MRC9304010-ACM

291001

SAGASCO RESOURCES LIMITED

WELL COMPLETION REPORT

FLINDERS 1

T/25P

BASS BASIN

APRIL 1993

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OR_298

291002

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ENCLOSURE 2

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VOLUME II

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1 LOCATION MAP

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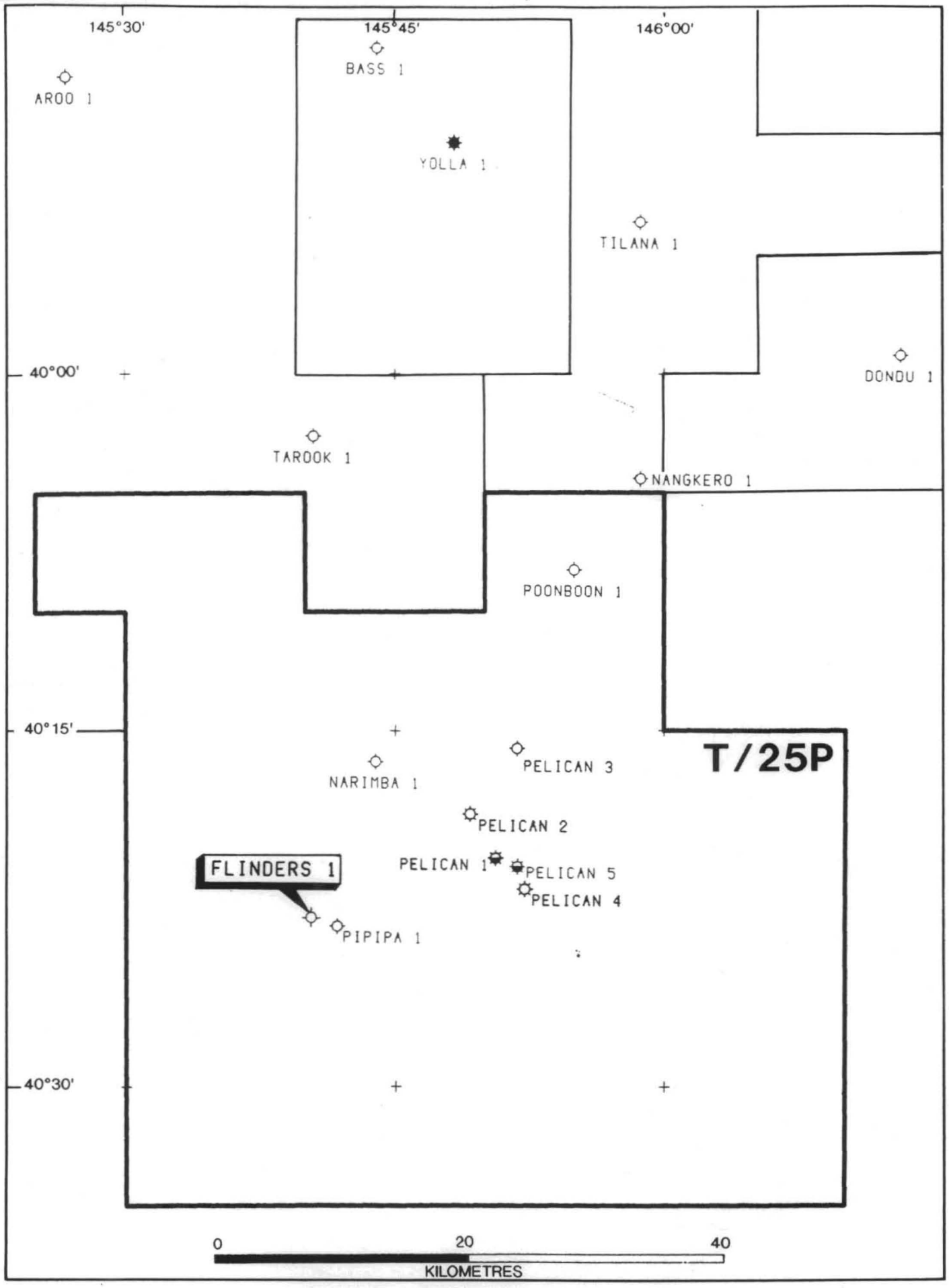

SAGASCO Resources Limited

BASS BASIN - TASMANIA

T/25P

WELL LOCATIONS

5 cm

AUTHOR: A. Migliucci	DRAWN: P. Oldham	DATE: April 93	SCALE: As Shown	No.: BAS00.8629	FIG: 1

PH 235 3737 Fax 223 1851 Interstate prefix 08 International prefix 618 A.C.N. 007 045 338

2 WELL DATA CARD

3 WELL HISTORY

3 WELL HISTORY

Please note all depths in this summary are drillers depths from RT unless otherwise annotated as logger's depths (L).

3.1 Drilling Summary

The first anchor was dropped at 0600 hours on 28 November 1992 and the Ocean Epoch rig towed onto location. Flinders 1 was spudded at 1000 hours on 29 November 1992 in 69.25m of water and some 0.4m from the intended location.

The 914mm (36") hole was drilled using a 600mm (26") bit and 914mm hole opener to 127.6m. Sea water and high viscosity pills were used to keep the hole clean with returns to the sea floor. 762mm (30") casing and the permanent guide base were run and cemented with the shoe at 124.5m.

A 445mm (17½") bit and bottom hole assembly were run in to drill out the cement, float, shoe and drill to the next casing point at 408m. Again sea water and high viscosity pills were used to keep the hole clean with returns to the sea floor. No problems were encountered during drilling.

340mm (13⅜") casing was run and cemented with the shoe at 403m. The BOP stack and riser were run and the flowline nippled up. After the stack and surface equipment were satisfactorily pressure tested, a 311mm (12¼") bit and bottom hole assembly were picked up and run in the hole, tagging cement at 377m. The cement, float collar, shoe and shoe track and 2m of formation were drilled to 410m. After displacing the hole to sea water gel polymer mud, an EMW of 1701kg/m^3 (14.2ppg) was obtained from the formation integrity test.

Drilling continued to the 244m (9⅝") casing point at 1525m. During the drilling of this interval of hole a number of tight intervals were encountered whilst tripping. These were reamed and generally caused little further problems while drilling. After a wiper trip a multishot tool was dropped and the pipe pulled out of the hole from 1525m.

Halliburton Logging Services (HLS) were rigged up to run Suite 1 of logs comprising the DLL-MSFL-LSS-GR-DTD-SP combination, but were unable to pass a bridge at 780m. Extensive reaming was required and the mud weight was raised to 1162kg/m^3 (9.7ppg). Reaming was again required on a wiper trip and the mud weight raised further to 1186kg/m^3. The hole was good on the way out and HLS rigged up to log. The combination tool hung up at 1240m some 280m off bottom and the hole logged out over the interval 1240m to 403m with the gamma ray to the mud line. A wiper trip was made and the 244mm (9⅝") casing run to 1520m.

The plug was bumped to 2000psi and the casing was pressure tested. The packoff was set and pressure tested. The BOP stack and surface equipment were similarly pressure tested satisfactorily.

The 216mm (8½") bit and bottom hole assembly were picked up and run in the hole. The cement from 1476m, float collar, shoe and shoe track were drilled plus 2m of new formation to 1527m. The old mud was displaced out of the hole with a freshwater PHPA mud and a formation integrity test performed. An EMW of 1713kg/m^3 (14.3ppg) was obtained.

Drilling continued to 2420m where a bottom hole sample was circulated up following a drilling break. No show was observed and drilling continued to TD at 2723m. During the drilling of the 216mm hole section numerous tight spots were encountered on frequent wiper trips. These were reamed and generally caused no further problems. A wiper trip was made and the mud conditioned prior to logging.

HLS were rigged up to run logging Suite 2 comprising five runs. On the final run, whilst running in the hole with the sidewall core gun a bridge towards the base of the sill was encountered at 2273m. The sidewall cores were abandoned and open ended drill pipe run in the hole.

With all sands interpreted as water wet, the well was plugged and abandoned with three cement plugs. Plug 1 was set from 2300m to 2177m, and Plug 2 was set from 1550m to 1470m. The 244mm (9⅝") casing and Plug 2 were pressure tested to 3000psi and the casing subsequently cut at 135m and retrieved. A 340mm (13⅜") bridge plug was set at 125m and cement Plug 3 set from 125m to 105m. This was pressure tested to 1000psi before the 340mm (13⅜") and 762mm (30") casing were cut at 97m allowing the recovery of the wellhead housings, permanent and temporary guide bases.

The anchors were pulled and the rig released at 1400 hours on 22 December 1992.

3.2 Mudlogging and Formation Sampling

Mudlogging services comprising full mudlogging, data acquisition and pore pressure monitoring were provided on a twenty four hour basis by Halliburton SDL (Geodata) utilising a crew consisting of a data engineer and mud logging geologist. During the 216mm (8½") hole interval sample catchers were utilised.

Cuttings were caught from 408m (first returns) to 1530m, at 10m intervals and from 1530m to TD at 3m intervals. While drilling the Torquay Group representative samples were collected at the pipe deck level shakers equipped with 40 to 60 mesh screens which allowed all but granules through. From the Demons Bluff Formation to TD representative samples were obtained from the three lower deck shakers equipped with 110 to 170 mesh screens which retained very fine grains and coarser. Full lithological sample descriptions are given in Appendix 1.

The following cutting samples, as detailed in Appendix 7 were collected:

1. Washed and air dried from 408m (first returns) to TD.
2. Unwashed 30m composite from 408m (first returns) to TD.
3. Washed sand samples (fission track analysis) composited over 30m intervals at approximately 200m intervals over the EVCM interval.

The following data was generated by Halliburton SDL:

1	Formation Evaluation (mud log)	1:500
2	Gas Ratio Log	1:500
3	Pressure Log	1:2500
4	End of Well Report	

3.3 Drill Stem Tests

No drill stem tests were performed in Flinders 1.

3.4 Conventional Cores

No conventional cores were cut in Flinders 1.

3.5 Sidewall Cores

The sidewall cores were abandoned after intersecting a bridge at 2273m. Owing to the temporary failure of the gamma ray and SP correlation, sidewall cores were not collected from the overlying openhole interval.

3.6 Wireline Logging

All Depths are Loggers unless annotated Drillers (Drlr).

Two suites of logs as detailed below were run by Halliburton Logging Services utilising a PLS II surface unit. Suite 1 comprising a DLL-MSFL-LSS-GR-DTD-SP combination was conducted at the 244mm (9⅝") casing point at 1525m (Drlr). On the first attempt at logging the tool hung up at 780m and a wiper trip was run. On the second attempt the tool hung up at 1243.2m and the hole logged out to 405.8m with the GR run to the mud line. An additional wiper trip required to obtain log data from 1525m (Drlr) to 1243.2m was not considered cost effective and consequently no open hole wireline data was obtained over the interval. Suite 2 was conducted at TD from 2717.7m to 1525.2m.

RUN	LOG TYPE	INTERVAL (M)
1A	DLL-MSFL-LSS-GR-SP-DTD-CAL	1241.9-405.8 GR to Mudline
2A	HRI-CAL-MSFL-LSS-GR-DTD-SP	2716.1-1525.2
2B	SDL-DSN-CSNG-CAL-DTD	2716.6-1525.2
2C	SED-GR	2716.4-1525.2
2D	VSP	100 levels 2705-350
2E	SWC-SP	Abandoned

In addition to the above logs, the following wellsite playbacks were made:

CSNG 2707.8-1525.2m

SHIVA 2716.4-1525.2m

The ULTRA computation was made at the Perth computing centre.

The following list gives the full name of the mnemonics used above:

DLL	Dual Laterolog
MSFL	Micro Spherical Focused Log
LSS	Long Spaced Sonic
GR	Gamma Ray
SP	Spontaneous Potential
DTD	Downhole Tension Device
HRI	High Resolution Induction
SDL	Spectral Density Log
DSN	Dual Spaced Neutron
CSNG	Compensated Spectral Natural Gamma Ray
SED	Six Armed Dipmeter
VSP	Vertical Seismic Profile
ULTRA	Universal Logging Tool Response Analysis (log interpretation package)
SHIVA	Dip Analysis

Hole condition in the 12¼" section was fair above 1100m and poor from 1100m to 1241.9m. A bridge at 781m curtailed the first logging attempt on Run 1A. On the second attempt the tools nearly became stuck while attempting to work past a bridge at 1241.9m and the hole was logged out. A third attempt to log the complete 12¼" interval was not considered cost effective.

In the 8½" section hole conditions were very good despite the tight hole experienced on trips prior to TD logging. The good hole conditions were significant to the overall excellent quality of the data recorded especially that from the pad contact tools.

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WELL: FLINDERS 1		WELL CATEGORY: EXPLORATION		
PERMIT:	T/25P	PROSPECT TYPE: Fault dependent closure.		SPUD: 1000hrs 29/11/92 RIG RELEASED: 1400hrs 22/12/92 STATUS: Plugged and Abandoned TYPE COMPLETION: Plugs 2300-2177m 1550-1470m 125m Bridge Plug 125-105m
BASIN:	Bass			
LAT:	40°22'51.810"S			
LONG:	145°40'18.690"E			
SEISMIC STN:	SP900 TNK4-79			
TD:	2723m RT			
WATER DEPTH:	69.25m			
RT:MSL:	22.3m			
RIG:	Ocean Epoch			

PARTICIPANTS:		CASING SIZE (mm)	SHOE DEPTH	TYPE
SAGASCO Resources Ltd (Operator)	45%	762 (30")	124.50m	B
Ampolex Ltd	25%	340 (13⅜")	403.00m	K-55
Bridge Oil Ltd	20%			
Gas & Fuel Exploration NL	10%	244 (9⅝")	1519.98m	N-80

AGE	FORMATION	PROGNOSED DEPTH (m)		ACTUAL DEPTHS (m)		THICKNESS (m)	(H)IGH/(L)OW
		RT	SS	RT	SS		
Oligocene - Pres	Torquay Group	91.6	69.25	91.6	69.25	-	-
Late Eocene	Demons Bluff	1442.3	1420	1436.5 (from cuttings)	1414.2	109.5	5.8mH
Eocene	Eastern View Coal Measures	1552.3	1530	1546	1523.7	+1172m	6.3mH
? Miocene	Intrusive	-	-	2208	2185.7	+67m	-

LOG	RUN #	INTERVAL (m)	MAX.T(°C)
Intermediate Logging Run			
DLL-MSFL-LSS-GR-SP-DTD-CAL	1A	1243-405.8m Did not reach TD GR to mudline	48.3
Final Logging Run			
HRI-MSFL-LSS-GR-SP-DTD-CAL	2A	2716.1-1525.2m	116.7
SDL-DSN-CSNG-DTD-CAL	2B	2707.8-1525.2m	123.3
SED-GR	2C	2716.5-1525.2m	126.1
VSP	2D	2705-350m	-
SWC-GR	2E	Abandoned	-

CORES					
FORMATION	NO	INTERVAL (MRT)	CUT	REC(m)	REC (%)
	None cut				

LOG INTERPRETATION		
INTERVAL (m)	ϕ	Sw
All sands are interpreted as water saturated and no net pay is recorded.		

FORMATION TESTS (SFT)

None Performed.

Note: Good quality reservoir sands were encountered throughout the EVCM. Minor shows of fluorescence were recorded in sandstones below 2000m, but wireline logs show all zones to be water-saturated. A dolerite sill was encountered at 2208m which ties to an amplitude anomaly observed on seismic data.

AUTHOR: AC MIGLIUCCI & JC REEVE DATE: APRIL 1993

Approximately 55 hours after pulling out to log a bridge developed in the altered base of the dolerite sill at 2273m. The SP and GR correlation depth control system subsequently failed and rather than shoot with no correlation depth control, the sidewall cores were abandoned.

During the final logging run, depth control was fair with loggers recording 1525.2m and drillers recording 1520m, for the 9⅝" casing shoe, an error difference of 0.34%.

Log Analysis and VSP results are presented in Section 4.6 and Appendix 3 respectively. The Ultra Interpretation is enclosed in Appendix 2.

3.7 Temperature Data

The following bottom hole temperatures were recorded during logging operations:

RUN	DEPTH (m)	MAX TEMP (°C)	TIME SINCE CIRCULATION (HOURS)	DURATION OF CIRCULATION (HOURS)
1A	1252.0	48.3	7.9	2.9
2A	2718.8	116.7	13.6	1.3
2B	2718.8	123.3	20.6	1.3
2C	2718.8	126.1	38.1	1.3

Using a horner plot, Figure 1, the projected stabilised bottom hole temperature is 130.5°C. This gives an average geothermal gradient from TD to the surface of 4.1°C per 100 metres, assuming an ambient mean surface temperature of 18°C.

3.8 Directional Data

Single shot surveys were taken while drilling each section and then on the final trip out of the hole prior to logging. At 1520m a multishot survey was recorded by Austoil Drilling Services and at TD a dipmeter was run. The data showed that the well had maintained a near vertical path until approximately 2225m, where upon there was a slight increase in inclination to 2.0° by 2550m which gradually increased to 2.5° by TD.

3.9 Sequential Formation Tester

No sequential formation tests were run.

3.10 Velocity Survey

A VSP was conducted by Seismograph Services Limited utilising an air gun for an energy source and the HLS winch and line. A total of 100 levels were recorded from 2705m to 350m, where data quality became unacceptable and the survey ceased. The final survey report is attached as Appendix 3.

3.11 Drillwater Source

Sea water pumped directly from the sea at Flinders 1 was used for the drilling fluid to the base of the 311mm (12¼") hole section.

For the freshwater base mud used to TD, water was shipped from Bell Bay.

The Mud Summary may be found in Section 5.5.

3.12 Mud System and Tracers

Mud Engineering services were provided by International Drilling Fluids Pty Ltd.

The 914mm (36") and 455m (17½") intervals to 128m and 408m respectively were drilled using sea water with returns to the sea floor. Hi Vis pills were periodically pumped to aid hole cleaning, but there was no attempt at controlling the mud properties.

A Sea water/Gel/Poly mud was used to drill the 311mm (12¼") hole section to 1525m. This hole section intersected the dominantly argillaceous lower part of the Torquay Group and Demons Bluff Formation. Neither was considered prospective and evaluation was secondary to keeping the hole clean and maintaining hole stability. Solids content was allowed to build up using the natural clays and then water loss controlled to about 11ml/30min. The associated increase in mud weight was controlled and maintained at 1128kg/m^3 through the addition of partially hydrolysed polyacrylamide (PHPA). Hi Vis pills were pumped on connections to aid hole cleaning and no problems were encountered. Hole condition was fair to good down to 1025m despite the bridge encountered at 780m by the logging tools. The caliper log showed the interval from 1025m to 1241.9m to be both heavily washed out and commonly under gauge. There is no open hole wireline data below the bridge encountered at 1241.9m. After hitting a bridge at 780m on the first logging attempt the weight was increased to 1158kg/m^3 and fluid loss reduced to 8.6ml/30min but this was ineffective at controlling the swelling clays below 1125m. After logging, the mud weight was increased to 1188kg/m^3 and no trouble was encountered running the casing. Casing was set in the Demons Bluff, some 27m above the EVCM and 216m (8½") hole drilled to total depth.

Formation salinities of 40,000 to 70,000 ppm NaCl equivalent were anticipated in the EVCM and a Fresh Water/IDBond mud was utilised primarily to assist in evaluation through enhanced contrast between Rmf and Rw.

To minimise formation damage in the 8½" hole, both weight and fluid loss were targeted to be kept below 1170kg/m^3 and 8ml/30 minutes respectively. This was achieved with the mud weight gradually rising from 1070kg/m^3 to a maximum of 1120kg/m^3 at TD. The maximum calculated ECD being 1200/m^3 over the interval 2400m to TD. Fluid loss ranged between 5.8 and 8.6ml/30 minutes. As the mud weight was controlled using drilled solids the barite content of the mud was minimal and never exceeded 0.5%.

The dipmeter log showed the hole to be very close to gauge throughout with only some of the coals having washed out, notably more so between 1650m and 2208m (L). The six arm caliper also showed the hole to be nearly circular in section with no evidence of break out except within the dolerite between 2240m and 2260m (L).

To assist in the identification of mud filtrate obtained in the event of formation testing, sodium nitrate was run in the mud in the 216mm (8½") section. Relatively consistent levels of 250 ppm were obtained which required treatment approximately every two days.

The mud data can be found in the Drilling Record, Section 5.5.

3.13 Porosity and Permeability

Within the Torquay Group sandstones were encountered between 1118m and 1149m (L). From cuttings the observed porosity was good in a clean and fair to well sorted sand. The sonic log indicated excellent porosity with uncorrected values in excess of 40%. Resistivity separation indicated some permeability. The bioclastic calcarenites of the Torquay Group exhibited poor to good with predominantly fair intraparticle visual porosity. Sonic log porosities range from 13% to 30% and are predominantly excellent. The resistivity profile suggests low permeability.

Porosity data for the EVCM sands falls into three sets. Two sets lie above the dolerite sill while all points below the sill comprise the third set. Above the sill the lower values generally correspond with sands less than 2-3m thick and the upper values with sands in excess of 3m. The lower porosity set has values evenly spread from 5% to 15% with the thicker sands being poorly sorted. In contrast the porosities of the higher set range from 18% to 36% with a clear median value of 23% and with no significant decrease of porosity with depth. These sands are generally fine to medium and locally coarse with moderate to good sorting but becoming predominantly very fine to granular and poorly sorted with depth.

Below the sill porosities range from 4% to 18% and unexpectedly display a general average increase with depth. The sands become increasingly well developed with depth with an associated decrease in calcareous cementation.

Comparison of the visual cuttings porosity with the log porosities shows that the visual estimates were generally conservative. This is both a function of the unconsolidated nature of the sands and the dispersive nature of the claystones as seen at surface. Porosity estimates being influenced by the amount of clay matrix assigned to the sandstone.

As no formation tests or cores were taken at Flinders 1 there have been no measurements of permeability but the induction, SP and caliper logs frequently show indications of good permeability.

3.14 Occurrence of Hydrocarbons

No significant hydrocarbons were encountered within the Torquay Group or Demons Bluff Formation. Methane was first detected after drilling out of the 340mm casing at about 880m. Volumes slowly increased with depth and at 1410m ethane, was first detected. From there through to the 244mm casing point at 1525m the gas maintained a background level of 12 units* with a chromatographic breakdown of $C_1$96%$C_2$3%$C_3$5% **. A maximum of 30 units was detected at 1383m comprising 100% methane.

* 1 unit = 200ppm methane equivalent in air.

** Chromatographic breakdown expressed as percent total volume analysed, C_1%C_2%C_3%C_4%C_5+% Routine analysis were run to C_5+.

Eastern View Coal Measures

Rare minor fluorescence and no significant gas shows characterised the EVCM. All observed gas peaks were from coals or carbonaceous shales.

From the 244mm casing shoe to the first observed occurrence of fluorescence at 2004m gas levels remained low at 2 to 3 units with the composition changing from $C_1$96%$C_2$4% to $C_1$65%$C_2$30%$C_3$5%. The only exceptions were gas peaks at 1947m (1951m (L)) and 1977m (1981m (L)) of 12.3 and 20.7 units respectively, both associated with coal seams. From 2004m (2008m (L)) to the top of the dolerite sill at 2204m (2208m (L)) the background gas levels remained low with the only gas peaks associated with the coal beds. The proportion of methane continued to decrease with depth such that the background gas gave a composition of $C_1$46%, $C_2$42%, $C_3$12% in the claystone above the sill.

The only shows recorded were very poor and over the intervals 2004m to 2012m (2008 to 2016m (L)) and 2070m to 2075m (2074m to 2079m (L)) and were associated with tight fine grained sandstone. The fluorescence was spotty dull yellow green with a slow milky cut but was unaccompanied by any gas peak.

From the base of the sill at 2271m (2276m (L)) to TD 2323m the background gas levels ranged from 5 to 10 units with a relatively stable composition of $C_1$83%, $C_2$12%, $C_3$5% Numerous gas peaks were observed, the maximum being 114 units at 2363m (2368m L) ($C_1$92%, $C_2$5%, $C_3$3%), but all were derived from coals.

Trace shows were observed at 2563m (2567m (L)) and 2673m (2676m (L)), but were both confined to thin fine grained tight sandstones.

3.15 Discussion

Flinders 1 was drilled with a minimum of problems which enabled the collection of good quality data in the 216mm (8½") section.

The low background gas levels and near absence of hydrocarbon fluorescence coupled with the consistently high log derived water saturations confirm the absence of hydrocarbons in the drilled section. The low mud weight and fluid loss will have

resulted in minimal overbalance, assuming the section to be normally pressured.

The wireline logs show interesting and quite varied mineralogical responses, especially the high resolution data. Gamma ray values in excess of 180 API units are associated with lithic and at times arkosic sandstones. The spectral gamma ray records higher thorium and occasionally uranium concentrations over these zones.

The induction log exhibits intervals of saturation, similar to those observed inside casing, between 2043m (L) to 2053m (L) and 2188m (L) to 2197m (L). These anomalies repeated on the down log and are formation dependent. The upper interval occurs over a sandstone and is attributed to abundant continuous pyritic cement. In contrast the lower interval occurs over a predominantly claystone section lying just above the dolerite sill. No abnormal mineral occurrences were observed during drilling of this interval.

Unusual mineralogy must also account for the high density spikes and high Pe values between 2350m and 2400m. The spectral GR shows no significant concentrations of uranium which suggests other heavy minerals must be responsible.

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4 GEOLOGY

4 GEOLOGY

4.1 Regional Setting

The Bass Basin is one of a series of basins along the southern margin of Australia that were formed as a result of Cretaceous-Early Tertiary rifting between Australia and Antarctica, and were subsequently modified by Late Tertiary compression.

The Pelican and Cormorant Troughs are the two major depocentres of the Bass Basin (Figure 2). The Pelican Trough is bounded to the NE by a major NW to SE trending listric normal fault system downthrown to the SE. The proposed Flinders 1 well lies on the southwestern dip flank of the Pelican Trough.

4.2 Regional Stratigraphy

The stratigraphic succession in the Bass Basin includes sediments which range in age from the Early Cretaceous to Recent (Figure 3). The Early Cretaceous Otway Group rests unconformably on pre-rift Mesozoic and Palaeozoic rocks, but have not been penetrated by any wells in T/25P. The nearest control is provided by Durroon 1, located approximately 100km to the east, which penetrated an Early Cretaceous sequence of clastic and volcanoclastic fluvial and deltaic sediments comprising sandstone, siltstone, shale and coal. The Otway Group is considered to be less prospective than the overlying Eastern View Coal Measures on the basis of reservoir and source potential.

The Late Cretaceous to Late Eocene Eastern View Coal Measures (EVCM) unconformably overly the Otway Group and comprise a thick sequence of sandstone, siltstone, shale and coal deposited in predominantly fluvial, deltaic, and lacustrine environments, occasionally subjected to marine inundation. The EVCM are thickest in the centre of the troughs where seismic data suggest a total thickness greater than 5500m. The thickest sequence drilled is at Pelican 5 where 2507m was penetrated. The EVCM thins markedly towards the basin margins and exhibits both onlap onto basement and erosional truncation following uplift.

A three fold stratigraphic subdivision of the EVCM is recognised based on palynological and microfossil assemblages, and unconformities recognised on seismic. The intra-formational unconformities are most apparent over basement highs and near to the basin margins, but are less obvious in the centres of the major troughs where continuous deposition occurred. Each of the unconformities corresponds to a period of structural movement accompanied by volcanic activity.

The lowermost sequence of EVCM sediments is largely unexplored because of its depth of burial. It extends between the major unconformity at the base of the EVCM (usually top Otway Group) to the basal *T.longus* unconformity. The basal *T.longus* unconformity (Late Cretaceous) is associated with a period of major tectonic movement including extensional tilted block faulting and subsequent erosion. This sequence has only been partially penetrated within T/25P by Pelican 5.

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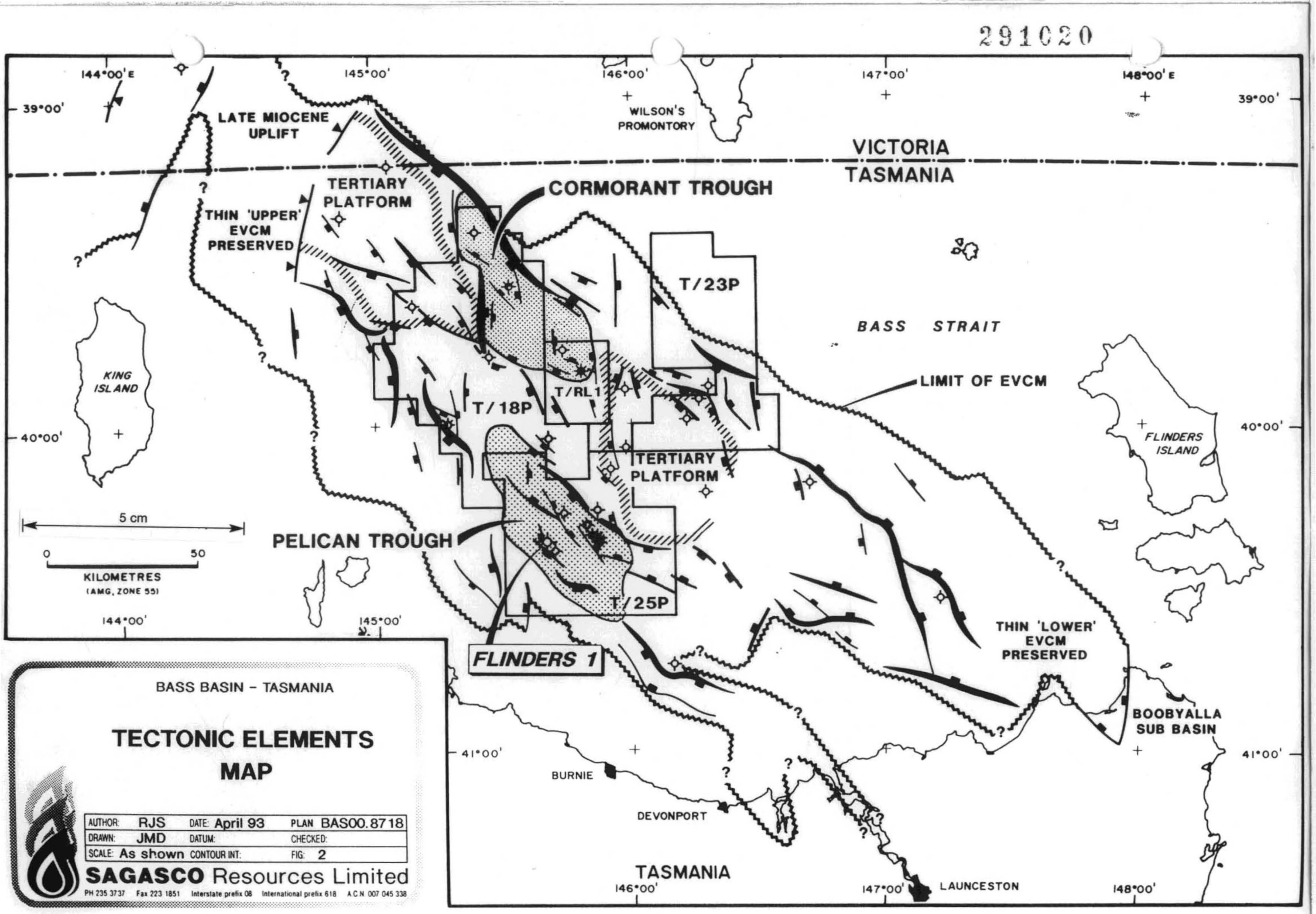

BASS BASIN – TASMANIA

TECTONIC ELEMENTS MAP

AUTHOR: RJS	DATE: April 93	PLAN BAS00.8718	
DRAWN: JMD	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT:	FIG: 2	

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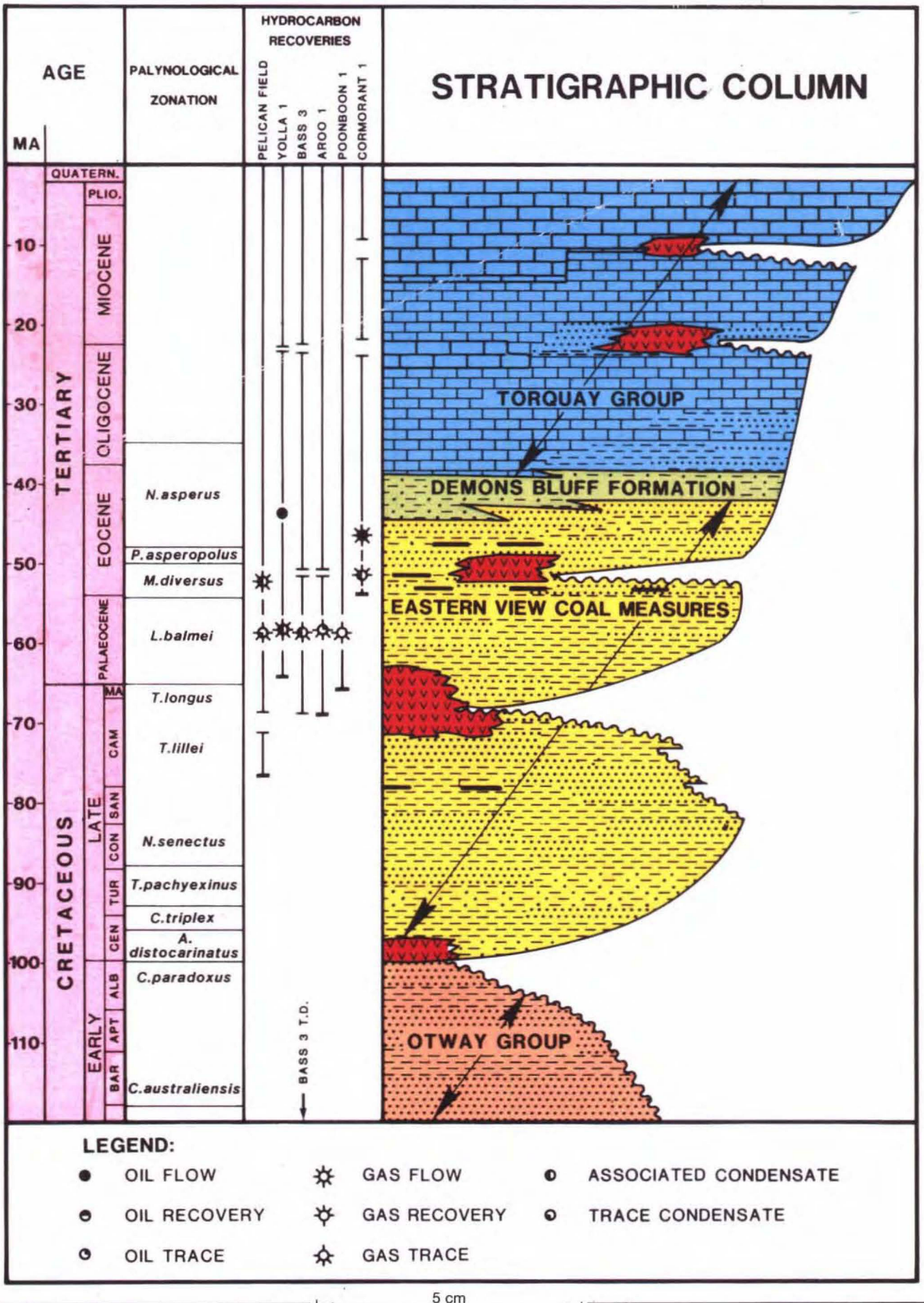
PH 235 3737 Fax 223 1851 Interstate prefix 08 International prefix 618 A.C.N. 007 045 338

291021



SAGASCO Resources Limited

BASS BASIN - TASMANIA

BASS BASIN STRATIGRAPHY

AUTHOR: R.Suttill DRAWN: J.Dutkiewicz DATE: April 93 SCALE: As shown No.: BAS00.8551 FIG: 3

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The middle sequence of the EVCM is bounded by the basal *T.longus* unconformity at its base and an unconformity at the base of the upper *M.diversus* zone (Early Eocene). Deposition during the *T.longus* and *L.balmei* zones appears to have been controlled by tectonic subsidence, induced by sediment compaction. This middle sequence has been penetrated by all wells in T/25P with the exception of Pipipa 1, and is considered to contain the most prospective reservoirs for gas and condensate. Known accumulations in this sequence occur in Yolla to the north and in the Pelican Field. Reservoirs within this zone formed the primary target for Flinders 1.

The uppermost sequence of the EVCM lies between the base of the upper *M.diversus* unconformity and the top of the formation. Basin sag was the dominant control on deposition. Oil shows were recorded at the base of this zone in Pipipa 1, but log analysis indicates only residual hydrocarbon saturations. There are no other significant shows in T/25P at this level, however a small oil and gas accumulation was discovered at the top of the zone at Yolla Field in T/RL1 and significant oil and gas shows were recorded in Cormorant 1 in T/18P.

Conformably overlying the EVCM is the Late Eocene Demon's Bluff Formation. Lithologically this unit consists of a sequence of fine grained shale and siltstone deposited in a marine environment. The unit has an average thickness over the basin of approximately 120m, but thins towards the basin margins. The Demon's Bluff Formation provides a regional top seal to hydrocarbons reservoired in the uppermost sandstones of the EVCM as demonstrated by the accumulation at Yolla 1.

The Demon's Bluff Formation is overlain by the Oligocene to Pliocene age Torquay Group which consists of a basal sequence of marl and calcareous shale grading upwards into a sequence of bioclastic limestone. The Torquay Group ranges in thickness from approximately 450m around the basin margins to about 1700m in the Pelican area. In addition to extrusive igneous rocks associated with the basal and intra-EVCM unconformities, intrusive and extrusive igneous rocks of Oligocene to Miocene age have been intersected in a number of wells drilled within the Bass Basin. Seismic data allow the mapping of the extrusive igneous rocks with a high level of confidence, whereas the intrusive igneous rocks are difficult to image and identify.

4.3 Regional Exploration Results

Prior to Flinders 1 eight petroleum exploration wells had been drilled in T/25P (Figure 1, Table 1). The closest well is Pipipa 1 which is located downdip and 2km from Flinders 1. Pipipa 1 terminated at a shallower stratigraphic level than the objective for Flinders 1. The nearest control for the primary target middle *M.diversus* and lower *M.diversus* reservoirs is the Pelican Field and Narimba 1. There are no wells on structural trend with Flinders 1 at the primary objective level.

The Flinders/Pipipa structure was previously evaluated by Pipipa 1 which was drilled in 1982 by Hematite to a total depth of 2115m KB (near to top middle *M.diversus*). The well was plugged and abandoned without testing despite encountering encouraging shows. Fluorescence shows were encountered between 1940m KB and total depth in sandstones which can be correlated, with wells logs and seismic, to the upper *M.diversus* zone sandstone of the Pelican Field. The bet show occurred in a sandstone over the interval 1045-1954m KB where 20-40% yellow to green milky

TABLE 1

WELLS DRILLED: PERMIT T/25P

YEAR	WELL NAME	OPERATOR	WELL TYPE	TARGET	TOTAL DEPTH (m) KB	STATUS	SHOWS
1970	Pelican 1	Esso	Expl	E. Eocene	3178.5	P & A	FIT's recovered gas & condensate
1970	Pelican 2	Esso	Aprl	E. Eocene	3068.1	P & A	FIT's recovered gas & condensate
1972	Pelican 3	Esso	Expl	E. Eocene	2906.9	P & A	-
1972	Poonboon 1	Esso	Expl	E. Eocene	3265.9	P & A	FIT's recovered minor gas
1973	Narimba 1	Esso	Expl	E. Eocene	3353.7	P & A	FIT's recovered minor gas
1979	Pelican 4	Hematite	Aprl	E. Eocene	3051.0	P & A	FIT's recovered gas & condensate
1982	Pipipa 1	Hematite	Expl	E. Eocene	2115.0	P & A	Oil & Gas shows
1985	Pelican 5	Amoco	Aprl	E.Eocene/ Palaeocene	4267.0	P & A	5.6 MMCFD & 302-441 BCPD
1992	Flinders 1	SAGASCO	Expl	E. Eocene	2723.0	P & A	-

2901023

fluorescence white, very fine to medium grained, moderately sorted, silty matrix and poorly cemented. It is characterised by an unusually high gamma response on logs, but good porosity (Hunt Raymer average porosity 20.2%), and good permeability, (mud cake build up), are inferred from wireline logs.

Palynological dating of the Pipipa 1 sequence below 1750m KB was impossible due to destruction of the palynomorphs by a high heat flow event (probably caused by a nearby intrusive) evidenced by high vitrinite reflectance values (up to 2.29%).

The Pelican Field approximately 15km to the NE of Flinders 1 in the deepest part of the Pelican Trough intersect the reservoir target of the lower *M.diversus* to middle *M.diversus*. At this level the Pelican Field wells demonstrate the presence of a large gas condensate accumulation in a series of fluvial sandstone beds. At Pelican 5, which is approximately 500m down dip of Flinders 1, deliverability was poor to moderate. The best result was from DST 6 which flowed gas to surface at 5.6 MMCFD with 302-441 BCPD and 662-705 BWPD, the water probably originating from a deeper sandstone via leakage behind casing. The other field wells, Pelican 1, 2 and 4 were only evaluated by FIT.

4.4 Drilling Rationale

Flinders 1 located on seismic line TNK4-79 at SP900 (Figure 4) tested a new structural trend updip of the Pelican Field. The prospect was associated with an amplitude anomaly (Proposal to Drill: Flinders 1 June 1992 SAGASCO Resources Limited). The primary objectives were the fluvial sandstones of the lower *M.diversus* to middle *M.diversus* (Pelican Zone) Eastern View Coal Measures.

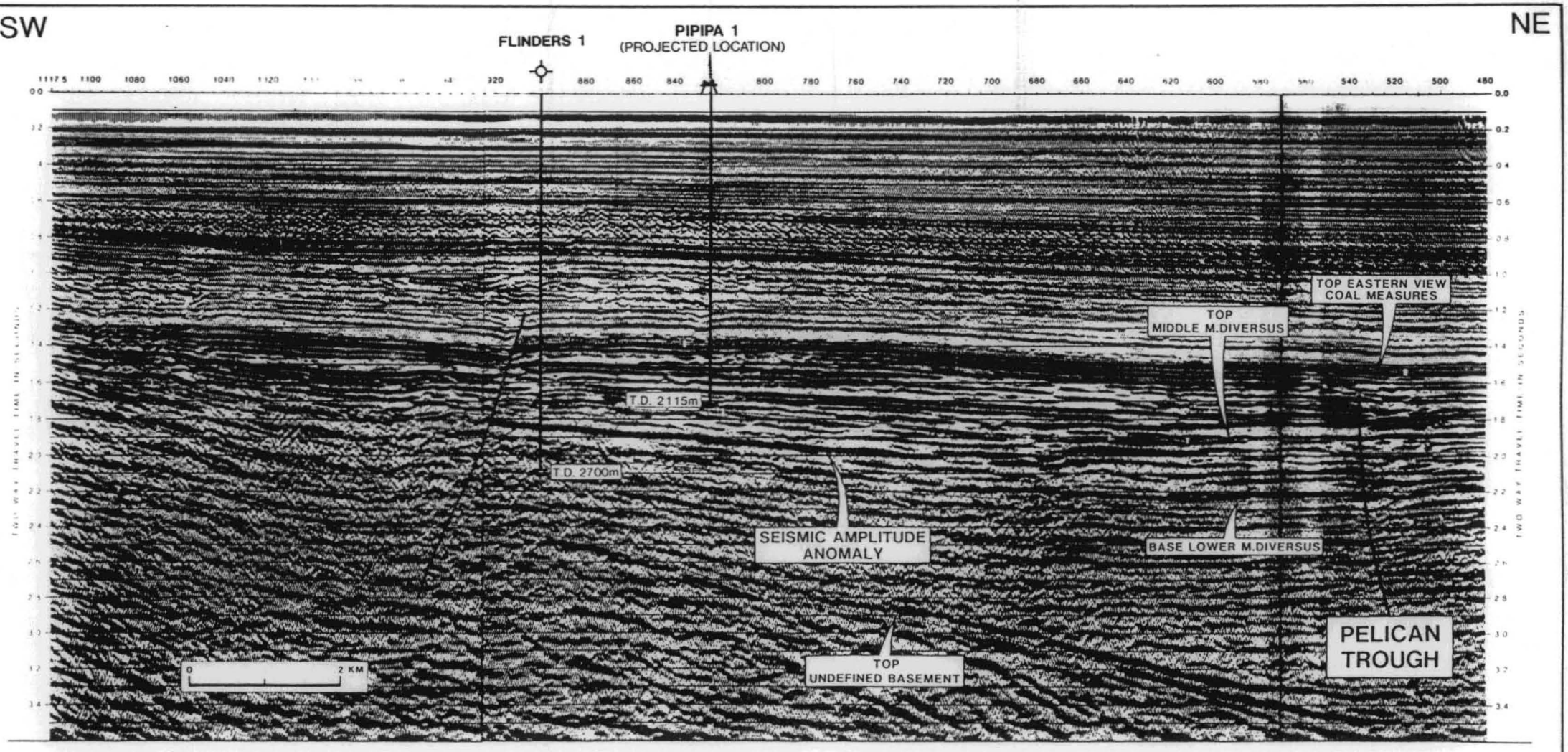
The prognosed versus actual stratigraphic sequence in Flinders 1 is tabulated below.

