



WEST TUNA W-21

FINAL WELL REPORT

Prepared by

Geoservices Overseas S.A.

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CONTENTS

SECTION 1 -- GENERAL WELL SUMMARY

WELL DATA	4
MUDLOGGING	5
WELL SUMMARY	6
WELL PROFILE	7
DAY VS DEPTH PLOT	8
BIT SUMMARY	9
CASING & CEMENTING DETAILS	9
WELL DIRECTIONAL PROFILE	10
WELL DIARY	11

SECTION 2 -- GEOLOGICAL SUMMARY

FORMATION TOPS	14
GEOLOGICAL SUMMARY	14
GAS REPORT	16

SECTION 3 -- GEOSERVICES WELL LOGS

West Tuna W-21 MASTERLOG --	1:500 scale from 168 to 3261 metres 1:200 scale from 2880 to 3261 metres
West Tuna W-21 DRILLING LOG --	1:1000 scale from 168 to 3261 metres
West Tuna W-21 GAS RATIO LOG --	1:200 scale from 2950 to 3261 metres

Revision	Date	Issued by	Approved by	Remarks
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Section 1
General Well Summary

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WELL DATA

Operator : Esso Australia Ltd
Platform : West Tuna
Well name : W-21
Country : Australia
Location : Gippsland Basin
Structure : Tuna M-1
Field : West Tuna
Permit : Vic/ L4

Location AMG co-ordinates 5771790.69 m N 621486.80 m E
Location local co-ordinates Lat :38° 11' 36.616" S Long :148° 23' 14.405" E
Target Local co-ordinates 2245.74 m N 1176.94 m W

Profile : Deviated
Reference depth : Rotary Table
RT to Seabed : 95.69 metres
RT above M.S.L. : 34.69 metres
Sea-water depth : 61.0 metres
Proposed total depth : 3200 metres
Actual total depth : 3261.0 metres
True vertical depth : 1460.0 metres
Spudded on : 1st July 2001
Total depth reached on : 14th July 2001

Drilling Contractor

Drilling Contractor : NABORS ISDL
Rig name : 453
Rig type : Platform

Drilling Phases

Diameter (inch)	From (m)	To (m)	Mud Type
12¼"	168	833	Gel / Water
8½"	833	3261	KCl / PHPA / Polymer

Cased Hole

Casing Diameter (inch)	Casing Type	Shoe Depth (m)
9 ⁵ / ₈ "	Surface	830
7"	Production	3261

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MUD LOGGING

Logging Unit Number: 95

Engineers: G. Doczy, P. Misquitta, M. Smith, M. Boyd.

Sampling Interval

Sample Type	Number of sets	Quantity per set	Sampling interval	From (m)	To (m)
Washed & Dried	3	100 grams	10 metres	2880	3010
	3	100 grams	5 metres	3010	3261

Cuttings Distribution

Company	Washed and Dried Sample Set
Esso Australia	1
Victorian Department of Energy and Minerals	1
Australian Bureau of Resources	1

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WELL SUMMARY

West Tuna W-21 was a new well, drilled from the unused W-21 conductor, with a primary objective of the M-1 sands on the Western flank of the Tuna Structure. The proposed deviated well was to be drilled to a total depth of 3200m MDRT (1446 m TVDRT) in 8½" hole, if possible, otherwise in 6" hole; with a single oil completion string of 3½" tubing in 7" production casing.

West Tuna W-21 was kicked off at 13:00 hrs on 1st July 2001 at 168m, from the W-21 conductor. A 12¼" steerable assembly, with a Reed-Hycalog DS195 PDC bit was used to drill this hole section. The final depth for this section was 833m. A gyro survey was run, on drillpipe, over the hole length. The 9⁵/₈" casing was run and cemented at 830m. A 8½" LWD/MWD steerable assembly with a Geodiamond S75BHPX bit was made up and run. The shoe track was drilled and the hole displaced to mud, before a PIT was performed, to ESSO requirements, after 5m of new hole. The well was drilled to 2263m, where a gyro survey was again run over the entire well length, to accurately plot the well path, due to concern over possible intersection with W-7. The well was further drilled to 2811m where it was necessary to trip to the shoe, while generator repairs were undertaken. The well was continued to 3076m, where excessive torque was encountered. The hole was backreamed while chemical additives were introduced to the mud system. The well was then drilled to the final depth.

