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ARGONAUT INTERNATIONAL CORPORATION

GRAPHIC WELL LOG

THOMAS No. 1

Location: Lat: 25°51'28.50" S
Long 137°38'24.53" E

Elevation: G.L. 30.41 m asl
K.B. (Datum): 37.41 m asl

Total Depth: Driller: 2612.7 m
Logger: 2617.2 m

State Northern Territory

Lease: OP 184

Partners: Beach Petroleum N.L.
North Broken Hill Limited

Logger: Schlumberger

Status: D & A

Driller: PDSA

Dates Spudded 5 Sept 1981

TD Reached: 2 Nov 1981

Well abandoned: 9 Nov 1981

Wireline Logs DLL(Sim) SP from 170.5 m to 1417.5 m
DLL(Sim) MSFL SP Cal from 1415 m to 2616.5 m
BHC Sonic GR Cal from 170.5 m to 1419.2 m
BHC Sonic GR Cal from 1414.5 m to 2613.5 m
FDC CNL GR Cal from 1414.7 m to 2617 m
HDT from 1420 m to 2615 m
CCL CBL GR Two runs in 9 5/8" casing

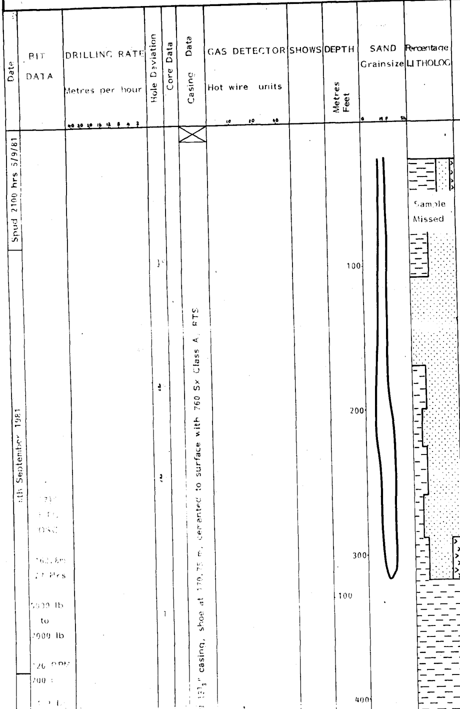
Mud Logging by Core Laboratories

Wellsite Geology Mike Wiltshire

Age Dating: Peter L. Price

Source Rock Study: A.C. Cook & J.Ellis

▭	Clay	▦	Limestone
▤	Mudstone	▧	Dolomite
▤	Shale	▨	Gypsum
░	Siltstone	■	Coal
░	Sandstone		
⧖	Plugged Interval		DST Interval
◣	Casing Shoe		



LITHOLOGIC INTERVAL DESCRIPTION

UNITS, AGES

Surface to 180.5 metres thickness 173.5 m

EYRE FORMATION TERTIARY

Sandstone and loose sand, with clay and gypsum.

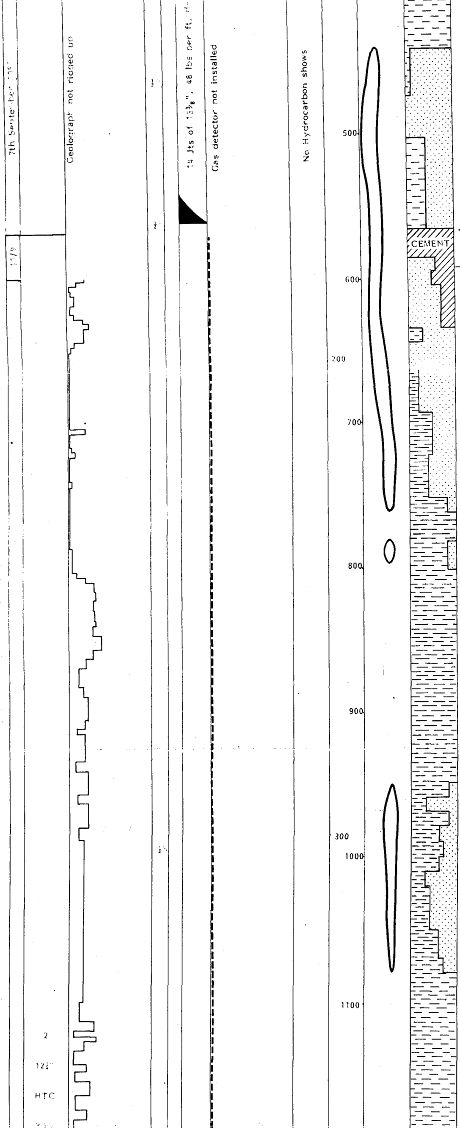
The sandstones are generally yellow and yellow brown, soft, friable fine to medium and coarse to very coarse grained. They consist of sub-rounded clear, white and some yellow quartz grains, stained and coated with limonitic iron oxides. Matrix is yellow clay, cement is clear gypsum, and limonitic iron oxides. There are rare red garnets, pyritic aggregates limonite nodules. Porosity is excellent, but there are no shows.

