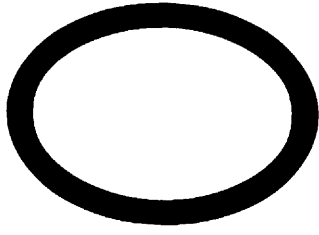


DEPT. NAT. RES & ENV



PE902369



W918. DRUMMER-1. Vol. 1.

**ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.**

WELL COMPLETION REPORT

DRUMMER-1 29 AUG 1986

VOLUME I BASIC

PETROLEUM DIVISION

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA LIMITED

DRUMMER-1

WELL COMPLETION REPORT

VOLUME 1

CONTENTS

1. Well Data Record
2. Operations Summary
3. Casing Data
4. Cement Data
5. Samples, Conventional Cores, Sidewall Cores
6. Wireline Logs and Surveys
7. Summary of Formation Test Programme
8. Temperature Record

FIGURES

1. Locality Map
2. Well Progress Curve
3. Well Bore Schematic
4. Abandonment Schematic
5. Horner Temperature Plot

APPENDICES

1. Lithological Descriptions
2. Sidewall Core Descriptions
3. RFT Results
4. Velocity Survey Report

ESSO AUSTRALIA LTDCOMPLETION REPORT

WELL : Drummer-1
LOCATION : Latitude : 38° 28' 33.999"S
Longitude : 148° 14' 58.337"E
X = 608 995.41 mE
Y = 5,740 603.07 mN
Map Projection: ANS UTM; ZONE 55 AMG; CM
147 E
Geographical Location: Bass Strait Victoria
Field: New Field

PERMIT : "West Fortescue" Location-Vic/P1
ELEVATION : 21 m ASL
WATER DEPTH : 74 m
TOTAL DEPTH : 2550 mSS, 2571 mKB
PLUG BACK TYPE : Cement
REASONS FOR PLUGGING BACK : Plugged and Abandoned
MOVE IN : 0015 hrs October 1, 1985
SPUDED : 2300 hrs October 1, 1985
REACHED T.D. : October 13, 1985
RIG RELEASED : 1315 hrs October 21, 1985
OPERATOR : Esso Exploration and Production Australia Inc.
PERMITTEE OR LICENCEE : BHP Petroleum Pty Ltd
ESSO INTEREST : 50%
OTHER INTEREST : 50%
CONTRACTOR : South Seas Drilling Company
RIG NAME : Southern Cross
EQUIPMENT TYPE : Semi Submersible
TOTAL RIG DAYS : 21 days
DRILLING AFE NO. : 03-235012
TYPE COMPLETION : Plugged and Abandoned
WELL CLASSIFICATION : Before Drilling New Field Wildcat
After Drilling Dry Hole - Plugged and
Abandoned

1945L/23

OPERATIONS SUMMARYDRUMMER-1Moving/Moorings

The Southern Cross departed the East Halibut-1 location at 1615 hours September 30, 1985 and arrived at the Drummer-1 location at 0015 hours October 1, 1985. The 19.5 nautical mile tow was completed in 7-3/4 hours at an average speed of 2.5 knots using the Lady Sally as the towboat.

Anchor No. 8 was dropped by the rig on approach to the location at 2400 hours September 30, 1985 and the remaining anchors were run by the Torrens Tide and Lady Sally.

All anchors except Anchor No. 6 were pretensioned to 200 kips. Anchor No. 6 was picked up after slipping with 140 kips tension applied. The anchor fluke wedges were missing and since no spares were available the anchor was rerun. A replacement anchor was set after running the BOP stack.

The final rig location was:

Latitude : 38° 28' 34.00" S
 Longitude : 148° 14' 58.34" E
 X = 608,995m E
 Y = 5,740,603m N

AMG Zone 55, Universal Transverse Mercator Projection,
 Australian Geodetic Datum.

The rig was located 2.5m at 219° from the called location and approximately 140 km at 159° from Lakes Entrance.

Drill 26" Hole for 20" Casing

The drilling template was run and landed at a seafloor depth of 95m. The 26" hole was drilled to 235m using seawater and high viscosity gel slugs to clean the hole. At TD a 100 barrel high viscosity gel pill was pumped and a wiper trip was made to the seafloor. Four metres of fill were washed to bottom and the hole was displaced with high viscosity gel mud.

The 20" casing hung up on a bridge at 114m. After washing the casing to 121m the well head was made up into the 4 post guidebase. Further washing was required to free the casing string after it became stuck when the hole packed off.

The 20" casing was cemented with the casing shoe at 218m. The BOP stack and riser were run and the casing and collet connector were tested against the shear rams to 500 psi.

Drill 17-1/2" Hole for 13-3/8" Casing

The cement and casing shoe were drilled out and the 17-1/2" hole was drilled to 820m using a seawater/gel mud system. A wiper trip was made to the 20" casing shoe prior to running a sonic log.

The 13-3/8" casing was run and cemented with the casing shoe at 805m. The plug was bumped with 1500 psi and the floats held. A Cameron 13-3/8" Weight Set seal assembly was set and pressure tested to 200/5000 psi. The BOP stack and C&K manifold were then pressure tested.

Drill 12-1/4" Hole to 2571m

The float collar and cement were drilled out and the casing was tested to 1500 psi. The remaining cement and float shoe were drilled out and after cleaning out the rat hole, new hole was drilled to 826m. A Phase II PIT was run to a leakoff of 900 psi, indicating an integrity of 15.6 ppg EMW at the 13-3/8" casing shoe.

The 12-1/4" hole was drilled to 1591m using conventional steel tooth bits. A Stratabit PD-11 polycrystalline diamond (PCD) bit drilled to 2055m where a short wiper trip was made. The bit was pulled at 2462m when the penetration rate dropped from 10m/hour to less than 2m/hour. The PD-11 drilled 871m in 48-3/4 hours at an average ROP of 17.9m/hours.

The PD-11 bit run was an economic success based on previous bit runs and bit performances in offset wells. Two 12-1/4" Hughes J22 bits drilled the remaining 109m to the FTD of 2571m. The bits were pulled 3/16" and 1/8" undergauge after drilling 37m in 4.25 hours and 72m in 7.25 hours respectively. This poor performance is believed to be caused by the same lithology that destroyed the PCD bit run previously.

An open hole PIT was run to a leakoff of 1225 psi, indicating an integrity of 18.1 ppg EMW at the 13-3/8" casing shoe. TD logs, which included 1 RFT and 1 CST run were run prior to plug and abandonment.

Plug and Abandonment

A cementing diverter tool run on 5" drillpipe set Plugs No. 1 - 5 at 2485m to 2395m, 2160m to 2045m, 1370m to 1285m, 1220m to 1140m and 995m to 920m respectively. The plugs were required to cover the hydrocarbon zones over these intervals. Plug No. 5 was tagged with 15 kips. Plug No. 6 was set across the 13-3/8" casing shoe from 840m to 735m. After tagging the plug with a gauge ring and junk basket, the plug was pressure tested to 1500 psi.

A 13-3/8" EZSV cement retainer was set at 708m and a Pengo cutter was used to cut the 13-3/8" casing at 209m. The casing was recovered with a casing spear.

Plug No. 7 was set across the casing stub from 244m to 124m and pressure tested to 500 psi against the shear rams.

After waiting on weather (WOW) for 1.5 days, the BOP stack was pulled. The 20" casing was mechanically cut at 107m and the wellhead running tool recovered the wellhead/pile joint and the 4 post guidebase.

Several attempts were made to recover the drilling template using the template running tool. The template was thought to have fallen to one side after the seafloor below the template was eroded while washing the 20" casing into the hole. The template was eventually recovered after the divers connected slings between inverted elevators and the template.

Pull Anchors

Anchor handling operations were delayed by approximately 2.5 days due to rough weather. The Lady Vera and Atlas Dampier were used for anchor recovery. The chain chaser, which was connected to Anchor No. 7, was beneficial when working anchors in the marginal weather conditions. The rig departed the Drummer-1 location, enroute to Eden, at 1315 hours October 21, 1985, under tow by the Atlas Dampier.

3.

DRUMMER1 CASING DATA

CSG O.D. in.	CSG WT. ppf	CSG GRADE	CSG CONN.	CSG LGTH mtrs.	CENTRALIZER POSITION.	SHOE DPTH mRKB	REMARKS
20	94	X-52	JV	12.51		218	Float Shoe Jt
20	94	X-52	JV	87.87	Across Collars on First Three Jts		7 Jts
20	129	X-52	JV/CC	13.28			Crossover Jt.
24	670		CC	11.00			Wellhead Pile Jt No EP9-1-2
13-3/8	54.5	K-55	Butt.	12.44		805.5	Float Shoe Jt
13-3/8	54.5	K-55	Butt.	11.56	Across Collars on First Seven Jts		Float Collar Jt
13-3/8	54.5	K-55	Butt.	675.10			57 Jts
13-3/8	54.5	K-55	Butt.	11.54			Hanger Jt No EHW31 SealAss'y No ESW31

DRUMMER I CEMENT DATA

4.

CEMENT JOB TYPE	CEMENT TOP mRKB	CEMENT BTM mRKB	CEMENT ADDITIVES	CEMENT VOLUME sxs	CEMENT WEIGHT ppg	REMARKS
20" Csg	95	218	2.2% Gel w/ 175 Bbl Seawater	750	13.5	Lead Slurry. Divers retrieved sample at TGB.
20" Csg	95	218	42 Bbl Seawater	350	15.8	Tail Slurry
13-3/8" Csg	310	805.5	125 Bbl Seawater	1,050	15.8	Bumped plug w/ 1500 psi.
P&A Plug No. 1	2,395	2,485	26 Bbl Freshwater w/ 0.8% HR6L	215	15.8	
P&A Plug No. 2	2,045	2,160	34.5 Bbl FW w/ 0.7% HR6L	290	15.8	
P&A Plug No. 3	1,285	1,370	26 Bbl Freshwater	220	15.8	
P&A Plug No. 4	1,140	1,220	27 Bbl Freshwater	225	15.8	
P&A Plug No. 5	920	995	31.5 Bbl Seawater	264	15.8	Tagged w/ 15 klps @ 920m.
P&A Plug No. 6	735	840	33 Bbl Seawater	278	15.8	Tagged w/ JB. Pressure tested to 1500 psi w/ 9.2 ppg mud.
P&A Plug No. 7	124	244	68 Bbl Seawater	572	15.8	Pressure tested to 500 psi w/ seawater.

CLASS 'G' CEMENT USED ON ALL JOBS. GEL ADDITIVE IS PRE-HYDRATED.

WELL: DRUMMER-1

SAMPLES, CONVENTIONAL CORES, SIDEWALL CORES

<u>INTERVAL</u>	<u>TYPE</u>
235.0-2571.0m	<p><u>Cuttings samples.</u> 3 sets of washed and oven dried and 1 set of bagged and air dried cuttings.</p> <p><u>10m intervals</u> 240.0-2390.0m</p> <p><u>5m intervals</u> 235.0- 240.0m 2390.0-2571.0m</p>
235.0-2571.0m	<p><u>Geochemical Samples</u> - 1 set of canned, unwashed cuttings every 15m collected as a composite of the previous 5m intervals.</p>
2541.0-2427.5m	<p><u>Sidewall Cores</u> - shot 30, recovered 30. No conventional cores cut in Drummer-1</p>

1945L/21

WELL: DRUMMER-1

WIRELINE LOGS AND SURVEYS

<u>Type and Scale</u>	<u>From</u>	<u>To</u>
	<u>Suite 1</u>	
DD BHC-GR	817.0	219.0m
	<u>Suite 2</u>	
DLTE-MSFL-GR)	2570.0	805.0m
LDTC-CNTH-GR) COMBINATION TOOL	2565.5	2400.0m
DDBHC-GR	2568.5	805.5m
HDT-GR	2570.0	2350.0m
RFT's (11 PRESSURE TESTS)	2555.0	2462.0m
WST-GR (11 LEVELS)	2560.0	300.0m
CST-GR (SHOT 30, RECOVERED 30)	2565.0	2427.5m

2307L/53

SUMMARY OF WIRELINE FORMATION TEST PROGRAMME - DRUMMER-I

TEST SEAT	DEPTH (METRES) K.B.	CHAMBER	RECOVERY (LITRES)				HEWLETT-PACKARD FORMATION PRESSURE		HEWLETT-PACKARD HYDROSTATIC PRESSURE		REMARKS	
			OIL	COND.	GAS	FORMATION WATER	MUD FILTRATE	MPaa	Psia	MPaa		Psia
		Litres	Litres	Litres	m ³	Litres	Litres					
I 1	2555.0	-	-	-	-	-	-	24.36	3533.9	27.70	4018.0	VALID
I 2	2545.0	-	-	-	-	-	-	24.28	3521.4	27.58	3999.8	VALID, TIGHT
I 3	2525.5	-	-	-	-	-	-	24.08	3491.9	27.37	3969.2	VALID
I 4	2515.0	-	-	-	-	-	-	23.97	3476.7	27.24	3950.8	VALID/POSSIBLE PLUGGING
I 5	2493.2	-	-	-	-	-	-	23.75	3444.7	26.98	3912.4	VALID
I 6	2472.0	-	-	-	-	-	-	23.55	3415.2	26.76	3881.7	VALID
I 7	2455.0	-	-	-	-	-	-	-	-	26.58	3854.9	V. TIGHT/PLUGGED
I 8	2456.1	-	-	-	-	-	-	-	-	26.59	3857.0	V. TIGHT/PLUGGED
I 9	2453.0	-	-	-	-	-	-	-	-	26.57	3853.8	PLUGGED
I 10	2453.0	-	-	-	-	-	-	-	-	26.67	3853.8	PLUGGED
I 11	2462.0	-	-	-	-	-	-	23.45	3401.1	26.67	3868.0	VALID.