The 12¼" phase was drilled with a Gel/Water mud system. A mud weight of 9.5 ppg was maintained by dilution with water and prehydrated Gel. The cement was drilled out with seawater before displacing to a KCl/PHPA/Polymer mud system with an initial mud weight of 9.0 ppg. Mud properties were maintained by continual dumping and dilution with new mud. Baracarb-25 and Baracarb-100 were added to the mud system prior to entering the Latrobe Formation to bridge the pore throats and reduce the likelihood of differential sticking and seepage losses. Finagreen-EBL was added from 3076m to help reduce the effects of increasing torque.

West Tuna W-21 reached a total depth of 3261m (1460m TVD) at 00:45 hrs on 14th July 2001. The final survey at a depth of 3245.25m, had an inclination of 73.89 deg and an azimuth of 335.41deg.

7" production casing was run to a depth of 3261m. West Tuna W-21 was completed as a single oil string with 3½" completion tubing run to 3066.52m. West Tuna W-21 was handed over to Production on 24-07-2001.

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1	16-07-2001	Geoservices Unit 95	Base Mudlogging Coordinator	

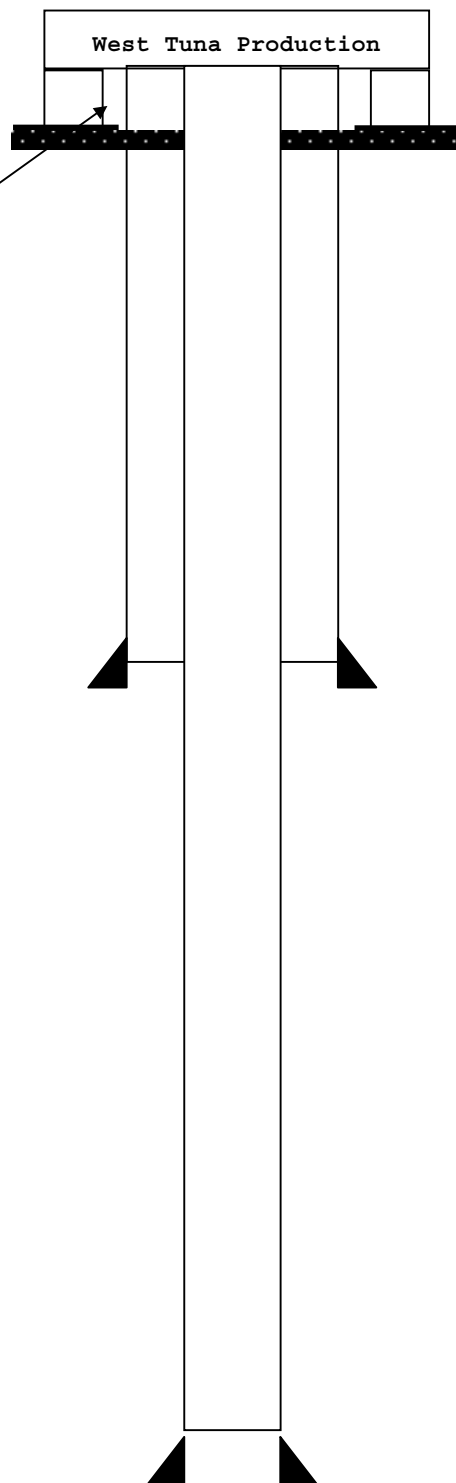
WELL PROFILE

Rotary Table to Mean Sea Level

34.69 m

Rotary Table to Sea Bed 61.00 m

Existing conductor shoe at 168m



Nabors Rig 453

Kick-off W-21

1 July 2001

From 168m

Mud Weight 9- 9.5 ppg

12¹/₄" hole to 833m

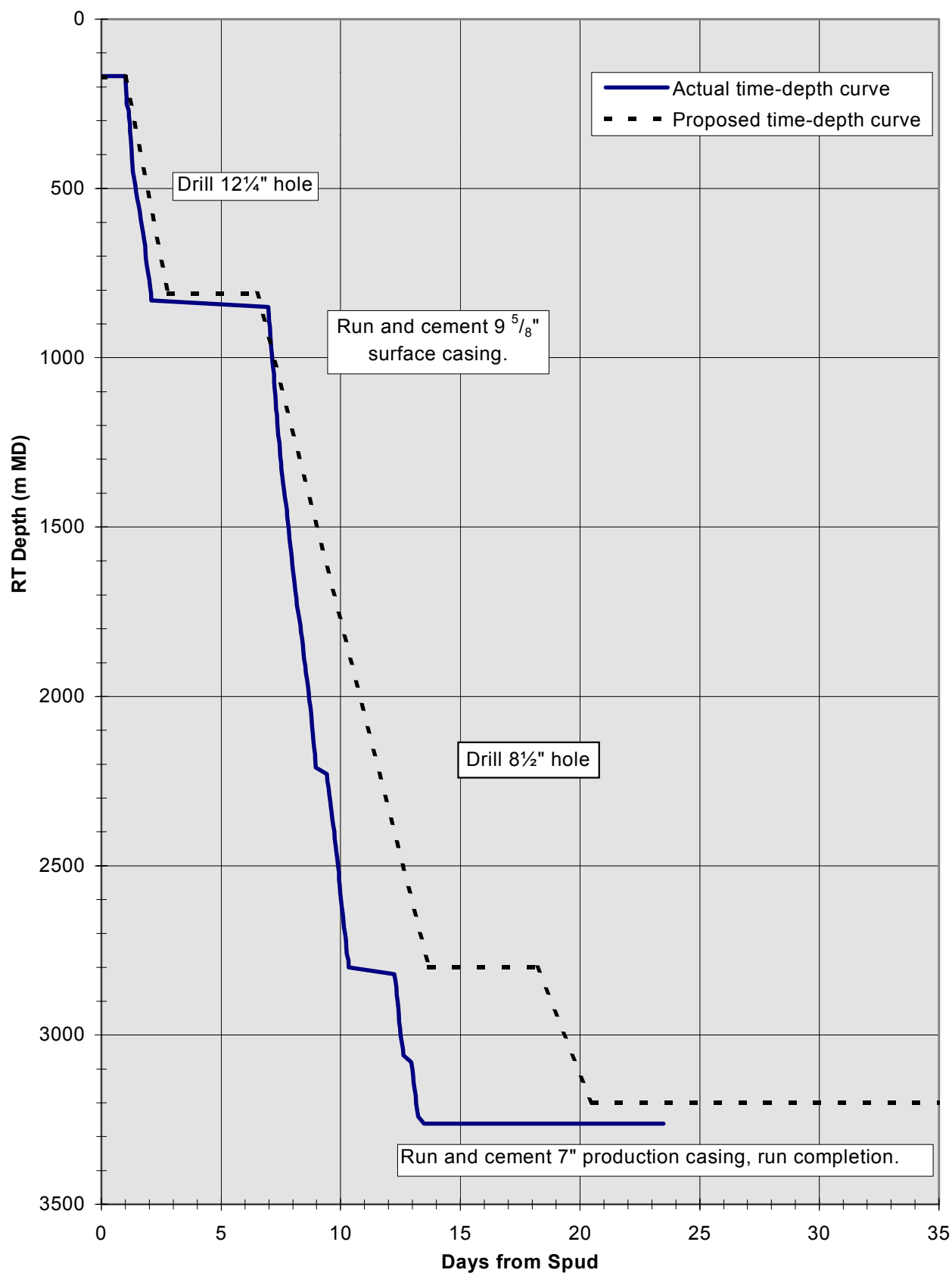
933m-2312m
Mud Weight 9.0-10.0 ppg

2312m-3261m
Mud Weight 10.0-10.5 ppg

8¹/₂" Hole drilled to 3261m

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West Tuna W-21 TIME-DEPTH CURVE (measured depth)