The clays are pale to medium yellow brown pink brown and white to beige, soft, sticky, sandy and gypsiferous.

The gypsum is present as abundant bladed crystal aggregates and as cement in the sandstones.

The basal 5 metres of the unit consists of clean white to light grey very fine grained quartzose sandstone with pyrite cement, and very high porosity.

EYRE FORMATION
TERTIARY



180.5 m to 804 metres   thickness 623.5 m

WINTON FORMATION UPPER CRETACEOUS

TO LOWER CRETACEOUS

Sandstones, mudstones, minor siltstones and lignitic coals.

The sandstones at the top (25 metres) are weathered, leached and oxidized, with enhanced porosity due to removal of clays and the reduction of chloritic clay matrix material to pyrite. These sandstones are light grey fine grained well sorted quartzose with minor grey lithics, and excellent porosity.

Within the unweathered section the sandstones are medium grey, speckled pale green grey due to the presence of abundant fine lithic material and its subsequent alteration to chloritic clays which now choke the matrix. Detrital material is all well sorted fine grained subrounded quartz and dark grey to black and green lithic grains, and minor black coally grains. The coally content of the section slowly decreases downward from about 500 metres, and there is a slow downward increase in the calcite content of the matrix. The matrix of the sandstones is clay at the top of the unit, and calcite and clays at the base of the unit. Cement is chloritic clays, minor calcite and pyrite. Porosity is poor, with low permeability and no shows

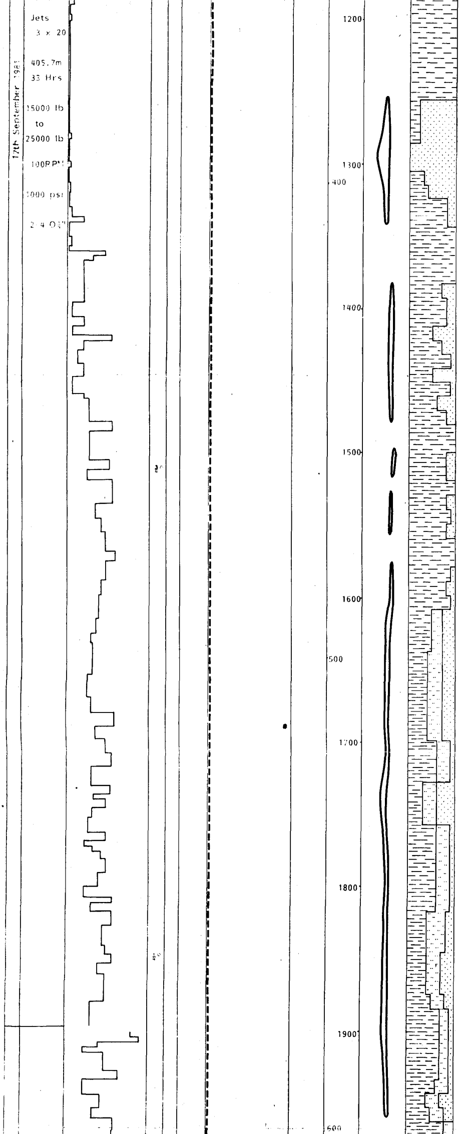
Towards the base of the unit, thin limy streaks are common.

The mudstones are medium grey, moderately firm, silty and sandy, sticky, carbonaceous, lignitic, passing with depth into softer, calcareous, sticky light grey mudstones near the base of the unit.

The siltstones are gradational between the finer sandstones and the mudstones described above.