N.B. - ALL PRETESTS USING LONG NOSE PROBE
- NO RFT SAMPLES TAKEN

TEMPERATURE RECORD - DRUMMER-1

LOGGING RUN	THERMOMETER DEPTH (m)	MAX. RECORDED TEMPERATURE (C°)	CIRCULATION TIME (t_k) (hours)	TIME AFTER CIRCULATION STOPPED (t)	HORNER TEMPERATURE (C°)	GEOHERMAL GRADIENT (C°/km)
<u>Suite 1</u>						
DDBHC-GR	817.0 m	75.0	1.0	2.3	-	-
<u>Suite 2</u>						
DLTE-MSFL-GR) combination LDTC-CNTH-GR) tool	2570.0 m	78.3	1.25	10.8	112.6	41.49
DDBHC-GR	2568.5	85.6	1.25	12.0		
HDT-GR	2570.0	87.5	1.25	16.5		

FIGURES



LOCALITY MAP DRUMMER - 1

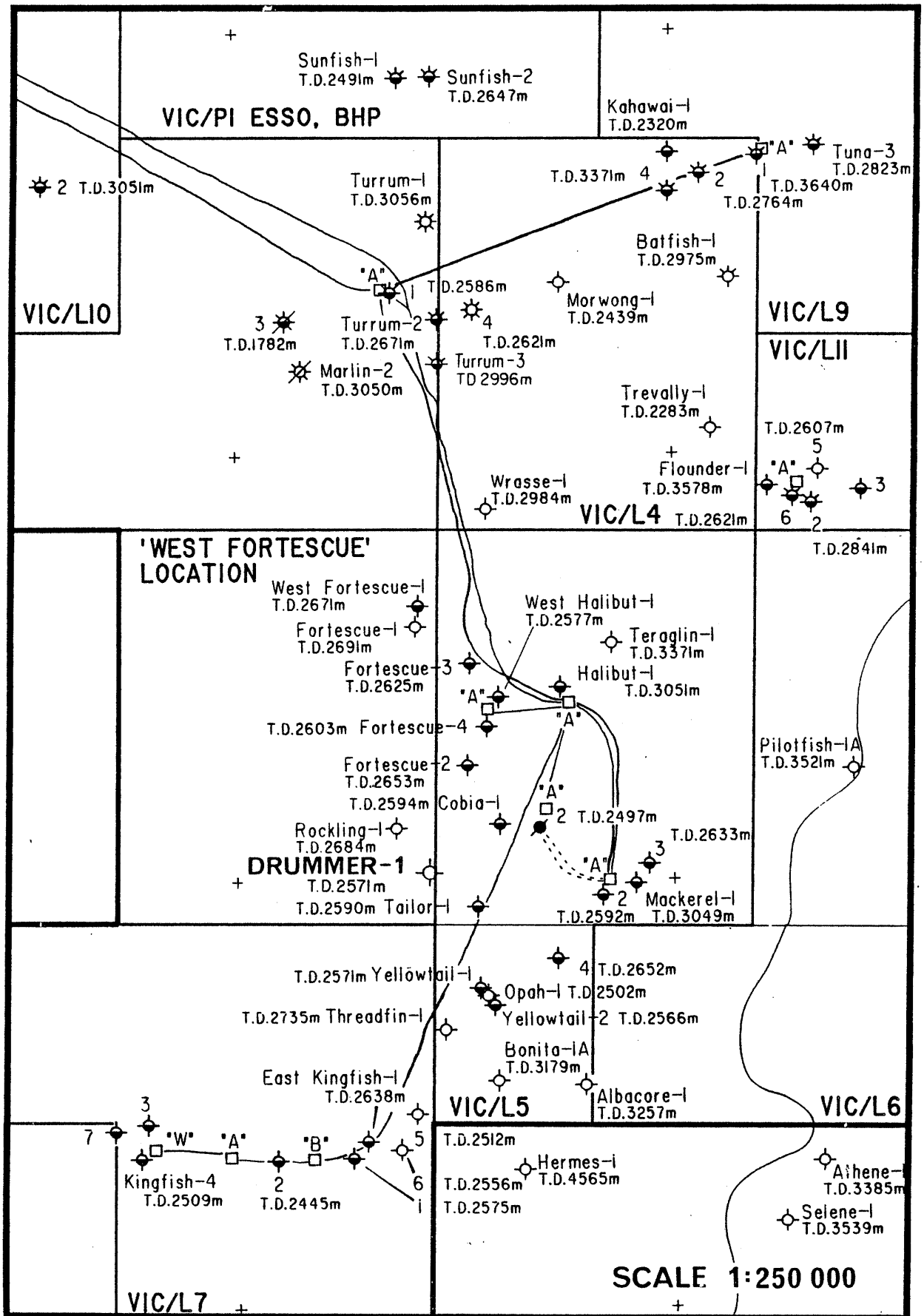


Figure 1

DRUMMER1 PROGRESS CURVE SOUTHERN CROSS

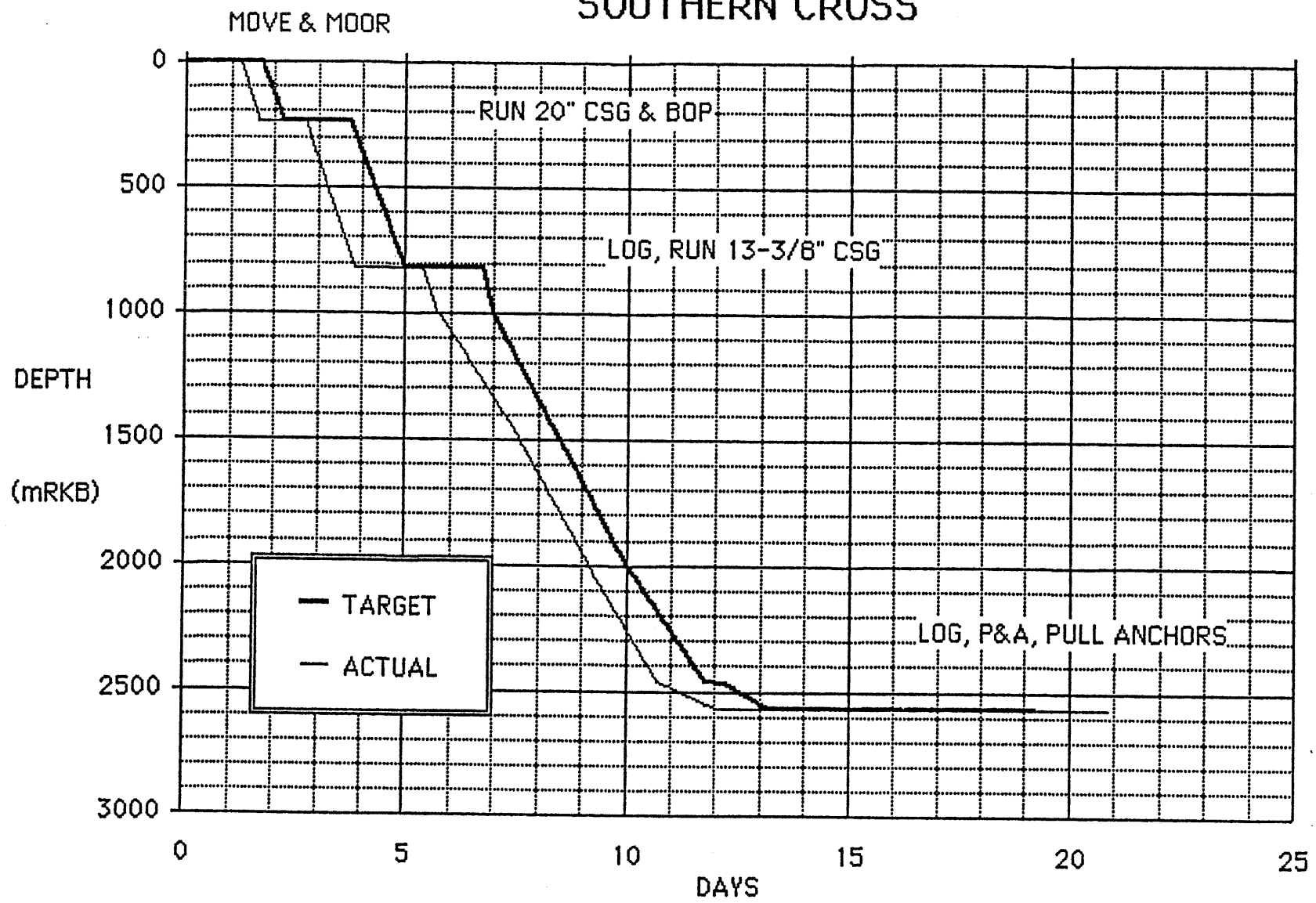


FIGURE 2

DRUMMER 1 WELLBORE SCHEMATIC

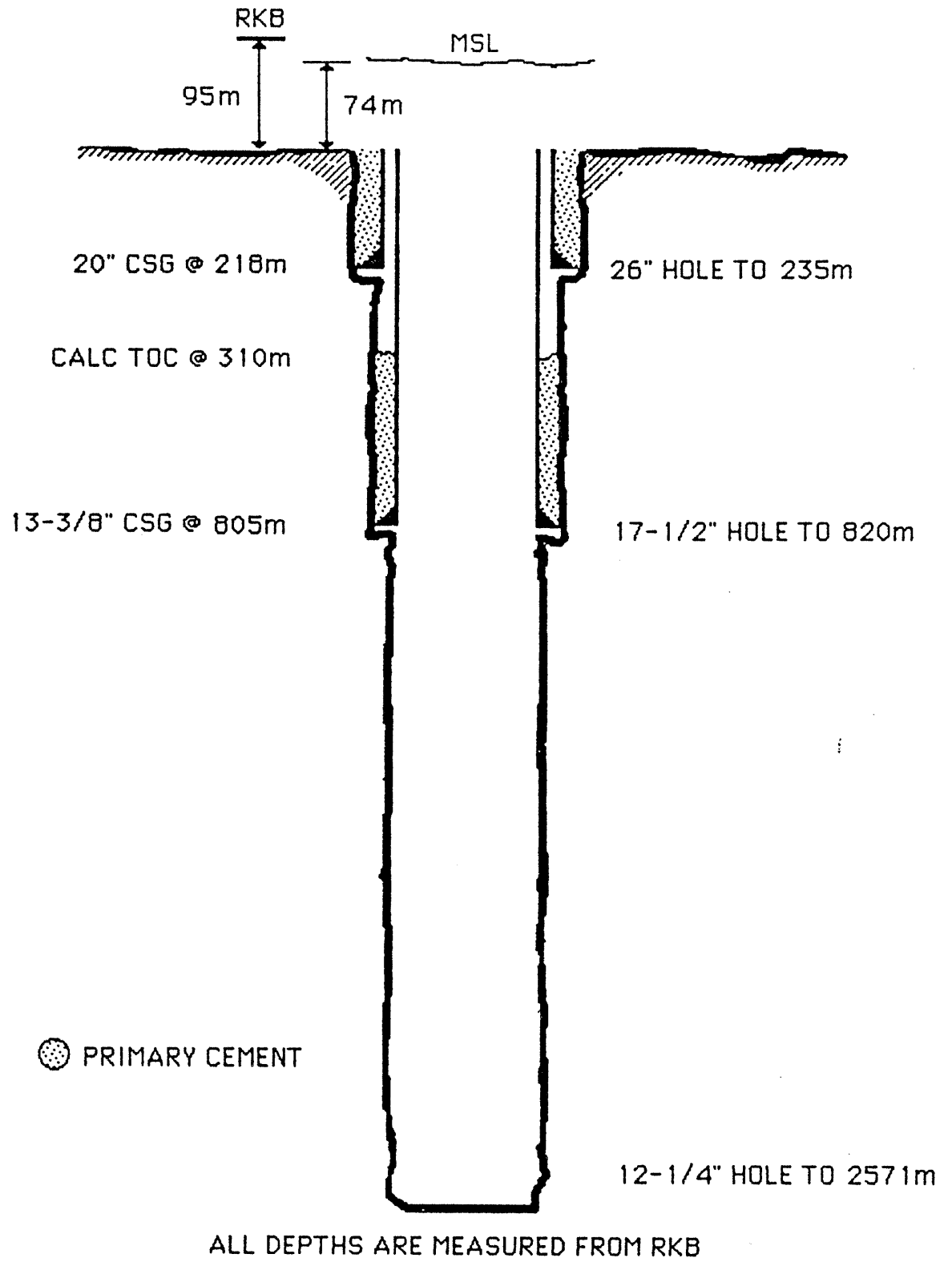
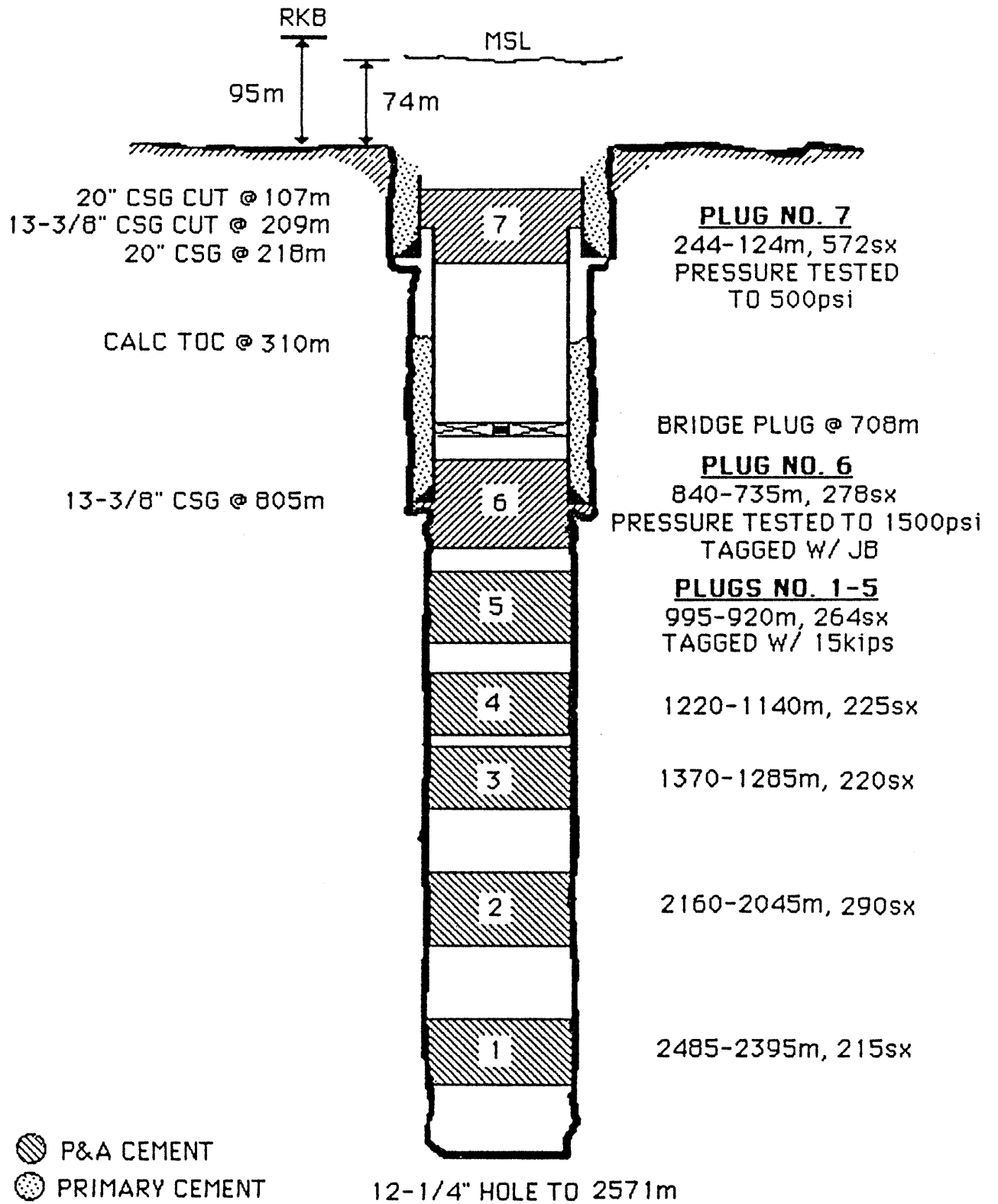


FIGURE 3

DRUMMER 1 ABANDONMENT SCHEMATIC



ALL DEPTHS ARE MEASURED FROM RKB

FIGURE 4

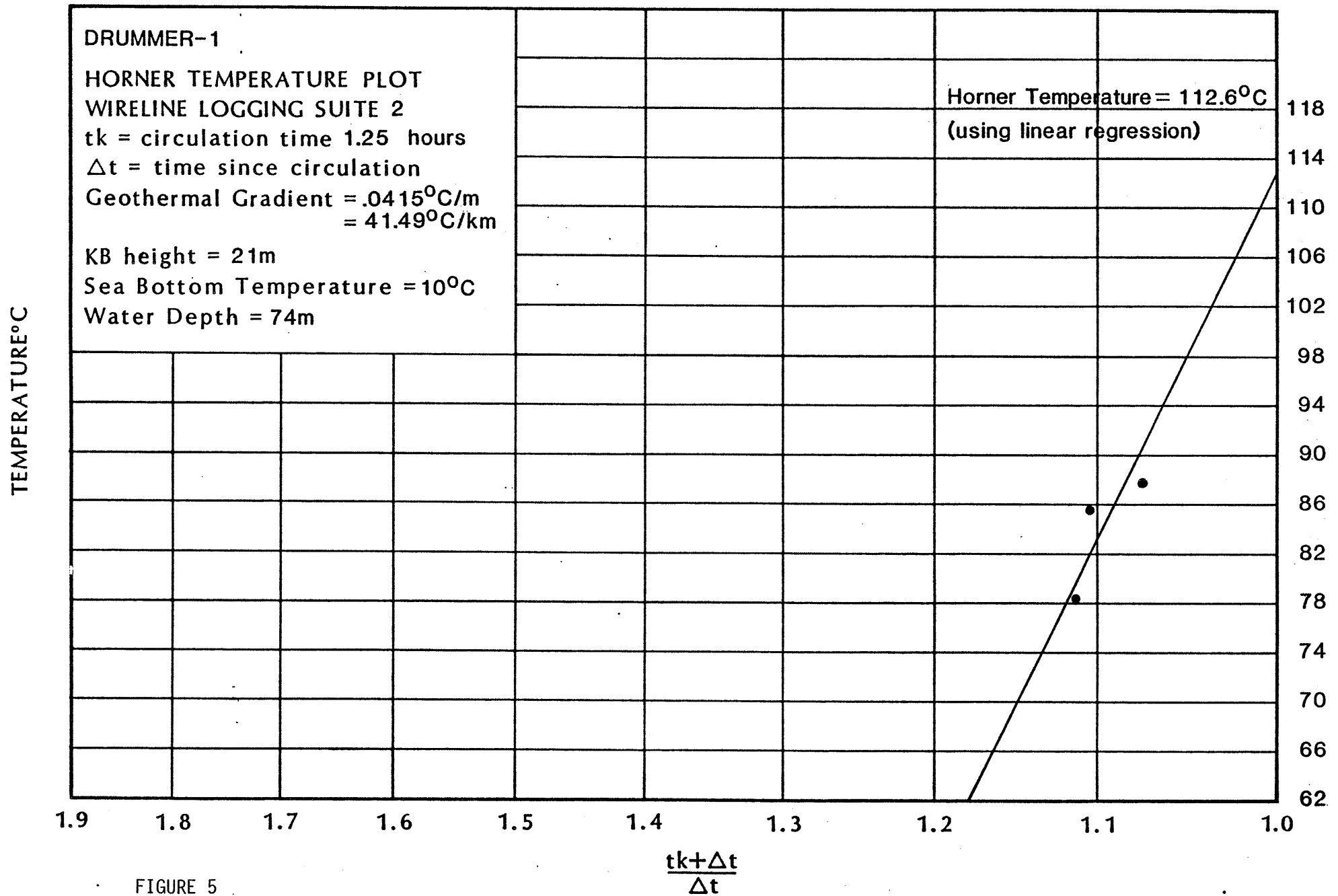


FIGURE 5

APPENDIX 1

DRUMMER-1

Lithology Descriptions

<u>Depth</u>	<u>%</u>	<u>Descriptions</u>
235-240m	60	CEMENT.
	30	SHELL FRAGMENTS.
	10	LIMESTONE: light grey to white, firm to moderately hard, fine grains abundant fossils.
240-250m	60	SHELL FRAGMENTS.
	30	CEMENT.
	10	LIMESTONE: white to grey, firm to hard, angular to subangular, argillaceous, fossils.
250-260m	50	SHELL FRAGMENTS: Yellow, brown, white
	30	LIMESTONE: as above.
	20	CEMENT.
260-270m	50	LIMESTONE: as above.
	40	SHELL FRAGMENTS:
	10	CEMENT.
270-280m	50	SHELL FRAGMENTS: as above.
	50	LIMESTONE: as above.
	Trace	CEMENT.
280-290m	80	CALCARENITE: as above.
	20	SHELL FRAGMENTS:
	Trace	CEMENT.
290-300m	90	CALCARENITE: white to grey, firm to hard, well sorted, abundant fossils, argillaceous.
	10	SHELL FRAGMENTS.
300-310m	100	CALCARENITE: white to light grey, firm to hard, well sorted, abundant fossils, abundant shell fragments, argillaceous.
310-320m	100	CALCARENITE: as above.
320-330	100	CALCARENITE: as above.