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BIT RUN SUMMARY

BIT	Size (")	Type	Jets	In (m)	Out (m)	Hours	Condition
1	12¼"	REED DS195	5x16	168	833	15.7	0-1-CT-G-X-IN-NO-TC
2	8½"	GEOD S75BHPX	7x14	833	3261	55.85	6-7-WT-A-X-IN-CT-TD

CASING DATA

Type	Size (Inches)	Weight (lb/ft)	Grade	Thread	Depth (mMDRT)
Surface	9 ⁵ / ₈ "	47	L - 80	LTC	Surface to 830m
Production	7"	26	L - 80	LTC	Surface to 3261m

CEMENTING DATA

Casing details	Cement Type	Dry Cement Volume (sx)	Cement Additives	Mix Water (bbls)	Slurry Volume (bbls)	Slurry Density (ppg)	Cement to/from (mMDRT)	Casing Pressure Test (psi)
9 ⁵ / ₈ "	ABC Class G	Lead 700 Tail 300	14.6gal/10bbl Econolite 0.25gal/10bbl NF-5 0.25 gal/10bbl NF-5	Lead 198 Tail 37.8	Lead 275 Tail 62	Lead 12.5 Tail 15.9	Lead Surface to 540m Tail 540.57 to 842.57	2000
7"	ABC Class G	Lead 920	32gal/10bbl HALAD 413L 2gal/10bbl SCR100L 0.25gal/10bbl NF5	113	190	15.8	2447 to 3261	2000

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WELL DIRECTIONAL PROFILE

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WELL DIARY

30th June 2001	Skid rig over W-21. Nipple up Riser, mud cross, annular preventer and overboard lines.
1st July 2001	Change out TDS from 3½" to 5" running gear. Modify bell nipple return line, install hole fill line. Test mud pumps after changing out the liners. Install diverter lines, test diverter assembly. Function test diverter. Make up 12¼" kick off assembly, run in hole to 23m and set the bend of the motor to 1½°. Programme MWD. Run in from 23 to 43m, Test MWD and motor to 900psi with 150 strokes. Run in to 125m and wash down to 168m. Spud W-21 and rotate drill/slide 12¼" hole from 168m to 254m. Reciprocate while Anadrill repair computer fault. Pull back into shoe. Run in hole from 168m to 220m, wash down last stand to 254m and drill ahead to 497m.
2nd July 2001	Rotary drill/ slide from 497m to 833m, circulate the hole clean. Rig up Schlumberger and gyro tool. Run in to 797m and pull out of hole. Circulate the hole clean, spot pill on bottom.
3rd July 2001	Pull out from 833m to 253m. Remove Schlumberger wireline and sheaves from the derrick. Rack back HWDP, lay out BHA. Prepare to run casing. Service rig. Run in with 9 ⁵ / ₈ " Casing. Rig up cement head and line, circulate 1½ times casing volume. Test cement lines to 300/3000 psi for 10 minutes; OK. Pump cement as per programme. Displace cement with Halliburton. Plug does not bump. Floats hold OK. Cement returns observed at surface. Wait on cement.
4th July 2001	Wait on cement. Rig down cement head and lines. Slack-off on casing, holds okay. Nipple down riser and rough cut 9 ⁵ / ₈ " casing. Lay out casing joint, lay out riser and diverter. Cut casing at well head and lay out casing joint. Rig up and cut 20" conductor and lay out. Cut and dress 9 ⁵ / ₈ " stump. Build habitat around well head. Pre-heat and weld braden head.
5th July 2001	Post heat treatment of braden head. Pressure test BOPs. X-ray weld on 'A' section. Check survey of 'A' section orientation. Check gauge of weld. Pick up and install H/P riser. Nipple up BOPs.
6th July 2001	Make up bit and BHA (loaded source), carry out rig service, run in hole on drillpipe.
7th July 2001	Make up bit and BHA, load source, shallow test MWD and run in hole to 248m. Carry out rig service and run in hole on drill pipe to 761m. Precautionary wash to 790m. Test casing to 200/2000psi. Drill cement and shoe track from 795m to 833m. Displace hole to mud while drilling new hole to 838m. Circulate and condition mud. Conduct PIT, 8.8ppg at 400psi gives 12.5ppg EMW. Drill, steer and survey 8½" hole from 838m to 1248m.
8th July 2001	Drill, steer and survey 8½" hole from 1248m to 1860m.
9th July 2001	Drill, steer and survey 8½" hole from 1860m to 2223m. Rotate hole clean and rig up Schlumberger wireline to run gyro survey while monitoring well. Run gyro survey, rig down Schlumberger wireline, drill ahead from 2223m to 2249m.
10th July 2001	Drill Steer and survey hole, conduct rig service and flow check well on connections. Continue to drill steer and survey. Backream and circulate while waiting on repairs to faulty SCR.
11th July 2001	Backream and circulate, run in hole from 2598m to 2801m. Drill steer and survey from 2801m to 2811m. Hole packing off, circulate at 2811m and replace pressure relief valve on pump number 2. Continue to circulate and condition hole. Pull out of hole from 2811m to shoe. Circulate hole clean, monitor well and cut and slip drilling line. Perform rig service. Run in hole from 832m to 2770m washing last stands to bottom. Circulate while working on rig SCR / generators
12th July 2001	Continue to circulate while working on rig SCR equipment. Pull out of hole to shoe and repair SCR. Run in hole, washing from 2277m to 2811m. Drill ahead from 2811m to 2946m.