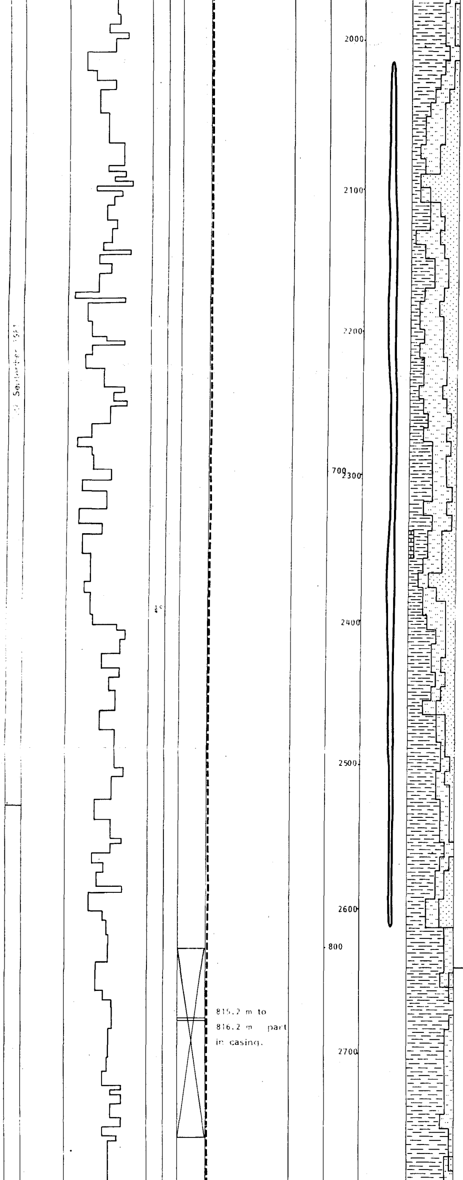
The lignitic coals are soft, dull and shaly.

The depositional environment of the unit is paralic at the top, grading down to *marine at the base of the unit. It is low energy throughout.*



WINTON FORMATION

UPPER TO LOWER CRETACEOUS

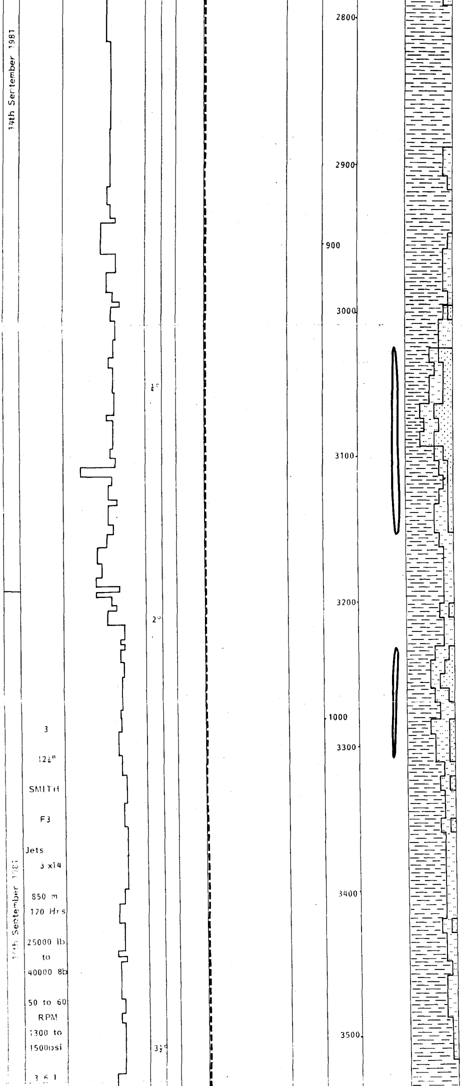


804 m to 1107 metres thickness 303 m

OODNADATTA SHALE LOWER CRETACEOUS

Mudstones, very minor siltstones and sandstones.

The mudstones are light to medium grey, massive, soft to moderately firm, silty, calcareous, fossiliferous, with minor pyrite and glauconite, and traces of carbonaceous fragments. Fossil content increases with