PROGNOSED VERSUS ACTUAL STRATIGRAPHIC SEQUENCE

FLINDERS 1

FORMATION	SUBSEA DEPTH (m)			THICKNESS (m)	
	Actual	Prognosed		Actual	Prognosed
Torquay Group	69.25	70	0.75mH	3345	1350
Demons Bluff Formation	1414.2	1420	5.8mH	109.5	110
Eastern View Coal Measures	1523.7	1530	6.3mH	>1175	>1170
(Middle *M.diversus*)	indeterminate	2120	-	-	(500)
(*L.balmei*)	2415.7	2620	204.3mH	>285	(>80)
Total Depth	2700	2700	0m		

221025



5 cm

SAGASCO Resources Limited

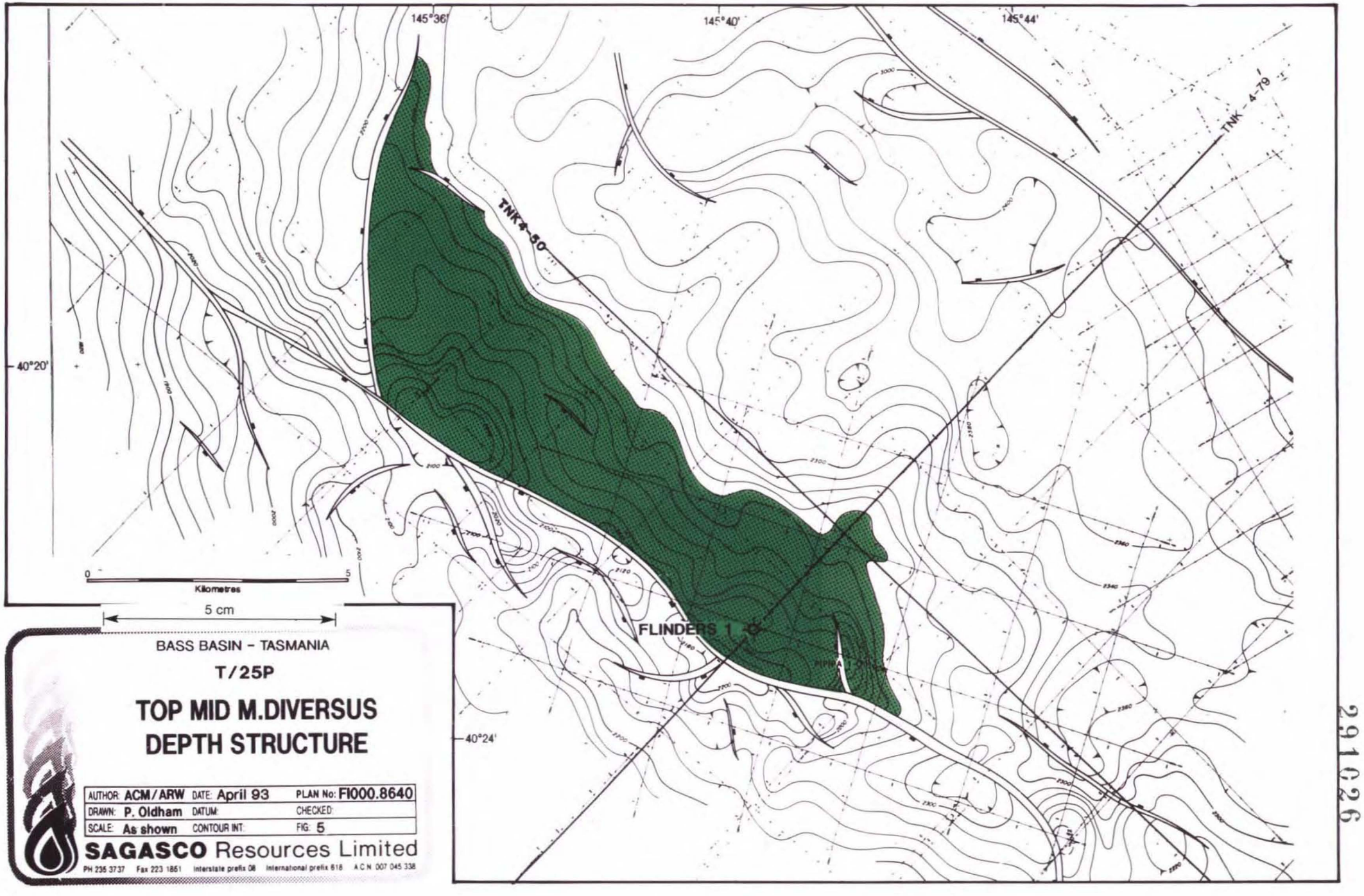
BASS BASIN - TASMANIA

T/25P

SEISMIC LINE TNK 4-79

AUTHOR: A. Migliucci DRAWN: P. Oldham DATE: July 1992 SCALE: As shown No.: FI000.8643 FIG: 4

PH 235 3737 Fax 223 1851 Interstate prefix 08 International prefix 618 A.C.N 007 045 338



BASS BASIN - TASMANIA

T/25P

TOP MID M.DIVERSUS DEPTH STRUCTURE

AUTHOR: ACM/ARW	DATE: April 93	PLAN No: FI000.8640	
DRAWN: P. Oldham	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT:	FIG: 5	

SAGASCO Resources Limited

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291026

4.5 Pre-drilling Structure

The Flinders Prospect is located on the southwestern flank of the Pelican Trough and is one of a series of structures which are ideally positioned to trap hydrocarbons. The Flinders Prospect is a fault dependent closure mapped at the top middle *M.diversus* level, located on the upthrown side of two intersecting normal faults. Closure occurs at all mapped levels within the EVCM (Proposal to Drill: Flinders 1 June 1992 SAGASCO Resources Limited).

At top EVCM and top middle *M.diversus* levels closure occurs against a major normal fault trending NW and downthrown to the SW (Figure 5). At the deeper levels (top seismic amplitude anomaly, base lower *M.diversus*, and top undefined basement reflector) the closure is further controlled by an intersecting orthogonal normal fault trending NE and downthrown to the NW. The mapping (Proposal to Drill: Flinders 1 June 1992 SAGASCO Resources Limited) demonstrates that the Flinders structure is dominated by a Late Eocene age normal fault that penetrates through to basement, and trends in a north westerly direction.

4.6 Log Analysis

Summary

Flinders 1 is located in T/25P, approximately 2km SW of Pipipa 1 and 17km WSW of the Pelican Field. Flinders 1 was drilled to appraise the reservoir quality and hydrocarbon potential of the Upper Eastern View Coal Measures (EVCM) and to test the "Pelican Zone" reservoirs within a fault dependent closure.

A quicklook log interpretation was performed by SAGASCO Resources Limited using the HRI-MSFL-LSS and DSN-SDL-CSGR suites of logs. Interpretation was performed from 1550m (30m below the 9⅝" casing shoe) to 2700m (23m above the drillers TD). The well was zoned:

Zone 1:	1550-2199.5m	EVCM
Zone 2:	2200-2290m	Dolerite Sill
Zone 3:	2290.5-2700m	EVCM

A tabular listing of the interpreted log analyses is attached and an analog plot of the data is presented.

Drilling proved the seismic anomaly to be a 70m thick dolerite sill and log analysis indicated that all sandstone units were water saturated.

Flinders 1 was plugged and abandoned.

1 Net Hydrocarbon Pay Summary

No zones of net pay greater than 0.5m were indicated at Flinders 1. Intervals defined in the net pay listing represent log anomalies due to coal bed shoulder effects and/or thin coal beds < 0.5m thick.

2 Net Pay Criteria

Porosity	(ϕ)	>	10%
Shale Volume	(Vsh)	<	45%
Water Saturation	(Sw)	<	50%

3 Interpretation Method

Environmentally and depth corrected log readings were quantitatively evaluated using a quicklook interpretation method.

	PARAMETER		DERIVATION
*	Porosity	(ϕ)	Neutron - Density
**	Shale Volume	(Vsh)	Spontaneous Potential
	True Resistivity	(Rt)	HRI Deep Induction Log
	Water Saturation	(Sw)	Indonesian Equation
	Tortuosity	(a)	Variable (see 4)
	Saturation Exponent	(n)	2.0
	Cementation Exponent	(m)	Variable (see 4)

* Porosity (ϕ)

Porosities calculated using the density-neutron cross-plot method result in high porosity values over the coal seams and anomalously low water saturations.

In an attempt to resolve this problem the raw density and neutron log data were filtered and blocked, an algebraic statement was then used to define coals:

When: Density is $\leq$ 2.15 gcm^3
Neutron is $\geq$ 0.25 pu

Then: Porosity is = 0

Log calculated porosity is therefore a neutron-density cross plot with a user defined coal flag defaulting porosity to zero over coal beds.

** Shale Volume (Vsh)

Due to numerous coal seams present throughout the EVCM sequence at Flinders 1 the SP log was used to define shaliness rather than the GR log.

4 Summary of Geological Computational Parameter Values

The following values were defined within each zone:

	Zone:		1	2	3
1	GRmin	(API)	20.00	0.00	20.00
2	GRmax	(API)	90.00	20.00	90.00
3	Rw	(Ω/m)	0.045	0.045	0.045
4	Rw temp	(°C)	97.00	97.00	122.00
5	a		0.73	0.73	0.80
6	m		1.91	1.91	2.19
7	Rsh	(Ω/m)	2.50	70.00	5.00
8	SPmin	(mv)	-70.0	-80.00	-70.00
9	SPmax	(mv)	-15.0	-65.00	-15.00

5 Mud System (Fresh Water Polymer)

Mud Density		1.2	(9.35 ppg)
Mud Resistivity	(Rm)	1.3	Ω/m @ 22°C
Mud Filtrate Resistivity	(Rmf)	1.26	Ω/m @ 22°C
Mud Cake Resistivity	(Rmc)	1.75	Ω/m @ 19°C
Bottom Hole Temperature	(BHT)	134°C	(Static)

6 Formation Water Resistivity (Rw)

FORMATION	Rw @ 25°C	REMARKS
EVCM (Zone 1)	0.123 Ω/m	55000 ppm Calculated from Pickett Plot, Rwa and SP
EVCM (Zone 3)	0.140 Ω/m	48000 ppm Calculated from Pickett Plot, Rwa and SP

7 Core Summary

No full hole cores were cut at Flinders 1.

8 DST/RFT Summary

No Drill Stem Tests or Repeat Formation Tests were performed at Flinders 1.

9 Remarks

Hole conditions generally resulted in good quality log data although some wash outs (2"-3") occurred over the coals. Over the dolerite sill (2200-2280m) hole conditions deteriorated, this however had no impact on the log analysis.

Whilst hydrocarbon shows were limited to coal seams log analysis confirmed that the EVCM sandstone units were water wet. Some net pay was identified, this however was attributed to thin coals and/or coal shoulder bed effects.

Due to the lack of any producible economic hydrocarbons within the well, Flinders 1 was plugged and abandoned.

291031

NET PAY LISTING

Well Name: FLINDERS 1

291032

Vertical reference channel: DEPTH

Curve Type (#)	Cutoff value(s)	Method
Vshale (57)	.4000	LT
Sw (32)	.5000	LT
Porosity (100)	.1000	GT

SUMMATION STATISTICS

TOP INTERVAL	(F)	5085.3003
TOP INTERVAL	(M)	1550.0000
BASE INTERVAL	(F)	8858.2656
BASE INTERVAL	(M)	2700.0000
GROSS THICKNESS	(F)	3773.2927
GROSS THICKNESS	(M)	1150.1000
NET SAND THK	(F)	1065.2915
NET SAND THK	(M)	324.7009
SAND/GROSS RATIO		.2823
NET PAY THK	(F)	7.2177
NET PAY THK	(M)	2.2000
NET/GROSS RATIO		.0019
PAY ARITH AVG KSWIS		.0000
PAY GEOM AVG KSWIS		.0000
PAY HARM AVG KSWIS		.0000
LOWER VSHALE CUTOFF		.4000
UPPER VSHALE CUTOFF		.0000
RR ARITH AVG VSHALE		.1595
PAY ARITH AVG VSHALE		.2291
LOWER Sw CUTOFF		.5000
UPPER Sw CUTOFF		.0000
RR ARITH AVG Sw		.9428
PAY ARITH AVG Sw		.4138
PAY HC THK	(F)	.9821
PAY HC THK	(M)	.2994
SW (phi-wt)		.4138
LOWER POROSITY CUTOFF		.1000
UPPER POROSITY CUTOFF		.0000
RR ARITH AVG POROSITY		.2090
PAY ARITH AVG POROSITY		.2321
RR POROSITY THK	(F)	222.6968
RR POROSITY THK	(M)	67.8779
PAY POROSITY THK	(F)	1.6755
PAY POROSITY THK	(M)	.5107

NET PAY DEPTH LISTING FOR THE INTERVAL 1550.0000 to 2700.0000

Depth	Vshale	Sw	Porosity	
1946.9000	.1167	.4843	.2331	
Averages	.1167	.4843	.2331	
Interval Thickness =		.1000	Porosity Thickness =	.0233
2046.0000	.1472	.4401	.2050	
Averages	.1472	.4401	.2050	
Interval Thickness =		.1000	Porosity Thickness =	.0205
2052.5000	.0267	.4009	.2295	
2052.6001	.0302	.3014	.2286	
2052.7000	.0328	.3660	.2280	
2052.8000	.0345	.4246	.2276	
2052.9001	.0353	.3786	.2274	
Averages	.0319	.3743	.2282	
Interval Thickness =		.5000	Porosity Thickness =	.1141
2066.4001	.2424	.4649	.2347	
Averages	.2424	.4649	.2347	
Interval Thickness =		.1001	Porosity Thickness =	.0235
2090.2000	.2901	.4593	.2505	
2090.3000	.3084	.2968	.2459	

2090.4001	.3253	.2422	.2417	
Averages	.3079	.3328	.2461	
Interval Thickness =		.3000	Porosity Thickness =	.0738
2540.5000	.1290	.4961	.2200	
Averages	.1290	.4961	.2200	
Interval Thickness =		.0999	Porosity Thickness =	.0220
2622.6001	.3953	.4401	.2450	
2622.7000	.3349	.4626	.2599	
2622.8000	.3005	.4809	.2683	
2622.9001	.2841	.4928	.2722	
Averages	.3287	.4691	.2613	
Interval Thickness =		.4001	Porosity Thickness =	.1046
2631.5000	.2980	.4810	.1612	
Averages	.2980	.4810	.1612	
Interval Thickness =		.0999	Porosity Thickness =	.0161
2658.0000	.3823	.3690	.2157	
2658.1001	.3631	.3928	.2204	
2658.2000	.3408	.4063	.2259	
2658.3000	.3160	.4105	.2320	
2658.4001	.3074	.4115	.2341	
Averages	.3419	.3980	.2256	
Interval Thickness =		.5000	Porosity Thickness =	.1128

291034

INTERPRETED LOG LISTING

Well Name: FLINDERS 1
Location: BASS BASIN Date: SPUDDED 29/11/92
Constraints: None