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13th July 2001	Continue to drill 8½" hole. Backreamed and circulate while adding Finagreen to reduce excess torque. Pick up extra pipe to reach TD. Continue to drill 8½" hole.
14th July 2001	Drill 8½" hole to 3261m, Circulate bottoms up and backream to top of Latrobe formation. Run in hole to bottom and circulate 1.5 time Latrobe volume. Pull out of hole to top of Latrobe, circulate 1.5 times bottoms up. Pull out of hole to shoe, cut and slip drilling line, run in hole to TD, backream out of Latrobe, circulate shakers clean. Pull out of hole.
15th July 2001	Continue to pull out of hole, lay out E grade 5" drill pipe from 1846m to 832m. Work string and circulate hole clean at 832m. Continue to pull out of hole laying down E grade drill pipe. Wait on weather monitoring well. Remove radioactive source from LWD tools and lay out BHA. Change out pipe rams and blind rams and pressure test with Halliburton to 300/3000 psi. Rig up to run 7" casing. Hold JSA and make up lipstick and float assembly, run in hole with 7" casing.
16th July 2001	Continue to run in hole with 7" casing. Circulate hole volume, rig up cement head and lines and pressure test with Halliburton cement unit. Pump cement and displace with Halliburton. Wait on cement. Remove excess equipment from rig floor while waiting on cement.
17th July 2001	Continue to wait on cement. Slack off on casing, pressure test casing to 2000psi. Rig down cement head and lines. Change out pipe rams to 3½". Change out pump liners to 5" Nipple up BOPs and change out saver sub, prepare for pressure testing. Wait on weather.
18th July 2001	Continue to pressure test BOPs and complete changing out pump liners to 5". Crane shut down due to high winds, wait on weather.
19th July 2001	Continue to pick up 3½" drill pipe from deck and run in hole. Rack back 10 stands in derrick and continue picking up drill pipe, wash and rotate pipe through cement stringers, tag cement at 3123m and mill ahead.
20th July 2001	Continue to mill cement to 3237m. Displace hole to inhibited brine and pull out of hole.
21st July 2001	Lay out BHA and conduct JSA prior to running in hole with guns and spacer assembly. Rig up Weatherford and 3½" handling gear. Run in hole with guns and spacer assembly on 3½" drill pipe. Rig up Schlumberger sheaves and side entry sub for GR/CCL.
22nd July 2001	Continue to pull out of hole with 3½" drill pipe. Lay out 17 stands of drill pipe and rig up Weatherford to run completion string. Run in hole with 3½" tubing.
23rd July 2001	Continue to run in hole with 3½" tubing. Sting into packer and perform spaceout as per programme. Install hanger and landing joint. Land out and pressure test tubing and annulus. Install tubing head adapter flange and Christmas tree.
24th July 2001	Rig up to test integrity of annulus, tubing and Christmas tree. Test annulus, tubing and Christmas tree to 2000 psi. Reinstall grating over W21 and prepare rig to skid to W4.