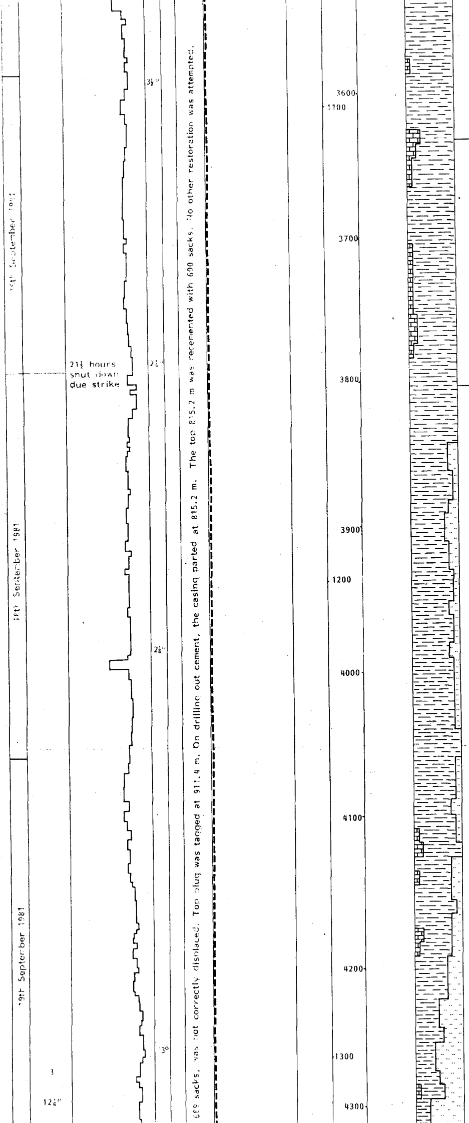


depth.

The sandstones and siltstones are medium grey speckled, very fine to fine grained sandstones grading into siltstones, lithic, calcareous, tight with no shows.

OODNADATTA FORMATION

LOWER CRETACEOUS



1107 m to 1159 metres thickness 52 m.

TOOLEBUC FORMATION LOWER CRETACEOUS

Shales, silty limestones, fossil limestones, with a basal thin coal.

The shales are dark grey, flecked with black organic material, silty, moderately firm, calcareous, slightly pyritic, fissile.

The limestones are medium brown, silty, very fossil rich, grading to coquina. They are massive, with silty matrix material completely infilling porosity.

The basal coal is black, dull, silty and shaly.

TOOLEBUC FORMATION

LOWER CRETACEOUS

1159 m to 1395.5 metres thickness 236.5 m

BULLDOG SHALE LOWER CRETACEOUS

Shales, minor siltstones and limestones, minor sandstone near the base of unit.

The shales are medium to dark grey, moderately hard to hard, silty, calcareous, slightly glauconitic and pyritic.

The siltstones are medium grey, moderately hard, fossiliferous and calcareous, and grade into the mudstones.

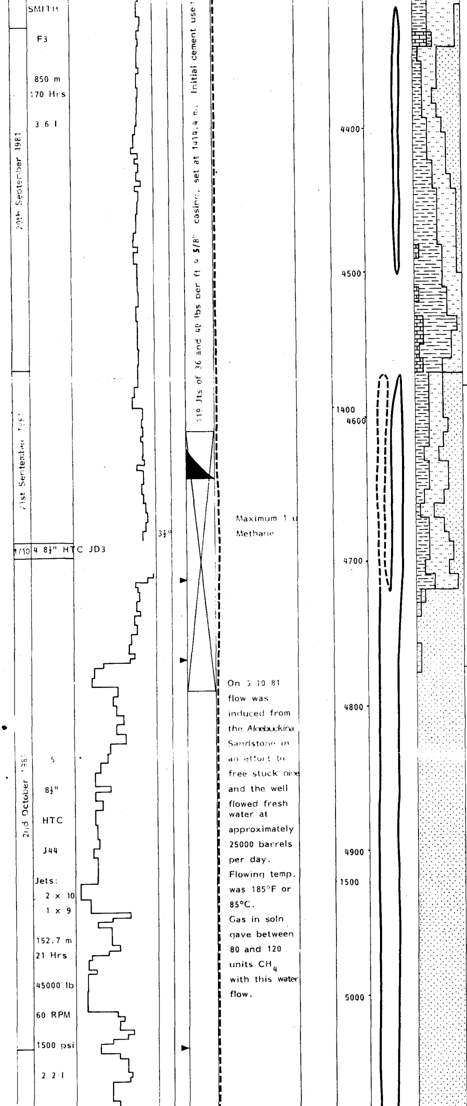
The limestones are present as thin, hard limy enrichments in the silty phases, and may represent adjustment of lime-rich fossil layers.

The sandstones are medium grey, fine to very fine grained, downward fining, moderately hard, lithic, calcareous, glauconitic, slightly pyritic, and are tight with no shows.

On the basis of fossil content, presence of glauconite, slow grainsize changes and uniformly low energy environments, the Oodnadatta and Bulldog shales are considered to be shallow low energy marine sequences. The Toolebuc represents a short-duration regressive phase in this dominantly quiet, low energy marine regime. The Toolebuc environments are shallow marine carbonate shelf to lagunal.