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1550.000	.4347	1.135	.1766	.7419	.1664	.1310	.0000	.0000
1551.000	.4419	1.323	.1021	.9378	.1008	.0957	.0000	.0000
1552.000	.3801	1.166	.1520	.8015	.1454	.1218	.1000	.0000
1553.000	.4469	1.231	.1533	.7436	.1445	.1140	.0000	.0000
1554.000	.4598	1.272	.1509	.7336	.1418	.1107	.0000	.0000
1555.000	.3972	1.256	.1620	.7294	.1521	.1182	.1000	.0000
1556.000	.3876	1.282	.1675	.7088	.1564	.1187	.1000	.0000
1557.000	.3790	1.205	.1732	.7170	.1620	.1242	.1000	.0000
1558.000	.3646	1.288	.1384	.8230	.1332	.1139	.1000	.0000
1559.000	.3009	1.024	.2172	.7191	.2034	.1562	.1000	.0000
1560.000	.3238	1.091	.1666	.8025	.1594	.1337	.1000	.0000
1561.000	.2990	.8320	.2096	.7806	.1994	.1636	.1000	.0000
1562.000	.5816	1.325	.0870	.9240	.0856	.0804	.0000	.0000
1563.000	1.000	1.100	.0296	1.171	.0296	.0296	.0000	.0000
1564.000	1.000	.9390	.0351	1.218	.0351	.0351	.0000	.0000
1565.000	1.000	.9630	.0000	1.512	.0000	.0000	.0000	.0000
1566.000	1.000	1.083	.0060	1.135	.0060	.0060	.0000	.0000
1567.000	1.000	1.157	.0377	1.078	.0377	.0377	.0000	.0000
1568.000	1.000	1.044	.0210	1.281	.0210	.0210	.0000	.0000
1569.000	1.000	1.165	.0383	1.071	.0383	.0383	.0000	.0000
1570.000	1.000	1.068	.0112	1.373	.0112	.0112	.0000	.0000
1571.000	.8857	1.130	.0401	1.127	.0401	.0401	.0000	.0000
1572.000	1.000	1.078	.0121	1.356	.0121	.0121	.0000	.0000
1573.000	.8051	1.057	.0345	1.269	.0345	.0345	.0000	.0000
1574.000	.5229	1.138	.0751	1.122	.0751	.0751	.0000	.0000
1575.000	.3643	1.255	.1270	.8836	.1239	.1122	.1000	.0000
1576.000	.3170	1.122	.1674	.8270	.1611	.1384	.1000	.0000
1577.000	.8041	1.010	.0745	.9995	.0744	.0744	.0000	.0000
1578.000	.9498	.9340	.0484	1.140	.0484	.0484	.0000	.0000
1579.000	.7634	.9140	.1039	.9832	.1035	.1021	.0000	.0000
1580.000	.7415	1.024	.0801	.9917	.0800	.0794	.0000	.0000
1581.000	.7776	.9830	.0849	.9681	.0843	.0822	.0000	.0000
1582.000	.4349	.7980	.1853	.9227	.1823	.1710	.0000	.0000
1583.000	.4324	.6920	.2031	.8136	.1949	.1652	.0000	.0000
1584.000	.4296	.7710	.1942	.7978	.1856	.1549	.0000	.0000
1585.000	.3604	.7050	.2313	.7733	.2197	.1789	.1000	.0000
1586.000	.3487	.6320	.0000	1.000	.0000	.0000	.0000	.0000
1587.000	.4071	.7390	.2127	.7953	.2032	.1692	.0000	.0000
1588.000	.8241	.8360	.1006	.9486	.0996	.0955	.0000	.0000
1589.000	.7488	.8650	.1081	.9286	.1065	.1003	.0000	.0000
1590.000	.6530	.8450	.1422	.8408	.1374	.1196	.0000	.0000
1591.000	.3713	.6790	.0000	1.116	.0000	.0000	.0000	.0000
1592.000	.4263	.6890	.1978	1.065	.1978	.1978	.0000	.0000
1593.000	.4121	.6910	.2035	.8331	.1962	.1696	.0000	.0000
1594.000	.3235	.7230	.2208	.8803	.2153	.1944	.1000	.0000
1595.000	.3861	.7290	.2017	1.015	.2017	.2017	.1000	.0000
1596.000	.3310	.6750	.2296	.8733	.2235	.2005	.1000	.0000
1597.000	.3468	.6690	.2220	1.175	.2220	.2220	.1000	.0000
1598.000	.2756	.6360	.2488	1.177	.2488	.2488	.1000	.0000
1599.000	.4735	.6990	.1796	1.219	.1796	.1796	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1600.000	.7680	.7840	.0977	1.189	.0977	.0977	.0000	.0000
1601.000	.7299	.8110	.1211	1.160	.1211	.1211	.0000	.0000
1602.000	.7703	.8000	.1005	1.118	.1005	.1005	.0000	.0000
603.000	.7007	.7940	.1096	1.266	.1096	.1096	.0000	.0000
1604.000	.7119	.7860	.1322	1.093	.1322	.1322	.0000	.0000
1605.000	.8803	.8300	.0797	1.034	.0797	.0797	.0000	.0000
1606.000	.9532	.9140	.0566	1.092	.0566	.0566	.0000	.0000
1607.000	.8424	.9060	.0861	.9727	.0856	.0837	.0000	.0000
1608.000	.9167	.8760	.0617	1.097	.0617	.0617	.0000	.0000
1609.000	.6952	.8940	.1198	.8838	.1168	.1058	.0000	.0000
1610.000	.7054	1.016	.1242	.8085	.1190	.1004	.0000	.0000
1611.000	.7165	1.086	.1094	1.041	.1094	.1094	.0000	.0000
1612.000	.5695	.9050	.1448	1.146	.1448	.1448	.0000	.0000
1613.000	.7290	.9910	.0920	1.172	.0920	.0920	.0000	.0000
1614.000	.9357	1.027	.0126	1.426	.0126	.0126	.0000	.0000
1615.000	.5502	1.053	.1385	1.211	.1385	.1385	.0000	.0000
1616.000	.7277	1.015	.0952	.9210	.0936	.0877	.0000	.0000
1617.000	1.000	1.756	.0000	1.000	.0000	.0000	.0000	.0000
1618.000	1.000	1.683	.1084	1.000	.1084	.1084	.0000	.0000
1619.000	1.000	2.752	.0000	1.000	.0000	.0000	.0000	.0000
1620.000	1.000	4.274	.0000	1.000	.0000	.0000	.0000	.0000
1621.000	1.000	1.520	.0281	1.005	.0281	.0281	.0000	.0000
1622.000	1.000	1.489	.0000	1.000	.0000	.0000	.0000	.0000
1623.000	.7044	10.300	.0000	1.000	.0000	.0000	.0000	.0000
1624.000	.7933	58.055	.0000	1.000	.0000	.0000	.0000	.0000
1625.000	1.000	15.714	.0000	1.000	.0000	.0000	.0000	.0000
1626.000	1.000	1.560	.0076	1.031	.0076	.0076	.0000	.0000
1627.000	1.000	1.306	.0140	1.211	.0140	.0140	.0000	.0000
1628.000	1.000	1.382	.0108	1.211	.0108	.0108	.0000	.0000
629.000	1.000	1.431	.0113	1.184	.0113	.0113	.0000	.0000
1630.000	1.000	6.004	.0000	1.000	.0000	.0000	.0000	.0000
1631.000	1.000	3.390	.0000	1.000	.0000	.0000	.0000	.0000
1632.000	.8941	1.164	.0399	1.104	.0399	.0399	.0000	.0000
1633.000	1.000	1.136	.0228	1.209	.0228	.0228	.0000	.0000
1634.000	1.000	1.332	.0123	1.217	.0123	.0123	.0000	.0000
1635.000	1.000	1.662	.0214	1.010	.0214	.0214	.0000	.0000
1636.000	1.000	2.224	.0000	1.000	.0000	.0000	.0000	.0000
1637.000	1.000	25.665	.0000	1.000	.0000	.0000	.0000	.0000
1638.000	1.000	9.524	.0000	1.000	.0000	.0000	.0000	.0000
1639.000	1.000	1.580	.0032	1.000	.0032	.0032	.0000	.0000
1640.000	1.000	1.250	.0090	1.134	.0090	.0090	.0000	.0000
1641.000	.8700	1.009	.0391	1.206	.0391	.0391	.0000	.0000
1642.000	.6914	.9250	.0729	1.113	.0729	.0729	.0000	.0000
1643.000	.4685	.7820	.1678	.8548	.1626	.1434	.0000	.0000
1644.000	.5635	1.107	.1219	.8387	.1177	.1022	.0000	.0000
1645.000	.3372	.8120	.1828	.8483	.1769	.1550	.1000	.0000
1646.000	.1631	.6530	.2333	.8545	.2261	.1994	.1000	.0000
1647.000	.3363	.8340	.1427	1.008	.1427	.1427	.1000	.0000
1648.000	.5131	1.014	.1095	1.269	.1095	.1095	.0000	.0000
1649.000	.5258	1.011	.1001	1.009	.1001	.1001	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1650.000	.3959	.9770	.1593	1.159	.1593	.1593	.1000	.0000
1651.000	.3255	.9400	.1724	1.368	.1724	.1724	.1000	.0000
1652.000	.4155	1.172	.0969	1.060	.0969	.0969	.0000	.0000
1653.000	.3631	1.255	.1207	1.138	.1207	.1207	.1000	.0000
1654.000	.1283	.8170	.2151	.8749	.2094	.1882	.1000	.0000
1655.000	.2661	.7190	.1788	1.075	.1788	.1788	.1000	.0000
1656.000	.7661	.9850	.1294	.7838	.1232	.1014	.0000	.0000
1657.000	.8445	1.191	.0471	1.062	.0471	.0471	.0000	.0000
1658.000	1.000	1.314	.0333	1.039	.0333	.0333	.0000	.0000
1659.000	1.000	1.367	.0000	1.000	.0000	.0000	.0000	.0000
1660.000	1.000	7.318	.0000	1.000	.0000	.0000	.0000	.0000
1661.000	1.000	29.862	.0000	1.000	.0000	.0000	.0000	.0000
1662.000	1.000	2.063	.0000	1.000	.0000	.0000	.0000	.0000
1663.000	1.000	1.627	.0000	1.000	.0000	.0000	.0000	.0000
1664.000	.7418	1.078	.0340	1.309	.0340	.0340	.0000	.0000
1665.000	.6174	.9450	.0850	1.313	.0850	.0850	.0000	.0000
1666.000	.2791	1.834	.1230	1.163	.1230	.1230	.1000	.0000
1667.000	.2234	2.627	.0000	2.185	.0000	.0000	.0000	.0000
1668.000	.1662	1.144	.1687	.8494	.1633	.1433	.1000	.0000
1669.000	.1149	.5260	.2580	1.039	.2580	.2580	.1000	.0000
1670.000	.3264	.7120	.1711	1.222	.1711	.1711	.1000	.0000
1671.000	.5410	1.019	.1220	1.152	.1220	.1220	.0000	.0000
1672.000	.5272	.9660	.1268	1.231	.1268	.1268	.0000	.0000
1673.000	.2938	.7540	.2134	.8461	.2064	.1806	.1000	.0000
1674.000	.5004	.8140	.1242	1.001	.1242	.1242	.0000	.0000
1675.000	.5900	.9860	.0987	.9842	.0984	.0971	.0000	.0000
1676.000	.2447	.7090	.2255	.8179	.2166	.1844	.1000	.0000
1677.000	.2536	.6700	.2113	.8686	.2054	.1835	.1000	.0000
1678.000	.2921	.7030	.1781	.9513	.1763	.1694	.1000	.0000
1679.000	.1791	.5690	.0000	1.000	.0000	.0000	.0000	.0000
1680.000	.6884	.7720	.0567	1.352	.0567	.0567	.0000	.0000
1681.000	1.000	1.095	.0000	1.000	.0000	.0000	.0000	.0000
1682.000	.7111	.9420	.0715	1.273	.0715	.0715	.0000	.0000
1683.000	1.000	1.047	.0079	1.235	.0079	.0079	.0000	.0000
1684.000	.8685	1.010	.0182	1.419	.0182	.0182	.0000	.0000
1685.000	.8472	.9970	.0302	1.310	.0302	.0302	.0000	.0000
1686.000	.7456	.9690	.0385	1.326	.0385	.0385	.0000	.0000
1687.000	.3013	.6990	.2261	.8558	.2191	.1935	.1000	.0000
1688.000	.6210	.7790	.0839	1.180	.0839	.0839	.0000	.0000
1689.000	1.000	1.158	.0000	1.000	.0000	.0000	.0000	.0000
1690.000	1.000	1.118	.0065	1.000	.0065	.0065	.0000	.0000
1691.000	.9562	1.008	.0078	1.324	.0078	.0078	.0000	.0000
1692.000	.2826	.6670	.2182	.8971	.2135	.1957	.1000	.0000
1693.000	.1917	.5850	.2105	.9660	.2091	.2034	.1000	.0000
1694.000	.1204	.5410	.0000	1.000	.0000	.0000	.0000	.0000
1695.000	.0882	.3950	.0000	1.000	.0000	.0000	.0000	.0000
1696.000	.2729	.6560	.1746	1.010	.1746	.1746	.1000	.0000
1697.000	.8952	1.054	.0739	1.001	.0739	.0739	.0000	.0000
1698.000	1.000	1.967	.0000	1.000	.0000	.0000	.0000	.0000
1699.000	1.000	1.820	.0141	1.023	.0141	.0141	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1700.000	1.000	1.589	.0000	1.000	.0000	.0000	.0000	.0000
1701.000	1.000	1.169	.0122	1.298	.0122	.0122	.0000	.0000
1702.000	1.000	.9930	.0132	1.396	.0132	.0132	.0000	.0000
1703.000	.7139	.8420	.0844	1.359	.0844	.0844	.0000	.0000
1704.000	.6668	.8030	.1119	1.356	.1119	.1119	.0000	.0000
1705.000	1.000	.8730	.0055	1.000	.0055	.0055	.0000	.0000
1706.000	1.000	.9910	.0044	1.000	.0044	.0044	.0000	.0000
1707.000	.6339	.8800	.0995	1.007	.0995	.0995	.0000	.0000
1708.000	.5341	.8220	.1115	1.037	.1115	.1115	.0000	.0000
1709.000	.4396	.8130	.1478	.9225	.1454	.1363	.0000	.0000
1710.000	.2855	.6250	.1898	.9582	.1882	.1819	.1000	.0000
1711.000	.2799	.6490	.1513	1.128	.1513	.1513	.1000	.0000
1712.000	.2892	.6650	.1969	.9183	.1935	.1808	.1000	.0000
1713.000	.1905	.6260	.2233	.9285	.2201	.2074	.1000	.0000
1714.000	.1988	.6110	.2207	1.072	.2207	.2207	.1000	.0000
1715.000	.2221	.6960	.1960	.9181	.1927	.1800	.1000	.0000
1716.000	.1323	.5500	.0000	1.000	.0000	.0000	.0000	.0000
1717.000	.1387	.3630	.2499	1.079	.2499	.2499	.1000	.0000
1718.000	.2024	.6030	.1495	1.249	.1495	.1495	.1000	.0000
1719.000	.1572	.6430	.2195	.9318	.2165	.2046	.1000	.0000
1720.000	.2081	.4070	.1646	1.399	.1646	.1646	.1000	.0000
1721.000	.0768	.4560	.2637	.9752	.2624	.2572	.1000	.0000
1722.000	.0817	.4970	.2426	.9744	.2413	.2364	.1000	.0000
1723.000	.1016	.5440	.2308	.9908	.2304	.2287	.1000	.0000
1724.000	.0990	.5490	.1878	1.157	.1878	.1878	.1000	.0000
1725.000	.0772	.5000	.2447	.9652	.2430	.2362	.1000	.0000
1726.000	.0672	.4390	.2741	.9735	.2726	.2668	.1000	.0000
1727.000	.0787	.4480	.2717	1.092	.2717	.2717	.1000	.0000
1728.000	.2394	.4170	.1828	1.241	.1828	.1828	.1000	.0000
1729.000	.1029	.4570	.2601	.9892	.2595	.2573	.1000	.0000
1730.000	.3753	.6910	.1653	.9574	.1639	.1583	.1000	.0000
1731.000	1.000	1.029	.0134	1.368	.0134	.0134	.0000	.0000
1732.000	1.000	1.389	.0485	.9086	.0476	.0441	.0000	.0000
1733.000	.8026	1.065	.0418	1.188	.0418	.0418	.0000	.0000
1734.000	.2614	.6410	.1820	.9892	.1817	.1801	.1000	.0000
1735.000	.5863	1.456	.0000	2.191	.0000	.0000	.0000	.0000
1736.000	1.000	5.653	.0000	1.000	.0000	.0000	.0000	.0000
1737.000	1.000	4.116	.0000	1.000	.0000	.0000	.0000	.0000
1738.000	1.000	28.964	.0000	1.000	.0000	.0000	.0000	.0000
1739.000	.9691	33.346	.0000	1.000	.0000	.0000	.0000	.0000
1740.000	1.000	34.672	.0000	1.000	.0000	.0000	.0000	.0000
1741.000	1.000	96.696	.0000	1.000	.0000	.0000	.0000	.0000
1742.000	1.000	1.602	.0000	1.000	.0000	.0000	.0000	.0000
1743.000	1.000	2.459	.0000	1.000	.0000	.0000	.0000	.0000
1744.000	1.000	2.096	.0000	1.000	.0000	.0000	.0000	.0000
1745.000	.1244	.7240	.2736	1.000	.2736	.2736	.1000	.0000
1746.000	.0880	.4760	.2774	.8927	.2712	.2476	.1000	.0000
1747.000	.1293	.5070	.2558	.9465	.2530	.2422	.1000	.0000
1748.000	.2629	2.739	.0000	1.000	.0000	.0000	.0000	.0000
1749.000	.4521	129.34	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1750.000	.9233	20000.	.0000	1.000	.0000	.0000	.0000	.0000
1751.000	1.000	23.776	.0000	1.000	.0000	.0000	.0000	.0000
1752.000	1.000	2.420	.0458	1.000	.0458	.0458	.0000	.0000
1753.000	1.000	2.517	.0283	1.000	.0283	.0283	.0000	.0000
1754.000	1.000	2.538	.0000	1.000	.0000	.0000	.0000	.0000
1755.000	1.000	1.889	.0000	1.000	.0000	.0000	.0000	.0000
1756.000	1.000	1.739	.0370	.8755	.0360	.0324	.0000	.0000
1757.000	1.000	1.847	.0052	1.000	.0052	.0052	.0000	.0000
1758.000	1.000	1.871	.0140	1.008	.0140	.0140	.0000	.0000
1759.000	1.000	1.484	.0000	1.351	.0000	.0000	.0000	.0000
1760.000	.1409	.6330	.2351	.9997	.2350	.2350	.1000	.0000
1761.000	.0656	.5190	.2702	.9007	.2646	.2434	.1000	.0000
1762.000	.1771	.5840	.2139	.9792	.2130	.2094	.1000	.0000
1763.000	.1320	.7160	.2269	.8550	.2199	.1940	.1000	.0000
1764.000	.1133	.6030	.2387	.9040	.2339	.2158	.1000	.0000
1765.000	.0681	.5150	.2629	.8880	.2567	.2334	.1000	.0000
1766.000	.0756	.5140	.2665	.8792	.2598	.2343	.1000	.0000
1767.000	.0559	.4040	.0000	1.000	.0000	.0000	.0000	.0000
1768.000	.7553	.9380	.0000	1.000	.0000	.0000	.0000	.0000
1769.000	1.000	2.678	.0285	.7496	.0269	.0214	.0000	.0000
1770.000	1.000	2.238	.0087	1.000	.0087	.0087	.0000	.0000
1771.000	1.000	1.548	.0025	1.000	.0025	.0025	.0000	.0000
1772.000	.9384	1.096	.0354	1.143	.0354	.0354	.0000	.0000
1773.000	.2801	.8060	.2133	.7627	.2021	.1627	.1000	.0000
1774.000	.5032	1.105	.1617	.7117	.1510	.1151	.0000	.0000
1775.000	1.000	3.449	.0000	1.000	.0000	.0000	.0000	.0000
1776.000	.7037	1.372	.0512	1.037	.0512	.0512	.0000	.0000
1777.000	.5667	1.011	.1194	.8733	.1162	.1043	.0000	.0000
1778.000	1.000	1.295	.0187	1.164	.0187	.0187	.0000	.0000
1779.000	1.000	1.390	.0326	1.009	.0326	.0326	.0000	.0000
1780.000	1.000	1.487	.0376	1.000	.0376	.0376	.0000	.0000
1781.000	1.000	1.471	.0053	1.000	.0053	.0053	.0000	.0000
1782.000	.8048	1.295	.0531	.9910	.0530	.0526	.0000	.0000
1783.000	.5278	1.068	.1253	1.238	.1253	.1253	.0000	.0000
1784.000	.5178	1.001	.1347	.8684	.1310	.1170	.0000	.0000
1785.000	.4390	1.006	.1630	.8658	.1584	.1411	.0000	.0000
1786.000	.3978	.9280	.1606	.8309	.1548	.1335	.1000	.0000
1787.000	.3125	.8770	.1768	1.325	.1768	.1768	.1000	.0000
1788.000	.3555	.8500	.1766	1.231	.1766	.1766	.1000	.0000
1789.000	.5717	1.052	.1062	1.215	.1062	.1062	.0000	.0000
1790.000	.5988	1.375	.1050	1.000	.1050	.1050	.0000	.0000
1791.000	.9456	1.224	.0350	1.085	.0350	.0350	.0000	.0000
1792.000	.9171	1.161	.0345	1.198	.0345	.0345	.0000	.0000
1793.000	.9868	1.109	.0047	1.000	.0047	.0047	.0000	.0000
1794.000	.8392	1.110	.0376	1.172	.0376	.0376	.0000	.0000
1795.000	.5816	1.183	.0648	1.105	.0648	.0648	.0000	.0000
1796.000	1.000	1.334	.0000	1.000	.0000	.0000	.0000	.0000
1797.000	1.000	1.492	.0002	1.000	.0002	.0002	.0000	.0000
1798.000	.6493	1.178	.1063	1.162	.1063	.1063	.0000	.0000
1799.000	.4309	.9410	.1504	1.196	.1504	.1504	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1800.000	.1071	.5600	.2658	.9504	.2631	.2526	.1000	.0000
1801.000	.0769	.5590	.2555	.9586	.2534	.2450	.1000	.0000
1802.000	.0805	.5560	.2637	.9397	.2604	.2478	.1000	.0000
1803.000	.0912	.5700	.2439	.9303	.2404	.2269	.1000	.0000
1804.000	.0775	.5690	.2497	.9328	.2462	.2329	.1000	.0000
1805.000	.0663	.5090	.2671	.9384	.2637	.2506	.1000	.0000
1806.000	.0485	.4430	.2675	1.015	.2675	.2675	.1000	.0000
1807.000	.0335	.4140	.2694	1.010	.2694	.2694	.1000	.0000
1808.000	.0632	.4120	.2758	.9770	.2745	.2694	.1000	.0000
1809.000	.0311	.4170	.2979	.9578	.2953	.2853	.1000	.0000
1810.000	.1020	.5290	.2626	.9654	.2608	.2535	.1000	.0000
1811.000	.4763	1.285	.0584	1.217	.0584	.0584	.0000	.0000
1812.000	.8208	2.617	.0000	1.000	.0000	.0000	.0000	.0000
1813.000	.4793	1.654	.1109	1.000	.1109	.1109	.0000	.0000
1814.000	.1824	.8370	.2065	1.656	.2065	.2065	.1000	.0000
1815.000	.0350	.4270	.2938	.9475	.2906	.2784	.1000	.0000
1816.000	.0142	.3200	.0000	1.000	.0000	.0000	.0000	.0000
1817.000	.0112	.3110	.0000	1.000	.0000	.0000	.0000	.0000
1818.000	.0239	.3630	.0000	1.000	.0000	.0000	.0000	.0000
1819.000	.0236	.2960	.0000	1.009	.0000	.0000	.0000	.0000
1820.000	.0117	.3270	.0000	1.000	.0000	.0000	.0000	.0000
1821.000	.0170	.3420	.0000	1.000	.0000	.0000	.0000	.0000
1822.000	.0099	.3270	.0000	1.048	.0000	.0000	.0000	.0000
1823.000	.0235	.5330	.2736	.8911	.2674	.2438	.1000	.0000
1824.000	.0507	.5810	.2480	.9506	.2455	.2358	.1000	.0000
1825.000	.0433	.5220	.2625	.9940	.2621	.2609	.1000	.0000
1826.000	.0367	.4930	.2749	.9125	.2699	.2508	.1000	.0000
1827.000	.0334	.4640	.2766	.9136	.2717	.2527	.1000	.0000
1828.000	.0256	.5300	.2824	.8955	.2763	.2529	.1000	.0000
1829.000	.0444	.5110	.2695	.9119	.2646	.2458	.1000	.0000
1830.000	.0441	.5510	.2598	.8986	.2543	.2334	.1000	.0000
1831.000	.0493	.5620	.2697	.8908	.2635	.2402	.1000	.0000
1832.000	.0561	.5150	.2842	.8716	.2765	.2477	.1000	.0000
1833.000	.0416	.5730	.2652	.8699	.2579	.2307	.1000	.0000
1834.000	.0503	.6350	.2701	.8294	.2601	.2240	.1000	.0000
1835.000	.0258	.5010	.2790	.9105	.2739	.2541	.1000	.0000
1836.000	.0598	.5050	.2760	.8996	.2702	.2483	.1000	.0000
1837.000	.0748	.6690	.2388	.8654	.2320	.2066	.1000	.0000
1838.000	.0494	.5540	.2700	.8686	.2625	.2345	.1000	.0000
1839.000	.0717	.6940	.1835	1.108	.1835	.1835	.1000	.0000
1840.000	.1162	1.200	.1631	.8926	.1594	.1456	.1000	.0000
1841.000	.0382	.6050	.0000	1.000	.0000	.0000	.0000	.0000
1842.000	.0141	.4080	.0000	1.000	.0000	.0000	.0000	.0000
1843.000	.0163	.4190	.0000	1.000	.0000	.0000	.0000	.0000
1844.000	.0379	.5690	.2587	.8954	.2531	.2317	.1000	.0000
1845.000	.0141	.4610	.0000	1.000	.0000	.0000	.0000	.0000
1846.000	.0443	.4490	.2869	.8772	.2795	.2517	.1000	.0000
1847.000	.2903	1.085	.1638	.8807	.1597	.1443	.1000	.0000
1848.000	.0326	.5440	.2917	.9453	.2884	.2757	.1000	.0000
1849.000	.0275	.4330	.2515	1.045	.2515	.2515	.1000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1850.000	.3648	.6990	.1700	1.321	.1700	.1700	.1000	.0000
1851.000	.5897	.9120	.0861	1.082	.0861	.0861	.0000	.0000
1852.000	.9581	1.220	.0135	1.276	.0135	.0135	.0000	.0000
1853.000	1.000	7.230	.0000	1.000	.0000	.0000	.0000	.0000
1854.000	1.000	2.699	.0000	1.000	.0000	.0000	.0000	.0000
1855.000	.8307	1.680	.0211	1.092	.0211	.0211	.0000	.0000
1856.000	.6255	1.232	.0979	1.000	.0979	.0979	.0000	.0000
1857.000	.8351	1.346	.0388	1.054	.0388	.0388	.0000	.0000
1858.000	.9326	1.407	.0117	1.224	.0117	.0117	.0000	.0000
1859.000	1.000	1.701	.0000	1.000	.0000	.0000	.0000	.0000
1860.000	.5147	1.147	.1430	1.162	.1430	.1430	.0000	.0000
1861.000	.1380	.7680	.2384	1.027	.2384	.2384	.1000	.0000
1862.000	.1250	.7500	.2371	.8748	.2309	.2075	.1000	.0000
1863.000	.1338	.9290	.2226	.9190	.2189	.2046	.1000	.0000
1864.000	.1718	1.024	.2120	1.270	.2120	.2120	.1000	.0000
1865.000	.0966	.8070	.2423	.8919	.2368	.2161	.1000	.0000
1866.000	.1114	.8410	.2166	.9217	.2131	.1997	.1000	.0000
1867.000	.2173	1.264	.2577	.7739	.2449	.1995	.1000	.0000
1868.000	.5697	12.278	.0000	1.000	.0000	.0000	.0000	.0000
1869.000	1.000	3.648	.0111	1.000	.0111	.0111	.0000	.0000
1870.000	1.000	3.969	.1231	.4496	.1049	.0554	.0000	.0000
1871.000	1.000	5.055	.0000	1.000	.0000	.0000	.0000	.0000
1872.000	1.000	1.839	.0000	1.000	.0000	.0000	.0000	.0000
1873.000	1.000	1.807	.0056	1.000	.0056	.0056	.0000	.0000
1874.000	1.000	2.535	.0028	1.000	.0028	.0028	.0000	.0000
1875.000	1.000	2.086	.0061	1.000	.0061	.0061	.0000	.0000
1876.000	1.000	2.325	.0000	1.000	.0000	.0000	.0000	.0000
1877.000	1.000	2.231	.0000	1.000	.0000	.0000	.0000	.0000
1878.000	.6389	1.662	.0710	1.000	.0710	.0710	.0000	.0000
1879.000	.3260	.9700	.1767	1.052	.1767	.1767	.1000	.0000
1880.000	.3451	.8400	.1820	1.331	.1820	.1820	.1000	.0000
1881.000	.3131	.9490	.1776	.9246	.1748	.1642	.1000	.0000
1882.000	.2192	.8990	.1935	.9235	.1905	.1787	.1000	.0000
1883.000	.1986	.8850	.2169	.7675	.2057	.1664	.1000	.0000
1884.000	.1399	.7730	.2372	.7863	.2260	.1865	.1000	.0000
1885.000	.0171	.5170	.2698	.9047	.2644	.2441	.1000	.0000
1886.000	.0533	.7170	.0000	1.000	.0000	.0000	.0000	.0000
1887.000	.2840	1.839	.2125	.5856	.1909	.1244	.1000	.0000
1888.000	.1475	1.002	.2005	1.000	.2005	.2005	.1000	.0000
1889.000	.0945	.6840	.2257	1.018	.2257	.2257	.1000	.0000
1890.000	.1032	.9360	.1928	.8787	.1879	.1694	.1000	.0000
1891.000	.0820	1.153	.1446	.9978	.1445	.1443	.1000	.0000
1892.000	.0769	.8970	.2473	.7476	.2333	.1848	.1000	.0000
1893.000	.0702	.7340	.2346	.9213	.2307	.2161	.1000	.0000
1894.000	.0874	.9550	.2355	.7723	.2236	.1818	.1000	.0000
1895.000	.0912	.9520	.2318	1.281	.2318	.2318	.1000	.0000
1896.000	.0759	.9760	.2366	1.261	.2366	.2366	.1000	.0000
1897.000	.0756	.9640	.2425	1.247	.2425	.2425	.1000	.0000
1898.000	.0728	.8320	.2433	1.330	.2433	.2433	.1000	.0000
1899.000	.0772	.7880	.2249	1.378	.2249	.2249	.1000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1900.000	.0972	.8340	.2218	1.359	.2218	.2218	.1000	.0000
1901.000	.1261	.9890	.2316	.7712	.2199	.1786	.1000	.0000
1902.000	.9528	1.577	.0000	1.000	.0000	.0000	.0000	.0000
1903.000	.5648	1.071	.0932	1.000	.0932	.0932	.0000	.0000
1904.000	.4031	1.126	.1240	1.000	.1240	.1240	.0000	.0000
1905.000	.4583	1.333	.1188	1.000	.1188	.1188	.0000	.0000
1906.000	.3040	1.235	.1712	1.000	.1712	.1712	.1000	.0000
1907.000	.3155	1.140	.1661	1.000	.1661	.1661	.1000	.0000
1908.000	.2925	1.277	.1633	1.000	.1633	.1633	.1000	.0000
1909.000	.1466	1.270	.2065	1.000	.2065	.2065	.1000	.0000
1910.000	.1156	6.044	.0000	1.000	.0000	.0000	.0000	.0000
1911.000	.1625	70.087	.0000	1.000	.0000	.0000	.0000	.0000
1912.000	.2531	20000.	.0000	1.000	.0000	.0000	.0000	.0000
1913.000	.4112	18.432	.0000	1.000	.0000	.0000	.0000	.0000
1914.000	.3761	1.569	.1605	1.025	.1605	.1605	.1000	.0000
1915.000	.8508	1.875	.0111	1.119	.0111	.0111	.0000	.0000
1916.000	1.000	2.495	.0000	1.000	.0000	.0000	.0000	.0000
1917.000	1.000	3.246	.0000	1.000	.0000	.0000	.0000	.0000
1918.000	.9899	2.118	.0038	1.000	.0038	.0038	.0000	.0000
1919.000	1.000	3.181	.0000	1.000	.0000	.0000	.0000	.0000
1920.000	1.000	3.880	.0000	1.000	.0000	.0000	.0000	.0000
1921.000	1.000	4.090	.0000	1.000	.0000	.0000	.0000	.0000
1922.000	1.000	4.846	.0000	1.000	.0000	.0000	.0000	.0000
1923.000	1.000	4.531	.0000	1.000	.0000	.0000	.0000	.0000
1924.000	1.000	3.561	.0000	1.000	.0000	.0000	.0000	.0000
1925.000	1.000	2.607	.0000	1.000	.0000	.0000	.0000	.0000
1926.000	.5119	1.314	.1320	1.094	.1320	.1320	.0000	.0000
1927.000	.0187	.5720	.2966	.8248	.2854	.2446	.1000	.0000
1928.000	.0343	.6510	.2098	.9906	.2095	.2079	.1000	.0000
1929.000	.0299	.7350	.2579	.8216	.2479	.2119	.1000	.0000
1930.000	.0104	.5930	.2899	.7997	.2773	.2319	.1000	.0000
1931.000	.0095	.5780	.2706	.8445	.2616	.2285	.1000	.0000
1932.000	.4654	1.044	.0602	1.331	.0602	.0602	.0000	.0000
1933.000	1.000	2.708	.0000	1.000	.0000	.0000	.0000	.0000
1934.000	.8545	1.896	.0000	1.000	.0000	.0000	.0000	.0000
1935.000	.7516	1.763	.0239	1.095	.0239	.0239	.0000	.0000
1936.000	.1477	.9610	.2129	.8176	.2045	.1741	.1000	.0000
1937.000	.0198	.5730	.2977	.8819	.2903	.2625	.1000	.0000
1938.000	.0941	.7060	.2201	1.158	.2201	.2201	.1000	.0000
1939.000	.0509	.8080	.2609	.8073	.2500	.2106	.1000	.0000
1940.000	.0160	.6470	.2853	.8058	.2732	.2299	.1000	.0000
1941.000	.0018	.7060	.2716	.7835	.2587	.2128	.1000	.0000
1942.000	.0184	.6410	.2734	.8152	.2625	.2229	.1000	.0000
1943.000	.0593	.9090	.2260	.7816	.2151	.1766	.1000	.0000
1944.000	.1146	1.197	.2090	.7381	.1967	.1543	.1000	.0000
1945.000	.1170	.7620	.2059	.9595	.2043	.1976	.1000	.0000
1946.000	.1890	1.385	.1823	.8156	.1750	.1487	.1000	.0000
1947.000	.1078	2.818	.0000	1.000	.0000	.0000	.0000	.0000
1948.000	.0567	36.238	.0000	1.000	.0000	.0000	.0000	.0000
1949.000	.0561	20000.	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
1950.000	.0778	76.371	.0000	1.000	.0000	.0000	.0000	.0000
1951.000	.0651	66.339	.0000	1.000	.0000	.0000	.0000	.0000
1952.000	.0315	20000.	.0000	1.000	.0000	.0000	.0000	.0000
1953.000	.0309	23.957	.0000	1.000	.0000	.0000	.0000	.0000
1954.000	.0232	4.711	.0000	1.000	.0000	.0000	.0000	.0000
1955.000	.1143	.9340	.2280	1.194	.2280	.2280	.1000	.0000
1956.000	.7275	1.589	.0224	1.191	.0224	.0224	.0000	.0000
1957.000	.8610	1.904	.0000	1.000	.0000	.0000	.0000	.0000
1958.000	.9086	1.752	.0054	1.000	.0054	.0054	.0000	.0000
1959.000	.4604	1.412	.1187	1.000	.1187	.1187	.0000	.0000
1960.000	.8923	1.648	.0000	1.114	.0000	.0000	.0000	.0000
1961.000	.7415	1.668	.0326	1.048	.0326	.0326	.0000	.0000
1962.000	1.000	1.849	.0000	1.000	.0000	.0000	.0000	.0000
1963.000	1.000	2.082	.0000	1.000	.0000	.0000	.0000	.0000
1964.000	1.000	2.235	.0000	1.000	.0000	.0000	.0000	.0000
1965.000	1.000	2.924	.0000	1.000	.0000	.0000	.0000	.0000
1966.000	1.000	2.249	.0000	1.020	.0000	.0000	.0000	.0000
1967.000	1.000	2.088	.0000	1.000	.0000	.0000	.0000	.0000
1968.000	1.000	2.414	.0000	1.000	.0000	.0000	.0000	.0000
1969.000	1.000	2.431	.0000	1.000	.0000	.0000	.0000	.0000
1970.000	1.000	2.180	.0000	1.000	.0000	.0000	.0000	.0000
1971.000	.8779	2.201	.0000	1.000	.0000	.0000	.0000	.0000
1972.000	.9239	2.462	.0000	1.000	.0000	.0000	.0000	.0000
1973.000	.7937	2.319	.0243	1.000	.0243	.0243	.0000	.0000
1974.000	.6713	2.246	.0471	.8778	.0459	.0413	.0000	.0000
1975.000	.5849	2.073	.0704	1.000	.0704	.0704	.0000	.0000
1976.000	.5436	2.195	.0718	1.000	.0718	.0718	.0000	.0000
1977.000	.8602	2.482	.0000	1.000	.0000	.0000	.0000	.0000
1978.000	.7057	55.530	.0000	1.000	.0000	.0000	.0000	.0000
1979.000	.9832	3.455	.0000	1.000	.0000	.0000	.0000	.0000
1980.000	.9547	41.393	.0000	1.000	.0000	.0000	.0000	.0000
1981.000	1.000	12.778	.0000	1.000	.0000	.0000	.0000	.0000
1982.000	1.000	77.362	.0000	1.000	.0000	.0000	.0000	.0000
1983.000	.8614	20000.	.0000	1.000	.0000	.0000	.0000	.0000
1984.000	.9254	20000.	.0000	1.000	.0000	.0000	.0000	.0000
1985.000	1.000	2.711	.0000	1.000	.0000	.0000	.0000	.0000
1986.000	1.000	2.926	.0139	.8028	.0133	.0112	.0000	.0000
1987.000	1.000	2.503	.0138	.8692	.0134	.0120	.0000	.0000
1988.000	1.000	2.405	.0190	.8470	.0184	.0161	.0000	.0000
1989.000	1.000	2.319	.0247	.8229	.0238	.0203	.0000	.0000
1990.000	1.000	2.296	.0182	.8727	.0177	.0159	.0000	.0000
1991.000	1.000	2.403	.0127	.8962	.0124	.0113	.0000	.0000
1992.000	1.000	2.343	.0127	.9069	.0125	.0116	.0000	.0000
1993.000	1.000	2.186	.0000	1.000	.0000	.0000	.0000	.0000
1994.000	.9531	2.564	.0000	1.000	.0000	.0000	.0000	.0000
1995.000	1.000	2.410	.0000	1.000	.0000	.0000	.0000	.0000
1996.000	1.000	2.461	.0103	1.000	.0103	.0103	.0000	.0000
1997.000	1.000	2.481	.0174	.8453	.0168	.0147	.0000	.0000
1998.000	1.000	2.393	.0479	.7197	.0448	.0345	.0000	.0000
1999.000	1.000	2.311	.0153	.8919	.0150	.0137	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2000.000	1.000	2.297	.0128	.9153	.0126	.0117	.0000	.0000
2001.000	.9932	2.504	.0141	1.000	.0141	.0141	.0000	.0000
2002.000	.7232	2.087	.0138	1.136	.0138	.0138	.0000	.0000
003.000	.6378	2.164	.0238	1.087	.0238	.0238	.0000	.0000
2004.000	.1992	1.344	.1909	1.000	.1909	.1909	.1000	.0000
2005.000	.1948	1.450	.1787	1.000	.1787	.1787	.1000	.0000
2006.000	.0135	.5570	.0000	1.338	.0000	.0000	.0000	.0000
2007.000	.0076	.5750	.0916	2.411	.0916	.0916	.0000	.0000
2008.000	.0000	.5770	.2942	.8034	.2816	.2363	.1000	.0000
2009.000	.0000	.4850	.3006	.8628	.2918	.2593	.1000	.0000
2010.000	.0000	.5260	.2938	.8268	.2828	.2429	.1000	.0000
2011.000	.0000	.5920	.2754	.8006	.2634	.2205	.1000	.0000
2012.000	.0015	.7060	.2746	.7581	.2598	.2082	.1000	.0000
2013.000	.0000	.7650	.2709	.7331	.2546	.1986	.1000	.0000
2014.000	.0210	.8650	.2568	.7065	.2395	.1814	.1000	.0000
2015.000	.0082	.9090	.2741	.6701	.2530	.1837	.1000	.0000
2016.000	.1830	1.315	.1277	1.085	.1277	.1277	.1000	.0000
2017.000	.3345	1.582	.1435	1.000	.1435	.1435	.1000	.0000
2018.000	.3798	1.851	.1189	1.007	.1189	.1189	.1000	.0000
2019.000	.7304	2.452	.0296	1.000	.0296	.0296	.0000	.0000
2020.000	1.000	3.986	.0903	1.000	.0903	.0903	.0000	.0000
2021.000	1.000	34.058	.0000	1.000	.0000	.0000	.0000	.0000
2022.000	1.000	4.357	.0000	1.000	.0000	.0000	.0000	.0000
2023.000	.7865	2.813	.0149	1.000	.0149	.0149	.0000	.0000
2024.000	1.000	3.050	.0000	1.000	.0000	.0000	.0000	.0000
2025.000	.1889	1.879	.0000	1.000	.0000	.0000	.0000	.0000
2026.000	.0686	.7980	.2739	.6602	.2521	.1808	.1000	.0000
2027.000	.2920	1.565	.1507	1.000	.1507	.1507	.1000	.0000
2028.000	.3467	1.688	.1470	1.000	.1470	.1470	.1000	.0000
029.000	.3579	1.831	.1325	1.000	.1325	.1325	.1000	.0000
2030.000	.6891	1.876	.0525	1.000	.0525	.0525	.0000	.0000
2031.000	.7041	2.122	.0424	1.000	.0424	.0424	.0000	.0000
2032.000	.8522	2.279	.0000	1.000	.0000	.0000	.0000	.0000
2033.000	.7768	2.192	.0171	1.025	.0171	.0171	.0000	.0000
2034.000	.8338	2.104	.0061	1.000	.0061	.0061	.0000	.0000
2035.000	.3100	1.653	.1890	.9863	.1885	.1864	.1000	.0000
2036.000	.6464	2.769	.0000	1.000	.0000	.0000	.0000	.0000
2037.000	.8722	11.327	.0000	1.000	.0000	.0000	.0000	.0000
2038.000	1.000	3.240	.0000	1.000	.0000	.0000	.0000	.0000
2039.000	1.000	5.262	.0000	1.000	.0000	.0000	.0000	.0000
2040.000	1.000	4.185	.0000	1.000	.0000	.0000	.0000	.0000
2041.000	.6748	2.678	.0335	1.000	.0335	.0335	.0000	.0000
2042.000	.2981	.9970	.1408	1.000	.1408	.1408	.1000	.0000
2043.000	.1284	.9220	.2152	1.291	.2152	.2152	.1000	.0000
2044.000	.1123	.8170	.1791	1.350	.1791	.1791	.1000	.0000
2045.000	.0557	.5750	.2379	1.181	.2379	.2379	.1000	.0000
2046.000	.1472	2.763	.2050	.4401	.1739	.0902	.1000	.1148
2047.000	.2388	.1420	.1398	2.519	.1398	.1398	.1000	.0000
2048.000	.1459	.9834	.2237	.6832	.2073	.1528	.1000	.0000
2049.000	.0747	.8360	.2627	.7001	.2446	.1839	.0999	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2050.000	.1263	.9000	.2117	.7910	.2020	.1675	.0999	.0000
2051.000	.0867	.5660	.2391	.9395	.2362	.2247	.0999	.0000
2052.000	.0239	.1680	.2675	1.580	.2675	.2675	.0999	.0000
2053.000	.0365	.5612	.2500	.8615	.2427	.2154	.0999	.0000
2054.000	.0096	1.283	.2518	15.050	.2518	.2518	.0999	.0000
2055.000	.0045	.9375	.2883	.6050	.2607	.1744	.0999	.0000
2056.000	.0162	.2790	.2357	1.338	.2357	.2357	.0999	.0000
2057.000	.0000	.5100	.2999	.8446	.2899	.2533	.0999	.0000
2058.000	.0571	.5990	.2350	.9068	.2304	.2131	.0999	.0000
2059.000	.3269	1.167	.1713	1.130	.1713	.1713	.0999	.0000
2060.000	.0979	1.608	.1754	.7399	.1652	.1298	.0999	.0000
2061.000	.1285	1.057	.2356	.8840	.2299	.2083	.0999	.0000
2062.000	.1818	1.616	.2141	.9582	.2122	.2051	.0999	.0000
2063.000	.2075	1.509	.1850	.6555	.1700	.1213	.0999	.0000
2064.000	.3276	1.562	.1651	.7991	.1579	.1319	.0999	.0000
2065.000	.2935	1.963	.1739	.8464	.1682	.1472	.0999	.0000
2066.000	.1661	1.280	.2523	.6878	.2341	.1735	.0999	.0000
2067.000	.5045	3.231	.1019	1.000	.1019	.1019	.0000	.0000
2068.000	.6119	2.381	.0790	.6818	.0732	.0539	.0000	.0000
2069.000	.7011	2.370	.0378	1.000	.0378	.0378	.0000	.0000
2070.000	.7635	2.451	.0193	1.000	.0193	.0193	.0000	.0000
2071.000	.8138	2.746	.0105	1.000	.0105	.0105	.0000	.0000
2072.000	.9633	3.398	.0000	1.000	.0000	.0000	.0000	.0000
2073.000	.4632	3.159	.0000	1.000	.0000	.0000	.0000	.0000
2074.000	.2079	2.747	.1889	1.000	.1889	.1889	.0999	.0000
2075.000	.0241	.9590	.2726	.6335	.2488	.1727	.0999	.0000
2076.000	.0078	.8610	.2633	.6765	.2435	.1781	.0999	.0000
2077.000	.0615	1.314	.2099	.6693	.1937	.1405	.0999	.0000
2078.000	.0982	1.343	.1976	.6675	.1823	.1319	.0999	.0000
2079.000	.4863	2.491	.0599	.8362	.0578	.0501	.0000	.0000
2080.000	.7463	3.158	.0194	1.000	.0194	.0194	.0000	.0000
2081.000	.4860	7.588	.0000	1.000	.0000	.0000	.0000	.0000
2082.000	.2376	19.150	.0000	1.000	.0000	.0000	.0000	.0000
2083.000	.1420	1.746	.2035	1.000	.2035	.2035	.0999	.0000
2084.000	.4472	2.073	.1058	1.000	.1058	.1058	.0000	.0000
2085.000	.0295	1.237	.2834	.9132	.2783	.2588	.0999	.0000
2086.000	.0970	1.266	.2371	1.110	.2371	.2371	.0999	.0000
2087.000	.3891	2.960	.0784	1.000	.0784	.0784	.0000	.0000
2088.000	.2652	2.049	.1650	1.000	.1650	.1650	.0999	.0000
2089.000	.1720	1.963	.2297	1.000	.2297	.2297	.0999	.0000
2090.000	.2560	2.334	.2592	.5464	.2297	.1416	.0999	.0000
2091.000	.4141	5.665	.1466	1.000	.1466	.1466	.0000	.0000
2092.000	.1949	2.162	.1679	.6954	.1561	.1168	.0999	.0000
2093.000	.1280	1.492	.1985	1.065	.1985	.1985	.0999	.0000
2094.000	.2341	1.983	.1545	1.000	.1545	.1545	.0999	.0000
2095.000	.2030	1.889	.1692	1.000	.1692	.1692	.0999	.0000
2096.000	.2639	2.130	.1382	.8167	.1327	.1128	.0999	.0000
2097.000	.5576	3.188	.0629	.7214	.0589	.0454	.0000	.0000
2098.000	.2346	2.043	.1736	.6728	.1604	.1168	.0999	.0000
2099.000	.1586	1.680	.1619	.8394	.1564	.1359	.0999	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2100.000	.1801	2.055	.1645	.6909	.1528	.1136	.0999	.0000
2101.000	.1174	1.622	.2000	.6497	.1835	.1299	.0999	.0000
2102.000	.1721	1.954	.1954	.5962	.1762	.1165	.0999	.0000
2103.000	.1777	2.173	.1705	.6262	.1553	.1068	.0999	.0000
2104.000	.0096	1.020	.2646	.6854	.2453	.1814	.0999	.0000
2105.000	.0302	1.135	.2623	.6461	.2404	.1695	.0999	.0000
2106.000	.0467	1.392	.2260	.6155	.2051	.1391	.0999	.0000
2107.000	.0633	1.548	.2321	.5989	.2095	.1390	.0999	.0000
2108.000	.0747	1.413	.2200	.6330	.2008	.1393	.0999	.0000
2109.000	.0064	.9730	.2516	.6700	.2323	.1686	.0999	.0000
2110.000	.0000	.9300	.2728	.6546	.2506	.1786	.0999	.0000
2111.000	.0000	.9570	.2720	.6479	.2494	.1762	.0999	.0000
2112.000	.0016	1.063	.2437	.6744	.2252	.1643	.0999	.0000
2113.000	.0254	1.334	.0000	1.000	.0000	.0000	.0000	.0000
2114.000	.1468	11.093	.0000	1.000	.0000	.0000	.0000	.0000
2115.000	.4369	88.189	.0000	1.000	.0000	.0000	.0000	.0000
2116.000	.7069	4.280	.0267	1.000	.0267	.0267	.0000	.0000
2117.000	.4948	3.137	.1146	1.000	.1146	.1146	.0000	.0000
2118.000	.7551	3.533	.0363	1.000	.0363	.0363	.0000	.0000
2119.000	.6749	3.605	.0765	1.000	.0765	.0765	.0000	.0000
2120.000	.5073	2.979	.0954	1.000	.0954	.0954	.0000	.0000
2121.000	.4181	2.419	.1123	1.000	.1123	.1123	.0000	.0000
2122.000	.4925	2.882	.0896	1.000	.0896	.0896	.0000	.0000
2123.000	.5442	3.205	.0784	1.000	.0784	.0784	.0000	.0000
2124.000	.6049	3.045	.0693	1.000	.0693	.0693	.0000	.0000
2125.000	.2602	1.889	.1694	1.000	.1694	.1694	.0999	.0000
2126.000	.4261	2.992	.1141	1.000	.1141	.1141	.0000	.0000
2127.000	.2071	1.658	.2091	1.000	.2091	.2091	.0999	.0000
2128.000	.2132	1.886	.2081	1.000	.2081	.2081	.0999	.0000
2129.000	.0604	1.556	.2525	1.000	.2525	.2525	.0999	.0000
2130.000	.0130	1.452	.2604	.6949	.2421	.1809	.0999	.0000
2131.000	.0601	1.661	.2446	1.000	.2446	.2446	.0999	.0000
2132.000	.0928	1.715	.2371	1.000	.2371	.2371	.0999	.0000
2133.000	.2624	2.837	.1662	1.000	.1662	.1662	.0999	.0000
2134.000	.2674	2.375	.1825	1.000	.1825	.1825	.0999	.0000
2135.000	.3826	2.217	.1604	1.000	.1604	.1604	.0999	.0000
2136.000	.3868	2.393	.1610	1.000	.1610	.1610	.0999	.0000
2137.000	.5624	3.442	.0605	1.000	.0605	.0605	.0000	.0000
2138.000	.6196	3.378	.1102	.4888	.0955	.0539	.0000	.0000
2139.000	.4260	3.426	.2443	1.000	.2443	.2443	.0000	.0000
2140.000	.4231	15.195	.0000	1.000	.0000	.0000	.0000	.0000
2141.000	.5507	4.377	.0000	1.000	.0000	.0000	.0000	.0000
2142.000	.6173	5.266	.0000	1.000	.0000	.0000	.0000	.0000
2143.000	.4786	4.675	.0000	1.000	.0000	.0000	.0000	.0000
2144.000	.5024	20000.	.0000	1.000	.0000	.0000	.0000	.0000
2145.000	.6331	6.546	.1133	1.000	.1133	.1133	.0000	.0000
2146.000	.6347	3.537	.0949	1.000	.0949	.0949	.0000	.0000
2147.000	.5617	2.401	.0843	1.000	.0843	.0843	.0000	.0000
2148.000	.4112	2.423	.1249	1.000	.1249	.1249	.0000	.0000
2149.000	.3968	2.340	.1285	.6439	.1177	.0828	.0999	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2150.000	.5125	2.468	.0752	.7978	.0719	.0600	.0000	.0000
2151.000	.5441	3.014	.0654	1.000	.0654	.0654	.0000	.0000
2152.000	.4698	6.397	.0000	1.000	.0000	.0000	.0000	.0000
2153.000	.3832	3.071	.1399	.7542	.1322	.1055	.0999	.0000
2154.000	.2484	2.770	.0000	1.000	.0000	.0000	.0000	.0000
2155.000	.6779	5.346	.0573	1.000	.0573	.0573	.0000	.0000
2156.000	.8787	3.817	.0000	1.000	.0000	.0000	.0000	.0000
2157.000	.8355	4.473	.0052	1.000	.0052	.0052	.0000	.0000
2158.000	.6984	3.825	.0182	.8149	.0174	.0148	.0000	.0000
2159.000	.6982	3.025	.0403	1.000	.0403	.0403	.0000	.0000
2160.000	.3960	2.649	.1150	1.000	.1150	.1150	.0999	.0000
2161.000	.2040	2.101	.1595	1.000	.1595	.1595	.0999	.0000
2162.000	.0329	1.693	.2358	.5783	.2113	.1364	.0999	.0000
2163.000	.0311	1.470	.2456	.5991	.2217	.1471	.0999	.0000
2164.000	.1406	1.874	.2036	.6442	.1865	.1312	.0999	.0000
2165.000	.1753	1.970	.1873	.5721	.1675	.1071	.0999	.0000
2166.000	.3287	2.379	.1327	1.000	.1327	.1327	.0999	.0000
2167.000	.2321	2.268	.1742	.6062	.1576	.1056	.0999	.0000
2168.000	.3578	2.472	.1291	.6753	.1194	.0872	.0999	.0000
2169.000	.1296	2.268	.1946	.5672	.1737	.1104	.0999	.0000
2170.000	.0691	1.915	.2323	.7973	.2220	.1852	.0999	.0000
2171.000	.0717	1.882	.2103	.5819	.1887	.1224	.0999	.0000
2172.000	.0000	1.377	.2667	.5624	.2377	.1500	.0999	.0000
2173.000	.0000	.9630	.2477	.6816	.2294	.1689	.0999	.0000
2174.000	.0000	.7430	.2966	.6537	.2724	.1939	.0999	.0000
2175.000	.0787	1.293	.2719	.8750	.2647	.2379	.0999	.0000
2176.000	.3804	4.411	.0000	1.000	.0000	.0000	.0000	.0000
2177.000	.4309	5.186	.0000	1.000	.0000	.0000	.0000	.0000
2178.000	.2115	10.914	.0000	1.000	.0000	.0000	.0000	.0000
2179.000	.2849	8.650	.0000	1.000	.0000	.0000	.0000	.0000
2180.000	.2328	3.024	.1604	.7940	.1531	.1273	.0999	.0000
2181.000	.1492	2.352	.1719	1.000	.1719	.1719	.0999	.0000
2182.000	.0185	1.505	.2440	.6243	.2221	.1523	.0999	.0000
2183.000	.0000	.9540	.2548	.7042	.2376	.1794	.0999	.0000
2184.000	.0070	1.306	.2374	1.128	.2374	.2374	.0999	.0000
2185.000	.1439	1.461	.1634	1.000	.1634	.1634	.0999	.0000
2186.000	.2797	20000.	.1314	1.000	.1314	.1314	.0999	.0000
2187.000	.0744	.0360	.0000	1.000	.0000	.0000	.0000	.0000
2188.000	.2189	.0410	.1212	5.231	.1212	.1212	.0999	.0000
2189.000	.3512	20000.	.1127	1.000	.1127	.1127	.0999	.0000
2190.000	.2857	1.506	.1388	1.000	.1388	.1388	.0999	.0000
2191.000	.3290	1.552	.1072	1.000	.1072	.1072	.0999	.0000
2192.000	.3371	.2250	.0666	3.024	.0666	.0666	.0000	.0000
2193.000	.3719	.1250	.0700	3.797	.0700	.0700	.0000	.0000
2194.000	.3647	20000.	.0730	1.000	.0730	.0730	.0000	.0000
2195.000	.1500	.2490	.1511	1.867	.1511	.1511	.0999	.0000
2196.000	.2441	20000.	.1183	1.000	.1183	.1183	.0999	.0000
2197.000	.6647	6.094	.0168	1.000	.0168	.0168	.0000	.0000
2198.000	.9102	5.637	.0000	1.000	.0000	.0000	.0000	.0000
2199.000	1.000	5.847	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2200.000	1.000	5.811	.0000	1.000	.0000	.0000	.0000	.0000
2201.000	1.000	4.704	.0000	1.000	.0000	.0000	.0000	.0000
2202.000	1.000	5.246	.0000	1.000	.0000	.0000	.0000	.0000
2203.000	1.000	4.147	.0000	1.000	.0000	.0000	.0000	.0000
2204.000	1.000	3.998	.0000	1.000	.0000	.0000	.0000	.0000
2205.000	1.000	3.270	.0127	2.628	.0127	.0127	.0000	.0000
2206.000	1.000	2.784	.0060	1.000	.0060	.0060	.0000	.0000
2207.000	1.000	4.258	.0000	1.000	.0000	.0000	.0000	.0000
2208.000	1.000	6.550	.0000	1.000	.0000	.0000	.0000	.0000
2209.000	1.000	18.742	.0000	1.000	.0000	.0000	.0000	.0000
2210.000	1.000	17.645	.0000	1.000	.0000	.0000	.0000	.0000
2211.000	1.000	19.670	.0000	1.000	.0000	.0000	.0000	.0000
2212.000	1.000	16.638	.0000	1.000	.0000	.0000	.0000	.0000
2213.000	1.000	33.025	.0000	1.000	.0000	.0000	.0000	.0000
2214.000	1.000	64.875	.0000	1.000	.0000	.0000	.0000	.0000
2215.000	1.000	25.046	.0000	1.000	.0000	.0000	.0000	.0000
2216.000	1.000	45.344	.0000	1.000	.0000	.0000	.0000	.0000
2217.000	1.000	44.558	.0000	1.000	.0000	.0000	.0000	.0000
2218.000	1.000	49.436	.0000	1.000	.0000	.0000	.0000	.0000
2219.000	1.000	56.242	.0000	1.000	.0000	.0000	.0000	.0000
2220.000	1.000	34.150	.0000	1.000	.0000	.0000	.0000	.0000
2221.000	1.000	28.900	.0000	1.000	.0000	.0000	.0000	.0000
2222.000	1.000	40.231	.0000	1.000	.0000	.0000	.0000	.0000
2223.000	1.000	24.126	.0000	1.000	.0000	.0000	.0000	.0000
2224.000	1.000	18.126	.0000	1.000	.0000	.0000	.0000	.0000
2225.000	1.000	47.651	.0000	1.000	.0000	.0000	.0000	.0000
2226.000	1.000	23.113	.0000	1.000	.0000	.0000	.0000	.0000
2227.000	1.000	21.726	.0000	1.000	.0000	.0000	.0000	.0000
2228.000	1.000	72.582	.0000	1.000	.0000	.0000	.0000	.0000
229.000	1.000	52.879	.0000	1.000	.0000	.0000	.0000	.0000
2230.000	1.000	20.497	.0000	1.000	.0000	.0000	.0000	.0000
2231.000	1.000	21.482	.0000	1.000	.0000	.0000	.0000	.0000
2232.000	1.000	24.069	.0000	1.000	.0000	.0000	.0000	.0000
2233.000	1.000	27.883	.0000	1.000	.0000	.0000	.0000	.0000
2234.000	1.000	54.594	.0000	1.000	.0000	.0000	.0000	.0000
2235.000	1.000	38.669	.0000	1.000	.0000	.0000	.0000	.0000
2236.000	1.000	69.390	.0000	1.000	.0000	.0000	.0000	.0000
2237.000	1.000	58.070	.0000	1.000	.0000	.0000	.0000	.0000
2238.000	1.000	32.634	.0000	1.000	.0000	.0000	.0000	.0000
2239.000	1.000	9.596	.0000	1.000	.0000	.0000	.0000	.0000
2240.000	1.000	57.998	.0000	1.000	.0000	.0000	.0000	.0000
2241.000	1.000	44.635	.0000	1.000	.0000	.0000	.0000	.0000
2242.000	1.000	70.792	.0000	1.000	.0000	.0000	.0000	.0000
2243.000	1.000	58.925	.0000	1.000	.0000	.0000	.0000	.0000
2244.000	1.000	59.657	.0000	1.000	.0000	.0000	.0000	.0000
2245.000	1.000	86.880	.0000	1.000	.0000	.0000	.0000	.0000
2246.000	1.000	53.454	.0000	1.000	.0000	.0000	.0000	.0000
2247.000	1.000	72.254	.0000	1.000	.0000	.0000	.0000	.0000
2248.000	1.000	79.980	.0000	1.000	.0000	.0000	.0000	.0000
2249.000	1.000	83.834	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2250.000	1.000	67.658	.0000	1.000	.0000	.0000	.0000	.0000
2251.000	1.000	95.119	.0000	1.000	.0000	.0000	.0000	.0000
2252.000	1.000	89.523	.0000	1.000	.0000	.0000	.0000	.0000
2253.000	1.000	91.967	.0000	1.000	.0000	.0000	.0000	.0000
2254.000	1.000	62.715	.0000	1.000	.0000	.0000	.0000	.0000
2255.000	1.000	74.935	.0000	1.000	.0000	.0000	.0000	.0000
2256.000	1.000	49.989	.0000	1.000	.0000	.0000	.0000	.0000
2257.000	1.000	39.264	.0000	1.000	.0000	.0000	.0000	.0000
2258.000	1.000	43.122	.0000	1.000	.0000	.0000	.0000	.0000
2259.000	1.000	50.591	.0000	1.000	.0000	.0000	.0000	.0000
2260.000	1.000	26.843	.0000	1.000	.0000	.0000	.0000	.0000
2261.000	1.000	30.668	.0000	1.000	.0000	.0000	.0000	.0000
2262.000	1.000	39.492	.0000	1.000	.0000	.0000	.0000	.0000
2263.000	1.000	71.221	.0000	1.000	.0000	.0000	.0000	.0000
2264.000	1.000	49.151	.0000	1.000	.0000	.0000	.0000	.0000
2265.000	1.000	44.033	.0000	1.000	.0000	.0000	.0000	.0000
2266.000	1.000	40.334	.0000	1.000	.0000	.0000	.0000	.0000
2267.000	1.000	35.024	.0000	1.000	.0000	.0000	.0000	.0000
2268.000	1.000	24.617	.0000	1.000	.0000	.0000	.0000	.0000
2269.000	1.000	18.643	.0000	1.000	.0000	.0000	.0000	.0000
2270.000	1.000	20.935	.0000	1.000	.0000	.0000	.0000	.0000
2271.000	1.000	43.275	.0000	1.000	.0000	.0000	.0000	.0000
2272.000	1.000	739.92	.0007	1.000	.0007	.0007	.0000	.0000
2273.000	1.000	7.404	.0135	1.697	.0135	.0135	.0000	.0000
2274.000	1.000	11.893	.0018	1.000	.0018	.0018	.0000	.0000
2275.000	1.000	13.985	.0000	1.000	.0000	.0000	.0000	.0000
2276.000	1.000	10.281	.0163	1.323	.0163	.0163	.0000	.0000
2277.000	1.000	7.888	.0147	1.581	.0147	.0147	.0000	.0000
2278.000	1.000	5.727	.0139	1.902	.0139	.0139	.0000	.0000
2279.000	1.000	4.800	.0214	1.687	.0214	.0214	.0000	.0000
2280.000	1.000	6.582	.0032	1.000	.0032	.0032	.0000	.0000
2281.000	1.000	11.815	.0000	1.000	.0000	.0000	.0000	.0000
2282.000	1.000	4.563	.0000	1.000	.0000	.0000	.0000	.0000
2283.000	1.000	4.078	.0000	1.000	.0000	.0000	.0000	.0000
2284.000	1.000	3.900	.0000	1.000	.0000	.0000	.0000	.0000
2285.000	1.000	3.365	.0000	1.000	.0000	.0000	.0000	.0000
2286.000	1.000	3.464	.0000	1.000	.0000	.0000	.0000	.0000
2287.000	1.000	4.263	.0000	1.000	.0000	.0000	.0000	.0000
2288.000	1.000	4.567	.0000	1.000	.0000	.0000	.0000	.0000
2289.000	1.000	4.543	.0000	1.000	.0000	.0000	.0000	.0000
2290.000	1.000	4.416	.0000	1.000	.0000	.0000	.0000	.0000
2291.000	.7357	5.126	.0207	1.000	.0207	.0207	.0000	.0000
2292.000	.8034	5.526	.0093	1.000	.0093	.0093	.0000	.0000
2293.000	.8140	6.571	.0587	.6216	.0534	.0365	.0000	.0000
2294.000	.7049	8.607	.0514	.6122	.0466	.0314	.0000	.0000
2295.000	.7106	4.910	.0538	.7924	.0514	.0426	.0000	.0000
2296.000	.8981	4.401	.0194	1.000	.0194	.0194	.0000	.0000
2297.000	.9226	5.289	.0000	1.000	.0000	.0000	.0000	.0000
2298.000	1.000	4.401	.0000	1.000	.0000	.0000	.0000	.0000
2299.000	1.000	5.479	.0097	1.000	.0097	.0097	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2300.000	1.000	3.661	.0181	1.022	.0181	.0181	.0000	.0000
2301.000	1.000	3.714	.0137	1.050	.0137	.0137	.0000	.0000
2302.000	1.000	4.511	.0203	.9056	.0199	.0184	.0000	.0000
2303.000	1.000	3.704	.0181	1.016	.0181	.0181	.0000	.0000
2304.000	.9754	3.687	.0161	1.046	.0161	.0161	.0000	.0000
2305.000	1.000	3.830	.0134	1.036	.0134	.0134	.0000	.0000
2306.000	1.000	4.327	.0000	1.000	.0000	.0000	.0000	.0000
2307.000	1.000	3.829	.0508	.7920	.0484	.0402	.0000	.0000
2308.000	.2513	2.641	.1873	.6405	.1713	.1199	.0999	.0000
2309.000	.2565	2.238	.1523	.8396	.1470	.1278	.0999	.0000
2310.000	.0541	1.248	.2733	.7006	.2545	.1915	.0999	.0000
2311.000	.0285	1.278	.2651	.7227	.2484	.1916	.0999	.0000
2312.000	.0630	1.135	.2532	.7940	.2417	.2010	.0999	.0000
2313.000	.0905	1.480	.2247	.7788	.2137	.1750	.0999	.0000
2314.000	.1910	1.708	.1504	1.019	.1504	.1504	.0999	.0000
2315.000	.1829	1.718	.2224	.6968	.2069	.1549	.0999	.0000
2316.000	.7633	4.924	.0884	1.000	.0884	.0884	.0000	.0000
2317.000	.3416	2.279	.1509	.7909	.1440	.1194	.0999	.0000
2318.000	.4669	2.281	.1113	.9220	.1095	.1026	.0000	.0000
2319.000	1.000	4.128	.0000	1.000	.0000	.0000	.0000	.0000
2320.000	1.000	4.325	.0000	1.000	.0000	.0000	.0000	.0000
2321.000	.4650	2.309	.1221	.8578	.1184	.1047	.0000	.0000
2322.000	1.000	3.468	.0000	1.000	.0000	.0000	.0000	.0000
2323.000	1.000	3.925	.0000	1.000	.0000	.0000	.0000	.0000
2324.000	1.000	4.799	.0000	1.000	.0000	.0000	.0000	.0000
2325.000	1.000	3.816	.0138	1.034	.0138	.0138	.0000	.0000
2326.000	1.000	4.271	.0000	1.000	.0000	.0000	.0000	.0000
2327.000	1.000	3.972	.0012	1.000	.0012	.0012	.0000	.0000
2328.000	1.000	4.992	.0000	1.000	.0000	.0000	.0000	.0000
329.000	.8730	4.072	.0000	1.000	.0000	.0000	.0000	.0000
2330.000	.4380	3.059	.0914	.9325	.0902	.0852	.0000	.0000
2331.000	.9027	4.122	.0016	1.000	.0016	.0016	.0000	.0000
2332.000	1.000	4.768	.0000	1.000	.0000	.0000	.0000	.0000
2333.000	1.000	4.930	.0000	1.000	.0000	.0000	.0000	.0000
2334.000	.8073	6.616	.0000	1.000	.0000	.0000	.0000	.0000
2335.000	.9295	2.816	.0000	1.000	.0000	.0000	.0000	.0000
2336.000	1.000	2.992	.0000	1.000	.0000	.0000	.0000	.0000
2337.000	1.000	4.114	.0000	1.000	.0000	.0000	.0000	.0000
2338.000	1.000	3.739	.0000	1.000	.0000	.0000	.0000	.0000
2339.000	1.000	4.380	.0000	1.000	.0000	.0000	.0000	.0000
2340.000	1.000	5.307	.0000	1.000	.0000	.0000	.0000	.0000
2341.000	1.000	8.366	.0310	1.000	.0310	.0310	.0000	.0000
2342.000	1.000	6.185	.0000	1.000	.0000	.0000	.0000	.0000
2343.000	1.000	5.016	.0992	.5180	.0870	.0514	.0000	.0000
2344.000	.6254	2.412	.0609	1.136	.0609	.0609	.0000	.0000
2345.000	.5777	2.377	.0642	1.158	.0642	.0642	.0000	.0000
2346.000	1.000	3.648	.0000	1.000	.0000	.0000	.0000	.0000
2347.000	1.000	4.656	.0000	1.000	.0000	.0000	.0000	.0000
2348.000	1.000	5.319	.0000	1.000	.0000	.0000	.0000	.0000
2349.000	1.000	5.676	.0011	1.000	.0011	.0011	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2350.000	1.000	5.437	.0000	1.000	.0000	.0000	.0000	.0000
2351.000	1.000	12.626	.0000	1.000	.0000	.0000	.0000	.0000
2352.000	1.000	5.798	.0000	1.000	.0000	.0000	.0000	.0000
2353.000	1.000	4.741	.0000	1.000	.0000	.0000	.0000	.0000
2354.000	1.000	3.036	.0294	1.030	.0294	.0294	.0000	.0000
2355.000	1.000	3.366	.0744	.7264	.0698	.0540	.0000	.0000
2356.000	1.000	5.357	.0000	1.000	.0000	.0000	.0000	.0000
2357.000	1.000	23.633	.0000	1.000	.0000	.0000	.0000	.0000
2358.000	1.000	4.618	.0000	1.000	.0000	.0000	.0000	.0000
2359.000	1.000	3.566	.0000	1.000	.0000	.0000	.0000	.0000
2360.000	1.000	4.155	.0000	1.000	.0000	.0000	.0000	.0000
2361.000	1.000	4.791	.0000	1.000	.0000	.0000	.0000	.0000
2362.000	1.000	5.329	.0000	1.000	.0000	.0000	.0000	.0000
2363.000	1.000	5.841	.0000	1.000	.0000	.0000	.0000	.0000
2364.000	1.000	5.956	.0000	1.000	.0000	.0000	.0000	.0000
2365.000	.9184	22.084	.0000	1.000	.0000	.0000	.0000	.0000
2366.000	.7946	36.737	.0000	1.000	.0000	.0000	.0000	.0000
2367.000	1.000	5.442	.0000	1.000	.0000	.0000	.0000	.0000
2368.000	.9536	4.487	.0000	1.000	.0000	.0000	.0000	.0000
2369.000	1.000	4.818	.0000	1.000	.0000	.0000	.0000	.0000
2370.000	1.000	5.224	.0000	1.000	.0000	.0000	.0000	.0000
2371.000	1.000	5.427	.0000	1.000	.0000	.0000	.0000	.0000
2372.000	.9672	4.850	.0000	1.000	.0000	.0000	.0000	.0000
2373.000	1.000	34.150	.0000	1.000	.0000	.0000	.0000	.0000
2374.000	1.000	16.506	.0653	1.000	.0653	.0653	.0000	.0000
2375.000	1.000	4.234	.0000	1.000	.0000	.0000	.0000	.0000
2376.000	1.000	4.999	.0000	1.000	.0000	.0000	.0000	.0000
2377.000	1.000	5.214	.0186	1.000	.0186	.0186	.0000	.0000
2378.000	1.000	4.273	.0000	1.000	.0000	.0000	.0000	.0000
2379.000	1.000	4.328	.0593	.7024	.0552	.0416	.0000	.0000
2380.000	1.000	4.013	.0328	.8735	.0320	.0287	.0000	.0000
2381.000	1.000	4.145	.0000	1.000	.0000	.0000	.0000	.0000
2382.000	1.000	5.527	.0000	1.000	.0000	.0000	.0000	.0000
2383.000	1.000	5.356	.0000	1.000	.0000	.0000	.0000	.0000
2384.000	.8917	4.488	.0000	1.000	.0000	.0000	.0000	.0000
2385.000	1.000	5.706	.0041	1.000	.0041	.0041	.0000	.0000
2386.000	1.000	4.261	.0000	1.000	.0000	.0000	.0000	.0000
2387.000	1.000	10.637	.0000	1.000	.0000	.0000	.0000	.0000
2388.000	.8346	5.792	.0000	1.000	.0000	.0000	.0000	.0000
2389.000	.6692	6.055	.0120	1.059	.0120	.0120	.0000	.0000
2390.000	.6975	5.956	.0240	1.000	.0240	.0240	.0000	.0000
2391.000	.6918	5.411	.0167	1.047	.0167	.0167	.0000	.0000
2392.000	.3922	4.673	.0563	1.063	.0563	.0563	.0000	.0000
2393.000	.3520	4.615	.0732	.9522	.0725	.0697	.0000	.0000
2394.000	.5843	5.115	.0548	1.000	.0548	.0548	.0000	.0000
2395.000	.4215	5.287	.0823	1.000	.0823	.0823	.0000	.0000
2396.000	.0300	2.604	.2523	1.000	.2523	.2523	.0999	.0000
2397.000	.0989	7.789	.0000	1.000	.0000	.0000	.0000	.0000
2398.000	.5783	16.124	.0000	1.000	.0000	.0000	.0000	.0000
2399.000	1.000	13.349	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2400.000	1.000	7.241	.0000	1.000	.0000	.0000	.0000	.0000
2401.000	1.000	4.893	.0421	1.000	.0421	.0421	.0000	.0000
2402.000	1.000	3.879	.0037	1.000	.0037	.0037	.0000	.0000
2403.000	1.000	4.410	.0906	.5967	.0817	.0541	.0000	.0000
2404.000	1.000	6.838	.0000	1.000	.0000	.0000	.0000	.0000
2405.000	1.000	4.784	.0000	1.000	.0000	.0000	.0000	.0000
2406.000	1.000	4.995	.0053	1.000	.0053	.0053	.0000	.0000
2407.000	1.000	6.213	.0487	1.000	.0487	.0487	.0000	.0000
2408.000	1.000	3.391	.0000	1.000	.0000	.0000	.0000	.0000
2409.000	1.000	4.855	.0000	1.000	.0000	.0000	.0000	.0000
2410.000	1.000	5.515	.0000	1.000	.0000	.0000	.0000	.0000
2411.000	1.000	4.402	.0000	1.000	.0000	.0000	.0000	.0000
2412.000	1.000	4.947	.0000	1.000	.0000	.0000	.0000	.0000
2413.000	1.000	4.732	.0000	1.000	.0000	.0000	.0000	.0000
2414.000	1.000	4.709	.0000	1.000	.0000	.0000	.0000	.0000
2415.000	1.000	6.022	.0000	1.000	.0000	.0000	.0000	.0000
2416.000	1.000	5.387	.0000	1.000	.0000	.0000	.0000	.0000
2417.000	1.000	5.225	.0081	1.000	.0081	.0081	.0000	.0000
2418.000	1.000	5.040	.0000	1.000	.0000	.0000	.0000	.0000
2419.000	1.000	4.832	.0000	1.000	.0000	.0000	.0000	.0000
2420.000	1.000	5.224	.0000	1.000	.0000	.0000	.0000	.0000
2421.000	1.000	4.578	.0000	1.000	.0000	.0000	.0000	.0000
2422.000	.9604	3.959	.0000	1.000	.0000	.0000	.0000	.0000
2423.000	.4616	2.758	.0578	1.257	.0578	.0578	.0000	.0000
2424.000	.3024	2.714	.1089	.9684	.1082	.1054	.0999	.0000
2425.000	.1000	1.671	.2106	1.032	.2106	.2106	.0999	.0000
2426.000	.4403	2.635	.0579	1.314	.0579	.0579	.0000	.0000
2427.000	1.000	4.965	.0000	1.000	.0000	.0000	.0000	.0000
2428.000	1.000	5.167	.0054	1.000	.0054	.0054	.0000	.0000
429.000	1.000	4.077	.0000	1.000	.0000	.0000	.0000	.0000
2430.000	1.000	4.783	.0000	1.000	.0000	.0000	.0000	.0000
2431.000	1.000	4.820	.0000	1.000	.0000	.0000	.0000	.0000
2432.000	1.000	4.930	.0450	1.000	.0450	.0450	.0000	.0000
2433.000	1.000	4.175	.0000	1.000	.0000	.0000	.0000	.0000
2434.000	1.000	5.491	.0000	1.000	.0000	.0000	.0000	.0000
2435.000	1.000	5.409	.0000	1.000	.0000	.0000	.0000	.0000
2436.000	1.000	4.921	.0000	1.000	.0000	.0000	.0000	.0000
2437.000	1.000	4.736	.0000	1.000	.0000	.0000	.0000	.0000
2438.000	.5697	3.072	.0485	1.162	.0485	.0485	.0000	.0000
2439.000	.2202	2.694	.1461	1.000	.1461	.1461	.0999	.0000
2440.000	.1660	2.323	.1443	1.000	.1443	.1443	.0999	.0000
2441.000	.1439	2.470	.1533	.8467	.1483	.1298	.0999	.0000
2442.000	.1087	2.835	.1013	1.223	.1013	.1013	.0999	.0000
2443.000	.1469	2.819	.1492	.8117	.1431	.1211	.0999	.0000
2444.000	.1202	2.562	.1637	.7913	.1562	.1295	.0999	.0000
2445.000	.2098	2.656	.1309	.9011	.1282	.1180	.0999	.0000
2446.000	.1995	2.346	.1413	.9006	.1384	.1272	.0999	.0000
2447.000	.4444	3.142	.0632	1.139	.0632	.0632	.0000	.0000
2448.000	.0984	2.022	.1961	.8712	.1908	.1709	.0999	.0000
2449.000	.3393	3.040	.0894	1.028	.0894	.0894	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2450.000	.9230	5.977	.0000	1.000	.0000	.0000	.0000	.0000
2451.000	.8845	4.865	.0000	1.000	.0000	.0000	.0000	.0000
2452.000	.4411	3.155	.0000	1.164	.0000	.0000	.0000	.0000
2453.000	.5956	6.731	.0000	1.145	.0000	.0000	.0000	.0000
2454.000	.8573	3.431	.0000	1.000	.0000	.0000	.0000	.0000
2455.000	1.000	5.144	.0083	1.000	.0083	.0083	.0000	.0000
2456.000	1.000	23.949	.0000	1.000	.0000	.0000	.0000	.0000
2457.000	1.000	24.469	.0000	1.000	.0000	.0000	.0000	.0000
2458.000	1.000	6.449	.0000	1.000	.0000	.0000	.0000	.0000
2459.000	1.000	6.255	.0000	1.000	.0000	.0000	.0000	.0000
2460.000	1.000	4.494	.0000	1.000	.0000	.0000	.0000	.0000
2461.000	1.000	4.219	.0000	1.000	.0000	.0000	.0000	.0000
2462.000	1.000	5.817	.0000	1.000	.0000	.0000	.0000	.0000
2463.000	1.000	5.699	.0000	1.000	.0000	.0000	.0000	.0000
2464.000	1.000	5.149	.0000	1.000	.0000	.0000	.0000	.0000
2465.000	1.000	5.333	.0000	1.000	.0000	.0000	.0000	.0000
2466.000	1.000	5.430	.0000	1.000	.0000	.0000	.0000	.0000
2467.000	.9878	13.080	.0000	1.000	.0000	.0000	.0000	.0000
2468.000	1.000	2.801	.0000	1.000	.0000	.0000	.0000	.0000
2469.000	1.000	5.763	.0000	1.000	.0000	.0000	.0000	.0000
2470.000	1.000	4.513	.0000	1.000	.0000	.0000	.0000	.0000
2471.000	1.000	4.310	.0127	1.000	.0127	.0127	.0000	.0000
2472.000	.7800	3.202	.0000	1.000	.0000	.0000	.0000	.0000
2473.000	.6992	3.005	.0073	1.000	.0073	.0073	.0000	.0000
2474.000	1.000	4.558	.0000	1.000	.0000	.0000	.0000	.0000
2475.000	1.000	4.852	.0000	1.000	.0000	.0000	.0000	.0000
2476.000	.7163	4.070	.0222	1.118	.0222	.0222	.0000	.0000
2477.000	.2548	2.586	.1274	1.000	.1274	.1274	.0999	.0000
2478.000	.2119	3.073	.1464	1.000	.1464	.1464	.0999	.0000
2479.000	.4817	4.490	.0585	1.000	.0585	.0585	.0000	.0000
2480.000	1.000	9.448	.0000	1.000	.0000	.0000	.0000	.0000
2481.000	1.000	5.877	.0000	1.000	.0000	.0000	.0000	.0000
2482.000	.9273	3.898	.0000	1.000	.0000	.0000	.0000	.0000
2483.000	1.000	3.693	.0000	1.000	.0000	.0000	.0000	.0000
2484.000	1.000	4.285	.0000	1.000	.0000	.0000	.0000	.0000
2485.000	.8274	3.137	.0000	1.000	.0000	.0000	.0000	.0000
2486.000	1.000	4.656	.0000	1.000	.0000	.0000	.0000	.0000
2487.000	1.000	5.299	.0000	1.000	.0000	.0000	.0000	.0000
2488.000	1.000	4.453	.0000	1.000	.0000	.0000	.0000	.0000
2489.000	1.000	5.088	.0000	1.000	.0000	.0000	.0000	.0000
2490.000	1.000	3.969	.0000	1.000	.0000	.0000	.0000	.0000
2491.000	1.000	5.442	.0000	1.000	.0000	.0000	.0000	.0000
2492.000	1.000	6.267	.0166	.7876	.0159	.0131	.0000	.0000
2493.000	.9773	4.213	.0000	1.000	.0000	.0000	.0000	.0000
2494.000	1.000	5.135	.0000	1.000	.0000	.0000	.0000	.0000
2495.000	1.000	4.225	.0598	1.000	.0598	.0598	.0000	.0000
2496.000	.7964	3.019	.0000	1.000	.0000	.0000	.0000	.0000
2497.000	1.000	4.843	.0000	1.000	.0000	.0000	.0000	.0000
2498.000	1.000	9.649	.0000	1.000	.0000	.0000	.0000	.0000
2499.000	1.000	4.192	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2500.000	1.000	4.136	.0000	1.000	.0000	.0000	.0000	.0000
2501.000	1.000	3.672	.0000	1.000	.0000	.0000	.0000	.0000
2502.000	1.000	3.674	.0000	1.000	.0000	.0000	.0000	.0000
2503.000	1.000	4.825	.0000	1.000	.0000	.0000	.0000	.0000
2504.000	.8636	3.671	.0000	1.000	.0000	.0000	.0000	.0000
2505.000	1.000	4.210	.0000	1.000	.0000	.0000	.0000	.0000
2506.000	1.000	5.752	.0000	1.000	.0000	.0000	.0000	.0000
2507.000	1.000	5.139	.0000	1.000	.0000	.0000	.0000	.0000
2508.000	1.000	5.376	.0000	1.000	.0000	.0000	.0000	.0000
2509.000	1.000	5.335	.0052	1.000	.0052	.0052	.0000	.0000
2510.000	1.000	6.843	.0000	1.000	.0000	.0000	.0000	.0000
2511.000	1.000	7.290	.0000	1.000	.0000	.0000	.0000	.0000
2512.000	1.000	11.979	.0000	1.000	.0000	.0000	.0000	.0000
2513.000	1.000	4.554	.0000	1.000	.0000	.0000	.0000	.0000
2514.000	1.000	4.971	.0000	1.000	.0000	.0000	.0000	.0000
2515.000	1.000	5.245	.0000	1.000	.0000	.0000	.0000	.0000
2516.000	1.000	5.167	.0000	1.000	.0000	.0000	.0000	.0000
2517.000	1.000	4.629	.0000	1.000	.0000	.0000	.0000	.0000
2518.000	.4569	2.367	.0887	1.047	.0887	.0887	.0000	.0000
2519.000	.1606	2.208	.1503	.8925	.1470	.1342	.0999	.0000
2520.000	.2621	2.583	.1073	1.031	.1073	.1073	.0999	.0000
2521.000	.3804	8.028	.0000	1.000	.0000	.0000	.0000	.0000
2522.000	.4027	6.427	.1553	.4575	.1328	.0711	.0000	.0000
2523.000	1.000	4.777	.0000	1.000	.0000	.0000	.0000	.0000
2524.000	1.000	5.176	.0000	1.000	.0000	.0000	.0000	.0000
2525.000	1.000	3.888	.0000	1.000	.0000	.0000	.0000	.0000
2526.000	.3005	1.922	.1168	1.076	.1168	.1168	.0999	.0000
2527.000	1.000	4.112	.0000	1.000	.0000	.0000	.0000	.0000
2528.000	.4001	2.533	.1352	1.000	.1352	.1352	.0000	.0000
2529.000	1.000	3.318	.0000	1.000	.0000	.0000	.0000	.0000
2530.000	.7063	3.717	.0004	1.000	.0004	.0004	.0000	.0000
2531.000	.0911	2.417	.1710	.7852	.1629	.1343	.0999	.0000
2532.000	.0544	2.193	.1935	.7402	.1822	.1432	.0999	.0000
2533.000	.0954	3.278	.1590	1.000	.1590	.1590	.0999	.0000
2534.000	.0685	2.659	.1838	1.000	.1838	.1838	.0999	.0000
2535.000	.0965	2.821	.1820	.6786	.1685	.1235	.0999	.0000
2536.000	.2559	2.710	.1059	1.022	.1059	.1059	.0999	.0000
2537.000	.7730	4.473	.0000	1.000	.0000	.0000	.0000	.0000
2538.000	.4723	3.926	.0466	1.151	.0466	.0466	.0000	.0000
2539.000	.1332	4.428	.1182	.8125	.1134	.0960	.0999	.0000
2540.000	.1267	4.598	.1536	.6191	.1395	.0951	.0999	.0000
2541.000	.1482	3.071	.1533	.7473	.1446	.1145	.0999	.0000
2542.000	.4336	3.568	.0630	1.075	.0630	.0630	.0000	.0000
2543.000	1.000	3.516	.0000	1.000	.0000	.0000	.0000	.0000
2544.000	1.000	3.816	.0000	1.000	.0000	.0000	.0000	.0000
2545.000	1.000	4.084	.0000	1.000	.0000	.0000	.0000	.0000
2546.000	1.000	5.270	.0000	1.000	.0000	.0000	.0000	.0000
2547.000	1.000	5.388	.0000	1.000	.0000	.0000	.0000	.0000
2548.000	1.000	4.828	.0000	1.000	.0000	.0000	.0000	.0000
2549.000	1.000	5.771	.0000	1.000	.0000	.0000	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2550.000	1.000	4.751	.0000	1.000	.0000	.0000	.0000	.0000
2551.000	1.000	4.645	.0000	1.000	.0000	.0000	.0000	.0000
2552.000	1.000	4.686	.0000	1.000	.0000	.0000	.0000	.0000
2553.000	.0703	1.740	.2196	.7184	.2056	.1578	.0999	.0000
2554.000	.0494	2.149	.2762	.5105	.2415	.1410	.0999	.0000
2555.000	.0840	1.650	.1890	.8576	.1832	.1621	.0999	.0000
2556.000	.2532	2.313	.1222	.9781	.1217	.1195	.0999	.0000
2557.000	.7771	3.146	.0003	1.000	.0003	.0003	.0000	.0000
2558.000	1.000	3.320	.0000	1.000	.0000	.0000	.0000	.0000
2559.000	1.000	3.694	.0000	1.000	.0000	.0000	.0000	.0000
2560.000	1.000	4.223	.0000	1.000	.0000	.0000	.0000	.0000
2561.000	1.000	3.599	.0000	1.000	.0000	.0000	.0000	.0000
2562.000	1.000	4.528	.0000	1.000	.0000	.0000	.0000	.0000
2563.000	1.000	4.235	.0000	1.000	.0000	.0000	.0000	.0000
2564.000	1.000	4.639	.0000	1.000	.0000	.0000	.0000	.0000
2565.000	1.000	5.531	.0000	1.000	.0000	.0000	.0000	.0000
2566.000	1.000	5.234	.0000	1.000	.0000	.0000	.0000	.0000
2567.000	.3533	2.692	.1211	.8431	.1170	.1021	.0999	.0000
2568.000	.6232	2.886	.0162	1.541	.0162	.0162	.0000	.0000
2569.000	1.000	4.804	.0000	1.000	.0000	.0000	.0000	.0000
2570.000	1.000	6.277	.0000	1.000	.0000	.0000	.0000	.0000
2571.000	1.000	5.460	.0000	1.000	.0000	.0000	.0000	.0000
2572.000	1.000	5.092	.0000	1.000	.0000	.0000	.0000	.0000
2573.000	.7415	3.362	.0303	1.118	.0303	.0303	.0000	.0000
2574.000	.8256	5.106	.0000	1.000	.0000	.0000	.0000	.0000
2575.000	.2350	2.435	.1149	1.020	.1149	.1149	.0999	.0000
2576.000	.6591	2.829	.0000	1.000	.0000	.0000	.0000	.0000
2577.000	1.000	5.763	.0000	1.000	.0000	.0000	.0000	.0000
2578.000	1.000	5.783	.0000	1.000	.0000	.0000	.0000	.0000
2579.000	1.000	5.317	.0000	1.000	.0000	.0000	.0000	.0000
2580.000	1.000	5.500	.0000	1.000	.0000	.0000	.0000	.0000
2581.000	1.000	5.287	.0000	1.000	.0000	.0000	.0000	.0000
2582.000	1.000	6.276	.0000	1.000	.0000	.0000	.0000	.0000
2583.000	.9082	5.052	.0000	1.000	.0000	.0000	.0000	.0000
2584.000	1.000	6.164	.0000	1.000	.0000	.0000	.0000	.0000
2585.000	1.000	6.542	.0000	1.000	.0000	.0000	.0000	.0000
2586.000	1.000	6.348	.0109	.8176	.0105	.0089	.0000	.0000
2587.000	1.000	4.757	.0000	1.000	.0000	.0000	.0000	.0000
2588.000	1.000	5.077	.0000	1.000	.0000	.0000	.0000	.0000
2589.000	1.000	5.588	.0000	1.000	.0000	.0000	.0000	.0000
2590.000	.6432	3.156	.0307	1.250	.0307	.0307	.0000	.0000
2591.000	1.000	4.464	.0000	1.000	.0000	.0000	.0000	.0000
2592.000	1.000	6.113	.0000	1.000	.0000	.0000	.0000	.0000
2593.000	1.000	5.266	.0000	1.000	.0000	.0000	.0000	.0000
2594.000	1.000	5.806	.0000	1.000	.0000	.0000	.0000	.0000
2595.000	.6151	5.035	.0287	1.036	.0287	.0287	.0000	.0000
2596.000	.3975	3.783	.0953	1.000	.0953	.0953	.0000	.0000
2597.000	.2328	3.788	.1371	.6975	.1276	.0957	.0999	.0000
2598.000	.0909	3.462	.1728	.6432	.1582	.1112	.0999	.0000
2599.000	.0444	4.204	.1203	.8825	.1173	.1061	.0999	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2600.000	.1440	9.797	.0915	1.000	.0915	.0915	.0000	.0000
2601.000	.1437	3.692	.1387	1.000	.1387	.1387	.0999	.0000
2602.000	.6129	5.586	.0246	1.027	.0246	.0246	.0000	.0000
2603.000	1.000	5.970	.0000	1.000	.0000	.0000	.0000	.0000
2604.000	.6230	2.985	.0179	1.488	.0179	.0179	.0000	.0000
2605.000	1.000	3.814	.0000	1.000	.0000	.0000	.0000	.0000
2606.000	1.000	5.529	.0000	1.000	.0000	.0000	.0000	.0000
2607.000	1.000	5.508	.0000	1.000	.0000	.0000	.0000	.0000
2608.000	1.000	5.674	.0000	1.000	.0000	.0000	.0000	.0000
2609.000	1.000	5.334	.0000	1.000	.0000	.0000	.0000	.0000
2610.000	1.000	6.125	.0000	1.000	.0000	.0000	.0000	.0000
2611.000	.4895	3.423	.0481	1.186	.0481	.0481	.0000	.0000
2612.000	.8845	6.787	.0000	1.000	.0000	.0000	.0000	.0000
2613.000	1.000	6.590	.0000	1.000	.0000	.0000	.0000	.0000
2614.000	1.000	5.832	.0018	1.000	.0018	.0018	.0000	.0000
2615.000	1.000	5.892	.0000	1.000	.0000	.0000	.0000	.0000
2616.000	1.000	7.800	.0027	1.000	.0027	.0027	.0000	.0000
2617.000	1.000	6.584	.0000	1.000	.0000	.0000	.0000	.0000
2618.000	1.000	5.900	.0000	1.000	.0000	.0000	.0000	.0000
2619.000	1.000	5.720	.0037	1.000	.0037	.0037	.0000	.0000
2620.000	1.000	12.434	.0000	1.000	.0000	.0000	.0000	.0000
2621.000	.7897	3.702	.0000	1.000	.0000	.0000	.0000	.0000
2622.000	1.000	5.890	.0703	.5542	.0625	.0390	.0000	.0000
2623.000	.2689	1.884	.1404	.9400	.1387	.1320	.0999	.0000
2624.000	.8393	3.188	.0000	1.000	.0000	.0000	.0000	.0000
2625.000	1.000	3.912	.0000	1.000	.0000	.0000	.0000	.0000
2626.000	1.000	5.636	.0000	1.000	.0000	.0000	.0000	.0000
2627.000	1.000	5.188	.0000	1.000	.0000	.0000	.0000	.0000
2628.000	1.000	6.378	.0000	1.000	.0000	.0000	.0000	.0000
2629.000	1.000	5.914	.0000	1.000	.0000	.0000	.0000	.0000
2630.000	1.000	5.574	.0000	1.000	.0000	.0000	.0000	.0000
2631.000	.3969	17.219	.0000	1.000	.0000	.0000	.0000	.0000
2632.000	.2004	3.347	.1339	.7749	.1272	.1037	.0999	.0000
2633.000	.3209	3.414	.0912	.9552	.0904	.0871	.0000	.0000
2634.000	.8421	7.339	.0000	1.000	.0000	.0000	.0000	.0000
2635.000	1.000	8.014	.0000	1.000	.0000	.0000	.0000	.0000
2636.000	1.000	5.004	.0000	1.000	.0000	.0000	.0000	.0000
2637.000	1.000	4.561	.0000	1.000	.0000	.0000	.0000	.0000
2638.000	1.000	6.802	.0000	1.000	.0000	.0000	.0000	.0000
2639.000	1.000	7.967	.0000	1.000	.0000	.0000	.0000	.0000
2640.000	1.000	7.415	.0000	1.000	.0000	.0000	.0000	.0000
2641.000	1.000	11.501	.0000	1.000	.0000	.0000	.0000	.0000
2642.000	1.000	6.822	.0000	1.000	.0000	.0000	.0000	.0000
2643.000	1.000	6.754	.0000	1.000	.0000	.0000	.0000	.0000
2644.000	1.000	7.216	.0000	1.000	.0000	.0000	.0000	.0000
2645.000	1.000	6.647	.0000	1.000	.0000	.0000	.0000	.0000
2646.000	1.000	4.433	.0000	1.000	.0000	.0000	.0000	.0000
2647.000	.5278	3.147	.0391	1.295	.0391	.0391	.0000	.0000
2648.000	.5110	2.928	.0484	1.246	.0484	.0484	.0000	.0000
2649.000	.9673	4.121	.0000	1.000	.0000	.0000	.0000	.0000