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Section 2

Geological Summary

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FORMATION TOPS

DESCRIPTION	MD (m) - RT	TVD (m) - RT
Top of LAKES ENTRANCE	2312.0	1142.35m
Top of LATROBE GROUP	3021.0m	1383.4m
Top of COARSE CLASTICS	3056.0	1395.66m
GOC	3104.5	1412.33
OWC	3129.0	1420.3
Top of CARBONACEOUS SHALE	3150.5	1427.15
TOTAL DEPTH	3261.0m	1460.0m

GEOLOGICAL SUMMARY**GIPPSLAND LIMESTONE FORMATION**168m - 840m **CALCARENITE with minor CALCISILTITE**

CALCARENITE: Light grey, light olive grey, occasionally medium dark grey, fine to medium grained, commonly medium to coarse at shallow depth, argillaceous in part, minor fossils and shell fragments, trace to minor glauconite, trace to minor carbonaceous specks, in part abundant, friable to moderately hard, poor to fair visual porosity, no fluorescence.

CALCISILTITE: Medium grey to medium light grey, light olive grey, arenaceous, trace ooids, occasional carbonaceous specks, trace glauconite, soft to occasionally firm, moderately hard in part, sub-blocky.

840m - 2312m **CALCILUTITE**

CALCILUTITE: Light olive grey to olive grey, medium grey to medium dark grey in part, argillaceous to very argillaceous, silty in part, grading to CALCISILTITE, trace fossil fragments, trace ooids, trace foraminifera, trace microcarbonaceous specks, trace disseminated and nodular pyrite, locally trace glauconite, locally trace microcrystalline calcite, very soft to firm, amorphous to sub-blocky.

LAKES ENTRANCE FORMATION2313m - 3021m **CLAYSTONE**

CLAYSTONE: Light olive grey to olive grey, medium grey to medium dark grey, locally light brown grey, locally green grey, moderately calcareous, slightly silty in part, locally slightly micromicaceous, trace fossil fragments, trace ooids, trace foraminifer, locally trace microcarbonaceous specks, trace disseminated and nodular pyrite, locally trace glauconite, locally trace microcrystalline calcite, very soft to firm, amorphous to sub-blocky, rarely sub-fissile.

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LA TROBE FORMATION

3021m - 3056m

SILTSTONE with minor CLAYSTONE and SANDSTONE**CLAYSTONE:**

Dark yellow orange, grading to Siltstone in part, moderately calcareous, common limonitic staining, common disseminated glauconite, occasional glauconite grains, very soft, amorphous.

SILTSTONE:

Grey brown to dusky brown in part, occasionally dark yellow orange, grading to Claystone in part, grading to very fine Sandstone in part, common disseminated glauconite, trace disseminated pyrite, firm, commonly soft, moderately hard in part, subblocky to blocky.

SANDSTONE:

Clear, translucent, opaque, predominantly fine to medium, moderately sorted, subangular to subrounded, clean and loose, poor inferred porosity, no fluorescence.