330-340m	100	CALCARENITE: white to light grey, firm, hard, well sorted, predominantly fine grains to coarse grains in parts, abundant fossils, abundant shell fragments. Calcite fragments abundant, platy, firm to hard, angular cuttings, opaque, white to clear.
340-350m	100	CALCARENITE: as above.
250-360m	100	CALCARENITE: as above, also grading to light grey to grey, argillaceous, otherwise as above.
360-370m	100	CALCARENITE: as above.
370-380m	100	CALCARENITE: as above.

380-390m	100	CALCARENITE: light grey to grey, occasionally firm to hard, well sorted, predominantly fine grained, occasionally coarse grained, fossils common, trace of shell fragments, argillaceous. Calcite fragments less common.
190-400m	100	CALCARENITE: as above.
400-410m	100 Trace Trace Trace	CALCARENITE: as above. FOSSIL FRAGMENTS: probable bivalves. GASTROPODS: Conical shells. FORAMS.
410-420m	100 Trace	CALCARENITE: as above, minor calcilutite. FOSSIL FRAGMENTS.
420-430m	100 Trace	CALCARENITE: as above. FORAMS.
430-440m	100 Trace Trace	CALCARENITE: as above. BRYOZOANS. FORAMS.
440-450m	100 Trace Trace Trace	CALCARENITE: as above. CALCILUTITE: FOSSIL FRAGMENTS. FORAMS.
450-460m	100 Trace Trace	LIMESTONE: 60% Calcarenite: as above. 40% Calcilutite: cream, very soft, highly calcareous FOSSIL FRAGMENTS. FORAMS.
460-470m	100 Trace	LIMESTONE: 70% Calcilutite, cream, very soft, gummy, highly calcareous. 30% Calcarenite, cream to light grey, friable to moderately hard, moderately poorly sorted, medium to fine grained, abundant skeletal remains, argillaceous, calcareous matrix and cement. FORAMS.
470-480m	100	LIMESTONE: 80% Calcilutite as above, 20% calcarenite as above.
480-490m	100	LIMESTONE: 10% Calcilutite as above, 90% calcarenite as above.
490-500m	100 Trace	LIMESTONE: 50% Calcilutite as above, 50% calcarenite as above. FORAMS: highly abundant.
500-510m	100	LIMESTONE: 80% Calcilutite as above, 20% Calcarenite as above, glauconite inclusions.
510-520m	100 Trace	LIMESTONE: 50% Calcilutite as above, 50% Calcarenite as above. FORAMS.