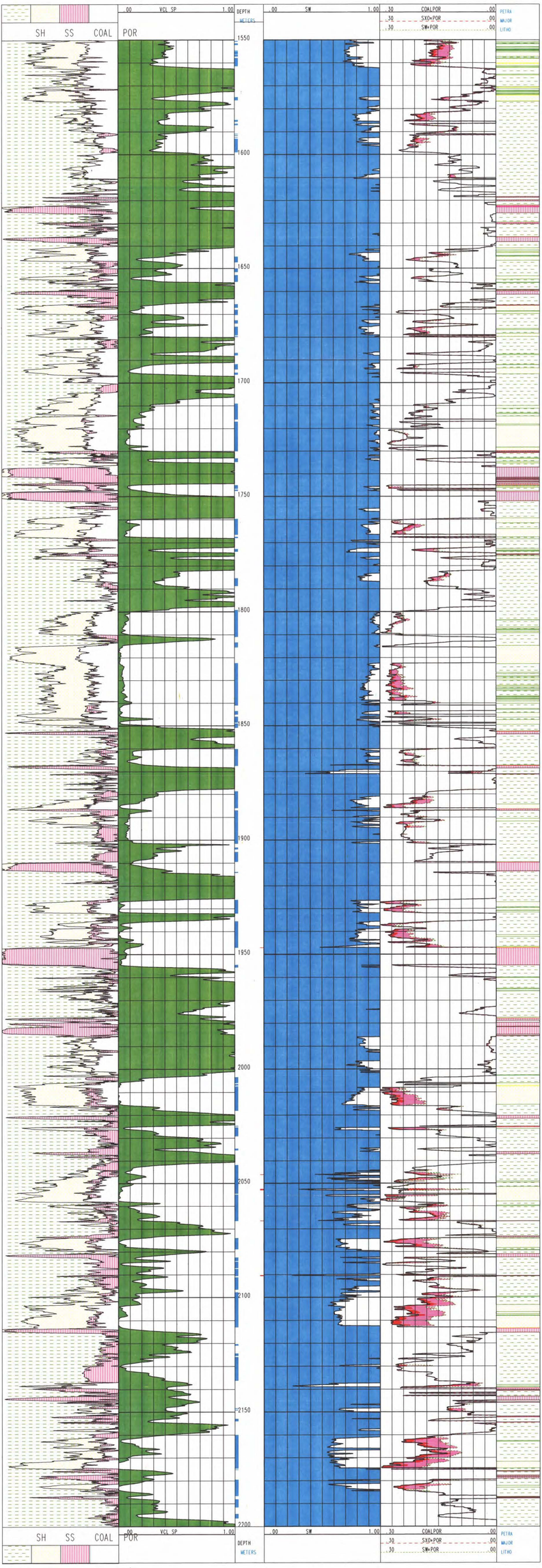
DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2650.000	1.000	7.061	.0000	1.000	.0000	.0000	.0000	.0000
2651.000	1.000	6.327	.0000	1.000	.0000	.0000	.0000	.0000
2652.000	1.000	7.287	.0000	1.000	.0000	.0000	.0000	.0000
2653.000	.8185	6.371	.0000	1.000	.0000	.0000	.0000	.0000
2654.000	.9971	7.705	.0000	1.000	.0000	.0000	.0000	.0000
2655.000	.8367	5.737	.0000	1.000	.0000	.0000	.0000	.0000
2656.000	.9026	8.526	.0000	1.000	.0000	.0000	.0000	.0000
2657.000	.7225	8.047	.0328	1.000	.0328	.0328	.0000	.0000
2658.000	.3823	4.927	.2157	.3690	.1767	.0796	.0999	.1361
2659.000	.3328	4.208	.1000	.7909	.0954	.0791	.0000	.0000
2660.000	.9538	9.628	.0000	1.000	.0000	.0000	.0000	.0000
2661.000	1.000	39.016	.0000	1.000	.0000	.0000	.0000	.0000
2662.000	1.000	6.076	.0000	1.000	.0000	.0000	.0000	.0000
2663.000	1.000	8.283	.0000	1.000	.0000	.0000	.0000	.0000
2664.000	1.000	7.934	.0000	1.000	.0000	.0000	.0000	.0000
2665.000	1.000	4.862	.0000	1.000	.0000	.0000	.0000	.0000
2666.000	1.000	6.713	.0000	1.000	.0000	.0000	.0000	.0000
2667.000	1.000	8.297	.0000	1.000	.0000	.0000	.0000	.0000
2668.000	1.000	7.475	.0000	1.000	.0000	.0000	.0000	.0000
2669.000	1.000	7.164	.0000	1.000	.0000	.0000	.0000	.0000
2670.000	1.000	8.133	.0000	1.000	.0000	.0000	.0000	.0000
2671.000	1.000	8.232	.0000	1.000	.0000	.0000	.0000	.0000
2672.000	1.000	15.622	.0407	.4142	.0341	.0168	.0000	.0000
2673.000	1.000	85.727	.0000	1.000	.0000	.0000	.0000	.0000
2674.000	1.000	41.462	.0503	1.000	.0503	.0503	.0000	.0000
2675.000	1.000	11.476	.0000	1.000	.0000	.0000	.0000	.0000
2676.000	1.000	6.808	.0000	1.000	.0000	.0000	.0000	.0000
2677.000	1.000	9.977	.0000	1.000	.0000	.0000	.0000	.0000
2678.000	.8703	4.666	.0000	1.000	.0000	.0000	.0000	.0000
2679.000	1.000	12.288	.0000	1.000	.0000	.0000	.0000	.0000
2680.000	1.000	11.767	.0000	1.000	.0000	.0000	.0000	.0000
2681.000	1.000	16.584	.0000	1.000	.0000	.0000	.0000	.0000
2682.000	1.000	20.514	.0000	1.000	.0000	.0000	.0000	.0000
2683.000	1.000	21.500	.0000	1.000	.0000	.0000	.0000	.0000
2684.000	1.000	10.274	.0748	1.000	.0748	.0748	.0000	.0000
2685.000	1.000	15.064	.0064	1.000	.0064	.0064	.0000	.0000
2686.000	1.000	16.292	.0000	1.000	.0000	.0000	.0000	.0000
2687.000	1.000	10.530	.0000	1.000	.0000	.0000	.0000	.0000
2688.000	1.000	26.544	.0000	1.000	.0000	.0000	.0000	.0000
2689.000	1.000	9.345	.0000	1.000	.0000	.0000	.0000	.0000
2690.000	1.000	7.099	.0000	1.000	.0000	.0000	.0000	.0000
2691.000	1.000	7.484	.0000	1.000	.0000	.0000	.0000	.0000
2692.000	1.000	11.397	.0000	1.000	.0000	.0000	.0000	.0000
2693.000	1.000	6.496	.0000	1.000	.0000	.0000	.0000	.0000
2694.000	.5496	3.820	.0298	1.259	.0298	.0298	.0000	.0000
2695.000	.8604	5.081	.0000	1.000	.0000	.0000	.0000	.0000
2696.000	.6674	6.306	.0000	1.000	.0000	.0000	.0000	.0000
2697.000	.2931	5.575	.0820	.8289	.0790	.0680	.0000	.0000
2698.000	.1019	3.802	.1384	.7547	.1309	.1045	.0999	.0000
2699.000	.5192	8.580	.0333	.8379	.0322	.0279	.0000	.0000

DEPTH	VCL_SP	HDRS	COALPO	SW	SXO*PO	SW*POR	RESROC	NETPAY
2700.000	.8782	8.286	.7257	.0813	.4393	.0590	.0000	.0000

291059

FLINDERS 1

5 cm



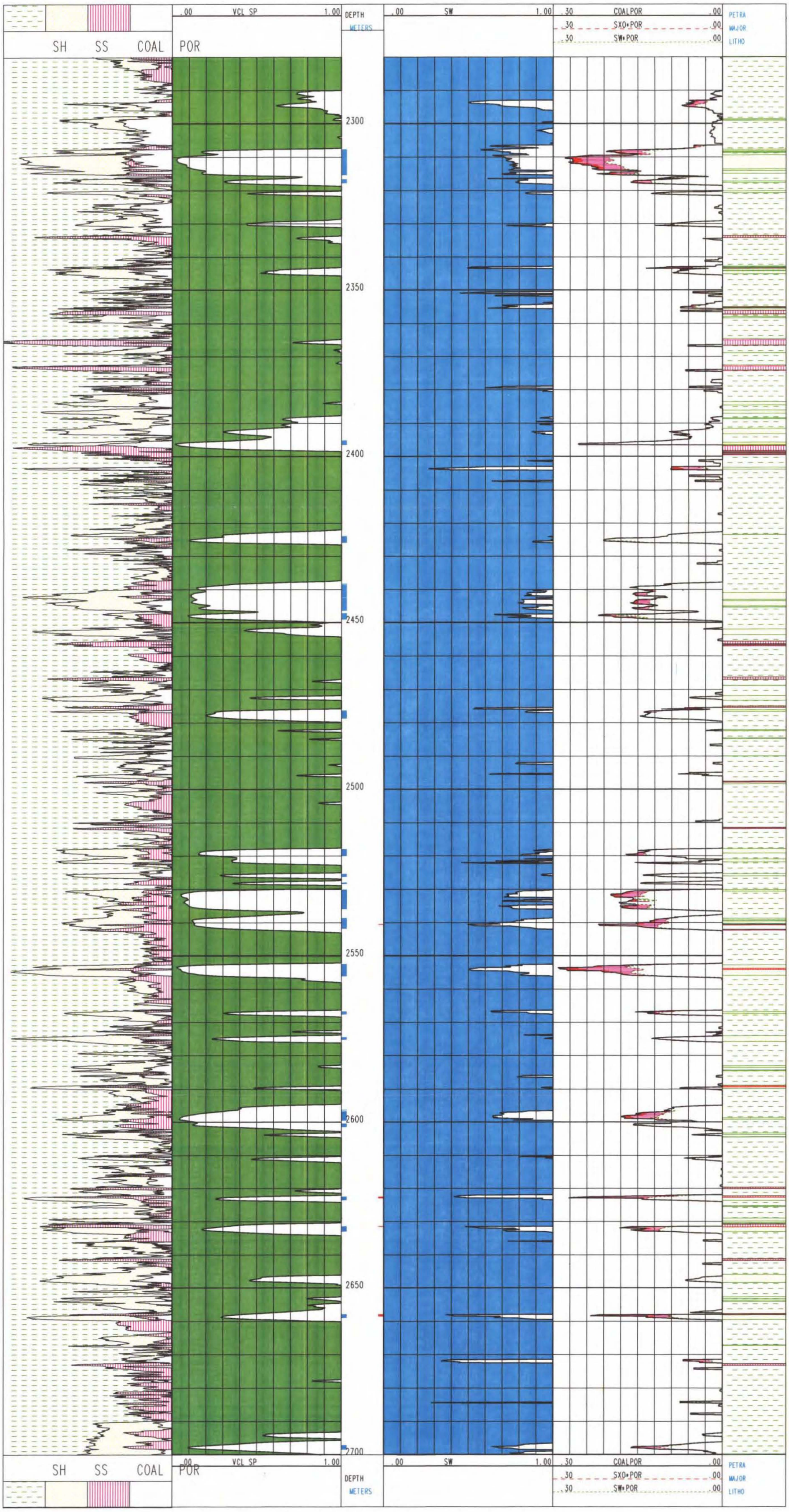
FLINDERS 1

OR-0298

291060

FLINDERS 1

5 cm



FLINDERS 1

OR-0098

4.7 Palynology

A palynology report by AD Partridge and R Morgan is included in Appendix 5.

4.8 Geochemistry

Selected cuttings samples from the Eastern View Coal Measures were submitted to Geotech (Geotechnical Services Pty Ltd) for maturity and geochemical analyses. Twenty-seven samples were analysed by Rock Eval and twenty five of these samples were submitted for determination of vitrinite reflectance measurements (see Appendix 4).

Total Organic Carbon (TOC) is consistently high partly due to the presence of coals in the cuttings samples. Consequently TOC values typically fall in the very good to excellent category (2->4%). Free hydrocarbon richness (S_1) is fair to very good (0.20-1.60 mg/g) and locally excellent (> 1.60 mg/g).

The potential yield or genetic potential (S_1/S_2) is generally moderate to very good (2-20 mg/g) and is occasionally excellent (>20 mg/g). The production indicies ($S_1/(S_1 + S_2)$) are largely affected by igneous activity observed at the Flinders 1 and are high (circa 0.3) above and immediately below the igneous intrusion, and decrease to approximately 0.15 below the intrusion.

TMax values show an unusual profile resulting from igneous activity associated with the Flinders structure. From the near top EVCM to immediately below the igneous intrusion TMax values are consistently overmature (>460°C) whilst the lower part of the EVCM below approximately 2400m has TMax values in the oil mature window (430-460°C) consistent with a regional maturity profile unaffected by intrusives.

The vitrinite reflectance profile is in agreement with that shown by the TMax data, although because all the samples are from cuttings many of the histograms are bimodal due to contamination by cavings. A hydrogen index verses oxygen index plot shows that the sources material is mixed type II and III kerogen consistent with other source material from the Eastern View Coal Measures elsewhere in the Bass Basin.

4.9 Conclusions and Contributes to Geological Knowledge

The primary objectives of Flinders 1 were the fluvial sandstones of the lower to middle *M.diversus* (Primary Zone) of the Eastern View Coal Measures, located some 500m updip of the Pelican Field in a large fault bounded structure. The primary objective fluvial sandstones were intersected as prognosed, an amplitude anomaly observed on seismic data was caused by the presence of an igneous intrusion, intruded near to the top of the primary target. There were no significant shows associated with the primary target. Sandstones below the primary target, age dated as Palaeocene, over the intervals 2559-2562m and 2673-2676m have minor shows of fluorescence and cut, possibly resulting from early *insitu* generation or migration of hydrocarbons.

The secondary objective sandstones in the upper *M.diversus* zone which contained shows at Pipipa 1 also contained shows in Flinders 1 but were generally less well developed. It is now interpreted that these shows are probably due to local sourcing associated with the elevated maturity profile associated with the igneous intrusion, rather than being indicative of migration from the Pelican Trough as was proposed prior to drilling. However the deeper shows in Palaeocene sandstones are either evidence of local sourcing due to the regional maturity gradient or are evidence of hydrocarbon migration from the Pelican Trough.

The absence of hydrocarbons in Flinders 1 is therefore due to inadequate sourcing and migration of hydrocarbons into the structure and/or to failure of the cross fault seals bounding the structure. The presence of minor shows in Palaeocene sandstones towards total depth is indicative of either local sourcing as the sequence is in the early oil mature window or migration of hydrocarbons from down dip in the Pelican Trough. There is therefore a possibility of untested hydrocarbons being trapped in deeper Palaeocene and late Cretaceous sandstones.

Maturity data (TMax and Vitrinite reflectance data) show unusually constant high values throughout the upper Eastern View Coal Measures down to the top of the igneous intrusion (a thickness in excess of 500m). Normally it would be expected that the high maturity profile above the intrusive would be quite small similar to that observed below it (approximately 50m). The reason for this unusual profile is not clear but it is considered most likely to be associated with igneous activity along the nearby NW-SE trending fault bounding the structure. Seismic data shows evidence of a possible (? Miocene) sequence of extrusive igneous rocks to the SW of the fault, this igneous activity may have caused the high heat flow which matured the upper Eastern View Coal Measures. The extrusives are probably the same age as the intrusion penetrated in Flinders 1. Below the intrusion the regional maturity gradient (as observed at Pelican 5) is re-established so that at total the depth the sequence is in the early oil maturity window.

Wireline interpretation showed that all zones in Flinders 1 were water wet and consequently no testing was undertaken and the well was plugged and abandoned.

5 DRILLING RECORD

5 DRILLING RECORD

5.1 Daily Well Summary - Flinders 1

DATE	DEPTH M(BRT)	PROGRESS M	DOL/ DSS*	OPERATION
27 Nov 92	-	-	-	Ocean Epoch under tow to Flinders 1 location at 1730 hours on 27 November 92.
28 Nov 92	-	-	1/0	Rig arrived at Flinders 1 location and dropped first anchor at 0600 hours. Run and pretension anchors to 250 kips. Ballast rig to drilling draft.
29 Nov 92	127.6	36	2/1	Make up 36" BHA and stand in derrick. Run and land TGB on seabed. Water depth 69.25m. RT to seabed 91.55m. Run 30" casing and land in PGB. Hang in moon pool. Run 36" BHA. Spud Flinders 1 at 1000 hours and drill 36" hole from 91.55 to 127.6m. Observe with ROV. Circulate hole and displace with Hi Vis mud. POOH. Run and land 30" casing and PGB. Cement 30" casing with shoe at 124.5m. Back out and retrieve running tool. Make up 18¾" housing and running tool. Lay out 36" BHA. Make up 17½" BHA and RIH.
30 Nov 92	408	280.4	3/2	Tag top of cement at 122m. Drill out cement, float shoe and shoe track to 127.6m. Drill ahead to 408m with sea water and Hi Vis sweeps. Circulate hole with Hi Vis mud sweep. POOH to 30" shoe. Run back to bottom. Displace hole to Hi Vis mud. Drop survey and POOH. Rig up, run and land 13⅜" casing and 18¾" well head housing with the shoe at 403m. Check housing latched with 40,000 lbs overpull. Rig up and test cement lines to 3000 psi.
1 Dec 92	408	0	4/3	Cement 13⅜" casing. Bump plug with 1500 psi and pressure test casing. Release running tool and retrieve. Move BOP onto moon pool beams and test to 250 and 7500 psi. Run riser and BOP. Nipple up slip joint. Land and latch BOP. Test latch with 50,000 lbs overpull. Nipple up Diverter and flow line. RIH with test plug and test BOP to 250 and 5000 psi. Test Annular to 250 and 3000 psi. POOH with test plug. Test casing to 1500 psi. Test surface equipment to 250 and 5000 psi. RIH and install wear bushing. Lay out 17½" BHA.

*** DOL - DAYS ON LOCATION**
DSS - DAYS SINCE SPUD

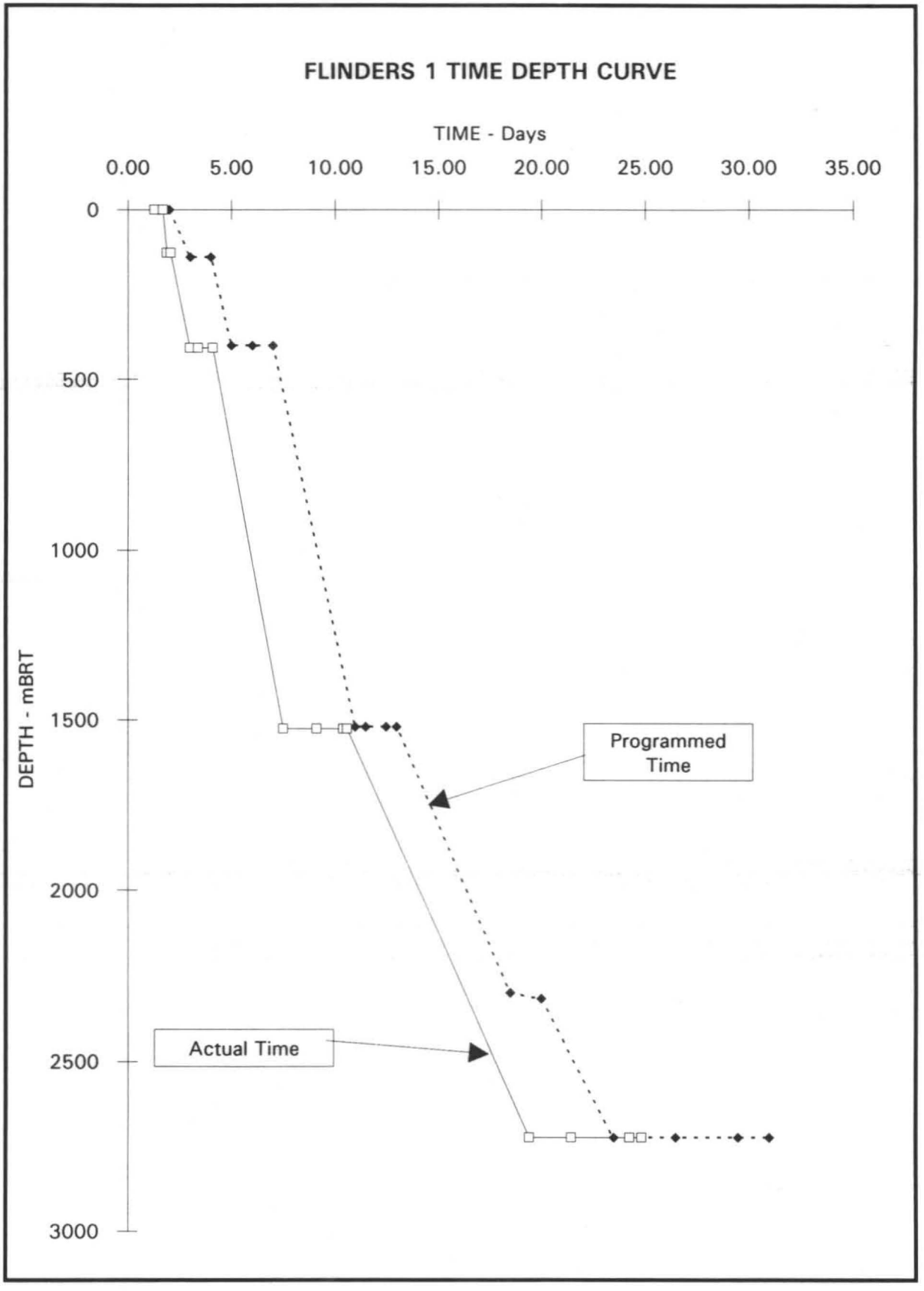
DATE	DEPTH M(BRT)	PROGRESS M	DOL/ DSS*	OPERATION
2 Dec 92	686	278	5/4	Make up 12¼" BHA. RIH and tag cement at 377m. Function test Diverter. Drill out cement, float collar and shoe and 2m of new hole to 410m. Circulate hole to new mud. Perform FIT. Obtained EMW of 14.2ppg. Drill 12¼" hole from 410 to 686m.
3 Dec 92	1225	539	6/5	Drill from 686 to 1014m. Circulate hole. Drop survey. Make wiper trip to 13⅜" shoe. First 5 stands tight with up to 50,000 lbs overpull. Hole good above with average 20,000 lbs overpull. Retrieve survey. RIH with 20,000lb drag to 1012m. Wash to bottom. Drill ahead from 1014 to 1225m.
4 Dec 92	1525	300	7/6	Drill ahead from 1225 to 1525m. Circulate hole clean and condition mud. Make wiper trip to 13⅜" casing shoe. First 10 stands tight with 50,000 lbs overpull. RIH to 1523m. Tight spots encountered at 1131, 1260, 1275, 1290 and 1319 while RIH required reaming. Wash to bottom. Circulate hole clean and condition mud.
5 Dec 92	1525	0	8/7	Drop Magnetic Multi Shot Survey tool. POOH and perform Multi Shot Survey. Rig up HLS and run Log Suite 1A: DLL-MSFL-LSS-GR-SP-DTD-CAL. Hit bridge at 708m. Unable to pass. Log up to 403m. Rig down HLS. RIH with 12¼" assembly to 781m. Wash and ream bridge at 781m. RIH to 1128m. Wash and ream from 1128 to 1331m. RIH to 1363m. Wash and ream from 1363 to 1417m. RIH to 1446m. Wash and ream from 1446 to 1525m.
6 Dec 92	1525	0	9/8	Circulate and raise mud weight to 9.7 ppg. Make wiper trip to 13⅜" shoe. Intermittent tight hole with 50,000 lbs drag. RIH to 1525m. Circulate and raise mud weight to 9.9 ppg. POOH. Rig up HLS and re run Log Suite 1A. Unable to pass 1240m. Log back to 403m. Rig Down HLS. Make up cement head on running string.
7 Dec 92	1525	0	10/9	Make up 9⅝" casing hanger joint and running tool and stand in derrick. Pick up 12¼" BHA and RIH to 1525m. 2m of fill. Circulate hole clean. POOH. Retrieve wear bushing. Rig up and run 9⅝" casing. Land casing with shoe at 1519.8m. Circulate and condition mud.
8 Dec 92	1525	0	11/10	Cement 9⅝" casing, bump plug with 2000 psi and test casing. Set seal assembly and test to 5000 psi. Test BOP and manifold to 250 and 5000 psi. Test Annular to 3000 psi. Back out running tool and POOH. RIH and install wear bushing. Lay out 12¼" BHA. Pick up 8½" BHA, RIH and tag cement at 1476m.
9 Dec 92	1731	206	12/11	Test 9⅝" casing to 3500 psi. Drill out cement, float collar and shoe. Drill 2m of new formation to 1527m. Circulate and displace hole to new FW/PHPA mud. Perform FIT. Obtain EMW of 14.3 ppg. Drill ahead from 1527 to 1634m. Make wiper trip to shoe. Drill ahead from 1634 to 1731m.

DATE	DEPTH M(BRT)	PROGRESS M	DOL/ DSS*	OPERATION
10 Dec 92	1944	213	13/12	Drill from 1731 to 1775m. Circulate hole clean. Drop survey tool. POOH and retrieved survey. Make up new bit and RIH to 1704m. Wash and ream to 1775m. Drill ahead from 1775 to 1944m.
11 Dec 92	2183	239	14/13	Drill ahead from 1944 to 2031m. Circulate hole. POOH to 1862m. Tight hole in places with 50,000 lbs overpull. Back ream from 1862 to 1748m. Tight hole with 15000 to 30,000 lbs overpull from 1748 to 1662m. POOH to shoe. RIH to 2017. Wash and ream to 2031m. Drill ahead from 2031 to 2161m. Make wiper trip to 2031m. Drill ahead from 2161 to 2183m.
12 Dec 92	2355	172	15/14	Drill ahead from 2183 to 2317m. Circulate bottoms up. Make wiper trip to 2025m. 60,000 lbs overpull at 2136, 2132 and 2111 to 2106m. RIH. Wash and ream from 2309 to 2317m. Drill ahead from 2317 to 2355m.
13 Dec 92	2407	52	16/15	Drill ahead from 2355 to 2382m. Circulate hole. Drop survey tool. POOH. 50,000 lbs overpull from 2320 to 2291m. POOH. Retrieve survey. Change bit and BHA. RIH to 1592m and ream to bottom. Drill ahead from 2382 to 2407m.
14 Dec 92	2542	135	17/16	Drill ahead from 2407 to 2420m. Circulate bottoms up and work pipe. Drill ahead from 2420 to 2482m. Make wiper trip. 80,000 lbs overpull at 2424m. Back ream 2456 to 2322m. Run to bottom. Drill ahead from 2484 to 2542m.
15 Dec 92	2664	122	18/17	Drill ahead from 2542 to 2609m with occasional high torque. Make 7 stand wiper trip. Tight hole with 80,000 lbs overpull at 2553, 2496 and 2467m. Back ream from 2580 to 2439m. Drill ahead from 2609 to 2664m.
16 Dec 92	2723 (TD)	59	19/18	Drill to 2666m. Make wiper trip to 2525m. Back ream from 2610 to 2525m. Run to bottom. Drill ahead from 2666 to 2723m. Circulate and condition hole. Make wiper trip to 9⅝" casing shoe. RIH. Drop survey and strap pipe out of hole.
17 Dec 92	2723	-	20/19	RIH and retrieve wear bushing. Test BOP and manifold to 250 and 5000 psi. Test Annular to 250 and 3000 psi. RIH and install wear bushing. Rig up HLS to Log. Run Log Suite 2A: HRI-MSFL-LSS-GR-SP-DTD-CAL. Run Log Suite 2B: SDL-DSN-CSNG-DTD-CAL. Run Log Suite 2C: SED-GR Tool malfunction.
18 Dec 92	2723	-	21/20	Re run Log Suite 2C with new tools. Run Log Suite 2D: VSP.

DATE	DEPTH M(BRT)	PROGRESS M	DOL/ DSS*	OPERATION
19 Dec 92	1470 (PB)	-	22/21	Run Log Suite 2E: SWC-GR. Rig down HLS. Lay down 8½" BHA. Make up 2⅜" tubing cementing stinger and RIH with DP to 2300m. Set cement abandonment Plug 1 from 2300 to 2177m. POOH. Reverse circulate. WOC. RIH and tag top of cement plug 1 at 2177m with 5000 lbs. POOH to 1550m and set cement abandonment plug 2 from 1550 to 1470m. POOH.
20 Dec 92	105 (PB)	-	23/22	POOH. Lay out tubing and DP. Pressure test Plug 2 and casing to 3000 psi. Retrieve wear bushing. RIH and retrieve 9⅝" pack off assembly. Make up 9⅝" casing cutter and RIH. Cut 9⅝" casing at 135m. Engage spear and retrieve 9⅝" casing and hanger. RIH with 13⅜" bridge plug and set at 125m. RIH with DP and circulate hole to sea water. Set cement abandonment Plug 3 from 125 to 105m. POOH to 100m and circulate hole clean with sea water. POOH. Pressure test 13⅜" casing and plus 3 to 1000 psi. Nipple down flow line and Diverter. Unlatch BOP. Retrieve and lay out slip joint, riser and BOP. Make up 30" casing cutter and RIH. Observe with ROV.
21 Dec 92	-	-	24/23	Cut 20 and 30" casing at 97m. POOH with casing cutter. Cutter blades indicate casing cut not complete. RIH and complete cutting 20" and 30" casings at 97m. POOH and lay out casing cutting assembly. Make up 18¾" well head housing running tool. RIH and engage in 18¾" well head. Retrieve and lay down 18¾" well head housing, 30" housing, PGB and TGB. Perform post drilling seabed survey with ROV. Debalast rig to towing draft.
12 Dec 92	-	-	25/24	Pull and bolster anchors 5, 1, 4, 3, 8, 7, 6 and 2. Ocean Epoch was released from Flinders 1 location at 1400 hours.

