to very coarse mica flakes, slightly silty in part, moderately hard, sub-fissile to fissile* and siltstone as *SILTSTONE: dark grey/greyish-black, arenaceous grading to silty sandstone, granular texture, common biotite, micaceous, carbonaceous matrix (bituminised with granular texture in parts), blocky, hard to brittle.* Traces of silty sandstone were described as *SILTY SANDSTONE: black, greyish-black aggregates, common translucent quartz, very fine, common silt sized quartz grains grading to arenaceous siltstone, local mica and carbonaceous matrix, hard to moderately friable, poor to tight visual porosity, no fluorescence.*

Massive sandstone of the upper Moroak Sandstone was penetrated from 1815-1717m. On logs this appeared as almost wholly 'blocky' sandstone with very clean GR profile. The neutron, density and sonic porosity varies though indicating variations in porosity. The sandstone was typically *white / clear aggregates, translucent, clear and minor pale grey quartz grains, occasional pale yellow brown and occasional medium smokey grey quartz, silicified aggregates with welded very fine to fine and occasionally medium to local coarse grains, originally moderately well sorted, clean, minor occluded dark grey silty matrix, hard to very hard, no visual porosity, no fluorescence.* Traces of intergradational silty sandstone were *SILTY SANDSTONE: pale red brown to greyish red, very fine to fine, clear to translucent quartz in silty haematitic matrix, brittle to firm, no visual porosity* and rare siltstone was *pale red brown, finely arenaceous, minor very fine quartz, siliceous, hard, subfissile to sub blocky.*

The red colouration of these sandstones suggested terrestrial origin (glauconite was also absent) with periods of sub-aerial exposure accounting for the oxidisation of the iron content. A relatively high energy, deltaic-front to delta-plain depositional environment is suggested by the sample and log characteristics. Thin siltstones and silty sandstones may be overbank or abandoned channel deposits.

As the basin subsided, thin sandstones lying above the medium to coarse-grained sandstones of the Moroak Sandstone, were overall finer grained and interspersed with silty sandstones and siltstones. A few better developed units had medium to occasional coarse grains. These comprised the basal units of the **KYALLA FORMATION (Late Proterozoic)**.

From 1717-1685m these thin sandstones were predominantly coarsening-upward and suggestive of shoreline units. Typical descriptions were *SANDSTONE: clear to translucent, minor grey-brown quartz, very fine to fine, trace medium, subrounded, moderately well sorted, strong to moderately strong siliceous cement, clean to silty aggregates, local carbonaceous matrix, moderately friable to very hard,* ***poor*** *to tight visual porosity, no fluorescence; SILTY SANDSTONE: translucent to dark brown-grey quartz, fine to very fine, common silt sized quartz grains, silty and carbonaceous matrix, common mica, finely laminated in parts, hard to friable, occasionally brittle, tight porosity; SILTSTONE: minor medium grey, argillaceous to arenaceous, waxy lustre, phyllitic, fissile to subfissile, brittle to firm.*

Thinly interbedded sandstone, silty sandstone and siltstone persisted up to 1650m from where shale became the dominant lithology to the casing shoe at 1555m. Occasional associated lithologies were siltstones and thin sandstones: *SHALE: dark-grey/black, carbonaceous in parts – common vitreous to sub vitreous mica flakes, silty laminae and lenses in parts, trace very fine sandstone, fissile; SILTSTONE: dark grey brown/grey black, common silt sized quartz grains, occasional subrounded to subangular very fine quartz, common argillaceous matrix, common vitreous to sub vitreous carbonaceous flakes, local brown and clear mica, brittle to moderately friable.*
The occasional sandstones were generally described as *SANDSTONE: clear, translucent brown quartz grains in parts, very fine to fine, trace medium, angular, poorly sorted, common silica overgrowths and silicified aggregates, trace relic matrix, common shards and slivers of very had aggregates showing sheared quartz grains, clean to silty in parts, hard, no visual porosity, no fluorescence.*
Core chips and sections examined from Core-1 (1585-1595.5m) contained numerous lenses and laminae of *MICACEOUS SANDSTONE: medium dark grey to dark grey, clear to translucent and minor smokey grey quartz, very fine to silt sized quartz grains, angular to sub angular, moderately well sorted, strong siliceous cement, abundant (30%+) brown and clear mica, disseminated micro flakes of sub vitreous carbonaceous matter, generally hard, no visual porosity, no fluorescence (no solvent cut).* Carbonaceous matter was described but porosity was poor. Some open (unmineralised) fractures were visible to the naked eye.