520-530m	100	LIMESTONE: 50% Calcilutite as above, 50% Calcisiltite as above. Trace FORAMS: abundant. Trace PYRITE. Trace SILTSTONE: Medium grey, moderately hard, non calcareous, carbonaceous inclusions.
530-540m	100	LIMESTONE: 70% Calcarenite as above, more glauconite; 30% Calcilutite as above. Trace FORAMS: abundant Trace PYRITIZED FOSSIL FRAGMENTS: Trace SHELL FRAGMENTS:
540-550m	100	LIMESTONE: all Calcilutite as above. Trace CALCARENITE: as above, glauconitic.
550-560m	100	LIMESTONE: 90% Calcilutite 10% Calcarenite.
560-570m	100	LIMESTONE: 80% Calcilutite 20% Calcarenite.
570-580m	100	LIMESTONE: 60% Calcarenite light to medium grey, moderately hard, very calcareous, glauconitic, fossiliferous, forams abundant. 40% Calcilutite: as above.
580-590m	100	LIMESTONE: 80% Calcarenite 20% Calcilutite.
590-600m	100	LIMESTONE: 100% Calcarenite silty in parts.
600-610m	100	LIMESTONE: 100% Calcarenite.
610-620m	100	LIMESTONE: 100% Calcarenite as above, glauconite inclusions.
620-630m	100	LIMESTONE: 100% Calcarenite as above, trace calcilutite as above. Trace FORAMS.
630-640m	100	CALCARENITE: as above.
640-650m	100	CALCARENITE: as above.
650-660m	100	CALCARENITE: as above.
660-670m	100	CALCARENITE: as above.
670-680m	100	CALCARENITE: as above; glauconitic inclusions. Trace FORAMS.
680-690m	100	CALCARENITE: as above.
690-700m	100	CALCARENITE: as above.
700-710m	100	CALCARENITE: Light grey to white grey, abundant fossils, moderately hard to hard. Trace PYRITE.
710-720m	100	CALCARENITE: Fossils as above.

720-730m	100 Trace	CALCARENITE: as above. PYRITE.
730-740m	100 Trace	CALCARENITE: as above. PYRITE.
740-750m	100 Trace	CALCARENITE: as above. QUARTZ.
750-760m	100	CALCARENITE: as above.
760-770m	100 Trace	CALCARENITE: as above. CARBONACEOUS SPECKS.
770-780m	100 Trace	CALCARENITE: light grey to grey, as above. QUARTZ.
780-790m	100	CALCARENITE: as above.
790-800m	100	CALCARENITE: as above.
800-810m	100 Trace	CALCARENITE: as above. CARBONACEOUS SPECKS.
810-820m	100 Trace	CALCARENITE: as above, glauconitic inclusions. FORAMS. POOH for 13 3/8" casing.
820-830m	70 30 Trace Trace	CEMENT. CALCARENITE. CARBONACEOUS SPECKS. Fossils.
830-840m	70 30 Trace	CALCARENITE. CEMENT. QUARTZ.
840-850m	70 30 Trace	CALCARENITE. CEMENT. QUARTZ.
850-860m	70 30 Trace	CALCARENITE: light grey to white, brittle. CEMENT. QUARTZ: Carbonaceous specks, fossils.
860-870m	90 10	LIMESTONE: 90% Calcarenite, 10% Calcilutite CEMENT.
870-880m	100	LIMESTONE: 90% Calcarenite, 10% Calcilutite.
880-890m	100 Trace	LIMESTONE: 70% Calcarenite, 30% Calcilulite. FOSSILS: Quartz, pyrite.
890-900m	100 Trace	LIMESTONE: 60 Calcarenite, 40% Calcilulite QUARTZ: Carbonaceous specks.
900-910m	100	LIMESTONE: 70% Calcarenite 30% Calcilutite as above.

910-920m	100	LIMESTONE: 70% Calcarenite 30% Calcilutite as above.
920-930m	100	LIMESTONE: 60% Calcarenite 40% Calcilutite as above.
930-940m	100	LIMESTONE: 60% Calcarenite 40% Calcilutite as above.
940-950m	100 Trace	LIMESTONE: 70% Calcarenite, grey, soft to hard, brittle. Calcilutite 30%, abundant fossils. CARBONACEOUS SPECKS.
950-960m	100	LIMESTONE: 70% Calcarenite, 30% Calcilutite as above.
960-970m	100	LIMESTONE: 60% Calcarenite: white to grey, firm to hard, abundant fossils, 30% Calcilutite: white to light grey, soft, sticky. 10% Calcisiltite: dark brown to brown, hard, blocky, angular.
970-980m	100 Trace	LIMESTONE: 70% Calcarenite, 30% Calcilutite. CALCISILTITE.
980-990m	100 Trace	LIMESTONE: 30% Calcilutite, 70% Calcarenite, fossils present. CALCISILTITE.
990-1000m	100	LIMESTONE: 60% Calcarenite, 40% Calcilutite.
1000-1010m	100	LIMESTONE: 50% Calcarenite, 50% Calcilutite
1010-1020m	100 Trace Trace	LIMESTONE: 50% Calcarenite, 50% Calcilutite. CALCISILTITE. FOSSILS.
1020-1030m	100 Trace Trace	LIMESTONE: 50% Calcarenite, brittle, very soft, 50% Calcilutite, minor fossils. CARBONACEOUS SPECKS. QUARTZ.
1030-1040m	100	LIMESTONE: 50% Calcarenite, 50% Calcilutite as above.
1040-1050m	100	LIMESTONE: 70% Calcarenite, mainly soft to brittle 30% Calcilutite, fossils.
1050-1060m	100	LIMESTONE: 80% Calcarenite, 20% Calcilutite as above.
1060-1070m	100	LIMESTONE: 50% Calcarenite, 50% Calcisiltite.
1070-1080m	100 Trace	LIMESTONE: 80% Calcarenite/Calcisiltite, 20% Calcilutite. PYRITE.
1080-1090m	100 Trace	LIMESTONE: 70% Calcisiltite/Calcarenite. 30% Calcilutite. FOSSILS.

1090-1100m	100 Trace	LIMESTONE: 60% Calcisiltite/Calcarenite. 40% Calcilutite. FOSSILS.
1100-1110m	100 Trace	LIMESTONE: 60% Calcisiltite. 40% Calcilutite. FOSSILS.
1110-1120m	100 Trace	LIMESTONE: 70% Calcisiltite. 30% Calcilutite. FOSSILS.
1120-1130m	100 Trace	LIMESTONE: 70% Calcisiltite. 30% Calcilutite. FOSSILS.
1130-1140m	100 Trace	LIMESTONE: 60% Calcisiltite. 40% Calcilutite. FOSSILS.
1140-1150m	100 Trace	LIMESTONE: 60% Calcisiltite. 40% Calcilutite. FOSSILS.
1150-1160m	100 Trace	LIMESTONE: 60% Calcisiltite, light grey, soft occasionally firm. Trace carbonaceous specks. 40% Calcilutite, light grey, very soft, trace carbonaceous specks, shell fragments and forams. FOSSILS: Glauconitic.
1160-1170m	100 Trace	LIMESTONE: 70% Calcisiltite, light grey, soft to firm, occasionally hard as above. 30% Calcilutite as above. FOSSILS.
1170-1180m	100	LIMESTONE: As above.
1180-1190m	100 Trace	LIMESTONE: 80% Calcisiltite, medium to blue grey, soft to firm occasionally hard, possibly dolomitic. 20% Calcilutite, medium blue grey, soft. FOSSILS: carbonaceous material, pyrite, quartz.
1190-1200m	100	LIMESTONE: 10% Calcilutite, light grey to white, very soft to soft, silty in parts, fossiliferous, forams. 90% Calcisiltite, grey brown to light grey, occasionally medium grey, soft to firm, occasionally sand size grains, blocky, carbonaceous flecks in parts, fossiliferous, forams. Trace mineral fluorescence. Grading to Calcareous, siltstone in parts.
1200-1210m	100 Trace	LIMESTONE: 90% Calcisiltite, medium grey to medium dark grey, soft to firm occasionally hard, occasional sand size grains, blocky. Trace carbonaceous flecks, fossiliferous, forams. Trace mineral fluorescence. 10% Calcilutite, light grey, white, very soft, silty in parts, fossils, forams. FOSSILS.

1210-1220m	100	LIMESTONE: 90% Calcisiltite, medium grey to medium dark grey, soft to firm occasionally moderately hard, brittle in parts, siliceous, occasional sand sized grains, blocky, trace carbonaceous flecks, fossiliferous, forams, trace mineral fluorescence. 10% Calcilutite as above.
	Trace	FOSSILS.
1220-1230m	100	LIMESTONE: 90% Calcisiltite as above. 10% Calcilutite as above.
	Trace	FOSSILS.
1230-1240m	100	LIMESTONE: 90% Calcisiltite, as above; 10% Calcilutite as above.
	Trace	FOSSILS.
1220-1230m	100	LIMESTONE: 90% Calcisiltite as above. 10% Calcilutite as above.
	Trace	FOSSILS.
1230-1240m	100	LIMESTONE: 90% Calcisiltite as above. 10% Calcilutite as above.
	Trace	FOSSILS.
1240-1250m	100	LIMESTONE: 90% Calcisiltite as above. 10% Calcilutite as above.
	Trace	FOSSILS.
1250-1260m	100	LIMESTONE: 100% Calcisiltite. Medium dark grey, soft/firm and occasionally dark grey, hard, blocky, trace carbonaceous flecks, shell fragments, forams. Trace mineral fluorescence.
	Trace	CALCILUTITE.
1260-1270m	100	CALCISILTITE: fossils
	Trace	CALCILUTITE.
1270-1280m	100	CALCISILTITE: as above
	Trace	QUARTZ.
1280-1290m	100	CALCISILTITE: light grey, firm, blocky, fossiliferous including forams and bryozoans, quartzose in part, slightly water sensitive silt matrix.
1290-1300m	100	CALCISILTITE: as above
	Trace	CARBONACEOUS SPECKS.
1300-1310m	100	CALCISILTITE: as above (white-grey)
	Trace	QUARTZITE.
1310-1320m	100	CALCISILTITE: Blue grey, firm, blocky, fossiliferous, forams and bryozoans, occasional sandgrains; slightly water sensitive siltstone matrix, carbonaceous specks.
	Trace	FOSSILS.

1320-1330m	100	CALCISILTITE: Blue grey, firm, blocky, fossiliferous, occasional sandgrains, occasional hard dark grey chips. Slightly water sensitive siltstone matrix, carbonaceous material, some pyritic.
1330-1340m	100	CALCISILTITE: Blue grey to dark grey, firm to hard, blocky, fossiliferous ranging from forams to bryozoans, quartzose in part; slightly water sensitive siltstone matrix, carbonaceous specks, trace quartz.
1340-1350m	100	CALCISILTITE: Blue grey, firm to occasionally hard, dark grey, blocky, fossiliferous, quartzose in part; slightly water sensitive siltstone matrix.
1350-1360m	100	CALCISILTITE: as above.
1360-1370m	100	CALCISILTITE: blue grey, soft to firm, blocky, fossiliferous, quartzose in part - slightly water sensitive siltstone matrix with carbonaceous specks.
1370-1380m	90 10	CALCISILTITE: as above. CALCILUTITE: blue grey, very soft, rounded, fossiliferous (forams, spicules), quartzose in part; slightly water sensitive siltstone matrix with carbonaceous specks.
1380-1390m	80 20	CALCISILTITE: as above. CALCILUTITE: as above.
1390-1400m	70 30	CALCISILTITE: as above. CALCILUTITE: as above.
1400-1410m	70 30	CALCISILTITE: as above. CALCILUTITE: as above.
1410-1420m	80 20	CALCISILTITE: grey, light grey, occasional blue grey, blocky, firm to soft, moderately hard in parts, sticky in parts, fossiliferous, forams/bryozoans, occasionally sandy in parts. CALCILUTITE: light grey/cream, speckled, very soft, water sensitive, gummy, silty in parts, fossiliferous.
1420-1430m	80 20	CALCISILTITE: as above. CALCILUTITE: as above.
1430-1440m	70 30	CALCISILTITE: as above. CALCILUTITE: as above.
1440-1450m	60 40	CALCISILTITE: as above CALCILUTITE: as above
1450-1460m	70 30	CALCISILTITE: white-grey, as above. CALCILUTITE: as above.