291068

5.2 WELL HISTORY


FLINDERS 1 TIME DEPTH CURVE
TIME - Days
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
0
500
1000
1500
2000
2500
3000
DEPTH - mBRT
Programmed Time
Actual Time

5 cm

TIME DEPTH SUMMARY

PERMIT: **T/25P**
WELL NAME : **FLINDERS 1**

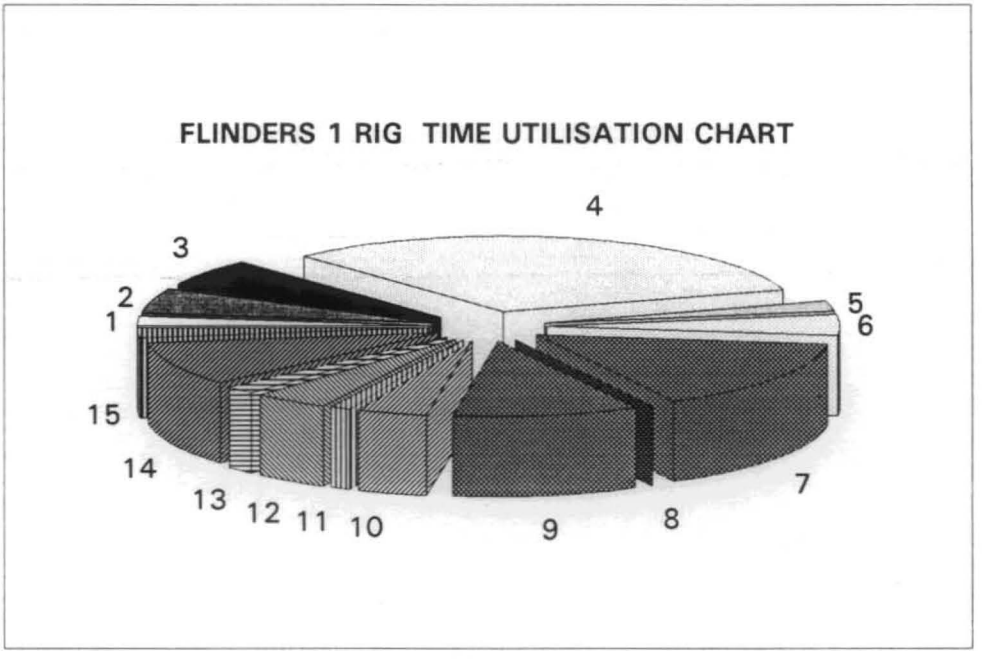
PROGRAM TOTAL DEPTH: 2723m
ACTUAL TOTAL DEPTH: 2723m

	DATE	TIME
START TOW:	27-Nov-92	17:30
RIG ARRIVED:	28-Nov-92	6:00
SPUD:	29-Nov-92	10:00
TD REACHED:	16-Dec-92	11:30
RIG DEPART:	22-Dec-92	14:00

ACTIVITY	DEPTH m (BRT)		PROGRAM DAYS		ACTUAL DAYS	
	PROGRAM	ACTUAL	PER ITEM	ACCUM.	PER ITEM	ACCUM.
MOVE/ANCHOR/RIG UP	0	0.00	1.50	1.50	1.27	1.27
PREPARE TO SPUD	0	0.00	0.50	2.00	0.42	1.69
DRILL 36" HOLE	140	127.60	1.00	3.00	0.19	1.88
RUN & SET 30"CASING	140	127.60	1.00	4.00	0.18	2.05
DRILL 17.50" HOLE	400	408.00	1.00	5.00	0.94	2.99
RUN & SET 13.375" CASING	400	408.00	1.00	6.00	0.38	3.37
RUN & TEST BOP	400	408.00	1.00	7.00	0.73	4.10
DRILL 12.25" HOLE	1520	1525.00	4.00	11.00	3.42	7.51
LOG	1520	1525.00	0.50	11.50	1.60	9.12
RUN & SET 9.625" CASING	1520	1525.00	1.00	12.50	1.31	10.43
TEST BOP	1520	1525.00	0.50	13.00	0.17	10.60
DRILL 8.5" HOLE	2300	2723.00	5.50	18.50	8.83	19.43
CORE	2318	2723.00	1.50	20.00	0.00	19.43
DRILL 8.5" HOLE	2723	2723.00	3.50	23.50	0.00	19.43
LOG	2723	2723.00	3.00	26.50	2.02	21.45
PLUG & ABANDON	2723	2723.00	3.00	29.50	2.81	24.26
PULL ANCHORS	2723	2723.00	1.50	31.00	0.58	24.85
TOTAL -Days:			31.00	31.00	24.85	24.85

FLINDERS 1 TIME UTILISATION

ITEM NO.	OPERATION	TIME Hours	% TOTAL TIME
1	RIG MOVE	12.50	2.10
2	ANCHOR HANDLING	32.00	5.36
3	P/U - L/O BHA	34.50	5.78
4	DRILLING	191.50	32.10
5	REAMING	13.50	2.26
6	CIRC & COND.	26.00	4.36
7	TRIPPING	91.50	15.34
8	SURVEY	1.00	0.17
9	ELECTRIC LOGGING	60.50	10.14
10	CASING	22.50	3.77
11	CEMENTING	7.00	1.17
12	N/U - TEST BOP	26.00	4.36
13	RIG MAINT/REPAIR	10.00	1.68
14	P & A	55.50	9.30
15	OTHER	12.50	2.10
	TOTAL	596.50	100.00



291072

5.3 CASING AND CEMENTING RECORDS

291073

5.3.1

SAGASCO Resources Ltd

CASING AND CEMENTING RECORD

Well Name:	Flinders 1	**Permit:**	T/25P
Job Type:	30" Casing	**Rig Name:**	Ocean Epoch

CASING DETAILS :

Jts	Size	Weight	Grade	Range	Connection	Burst	Collapse
3	30"	310 ppf	B	3	ST-2		

Note: All measurements RKB; give depth of float collar and float shoe.

Description	Length	Bottom	Top
30" Float Shoe (Halliburton)	12.38	124.53	112.15
30" Intermediate Jt	11.90	112.15	100.25
30" Housing Jt (Vetco SG5)	10.25	110.25	90.00
Top PGB/Housing to RT.	90.00	90.00	RT
Total:	124.53		

Centralisers:	Number:	N/A
	Location:	

Cementing Data

Mud Type :	SW / Bentonite / Polymer							
Mud Wt (ppg):	8.6	VIS/PV/YP :	-	Gels (10s/10m):	- - -	WL (ml) :	-	
Bit Size (in):	26/36	Total Depth:(m)	127.6	Ave. Hole Dia."	38	Based on :	Cmt Returns**	
Last Casing :	Size / Weight :	nil	ins / ppf	Set at : (m)		Excess (%) :	+100**	
Cement Fill :	Lead Slurry :	From : (m)		To : (m)		RT to GL : (m)	n/a	
	Tail Slurry :	From : (m)	124.53	To : (m)	91.55	RT to ML : (m)	91.55	
Hole Volume:	Open Hole-cuft:	545	Cased Hole-cuft:	80	Total :	625	cuft.	
Slurry Volume:	Lead Slurry-cuft:	0	Tail Slurry - cuft :	805	Total :	805	cuft.	
Mud Flush :	5	Bbl .]	[Type:	SW				
Lead Slurry :	Cement:		Sacks] [Class:		Slurry Density :		ppg	
Additives:								
Mix Water:		gal/sack	FW or SW ?		Slurry Yield :		cuft/sack	
Tail Slurry:	Cement :	700	Sacks] [Class:	G	Slurry Density :	15.8	ppg	
Additives :	2% CaCl2							
Mix Water :	5.00	gal/sack	FW or SW ?	SW	Slurry Yield :	1.15	cuft/sack	
Displacement								
Cement Unit :	Fluid 1 Type:	SW	Pumped:	11	Bbl. actual	11	Bbl. calculated	
	Fluid 2 Type:	n/a	Pumped:		Bbl. actual		Bbl. calculated	
Mud Pump:	Fluid 1 Type:	n/a	Pumped:		Bbl. actual		Bbl. calculated	
	Fluid 2 Type:	n/a	Pumped:		Bbl. actual		Bbl. calculated	
Plugs Used:	Top - (Y/N)	N	Type :		Make:			
	Bottom-(Y/N)	N	Type:		Make:			
Returns during job. (Y/N)		Y	Comment:	Full returns. Observe with ROV.Estimate 8Bbl cmt to sea bed.				

TIME Hr:min	Pressure psi	Rate BPM	Description/Comment
17:31	1000		Rig up &Test Lines
17:35	100	4	Pump 5 bbl preflush
17:47	250	5	Mix & pump cement
18:18	150	5	Displace cement
18:20			Bleed off. No flow back - float holding.Back out & retrieve R/tool.

Remarks: Cement job performed by inner string method using 5" DP stinger below 30" running tool.

Cementing Service Company:	Halliburton	Cementer:	P.Burr
SAGASCO Representantive:	J.Lambert	Date:	29-Dec-92

291074

5.3.2

SAGASCO Resources Ltd

CASING AND CEMENTING RECORD

Well Name:	Flinders 1	**Permit:**	T/25P
Job Type:	13 - 3/8" Casing	**Rig Name:**	Ocean Epoch

CASING DETAILS :

Jts	Size	Weight	Grade	Range	Connection	Burst	Collapse
26	13 - 3/8"	68	K55	3	Buttress	3450	1950
1	13-3/8"x20"	68/94	4130		**		
1	20"x18-3/4"						

Note: All measurements RKB; give depth of float collar and float shoe.

Description	Length	Bottom	Top
13-3/8" Float Shoe (Weatherford)	0.56	403.00	402.44
13-3/8" Casing x 2 jts	23.39	402.44	379.05
13-3/8" Float Collar (Weatherford)	0.60	379.05	378.45
13-3/8" Casing x 24 jts	281.78	378.45	96.67
X-O jt (13-3/8" Buttress x 20" ALT)**	3.15	96.67	93.52
18-3/4" Housing (Vetco-SG5)	3.52	93.52	92.62
18-34" Housing (Stick up)	0.90	92.62	89.10
RT to top of 18-3/4" Housing.	89.10	89.10	RT
Total :	403.00		

Centralisers:	Number:	4
	Location:	1 @4m above shoe, 1ea on first 3 casing collars

Cementing Data

Mud Type :	SW/Bentonite/Polymer						
Mud Wt (ppg):	8.6	VIS/PV/YP :	- - -	Gels (10s/10m):	- -	WL (ml) :	-
Bit Size (in):	17.5"	Total Depth:(m)	408	Ave. Hole Dia."	17.5"	Based on :	Bit size
Last Casing :	Size / Weight :	30"/310	ins / ppf	Set at : (m)	124.53	Excess (%) :	100
Cement Fill :	Lead Slurry :	From : (m)	303	To : (m)	91.55	RT to GL : (m)	n/a
	Tail Slurry :	From : (m)	403	To : (m)	303	RT to ML : (m)	91.55
Hole Volume:	Open Hole-cuft	1428	Cased Hole-cuft	437	Total - cuft:	1865	
Slurry Volume:	Lead - cuft:	1312	Tail - cuft :	573	Total - cuft:	1885	
Mud Flush :	40	Bbl .]	[Type:	SW			
Lead Slurry :	Cement:	733	Sacks] [Class:	G	Slurry Density :	13.2	ppg
Additives:	2.2 % Prehydrated Bentonite						
Mix Water:	9.72	gal/sack	FW or SW ?	FW	Slurry Yield :	1.79	cuft/sack
Tail Slurry:	Cement :	498	Sacks] [Class:	G	Slurry Density :	15.8	ppg
Additives :							
Mix Water :	5.00	gal/sack	FW or SW ?	SW	Slurry Yield :	1.15	cuft/sack
Displacement							
Cement Unit :	Fluid 1 Type:	SW	Pumped:	10	Bbl. actual	10	Bbl. calculated
	Fluid 2 Type:		Pumped:		Bbl. actual		Bbl. calculated
Mud Pump:	Fluid 1 Type:	SW	Pumped:	136	Bbl. actual	132	Bbl. calculated
	Fluid 2 Type:		Pumped:		Bbl. actual		Bbl. calculated
Plugs Used:	Top - (Y/N)	Y	Type :	SS	Make:	Halliburton	
	Bottom-(Y/N)	N	Type:		Make:		
Returns during job. (Y/N)		Y	Comment:	Observe w/ ROV - Poor visability, difficult to see returns.			

TIME Hr:min	Pressure psi	Rate BPM	Description/Comment
30-Nov-92			
23:46	3000		Test cementing lines.
23:52			Pump mud Flush.
1-Dec-92			
0:04	350-500	8-10	Mix & pump Lead Slurry.
0:28	350-500	3-7	Mix & pump Tail Slurry.
0:54	1350		Drop dart & shear top plug
0:55	350	10	Pump 10 bbl SW behind cement
	500	10-12	Displace cement
1:10	1500		Bump plug - Cement in place - Hold 5 min.
			Bleed off - No flow back. Back out & retrieve running tool.

Remarks: Cement to surface.

Cementing Service Company:	Halliburton	Cementer:	P. Burr
SAGASCO Representantive:	J. Lambert	Date:	1-Dec-92

291075

5.3.3

SAGASCO Resources Ltd

CASING AND CEMENTING RECORD

Well Name:	Flinders 1	**Permit:**	T/25P
Job Type:	9-5/8" Casing	**Rig Name:**	Ocean Epoch

CASING DETAILS :

Jts	Size	Weight	Grade	Range	Connection	Burst	Collapse
119	9.625	47 ppf	N80	3	New Vamm	6800 psi	4750 psi
1	9.625	47 ppf	N80	pup jt	New Vamm	6800 psi	4750 psi

Note: All measurements RKB; give depth of float collar and float shoe.

Description	Length	Bottom	Top
9-5/8" Float Shoe (Weatherford)	0.45	1519.98	1519.53
9-5/8" Casing x 2 jts.	23.99	1519.53	1495.54
9-5/8" Float Collar (Weatherford)	0.43	1495.54	1495.11
9-5/8" Casing x 117 jts.	1401.64	1495.11	93.47
9-5/8" Casing Hanger & Pup jt.	2.90	93.47	90.57
Hang off point to top of 18-3/4" Housing.	1.47	90.57	89.10
RT to top of 18-3/4" Housing.	89.10	89.10	RT
Total:	1519.98		

Centralisers:	Number:	Total = 9
	Location:	1 ea on first 3 jts with stop rings. 1 ea on first 6 casing collars.

Cementing Data

Mud Type :	SW/Bentonite/Polymer						
Mud Wt:	9.9	VIS/PV/YP:	45/8/18	Gels 10s/10m:	9/17	WL ml :	9.6
Bit Size:	12.25"	Total Depth:(m)	1525	Ave Hole Dia."	13.25"	Based on :	Logs
Last Casing :	Size / Weight :	13-3/8" / 68	ins / ppf	Set at : (m)	403	Excess (%) :	10
Cement Fill :	Lead Slurry :	From : (m)	1370	To : (m)	303	RT to GL : (m)	n/a
	Tail Slurry :	From : (m)	1520	To : (m)	1370	RT to ML : (m)	91.55
Hole Volume:	Open Hole-cuft	1775	Cased Hole - cuft	144	Total - cuft:	1919	
Slurry Volume	Lead - cuft:	1661	Tail - cuft :	276	Total - cuft :	1937	
Mud Flush :	40	Bbl .] [Type:	SW				
Lead Slurry :	Cement:	928	Sacks] [Class:	G	Slurry Density :	13.2	ppg
Additives:	2.2 % Prehydrated Bentonite						
Mix Water:	9.72	gal/sack	FW or SW ?	FW	Slurry Yield:	1.79	cuft/sack
Tail Slurry:	Cement :	240	Sacks] [Class	G	Slurry Density :	15.8	ppg
Additives :	SCR-100L 4 gal/10bbl mix water						
Mix Water :	5.00	gal/sack	FW or SW ?	SW	Slurry Yield :	1.15	cuft/sack
Displacement							
Cement Unit :	Fluid 1Type:	SW	Pumped:	10	Bbl. actual	10	Bbl. calculated
	Fluid 2 Type		Pumped:		Bbl. actual		Bbl. calculated
Mud Pump:	Fluid 1 Type:	Mud	Pumped:	333	Bbl. actual	330	Bbl. calculated
	Fluid 2 Type		Pumped:		Bbl. actual		
Plugs Used:	Top - (Y/N)	Y	Type :	SS	Make:	Halliburton	
	Bottom(Y/N)	Y	Type:	SS	Make:	Halliburton	
Returns during job. (Y/N)		Y	Comment:				

TIME Hr:min	Pressure psi	Rate BPM	Description/Comment
0:35	3000		Test lines
0:37	500	9	Pump Mud Flush
0:43	1200		Drop ball & shear top plug
0:54	250-700	8-10	Mix & pump Lead Slurry
1:37	200-500	3-6	Mix & Pump Tail Slurry
1:55	2500		Drop dart & shear bottom plug
2:00	350	7	Pump flush behind cement
2:03	500	9	Displace cement
2:30	2000		Bump plug / cement in place
			Bleed back - float holding

Remarks:

Cementing Service Co:	Halliburton	Cementer:	P.Burr
SAGASCO Rep:	J.Lambert	Date:	8-Dec-92

291076

5.3.4

SAGASCO Resources Ltd

CASING AND CEMENTING RECORD

Well Name:	Flinders 1	**Permit:**	T/25P
Job Type:	Abandonment Plug 1	**Rig Name:**	Ocean Epoch

CASING DETAILS :

Jts	Size	Weight	Grade	Range	Connection	Burst	Collapse

Note: All measurements given Below Rotary Table. (Show depth of float collar and float shoe).

Description	Length	Bottom	Top
Total :	0.00		

Centralisers:	Number:							
	Location:							
Cementing Data								
Mud Type :	FW / PHPA							
Mud Wt (ppg):	9.3	VIS/PV/YP :	52/22/28	Gels (10s/10m):	5/7	WL (ml) :	6	
Bit Size (in):	8.5	Total Depth:(m)	2723	Ave. Hole Dia."	8.5	Based on :	Caliper	
Last Casing :	Size / Weight :	9.625/47	ins / ppf	Set at : (m)	1520	Excess (%) :	n/a	
Cement Fill :	Lead Slurry :	From : (m)	n/a	To : (m)	n/a	RT to GL : (m)	n/a	
	Tail Slurry :	From : (m)	2300	To : (m)	2175	RT to ML : (m)	91.55	
Hole Volume:	Open Hole-cuft:	161	Cased Hole-cuft:	0	Total :	161	cuft.	
Slurry Volume:	Lead Slurry-cuft:	0	Tail Slurry - cuft :	161	Total :	161	cuft.	
Mud Flush :	5	Bbl .]	[Type:	FW				
Lead Slurry :	Cement:	0	Sacks] [Class:		Slurry Density :		ppg	
Additives:								
Mix Water:		gal/sack	FW or SW ?		Slurry Yield :		cuft/sack	
Tail Slurry:	Cement :	140	Sacks] [Class:	G	Slurry Density :	15.8	ppg	
Additives :	1 gal. SCR100 / 10 bbl mixwater							
Mix Water :	5.00	gal/sack	FW or SW ?	FW	Slurry Yield :	1.15	cuft/sack	
Displacement								
Cement Unit :	Fluid 1 Type:	FW	Pumped:	0.3	Bbl. actual	0.3	Bbl. calculated	
	Fluid 2 Type:	Mud	Pumped:	124	Bbl. actual	124	Bbl. calculated	
Mud Pump:	Fluid 1 Type:		Pumped:		Bbl. actual		Bbl. calculated	
	Fluid 2 Type:		Pumped:		Bbl. actual		Bbl. calculated	
Plugs Used:	Top - (Y/N)	N	Type :		Make:			
	Bottom-(Y/N)	N	Type:		Make:			
Returns during job. (Y/N)		Y	Comment:					

TIME Hr:min	Pressure psi	Rate BPM	Description/Comment
11:21	200	5	Pump water ahead
11:25	2000		Test lines
11:45	100-400	4-8	Mix & pump cement
11.56	100	3	Pump water behind
11:57	350-800	7	Displace with mud.
12:15			Shut down

Remarks: Use 5"DP with 12 jts 2-3/8" tubing cementing string
Tag top of cement plug #1 @ 2177m

Cementing Service Company:	Halliburton	Cementer:	P. Watson
SAGASCO Representantive:	A. Chapman	Date:	19/12/92

291077 5.3.5

SAGASCO Resources Ltd

CASING AND CEMENTING RECORD

Well Name:	Flinders 1	**Permit:**	T/25P
Job Type:	Abandonment Plug 2	**Rig Name:**	Ocean Epoch

CASING DETAILS :

Jts	Size	Weight	Grade	Range	Connection	Burst	Collapse

Note: All measurements given Below Rotary Table. (Show depth of float collar and float shoe).

Description	Length	Bottom	Top
Total :	0.00		

Centralisers:	Number:	
	Location:	

Cementing Data

Mud Type :	FW / PHPA							
Mud Wt (ppg):	9.3	VIS/PV/YP :	52/22/28	Gels (10s/10m):	5/7	WL (ml) :	6	
Bit Size (in):	8.5	Total Depth:(m)	2177 (PB)	Ave. Hole Dia."	8.6	Based on :	Caliper	
Last Casing :	Size / Weight :	9.625/47	ins / ppf	Set at : (m)	1520	Excess (%) :	n/a	
Cement Fill :	Lead Slurry :	From : (m)	n/a	To : (m)	n/a	RT to GL : (m)	n/a	
	Tail Slurry :	From : (m)	1550	To : (m)	1470	RT to ML : (m)	91.55	
Hole Volume:	Open Hole-cuft:	40	Cased Hole-cuft:	41	Total :	81	cuft.	
Slurry Volume:	Lead Slurry-cuft:	0	Tail Slurry - cuft :	149.5	Total :	149.5	cuft.	
Mud Flush :	5	Bbl .]	[Type:	FW				
Lead Slurry :	Cement:	0	Sacks] [Class:		Slurry Density :		ppg	
Additives:								
Mix Water:		gal/sack	FW or SW ?		Slurry Yield :		cuft/sack	
Tail Slurry:	Cement :	130	Sacks] [Class:	G	Slurry Density :	15.8	ppg	
Additives :								
Mix Water :	5.00	gal/sack	FW or SW ?	FW	Slurry Yield :	1.15	cuft/sack	
Displacement								
Cement Unit :	Fluid 1 Type:	FW	Pumped:	0.3	Bbl. actual	0.3	Bbl. calculated	
	Fluid 2 Type:	Mud	Pumped:	81	Bbl. actual	81	Bbl. calculated	
Mud Pump:	Fluid 1 Type:		Pumped:		Bbl. actual		Bbl. calculated	
	Fluid 2 Type:		Pumped:		Bbl. actual		Bbl. calculated	
Plugs Used:	Top - (Y/N)	N	Type :		Make:			
	Bottom-(Y/N)	N	Type:		Make:			
Returns during job. (Y/N)		Y	Comment:					

TIME Hr:min	Pressure psi	Rate BPM	Description/Comment
18:23	2000		Test lines
18:25	200	3	Pump water ahead
18:31	100-400	5	Mix & pump cement
18:37	100	4	Pump water behind
18:38	250-800	6-7	Displace with mud.
18:51			Shut down

Remarks: Use 5"DP with 12 jts 2-3/8" tubing cementing string
Cement plug #2 & casing tested to 3000 psi

Cementing Service Company:	Halliburton	Cementer:	P. Watson
SAGASCO Representantive:	A. Chapman	Date:	19/12/92

291078 5.3.6

SAGASCO Resources Ltd

CASING AND CEMENTING RECORD

Well Name:	Flinders 1	**Permit:**	T/25P
Job Type:	Abandonment Plug 3	**Rig Name:**	Ocean Epoch

CASING DETAILS :

Jts	Size	Weight	Grade	Range	Connection	Burst	Collapse

Note: All measurements given Below Rotary Table. (Show depth of float collar and float shoe).

Description	Length	Bottom	Top
Total :	0.00		

Centralisers:	Number:							
	Location:							
Cementing Data								
Mud Type :	Sea Water							
Mud Wt (ppg):	8.6	VIS/PV/YP :		Gels (10s/10m):		WL (ml) :		
Bit Size (in):	n/a	Total Depth:(m)	125**	Ave. Hole Dia."		Based on :	Casing	
Last Casing :	Size / Weight :	13.375/68	ins / ppf	Set at : (m)	403	Excess (%) :	n/a	
Cement Fill :	Lead Slurry :	From : (m)	n/a	To : (m)	n/a	RT to GL : (m)	n/a	
	Tail Slurry :	From : (m)	125	To : (m)	105	RT to ML : (m)	91.55	
Hole Volume:	Open Hole-cuft:	0	Cased Hole-cuft:	55	Total :	55	cuft.	
Slurry Volume:	Lead Slurry-cuft:	0	Tail Slurry - cuft :	57.5	Total :	57.5	cuft.	
Mud Flush :	5	Bbl .] [Type:	SW					
Lead Slurry :	Cement:	0	Sacks] [Class:		Slurry Density :		ppg	
Additives:								
Mix Water:		gal/sack	FW or SW ?		Slurry Yield :		cuft/sack	
Tail Slurry:	Cement :	50	Sacks] [Class:	G	Slurry Density :	15.8	ppg	
Additives :								
Mix Water :	5.00	gal/sack	FW or SW ?	SW	Slurry Yield :	1.15	cuft/sack	
Displacement								
Cement Unit :	Fluid 1 Type:	SW	Pumped:	4	Bbl. actual	4	Bbl. calculated	
	Fluid 2 Type:		Pumped:		Bbl. actual		Bbl. calculated	
Mud Pump:	Fluid 1 Type:		Pumped:		Bbl. actual		Bbl. calculated	
	Fluid 2 Type:		Pumped:		Bbl. actual		Bbl. calculated	
Plugs Used:	Top - (Y/N)	N	Type :		Make:			
	Bottom-(Y/N)	N	Type:		Make:			
Returns during job. (Y/N)		Y	Comment:					

TIME Hr:min	Pressure psi	Rate BPM	Description/Comment
11:22	2000		Test lines
11:25	100	3	Pump water ahead
11:29	100-300	4	Mix & pump cement
11:33	300	3	Displace with SW
11:34			Shut down

Remarks: Use 5"DP with 12 jts 2-3/8" tubing cementing string
Cement plug #3 & casing tested to 1000 psi
** 13-3/8" Bridge Plug is set at 125 m in the 13-3/8" casing above the 9-5/8" casing cut at 135m.

Cementing Service Company:	Halliburton	Cementer:	P. Watson
SAGASCO Representantive:	A. Chapman	Date:	20/12/92

291079

5.4 FIT REPORT

PERMIT : T/25P - FLINDERS 1 - FIT @ 13.375" casing shoe.

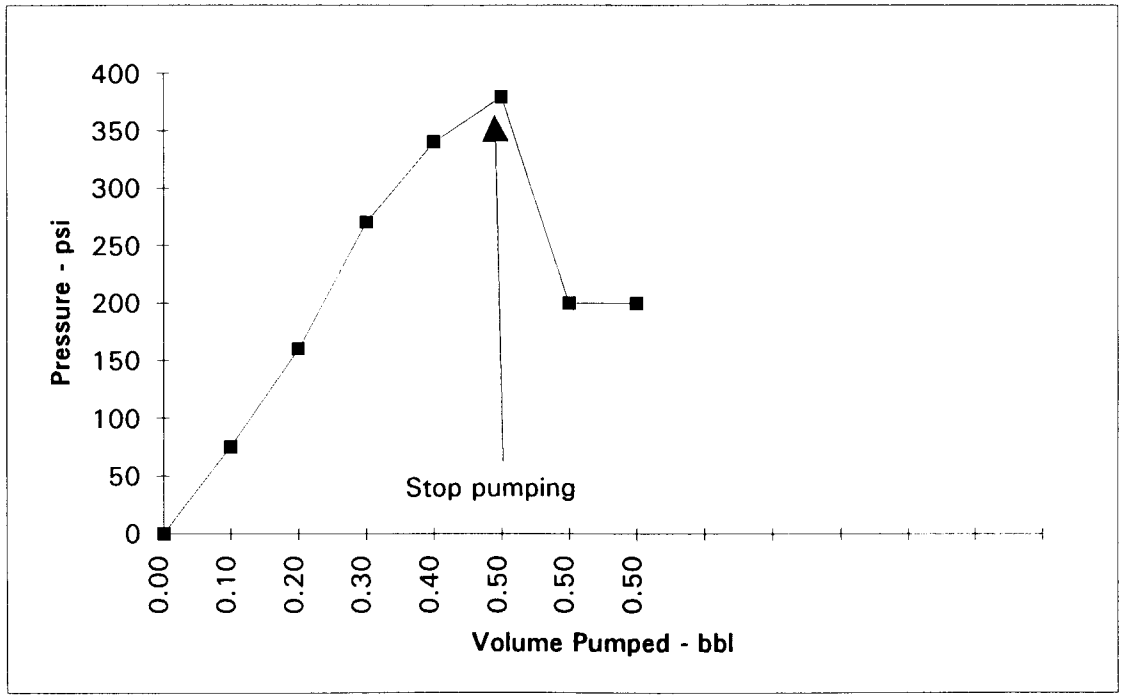
Date : 2-Dec-92

Vol. Pumped bbl	Pressures psi	Time mins
0.00	0	
0.10	75	0.50
0.20	160	1.00
0.30	270	1.50
0.40	340	2.00
0.50	380	2.50
0.50	200	4.50
0.50	200	6.50

Mud wt =	8.70 ppg
Depth =	410.00 m
LOP (max) =	380.00 psi
LOP (stab) =	200.00 psi

EMW (max) =	14.14 ppg
EMW (stab) =	11.56 ppg

Total Pumped =	0.50 bbl
Total Returned =	0.30 bbl



5 cm

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PERMIT : T/25P - FLINDERS 1 - FIT @ 9.625" casing shoe.

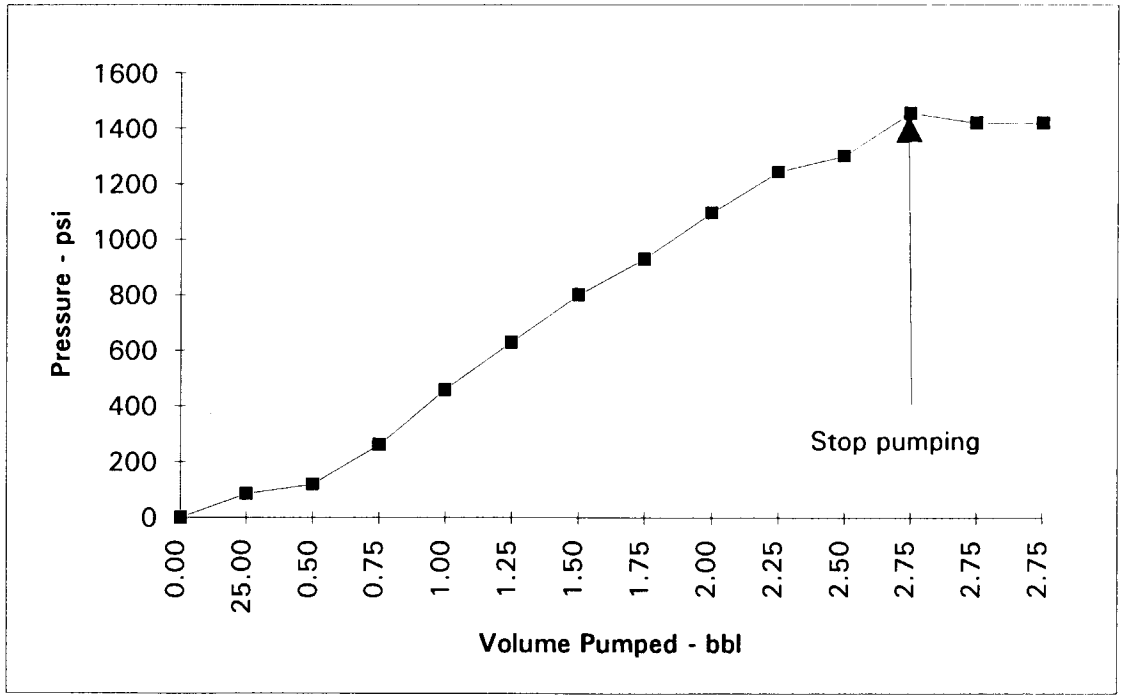
Date : 9-Dec-92

Vol. Pumped bbl	Pressures psi	Time mins
0.00	0	
25.00	85	
0.50	120	
0.75	260	
1.00	460	
1.25	630	
1.50	800	
1.75	930	
2.00	1095	
2.25	1244	
2.50	1300	
2.75	1456	
2.75	1420	
2.75	1420	

Mud wt =	8.90 ppg
Depth =	1527.00 m
LOP (max) =	1456.00 psi
LOP (stab) =	1420.00 psi

EMW (max) =	14.50 ppg
EMW (stab) =	14.36 ppg

Total Pumped =	2.75 bbl
Total Returned =	2.00 bbl



5 cm

2910081

5.5 MUD SUMMARY

291083

IDF

INTERNATIONAL DRILLING FLUIDS PTY LTD

WELL SUMMARY

FOR

OPERATOR: **SAGASCO RESOURCES LIMITED**

WELL: **FLINDERS #1**

ALL COSTS IN: **DOLLARS (AUSTRALIAN)**

Prepared by: C. Jensen / J. Fitzgerald

Date: December, 1992

Authorised by: Gary Schwab - Australian Manager

Revision: 1

INTERNATIONAL DRILLING FLUIDS PTY LTD
7A, 125 MELVILLE PARADE, COMO, W.A., 6152 AUSTRALIA. TELEPHONE (09) 474 3899 FAX (09) 474 3853

291084

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1 WELL DATA, GRAPHICAL SUMMARY

2 DETAILED DISCUSSION BY INTERVALS

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5 MATERIAL AND DRILLING FLUID CONSUMPTION

6 DRILLING FLUID PROPERTIES RECORD

7 DRILLING FLUID VOLUME RECORD



WELL DATA

RIG PLATFORM: OCEAN EPOCH

WELL: FLINDERS #1

OPERATOR REPRESENTATIVES:

Jack Lambert
Alan Chapman
Stuart Irvine
Carl Dorsch

CONTRACTOR REPRESENTATIVES:

Dave Deron
Paul Weaver
Rick Deighton
Ron Watts

IDF ENGINEERS:

Carl Jensen
Jim Fitzgerald

CASING	DEPTH	DATE SET	DRILLING FLUID	DAYS
30"	124.7	29/11/92	SEAWATER / GEL SWEEPS	1
$13^{3}/_{8}$"	403.0	01/12/92	SEAWATER / GEL SWEEPS	2
$9^{5}/_{8}$"	1519	08/12/92	SEAWATER / GEL / POLYMER	7
O/Hole	2723	16/12/92 TD	F.W. - IDBOND	8
Log P & A	2723	21/12/92		5

DAYS ON COMPLETION / TESING: NIL

DATE ENGINEER ON LOCATION: 28/11/92

DATE SPUDDED: 29/11/92

DATE T.D.: 16/12/92

TOTAL DAYS ON WELL: 23

COMMENTS:

Well drilled without significant problems at less than programmed mud cost.



WELL DATA

RKB - SEABED: 91.3 m

WATER DEPTH: 69.3 m

MAX. HOLE ANGLE: 2.75 deg.

INTERVAL	DEPTH	CASING	DEPTH	METERAGE	COST A$
36" Hole	127.6	30"	124.75	36	9170.38
$17^1/_2$" Hole	408.0	$13^3/_8$"	403.00	280	11210.56
$12^1/_4$" Hole	1525.0	$9^5/_8$"	1520.00	1117	40022.76
$8^1/_2$" Hole	2723	P & A		1198	57770.45
			TOTAL COST		**118174.15**

INTERVAL	COST/m A$	IRRECOVERABLE VOLUME	COST/m^3 A$	m_3/m
36" Hole	254.73	110	83.37	3.06
$17^1/_2$" Hole	40.04	198	56.62	0.71
$12^1/_4$" Hole	35.83	504	79.41	0.45
$8^1/_2$" Hole	48.22	294	196.50	0.25



DETAILED DISCUSSION BY INTERVALS

FLINDERS #1

The rig OCEAN EPOCH moved onto location on 28 November, 1992. Prior to spud, SM(X) polymer and Bentonite spud mud was mixed in the reserve pits.

At 10.00 am 29 November,1992 SAGASCO Resources' well, FLINDERS #1, was spudded.

36" HOLE SECTION

The 36" hole interval was drilled using a 26" bit combined with a 36" hole opener. The interval was drilled without problems from 91.55 m to 127.6 m using seawater and high viscosity SM(X) polymer sweeps as required. At 127.6 m the hole was swept with a 16 m^3 high viscosity sweep prior to making a wiper trip. No problems were encountered on the wiper trip and the hole was displaced with 50 m^3 of Bentonite fluid before pulling out to run 30" casing. The casing was run in without incident and cemented with the shoe at 124.75 m.

$17^1/_2$" HOLE SECTION

The $17^1/_2$" hole was drilled with seawater and SM(X) high viscosity sweeps with returns to the seabed. As in the previous section a funnel viscosity of 90-100 sec/l was maintained in the high viscosity sweeps. The $17^1/_2$" hole was drilled to a casing depth of 408 m without problems, again high viscosity sweeps were pumped as required. Prior to reaching casing depth 160 cu.m of Bentonite high viscosity fluid was mixed and stored. At casing depth the hole was swept with 16 m^3 of high viscosity fluid before making a trip to the shoe.

The wiper trip encountered no problems and when back on bottom the hole was displaced with 127 m^3 of high viscosity Bentonite fluid. The $13^3/_8$" casing was then run and cemented without problems with the shoe at 403 m.

$12^1/_4$" HOLE SECTION

While running the Blowout Preventer Stack and the riser, SEAWATER/GEL/POLYMER fluid was mixed on surface. The casing shoe was drilled out with seawater before displacing the hole to the pre-mixed system. An F.I.T. to an equivalent mud weight of 1.73 SG was carried out before drilling ahead.



While drilling ahead 5 cu.m high viscosity Polymer sweeps were pumped and incorporated into the system after each stand or at the drillers discretion. From 565 m there was a dramatic build up in drill solids which continued to the interval TD. While the formations proved to be far more dispersive than on the previous well they were less reactive which was evident from the easy to maintain yield point and gel strengths. Seepage losses, which started early in the interval continued until the shale and siltstone of the Torquay group was penetrated and started again as TD was approached and the mud weight increased. Dilution was made with seawater, treated for pH and low concentrations of IDFLO to control the waterloss. As TD approached the properties were brought into line with higher concentrations of IDFLO and light treatments of IDPAC and IDPAC XL. The weight continued to increase despite the dilution rate and by TD had reached 1.13 SG. A wiper trip at 1014 m showed the hole to be in good conditions. Cavings were evident on the shale shakers from approximately 1100 m and as a result a mud weight of 1.10 SG was the target weight. At 1525 m a wiper trip was made to the shoe, the first 10 stands were tight (60,000 overpull) but otherwise in good condition.

When running back in, tight spots were worked at 1131, 1260, 1275, 1290 and 1319 m with maximum drag of 70,000 lb. The hole was circulated clean before pulling out to log. During this final circulation the fluid was lightly treated with CHROME FREE LIGNOSULFONATE (CFL) to control gel strengths which had begun to increase. When POOH to log 30,000 kg overpull was encountered for the first 4 stands but thereafter the hole was good.

When running into the hole the logging tool tagged a bridge at 780 m. The hole was logged back to 403 m and the logging run abandoned. The bit was run back into the hole and tagged a bridge at 781 m which was washed and reamed before running in to 1128 m.

The hole required reaming from 1128 - 1131 m, 1363 - 1417 m and 1446 - 1525 m. When circulating a check showed that the pH had dropped and the waterloss increased. The fluid was treated with IDCIDE L and CAUSTIC SODA for suspected bacterial contamination and IDPAC XL to control the fluid loss. The mud weight was increased to 1.17SG. Once the mud weight was increased and the hole circulated clean of cavings a wiper trip was made. The first 6 stands had a maximum drag of 60,000 lbs and thereafter normal drag of 10 - 15,000 lbs at 1380 m. On the second run the logging tool was unable to pass 1280 m. Another wiper trip was made with maximum drag running in at 30,000 lbs at 1245 m. the mud weight was increased to 1.19 SG and the fluid was again lightly treated with CFL before pulling out to run casing. The $9^5/_8$" casing was run without problems to TD. While circulating casing the mud was conditioned by reducing yield point and gel strengths with CFL. The $9^5/_8$" casing was cemented with the shoe at 1520 m.



8½" HOLE SECTION

While pressure testing and picking up pipe 160 cu.m of FRESHWATER/IDBOND (PHPA) was mixed in the active and reserve pits. A pit of SEAWATER/GEL/POLYMER mud was kept to drill out the cement. The concentration of the IDBOND was kept low in the premix to avoid losses over the shakers. The cement, float, shoe and two metres of new formation were drilled with the old fluid before displacing to the FRESHWATER/IDBOND system.

Approximately 10 cu.m of contaminated new fluid was dumped in the process. An F.I.T. was carried out to an equivalent mud weight of 1.72 SG.

The $8^1/_2$" hole was then drilled to 1634 m with each connection reamed. After displacing the hole a further 74 cu.m of premix was mixed containing sufficient IDBOND to raise the concentration in the active system over several circulations. The top shaker screens (S40) were partially bypassed to minimise losses. The one mud cleaner was run with a 250 screen until it ripped and was then changed to a 325 screen. A four stand wiper trip was made without problems and drilling continued to 1775 m where a bit trip was made. No hole problems were encountered on the trip out or in. The sand trap and settling pit were dumped and cleaned out during the trip.

After drilling to 2031 m, a wiper trip encountered 20 - 50 k drag up to 1662 m, with no drag to the shoe. On running into the hole, 30k was tagged at 2017m and the hole reamed to 2031 m. The hole was reamed on each connection with wiper trips made from 2317, 2482, 2609 and 2666 m. A trip for a new bit was made from 2382 m. All trips encountered tight hole and 50 - 80 k drag over the new hole sections due to clay hydration in gauge hole. Back reaming was required on the first pass through the intervals 2456 - 2322, 2580 - 2439 and 2610 - 2525 m. The interval 1592 - 2382 m was reamed while running into the hole with a new bit to prevent bit damage by undergauge hole.

A dilution rate of 10 - 15 bbls/hr was required to prevent mud solids build up and control the mud weight at 1.09 SG to 2356 m and to 1.12 SG thereafter. At 2609 m DRILLING DETERGENT and freshwater dilution was used to prevent a hole packoff and bit balling, after a pump pressure increase.

A total depth of 2723 m was reached on 16 December, 1992 at 11.15 am. The hole was circulated and a wiper trip to the shoe indicated a clean stable hole with no drag or fill. The hole was again circulated and POOH to log with no drag.

Four logging runs were completed to TD. The fifth run for side wall cores (CST) encountered a bridge at 2273 m and was unable to pass. The bridge possibly resulted from progressive clay hydration over a three day period as indicated by successive calliper runs. The well was plugged and abandoned on the 19 - 21 December, 1992.

CONCLUSIONS AND RECOMMENDATIONS

FLINDERS #1

36" HOLE SECTION

The 36" hole was successfully drilled using seawater and high funnel viscosity SM(X) sweeps. No mud related hole problems were encountered and the 30" casing was run and cemented at the programmed depth of 124.75 m without problems. The SM(X) at concentrations of 2 - 3 lb/bbl gave viscosities in range 80 - 100 sec/l and yield points in the range of 50 - 60 lb/100 ft^2. This provided excellent hole cleaning characteristics as evidenced by the fill and trouble free nature of this and $17^1/_2$" hole sections. Due to the savings in transportation and handling costs and the elimination of prehydration requirements, the use of SM(X) is cost effective and efficient hole cleaning viscosifier. It is quick and easy to use. The pits can be continuously topped up with seawater and the polymer added between sweeps with small quantities required for high yields.

$17^1/_2$" HOLE SECTION

This section was drilled without hole problems again using a seawater and high funnel viscosity SM(X) sweeps. High viscosity Bentonite fluid was used to displace the hole prior to running casing due to its superior suspension properties.

$12^1/_4$" HOLE SECTION

Time delays incurred in the drilling and logging of the $12^1/_4$" section resulted possibly from clay hydration and caving due to under balanced mud weight. The hole was drilled from 408 m to 1525 m with the $9^5/_8$" casing set at 1520 m, using a SEAWATER/GEL/POLYMER mud system.

Heavy dilution with seawater (13 m^3/hr) was required to control solids and weight build up due to the dispersive nature of the formation and fast rates of penetration. The main affect of the solids on the fluid was the weight increase which was slowed by the dilution but not stopped. The losses noted below 565 m possibly occurred as a result of the porous nature of the formation drilled and stopped when the clay formations were drilled. They returned when the weight increased due to solids build up and later due to additions of BARITE to control the cavings.

The cavings noted below 1100 m, and the bridging during logging operations resulted from an underbalanced mud weight combined with clay hydration. The cavings continued until the final circulations by which time the mud weight had been increased to 1.19 SG.

The use of higher polymer concentrations and a progressively increasing mud weight, with depth, is recommended over this interval on future wells. DRILLING DETERGENT should be used as required to prevent bit balling and packoffs.

KCl use for clay inhibition is not recommended for future use over this interval due to the quantities and volumes required. However, its use at 3% to 5% is an available option.

8½" HOLE SECTION

This section was drilled to TD at 2723 m with no problems except tight hole on the first trip back through new hole. The FRESHWATER/IDBOND mud system provided a stable gauge hole for logging but was unable to prevent both initial and progressive tight hole from clay hydration. After three days of logging, with no wiper trip, the hole bridged off at 2273 m over a hydrophillic clay interval below the Dolerite volcanics.

If required a KCl/IDBOND mud system could be used on future wells to minimise formation damage and clay swelling over this interval. With formation water salinity at 25,000 ppm chlorides, the FRESHWATER/IDBOND system provided the required contrast at 3,000 ppm chlorides for logging purposes.



COST ANALYSIS

FLINDERS #1

36" HOLE SECTION

This section was drilled at a cost of $9,170.38. This exceeds the programmed cost of $5,831.90 by 57%, due to the volume of sweeps used and the inclusion of 119 cu.m prepared for use on the next interval. At $39.23/cu.m, this represents $4,668.37 *80%). The corrected interval cost was $4,502.01 (77%) or 23% below programme cost.

17½" HOLE SECTION

The interval cost $11,210.56, exceeded the programmed cost $7,760.73 by $3,449.83 or 44%. With 159 cu.m of mud remaining for the next section, at $4,914.69 and $4,668.37 received from the previous section, the net cost for the interval was $10,964.24 (41%). The extra cost was incurred by the volume and frequency of the high viscosity sweeps used.

12¼" HOLE SECTION

The interval cost $40,022.76, plus the mud value recovered from the previous interval $4,914.69 gives a net mud cost of $44,937.45. This is $5,328.89 or 11% below programmed cost. The saving is largely due to the amount of BARITE and IDBOND used.

8½" HOLE SECTION

The interval cost at $57,770.45 was less than the programmed cost of $62,626.51 by $4,856.06 (8%). The saving resulted from reduced BARITE consumption, which in turn was offset by increased polymer usage to minimise tight hole on trips.

TOTAL WELL

The total well cost at $121,193.25 was $5,292.25 (4.2%) less than the estimated cost of $126,485.50 due to an over-estimation in the 12½" hole section. However, the result represents very good correlation of anticipated and actual costs.