The persistence of sandstone and silty sandstone beds throughout the lower Kyalla Formation indicates a relatively shallow to nearshore environment of deposition.

Detailed lithological descriptions of the Shenandoah-1A sequence from drilled cuttings and core chips are contained in Appendix 1.

2.3 Seismic Summary: (from well proposal)

Many of the eleven wells drilled by Pacific Oil and Gas between 1984-1988 were stratigraphic wells and drilled without the benefit of seismic evaluation. The company did acquire approximately 2,500km of 2D seismic data covering much of the basin east of the Daly Waters Arch from 1988 to 1993. This resulted in the drilling of wells on generally poorly defined structures attempting to establish commercial hydrocarbon production in the Beetaloo Basin.

Intensive seismic reprocessing has been carried out upon a large portion of this generally poor quality data and a significant improvement was achieved. Sweetpea Petroleum Corporation acquired 690km of 2D seismic during 2006. New structural maps have been generated which revealed some of the old wells were located on inadequately defined closures. New, large undrilled structures have been mapped based upon the reprocessed data that constitute valid exploration objectives.

2.4 Hydrocarbon Summary:

Oil Show Summary:

All cuttings and core chip samples were checked for fluorescence throughout the drilling of the well. Minor yellow mineral fluorescence, predominantly from calcite, was observed. Oil fluorescence was absent in Shenandoah-1A.

Gas Show Summary:

Numerous good gas shows were recorded in the Shenandoah-1A well section. These were rated from poor to good based on rock type, interpreted porosity and peak over background gas values. Table 2 summarises the gas shows. (Driller's and logger's depths were practically the same).

TABLE 2: SUMMARY OF SHENANDOAH-1A GAS SHOWS

DEPTH, m	DESCRIPTION/REMARKS	GAS SHOWS, units & composition	RATING
LOWER KYALLA FORMATION from 1489m			
1584	POSSIBLE SWAB GAS.	GAS: 263u 5.56%)/70u, 28/26/23/16/7	GOOD SHOW
1616-1655	Background gas increases may have been enhanced in possible gas-cut mud – see note at the bottom of this table		
1632		GAS: 901 units, (18%) 36/30/20/10/4	GOOD SHOW
1635		GAS: 970 units, (19%) 36/30/20/10/4	GOOD SHOW
1640-1661	SHALE WITH MINOR INTERGRADATIONAL SILTSTONE	GAS: 727/18u 36/30/20/11/4	GOOD SHOW
1664		GAS: 175 units, (3.5%) 29/27/21/15/8	GOOD SHOW
1661-1676	FINELY INTERBEDDED AND SANDSTONE, SILTY SANDSTONE, SILTSTONE AND SHALE	GAS: 143/12u 34/28/20/13/5	GOOD SHOW
MOROAK SANDSTONE from 1717m			
2042-2048	SANDSTONE WITH MINOR INTERBEDDED SILTSTONE	GAS: 389u/6u 90/9/1/trace/trace/	GOOD SHOW
2048-2060	SANDSTONE WITH MINOR INTERBEDDED SILTSTONE	GAS: 9.7/1u 92/7/1/trace	POOR SHOW
2060-2066	SANDSTONE WITH MINOR INTERBEDDED SILTSTONE	GAS: 11.5/0.7u 90/8/2/trace	POOR SHOW
VELKERRI FORMATION 'A' ZONE from 2400m			
2400-2420	SANDSTONE WITH MINOR INTERBEDDED SILTSTONE	GAS: 34/1u 90/8/2/TRACE	FAIR SHOW
2420-2453	SANDSTONE WITH MINOR INTERBEDDED SILTSTONE	GAS: 40/2u 92/7/1/TRACE	FAIR SHOW
2453-2462	SILTSTONE WITH INTERBEDDED SANDSTONE	GAS: 12.6/5u 89/9/2/TRACE	POOR SHOW
2462-2470	SILTSTONE WITH INTERBEDDED SANDSTONE	GAS: 14/3u 90/9/1/trace	POOR SHOW
VELKERRI FORMATION 'B' ZONE from 2470m			
2470-2503	SANDSTONE WITH MINOR INTERBEDDED SILTSTONE	GAS: 35/5u 93/6/1/TRACE	FAIR SHOW
2503-2511	SILTSTONE WITH INTERBEDDED SANDSTONE	GAS: 26/8u 93/6/1/TRACE	FAIR SHOW
2517-2555	PREDOMINANTLY CLAYSTONE WITH TRACE SANDSTONE AND SILTSTONE	GAS: 176/18u 88/10/1/1/0	GOOD SHOW