1460-1470m	70	CALCISILTITE: grey, brittle, hard to soft, carbonaceous.
	30	CALCILUTITE: light grey, carbonaceous, very soft; fossils.
	Trace	DOLOMITE.
1470-1480m	80	CALCISILTITE. as above.
	20	CALCILUTITE: as above.
1480-1490m	80	CALCISILTITE. as above.
	20	CALCILUTITE: as above.
1490-1500m	100	CALCISILTITE: light grey, buff, soft, carbonaceous specks scattered throughout, non-fossiliferous, grading in part to calcilutite.
1500-1510m	90	CALCISILTITE: as above; grading in part to calcilutite.
	10	CALCILUTITE: as above.
1510-1520m	90	CALCISILTITE: very light grey white to grey, soft/brittle to hard, grading in part to calcilutite.
	10	CALCILUTITE: white, soft; fossils.
	Trace	CARBONACEOUS SPECKS.
1520-1530m	60	CALCISILTITE: white to grey, fossiliferous, soft/brittle to hard, grading in part to Calcilutite.
	40	CALCAREOUS SILTSTONE.
1530-1540m	50	CALCISILTITE: as above.
	50	SILTSTONE: dark grey to grey, relatively firm, blocky, predominantly calcareous matrix, tight, no shows.
1540-1550m	50	CALCISILTITE: light grey to grey, soft to firm, blocky grading in part to Calcilutite, fossils, carbonaceous specks
	50	CALCILUTITE: light grey, soft, rounded.
1550-1560m	60	CALCISILTITE: grey, relatively firm, carbonaceous in part, blocky.
	40	CALCILUTITE: light grey to buff-white, rounded, water sensitive, soft, occasional very fine grained quartz inclusions, non-fossiliferous.
1560-1570m	80	CALCISILTITE: as above.
	20	CALCILUTITE: as above.
1570-1580m	70	CALCISILTITE: grey to occasional dark grey, relatively firm, carbonaceous, blocky, trace fossils.
	30	CALCILUTITE: light grey, buff-white, water sensitive, soft, grading to gumbo in part.
1580-1590m	70	CALCISILTITE: as above.
	30	CALCILUTITE: as above.

1590-1600m	70 30	CALCISILTITE: as above. CALCILUTITE: as above.
1600-1610m	80 20	CALCISILTITE: as above. CALCILUTITE: as above; very silty, some fossils.
1610-1620m	100	CALCISILTITE: off white to grey, mainly soft to moderately hard, occasionally hard, grading to Calcilutite in part, carbonaceous, minor fossils, very silty.
1620-1630m	100 Trace	CALCISILTITE: as above. CALCILUTITE: as above.
1630-1640m	100	CALCISILTITE: light grey, soft to moderately hard, carbonaceous, very silty, fossils.
1640-1650m	100	CALCISILTITE: as above.
1650-1660m	100	CALCISILTITE: as above (slightly harder).
1660-1670	100 Trace	CALCISILTITE: as above (softer again); grading to CALCILUTITE. CALCILUTITE.
1670-1680	100 Trace	CALCISILTITE: as above. CALCILUTITE: fossils.
1680-1690	100 Trace	CALCISILTITE: as above. CALCILUTITE.
1690-1700	100 Trace	CALCISILTITE: light grey to grey, soft to firm, some hard, very silty, grading to siltstone. FOSSILS.
1700-1710	100	CALCISILTITE: as above.
1710-1720	100	CALCISILTITE: grading to siltstone.
1720-1730	100 Trace	CALCISILTITE. CALCILUTITE.
1730-1740	70 30	CALCISILTITE: grey to occasionally dark grey, soft to occasionally firm, carbonaceous, blocky, non-fossiliferous. CALCILUTITE: light grey, buff white, water sensitive, soft, grading to gumbo in part.
1740-1750	100 Trace	CALCISILTITE. DOLOMITE.
1750-1760	100	CALCISILTITE.
1760-1770	100	CALCISILTITE: grey, carbonaceous, blocky, soft to firm.
1770-1780	100	CALCISILTITE: as above.
1780-1790	100	CALCISILTITE: as above.

1790-1800	100	CALCISILTITE: as above.
1800-1810	70	CALCISILTITE: light grey, blocky, soft to firm, carbonaceous, non-fossiliferous.
	30	SILTSTONE.
	Trace	DOLOMITE.
1810-1820	50	CALCISILTITE: as above.
	50	SILTSTONE: grey, firm to soft, blocky in a calcareous matrix.
1820-1830	60	SILTSTONE.
	40	CALCISILTITE: as above
1830-1840	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above
1840-1850	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above
1850-1860	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above
1860-1870	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above
	Trace	FOSSILS, DOLOMITE.
1870-1880	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above
1880-1890	70	CALCAREOUS SILTSTONE: as above.
	30	CALCISILTITE: as above.
	Trace	PYRITE, FOSSILS, DOLOMITE.
1890-1900	70	CALCAREOUS SILTSTONE: as above.
	30	CALCISILTITE: light grey, blocky, soft to firm, carbonaceous.
	Trace	FOSSILS.
1900-1910	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above.
	Trace	FOSSILS, DOLOMITE.
1910-1920	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above.
	Trace	FOSSILS, DOLOMITE, PYRITE.
1920-1930	70	CALCAREOUS SILTSTONE: as above.
	30	CALCISILTITE: as above.
	Trace	FOSSILS, DOLOMITE.
1930-1940	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above.
	Trace	FOSSILS, DOLOMITE, PYRITE.
1940-1950	60	CALCAREOUS SILTSTONE: as above.
	40	CALCISILTITE: as above

1950-1960	70	CALCAREOUS SILTSTONE: medium grey, blocky cuttings, moderately hard, carbonaceous, very calcareous.
	30	CALCISILTITE: light to medium grey, angular to blocky cuttings, soft to firm, carbonaceous, grades into calcareous siltstone.
	Trace	PYRITE NODULES.
1960-1970	70	CALCAREOUS SILTSTONE: as above.
	30	CALCISILTITE: as above.
1970-1980	70	CALCAREOUS SILTSTONE: grey, occasionally light grey, blocky, firm to moderately soft, occasionally soft, very fine grained calcareous matrix, argillaceous.
	30	CALCISILTITE: medium grey, firm to soft, blocky to rounded cuttings, silty in parts.
	Trace	FOSSILS, FORAMS.
1980-1990	80	CALCAREOUS SILTSTONE: grey, blocky, soft to moderately firm, occasional carbonaceous specks, very argillaceous in a predominantly calcareous matrix.
	20	CALCISILTITE: light grey, soft, blocky, water sensitive with occasional medium to coarse clay clasts, grading in part to calcareous siltstone.
	Trace	FOSSILS.
1990-2000	80	CALCAREOUS SILTSTONE: as above.
	20	CALCISILTITE: grading to gumbo in part, otherwise as above.
2000-2010	80	CALCAREOUS SILTSTONE: as above.
	20	CALCISILTITE: as above.
2010-2020	70	CALCAREOUS SILTSTONE: as above.
	30	CALCISILTITE: as above.
2020-2030	80	CALCAREOUS SILTSTONE: as above.
	20	CALCISILTITE: as above.
2030-2040	80	SILTSTONE: as above.
	20	CALCISILTITE: as above.
2040-2050	70	CALCAREOUS SILTSTONE: grey, blocky, soft to moderately firm, speckled appearance, occasional carbonaceous flecks, very argillaceous, very calcareous matrix.
	30	CALCISILTITE: Light grey to grey, very soft to soft, occasionally firm, blocky, silty in parts, occasional medium to coarse clay clasts, fossiliferous.
	Trace	PYRITE.
2050-2060	80	SILTSTONE: as above.
	20	CALCISILTITE: as above.
2060-2070	70	SILTSTONE: as above; very calcareous.
	30	CALCISILTITE: as above; fossiliferous.
	Trace	PYRITE.
	Trace	FORAMS.

2070-2080	80	SILTSTONE: as above.
	20	CALCISILTITE: as above.
	Trace	SANDSTONE.
	Trace	CALCITE CRYSTALS.
2080-2090	90	SILTSTONE: as above.
	10	CALCISILTITE: as above.
2090-2100	90	SILTSTONE: as above.
	10	CALCISILTITE: as above.
	Trace	SANDSTONE: clear, loose quartz grains, coarse grained, moderately sorted, subrounded to rounded.
2100-2110	90	SILTSTONE: grey, calcareous, soft to occasionally firm, blocky to occasionally angular, very argillaceous, carbonaceous specks.
	Trace	PYRITE.
	10	CALCISILTITE: Light grey to grey, very soft to soft, silty in parts, fossiliferous.
	Trace	SANDSTONE.
2110-2120	90	CALCAREOUS SILTSTONE: light grey to brown, blocky, relatively soft, predominantly calcareous matrix, occasional coarse rounded quartz grains scattered throughout, argillaceous.
	10	CALCISILTITE: light grey, buff, crypto-crystalline with broken fossil fragments, diminishing with depth.
	Trace	DOLOMITE.
2120-2130	100	CALCAREOUS SILTSTONE: as above.
2130-2140	100	CALCAREOUS SILTSTONE: as above.
2140-2150	100	CALCAREOUS SILTSTONE: as above.
2150-2160	100	CALCAREOUS SILTSTONE: as above.
2160-2170	100	CALCAREOUS SILTSTONE: as above.
2170-2180	90	CALCAREOUS SILTSTONE: as above.
	10	CALCISILTITE: light grey, buff, very soft, fossiliferous, blocky.
2180-2190	90	CALCAREOUS SILTSTONE: as above.
	10	CALCISILTITE: as above.
2190-2200	100	CALCAREOUS SILTSTONE: light grey to grey, blocky, relatively firm in a calcareous matrix, quartzose in part, argillaceous.
2200-2210	100	CALCAREOUS SILTSTONE: as above.
2210-2220	90	CALCAREOUS SILTSTONE: as above.
	10	CLAYSTONE: white, buff, soft to friable, water sensitive, argillaceous in parts.

2220-2230	80	CALCAREOUS SILTSTONE: grey to brown, firm to soft, micromicaceous, carbonaceous, scattered subrounded quartz inclusions, occasional fine to medium grained, dark clay clasts scattered throughout, predominantly calcareous matrix.
	20	CLAYSTONE: white, buff, soft to friable, water sensitive, argillaceous.
2230-2240	80	CALCAREOUS SILTSTONE: as above.
	20	CLAYSTONE: as above.
2240-2250	80	CALCAREOUS SILTSTONE: as above.
	20	CLAYSTONE: as above.
2250-2260	90	CALCAREOUS SILTSTONE: as above.
	10	CLAYSTONE: as above.
2260-2270	80	CALCAREOUS SILTSTONE: grey, brown to tan, soft to moderately firm, blocky cuttings, carbonaceous flecks, argillaceous in a calcaceous matrix, common coarse to very coarse pyrite clasts, occasional clay clasts, water sensitive in part.
	20	CLAYSTONE: white, buff, soft, very argillaceous, grading to gumbo.
2270-2280	90	CALCAREOUS SILTSTONE: as above.
	10	CLAYSTONE: as above.
2280-2290	100	CALCAREOUS SILTSTONE: as above.
2290-2300	100	SILTSTONE: diminishing calcareous matrix, otherwise as above.
2300-2310	80	SILTSTONE: as above.
	20	CLAYSTONE: as above.
2310-2320	80	SILTSTONE: as above.
	20	CLAYSTONE: as above.
2320-2330	70	SILTSTONE: grey, blocky to angular cuttings, subfissile, calcareous, argillaceous, soft to firm, moderately hard to brittle in part.
	30	CLAYSTONE: light grey, very soft, blocky to rounded cuttings, water sensitive.
	Trace	PYRITE.
2330-2340	80	SILTSTONE: as above.
	20	CLAYSTONE: as above.
2340-2350	90	SILTSTONE: as above.
	10	CLAYSTONE: as above.
2350-2360	90	SILTSTONE: as above.
	10	CLAYSTONE: as above.
2360-2370	90	SILTSTONE: as above.
	10	CLAYSTONE: as above.