MATERIAL AND DRILLING FLUID CONSUMPTION

FLINDERS #1

36" HOLE SECTION

Product	Quantity and Unit	Unit Price	Total
BENTONITE	229 x 100 lb	22.18	5079.22
CAUSTIC SODA	6 x 25 kg	46.35	278.10
LIME	4 x 25 kg	11.15	44.60
IDF SM(X)	30 x 25 kg	112.55	3376.50
IDCIDE L	2 x 25 lt	158.90	317.80
SODA ASH	4 x 25 kg	18.54	74.16
		PRODUCT COST	**$9170.38**

Number of cubic metres mixed	238
Cost per cubic metre	$39.23
Volume carried forward, cu.m	119
Value of mud carried forward	$4668.37

Materials not used in the mud:

Product	Quantity and Unit	Unit Price	Total
CALCIUM CHLORIDE used in 30" cement job	57 x 25 kg	17.00	969.00



MATERIAL AND DRILLING FLUID CONSUMPTION

FLINDERS #1

17½" HOLE SECTION

Product	Quantity and Unit	Unit Price	Total
BENTONITE	259 x 100 lb	22.18	5744.62
CAUSTIC SODA	6 x 25 kg	46.35	278.10
SODA ASH	6 x 25 kg	18.54	111.24
LIME	7 x 25 kg	11.15	78.05
IDF SM(X)	43 x 25 kg	112.55	4839.65
IDCIDE L	1 x 25 lt	158.90	158.90
		PRODUCT COST	**$11210.56**

Number of cubic metres mixed	230
Cost per cubic metre	$48.74
Cubic Metres carried forward	159
Value of mud carried forward	$4,914.69

Materials not used in the mud:

Product	Quantity and Unit	Unit Price	Total
BENTONITE	32 x 25 kg	12.40	396.80
CALCIUM CHLORIDE used for cement.	3 x 10 kg	17.00	51.00



MATERIAL AND DRILLING FLUID CONSUMPTION

FLINDERS #1

12¼" HOLE SECTION

Product	Quantity and Unit	Unit Price	Total
BARITE	485 x 100 lb	13.84	6712.40
BENTONITE	318 x 100 lb	22.18	7053.24
IDPAC	42 x 25 kg	167.51	7035.42
IDPAC XL	29 x 25 kg	167.51	4857.79
IDFLO	112 x 25 kg	50.32	5635.84
SODA ASH	32 x 25 kg	18.54	593.28
CAUSTIC SODA	49 x 25 kg	46.35	2271.15
IDF CFL	60 x 25 kg	33.30	1998.00
IDCIDE L	12 x 25 kg	158.90	1906.80
IDF DETERGENT	2 x 200 lt	271.45	542.90
SODIUM SULPHITE	9 x 25 kg	28.00	252.00
IDVIS	3 x 25 kg	387.98	1163.94
		Product cost	**$40,022.76**

Cubic metres mixed	687
Cost per cubic metre	$58.26

Materials not used in the mud:

Product	Quantity and Unit	Unit Price	Total
BENTONITE used for casing cement	49 x 25 kg	12.40	$607.60



MATERIAL AND DRILLING FLUID CONSUMPTION

FLINDERS #1

8½" HOLE SECTION

Product	Quantity and Unit	Unit Price	Total
BARITE	455 x 100 lb	13.84	6297.20
BENTONITE	89 x 100 lb	22.18	1974.02
IDPAC	54 x 25 kg	167.51	9045.54
IDBOND	154 x 25 kg	185.38	28548.52
IDVIS	16 x 25 kg	387.98	6207.68
GYPSUM	40 x 25 kg	12.58	503.20
CAUSTIC SODA	22 x 25 kg	46.35	1019.70
SODIUM NITRATE	12 x 25 kg	28.12	337.44
IDCIDE L	4 x 25 kg	158.90	635.60
IDSPERSE	22 x 25 kg	121.75	2678.50
IDF DETERGENT	1 x 200 lt	271.45	271.45
IDFLO	5 x 25 kg	50.32	251.60
		Product Cost	**$57,770.45**

Cubic metres mixed	477
Cost per cubic metre	$121.11



MATERIAL AND DRILLING FLUID CONSUMPTION

FLINDERS #1

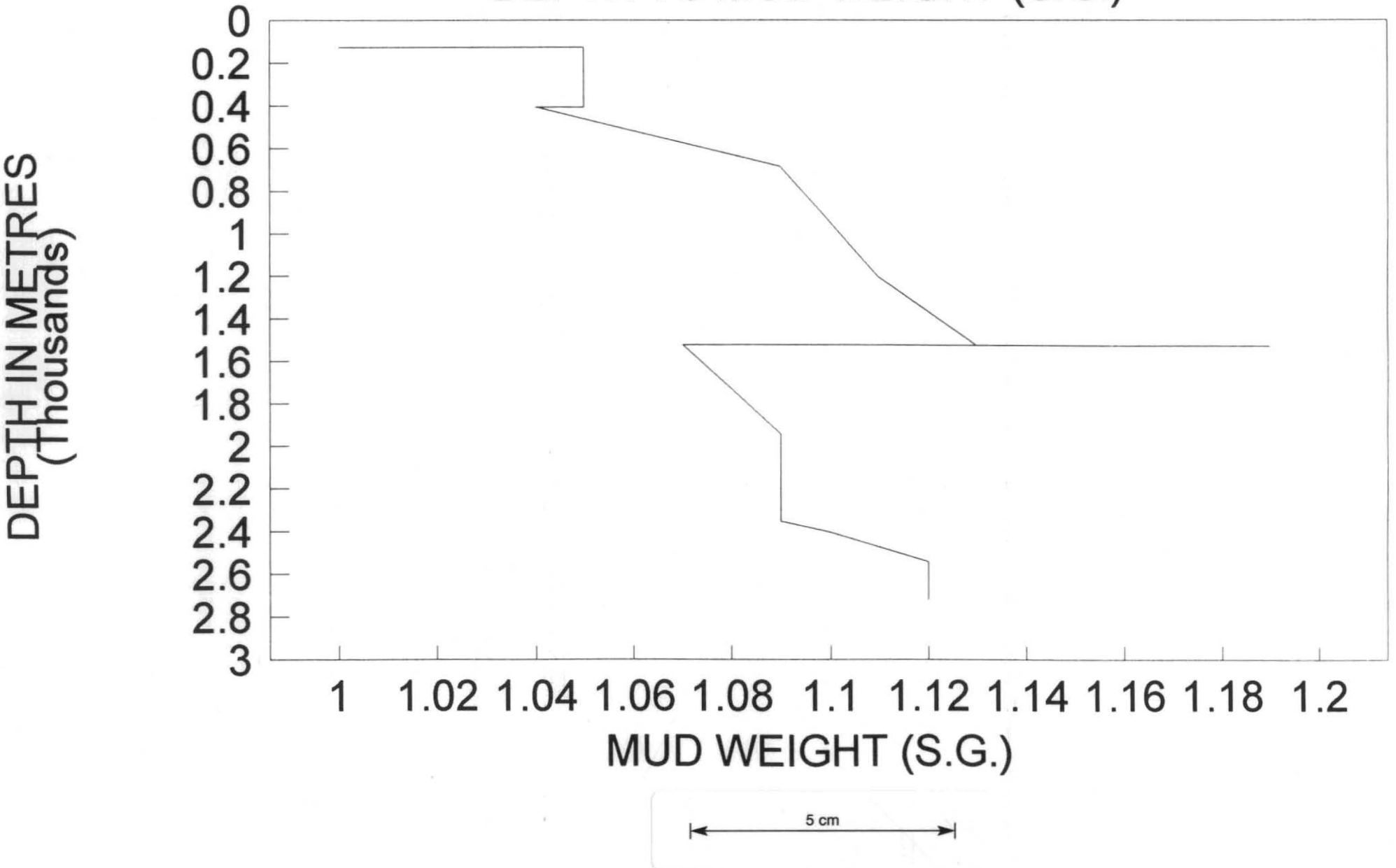
TOTAL WELL

Product	Quantity and Unit	Unit Price	Total
BARITE	940 x 100 lb	13.84	13,009.60
BENTONITE	895 x 100 lb	22.18	19,851.10
IDPAC	96 x 25 kg	167.51	16,080.96
IDPAC XL	29 x 25 kg	167.51	4,857.79
IDBOND	154 x 25 kg	185.38	28,548.52
IDVIS	19 x 25 kg	387.98	7,371.62
GYPSUM	40 x 25 kg	12.58	503.20
CAUSTIC SODA	83 x 25 kg	46.35	3,847.05
SODIUM NITRATE	12 x 25 kg	28.12	337.44
IDCIDE L	19 x 25 kg	158.90	3,019.10
IDSPERSE	22 x 25 kg	121.75	2,678.50
IDF DETERGENT	3 x 200 lt	271.45	814.35
IDFLO	117 x 25 kg	50.32	5,887.44
LIME	11 x 25 kg	11.15	122.65
IDF SM(X)	73 x 25 kg	112.55	8,216.15
IDCIDE L	19 x 25 lt	158.90	3,019.10
SODA ASH	42 x 25 kg	18.54	778.68
IDF CFL	60 x 25 kg	33.30	1,998.00
SODIUM SULPHITE	9 x 25 kg	28.00	252.00
		Product Cost	**$121,193.25**

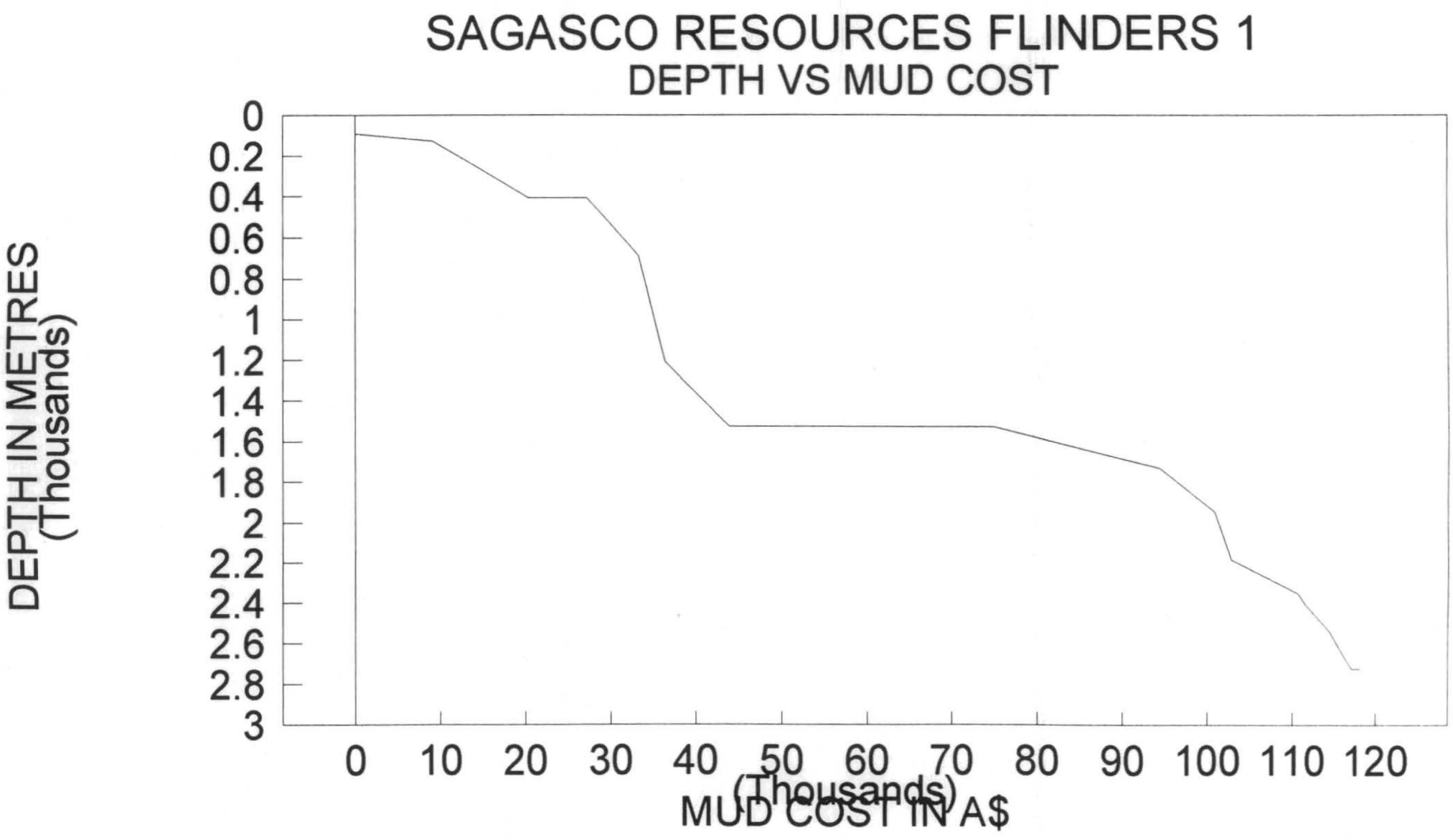
Cubic metres mixed	1632
Average cost per cubic metre	$72.41

SAGASCO RESOURCES FLINDERS 1

DEPTH VS MUD WEIGHT (S.G.)



S91095


SAGASCO RESOURCES FLINDERS 1
DEPTH VS MUD COST
DEPTH IN METRES
(Thousands)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
0 10 20 30 40 50 60 70 80 90 100 110 120
(Thousands)
MUD COST IN A$

291099

5 cm

WELL AND FLUID PROPERTIES SUMMARY

OPERATOR : SAGASCO RESOURCES RIG: DIAMOND M-ODECO "OCEAN EPOCH" LOCATION: BASS BASIN TASMANIA

WELL: FLINDERS 1 IDF ENGINEERS: J FITZGERALD/C JENSEN DATE: NOV/DEC 1992

DAY	DATE	DEPTH	HOLE DIAM	WT	FUNN VIS	AV	PV	YP	GEL 10Sec	GEL 10min	WATER %	SOLID %	FLUID LOSS	CL g/lt	SAND %	FANN 600	FANN 300	FANN 200	FANN 100	FANN 6	FANN 3	PF	MF	PM	TOTAL HARD	CA HARD	MG HARD	MBT	pH	CUMCOST
1	27-11-92	91.5	0.00	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	0.0	0.0	0.00
2	28-11-92	91.5	0.00	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	0.0	0.0	0.00
3	29-11-92	128	36.00	1.05	95	41	20	42	30	68	98	2	0.0	0.0	0.0	82	62	50	40	27	25	0.00	0.00	0.00	0	0	0	0.0	8.7	9170.38
4	30-11-92	408	17.50	1.05	105	48	16	64	35	48	98	2	0.0	0.0	0.0	96	80	58	50	34	31	0.00	0.00	0.00	0	0	0	0.0	8.7	20380.94
5	01-12-92	408	12.50	1.04	38	15	7	15	10	13	98	2	25.0	15.0	0.0	29	22	18	16	11	10	0.10	0.10	0.00	1600	1600	0	12.5	8.9	27281.96
6	02-12-92	686	12.25	1.09	39	14	6	16	6	18	94	6	17.4	15.0	0.5	28	22	16	13	6	5	0.10	0.20	1.10	1040	200	504	15.0	9.3	33309.53
7	03-12-92	1208	12.25	1.11	38	16	7	18	12	21	94	6	20.0	19.0	0.5	32	25	22	20	13	12	0.05	0.15	0.70	1160	200	504	17.5	9.3	36512.17
8	04-12-92	1525	12.25	1.13	43	21	11	20	20	49	94	7	11.4	19.0	0.5	42	31	27	25	21	20	0.05	0.15	0.70	1240	220	612	22.5	9.3	43957.81
9	05-12-92	1525	12.25	1.16	48	26	13	26	20	42	91	9	8.6	19.0	0.5	52	39	35	29	18	17	0.15	0.50	0.40	1320	240	648	27.5	9.7	52788.79
10	06-12-92	1525	12.25	1.19	54	20	10	20	20	53	90	11	9.2	19.0	TR	40	30	25	22	16	15	0.10	0.30	0.80	1040	160	528	27.5	9.4	59645.00
11	07-12-92	1525	12.25	1.19	45	21	14	14	9	17	90	11	9.2	19.0	TR	42	28	22	18	8	7	0.05	0.20	0.50	960	120	504	27.5	9.3	60403.70
12	08-12-92	1525	8.50	1.07	53	17	8	18	4	10	98	2	9.4	2.8	TR	34	26	21	17	7	4	0.05	0.15	0.15	240	120	72	5.0	9.4	74949.97
13	09-12-92	1731	8.50	1.08	49	23	13	19	5	10	97	3	8.6	2.8	0.5	45	32	21	18	7	5	0.05	0.10	0.20	240	200	24	7.5	9.4	94475.35
14	10-12-92	1944	8.50	1.09	48	24	13	22	3	10	96	4	6.6	2.8	0.5	48	35	30	20	7	3	0.05	0.20	0.20	240	200	24	7.5	9.4	101029.48
15	11-12-92	2184	8.50	1.09	53	33	19	28	8	12	96	4	6.8	3.0	TR	66	47	30	20	7	3	0.10	0.20	0.30	200	160	24	7.5	9.0	102950.85
16	12-12-92	2356	8.50	1.09	53	35	19	32	9	13	97	3	6.4	3.3	TR	70	51	41	30	7	4	0.40	0.60	0.60	160	120	24	10.0	9.5	110760.21
17	13-12-92	2407	8.50	1.1	50	32	19	26	6	11	96	4	6.0	3.3	TR	64	45	36	24	5	3	0.30	0.20	0.50	160	120	24	10.0	9.0	111557.97
18	14-12-92	2542	8.50	1.12	52	37	21	31	8	14	96	4	5.8	3.0	TR	73	52	42	28	6	3	0.30	0.50	0.60	160	120	24	10.0	9.0	114549.85
19	15-12-92	2664	8.50	1.12	53	34	20	27	7	12	95	5	6.4	3.0	TR	67	47	37	24	6	4	0.20	0.40	0.50	160	120	24	10.0	9.0	116243.13
20	16-12-92	2723	8.50	1.12	52	36	22	28	5	7	95	5	6.0	3.0	TR	72	50	40	26	5	3	0.30	0.60	0.60	80	80	0	10.0	9.5	117133.59
21	17-12-92	2723	8.50	1.12	52	36	22	28	5	7	95	5	6.0	3.0	TR	72	50	40	26	5	3	0.30	0.60	0.60	80	80	0	10.0	9.5	117925.03
22	18-12-92	2723	8.50	1.12	52	36	22	28	5	7	95	5	6.0	3.0	TR	72	50	40	26	5	3	0.30	0.60	0.60	80	80	0	10.0	9.5	117925.03
23	19-12-92	2723	8.50	1.12	52	36	22	28	5	7	95	5	6.0	3.0	TR	72	50	40	26	5	3	0.30	0.60	0.60	80	80	0	10.0	9.5	117925.03
24	20-12-92	2723	8.50	1.12	52	36	22	28	5	7	95	5	6.0	3.0	TR	72	50	40	26	5	3	0.30	0.60	0.60	80	80	0	10.0	9.5	118174.15

291100

5.6 BIT AND BOTTOM HOLE ASSEMBLY RECORD

SAGASCO RESOURCES

5.6.1

BIT RECORD

WELL NAME: FLINDERS 1
PERMIT: T/25P

LOCATION: BASS BASIN, TASMANIA
RIG NAME: OCEAN EPOCH

NO	SIZE INCH	MAKE	TYPE	NOZZLES 32ND IN	SERIAL NO	DEPTH OUT MTRS	DRILLED METRES	HRS TOTAL	ROP M/HR	WT KLB	RPM	PSI	GPM	ANN.VEL DC/DP M/MIN	IADC DULL GRADE							
															I	O	D	L	B	G	O	R
1RR	26	SMITH	DSJ	24, 24, 24	KS5832	127.6	36	2	18	5\10	40\80	350	250\800	17	1	1	NO	_	1	I	_	TD
	36	GRANT	H/O	4 X 20	2530	127.6	36	2	18	5\10	40\80	350	250\800	-	1	1	NO	_	1	I	_	TD
2RR	17 1/2	SMITH	DSJ	18, 18, 18	KS7976	408	280.4	12	23.3	5	90	350	600	28\23	1	1	NO	_	1	I	NO	TD
3	12 1/4	SMITH	FDS	14, 14, 14	NC2238	1525	1117	45	25	10\30	90\130	2700	600	52\35	2	2	SS	A	E	1\16	NO	TD
4	8 1/2	SMITH	FDGH	11, 11, 10	NC2923	1775	250	24	10.4	25	80\120	2400	400	74\47	8	8	ER,W	A	E	2\16	NO	PR
5	8 1/2	SMITH	F2	11, 11, 10	KS6612	2382	607	53	11.5	25	80\120	2800	400	100\63	3	3	WT	A	E	1\16	NO	PR
6	8 1/2	SMITH	F2	11, 11, 10	KS6746	2723	341	56.5	6	30	80\120	2900	400	100\63	1	1	NO	A	E	1\16	NO	TD

291102

5.6.2

SAGASCO Resources Ltd.

BOTTOM HOLE ASSEMBLY RECORD

WELL NAME: FLINDERS 1 **LOCATION:** BASS BASIN

PERMIT: T/25P **RIG NAME:** OCEAN EPOCH

BHA No:	#1			#2			#3		
HOLE SIZE:	36"			17-1/2"			12-1/4"		
DEPTH (m) - from/to:	91.55/127.6			127.6/408.0			408.0/1525.0		
	Item	Length (m)	Qty	Item	Length (m)	Qty	Item	Length (m)	Qty
	26" Bit	0.62	1	17.50" Bit	0.43	1	12.25" Bit	0.32	1
	36" H/O	2.05	1	Bit Sub	1.20	1	Bit Sub	1.22	1
	Bit Sub	1.20	1	9" DC	18.33	2	8" M. DC	9.12	1
	9" DC	55.17	6	17.50" Stab	2.27	1	8" DC	9.15	1
	X/O	0.79	1	9" DC	36.84	2	12.25" Stab	1.76	1
	8" DC	28.07	3	X-O	0.79	1	8" DC	101.90	11
	X/O	0.45	1	8" DC	55.80	6	8" Drl Jar	9.79	1
	5" HWDP	39.25	5	X-O	1.10	1	8" DC	27.73	3
				5" HWDP	110.68	12	X/O	1.10	1
							5" HWDP	110.69	12
	TOTAL	127.60		TOTAL	227.44		TOTAL	272.78	

BHA No:	#4			#5		
HOLE SIZE:	8-1/2"			8-1/2"		
DEPTH (m) - from/to:	1525.0/2382.0			2382.0/2723.0		
	Item	Length (m)	Qty	Item	Length (m)	Qty
	8.50" Bit	0.25	1	8.50" Bit	0.25	1
	Bit Sub	0.91	1	8.50"NB Stab	1.67	1
	6.50" M. DC	9.22	1	6.50" Pony DC	3.05	1
	8.50" Stab	1.60	1	8.50" Stab	1.56	1
	6.50" DC	130.01	14	6.50" Mon DC	9.22	1
	6.50" Drl Jar	9.95	1	8.50" Stab	1.34	17
	6.50" DC	27.50	3	6.50" DC	157.99	12
	5" HWDP	110.69	12	6.50" Drl Jar	9.72	1
				6.50" DC	27.50	3
				5" HWDC	110.69	12
	TOTAL	290.13		TOTAL	322.99	

5.7 WELL DEVIATION

DEVIATION SURVEY REPORT

PERMIT:	T/25P
WELL NAME :	FLINDERS 1

SURVEY DEPTH M (BRT)	DEVIATION ANGLE Degrees	AZIMUTH Degrees	SURVEY METHOD	SURVEY PERFORMED BY	SURVEY DATE
127.55	0.50		TOTCO	DMG	29-Nov-92
395.00	0.50		TOTCO	DMG	30-Nov-92
1014.00	0.75		TOTCO	DMG	3-Dec-92
1525.00	1.25		TOTCO	DMG	5-Dec-92
1774.00	0.25		TOTCO	DMG	10-Dec-92
2382.00	1.80		TOTCO	DMG	13-Dec-92
2723.00	2.75		TOTCO	DMG	16-Dec-92

COMMENT :

Deviation survey was performed in 12.25" open hole from 420.65m to 1516.00m by Austoil using Sperry Sun magnetic multi shot on 5-dec-92. (Copy of survey results attached).

Deviation survey was performed in 8.50" open hole from 1527.50m to 2716.00m by Hallihurton Logging Services in conjunction with wire line dipmeter logging on 18-Dec-92. (Refer to wire line logs for survey results).

291106

5.7.2.

AUSTOIL DRILLING SERVICES PTY LTD

3 Tay linson Street
O'Connor 6163
Western Australia
Telephone (09) 331 1444
Facsimile (09) 331 3687
Telex AA96827

COMPANY : SAGASCO RESOURCES
WELL NAME : FLINDERS #1 SURVEY TYPE : MAGNETIC MULTISHOT
MAGNETIC DECL. : 12.00 DEG. VERTICAL SECTION AZIMUTH : 0.00 DEG.

REC NUM	INS TYP	MD METRES	INCL DEG	AZIM DEG	NORTH METRES	EAST METRES	TVD METRES	DLS/ 30M	V/SECT METRES
1	SU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	MM	420.65	0.50	37.00	1.47	1.10	420.64	0.04	1.47
3	MM	499.24	0.00	0.00	1.74	1.31	499.23	0.19	1.74
4	MM	500.00	0.00	0.00	1.74	1.31	499.99	0.00	1.74
5	MM	506.08	0.00	0.00	1.74	1.31	506.07	0.00	1.74
6	MM	534.91	0.00	0.00	1.74	1.31	534.90	0.00	1.74
7	MM	563.66	0.25	84.00	1.75	1.37	563.65	0.26	1.75
8	MM	592.05	0.25	84.00	1.76	1.50	592.04	0.00	1.76
9	MM	620.64	0.25	86.00	1.77	1.62	620.63	0.01	1.77
10	MM	649.51	0.25	88.00	1.78	1.75	649.50	0.01	1.78
11	MM	678.20	0.00	0.00	1.78	1.81	678.19	0.26	1.78
12	MM	706.68	0.25	85.00	1.78	1.87	706.67	0.26	1.78
13	MM	735.56	0.00	0.00	1.79	1.93	735.55	0.26	1.79
14	MM	764.04	0.25	347.00	1.85	1.92	764.03	0.26	1.85
15	MM	792.40	0.25	297.00	1.94	1.85	792.39	0.22	1.94
16	MM	821.02	0.50	311.00	2.05	1.70	821.01	0.28	2.05
17	MM	849.44	0.25	293.00	2.15	1.55	849.43	0.29	2.15
18	MM	878.20	0.25	308.00	2.22	1.44	878.19	0.07	2.22
19	MM	906.95	0.25	285.00	2.27	1.33	906.94	0.10	2.27
20	MM	935.82	0.25	287.00	2.31	1.21	935.81	0.01	2.31
21	MM	964.15	0.50	297.00	2.38	1.04	964.14	0.27	2.38
22	MM	1021.23	0.75	250.00	2.37	0.47	1021.22	0.29	2.37
23	MM	1049.79	0.75	230.00	2.18	0.15	1049.77	0.27	2.18
24	MM	1078.29	0.75	247.00	1.99	-0.16	1078.27	0.23	1.99
25	MM	1106.98	0.75	247.00	1.84	-0.51	1106.96	0.00	1.84
26	MM	1135.84	0.75	237.00	1.67	-0.84	1135.82	0.14	1.67
27	MM	1164.30	1.00	269.00	1.56	-1.25	1164.27	0.57	1.56
28	MM	1221.38	0.50	277.00	1.58	-1.99	1221.35	0.27	1.58
29	MM	1250.17	0.50	277.00	1.61	-2.24	1250.14	0.00	1.61
30	MM	1279.11	0.50	286.00	1.66	-2.49	1279.08	0.08	1.66
31	MM	1307.32	0.50	287.00	1.73	-2.72	1307.29	0.01	1.73
32	MM	1336.11	0.50	267.00	1.76	-2.97	1336.07	0.18	1.76
33	MM	1364.74	0.50	295.00	1.81	-3.21	1364.70	0.25	1.81
34	MM	1393.33	0.25	347.00	1.92	-3.33	1393.29	0.42	1.92
35	MM	1422.18	0.25	347.00	2.05	-3.36	1422.14	0.00	2.05
36	MM	1451.12	0.50	8.00	2.23	-3.36	1451.08	0.29	2.23
37	MM	1479.55	1.00	28.00	2.57	-3.23	1479.51	0.59	2.57
38	MM	1508.16	1.25	34.00	3.05	-2.93	1508.11	0.29	3.05
39	MM	1516.00	1.25	34.00	3.20	-2.84	1515.95	0.00	3.20

Surveys computed using the MINIMUM CURVATURE method..

5.8 SITE SURVEY AND RIG POSITIONING SUMMARY

291108

ASSOCIATED SURVEYS INTERNATIONAL PTY LTD
ACN 009 172 990

5.8.1.

PC4/6433sd

FLINDERS #1
(PERMIT T/25P)

BATHYMETRIC AND GEOHAZARD SITE SURVEY

SURVEY REPORT
JUNE 1992

Prepared for: SAGASCO RESOURCES LIMITED
60 HINDMARSH SQUARE
ADELAIDE SOUTH AUSTRALIA

Prepared by: ASSOCIATED SURVEYS INTERNATIONAL PTY LTD
18 PROWSE STREET
WEST PERTH WESTERN AUSTRALIA 6005

ABSTRACT

Between 13th and 15th June, 1992, Associated Surveys International conducted an echo sounder and side scan sonar survey over a 3km by 3km site centred on the proposed Flinders 1 location with given co-ordinates of:

Latitude:	40 deg 22 min 51.83 sec South
Longitude:	145 deg 40 min 18.7 sec East

Eastings:	387261.113 m
Northings:	5529084.837 m

100m spaced primary lines were surveyed on a bearing of 160/340 deg, and cross lines were surveyed at 250 m spacing.

Results of echo sounding, show the seabed across the site to be flat with a very gentle slope from approximately 67m in the south to approximately 69m in the east.

At location a reduced depth of 68.4 m below LAT is recorded and the seabed is flat and smooth.

Preliminary side scan sonar interpretations show no protuberances or debris on the seabed over the site and no evidence of gas seepage is noted.

The side scan sonar records show the seabed to be moderately reflective and textured, interpreted as indicating moderately dense sediments with small scale irregular seabed relief due to the presence of shells and minor current scoured features.

Drop coring near the location confirms the presence of slightly to moderately dense and cohesive fine grained clayey sediments down to 2.6m.

The survey results indicate no hazards to the placement of a rig at this location, and the sediments as sampled near the location should have adequate anchor holding capacity if they are continuous over the rest of the survey area.

However in the absence of any other information from the sub-bottom, there is no way of determining whether the minimum sediment thickness as determined from coring is available at the anchor locations, and there is no way of determining the presence or absence of possible sub-bottom drilling hazards such as gas pockets.

CONCLUSIONS AND RECOMMENDATIONS

The seabed is essentially flat at the proposed Flinders 1 location and there are no bathymetric hazards to rig placement identified from the echo sounder or side scan sonar data.

The sidescan data also appears to be free of any other hazards such as gas seepages.

The 2.6 m or more of moderately dense fine grained clayey sediments sampled near the location should be adequate for anchor holding if they are continuous at anchoring positions.

The sidescan sonar results indicate uniform geology across the survey area so it can be assumed that these sediments are continuous across to the anchor positions.

However in the absence of any other information from the sub-bottom, there is no way of determining whether the minimum sediment thickness as determined from coring is available at the anchor locations, and there is no way of determining the presence or absence of possible sub-bottom drilling hazards such as gas pockets.

291112

POSITIONING REPORT

FOR

SAGASCO RESOURCES LIMITED

RIG MOVE OF THE

SEMI - SUBMERSIBLE DRILLING RIG

OCEAN EPOCH

LOCATION	:	**FLINDERS-1**
BLOCK	:	**T/25P**
DATED	:	**24th - 29TH NOVEMBER, 1992**
REPORT REF	:	**2010**

ABSTRACT

This report details the services provided by RACAL SURVEY AUSTRALIA LIMITED (Racal), prior to and during the positioning of semi-submersible rig OCEAN EPOCH over the FLINDERS-1 location in the Bass Strait, offshore northwest Tasmania for SAGASCO RESOURCES LIMITED (SAGASCO).

Personnel and equipment mobilised to Devonport on the 24th of November, 1992. Positioning equipment was set up on the "Ocean Epoch" on the 24th of November, 1992.

The "Ocean Epoch" was positioned over the Flinders-1 location, on the 28th of November, 1992.

A final Differential GPS fix was obtained, after the "Ocean Epoch" had pretensioned and ballasted down to drilling draught, during the morning of the 29th of November, 1992.

Proposed Location

The co-ordinates of the proposed location, Flinders-1, were provided by SAGASCO as follows:

Datum AGD 84

Latitude : 40° 22' 51.80" South
Longitude : 145° 40' 18.70" East

AMG Zone 55 C.M. 147° E

Easting : 387 261.099m
Northing : 5 529 085.762m

Final Differential GPS Position - Flinders-1

The final DGPS position of the "Ocean Epoch" was derived between 0105 and 0306 hours on the morning of the 29th of November, 1992. The final DGPS position was as follows:

Datum AGD 84

Latitude : 40° 22' 51.810" South
Longitude : 145° 40' 18.687" East

AMG Zone 55 C.M. 147° E

Easting : 387 260.80m
Northing : 5 529 085.46m

The final position is 0.42 metres on a bearing of 225.35° (T) from the intended location.

SUMMARY OF EVENTS

Racal personnel, Surveyor Mr. J. Austin and Electronics Engineer Mr. C. Hakkennes flew to Devonport airport on Tuesday 24th of November, 1992, arriving at 0930. On arrival, it was confirmed with Lloyd's helicopter personnel that Racal "SkyFix" equipment had already been transported to the "Ocean Epoch".

BHP Surveyor Mr. B. Edmonds arrived at Devonport airport at 1335 on the 24th of November 1992, and at 1425 all personnel departed Devonport airport for "Ocean Epoch", arriving aboard at the King-1 location at 1520. Equipment set-up commenced immediately, and by 2359 was complete, except for measurement of the gyro offset. Approach lines, anchor positions and rig heading were planned in accordance with instructions received during a meeting, at 1915, with Sagasco Company representative Mr. A. Chapman, and Barge Master Mr. D. Phillips.

By 0600 on Wednesday the 25th of November, 1992, anchor handling had commenced and Anchor No. 8 had been recovered, in winds of up to 25 knots and sea state 3. At 0658 Anchor No. 1 was recovered, and at 0718 Anchor No. 4 was also recovered; however at 0755 anchor-handling operations were postponed due to rising wind and seas. Anchor recovery did not recommence until over 48 hours later, after winds, which had risen to 45 knots, abated to 15 knots.

A gyro check was conducted at 2022 on the 25th of November, 1992, by observing the azimuth of the sun at sunset. Heavy cloud interfered with observations, however a preliminary C-O correction was derived and applied to the GNS navigation computer.

Anchor handling recommenced at 1011 on Friday the 27th of November 1992, and Anchor No.5 was recovered at 1100. At 1236, "Terje Viking" secured to the tow bridle and "Ragna Viking" finished with Anchor No.7. "Ragna Viking" recovered Anchor No.3 at 1417, and Anchor No.2 at 1630. "Ocean Epoch" lifted Anchor No.6 at 1713, and at 1740 it was secured and the tow to the Flinders-1 location commenced.

At 0522 on Saturday the 28th of November, 1992, the "Ocean Epoch" was one mile from the Anchor No.6 drop location, and sixty second position fix outputs were commenced. Anchor No.6 was let go at 0554, 29 metres from the intended position. By 0624 "Ocean Epoch" was located over the intended Flinders-1 position, and sixty second fixing was discontinued.

From 0705 to 0920 on the 28th of November, 1992, "Ragna Viking" placed Anchors 2, 7 and 3 on the bottom, generally close to intended locations except for Anchor No.7, which was placed some 12° from its intended bearing. At 1105 "Terje Viking" cast off the towing bridle, and at 1230 she placed Anchor No.8 on the bottom. "Ragna Viking" laid Anchor No.4 at 1339, "Terje Viking" laid Anchor No.1 at 1435, and "Ragna Viking" laid the last anchor, No.5, at 1445. Pretensioning then commenced.

Ocean Epoch completed successful pretensioning at 1848 on the 28th of November, 1992, and commenced ballasting down to drilling draught.

A second gyro check was conducted at 2026 on the 28th of November 1992, in good conditions, and a final gyro correction applied to the navigation software.

"Ocean Epoch" completed ballasting down at 2327 on the 28th of November 1992, and after the winch tensions were checked, observations of final position were commenced.

The final acoustic position was observed from 0015 to 0030 on Sunday the 29th of November, 1992, and then the final differential GPS position was observed from 0105 to 0306 during a period of good GPS coverage.

On completion of successful observations, the Racal navigation equipment was packed, ready for transport. At sunrise, Mr. Hakkennes transferred to the "Ragna Viking" to recover the Sonardyne seabed acoustic transponders, which operation was successfully completed at 0848 on the 29th of November 1992. Mr. Hakkennes transferred back to the rig, then all equipment was prepared for air and sea freighting.

At 1115 on Sunday the 29th of November 1992, all survey personnel and the Racal "SkyFix" equipment were flown to Devonport airport; at 1355 all personnel departed Devonport for Melbourne, thence home or Perth locations.

5.9 Fishing Operations

No fishing operations were performed on the well Flinders 1.

5.10 Hole Problems

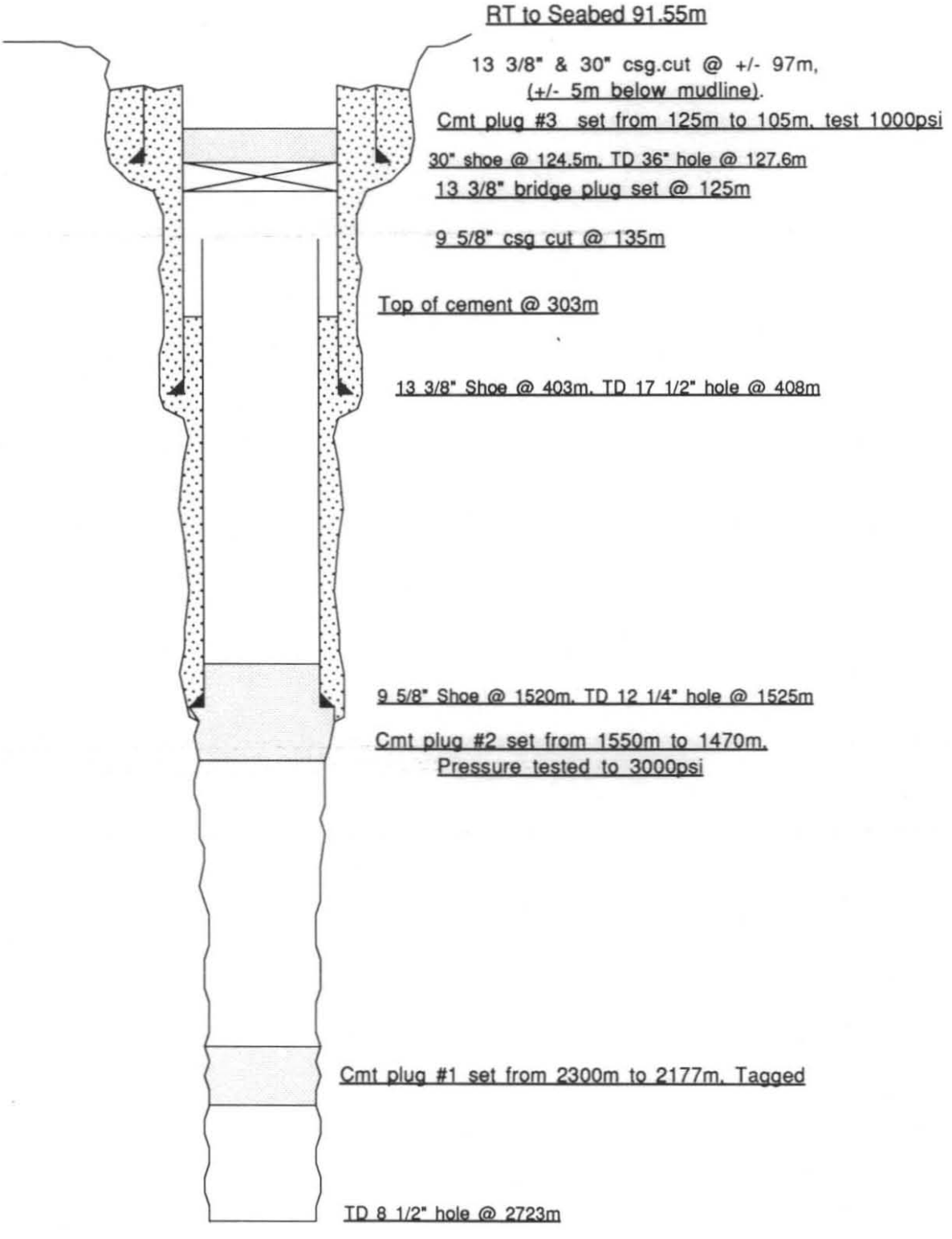
No significant hole problems were encountered while drilling the well Flinders 1 other than a number of tight hole sections encountered while tripping. These sections generally caused no further problem after being reamed. In the 12¼" hole section Log Suite 1A was unable to pass 708m on the first attempt. A wiper trip was subsequently made in the hole with the 12¼" bit and the mud weight was raised to 9.99 ppg. The second run with Log Suite 1A was unable to pass 1240m.

5.11 Perforating Record

No perforating operations were performed on the Flinders 1 well.

5.12 Well Abandonment Diagram

FLINDERS #1
PLUG & ABANDONMENT



5.13 Rig and Equipment Summary

5.13.1 Vessel and Equipment

DESCRIPTION		SPECIFICATION		
Section A: Classification and Certification				
Name		Diamond M Epoch		
Vessel Type and Class		Semisubmersible, ABS		
Owner		Diamond M General Company		
Country of Registration (Flag)		USA		
Designer		Diamond M Offshore, Inc		
Builder and Date of Construction Yard		Alabama Drydock and Shipbuilding/1977		
Date of Last Refit		March 1990		
Certification -	Classification Society	ABS		
	Class Notation, Expiry Dates	ABS Maltese Cross A1		
ABS Certification		March 1991		
UK, DOE Certification				
DNV Certification				
NMD Certificate of Compliance				
USGS Certification		March 1991		
Section B: Operational Constraints				
Max Water Depth - with present Equipment		1,200ft		
Min Water Depth - with present Equipment		150ft		
Max Variable Deck Load: (S Tons)		Ocean Transit	Drilling	Survival
Drill pipe				
Drill collars				
Subs and BHA components				
Riser and slip joints				
BOP				
Trav Block and Kelly				
Liquid Mud				
Stock/tools				
Bulk products				
Others				
	TOTAL	1,300	2,512	2,512

DESCRIPTION	SPECIFICATION		
Other Variable Loads:	Ocean Transit	Drilling	Survival
Personnel Anchors, chains and chain tension Riser and guideline tension Fuel Potable Water Drill Water Ballast tanks Others			
TOTAL	4,352	14,762	5,248
Maximum Wave Height		40ft	68-100ft
Maximum wind speed		50kts	100kts
Maximum Wave Period		10sec	15sec

Maximum Heave	10ft for drilling
Maximum Roll with 400,000 lbs of DP and DCS racked in derrick	7° x 8 sec single amplitude
Maximum Wind Velocity with above condition applicable	50 knots

Drilling Mode Limitations

	Running BOP	Drilling	Survival
- Maximum Roll (Dbl) Amplitude)	3°	5°	-
- Maximum Pitch (Dbl Amplitude)	3°	5°	-
- Maximum Heave	5°	10 ft	-

<u>Section C:</u>
Mooring System

Anchor Pattern	30/60
Anchors, Manufacturer/Weight (Lbs) No/System Capacity	Eight (8) Stevpris, 10 metric ton
Anchor Chains/Wires Size/Grade Length	**Chains:** 2¾ inch/ORQ 4,800 ft each
Windlasses/Winches Manufacture and type	SKAGIT, Double Drum WMD-44
Chain Chaser Type Number	J-type One (1) per anchor

DESCRIPTION	SPECIFICATION
Anchor Tension Instrumentation	
Recording devices	
Manufacturer	Oilfield Instruments
Type	Sensing/Indicating
Location	At Anchor Winches
Section D:	
Storage Capacities	
Tubular Goods	
Casing/tubing	950 s tons
Drill pipe	
Drill collars	
Sack Material Area	
Capacity (pallets)	4' x 4' pallets 5100 sacks total
Bulk Mud	
Barite	Three (3) 1250 cu ft each
Bentonite	One (1) 1250 cu ft each
Liquid Mud	
Active capacity (usable)	840 bbls
Reserve capacity (usable)	708 bbls
Total	1548 bbls
Bulk Cement	Four (4) 1250 cu ft each
Potable Water	755 bbls
Drill Water	15,842 bbls
Brine/Ballast	8,472 bbls
Fuel Oil	6,412 bbls
Lube Oil	10 bbls
Section E:	
Helicopter Facilities	
Helideck Dimensions	83 ft x 83 ft
Helideck Surface	Steel painted non-skid surface w/net designed for Sikorsky S-6IN or equivalent
Refuelling System	1200 gallons at 36 gal/min
Dedicated ND Beacon	
Frequency details etc	250 KHZ to 340 KHZ
Type	Southern Avionics Model SS800A, 100 watt
Heli Deck Fire Fighting Facilities	USCG approved fixed foam system and 1500 lb dry chemical system

DESCRIPTION	SPECIFICATION
Section F: Material Handling Equipment	
Crane (x2)	
Type/model	ABS 238
Manufacturer	FMC Linkbelt
Boom Length	120 ft
Typical lift capacity at specified radii	
a) Main hoist	41,800 lbs/60ft
b) Whip line	10,000 lbs/120ft
Max rated load capacity	99,200 lbs/30ft
Forklift Truck	
Handling Capabilities	4,800 lbs
Bulk Transfer Hoses	
Number	Four (4)
Size/rating	4"/150 psi
Connection type(s)	Quick Lock
Length	50ft
Personnel Transfer Basket	
Number	Two (2)
Type	Bill Pugh
Section G: Power Equipment	
Diesel Engines	
Number	Three (3)
Manufacturer	EMD
Type	Two (2) 16E-9/One (1) 16 E-8
Output (HP)	E-9 3070 HP/E-8 2200 HP
Generators	
Number	Three (3)
Manufacturer	EMD
Type	Two (2) A2ON6/One (1) A20T6
Output (KW)	N6-2000 KW/T6-1500 KW
Independent Emergency Generator	
Type/Manufacturer	Diesel/Detroit Diesel 8V-71N
Output	600 VAC/250 KW
Units supplied/services powered	Emergency lights, fire pump, radios, ballast pumps
Section H: Compressed Air System	
Main Air Compressors	
Manufacturer	Two (2) Quincy
Type	Screw type
Volume and Output press	490 CFM at 125 psi each

DESCRIPTION	SPECIFICATION
Emergency Air Supply	
Manufacturer	Quincy
Type	Model S120, Detroit Diesel 271 length
Output Press and Volume	123 CFM at 100 psi, 1750 RPM
Main Air Receivers, Capacity	
Auxiliary air receivers, capacity	Two (2) Horizontal 100 cu ft ea
Separate Bulk-Chemical Transfer	
Compressor	Quincy D50AS, 307
High Pressure Air Compressors	
Manufacturer	Ingersoll-Rand
Type	15T4 x 20, Type 30
Section I:	
Water Distillation System	
Desalinator	
Manufacturer	Alpha-Laval
Output	10,000 GPD
Number of Units	One (1)
Section J:	
Accommodation	
Number of Personnel Accommodated	
(Breakdown into single, double, 4 man rooms, etc)	19 - four (4) man rooms 5 - two (2) man rooms 2 - one (1) man rooms
Max number permitted on board overnight	88 men
Section K:	
Fire and Safety Equipment	
Lifeboats	
Size and capacity (no of men)	Two (2) 64 man each
Manufacturer	MASECO
Engine type	Diesel
Max speed and range	6 knots, 20 hour
Davits/launch system	Harkrader type S30-22
Release mechanism	MASECO Type 550
Inflatable Life Rafts	
Capacity	25 man each
Manufacturer	Viking DKF
Release mechanism	Davit Launch
Life Jackets	Per USCG requirements
Working Life Jackets	Per USCG requirements
Lifebuoys	Per USCG requirements
Rope Ladders/Escape Ropes	Per USCG requirements

DESCRIPTION	SPECIFICATION
Fire Hydrant System (No of Outlets)	26 outlets
Pumps, output	Two (2) 3 x 4 centrifugal, 700 GPM
Portable Fire Extinguishers	
Type	CO_2 and dry chemical
Number	96
Combustible Gas Detection System	
Manufacturer	Texas Analytical Systems
Smoke and Fire Detection System	
Manufacturer	Henschel
Type	TM
Complete Fireman's Outfits to Include	
Breathing apparatus	Two (2)
Fire proof suits, fire axe etc	
Location	Pilot House/Motor Room
Helideck Foam System	
Foam/water monitors	Dry chemical and 200 gal fixed foam system per USCG requirement
Survival Suits	
Manufacturer	Imperial Mfg
Quantity	90
Location on Unit	Each Bunk/Sick Bay
Breathing Apparatus	
Escape packs	Four (4) Scott air packs w/14 extra bottles
Self contained breathing apparatus (30 min duration)	
Emergency Shutdown System/	Electric kill switch
Inert Gas Flooding System	Sliding gate valves on main engines

DESCRIPTION	SPECIFICATION
5.13.2 Drilling and Associated Equipment	
DESCRIPTION	*SPECIFICATION*
Section A:	
Hoisting Equipment	
Make and Type	Oilwell E-3000
Rated capacity w/5" DP	25,000 ft
Drive	Two (2) GE 752 DC motors
Auxiliary brake	Baylor Model 7838
Maximum input HP	3000 HP (3000 HPW/add motor
Catheads	Two (2) Kelco Model 16
Derrick	
Make and Type	Skytop Brewster
Dimensions	40' x 40' x 185'
Gross nominal capacity	1,333,000 lb
Static	1,000,000 lb
Crown block - type	Oilwell Type 760
No + size of sheavees	Seven (7) 60" sheaves
Rating	760 ton
Racking capacity	25,000' of 5" DP 15 stands of 8" DC
Travelling Assembly	
Block, type and rating	Oilwell 650-650 ton
Hook, type and rating	BJ 5500 Dynaplex-500 ton
Elevator lins, size and rating	3½" x 132", 500 ton OR 2¾" x 144", 350 ton
Wirelines	
Drilling Line : size and length	1½" x 7500 ft
Sandline : size and length	9/16" x 7500 ft
Heave Compensator	
Make and type	Vetco Model 400-20D
Working capacity	400,000 lb
Static capacity	1,300,000 lb
Racking Arm	
Make and type	Victoria Machine Works
Section B:	
Rotary Equipment	
Rotary Table	
Make and Type	Oilwell
Drive	One (1) GE752 DC motor
Opening	37½"
Max input HP at 125 rpm	600 HP
Master bushings - split - dimensions	Varco MPCH
Static load rating	800 tons