BULLDOG SHALE

LOWER CRETACEOUS



On 5 10 81 flow was induced from the Algebuckina Sandstone in an effort to free stuck pipe and the well flowed fresh water at approximately 25000 barrels per day. Flowing temp. was 185°F or 85°C. Gas in soln gave between 80 and 120 units CH_4 with this water flow.

1395.5 m to 1455 metres thickness 59.5 m

CADNA OWIE FORMATION BASAL CRETACEOUS

Sandstones, siltstones and shales.

The sandstones are light grey to white, bimodal fine to medium grained with some coarse to very coarse grained subrounded to well rounded quartz, clean, with varying clay matrix and silica cement, with minor calcite and pyrite cement. The finer phases contain minor pyrite and glauconite. The sand units are downward fining. The sandstones are generally fine grained and porosity is poor. The coarsest phases have excellent porosity but no shows.

The shales and siltstones are dark grey, moderately hard, finely carbonaceous, laminated, slightly calcareous, glauconitic and pyritic.

CADNA - OWIE FORMATION

LOWER CRETACEOUS

1455 m to 2075 metres thickness 620 m

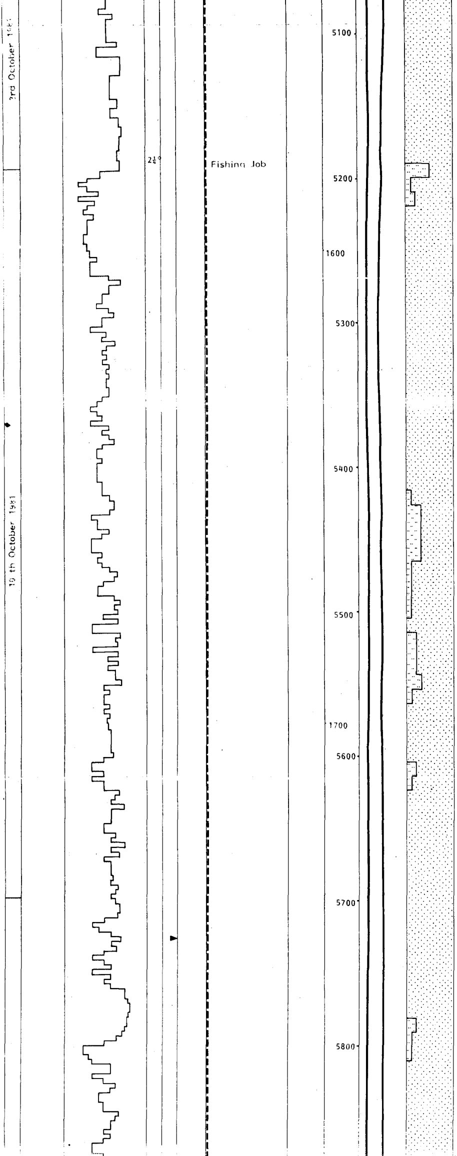
ALGEBUCKINA SANDSTONE (DE SOUZA SS)

UPPER JURASSIC

Sandstones, minor siltstones and shales.

This is a sequence of vertically stacked relatively high energy fluvial sediments. The overlying Cadna-Owie Formation is the marine front reworking and shoreface related sediments of the Early Cretaceous marine transgression, and contains much reworked detrital material from the fluvial sediments of the Upper Jurassic.

The Algebuckina Sandstone sediments are almost exclusively sandstones - light grey clean, coarse grained (grainsize range is from medium to very coarse grained), moderately hard and friable to hard and abrasive, consisting of subrounded to subangular clean quartz, with minor pink garnet present below 1690 metres. Matrix is generally absent, and the sandstone is now cemented by varying developments of silica overgraowths and infilling, and minor clays.



Porosity is fair to excellent throughout. Above 2000 metres the sequence has no shows. In the rocks immediately overlying the Poolowanna Beds there are traces of dull orange fluorescence with fair cut, but no associated mud gas shows.

The basal 25 metres is a downward fining sand unit which passes from coarse grained at the top to medium and fine grained at the base. With the downward fining, the finer sandstones develop a matrix of pale brown and green chloritic (?) clays and calcareous and siliceous clay cement. There are traces of brown carbonaceous siltstone near the base of the downward fining unit.