2370-2380	100	SILTSTONE: as above.
2380-2390	90	SILTSTONE: grey, light brown, blocky cuttings predominantly firm and occasionally soft and water sensitive, very calcareous matrix, argillaceous.
	10	SANDSTONE: white, buff, very fine to fine grained, subrounded quartz grains in a predominantly calcareous, slightly argillaceous matrix, tight, no shows.
	Trace Trace	PYRITE: grading to a very fine sandstone. GLAUCONITE: medium to coarse, rounded pellets.
2390-2395	90	SILTSTONE: as above.
	10	SANDSTONE: increasing percentage of glauconite, otherwise as above.
2395-2400	90	SILTSTONE: as above.
	10	SANDSTONE: as above.
2400-2405	90	SILTSTONE: as above.
	10	SANDSTONE: as above.
2405-2410	80	SILTSTONE: as above.
	20	SANDSTONE: as above.
2410-2415	80	SILTSTONE: grey, pale brown, mainly firm, occasionally soft, calcareous, minor argillaceous content.
	20	SANDSTONE: pale grey, very fine to fine grained, subrounded quartz grains in a mainly calcareous matrix, occasionally medium grained, rounded, green glauconite pellets, tight, no shows.
2415-2420	70	SILTSTONE: as above.
	30	SANDSTONE: as above.
2420-2425	60	SILTSTONE: as above.
	40	SANDSTONE: as above.
2425-2430	70	SILTSTONE: as above.
	30	SANDSTONE: as above.
2430-2435	70	SILTSTONE: as above.
	30	SANDSTONE: as above.
2435-2440	80	SILTSTONE: as above.
	20	SANDSTONE: as above.
2440-2445	50	SANDSTONE: light grey, beige, buff, very fine to fine, subrounded quartz aggregates in a siliceous to calcareous matrix, silty in parts, common coarse, angular glauconite scattered throughout.
	50 Trace	SILTSTONE: as above. PYRITE.

2445-2450	60	SANDSTONE: various colours, including white, buff, grey brown, black, very fine to medium grained, subrounded to subangular, slightly calcareous, silty matrix, micaceous, common coarse dark green glauconite pellets, possible chloritic or feldspathic accessories, occasional scattered clear, subrounded quartz clasts, tight, no shows.
	40	SILTSTONE: grey, beige, blocky cuttings, slightly calcareous matrix, carbonaceous, argillaceous, grading to very fine sandstone.
2450-2455	60	SANDSTONE: clear to translucent, subrounded, coarse to pebble quartz fragments becoming more abundant, common coarse pyrite.
	40	SILTSTONE: as above.
2455-2460	80	SANDSTONE: clear, translucent, subrounded to subangular, loose coarse to pebble sized quartz fragments, occasionally fine to medium grained, glauconitic sandstone, good inferred porosity, no shows.
	Trace	PYRITE.
	20	SILTSTONE: as above.
2460-2465	80	SANDSTONE: as above.
	20	SILTSTONE: as above.
2465-2470	80	SANDSTONE: as above.
	20	SILTSTONE: as above.
2470-2475	80	SANDSTONE: as above.
	20	SILTSTONE: as above.
2475-2480	90	SANDSTONE: no glauconitic sandstone, otherwise as above.
	10	SILTSTONE: as above.
2480-2485	90	SANDSTONE: clear, translucent, subrounded to subangular, loose quartz grains, predominantly very coarse to granular, occasional pyrite concentrations, well sorted, good inferred porosity, no shows.
	10	SILTSTONE: light grey, blocky cuttings, firm, siliceous, clean, occasionally argillaceous.
	90	SANDSTONE: as above.
2485-2490	90	SANDSTONE: as above.
	10	SILTSTONE: as above.
2490-2495	90	SANDSTONE: as above.
	10	SILTSTONE: as above.
2495-2500	90	SANDSTONE: clear, translucent, occasionally yellow, rounded to subangular, loose quartz grains, becoming finer grained with depth, predominantly medium to coarse grained, occasionally granular to very coarse grained, well sorted, good inferred porosity, no shows.
	10	SILTSTONE: as above.

2500-2505	40	SANDSTONE: as above.
	60	SILTSTONE: as above.
2505-2510	30	SANDSTONE: as above.
	70	SILTSTONE: as above.
2510-2515	30	SANDSTONE: as above.
	70	SILTSTONE: as above.
	Trace	COAL.
2515-2520	80	SANDSTONE: as above.
	20	SILTSTONE: as above.
2520-2525	90	SANDSTONE: clear, translucent, subrounded to subangular, loose coarse to granular quartz grains, good sorting, good inferred porosity, no shows.
	10	SILTSTONE: light grey, siliceous, clean, firm to occasionally soft.
2525-2530	100	SANDSTONE: as above.
2530-2535	100	SANDSTONE: as above.
	Trace	COAL.
2535-2540	100	SANDSTONE: as above.
2540-2545	100	SANDSTONE: as above.
2545-2550	100	SANDSTONE: clear, translucent, sub rounded loose coarse to granular sized grains, good sorting, good inferred porosity, no shows.
2550-2555	100	SANDSTONE: as above.
2555-2560	100	SANDSTONE: as above.
2560-2565	100	SANDSTONE: becoming finer grained ranging from medium to coarse grained, good sorting, clean, excellent inferred porosity.
2565-2571	100	SANDSTONE: as above.

APPENDIX 2

DRUMMER-1SIDEWALL CORE DESCRIPTIONS

<u>No.</u>	<u>Depth</u>	<u>Rec.</u> (mm)	<u>Rock</u> <u>Type</u>	<u>Description</u>
1	2541.0		SILTSTONE	grey siltstone, soft; argillaceous, with quartz grains.
2	2539.0		SHALE	black hard, pyritic, silty.
3	2534.20		SHALE	black, firm; carbonaceous, coaly.
4	2531.50		SILTSTONE	grey siltstone, firm; argillaceous, micaceous.
5	2511.50		SHALE	black, firm; carbonaceous, pyritic.
6	2509.0		SANDSTONE	white to grey, fine to very fine grained, moderately sorted, subrounded; friable; argillaceous, carbonaceous.
7	2504.5		SHALE	brown, soft; argillaceous, carbonaceous.
8	2502.5		SANDSTONE	white to grey, very fine to fine grained, well sorted, subrounded, friable; pyritic, mica.
9	2500.1		SILTSTONE	white to grey, friable; pyritic, carbonaceous, argillaceous.
10	2499.0		SHALE	black, firm; carbonaceous.
11	2496.0		SHALE	black, hard; carbonaceous, coaly, pyritic.
12	2493.5		SANDSTONE	white to grey, medium to coarse grained, subangular; carbonaceous, silty.
13	2487.8		SILTSTONE	light grey, hard; quartzitic.
14	2485.5		SILTSTONE	light grey, soft; quartzitic.
15	2481.2		SILTSTONE	light grey, firm; quartzitic, micaceous.
16	2478.8		SHALE	black firm; carbonaceous, coaly.
17	2450.2		SHALE	black, hard; carbonaceous, coaly.
18	2448.2		SHALE	black, hard; carbonaceous, coaly.
19	2446.7		SANDSTONE	black, medium grained, poorly sorted, subrounded to subangular, hard; carbonaceous, coaly.
20	2445.0		SANDSTONE	white to grey, fine to very fine grained, well sorted, subrounded to subangular, friable; silty.

21	2443.5	SANDSTONE	grey green, silty to medium grained, poorly sorted, subrounded to subangular, friable; glauconite, carbonaceous.
22	2441.5	SILTSTONE	dark brown, firm; coaly, carbonaceous, argillaceous.
23	2439.5	SILTSTONE	brown, firm; mica, carbonaceous, sandy.
24	2438.5	SILTSTONE	brown, firm; mica, carbonaceous, sandy.
25	2436.5	SILTSTONE	brown, firm; mica, carbonaceous, sandy.
26	2435.0	SILTSTONE	light brown, firm; glauconite, carbonaceous, pyritic.
27	2433.0	CLAYSTONE	light grey, soft; glauconite, argillaceous.
28	2431.5	CLAYSTONE	light grey, soft; glauconite, argillaceous, pyritic.
29	2429.0	CLAYSTONE	light brown, soft; glauconite, argillaceous, carbonaceous.
30	2427.5	CLAYSTONE	light brown, soft; glauconite, argillaceous, carbonaceous.

APPENDIX 3

RFT PRESSURE DATA

WELL: DRUMMER-1
 DATE: 13th October, 1985

GEOLOGIST/ENGINEER: JEFF ROCHE

RFT No. Run/Seat	Depth		Initial Hydrostatic HP / RFT gauge psia / psig	Time Set	Minimum Flowing Pressure psia (Pretest)	Formation Pressure		Temp °C	Time Retract	Final Hydrostatic HP psia	Comments (include Probe type)
	m MDKB	m TVDSS KB=21				ppg	ppg				
1/1	2555.0	2534.0	4018.0/4002	07:27	3426.0	3533.9/3518	8.1	90.4	07:36	4016.8	Good PT L
1/2	2545.0	2524.0	3999.8/3984	07:43	26.0	3521.4/3503	8.1	89.2	07:59	3999.0/3981	Tight L
1/3	2525.5	2504.5	3969.2/3950	08:05	3468.0	3491.9/3473	8.1	88.4	08:18	3970.0/3950	Good PT L
1/4	2515.0	2494.0	3950.8/3921	08:25	2002.0	3476.7/3440	8.1	88.0	08:37	3951.8/3919	Good PT L
1/5	2493.0	2471.2	3912.4/3895	08:25	3079.0	3444.7/3425	8.1	87.0	09:07	3915.7/3897	Good PT L
1/6	2472.0	2451.0	3881.7/3863	09:18	3122.0	3415.2/3396	8.1	85.7	09:33	3883.0/8865	Good PT L
1/7	2455.0	2434.0	3854.9/3838	09:41	3.0	-	-	85.1	09:43	3857.8/ -	Tight L

RFT PRESSURE DATA

WELL: DRUMMER-1
 DATE: 13th October, 1985

GEOLOGIST/ENGINEER: JEFF ROCHE

RFT No. Run/Seat	Depth		Initial Hydrostatic HP / RFT gauge psia / psig	Time Set	Minimum Flowing Pressure psia (Pretest)	Formation Pressure HP / RFT gauge psia / psig	Temp °C	Time Retract	Final Hydrostatic HP psia	Comments (include Probe type)
	m MDKB	m TVDSS KB=21								
1/8	2456.1	2435.1	3857.0/3840 9.2	09:48	7.0	-	84.7	09:50	3861.0/3839	Tight L = Long nose probe M = Martineau probe
1/9 1/10	2453.0	2432.0	3853.8/3835 9.2	09:55 09:57	6.0 6.0	-	84.7	09:56 09:59	3856.0/ -	Tight
1/11	2462.0	2441.0	3868.0/3851 9.2	10:04	3163.0	3401.1/3383 8.1	84.8	10:09	3867.7/3851	Good PT

APPENDIX 4

VELOCITY SURVEY REPORT

1. Marine Velocity Survey Report.
2. Schlumberger Velocity Report.
 - a. Data Acquisition.
 - b. Processing Parameters.
 - c. Shot Data.
 - d. Sonic Calibration.
 - e. Sonic Calibration Processing.
 - f. Geogram Processing.
3. Schlumberger Field Report.
4. Check Shot Data Observed and Corrected.

FIGURES

1. Schlumberger Wavelet Polarity Convention.
2. Gun Geometry Sketch.

ENCLOSURES

1. Schlumberger Seismic Calibration Log Drift Curve, Adjusted Continuous Velocity Log, and Time/Depth Log Velocities.
2. Schlumberger WST Raw Stack & Stack shots.
3. Schlumberger Geogram.
4. Time-Depth Curve.

2322L:1

1. MARINE VELOCITY SURVEY REPORT

CONTRACTOR: Schlumberger

BASIN: Gippsland

WELL: Drummer-1

LEASE: W. Fortescue Location

CO-ORDINATES: 38⁰ 28' 33.99" S
148⁰ 14' 58.34" E

RIG: Southern Cross

ELEVATIONS: Ground Level at - 74.0m AMSL
Derrick Floor at 20.7m AMSL

DATE OF SURVEY: October 13, 1985

CASING DEPTHS: 20" @ 218m, 13 3/8 @ 805.5m

TD AT SHOOTING: 2570

NO OF SHOOTING LEVELS: 12

RECORDED BY: D. Dawson

WITNESSED BY: D.J. Lee

2322L:2

2. SCHLUMBERGER VELOCITY REPORT

a. DATA ACQUISITION

Field Equipment

Energy Source: Bolt airgun, 200 cu. in.

Source offset: 41m

Source Depth: 9m below MSL.

Source Azimuth: 50⁰

Reference Sensor: Accelerometer

Sensor Offset: 41m

Sensor Depth: 9m below MSL.