COARSE CLASTICS

3056m - 3261m

SANDSTONE with minor SILTSTONE**SANDSTONE:**

Clear, translucent, opaque and pale grey in part, minor medium dark grey, rare milky and rare pink quartz in part, fine to very coarse, predominantly medium to very coarse, poorly sorted, subangular to subrounded, locally rounded, locally angular, minor fractured grains, minor disseminated pyrite, trace pyrite nodules, loose and clean, fair to good porosity grading to poor to fair porosity with depth.

SILTSTONE

medium grey to medium light grey, olive grey to dark olive grey in part, argillaceous, grading to Claystone in part, slightly to moderately calcareous, micromicaceous in part, firm to moderately hard in part, soft, subblocky, amorphous in part.

FLUORESCENCE:

3100m - 3130m, 15% to 5%, trace pale yellow white spotted fluorescence, pale cream diffuse crush cut, thick ring residue.

3230m - 3255m, 5%, moderately bright pink white spotted fluorescence, no cut.

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GAS REPORT

No gas was recorded while drilling out from the conductor at 168m. Gas was first recorded at 301m. This Gas, consisting of C₁ (Methane), continued through to 650m where traces of C₂ (Ethane) were detected. Trace amounts to 2% of C₂ persisted through to 1530m where trace amounts of C₃ (Propane) were detected. Throughout this section connection gas was also detected. Connection gas ranged from 7 units to 50 units above background gas from 874mMDRT prior to entering the Lakes Entrance formation at 2312mMDRT over this section the average connection gas was 20 units above the background gas. Apart from connection gases there were no significant gas peaks throughout this section with the trend of the gas curve matching the ROP. The gas level in this section ranged from 15 to 70 units with the average being around 30 units.

In the Claystone of the Lakes Entrance formation the trend of the gas curve was to increase gradually from an average of around 30 units at 2330mMDRT to between 50 and 70 units near 3000mMDRT. The gas consisted predominantly of C₁ with C₂ and C₃ gradually increasing for C₂ from 2% to 6% and for C₃ from trace amounts to 2% prior to entering the Latrobe at 3021mMDRT. Connection gas in this section ranged from 5 units to 75 units above background gas. The general trend of connection gas throughout the Lakes Entrance formation was to increase with depth although it was not detected on every connection. The average amount of connection gas recorded for this section was around 45units.

On penetrating the Latrobe Formation at 3021mMDRT, there was a marked increase in the gas levels, not only on magnitude but also in composition, indicating the first hydrocarbon bearing lithology. Drilling with a MW of 10.3 to 10.5 ppg, the background gas ranged from 70 to 160 units, consisting of gas components from C₁ to C₅. Connection gas in this section was not distinguishable from the high levels of background gas.

No CO₂ or H₂S was detected while drilling West Tuna W-21

Gas peaks through the Latrobe Group

Depth metres	Total Gas units	C ₁ %	C ₂ %	C ₃ %	iC ₄ %	nC ₄ %	iC ₅ %	nC ₅ %
3030	731	7.30	0.56	0.22	0.03	0.04	0.01	0.00
3035	726	3.18	0.22	0.10	0.01	0.02	0.01	0.00
3038	656	7.00	0.54	0.23	0.03	0.05	0.01	0.01
3057	1969	13.96	3.09	0.17	0.14	0.22	0.04	0.03
3065	1747	13.32	2.80	1.09	0.13	0.20	0.03	0.02
3081	706	7.71	0.69	0.25	0.02	0.04	0.01	0.01
3094	1114	8.85	0.87	0.28	0.03	0.05	0.01	0.01
3103	1741	12.24	1.97	0.84	0.11	0.18	0.04	0.04
3125	675	6.47	0.81	0.44	0.07	0.14	0.04	0.04
3153	160	1.02	0.17	0.14	0.03	0.04	0.01	0.02
3168	94	0.42	0.08	0.10	0.03	0.04	0.02	0.02
3183	171	1.27	0.17	0.21	0.04	0.07	0.02	0.03
3218	162	1.29	0.10	0.09	0.02	0.03	0.01	0.02

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