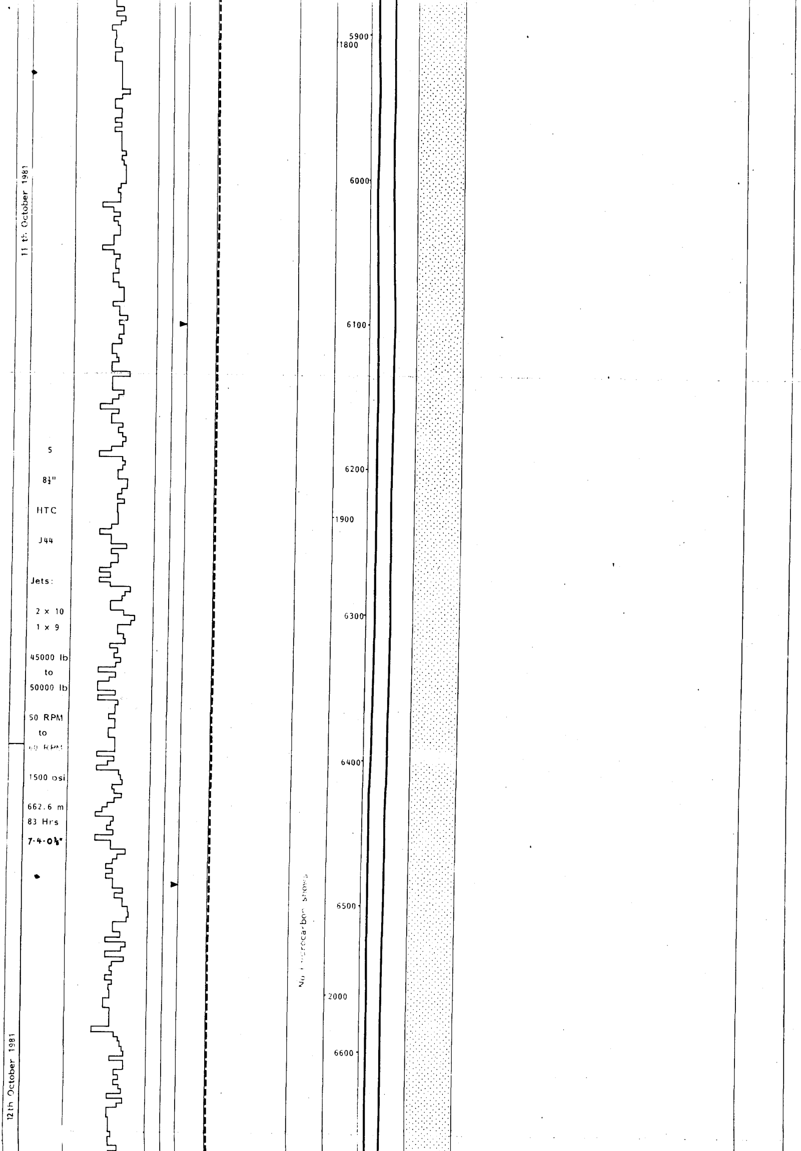
Within the Algebuckina sequence the shales and siltstones are light brown, moderately firm, fissile, devoid of organic material, and show signs of iron oxide enrichment.

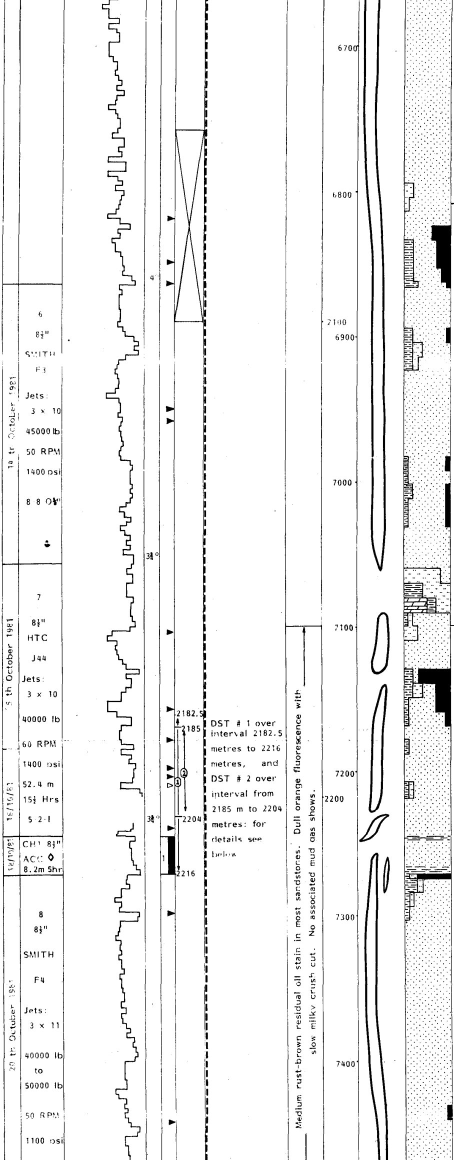
The environment of deposition of the unit in general is medium to high energy fluvial, braided stream.