DEPTH, m	DESCRIPTION/REMARKS		GAS SHOWS, units & composition	RATING
2555-2573	CLAYSTONE WITH RARE LAMINAE OF SANDSTONE AND SILTSTONE	GAS:	167/4u 88/10/1/1/0	GOOD SHOW
LOWER VELKERRI FORMATION from 2558m				
2573-2591	CLAYSTONE WITH RARE LAMINAE OF SANDSTONE AND SILTSTONE	GAS:	71/20u 86/12/2/trace/tr	FAIR SHOW
2591-2609	SILTSTONE WITH CLAYSTONE INTERBEDS AND THIN SANDSTONE LAMINAE	GAS:	37-25u 85/12/2/1/trace	FAIR SHOW
2609-2621	SILTSTONE WITH CLAYSTONE INTERBEDS AND THIN SANDSTONE LAMINAE	GAS:	35-23u 85/12/2/1/trace	FAIR SHOW
2621-2651	SILTSTONE WITH CLAYSTONE INTERBEDS AND THIN SANDSTONE LAMINAE	GAS:	55-19u 92/7/1/trace/trace	FAIR SHOW
2651-2672	SILTSTONE WITH CLAYSTONE INTERBEDS AND RARE SANDSTONE LAMINAE	GAS:	49-10u 91/7/2/trace/trace	FAIR SHOW
2672-2693	SILTSTONE WITH CLAYSTONE INTERBEDS AND THIN SANDSTONE LAMINAE	GAS:	59-12u 92/7/1/trace/trace	FAIR SHOW
2693-2714	SILTSTONE WITH CLAYSTONE INTERBEDS	GAS:	89/1u 93/6/1/trace	FAIR SHOW

Remarks: the very high gas levels were recorded during the drilling of dark carbonaceous shales from 1616m reaching nearly 1000 units (20%) at 1635m may have, in part, been the result of gas or air-cut mud. Though the cuttings remained relatively uniform in appearance, and the penetration rate (ROP) was relatively steady, background gas gradually increased from 150 units (3%) at 1616m to 750 units (15%) at 1647m. Recycled gas peaks were interpreted from surface activity and total circulation time correlations. At 1655m the degasser was activated to remove gas from the mud before it was once more pumped down the drill-string and gas levels gradually reduced. A period of circulation without drilling enabled the system to normalise and background gas decreased to 45 units. The subsequently drilled interval of 3m from 1655m to 1658m, in similar lithology, only produced gas up to 113 units. (The gas system was calibrated correctly and the gas-trap location and agitator air-pressure were kept constant throughout operations).