DESCRIPTION	SPECIFICATION
Swivel	
Make and Type	National PC-650
Rating (dead load)	650 tons
Top Drive	
Manufacture and type	Varco Model TDS-4
Load rating	650 ton
Drilling Kellys	
Make, type and size	One (1) 5¼" HEX
Section C:	
Mud System	
Mud Mixing	
Hoppers	Two (2)
Make and type	Demco, Venturi Type 6"
Shale Shaker System	One (1) Brandt Dual Tandem cascading to 3 x Triton NNF Linear Motion Shakers
Desander	
Make and Type	Demco 8-6V
No of cones - size	Six (6) eight inch cones
Desilter	
Make and type	Sweco PO-4C16
No of cones - size	Sixteen (16) four inch cones
Mud Cleaner	Two (2) Sweco Model MC-8
Degasser	Swaco Vacuum Type
Active Mud Tanks	
Total capacity x 3 tanks	1161 bbls
Reserve Mud Tank	
Total Capacity x 2 tanks	655 bbls
Trip Tank	28 bbls
Pumps - Mud Circulating	
Manufacturer	Oilwell
Number	Two (2)
Type	A1700 PT Triplex
Drive	Two (2) GE 752 DC Motors
Max input HP per pump	1600HP
Liner sizes available	6½"
High Pressure Mud Lines Dimensions	
Discharge line	5" nominal - SCH 160
Standpipe manifold	5" nominal - SCH 160
Working pressure	5000 psi
Section D:	
Pressure Prevention Equipment	
30" Pin Connector	Cameron 30" hydraulic latch

DESCRIPTION	SPECIFICATION
Ball Joint	Cameron 18¾" flex joint 10°
Ram Configuration	
No 1 Ram	Blind/Shear
No 2 Ram	5" pipe
No 3 Ram	5" pipe
No 4 Ram	Variable 3½" - 7⅝"
Manufacture and type	Cameron Double "UII"
Size and pressure rating	18¾", 10,000 psi
Lower Marine Riser Package	
BOP Hydraulic Connector	
Manufacturer and type	Cameron/Collet
Size and pressure rating	18¾", 10,000 psi
Annular BOP x 2	
Manufacturer and type	Cameron Type "DL"
Size and pressure rating	18¾" x 5,000 psi WP
Flex Joint/Ball Joint	
Manufacture and type	Cameron Flex Joint
Size and pressure rating	18¾", 5000 psi WP
Max vertical misalignment	10°
Kill/Choke Lines	
Nominal size ID and pressure ratings	3" x 10,000 psi WP
Kill/Choke Valves	
Manufacture and size	Cameron 3⅛" failsafe
Size and pressure rating	3⅛", 10,000 psi WP
Subsea Controls	
Subsea Accumulators	
Manufacture and type	Koomey Bladder Type
No of bottles and capacity	(On BOP) 26 bottles x 11 gals = 286 gals (Surface)46 bottles x 11 gals = 506 gals
Hydraulic Control Pods (Two)	
Manufacture and model	Koomey RHPS - 14 - 21 - 7DF
No of functions controlled	42
Marine Riser System	
Marine Riser	
Size (OD and ID) and total length	21" OD x 20½" ID - 1200 ft
Pipe manufacture	Cameron
Connector manufacturer and type	Cameron RCK
Integral kill and choke lines	3½" OD x 2½" ID, 10,000 psi W

DESCRIPTION	SPECIFICATION
Telescopic Slip Joint	
Manufacturer	Cameron
Stroke length	55 ft
Tensioner ring type	Fixed
No of attachments	Six (6)
Riser Tensioner System	
Manufacturer	Western Gear
Type of tensioner unit and nos	Pipemaster Type B307026-Six (6)
Unit rating	80,000 lbs each
Surface BOP Equipment and Controls	
Diverter	
Manufacturer and type	Regan KDFH
Nominal size	20
Max rotary size passed	37½"
Outlet size	12"
Control panels	Koomey
Choke Manifold	
Pressure rating	10,000 psi WP, H_2S Trim
Adjustable chokes	Two (2) Thornhill-Craver 2"
Hydraulic operated chokes	One (1) Swaco Super Choke
Drilling Choke Control Console	
Manufacture	Swaco
Type	Super Choke
Hydraulic Accumulator and Control Manifold	Koomey
Manufacturer	2 each, 60:1, Model 88660
Air powered pump	
Subsea TV System	
Manufacturer	Subsea Systems
Type	PAN and TILT
Monitor(s)	One (1) plus one spare
Camera(s)	One (1) plus one spare
Light(s)	One (1) plus one spare
Section E:	
Drill String and Accessories	
Float Valve	
Make, type and size	Baker Type "G" or similar For 9", 8", 6½" and 5" DC
Surface Safety Valve	
For 5" Drill String	
Make, type and size	Lynn or equal, Inside BOP
Connection	4½" IF

DESCRIPTION	SPECIFICATION
For 3½" IF Drill String	
Make, type & size	Gray or similar, Inside BOP
Connection	3½" IF
Drill Pipe	
Grade G	
OD., wt/ft, range	3½"-13.3 lbs/ft. Range 2
Tool joint thread	3½" IF
Grade E	
OD., wt/ft, range	5"-19.5 lbs/ft. Range 2
Tool joint thread	4½" IF
Grade S	
OD., wt/ft, range	5"-19.5 lbs/ft. Range 2
Tool joint thread	4½" IF
HeviWate Drill Pipe	
Weight/ft, range	50 lb/ft. Range 2
Joint thread	4½" IF
8" OD	
Length	Range 2
Connection	6⅝" Reg
	Yes
6½" OD	
Length	Range 2
Connection	4½" IF
4¾" OD ID	
Length	Range 2
Connection	3½" IF
Section F:	
Parameters Recording/Indicating Equipment	
Weight Indicator	Martin Decker Type E
Mud pressure gauge	Model GM4-502P
Torque indicator type	Model PR25-6P
Pump (SPM) type	Model P379A-21P
Rotary (RPM) type	Model P379A-35P
Wireline anchor type	E-80
Flowmeter	
Make	Heitman

DESCRIPTION	SPECIFICATION
Pit Level Indicator	
Make and type	Heitman
Recorder	Taylor Fulscope
Tong Torque Indicator	
Make and type	Martin Decker Model T-700
Parameters Recorder	
Make and type	Martin Decker Six Pen
Deviation Surveying Equipment	
Make and type	Eastco Non Directional
Retrieving tools	Go Devil w/Reed Type Overshot

5.14 Contractor Listing

SERVICE	CONTRACTOR
Drilling Rig	Diamond M General Company
Helicopters	Lloyd Helicopters Pty Ltd
Cementing	Halliburton Australia Pty Ltd
Coring	D B Stratabit Pty Ltd
Communications	Telecom
Drilling Fluids and Engineering	International Drilling Fluids Pty Ltd
Rental Drilling Tools	Austoil Drilling Services Pty Ltd
Casing Cutting and Fishing	Austoil Drilling Services Pty Ltd
Deviation Surveys	Austoil Drilling Services Pty Ltd
Mud Logging	Halliburton (SDL) Australia Pty Ltd
Production Testing (Surfaces and Downhole)	Schlumberger Seaco Inc
Rig Positioning	Racal Survey Australia Ltd
Site Survey	Associated Surveys Intl Pty Ltd
ROV	Subsea International
Tubular Handling	Weatherford Australia Pty Ltd
Weather Forecasting	Bureau of Meteorology
Well Head Equipment and Services	ABB Vetco Gray
Work Boats	Tidewater Port Jackson Marine Pty Ltd
Electric Logging	Halliburton (HLS) Australia Pty Ltd

5.15 References

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Migliucci AC, Suttill RJ & Waldron AR	1992	Proposal to Drill: Flinders 1 T/25P, Bass Basin. SAGASCO Resources Limited.
Migliucci AC, Reeve J	1993	Raw Data Report: Flinders 1 T/25P Bass Basin. SAGASCO Resources Limited.
Smit R, Suttill RJ	1989	SAGASCO Resources Limited 1989. An Assessment of the Hydrocarbon Potential of T/22P Bass Basin. SAGASCO Resources Limited.
Suttill RJ	1990	Petrophysical Analysis Pipipa 1 T/22P, Bass Basin. SAGASCO Resources Ltd.
Waldron AR	1990	Modelling of the Pipipa Deep Seismic Amplitude Anomaly. Permit T/22P, Bass Basin. SAGASCO Resources Ltd.
Waldron AR	1990	Seismic Signature of Igneous Intrusive and Extrusive Rocks in the Bass Basin. SAGASCO Resources Ltd.

SAGASCO Resources Ltd.

COMPOSITE LOG
FLINDERS 1

STATE: TASMANIA
BASIN: BASS
PERMIT: T/25P
LOCATION: Lat -40°25'56.10"
Long 145°40'16.680"

ELEVATION: KB:
DF-RT: 20.3m
WD-SL: 66.20m
TOTAL DEPTH: 3722m R T
STATUS: P & A

SEISMIC LINE: SP 900 TMK4-79

DATE SPUDDED: 1000hrs 23/12/92
DATE RIG RELEASED: 1400hrs 20/1/93
DRILLING CONTRACTOR: DIAMOND DOMINY
RIG: OCEAN EPOCH
MUDLOG by: INTERNATIONAL DRILLING FLUIDS PTY.LTD.
CEMENTING Co.: HALLIBURTON

WIRELINE LOGGING: HALLIBURTON
WELLSITE GEOLOGIST: J.REEVE
COMPOSITE LOG: R.J.BUTTLE/J.REEVE
SCALE: 1:500
DRAWN: P.OLDHAM
DRAWING No: **SASSO.0002**

LOCATION



LEGEND



LOGGING

LOG	RUN	INTERVAL (M)	BHST TEMP
DLL-MSFL-LSS-GR-SP-DTD-CAL	1A	1242-462.6m Old mud mark 10	46.2°C
HR-MSFL-LSS-GR-SP-DTD-CAL	2A	2718 - 1242.5m	106.7°C
DPL-CDN-CDM-GR-CAL	2B	2718 - 1000.0m	103.3°C
	2C	2718 - 1242.5m	106.1°C
VSP	2D	2700-300m	
DMC-GR	2E	Abandoned	

ENGINEERING DATA

HOLE SIZE

SIZE	TO
914mm (36")	554.7LDRF
445mm (17 1/2")	577.8m RT
311mm (12 1/4")	1242.5m RT
216mm (8 1/2")	1624.0m RT

CEMENT PLUGS

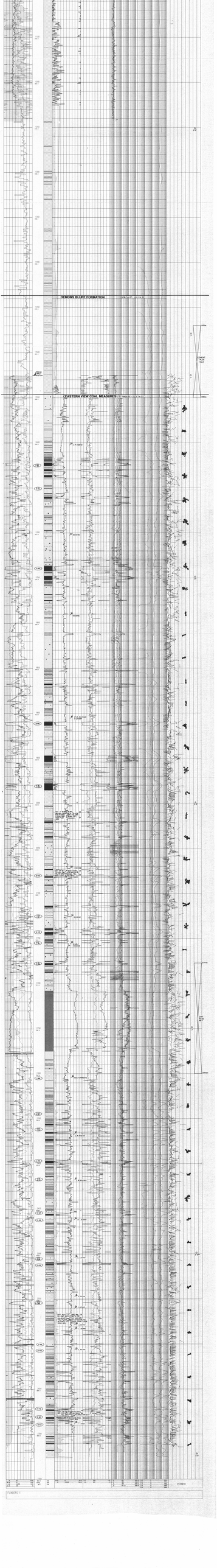
FROM	TO	CEMENT
2722m RT	2700m RT	150 sx
1000m RT	1470m RT	180 sx
1054m RT	1004m RT	90 sx

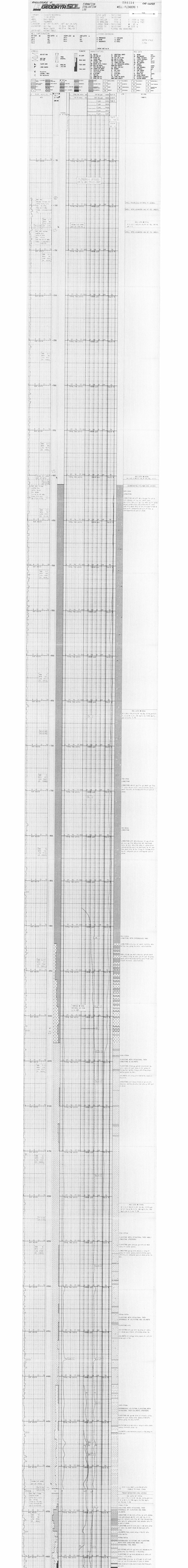
CASING

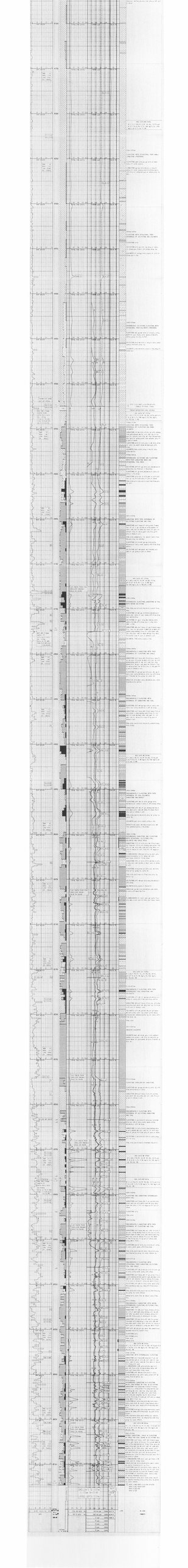
SIZE	WEIGHT	GRADE	DEPTH	CEMENT	CEM'D TO
762mm (30")	310 ppf		124.5m RT	700 sx	SEA FLOOR
340mm (13 3/8")	68 ppf	K-55	554.7m RT	750 sx	SEA FLOOR
244mm (9 5/8")	47 ppf	N-80	1618.8m RT	240 sx	35A FLOOR

Sea Floor
TORQUAY GROUP

DEMONS BLUFF FORMATION


DEMONS BLUFF FORMATION
EASTERN VIEW COAL MEASURES
FLINDERS 1


ANALOGUE to DIGITAL
GEOGRAPH SDI
FORMATION EVALUATION
WELL: FLOWERS 1



1 LITHOLOGICAL DESCRIPTIONS

FLINDERS 1

CUTTING DESCRIPTIONS

Interval(m)	%	Lithology
408 - 410	100	Cement.
410 - 420	100	Limestone: White to off white, occasionally grey, medium to granules, poorly sorted, angular, trace clay matrix, bioclastic, unconsolidated, abundant Coral and Bryozoa fragments, trace Echinoid spines and Foraminifera fragments, good inter and intra particle porosity, no show.
420 - 430	100	Limestone: As above.
430 - 440	100	Limestone: As above, but with abundant calcareous micrite matrix, trace interparticle porosity, fair intraparticle porosity, trace pyrite replacement.
440 - 450	100	Limestone: As above, with abundant calcareous micrite matrix, poor inter and intraparticle porosity, no show.
450 - 460	100	Limestone: As above, white to off white, occasionally grey, fine to very coarse grained, poorly sorted, subangular to angular, abundant Coral and Bryozoa, trace to common Echinoid spines and Foraminifera, trace pyrite replacement, trace to poor intra and interparticle porosity, no show.
460 - 470	100	Limestone: As above.
470 - 480	100	Limestone: As above, trace glauconite.
480 - 490	100	Limestone: White, occasionally speckled green, coarse to fine, predominantly medium grained, angular, moderately sorted, clean, trace calcareous matrix, trace glauconite, bioclastic calcarenite, unconsolidated, abundant Coral and Bryozoa fragments, common to trace Foraminifera, friable, poor to fair interparticle porosity, trace intraparticle porosity, no show.
490 - 500	100	Limestone: As above, becoming predominantly medium to very coarse.
500 - 510	100	Limestone: As above, predominantly medium grained.
510 - 520	100	Limestone: As above, predominantly coarse grained, friable, good inter and intraparticle porosity.
520 - 530	100	Limestone: As above, commonly grey, green and pale yellow orange grains, glauconite becoming more frequent.

530 - 540	100	Limestone: White to off white, cream, speckled grey, green and black, fine to coarse grained, angular to subround, poorly sorted, abundant calcareous matrix, trace to common glauconite, calcarenite, moderately bioclastic, abundant Bryozoa and Coral fragments, trace Foraminifera, friable to moderately hard, moderate calcareous cement, poor porosity, no show.
	Tr	Claystone: Dark grey, slightly calcareous, slightly dolomitic, trace glauconite, firm to hard, blocky.
540 - 550	100	Limestone: As above, becoming predominantly fine grained calcarenite, slightly bioclastic, moderately sucrosic, friable to hard, trace porosity, no show.
550 - 560	100	Limestone: As above.
560 - 570	100	Limestone: As above, with common glauconite.
570 - 580	100	Limestone: As above, with common glauconite.
580 - 590	100	Limestone: Off white to cream, fine to coarse grained, well to moderately sorted, subangular, slightly to occasionally recrystallised, slightly argillaceous, trace to common glauconite, fine calcarenite, slightly bioclastic, slightly sucrosic in part, trace to common Bryozoa and Coral fragments, trace Foraminifera, friable, trace to fair interparticle porosity, locally good intraparticle porosity, no show.
590 - 600	100	Limestone: As above, trace pyrite, trace Scaphopoda.
600 - 610	100	Limestone: As above, trace pyrite.
610 - 620	100	Limestone: As above, trace pyrite, moderately hard, recrystallised.
620 - 630	100	Limestone: As above, becoming grey in part, becoming more bioclastic, with Echinoid spines and more common Foraminifera, trace pyrite replacement, more friable, no glauconite.
630 - 640	100	Limestone: Off white to cream, grey, coarse grained, well sorted, angular, calcareous micrite matrix, recrystallised in part, rare trace glauconite, rare pyrite, bioclastic calcarenite, poorly consolidated, abundant Bryozoa, Coral and Echinoid fragments and Foraminifera, friable, good interparticle porosity, trace intraparticle porosity, no show.
640 - 650	100	Limestone: As above.
650 - 660	100	Limestone: As above, predominantly off white to cream, trace grey.
660 - 670	100	Limestone: As above.
670 - 680	100	Limestone: As above.

680 - 690	100	Limestone: As above.
690 - 700	100	Limestone: As above.
700 - 710	100	Limestone: Off white to cream, light grey, medium to very coarse grained, angular, moderately sorted, abundant grey argillaceous matrix in part, trace glauconite and pyrite, bioclastic calcarenite, friable, abundant Coral, Bryozoa, Foraminifera and shell fragments, poor interparticle porosity, no intraparticle porosity.
710 - 720	100	Limestone: As above, with abundant clay matrix, no porosity, no show.
720 - 730	100	Limestone: As above, with locally abundant grey clay matrix, abundant white calcitic sparitic matrix in part, no porosity, no show.
730 - 740	100	Limestone: As above, with locally abundant clay matrix, no porosity, no show.
740 - 750	100	Limestone: White to light grey, fine to coarse grained, subangular to angular, abundant grey clay matrix, rare trace glauconite and pyrite, bioclastic calcilutite, compact, abundant Coral, Bryozoa and Foraminifera, soft to friable, no porosity, no show.
750 - 760	100	Limestone: As above.
760 - 770	100	Limestone: As above.
770 - 780	100	Limestone: As above.
780 - 790	100	Limestone: As above.
790 - 800	100	Limestone: Off white to cream, coarse to fine grained, subangular, moderately grey argillaceous matrix in part, white recrystallised calcareous matrix in part, trace glauconite, bioclastic calcarenite, compact and recrystallised in part, friable to hard, abundant Coral, Bryozoa, Foraminifera and shell fragments, trace porosity, no show.
800 - 810	100	Limestone: As above.
810 - 820	100	Limestone: As above.
820 - 830	100	Limestone: As above.
830 - 840	100	Limestone: As above.
840 - 850	100	Limestone: As above.
850 - 860	100	Limestone: As above.
860 - 870	100	Limestone: As above, becoming more argillaceous.

870 - 880	100	Limestone: As above.
880 - 890	100	Limestone: Off white to cream, occasionally light grey, very fine to very coarse grained, occasional interstitial grey clay matrix, predominantly recrystallised calcite and calcareous micrite, trace glauconite, bioclastic calcarenite, compact to sucrosic in part, abundant Bryozoa and Corals, trace Foraminifera, friable to hard in part, no porosity, no show.
890 - 900	100	Limestone: As above.
900 - 910	100	Limestone: Off white to light grey, very fine to very coarse grained, poorly sorted, abundant calcilutite matrix, slightly argillaceous, trace glauconite, bioclastic calcilutite, predominantly compact, locally recrystallised and sucrosic, abundant Coral fragments, trace Foraminifera, friable to hard in part, no porosity, no show.
910 - 920	100	Limestone: As above.
920 - 930	60	Limestone: As above.
	40	Marl: Light grey, mottled cream, occasionally greenish, abundant very fine shell fragments and microcrystalline calcite, trace pyrite and glauconite, compact, soft to firm, blocky, grades to bioclastic calcilutite.
930 - 940	70	Limestone: As above.
	30	Marl: As above.
940 - 950	70	Limestone: As above.
	30	Marl: As above.
950 - 960	80	Limestone: As above, becoming predominantly clean with a recrystallised calcareous matrix, friable to hard.
	20	Marl: As above.
960 - 970	50	Limestone: Off white to cream, very fine to very coarse grained, angular, poorly sorted, abundant white recrystallised (microcrystalline)calcareous matrix, trace glauconite and pyrite, bioclastic calcarenite, compact, locally sucrosic, abundant Coral and Bryozoa fragments, occasionally Echinoid fragments and Foraminifera, friable to hard, poor to nil porosity, no show.
	50	Marl: As above, grading to argillaceous bioclastic calcarenite.
970 - 980	60	Limestone: As above.
	40	Marl: As above.
980 - 990	50	Limestone: As above.
	50	Marl: As above.
990 - 1000	30	Limestone: As above.

	70	Marl: Light to dark grey, becoming greenish when dark, speckled cream, abundant fossil fragments, trace pyrite and glauconite, compact, soft to moderately hard, blocky to subfissile, grades from calcareous Claystone to argillaceous bioclastic calcarenite.
1000 - 1010	20	Limestone: As above.
	80	Marl: As above.
1010 - 1020	30	Limestone: As above.
	70	Marl: As above.
1020 - 1030	70	Marl: As above, predominantly light grey to grey, grading to calcareous Claystone.
	30	Limestone: As above.
1030 - 1040	100	Claystone: Light to medium grey, moderately to very calcareous, trace pyrite nodules, rare trace glauconite, common fragments of Coral, Bryozoa and shells, trace Foraminifera, soft to firm, blocky to subfissile, grading to Marl.
	Tr	Dolomite: Brown to orange brown, cryptocrystalline, very hard, brittle.
1040 - 1050	100	Claystone: As above.
	Tr	Dolomite: As above.
1050 - 1060	100	Claystone: As above.
	Tr	Dolomite: As above.
1060 - 1070	100	Claystone: As above.
1070 - 1080	90	Claystone: As above.
	10	Dolomite: Light orange brown to tan, cryptocrystalline, very hard, brittle, angular.
1080 - 1090	90	Claystone: Light grey, greenish and brownish in part, moderately to very calcareous in part, trace pyrite nodules, rare trace glauconite, trace Foraminifera and Bryozoa fragments, soft to firm, blocky to subfissile, grades to Marl.
	10	Dolomite: As above.
1090 - 1100	100	Claystone: As above.
	Tr	Dolomite: As above.
1100 - 1110	100	Claystone: As above, becoming less marly.
1110 - 1120	100	Claystone: As above.
1120 - 1130	70	Claystone: As above.
	30	Sandstone: Colourless, translucent, medium grained, well sorted, angular, occasionally subround, unconsolidated loose quartz, good inferred porosity, no show.

1130 - 1140	80	Claystone: As above.
	20	Sandstone: As above, trace pyrite cement.
1140 - 1150	90	Claystone: As above.
	10	Sandstone: As above, becoming medium to coarse grained and subround to round in part, occasionally very coarse.
1150 - 1160	100	Claystone: Light to medium grey, light grey green, light grey brown, common calcareous grains and shell fragments, trace disseminated and nodular pyrite, glauconite in part, locally silty with carbonaceous specks, soft to firm.
1160 - 1170	100	Claystone: As above.
1170 - 1180	100	Claystone: As above.
1190 - 1200	100	Claystone: As above, becoming common grey brown and slightly to moderately calcareous.
1200 - 1210	100	Claystone: As above, generally medium grey to grey brown, grey green, slightly to moderately calcareous.
1210 - 1220	100	Claystone: As above, at 1210m
1220 - 1230	100	Claystone: As above, grey, grey green, rarely grey green, slightly to moderately calcareous, common shell fragments and Foraminifera, trace disseminated pyrite, trace glauconite in part, trace carbonaceous specks, soft to firm, blocky to subfissile, locally common silt sized calcite, locally grades to argillaceous calcilutite.
1230 - 1240	100	Claystone: As above.
1240 - 1250	100	Claystone: As above.
	Tr	Dolomite: Orangey tan, cryptocrystalline, very hard, brittle.
	Tr	Limestone: White, microcrystalline, glauconite, hard, blocky, no porosity, no show, grades to calcilutite.
1250 - 1260	100	Claystone: As above.
	Tr	Limestone: As above, and light grey.
1260 - 1270	90	Claystone: As above.
	10	Limestone: Grey to grey brown, microcrystalline, very argillaceous, trace glauconite and carbonaceous specks, calcisiltite, soft and friable, trace intergranular porosity, grades to Marl.
1270 - 1280	90	Claystone: As above.
	10	Limestone: As above.
1280 - 1290	90	Claystone: As above.
	10	Limestone: As above.

1290 - 1300	90	Claystone: As above.
	10	Limestone: As above.
1300 - 1310	100	Claystone: As above, predominantly slightly calcareous.
	Tr	Limestone: As above.
1310 - 1320	100	Claystone: As above.
	Tr	Limestone: As above.
1320 - 1330	90	Claystone: As above.
	10	Limestone: As above.
1330 - 1340	90	Claystone: As above.
	10	Siltstone: Brown grey, argillaceous, slightly calcareous, trace pyrite, trace carbonaceous specks, friable, no show.
	Tr	Limestone: As above.
	Tr	Dolomite: As above.
1340 - 1350	80	Claystone: As above, abundant pyrite.
	20	Siltstone: As above.
	Tr	Dolomite: Light orangey brown, cryptocrystalline, trace quartz, very hard, brittle.
1350 - 1360	80	Claystone: As above.
	20	Siltstone: As above.
	Tr	Dolomite: Light orange grey brown, cryptocrystalline, trace quartz, very hard, brittle.
1360 - 1370	80	Claystone: As above.
	20	Siltstone: As above.
	Tr	Dolomite: As above.
1370 - 1380	100	Claystone: Light grey green, light grey, grey brown to brown, slightly calcareous, locally silty, trace carbonaceous specks, trace Bryozoa and Foraminifera, abundant pyrite nodules, firm to moderately hard, subfissile to blocky.
1380 - 1390	100	Claystone: As above.
	Tr	Siltstone: As above.
1390 - 1400	90	Claystone: As above becoming grey and grey brown in part.
	10	Siltstone: Brown, argillaceous, slightly calcareous, firm, blocky, disseminated and nodular pyrite.
	Tr	Dolomite: Brown to light brown, cryptocrystalline, silty, carbonaceous specks, disseminated pyrite, very hard.
1400 - 1410	80	Claystone: As above.
	20	Siltstone: As above.
	Tr	Dolomite: As above.

1410 - 1420	50	Claystone: Light grey to grey to light grey green, light brown, slightly calcareous, calcareous shell fragments and Foraminifera, carbonaceous specks, firm, blocky to subfissile, pyrite nodules.
	40	Siltstone: Brown, very argillaceous, non calcareous, carbonaceous specks, firm to very soft, dispersive.
	10	Dolomite: As above.
1420 - 1430	50	Claystone: As above.
	40	Siltstone: As above.
	10	Dolomite: As above.
1430 - 1440	50	Claystone: As above.
	50	Siltstone: As above.
1440 - 1450	60	Claystone: Dark grey to dark brown, slightly to non calcareous, silty, abundant pyrite nodules, carbonaceous specks, firm to soft, subfissile.
	40	Siltstone: As above.
	Tr	Dolomite: Cream to tan, cryptocrystalline, very hard, angular.
1450 - 1460	50	Claystone: As above, grading to Siltstone.
	40	Siltstone: As above.
	10	Dolomite: As above, also brown with disseminated pyrite.
1460 - 1470	60	Siltstone: As above.
	40	Claystone: As above.
	Tr	Dolomite: As above.
1470 - 1480	70	Claystone: As above.
	30	Siltstone: As above.
1480 - 1490	60	Claystone: As above.
	40	Siltstone: As above.
1490 - 1500	70	Claystone: As above, becoming predominantly dark grey brown, very silty.
	30	Siltstone: As above.
1500 - 1510	50	Claystone: As above, dark grey brown.
	50	Siltstone: As above.
1510 - 1520	60	Claystone: As above, predominantly dark grey brown.
	40	Siltstone: As above.
1520 - 1525	70	Claystone: As above, predominantly dark grey brown.
	30	Siltstone: As above.
1525 - 1530		Heavy caving and cement contamination.
1530 - 1533	100	Claystone: Very dark grey, slightly silty, slightly calcareous in part, micromicaceous, trace disseminated and nodular pyrite, firm, subfissile,

		dispersive and sticky in part, trace calcite veinlets.
1533 - 1536	100	Claystone: As above.
1536 - 1539	90	Claystone: As above.
	10	Siltstone: Very dark brown, very argillaceous, common very fine quartz, soft, sticky, plastic, moderately calcareous, no show.
1539 - 1542	90	Claystone: As above.
	10	Siltstone: As above.
1542 - 1545	80	Claystone: As above.
	10	Siltstone: As above.
	10	Sandstone: Brown to dark brown, very fine to fine grained, subround to round, well sorted, spherical, loose unconsolidated quartz, trace brown clay adhering to grain surfaces, fair inferred porosity, no show.
1545 - 1548	70	Claystone: As above.
	30	Sandstone: As above.
1548 - 1554	30	Claystone: As above.
	70	Sandstone: Light to medium brown, medium to coarse, occasionally very fine, well sorted, subangular to round, moderately spherical, trace light brown clay adhering to grains, trace green glauconite/chlorite?, trace quartz overgrowths/frosting, trace pyrite cement, predominantly loose unconsolidated quartz, good inferred porosity, no show.
1554 - 1560	90	Sandstone: Colourless to brown, very fine to very coarse, very poorly sorted, subangular to round spherical, weak to trace siliceous cement, trace interstitial brown clay, trace pyrite cement in part, trace glauconite, silty matrix in part, friable, poor to fair porosity, no show.
	10	Claystone: As above.
	Tr	Dolomite: Tan, cryptocrystalline, argillaceous, very hard, trace quartz, blocky to splintery.
1560 - 1563	70	Sandstone: As above, becoming predominantly coarse to very coarse and rounded.
	30	Claystone: Brown to light brown, occasionally very dark brown, silty, slightly calcareous in part, soft, dispersive, abundant disseminated and nodular pyrite.
1563 - 1566	60	Sandstone: As above predominantly very coarse to very fine, very poorly sorted.
	40	Claystone: As above.
1566 - 1569	60	Sandstone: As above.
	40	Claystone: As above.
1569 - 1572	80	Sandstone: As above, becoming cleaner, colourless to light brown.

	20	Claystone: As above.
	Tr	Siltstone: Light brown, greenish, very glauconitic, sandy, very hard and siliceous, blocky to splintery.
1572 - 1575	20	Sandstone: As above, predominantly medium grained.
	50	Claystone: Light grey brown, micromicaceous, non calcareous, slightly silty, very soft and dispersive.
	30	Siltstone: Off white to very light brown grey, firm, blocky, siliceous, trace glauconite, micromicaceous, non calcareous, locally hard, argillaceous in part, locally grades to Silty Sandstone.
1575 - 1578	20	Sandstone: As above, predominantly very coarse grained.
	50	Claystone: As above.
	30	Siltstone: As above.
1578 - 1584	10	Sandstone: As above, predominantly very coarse grained.
	20	Siltstone: As above, trace glauconite.
	70	Claystone: As above.
	Tr	Dolomite: Brown, cryptocrystalline, trace micromicaceous, slightly argillaceous, very hard, splintery
1584 - 1590	10	Sandstone: As above.
	40	Siltstone: As above, trace glauconite, becoming more siliceous and harder.
	50	Claystone: As above.
1590 - 1596	20	Sandstone: As above, fine to coarse, poorly sorted.
	40	Siltstone: As above.
	40	Claystone: As above.
1596 - 1599	80	Siltstone: Off white, greyish, micromicaceous, non calcareous, argillaceous, moderately siliceous, hard in part, generally friable, soft and dispersive.
	10	Sandstone: As above.
	10	Claystone: As above.
1599 - 1602	80	Siltstone: As above.
	10	Claystone: As above.
	10	Sandstone: As above.
1602 - 1605	60	Siltstone: As above.
	40	Claystone: Brown to light brown to light grey, non calcareous, occasionally slightly silty, soft, dispersive, micromicaceous.
	Tr	Coal: Brown black to black, dull, hard, trace pyrite, blocky.
1605 - 1608	10	Coal: As above.
	50	Claystone: As above, predominantly pale brown to light grey, micromicaceous, slightly silty, non calcareous, very soft, dispersive.
	40	Siltstone: As above.

1608 - 1614	20	Coal: As above.
	30	Siltstone: As above.
	40	Claystone: As above.
	10	Sandstone: Colourless, fine to medium grained, well sorted, subspherical, unconsolidated loose quartz, trace of clay adhering to grains, trace pyrite cement in part, predominantly good inferred porosity, no show.
1614 - 1617	20	Coal: As above.
	10	Sandstone: As above, predominantly very fine to fine, subangular to subround, well sorted, spherical, weak siliceous cement, common interstitial clay and mica, trace to fair porosity, no show.
	30	Siltstone: As above.
	40	Claystone: As above.
1617 - 1620	70	Coal: Black, resinous to subvitreous, firm to hard, irregular fracture, sub-bituminous, splintery.
	30	Claystone: Off white to predominantly brown, micromicaceous, non calcareous, silty, disseminated pyrite, soft, dispersive.
1620 - 1623	20	Coal: As above.
	20	Sandstone: Off white to colourless, very fine to fine, subangular, spherical, well sorted, weak siliceous cement, abundant white clay matrix and mica, friable, trace porosity, no show.
	30	Claystone: As above.
	30	Siltstone: Off white, non calcareous, micromicaceous, soft, dispersive.
1623 - 1626	30	Coal: As above.
	10	Sandstone: As above, fine to very coarse.
	20	Siltstone: As above, greenish and glauconitic.
	40	Claystone: As above.
1626 - 1629	10	Coal: As above.
	30	Sandstone: As above, predominantly medium grained.
	30	Siltstone: As above.
	30	Claystone: As above.
1629 - 1632	20	Sandstone: As above.
	40	Siltstone: As above.
	40	Claystone: Dark grey, soft to firm, subfissile to firm, non calcareous, carbonaceous in part, micromicaceous.
1632 - 1635	10	Coal: Black, subvitreous, hard to soft, blocky to platey, pyrite, sub-bituminous.
	10	Siltstone: As above.
	10	Claystone: As above.
	70	Sandstone: Colourless to light brown, very fine to coarse, predominantly fine to coarse, well sorted, subround, spherical, loose unconsolidated quartz with trace clay coatings, trace calcite, good inferred porosity, no show.

1635 - 1641	10	Siltstone: As above.
	10	Claystone: As above.
	80	Sandstone: As above, predominantly very fine grained, slightly carbonaceous.
1641 - 1644	90	Sandstone: As above, colourless, brownish, fine grained, rare very fine and coarse grained, subround, well sorted, trace calcareous cement, trace interstitial clay, trace carbonaceous residue adhering to grains, good inferred porosity, no show, no cut.
	10	Claystone: As above.
1644 - 1647	100	Sandstone: As above, fine to very fine, no show, no cut.
1647 - 1650	100	Sandstone: As above, colourless, very fine to fine, occasionally medium, well sorted, trace white matrix in part, trace carbonaceous residue as above, good inferred porosity, no show, no cut.
1650 - 1653	100	Sandstone: As above, colourless, very fine to fine, good inferred porosity, no show, no cut.
1653 - 1656	20	Sandstone: As above.
	50	Coal: Black, submetallic to subvitreous lustre, soft to firm, subblocky, argillaceous in part, pyrite, sub-bituminous.
	30	Claystone: Light brownish grey to grey brown, silty, micromicaceous, non calcareous, carbonaceous specks, soft, dispersive.
1656 - 1659	20	Coal: As above.
	20	Sandstone: As above.
	10	Siltstone: Off white to greenish white, firm to hard, siliceous cement, green glauconite, no porosity no show.
	50	Claystone: As above.
1659 - 1662	10	Coal: As above.
	10	Siltstone: As above.
	30	Claystone: As above.
	50	Sandstone: Colourless, translucent, opaque in part, fine to medium grained, occasionally coarse, well sorted, spherical, trace calcareous cement, trace pyrite cement in part, trace to common white interstitial clay, trace carbonaceous specks, friable to loose, good inferred porosity, no show, no cut.
1662 - 1665	10	Coal: As above.
	20	Claystone: As above.
	70	Sandstone: Light grey to white, translucent to colourless, very fine to medium, subangular, subspherical, well sorted, weak calcareous cement, trace interstitial clay, trace carbonaceous specks, trace pyrite, friable to loose, fair inferred porosity, no show, no cut.
1665 - 1668	10	Claystone: As above.
	90	Sandstone: As above, occasionally coarse grained, predominantly fine

		grained, locally very well cemented with strong calcareous cement, friable to loose, fair visual porosity, no show, no cut.
1668 - 1671	100	Sandstone: As above, fine to medium, well sorted, weak calcareous cement, trace mica, friable, fair porosity, no show, no cut.
1671 - 1674	100	Sandstone: As above, fine to medium, well sorted, trace pink and orange quartz and chert, trace mica, trace pyrite, weak calcareous cement, friable, fair porosity, no show, no cut, becoming cleaner.
1674 - 1677	90	Sandstone: As above, fine to medium, well sorted, subangular, weak calcareous cement, fair porosity, no show, no cut.
	10	Claystone: Dark grey brown, carbonaceous, firm, subfissile.
1677 - 1680	100	Sandstone: As above, fine to medium grained, subangular, weak calcareous cement, clean, trace mica, trace pyrite, fair porosity, no show, no cut.
1680 - 1683	80	Sandstone: As above, fine to medium, subangular, weak calcareous cement, fair porosity, no show, no cut.
	10	Claystone: As above, soft and dispersive.
	10	Siltstone: greenish white, dolomitic, glauconite, very hard to hard, no porosity, no show.
	Tr	Dolomite: Brown, cryptocrystalline, very hard, brittle.
1683 - 1686	70	Sandstone: As above, fine to medium grained, subangular, well sorted, weak calcareous cement, common pyrite, trace mica, fair porosity, no show, no cut.
	10	Claystone: As above.
	10	Siltstone: As above.
	10	Coal: Black, subvitreous to dull, firm to hard, platey, sub-bituminous.
1686 - 1689	100	Sandstone: As above, fine to medium grained, subangular, well sorted, weak calcareous cement, trace pyrite, trace mica, fair porosity, no show, no cut.
1689 - 1692	100	Sandstone: White, translucent, clean, as above, fine to medium, subangular, weak calcareous cement, trace pyrite, trace mica, good porosity, no show, no cut.
1692 - 1695	90	Sandstone: As above, fine to coarse grained, moderately sorted, subangular to subround, weak calcareous cement, trace pyrite, trace interstitial clay, trace mica, friable, fair porosity, no show, no cut.
	10	Claystone: Dark grey brown, micromicaceous, non calcareous, firm to hard, subfissile to fissile.
1695 - 1698	50	Sandstone: As above, fine, locally very well cemented and very hard.
	50	Claystone: As above, becoming soft and dispersive.
1698 - 1701	70	Sandstone: As above, colourless, translucent to opaque, fine,

		subangular, well sorted, occasionally very fine and medium grained, spherical, trace white calcareous cement, trace pyrite cement and nodules, trace interstitial clay, trace mica, friable, fair porosity, no show, no cut, locally very well cemented with calcareous cement and very hard.
	30	Claystone: As above.
	Tr	Dolomite: Light yellow brown, cryptocrystalline, very hard, splintery.
1701 - 1704	100	Sandstone: As above, fine grained.
1704 - 1707	100	Sandstone: As above, fine grained, well sorted, trace calcareous cement, clean, trace pyrite, trace mica, friable, fair to good porosity, no show, no cut.
1707 - 1710	100	Sandstone: As above, fine grained, subangular, well sorted, trace calcareous cement, clean, trace pyrite, trace mica, friable, fair to good porosity, no show, no cut.
1710 - 1713	90	Sandstone: As above, fine grained, occasionally medium and coarse grains, subangular, well sorted, trace calcareous cement, clean, unconsolidated, friable, fair to good porosity, no show, no cut.
	10	Claystone: Brown to dark brown, micromicaceous, carbonaceous specks, silty in part, soft to firm, dispersive, subfissile.
1713 - 1716	100	Sandstone: White to colourless, translucent to occasionally opaque, fine to coarse, poorly sorted, subangular, spherical to elongate, trace calcareous cement, clean, trace pyrite cement, friable, good porosity, no show, no cut.
1716 - 1719	100	Sandstone: As above.
1719 - 1722	80	Sandstone: As above.
	10	Claystone: As above.
	10	Siltstone: Off white to greenish white, pyrite, glauconite, siliceous, very hard to hard, brittle, blocky.
1722 - 1725	90	Sandstone: As above, fine and medium, occasionally coarse, locally strong pyrite cement, clean, friable, good porosity, no show, no cut.
	10	Coal: Black, dull to subvitreous, hard, brittle, irregular to conchoidal fracture, blocky to platey.
1725 - 1728	90	Sandstone: As above.
	10	Claystone: Light to dark brown, silty, micromicaceous in part, soft to firm, subfissile.
1728 - 1731	100	Sandstone: As above, fine to coarse, poorly sorted, subangular, trace pyrite cement, trace calcareous cement, clean, trace mica, fair to good porosity, no show, no cut.
1731 - 1734	40	Sandstone: As above.

	60	Coal: Black, subvitreous to vitreous, hard, brittle, conchoidal fracture, angular.
1734 - 1737	30	Sandstone: As above.
	70	Coal: As above.
1737 - 1740	30	Coal: As above.
	40	Sandstone: As above, fine to coarse, moderately sorted, trace feldspar.
	30	Claystone: Light grey brown, micromicaceous, non calcareous, slightly carbonaceous, soft to firm, dispersive.
1740 - 1743	20	Coal: As above.
	30	Claystone: As above.
	50	Sandstone: As above, white to colourless, fine to medium with occasionally very coarse grains, moderately to well sorted, trace calcareous cement, clean, trace mica and feldspar, friable, good porosity, no show, no cut.
1743 - 1746	20	Sandstone: As above.
	80	Coal: Black, subvitreous, hard, brittle, subconchoidal, angular.
1746 - 1749	50	Coal: As above.
	50	Sandstone: As above, abundant pyrite nodules.
	Tr	Dolomite: Brown, cryptocrystalline, very hard, brittle.
1749- 1752	10	Coal: As above.
	20	Sandstone: medium to dark grey brown, carbonaceous, non calcareous, micromicaceous, soft to firm, subfissile to fissile.
	Tr	Dolomite: Yellow brown as above.
	70	Claystone: As above.
1752 - 1755	10	Coal: As above.
	10	Sandstone: As above.
	80	Claystone: As above.
1755 - 1758	80	Sandstone: White to colourless, translucent to opaque, medium grained, occasionally coarse grains, subangular, well sorted, frosted, trace calcareous cement, trace pyrite nodules and cement, trace interstitial clay, friable, good inferred porosity, no show, no cut.
	20	Claystone: As above.
1758 - 1761	60	Sandstone: As above, trace feldspars, locally very strong dolomitic cement.
	40	Claystone: As above.
1761 - 1764	80	Sandstone: As above, fine to coarse , moderately sorted, frosted, trace pyrite cement and nodules, good inferred porosity, no show, no cut.
	20	Claystone: As above.
1764 - 1767	20	Sandstone: As above, fine to coarse, predominantly medium,

		moderately sorted, common pyrite nodules and cement.
	70	Claystone: Dark brownish grey, micromicaceous, non calcareous, firm, dispersive, fissile, carbonaceous nodules.
	10	Coal: Black, subvitreous, hard, brittle.
1767 - 1770	20	Sandstone: As above.
	80	Claystone: As above.
	Tr	Coal: As above.
1770 - 1773	10	Coal: As above.
	30	Sandstone: As above.
	60	Claystone: As above.
1773 - 1776	50	Sandstone: As above.
	50	Claystone: As above.
1775 - 1776		Heavily contaminated by cavings.
1776 - 1782	20	Sandstone: Light grey, fine grained, subangular, well sorted, spherical, weak siliceous cement, trace ankeritic cement, abundant white to grey argillaceous matrix, common mica and carbonaceous detritus, friable to occasionally hard, trace pyrite cement in part, trace to poor porosity, no show, no cut.
	20	Siltstone: Light grey, very argillaceous, micromicaceous, carbonaceous specks and microlaminations, soft, dispersive, occasionally very hard with strong calcareous cement.
	60	Claystone: Light grey to grey brown, silty, non calcareous, trace disseminated and nodular pyrite, very carbonaceous in part, subfissile to fissile, soft and dispersive, firm.
	Tr	Dolomite: Brown, cryptocrystalline, very hard.
1782 - 1785	20	Sandstone: As above.
	10	Siltstone: As above.
	70	Claystone: As above.
1785 - 1791	30	Siltstone: As above.
	70	Claystone: As above.
	Tr	Dolomite: As above.
1791 - 1794	30	Claystone: Light grey to grey to grey brown, occasionally dark grey, non calcareous, variably carbonaceous, micromicaceous, silty in part, soft and dispersive, occasionally firm and subfissile.
	10	Siltstone: As above.
	60	Sandstone: White to grey, translucent to opaque, very fine to medium, moderately to poorly sorted, occasionally coarse grained, angular, subspherical to spherical, weak siliceous cement, trace ankeritic and pyritic cement, locally very well cemented, trace to moderately white argillaceous matrix, trace mica, friable to occasionally hard, poor porosity, no show, no cut.
	Tr	Dolomite: As above.