The basal sequence is related to the onset of the braided fluvial regime, and to adjacent basement and sedimentary outcrop.

ALGEBUCKINA SANDSTONE

UPPER JURASSIC





Middle Jurassic $J_{5\ 6}$

2075 m to 2164 metres thickness 89 m

POOLOWANNA BEDS UPPER UNIT

MIDDLE JURASSIC

Sandstones, shales and coals.

The shales and coals mark the top of the unit. The shales are dark grey to brown grey, moderately hard to hard, fissile to blocky, silty, carbonaceous and coally. The coals are black, dull and shaly.

The sandstones are generally medium to coarse grained but range to fine grained, are moderately hard and friable quartzose, consisting of subrounded to subangular clear and white quartz grains with silica overgrowths and silica, clay and traces of calcite cement. Porosity is fair, and permeability modest, but there are no shows of hydrocarbons of any significance.
The basal 12 metres appears as a clean sand on the Gamma Ray log, but is a siltstone which slowly fines down into a brown, dolomitic (?) shale. The G R suggests there is little layered clay/shale material in the rock, but it is fine grained and silty.

UPPER UNIT POOLOWANNA BEDS

MIDDLE JURASSIC

J_{2-5}

2164 m to 2280 metres – thickness 116 m

POOLOWANNA BEDS LOWER UNIT

LOWER JURASSIC

Sandstones, shales and coals.

The top 51 metres of the unit is interbedded shales and sandstones with minor thin coals, and the rest of the unit is predominantly sandstone.

The shales are dark grey, moderately hard, silty, blocky to moderately fissile, carbonaceous and coally, finely micaceous.
The coals are black, dull and shaly.

The sandstones are medium to coarse grained, ranging to fine grained, moderately hard and friable to hard and brittle, consisting of subrounded quartz with clay matrix, and silica and clay cement with minor calcite. There are minor grey lithic grains and pink garnets. Porosity ranges up to about 15% at best, and averages about 11% to 12%. The sands commonly have redbrown residual oil staining of the matrix, and dull orange fluorescence with slow milky crush cut. There were no significant mud gas shows on drilling, and two open hole drill stem tests of the sands showing highest hydrocarbon saturation failed to produce any hydrocarbons.

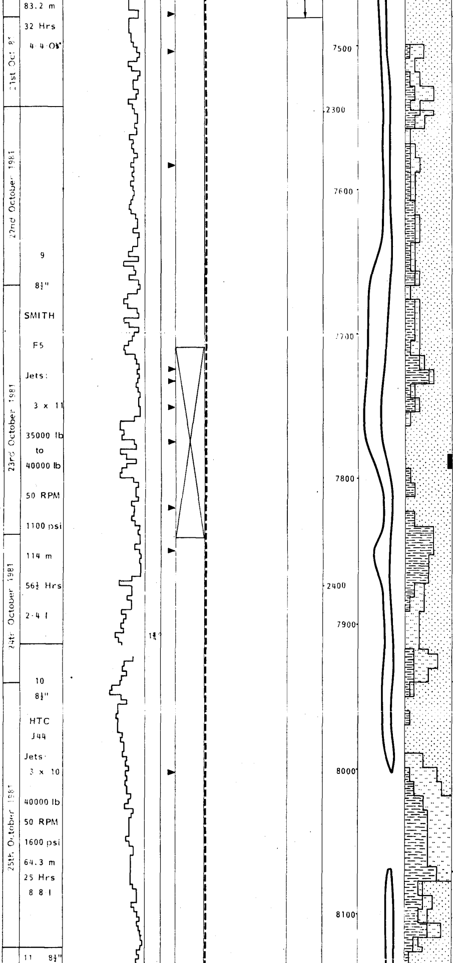
The basal 12 metres of the unit contains thin *coally shales and a single upward-fining sand* body, overlain by a thick clean sandstone.

J_{1-3}

J_1

LOWER UNIT POOLOWANNA BEDS

LOWER JURASSIC



TR 3 c-d

2280 m to 2363.5 metres thickness 83.5 m

PEERA PEERA BEDS MIDDLE TRIASSIC

Shales, siltstones and sandstones.