Sensor Azimuth: 50⁰

Downhole Geophone: Geospace HS-1
High Temp. (350⁰F), Coil.
Resist. 225 Ohms + 10%,
Natural Freq. 8-12 Hz,
Sensitivity 0.45 V/in/sec
Maximum tilt angle 60⁰

Recording Instrument: Schlumberger Computerised Service Unit
(CSU) using LIS format.

2322L:3

b. PROCESSING PARAMETERS

Seismic Reference Datum (SRD):	Mean Sea Level.
Elevation Derrick Floor:	20.7m AMSL
Elevation Kelly Bushing:	21.0m AMSL
Elevation Ground Level:	-74.0m AMSL
No. of Levels	12
Well Deviation:	Nil
Total Depth:	2570m below DF
Sonic Log Interval:	2240-2568m below DF
Density Log Interval:	942-995m below DF 1305-1348m below DF 2346-2568m below DF

c. SHOT DATA

A total of 12 check levels were shot during the survey.

The level at 515 metres below DF was shot both going into and coming out of the well. The transit times from both sets of data are similar. The bottom level at 2568 metres is noisy and has been omitted from the sonic calibration. The general data quality is good.

2322L:4

c. SHOT DATA (continued)

Level Depth (in below DF)	Stacked Shots	Rejected Shots	Quality	Comments
94.7	-	-	-	Imposed shot - sea floor
240	-	-	-	Imposed shot - top of sonic
300	4	0	Good	
515	5	1	Good	Shot going in
	11	9	Good	
820	4	1	Good	
1065	3	0	Good	
1327	3	0	Good	
1500	4	2	Good	
1800	3	1	Good	
2125	3	1	Good	
2324	3	1	Good	
2433	4	1	Good	
2560	6	0	Good	
2568	7	7	Good	Omitted

d. SONIC CALIBRATION

A 'drift' curve is obtained using the sonic log and the vertical check level times. The term 'drift' is defined as the seismic time (from check shots) minus the sonic time (from integration of edited sonic). Commonly the word 'drift' is used to identify the above difference, or to identify the gradient of drift verses increasing depth, or to identify a difference of drift between two levels.

The gradient of drift, that is the slope of the drive curve, can be negative or positive.

For a negative drift $\frac{\Delta \text{drift}}{\Delta \text{depth}} < 0$, the sonic time is greater than the seismic time over a certain section of the log.

2322L:5

For a positive drift $\frac{\Delta \text{drift}}{\Delta \text{depth}} > 0$, the sonic time is less than the seismic time over a certain section of the log.

The drift curve, between two levels, is then an indication of the error on the integrated sonic or an indication of the amount of correction required on the sonic to have the TTI of the corrected sonic match the check shot times.

Two methods of correction to the sonic log are used.

1. Uniform or block shift This method applies a uniform correction to all of the sonic values over the interval. This uniform correction is applied in the case of positive drift and is the average correction represented by the drift curve gradient expressed in usec/m.
2. TMinimum In the case of negative drift a second method is used, called t minimum. This applies a differential correction to the sonic log, where it is assumed that the greatest amount of transit time error is caused by the lower velocity sections of the log. Over a given interval the method will correct only t values which are higher than a threshold, the t_{\min} . Values of which are lower than the threshold are not corrected. The correction is a reduction of the excess of t over t_{\min} , $t - t_{\min}$.

is reduced through multiplication by a reduction coefficient which remains constant over the interval. This reduction coefficient, named G, can be defined as:

$$G = 1 + \frac{\text{drift}}{\int (\Delta t - \Delta t_{\min}) dz}$$

Where drift is the drift over the interval to be corrected and the value $\int (\Delta t - \Delta t_{\min}) dZ$ is the time difference between the integrals of the two curves Δt and Δt_{\min} , only over the intervals where $\Delta t > \Delta t_{\min}$.

Hence the corrected sonic: $t = G(\Delta t - \Delta t_{\min}) + \Delta t_{\min}$.

e. SONIC CALIBRATION PROCESSING

Open Hole Logs

Both the sonic and density logs used have been edited prior to input into the WST chain.

Density log data was available only over three small intervals. The data quality was good over the logged intervals and no patching of the data was necessary. The intermediate sections of the log have been spliced by linearly interpolating the density values from the end of a section to the beginning of the next.

The sonic log has been patched over zones of cycle skipping.

Source Offset

The source offset was calculated by recording the transit time from the gun to a hydrophone positioned in the moonpool, 2.2 metres from the wellhead. A moonpool hydrophone transit time of 26 milliseecs was measured. Using this time and a water velocity of 1480 metres/sec an offset of 39 metres was calculated between gun and moonpool hydrophone. Hence the offset of the gun from the wellhead was calculated as $39 + 2.2 = 41.2$ metres.

2322L:7

Correction to Datum

Seismic Reference Datum (SRD) is at Mean Sea Level. The airgun was positioned 9 metres below MSL. Using a water velocity of 1480 metres/sec a correction of 6.08 millisecs has been applied vertically between gun and datum.

Imposed Shots and Velocity Modelling

Two imposed shots were used in addition to the checkshot data to calibrate the sonic log.

1. Sea floor: depth 94.7 metres below DF, water velocity 1480 metres/sec.
2. Top sonic: depth 240.0 metres below DF. The velocities above and below this level were chosen to maintain a linear sonic drift curve from this level down to lower check levels.

The velocity model used is displayed below. Depths stated are referenced to metres below Derrick Floor and metres below Mean Sea Level respectively.

SRD	_____	207.7 / 0.0 metres
	1480 metres/sec	
Seabed	_____	94.7 / 74 metres
	2083 metres/sec	
Top of Sonic	_____	240.0 / 219.3 metres

2322L:8

Sonic Calibration Results

The top of the sonic log is chosen as the origin for the calibration drift curve. The drift curve indicates a number of corrections to be made to the sonic log. A list of shifts used on the sonic data is given below.

Depth Interval (m below DF)	Block Shift usec/m	Δt_{\min} usec/m	Equiv. Block Shift usec/m
240-1328	6.66	-	6.66
1328-1742	10.99	-	10.99
1742-2122	9.74	-	9.74
2122-2568	7.85	-	7.85

The adjusted sonic curve is considered to be the best result using the available data.

f. GEOGRAM PROCESSING

Geograms were generated using 20,25,30 and 35 hertz Ricker wavelets. The presentations include both normal and reverses polarity at 3.75in/sec.

Geogram processing produces synthetic seismic traces based on reflection coefficients generated from sonic and density measurements in the well-bore. The steps in the processing chain are the following:

- Time to depth conversion
- Generate reflection coefficients
- Generate attenuation coefficients
- Choose a suitable wavelet
- Convolution
- Output

2322L:9

Time to Depth Conversion

Open hole logs are recorded from the bottom to top with a depth index. This data is converted to a two-way time index and flipped to read from the top to bottom in order to match the seismic section.

Primary Reflection Coefficients

Sonic and density data are averaged over chosen time intervals (normally 2 or 4 milliseconds). Reflection coefficients are then computed using:

$$R = \frac{\rho_2 \cdot v_2 - \rho_1 \cdot v_1}{\rho_2 \cdot v_2 + \rho_1 \cdot v_1}$$

where

ρ_1 = density of the layer above the reflection interface

ρ_2 = density of the layer below the reflection interface

v_1 = compressional wave velocity of the layer above the reflection interface

v_2 = compressional wave velocity of the layer below the reflection interface

This computation is done for each time interval to generate a set of primary reflection coefficients without transmission losses.

Primaries with Transmission Loss

Transmission loss on two-way attenuation coefficients are computed using:

$$A_n = (1-R_1^2) \cdot (1-R_2^2) \cdot (1-R_3^2) \dots (1-R_n^2)$$

A set of primary reflection coefficients with transmission loss is generated using:

$$\text{Primary}_n = R_n A_{n-1}$$

Primaries plus Multiples

Multiples are computed from these input reflection coefficients using the transform technique from the top of the well to obtain the impulse response of the earth. The transform outputs primaries plus multiples.

Multiples Only

By subtracting previously calculated primaries from the above result we obtain multiples only.

Wavelet

A theoretical wavelet is chosen to use for convolution with the reflection coefficients previously generated. Choices available include:

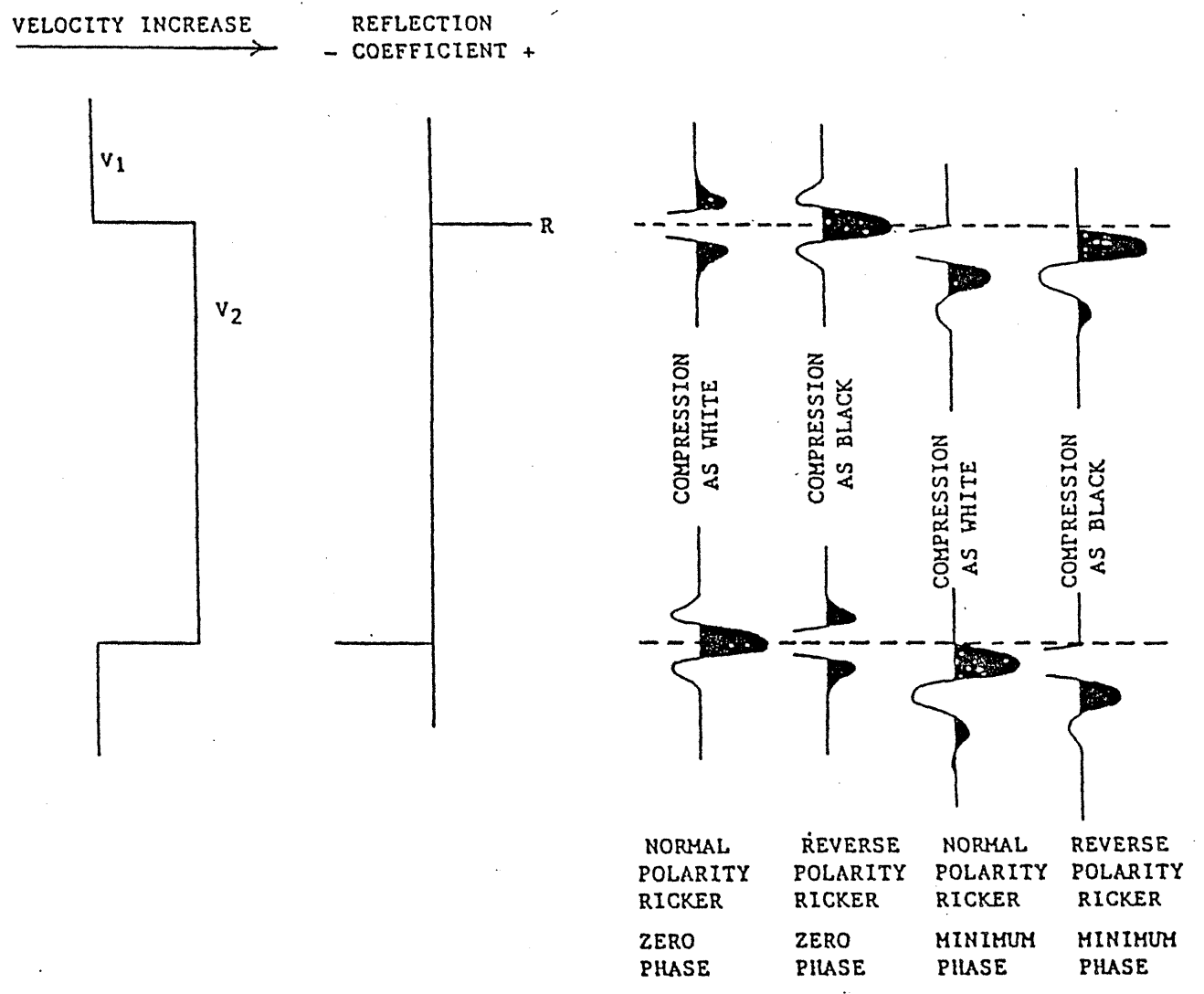
- Klauder wavelet
- Ricker zero phase wavelet
- Ricker minimum phase wavelet
- User defined wavelet.

All wavelets can be chosen with or without butterworth filtering and with user defined centre frequencies. Polarity conventions are shown in Figure 1. These Geograms were generated using zero and minimum phase ricker wavelets.

Convolution

Standard procedure of convolution of wavelet with reflection coefficients. The output is the synthetic seismogram.