The shales and siltstones are pale brown, *moderately hard, finely micaceous, carbonaceous*, with coally laminae.
The sandstones are very fine to fine grained down to about 2335 metres, and become coarse to very coarse grained below that depth. They are quartzose, generally fair sorted though sorting deteriorates as grainsize increases; they consist of subrounded quartz with minor grey lithics and rose pink garnets, with clay matrix. Cement is silica, clay and calcite, with calcite increasing to the base of the unit. The sandstones are tight to poorly porous, and no shows were seen.

The basal 12 metres of this unit is a relatively high radioactivity silt and sand, with between 150 and 200 API units GR activity. This zone may reflect enrichment of minerals at the top of the underlying redbeds sequence.

PEERA PEERA BEDS
MIDDLE TRIASSIC
TR3 c-d
? TR

2363.5 m to 2420 metres thickness 56.5 m

REDBEDS UNIT ? LOWER TRIASSIC ?

Shales, siltstones and minor sandstones.

The shales and siltstones are pale green, grey purple and redbrown to brick red, soft, (hydrating) finely micaceous at the top of the unit, with rare traces of black, micaceous, phyllitic shale.

The sandstones are pale grey, coarse grained to fine grained/ hard and tight to poorly porous, with no shows.

UN-NAMED REDBEDS UNIT
? LOWER TRIASSIC ?

2420 m to 2460 metres thickness 40 m

UNNAMED UNIT, AGE UNKNOWN

(? PERMO - TRIASSIC ?)

Downward fining unit of sandstones passing down into siltstones and shales.

The sandstones are pale grey and green-grey, fine grained well sorted quartose with minor pyrite, micas and grey lithics. Matrix is clay, cement is green clay with minor silica and calcite, tight with no shows.

The shales and siltstones are dark green-grey to black, hard, pyritic and siliceous, fissile, with traces of fossilized wood.

UN-NAMED UNIT
AGE UNKNOWN

2460 m to 2617.2 metres thickness 157.2 m +

25/10/81

SMITH
F57
9 9 11
45000 lb

50 RPM
1600 psi
14.9 m
10½ Hrs
8 4 O⅛"

27/10

12 8½"
SMITH F5
10 10 10
50000 lb

45 RPM
1600 psi
10.7 m
8½ Hrs
6 3 O⅛"

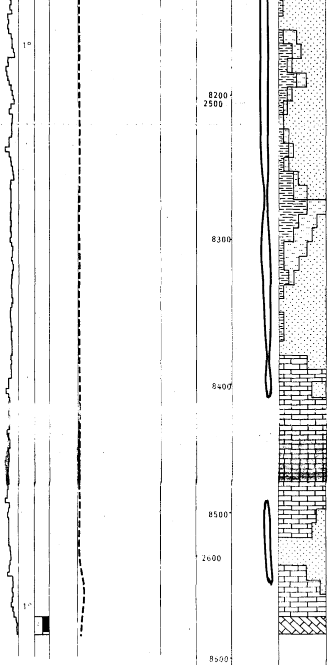
28th October 1981
29th Oct 1981

13
8½"
SMITH
F9
10 10 10
50000 lb
45 RPM
1600 psi
57.6 m
37 Hrs
6 8 O⅛"

30th October 1981
31st Oct 1981

8½"
SMITH
50000 lb
45 RPM
1600 psi
54 m
30 Hrs
2 3 I

1/11



Total Depth
2617.2 m

DST #1 open hole test over interval 2162.5 m to 2216 metres. Partial misrun, string stuck. Tool open for 68 minutes, recovered 4951 feet of water, with minor mud. Rw = 0.836 ohm m at 20°C
IFP 303.7 psi to 2105.9 psi, no closed in pressure.

DST #2 open hole straddle test, interval 2185 m to 2204 metres. Partial misrun, string stuck. Tool open for 220 minutes, shut in for 15 minutes when pulling loose. Recovered 1000 feet mud, 1368 feet water, slightly gas cut at base of recovery.
Rw = 0.24 ohm m at 22°c.

BASEMENT INDURATED SEDIMENTS

AGE UNKNOWN

Siltstone, sandstone, limy and dolomitic siltstone.

All lithotypes grade into each other. The rock is very hard, medium brown, brittle, dense, very hard drilling. It is generally silt to very fine grained sand size particles of quartz and layered clays (micas) with a matrix/cement of calcareous and dolomitic material, and silica cementation common. The sandier phases are orthoquartzitic, with white silica veining. Pyrite is common, on bedding planes and as fracture filling. A basement core shows dips of about 70°, but a thin section showed no definite evidence of metamorphism.

INDURATED SEDIMENTARY BASEMENT

AGE UNKNOWN