SCHLUMBERGER WAVELET POLARITY CONVENTION



NOTE: WAVELET DISPLAYED UNDER GEOGRAMS ARE FOR A REFLECTION COEFFICIENT OF -0

FIGURE 1

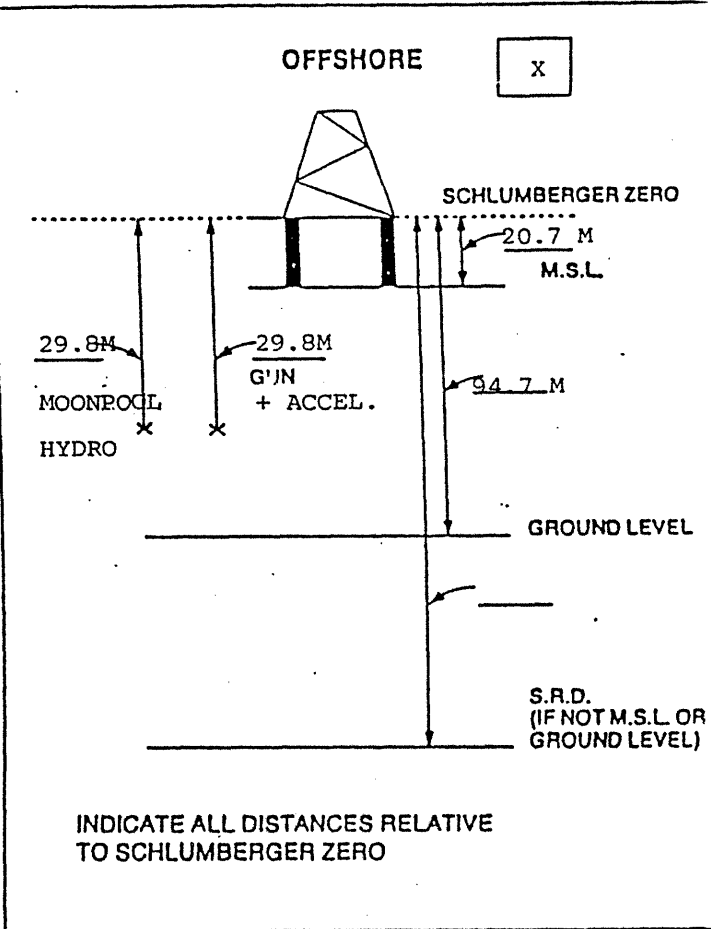
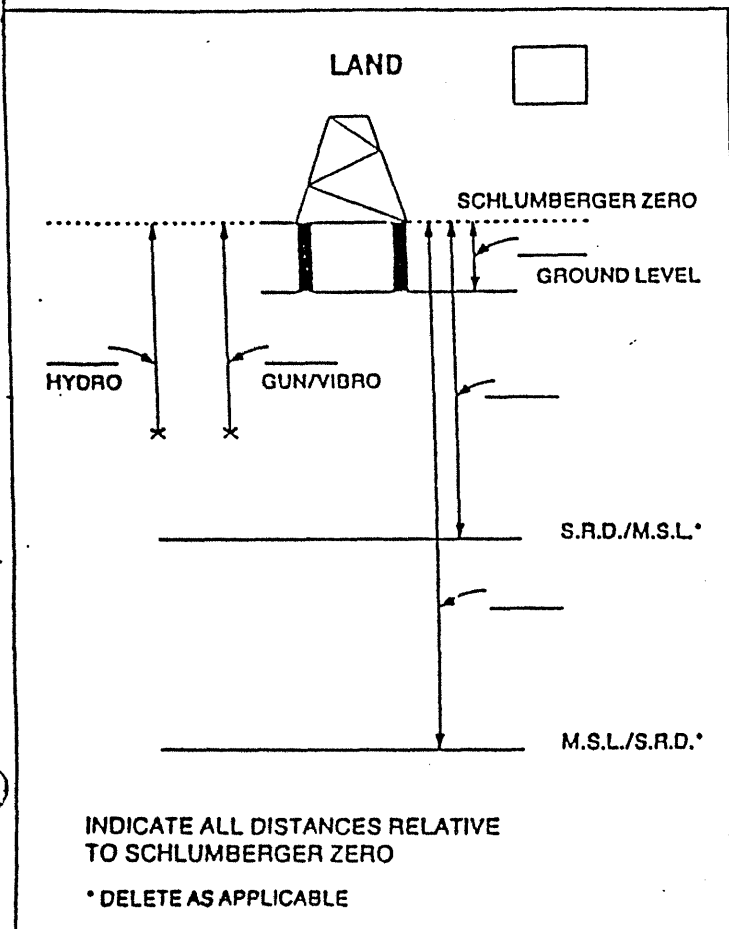
Schlumberger

GUN GEOMETRY SKETCH

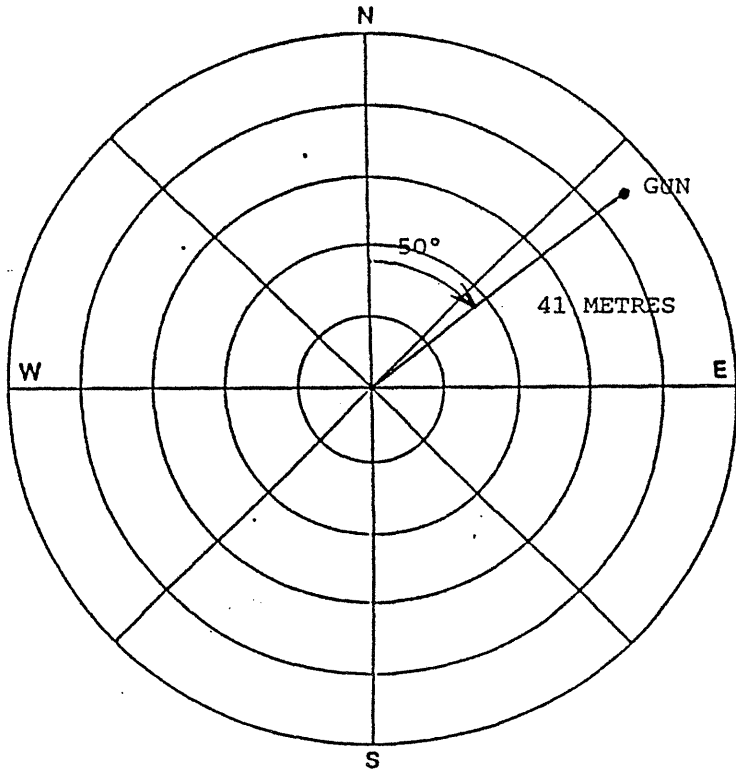
CLIENT: ESSO AUSTRALIA LTD.

WELL: DRUMMER #1

DATE: 13/10/85



SHOT POS'N	GUN OFFSET	ACCEL OFFSET	GUN DEPTH	ACCEL DEPTH
1	41M	9 M	41M	9 M
2				
3				
4				
5				
6				
7				



INDICATE GUN/VIBRO AND HYDROPHONE OFFSET AND AZIMUTH RELATIVE TO NORTH

4. CHECKSHOT DATA OBSERVED AND CORRECTED

DRUMMER-1 VELOCITY SURVEY

LEVEL NUMBER	MEASURED DEPTH FROM DF M	VERTICAL DEPTH FROM SRD M	VERTICAL DEPTH FROM GL M	OBSERVED TRAVEL TIME HYD/GEO MS*	VERTICAL TRAVEL TIME SRC/GEO MS	VERTICAL TRAVEL TIME SRD/GEO MS	AVERAGE VELOC SRD/GEO M/S	DELTA DEPTH BETWEEN SHOTS M	DELTA TIME BETWEEN SHOTS MS	INTERV VELOC BETWEEN SHOTS M/S
1	94.78	74.00	0	51.90	43.90	49.98	1480			
2	240.00	219.30	146.30	115.80	113.66	119.74	1831	145.30	69.76	2083
3	300.00	279.30	205.30	144.00	142.37	148.45	1881	60.00	28.71	2090
4	515.00	494.30	420.30	233.00	232.17	238.25	2075	215.00	89.80	2394
5	820.00	799.30	725.30	341.00	340.54	346.62	2306	305.00	108.37	2814
6	1065.00	1044.30	970.30	422.00	421.67	427.75	2441	245.00	81.13	3020
7	1327.00	1306.30	1232.30	503.00	502.75	508.83	2567	262.00	81.08	3231
8	1500.00	1479.30	1405.30	555.00	554.78	560.87	2638	173.00	52.04	3325
9	1800.00	1779.30	1705.30	655.00	654.82	660.91	2692	300.00	100.04	2999
10	2125.00	2104.30	2030.30	760.00	759.85	765.94	2747	325.00	105.03	3094
11	2324.00	2303.30	2229.30	828.00	827.87	833.95	2762	199.00	68.01	2926
12	2433.00	2412.30	2338.30	864.00	863.87	869.96	2773	109.00	36.01	3027
13	2660.00	2539.30	2465.30	897.00	896.88	902.96	2812	127.00	33.01	3848

* The observed travel times listed here differ slightly from the field transit times. Schlumberger edit the field data and use a different picking algorithm for final processing. The final data is more reliable.

2322L:12

PE601136

This is an enclosure indicator page.
The enclosure PE601136 is enclosed within the
container PE902369 at this location in this
document.

The enclosure PE601136 has the following characteristics:

- ITEM_BARCODE = PE601136
- CONTAINER_BARCODE = PE902369
- NAME = Seismic Calibration Log
- BASIN = GIPPSLAND
- PERMIT =
- TYPE = WELL
- SUBTYPE = VELOCITY_CHART
- DESCRIPTION = Seismic Calibration Log
- REMARKS =
- DATE_CREATED =
- DATE_RECEIVED = 29/08/1986
- W_NO = W918
- WELL_NAME = Drummer-1
- CONTRACTOR = ESSO
- CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601137

This is an enclosure indicator page.
The enclosure PE601137 is enclosed within the
container PE902369 at this location in this
document.

The enclosure PE601137 has the following characteristics:

- ITEM_BARCODE = PE601137
- CONTAINER_BARCODE = PE902369
- NAME = Seismic Calibration Log
- BASIN = GIPPSLAND
- PERMIT =
- TYPE = WELL
- SUBTYPE = VELOCITY_CHART
- DESCRIPTION = Seismic Calibration Log
- REMARKS =
- DATE_CREATED = 30/10/1985
- DATE_RECEIVED = 29/08/1986
- W_NO = W918
- WELL_NAME = Drummer-1
- CONTRACTOR = ESSO
- CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902372

This is an enclosure indicator page.
The enclosure PE902372 is enclosed within the
container PE902369 at this location in this
document.

The enclosure PE902372 has the following characteristics:

ITEM_BARCODE = PE902372
CONTAINER_BARCODE = PE902369
 NAME = Raw & Stacked Checkshot Data
 BASIN = GIPPSLAND
 PERMIT =
 TYPE = WELL
 SUBTYPE = VELOCITY_CHART
 DESCRIPTION = Raw & Stacked Checkshot Data
 REMARKS =
 DATE_CREATED = 30/10/1985
 DATE_RECEIVED = 29/08/1986
 W_NO = W918
 WELL_NAME = Drummer-1
 CONTRACTOR = ESSO
 CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE603719

This is an enclosure indicator page.
The enclosure PE603719 is enclosed within the
container PE902369 at this location in this
document.

The enclosure PE603719 has the following characteristics:

- ITEM_BARCODE = PE603719
- CONTAINER_BARCODE = PE902369
 - NAME = Drummer 1 Geogram (encl from app 1 of
WCR, Vol 1)
 - BASIN = GIPPSLAND
 - PERMIT = VIC/P1
 - TYPE = WELL
 - SUBTYPE = SYNTH_SEISMOGRAPH
- DESCRIPTION = Drummer 1 Geogram Synthetic Seismogram.
Enclosure within Appendix 4 of Volume 1
of WCR.
- REMARKS =
- DATE_CREATED = 30/10/85
- DATE_RECEIVED = 29/08/86
- W_NO = W918
- WELL_NAME = Drummer-1
- CONTRACTOR = Schlumberger
- CLIENT_OP_CO = Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE902370

This is an enclosure indicator page.
The enclosure PE902370 is enclosed within the
container PE902369 at this location in this
document.

The enclosure PE902370 has the following characteristics:

ITEM_BARCODE = PE902370
CONTAINER_BARCODE = PE902369
NAME = Time Depth Curve
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Time Depth Curve
REMARKS =
DATE_CREATED = 08/01/1986
DATE_RECEIVED = 29/08/1986
W_NO = W918
WELL_NAME = Drummer-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)