1794 - 1800	20	Claystone: As above.
	80	Sandstone: Colourless to white, translucent to occasionally opaque, fine to medium grained, occasionally very fine, well sorted, subangular, weak siliceous cement, trace ankeritic and pyrite cement, trace to moderately white interstitial clay, rare mica, friable to predominantly loose quartz, fair porosity, no show, no cut.
1800 - 1803	40	Claystone: As above.
	60	Sandstone: As above.
1803 - 1806	40	Sandstone: As above becoming fine to coarse, predominantly medium.
	50	Claystone: As above.
	10	Shale: Dark brown, non calcareous, micromicaceous, occasionally carbonaceous, firm to moderately hard and brittle, fissile.
1806 - 1809	10	Shale: As above.
	20	Claystone: As above.
	70	Sandstone: Colourless to white, fine to coarse, predominantly medium, subangular, trace siliceous cement, locally strong ankeritic and pyritic cement, moderate white interstitial clay, trace mica, friable to very hard in part, generally fair to poor porosity, no show, no cut.
	Tr	Siltstone: Brown, very well cemented with calcitic cement, very hard.
1809 - 1812	100	Sandstone: As above, very fine to predominantly medium, generally loose, no pyrite, trace ankeritic cement, trace to moderate matrix, good to fair porosity, no show, no cut.
1812 - 1815	100	Sandstone: As above, at 1812m, fine to coarse, predominantly medium.
1815 - 1821	100	Sandstone: As above, predominantly fine to medium, as at 1812m.
	Tr	Claystone: As above.
1821 - 1824	100	Sandstone: As above, predominantly fine to medium, as at 1812m.
	Tr	Claystone: As above.
1824 - 1827	10	Claystone: As above.
	90	Sandstone: As above, predominantly fine to medium, as at 1812m.
1827 - 1833	10	Claystone: As above.
	90	Sandstone: As above, white, colourless, translucent to opaque, fine to coarse, predominantly fine to medium, well sorted, subangular, spherical, weak siliceous cement, trace ankeritic cement, abundant white argillaceous matrix, trace mica, loose to friable quartz, no show, no cut.
1833 - 1839	100	Sandstone: As above, cleaner but more ankeritic cement, friable to predominantly loose.
1839 - 1845	60	Sandstone: As above, fine to very coarse, predominantly medium to

		coarse, locally well cemented with ankerite or pyrite, predominantly loose quartz, abundant white argillaceous matrix, no show, no cut.
	40	Claystone: Grey brown, non calcareous, carbonaceous specks, silty, micromicaceous, very soft, dispersive.
1845 - 1851	20	Claystone: As above.
	20	Coal: Black, subvitreous to vitreous, hard, brittle, conchoidal to irregular fracture, blocky.
	60	Sandstone: As above, colourless to white, translucent to opaque, fine to very coarse, poorly sorted, angular to subangular, spherical, frosted, trace siliceous cement, trace to common weak to moderate ankeritic cement, clean, trace mica, friable to loose, good inferred porosity, no show, no cut.
1851 - 1857	20	Sandstone: As above.
	70	Claystone: As above.
	10	Coal: As above.
1857 - 1860	30	Coal: As above.
	20	Sandstone: As above, locally well cemented by pyrite and haematite.
	50	Claystone: As above.
1860 - 1863	20	Coal: As above.
	20	Sandstone: As above.
	60	Claystone: Off white, grey to grey brown to brown, non calcareous, micromicaceous, variably carbonaceous, locally silty, soft to firm, generally very dispersive and sticky.
1863 - 1866	20	Coal: As above.
	10	Sandstone: As above.
	70	Claystone: As above.
	Tr	Siltstone: Yellowish brown, chlorotic, very hard, calcareous, blocky.
1866 - 1869	10	Coal: As above.
	10	Sandstone: As above.
	80	Claystone: As above, grading to carbonaceous shale in part.
1869 - 1872	20	Coal: As above.
	80	Claystone: Grey to brown grey, occasionally brown, micromicaceous, silty, variably carbonaceous, firm to soft, very sticky, dispersive, grades to carbonaceous shale in part.
1872 - 1875	10	Coal: As above, very argillaceous, grades to carbonaceous shale.
	50	Claystone: As above.
	40	Sandstone: White to light grey, translucent to opaque, fine to medium, rarely very coarse grains, subangular, well sorted, spherical, weak siliceous cement, occasionally strong ankeritic cement, trace to moderate white argillaceous matrix, trace mica, trace altered feldspars, friable to predominantly loose, locally very hard and well cemented, generally poor to fair porosity, no show, no cut.

1875 - 1878	50	Claystone: As above.
	50	Sandstone: As above.
	Tr	Coal: As above.
1878 - 1881	10	Coal: As above.
	30	Claystone: As above.
	60	Sandstone: As above, fine to medium, occasionally very coarse to granules, bimodal, strong dolomitic cement in part with white argillaceous matrix.
1881 - 1887	40	Claystone: As above, becoming predominantly light grey.
	60	Sandstone: As above, fine to granules, predominantly fine to medium, locally strong dolomitic and pyritic cement.
	Tr	Coal: As above.
1887 - 1893	10	Coal: Black, subvitreous to vitreous, hard, brittle, conchoidal fracture.
	30	Sandstone: As above, predominantly fine to medium, friable to hard, strong dolomitic cement, no show, no cut.
	60	Claystone: Grey to brownish grey, off white, non calcareous, micromicaceous, silty in part, variably carbonaceous, soft, sticky, dispersive.
1893 - 1899	30	Sandstone: As above.
	70	Claystone: As above.
1899 - 1902	20	Sandstone: As above.
	80	Claystone: As above.
1902 - 1905	10	Sandstone: As above.
	90	Coal: Black, subvitreous to vitreous, hard, brittle, conchoidal fracture, splintery.
1905 - 1911	70	Coal: As above.
	20	Siltstone: Light grey brown to brown grey, argillaceous, micromicaceous, non calcareous, friable to soft, dispersive.
	10	Sandstone: As above.
1911 - 1914	10	Coal: As above.
	10	Sandstone: As above.
	80	Claystone: Grey to dark grey, micromicaceous, silty, non calcareous, very soft, dispersive and sticky, slightly carbonaceous.
1914 - 1917	90	Claystone: As above.
	10	Sandstone: As above, medium grained, no show.
1917 - 1920	100	Claystone: As above.
1920 - 1923	100	Claystone: As above.
1923 - 1932	20	Claystone: As above.

	80	Sandstone: Colourless to light brown, translucent to opaque, fine to coarse, moderately sorted, spherical, angular, moderate dolomitic cement in part, generally siliceous, locally strong pyrite and haematite cement, white argillaceous matrix in part, trace mica, friable to predominantly loose quartz, very hard in part, good inferred porosity, nil in part, no show, no cut.
1932 - 1938	100	Sandstone: As above, predominantly medium grained, predominantly loose quartz, trace mica, good inferred porosity, no show, no cut.
1938 - 1944	30	Coal: Black, subvitreous, hard, brittle, conchoidal fracture.
	50	Sandstone: As above.
	20	Claystone: As above.
1944 - 1950	50	Coal: As above.
	30	Sandstone: As above, predominantly medium to coarse grained, loose, no show.
	20	Claystone: As above.
1950 - 1956	10	Coal: As above.
	20	Sandstone: As above, predominantly fine grained.
	70	Claystone: Light brownish grey, micromicaceous, slightly carbonaceous, non calcareous, very soft, dispersive, sticky.
1956 - 1962	20	Sandstone: As above.
	70	Claystone: Off white to light brown grey, micromicaceous, very silty, slightly to moderately calcareous, sandy in part, grades to argillaceous Siltstone, very soft, dispersive, very sticky.
1962 - 1965	90	Claystone: As above.
	10	Sandstone: Off white, very fine grained, subangular to subround, well sorted, moderate calcareous cement, white matrix, friable to moderately hard, blocky, no porosity, no show.
	Tr	Dolomite: Yellow brown, cryptocrystalline, silty, very hard.
1965 - 1968	90	Claystone: As above, predominantly pale brownish white.
	10	Sandstone: As above, becoming fine to medium grained, hard.
	Tr	Coal.
1968 - 1971	80	Claystone: As above, very light brown.
	10	Sandstone: As above, fine to medium grained, hard.
	10	Coal: Black, subvitreous, hard, brittle, conchoidal fracture.
1971 - 1974	10	Sandstone: As above, very fine grained, friable.
	30	Coal: As above.
	60	Claystone: As above.
1974 - 1977	60	Coal: As above, argillaceous in part grading to carbonaceous shale.
	40	Claystone/Shale: Grey to dark brown grey, moderately carbonaceous, trace pyrite, non calcareous, soft to firm, dispersive to fissile, sticky

when soft.

1977 - 1980	60	Coal: As above, argillaceous in part.
	40	Claystone/Shale: As above.
1980 - 1983	10	Coal: As above.
	90	Claystone: As above, predominantly grey brown, non calcareous, soft, sticky, dispersive, occasionally hard and fissile, non calcareous.
1983 - 1986	10	Coal: As above.
	90	Claystone: As above, grey brown, soft, sticky and dispersive, non calcareous, carbonaceous, occasionally hard and fissile.
1986 - 1989	100	Claystone: Light to medium grey brown, non calcareous, moderately carbonaceous, micromicaceous, soft, dispersive, sticky.
1989 - 1992	100	Claystone: As above, slightly silty in part, trace calcite veining.
1992 - 1995	100	Claystone: As above.
1995 - 1998	100	Claystone: As above, pale brown.
	Tr	Coal: As above.
1998 - 2001	60	Claystone: As above.
	30	Sandstone: Colourless, light brown, fine to medium grained, well sorted, subangular, spherical, loose unconsolidated quartz, trace mica, interstitial brown matrix, poor porosity, no show, no cut.
	10	Basalt: Black, speckled white in part, microcrystalline to cryptocrystalline, occasionally white feldspar phenocrysts, very hard.
	Tr	Dolomite: Brown to tan, cryptocrystalline, hard to very hard, brittle.
2001 - 2004	50	Sandstone: As above, no show, no cut.
	50	Claystone: As above.
2004 - 2010	10	Coal: Black, subvitreous, hard, brittle, subconchoidal fracture,
	90	Sandstone: Light brown, fine to medium grained, subangular, well sorted, predominantly loose unconsolidated quartz, common brown argillaceous matrix, poor inferred porosity, **Fluorescence** 10% moderately bright pin point yellow green, slow blooming milky white cut, colourless thin film residue.
2010 - 2016	50	Sandstone(1): As above, **Fluorescence** trace to 10% pin point as above, trace cut with trace residue.
	50	Claystone: As above.
	Tr	Sandstone(2): Light brown, very fine to fine, subround, well sorted, very strong dolomitic cement and matrix, very hard, blocky, no show, no cut.
2016 - 2019	10	Coal: Black, dull to subvitreous, firm to hard, brittle, blocky.
	30	Sandstone(1): As above, **Fluorescence** trace to 10% pin point as above,

		trace cut and residue.
	10	Sandstone(2): As above.
	50	Claystone: Pale brown, micromicaceous, non calcareous, very soft, dispersive, sticky.
2019 - 2022	80	Sandstone: Colourless, light brown, translucent, fine to medium, well sorted, angular, trace siliceous cement, trace to moderate interstitial clay, predominantly loose quartz, good to fair porosity, no show, no cut.
	10	Coal: Black, dull to subvitreous, firm, brittle, blocky.
	10	Claystone: Dark brown to dark grey, non calcareous, firm, subfissile.
2022 - 2028	10	Coal: As above.
	30	Claystone: As above, also light brown, micromicaceous, non calcareous, silty, very soft, sticky, dispersive.
	60	Sandstone: White to colourless, very fine to medium, predominantly fine, subangular to subround, well sorted, spherical, white interstitial clay, weak to moderate ankeritic cement, friable to hard, nil to good porosity, no show, no cut.
2028 - 2031	50	Siltstone: Off white to pale brown, argillaceous, micromicaceous, very soft, dispersive.
	10	Sandstone: As above, fine grained, well cemented, hard, no porosity, no show.
	40	Claystone: As above.
2031 - 2034	60	Siltstone: As above.
	40	Claystone: As above.
2034 - 2037	10	Coal: Black, dull to subvitreous, hard to firm, subfissile, argillaceous.
	30	Claystone/Shale: Grey brown to dark brown, micromicaceous, non calcareous, soft to firm, subfissile in part, generally soft and dispersive.
	60	Sandstone: Light grey to off white, colourless, translucent, fine to medium, subangular, well sorted, spherical, weak sideritic cement, abundant white interstitial clay, trace altered feldspars, friable to predominantly loose, poor to fair porosity, no show, no cut.
	Tr	Dolomite: Brown, cryptocrystalline, very hard, brittle.
2037 - 2043	100	Sandstone: As above.
2043 - 2046	100	Sandstone: As above, clean.
2046 - 2049	100	Sandstone: As above, light brown with abundant light brown argillaceous matrix, common pyrite nodules, poor to fair porosity, no show, no cut.
2049 - 2052	100	Sandstone: As above, light brown, very fine to medium, moderately sorted, subangular, spherical, trace sideritic cement, abundant brown, clay matrix, trace carbonaceous residue adhering to grains, trace mica and altered feldspars, friable to predominantly loose quartz, poor

		inferred porosity, no show, no cut.
2052 - 2055	100	Sandstone: As above.
2055 - 2058	100	Sandstone: As above.
2058 - 2061	70	Sandstone(1): As above.
	10	Sandstone(2): Off white, very fine to fine, subround, well sorted, spherical, moderate ankeritic cement, white argillaceous matrix, trace altered feldspars, no porosity, hard, no show, no cut.
	10	Coal: Black, dull, soft, argillaceous, subfissile, crumbly.
	10	Claystone: Light brown to brown, commonly greyish, micromicaceous, carbonaceous specks, occasionally silty, soft, sticky.
2061 - 2064	10	Coal: As above.
	20	Sandstone(1): As above.
	70	Claystone: As above, abundant fine to medium quartz, grading to argillaceous Sandstone.
2064 - 2067	100	Claystone: As above, very silty, grading to silty Claystone.
	Tr	Coal: As above.
2067 - 2070	10	Coal: Black, subvitreous, hard, brittle, blocky, conchoidal fracture.
	90	Claystone: Off white to pale grey brown, micromicaceous, non calcareous, sandy, very soft, dispersive, sticky.
2070 - 2073	30	Claystone: As above.
	70	Sandstone: Off white to light brown, very fine to medium, predominantly fine to medium, subangular, spherical, moderately to well sorted, trace calcareous cement, abundant light brown grey argillaceous matrix, trace mica and altered feldspars, occasionally pinkish orange chert, predominantly loose quartz, friable in aggregates, poor porosity, **Fluorescence** trace spotty dull yellow green, slow milky crush cut, trace to thin colourless residue.
	Tr	Coal: As above.
2073 - 2076	90	Sandstone: As above, **Fluorescence** as above.
	10	Shale: Brown to dark brown, micromicaceous, non calcareous, soft to firm, fissile.
	Tr	Dolomite: Light to medium brown, cream in part, cryptocrystalline, slightly argillaceous, very hard.
Spot @ 2078	100	Coal: Black, subvitreous to resinous, hard, brittle, blocky, conchoidal fracture.
2076 - 2079	30	Coal: As above.
	20	Claystone: As above.
	50	Sandstone: As above, trace **Fluorescence** as above.
2079 - 2082	10	Coal: As above.

	20	Claystone: As above.
	70	Sandstone: Light grey, medium grained, subround, spherical, well sorted, trace sideritic cement, abundant grey clay cement, carbonaceous detritus, altered feldspars, abundant mica, friable, nil to poor porosity, trace orange mineral fluorescence, no show, no cut.
2082 - 2085	10	Coal: As above.
	20	Claystone: As above.
	70	Sandstone: As above, fine to very coarse, poorly sorted, trace orange mineral fluorescence, no show, no cut.
2085 - 2088	10	Coal: As above.
	30	Sandstone: As above.
	60	Claystone: Light to pale brown, non calcareous, micromicaceous, abundant carbonaceous specks, silty, common fine quartz, soft, dispersive, sticky.
	Tr	Dolomite: Dark brown, microcrystalline to cryptocrystalline, hard, argillaceous, silty, grading to dolomitic Siltstone.
2088 - 2091	10	Coal: As above.
	50	Sandstone: As above, very fine to medium, occasionally very coarse, poorly sorted.
	40	Claystone: As above.
2091 - 2094	10	Coal: Black, dull, firm to hard, subfissile, argillaceous grading to Carbonaceous Shale.
	50	Sandstone: As above, very fine to medium, occasionally very coarse, poorly sorted, no show, no cut.
	40	Claystone: As above.
2094 - 2097	10	Coal: As above.
	30	Sandstone: As above, fine to medium, no porosity, no show, no cut.
	60	Claystone: As above.
2097 - 2100	100	Sandstone: Light brown, translucent to transparent, medium grained, subangular, spherical, trace weak siliceous cement, trace interstitial clay, carbonaceous specks, loose quartz, good inferred porosity, no show, no cut.
2100 - 2106	10	Coal: As above.
	90	Sandstone: fine to coarse, predominantly medium grained, as above, trace mica, trace feldspars.
2106 - 2109	20	Coal: Black, dull, firm, subfissile to blocky.
	80	Sandstone: Colourless to light brown, predominantly medium to coarse, clean, good inferred porosity, no show, no cut.
2109 - 2112	10	Coal: As above.
	80	Sandstone: As above, medium grained, well sorted, loose quartz, no show, no cut.

	10	Claystone: Light brown, carbonaceous specks, non calcareous, soft, sticky, dispersive.
2112 - 2115	10	Coal: As above, very argillaceous in part, grading to Carbonaceous Shale.
	30	Sandstone: As above, medium to coarse grained, no show, no cut.
	60	Claystone: Light to dark brown, micromicaceous, non calcareous, variably carbonaceous, very soft, sticky, dispersive, trace pyrite nodules,
2115 - 2118	10	Coal: As above.
	10	Sandstone: As above.
	80	Claystone: As above, off white in part, commonly silty.
2118 - 2121	100	Claystone: As above, off white in part, and very silty, grading to argillaceous Siltstone.
	Tr	Sandstone: As above.
	Tr	Coal: As above.
2121 - 2124	30	Claystone: As above.
	70	Sandstone: Colourless to light brown, fine to medium, occasionally coarse, subangular to angular, spherical, trace sideritic cement, trace to locally common white interstitial clay, carbonaceous specks, rare trace pyrite cement, trace mica, loose quartz, friable in aggregate, fair to good porosity, no show, no cut.
2124 - 2127	10	Claystone: As above.
	90	Sandstone: As above, fine to very coarse, poorly sorted.
2127 - 2130	20	Claystone: As above.
	80	Sandstone: As above, no show, no cut, orange mineral fluorescence.
2130 - 2133	30	Claystone: As above, predominantly dark brown.
	10	Siltstone: Off white to light brown, micromicaceous, argillaceous, soft, dispersive, sticky, grading to Silty Claystone.
	60	Sandstone: As above, very fine to granules, very poorly sorted, angular to round, unconsolidated, good to fair porosity, no show, no cut, orange mineral fluorescence.
2133 - 2136	50	Sandstone: As above, very fine to granules, very poorly sorted, oblong to spherical, friable to predominantly loose quartz, good to fair porosity, no show, no cut.
	30	Claystone: As above.
	20	Shale: Dark brown, firm to hard, fissile, carbonaceous, micromicaceous, trace pyrite, grading to Carbonaceous Shale.
2136 - 2139	30	Coal: Black, dull to subvitreous, firm to hard, conchoidal fracture, blocky to angular.
	20	Claystone: As above.
	50	Shale: As above, very carbonaceous, grading to Carbonaceous Shale

and Coal.

2139 - 2142	50	Coal: As above.
	20	Shale: As above.
	30	Claystone: As above.
2142 - 2145	10	Coal: As above.
	30	Shale: As above.
	60	Siltstone: Off white, argillaceous, micromicaceous, soft, sticky, dispersive.
2145 - 2148	10	Coal: As above.
	30	Shale: As above.
	50	Siltstone: As above.
	10	Sandstone: As above, coarse to very coarse, clean.
2148 - 2151	40	Claystone: As above.
	10	Coal: As above, very argillaceous, grading to Carbonaceous Shale.
	20	Shale: As above.
	30	Sandstone: As above, very fine to granules, very poorly sorted, subround to angular, friable to loose, fair porosity, no show, no cut.
2151 - 2154	10	Coal: As above.
	10	Shale: As above.
	10	Sandstone: Light brown, granules to very coarse, moderately sorted, subround, loose, unconsolidated, trace pyrite nodules, fair porosity, no show, no cut.
	70	Claystone: Off white to light brown, non calcareous, soft, dispersive, micromicaceous.
	Tr	Tuff: Pale green, silky lustre, translucent, trace very fine quartz grains, soft to firm, dispersive.
2154 - 2157	10	Shale: As above.
	30	Siltstone: Light brown, argillaceous, micromicaceous, non calcareous, soft, dispersive.
	30	Claystone: As above.
	30	Sandstone: As above, also fine to medium grained.
2157 - 2160	90	Sandstone: Colourless, translucent, very fine to fine, well sorted, subround to round, spherical, loose unconsolidated quartz, trace white clay matrix, fair to good porosity, no show, no cut.
	10	Claystone: As above.
2160 - 2163	30	Sandstone: As above, white to light brown, friable in aggregates, abundant clay matrix, pyrite cemented nodules in part, trace to nil porosity, no show, no cut.
	10	Shale: Dark grey to brown, micromicaceous, non calcareous, firm, fissile.
	20	Siltstone: Off white to light brown, argillaceous, micromicaceous, non

		calcareous, soft, dispersive, sticky.
	40	Claystone: Off white to light brown, soft, sticky, plastic, dispersive, non calcareous, micromicaceous, locally silty, carbonaceous specks.
	Tr	Dolomite: Dark grey, very argillaceous, very blocky.
2163 - 2166	80	Sandstone: As above, white to colourless to light brown, very fine to medium, predominantly fine, and very coarse to granules, bimodal, subangular to subround, well sorted, weak calcareous cement, white argillaceous matrix in part, predominantly loose quartz, trace mica, trace altered feldspars, friable, fair porosity, no show, no cut.
	10	Shale: As above.
	10	Claystone: As above.
2166 - 2169	90	Sandstone: As above, colourless to translucent, very fine to predominantly fine, loose quartz, good porosity, no show, no cut.
	10	Claystone: As above.
2169 - 2172	20	Shale: As above, predominantly dark grey and very carbonaceous, hard, brittle.
	20	Claystone: As above.
	60	Sandstone: As above, very fine to granules, very poorly sorted, subangular, loose to friable quartz, weak calcareous cement, trace pyrite cement, trace carbonaceous specks, white matrix, poor inferred porosity, no show, no cut.
2172 - 2175	60	Coal: Black to grey black, dull to subvitreous, very hard, brittle, blocky to subfissile.
	20	Sandstone: As above.
	20	Claystone: As above.
2175 - 2178	40	Coal: As above, becoming argillaceous and grading to carbonaceous Shale.
	20	Claystone: As above.
	40	Sandstone: White to colourless, very fine to coarse, poorly sorted, subround, spherical, weak calcareous cement, white argillaceous matrix, trace feldspars, trace mica, loose to friable quartz, fair porosity, no show, no cut.
2178 - 2181	20	Coal: As above, subvitreous.
	20	Sandstone: As above.
	60	Claystone: Off white to light grey, silty, micromicaceous, very soft, dispersive.
2181 - 2184	30	Sandstone: As above.
	40	Coal: Black, dull to subvitreous, hard, blocky to subconchoidal fracture.
	30	Claystone: As above, light grey to blue grey.
2184 - 2187	10	Coal: As above.
	20	Sandstone: As above.

	70	Claystone: As above, light grey to blue grey.
	Tr	Dolomite: Grey black, argillaceous and carbonaceous, very hard, cryptocrystalline.
2187 - 2190	20	Sandstone: As above.
	10	Coal: As above.
	70	Claystone: Light grey to grey, soft to firm in part, subfissile, grading to carbonaceous Shale.
2190 - 2193	10	Coal: Grey black, dull, hard, brittle, slightly argillaceous, platey.
	10	Sandstone: As above.
	80	Claystone: White, light to medium grey, occasionally brown, silty in part, commonly carbonaceous, soft to firm, commonly dispersive, subfissile in part.
	Tr	Volcanics: Light to pale green, cryptocrystalline, hard, blocky.
2193 - 2196	10	Coal: Black, subvitreous, hard, brittle, angular, conchoidal fracture.
	10	Volcanics: Pale green, slightly calcareous, soft to firm, cryptocrystalline, altered, dispersive.
	80	Claystone: As above.
2196 - 2199	10	Coal: As above.
	10	Volcanics: As above.
	80	Claystone: As above, very soft and dispersive, 'slop'.
	Tr	Siltstone: Light grey, siliceous, very hard, no porosity, no show.
2199 - 2202	10	Claystone: As above, light grey, soft to firm, subfissile, very dispersive.
	10	Volcanics: Off white, greenish to pale green, speckled white, cryptocrystalline, altered, slightly calcareous, soft, dispersive, with silty quartz phenocrysts.
	80	Sandstone: White to off white in part, fine to very coarse, very poorly sorted, subangular to round, elongated to spherical, abundant white argillaceous matrix, commonly tuffaceous, friable to loose, trace porosity, no show, no cut.
2202 - 2205	10	Volcanics: As above.
	10	Claystone: As above.
	80	Sandstone: As above.
	Tr	Coal: Black, hard, brittle, subvitreous, splintery to angular.
2205 - 2208	30	Volcanics: As above, predominantly pale green.
	20	Claystone: As above.
	50	Sandstone: As above.
2208 - 2211	70	Volcanics: Greenish white to pale green, silky lustre, altered, slightly calcareous, quartz (silt to medium) phenocrysts, soft to firm.
	30	Sandstone: As above.
	Tr	Coal: As above.

	Tr	Claystone: As above.
2211 - 2214	70	Volcanics: As above.
	30	Sandstone: As above.
2214 - 2217	100	Dolerite: Mottled white and dark green, coarsely crystalline, subhedral to anhedral crystals, predominantly coarse white feldspar in a green groundmass of pyroxenes and biotite with occasionally quartz, firm to hard in part, altered in part.
2217 - 2220	100	Dolerite: As above.
2220 - 2223	100	Dolerite: As above.
2223 - 2226	100	Dolerite: As above.
2226 - 2229	100	Dolerite: As above.
2229 - 2232	100	Dolerite: As above.
2232 - 2235	100	Dolerite: As above.
2235 - 2238	100	Dolerite: As above.
2238 - 2241	100	Dolerite: As above.
2241 - 2244	100	Dolerite: As above, predominantly coarse white feldspar with yellow brown olivines becoming common in a microcrystalline green groundmass of pyroxenes and biotite, trace pyrite.
2244 - 2247	100	Dolerite: As above.
2247 - 2250	100	Dolerite: As above.
2250 - 2253	100	Dolerite: As above.
2253 - 2256	100	Dolerite: As above, becoming more subhedral and less altered.
2256 - 2259	100	Dolerite: White to pale green, abundant white feldspar phenocrysts in a greenish white microcrystalline groundmass, common pyroxene phenocrysts, occasionally quartz crystals, euhedral, occasionally subhedral, rare pyrite and magnetite, hard, brittle, altered in part, trace olivines.
2259 - 2262	100	Dolerite: As above.
2262 - 2265	100	Dolerite: As above.
2265 - 2268	100	Dolerite: As above.

2268 - 2271	100	Dolerite: As above.
2271 - 2274	80	Sandstone: White, fine grained, well sorted, subround, spherical, abundant white argillaceous matrix, friable, poor to good porosity, no show, no cut.
	20	Dolerite: As above.
	Tr	Coal: Black, dull, firm, splintery.
2274 - 2277	60	Sandstone: As above.
	40	Dolerite: As above. Cavings???
2277 - 2280	80	Sandstone: As above.
	20	Dolerite: As above.
2280 - 2283	20	Sandstone: As above.
	80	Claystone: Light grey, micromicaceous, carbonaceous specks, soft to firm, dispersive in part, subfissile to fissile.
2283 - 2286	20	Sandstone: As above.
	80	Claystone: As above.
2286 - 2289	100	Claystone: As above, becoming predominantly medium grey.
	Tr	Sandstone: As above.
2289 - 2292	100	Claystone: Dark grey to grey, micromicaceous, carbonaceous in part, soft to firm, subfissile and dispersive, non calcareous.
2292 - 2295	100	Claystone: As above, becoming predominantly dark brown grey.
2295 - 2298	100	Claystone: As above, dark brown grey.
2298 - 2301	100	Claystone: As above, dark brown grey.
2301 - 2304	100	Claystone: As above, pale to medium brown.
2304 - 2307	100	Claystone: Brown, partly white and dark grey, non calcareous, generally non carbonaceous, soft to firm, subfissile to dispersive.
2307 - 2310	90	Sandstone: Light brown, translucent, colourless, angular to subangular, medium to coarse grained, well sorted, subspherical, weak siliceous cement, trace light brown argillaceous matrix, friable to loose quartz, fair porosity, no show.
	10	Claystone: As above.
2310 - 2313	20	Sandstone: As above.
	80	Claystone: As above.
2313 - 2316	50	Sandstone: As above. } Logged after
	50	Claystone: As above. } wiper trip.

2316 - 2319	50	Dolerite: Cavings	} Logged after
	20	Claystone: As above.	} wiper trip
	30	Sandstone: As above.	}
2319 - 2322	80	Claystone: Light to dark brown, slightly silty, micromicaceous, non calcareous, very soft, dispersive, trace disseminated pyrite.	
	20	Sandstone: As above.	
	Tr	Dolomite: Light Brown, cryptocrystalline, very hard, trace pyrite.	
2322 - 2325	100	Claystone: As above, very light to dark brown.	
2325 - 2328	100	Claystone: Pale to light brown, micromicaceous, silty, non calcareous, carbonaceous specks, soft, dispersive, sticky.	
2328 - 2331	30	Coal: Black, dull to subvitreous, firm, brittle.	
	50	Claystone: As above.	
	10	Siltstone: Light brown, non calcareous, argillaceous, soft.	
	10	Sandstone: Light brown, fine grained, subangular, subspherical, well sorted, weak siliceous cement, trace pale brown argillaceous matrix and grain coatings, friable, fair porosity, no show.	
2331 - 2334	40	Claystone: As above, very pale brown to light brown.	
	60	Siltstone: As above, very pale to light brown, very argillaceous.	
2334 - 2337	10	Coal: As above.	
	70	Claystone: As above.	
	20	Siltstone: As above.	
2337 - 2340	20	Coal: As above, also very argillaceous grading to carbonaceous Shale.	
	20	Siltstone: As above.	
	60	Claystone: As above.	
2340 - 2343	60	Sandstone: Colourless, fine grained, subround, subspherical, well sorted, weak siliceous cement, trace to moderate interstitial clay, friable to predominantly loose quartz, fair to good porosity, no show.	
	40	Claystone: As above.	
	Tr	Coal: As above.	
2343 - 2346	90	Claystone: Pale brown to grey brown, micromicaceous, carbonaceous specks in part, non calcareous, soft, plastic, sticky and dispersive.	
	10	Sandstone: As above.	
2346 - 2349	90	Claystone: As above, also dark brown, soft to firm, subfissile.	
	10	Sandstone: As above.	
2349 - 2352	20	Coal: Black, dull, hard, brittle, argillaceous in part.	
	80	Claystone: As above.	
2352 - 2355	20	Coal: As above.	
	80	Claystone: As above.	

2355 - 2358	100	Claystone: Off white to brownish white, light brown to dark brown in part, non calcareous, silty to very silty, micromicaceous, soft, plastic, sticky and dispersive.
2358 - 2361	20	Coal: Black, dull to subvitreous, firm to hard, brittle, blocky to angular, conchoidal fracture.
	80	Claystone: As above.
2361 - 2364	10	Coal: As above.
	90	Claystone: As above, becoming slightly silty.
2364 - 2367	100	Claystone: As above, slightly silty.
2367 - 2370	20	Coal: As above.
	80	Claystone: As above.
2370 - 2373	100	Claystone: As above, becoming predominantly pale brown.
	Tr	Coal: As above.
2373 - 2376	10	Coal: As above.
	90	Claystone: As above, pale to dark brown, occasionally off white, non calcareous, silty in part, micromicaceous in part, soft to firm, predominantly dispersive, subfissile in part.
2376 - 2379	100	Claystone: As above.
2379 - 2382	80	Claystone: As above.
	20	Sandstone: As above. (Abundant Dolerite cavings.)
2382 - 2385	80	Claystone: As above.
	20	Shale: Dark grey, firm, carbonaceous, fissile, micromicaceous, (Abundant Dolerite cavings.)
2385 - 2388	10	Coal: Black, dull, firm to hard, argillaceous, platey to blocky.
	10	Shale: As above, grading to carbonaceous Shale.
	80	Claystone: As above, predominantly very pale brown, generally silty.
2388 - 2391	90	Claystone: As above.
	10	Shale: As above.(Abundant Dolerite cavings.)
2391 - 2394	20	Coal: Black, dull to subvitreous, hard, blocky to splintery.
	20	Claystone: As above.
	60	Sandstone: Colourless, brownish, fine to very coarse grained, predominantly coarse, poorly sorted, subround, subspherical, trace weak siliceous cement, trace brown argillaceous matrix, trace mica, loose quartz, fair to good porosity, no show.
2394 - 2397	10	Coal: As above.
	70	Sandstone: As above.
	20	Claystone: Light to dark brown, carbonaceous in part, silty in part,

micromicaceous, soft to firm, dispersive to fissile, grades to carbonaceous Shale.

2397 - 2400	10	Coal: As above.
	90	Claystone: Pale brown to pale greyish brown, slightly carbonaceous in part, soft, dispersive.
2400 - 2403	10	Coal: As above.
	90	Claystone: As above.
2403 - 2406	10	Coal: As above.
	30	Sandstone: Colourless stained brown, translucent, fine to coarse grained, predominantly fine, subround to round, spherical, loose unconsolidated quartz, moderately sorted, good inferred porosity, no show.
	60	Claystone: As above.
2406 - 2409	10	Coal: As above.
	10	Sandstone: As above, predominantly fine grained.
	80	Claystone: As above.
2409 - 2412	20	Coal: Black, dull to subvitreous, hard, brittle, splintery.
	10	Sandstone: As above, fine grained, well sorted, loose quartz.
	70	Claystone: As above.
2412 - 2415	10	Coal: As above.
	10	Sandstone: As above, fine grained, well sorted, loose quartz.
	80	Claystone: As above.
2415 - 2418	50	Sandstone: Colourless to white, very fine to predominantly fine, subround to round, spherical, well sorted, weak siliceous cement, trace white argillaceous matrix, trace mica, friable to loose, good inferred porosity, no show.
	50	Claystone: As above.
2418 - 2421	80	Sandstone: Colourless to white, subangular to subround, predominantly spherical, fine grained, well sorted, abundant to common white argillaceous matrix, common loose quartz, very friable in aggregate, poor to fair porosity, no show.
	20	Claystone: As above.
2421 - 2424	100	Sandstone: As above, fine to medium, predominantly fine.
2424 - 2427	10	Sandstone: As above.
	90	Claystone: As above.
	Tr	Coal: As above.
2427 - 2430	20	Sandstone: As above.
	10	Coal: Black, dull, hard, brittle to splintery.
	70	Claystone: As above.

2430 - 2433	10	Sandstone: As above.
	90	Claystone: As above.
	Tr	Coal: As above.
2433 - 2436	20	Claystone: As above.
	80	Sandstone: As above, fine grained, well sorted, with a trace weak calcareous cement, clean to occasionally moderate argillaceous matrix, good porosity, no show, dull orange mineral fluorescence.
2436 - 2439	20	Claystone: As above.
	80	Sandstone: As above, fine grained, well sorted, no show.
2439 - 2442	90	Sandstone: As above, locally well cemented by sideritic cement, fine grained, subangular to subround, well sorted, trace to abundant white matrix, good porosity, locally nil to trace porosity.
	10	Claystone: As above.
2442 - 2445	10	Claystone: As above.
	90	Sandstone: As above.
2445 - 2448	40	Claystone: Pale brown to light brown, slightly silty, non calcareous, carbonaceous specks, soft to firm, dispersive.
	60	Sandstone: Colourless to white, fine grained, occasionally very fine to medium, subround to round, well sorted, spherical to subspherical, trace to moderate sideritic cement, common white interstitial clay, trace mica, friable to occasionally hard when well cemented, trace to poor occasionally fair porosity, no show, common orange mineral fluorescence.
2448 - 2451	20	Coal: Black, subvitreous, hard to very hard, brittle, argillaceous in part, blocky to platey, grading to carbonaceous Shale in part.
	30	Sandstone: As above.
	50	Claystone: As above, becoming predominantly light brown.
2451 - 2454	50	Coal: As above.
	40	Sandstone: As above, becoming predominantly moderately cemented with siderite.
	10	Claystone: As above.
2454 - 2457	20	Coal: As above.
	40	Claystone: Off white to light brown, non calcareous, silty, trace carbonaceous specks in part, micromicaceous in part, soft, dispersive.
	40	Sandstone: Colourless, white, occasionally stained light brown or orange brown, very fine to very coarse, poorly sorted, angular to round, spherical, weak to moderate siderite cement, off white interstitial matrix, trace mica, friable to hard, nil to poor porosity, no show, 10 to 20% bright orange mineral fluorescence.
2457 - 2460	60	Claystone: Pale brown to light grey brown, occasionally off white, silty, non calcareous, occasionally carbonaceous specks, soft,

		dispersive, sticky.
	40	Sandstone: White to off white, colourless, translucent, quartzose, fine grained, occasionally very fine to medium, predominantly well sorted, spherical, subangular to subspherical, moderate sideritic cement, trace to common white argillaceous matrix, trace mica, friable to hard, nil to poor porosity, no show, trace mineral fluorescence as above.
2460 - 2463	20	Coal: Black, dull to subvitreous, firm, brittle, blocky to splintery, subconchoidal fracture.
	50	Claystone: As above.
	30	Sandstone: As above, predominantly fine grained.
2463 - 2466	10	Coal: As above.
	30	Claystone: As above, light brown.
	60	Sandstone: As above, predominantly fine grained, well sorted, friable to hard, tight, 10 - 20% mineral fluorescence as above.
2466 - 2469	10	Coal: As above.
	30	Claystone: As above.
	60	Sandstone: As above, predominantly fine grained.
2469 - 2472	10	Coal: As above.
	30	Claystone: As above.
	60	Sandstone: Off white, translucent to opaque, very fine to very coarse, predominantly fine to medium, subround to subangular, spherical to elongated with increasing grain size, moderately sorted, weak to occasionally moderate sideritic cement, trace white interstitial clay, trace mica, friable to occasionally hard, poor to fair porosity, no show, trace orange mineral fluorescence as above.
2472 - 2475	80	Sandstone: Colourless to white, very fine to granules, very poorly sorted, as above with weak to moderate sideritic matrix, generally clean, white clay matrix in part, trace mica, friable, fair to good porosity, no show, trace mineral fluorescence.
	20	Claystone: Off white to white, soft, slightly sticky.
2475 - 2478	10	Coal: As above, cavings??
	40	Sandstone: As above, very fine to granules, poorly sorted.
	50	Claystone: Pale brown to light grey brown, non calcareous, silty, carbonaceous specks, soft, dispersive.
2478 - 2481	70	Claystone: As above.
	30	Sandstone: As above, fine to coarse, moderately sorted, weak sideritic cement, trace mica, friable to loose, fair porosity, no show, trace mineral fluorescence.
	Tr	Coal: As above.
2481 - 2484	70	Claystone: As above.
	30	Sandstone: As above.

2484 - 2487	10	Coal: Black, dull to subvitreous, hard, subconchoidal, argillaceous in part, grading to carbonaceous Shale.
	10	Sandstone: As above.
	80	Claystone: As above.
2487 - 2490	20	Sandstone: As above.
	10	Coal: As above.
	70	Claystone: As above.
2490 - 2493	20	Coal: As above.
	40	Claystone: As above.
	40	Dolerite: As above, probably cavings????
2493 - 2496	20	Claystone: As above.
	80	Dolerite: As above, probably cavings???
2496 - 2499	60	Dolerite: As above, probably cavings???
	20	Claystone: Off white, non calcareous, silty and sandy, firm to soft, sticky.
	20	Shale: Brown, carbonaceous flecks and laminations, non calcareous, firm, fissile.
2499 - 2502	80	Claystone: Off white to pale brown, non calcareous, silty, carbonaceous specks, soft, plastic, dispersive, very sticky.
	20	Siltstone: off white to light brown, carbonaceous specks, argillaceous matrix, micromicaceous, sandy in part, laminated, soft to firm, blocky to platey.
2502 - 2505	20	Siltstone: As above.
	20	Claystone: As above.
	40	Coal: Black to brown black, dull to subvitreous, hard to firm, argillaceous in part, grading to carbonaceous Shale.
	20	Shale: Dark brown, firm, non calcareous, carbonaceous, subfissile to fissile.
2505 - 2508	10	Coal: As above.
	20	Shale: As above.
	50	Claystone: As above.
	20	Siltstone: As above.
2508 - 2511	70	Claystone: As above.
	30	Siltstone: As above.
2511 -2514	20	Shale: As above.
	20	Claystone: As above.
	30	Siltstone: As above.
	30	Sandstone: Colourless to white to pale brown, medium grained and very coarse grained, bimodal, subround, spherical, well sorted, trace siliceous cement, clean, friable, fair to good porosity, no show.

2514 - 2517	20	Sandstone(1): As above.
	50	Sandstone(2): Pale brown to off white, fine to coarse grained, predominantly fine to medium, moderately sorted, angular, non spherical to spherical, very strong sideritic cement, white argillaceous matrix, abundant carbonaceous detritus and streaks, trace mica, very hard, nil porosity, no show.
	10	Shale: As above.
	20	Siltstone: As above.
2517 - 2520	10	Siltstone: As above.
	60	Claystone: As above.
	30	Sandstone(2): As above.
2520 - 2523	20	Shale: As above, light brown to brown.
	20	Siltstone: As above, and brown, argillaceous, carbonaceous specks and laminations.
	20	Claystone: As above.
	40	Sandstone(2): As above, no show.
	Tr	Tuff: Blue grey, firm, altered, microcrystalline, altered feldspars in a grey groundmass.
2523 - 2526	20	Claystone: Light brown to grey brown, firm, subfissile, non calcareous, silty, carbonaceous specks.
	80	Sandstone: White, colourless, translucent, very fine to very coarse, very poorly sorted, elongated to spherical, angular to subangular, white tuffaceous matrix in part, abundant biotite and muscovite, quartzose, common trace white feldspars, good porosity, no show.
	Tr	Tuff: Off white, pink, pale green speckled white, semi translucent, welded, hard, brittle, conchoidal fracture.
2526 - 2529	100	Sandstone: As above.
	Tr	Tuff: As above.
2529 - 2532	100	Sandstone: As above, fine to coarse, moderately sorted, occasionally very coarse to granular, becoming predominantly clean, trace lithic grains and common biotite and muscovite, quartzose, trace to common feldspar, trace pyrite, good porosity, friable, no show.
2532 - 2535	100	Sandstone(1): as at 2329m, trace smoky quartz, tuffaceous, abundant lithic grains and feldspars, predominantly quartz, grades to Lithic Arkose.
2535 - 2538	10	Coal: Black to brown black, firm to hard, dull, blocky.
	70	Sandstone(1): As above, grading to Lithic Arkose.
	20	Sandstone(2): White, fine grained, well sorted, subangular, abundant white matrix, moderate to predominantly weak siliceous cement, friable to hard, poor porosity, no show, moderate orange pink mineral fluorescence.
2538 - 2541	20	Claystone: Brown to dark brown, firm, blocky, carbonaceous in part,

		subfissile in part, grading to carbonaceous Shale.
	40	Sandstone(1): As above.
	40	Sandstone(2): As above.
2541 - 2544	50	Claystone: Pale brown, off white, soft, dispersive, carbonaceous specks, silty in part.
	50	Sandstone(2): As above.
2544 - 2547	80	Claystone: Off white to pale brown, dark brown, soft to firm, sticky, plastic, silty in part, non calcareous, carbonaceous in part, occasionally subfissile.
	20	Sandstone(2): As above.
2547 - 2550	20	Claystone: As above.
	80	Sandstone: Colourless to white, fine to medium, well sorted, occasionally coarse, angular to subround, spherical to occasionally subspherical, loose quartz, weak siliceous cement, trace white matrix, friable to predominantly loose, fair to good porosity, no show.
2550 - 2553	90	Sandstone: As above, fine grained, well sorted, slight calcareous cement in part, no show.
	10	Claystone: As above.
2553 - 2556	70	Sandstone: As above, fine to very coarse, predominantly fine to medium, slight calcareous cement in part.
	30	Claystone: As above.
2556 - 2559	30	Sandstone: As above.
	70	Claystone: As above.
	Tr	Coal: Black, dull, firm, blocky to platey, argillaceous, grading to carbonaceous Shale.
2559 - 2562	70	Sandstone: Colourless to white, medium to predominantly fine grained, subangular to subround, spherical, well sorted, weak siliceous cement, trace secondary calcareous cement, white interstitial clay, slight trace mica, friable to loose, poor to fair porosity, **Fluorescence** 10% spotty to patchy moderately bright yellow, slow streaming to blooming milky white cut, moderate to thin colourless ring residue.
	30	Claystone: As above.
2562 - 2565	70	Sandstone: As above, predominantly fine grained, fine to coarse, moderate to well sorted, poor to fair porosity, no show.
	30	Claystone: As above.
2565 - 2568	20	Sandstone: As above, predominantly fine grained, moderate to well sorted, poor to fair porosity, no show.
	80	Claystone: Off white to pale brown, dark brown to dark grey brown, soft to firm, silty, non calcareous, carbonaceous in part, subfissile, sticky in part.

2568 - 2571	80	Sandstone: Colourless to white, fine to predominantly medium grained, subrounded, well sorted, spherical, weak siliceous cement, trace white interstitial clay, trace mica, friable to loose quartz, fair porosity, no show.
	20	Claystone: Brown, non calcareous, micromicaceous, carbonaceous specks, firm, subfissile.
2571 - 2574	20	Claystone: Brown to light brown, off white, silty, non calcareous, carbonaceous in part, soft to firm, sticky in part, micromicaceous.
	80	Sandstone: Off white, colourless, translucent, fine to medium, well sorted, subangular to subround, spherical, weak siliceous cement, trace white argillaceous matrix, trace mica, friable, poor to fair porosity, no show.
2574 - 2577	60	Claystone: As above, brown, becoming very silty, grading to argillaceous Siltstone.
	40	Sandstone: As above.
	Tr	Dolomite: Medium grey brown, cryptocrystalline, very hard, angular, slightly argillaceous.
2577 - 2580	20	Sandstone: As above.
	80	Claystone: As above, becoming predominantly brown to grey brown, firm, laminated, subfissile, silty, micromicaceous, carbonaceous microlaminations.
2580 - 2583	20	Coal: Black to brownish black, dull, earthy, firm to hard, argillaceous, grading to carbonaceous Shale.
	70	Claystone: As above, brown to dark brown, grey brown.
	10	Siltstone: Light brown to grey brown, argillaceous, micromicaceous, carbonaceous, non calcareous, firm, blocky.
2583 - 2586	20	Coal: As above.
	10	Siltstone: As above.
	40	Claystone: As above.
	30	Sandstone: Light brown, fine to medium grained, subround to round, well sorted, spherical, weak siliceous cement, brown and white argillaceous matrix, friable, poor visual porosity, no show.
2586 - 2589	10	Coal: As above.
	20	Siltstone: As above.
	20	Sandstone: As above.
	50	Claystone: As above.
2589 - 2592	10	Claystone: As above.
	90	Sandstone: Colourless, white, translucent to transparent, very fine to very coarse, very poorly sorted, angular to subround, subspherical, common bit fractured grains, weak siliceous cement, white argillaceous matrix in part, trace mica, friable to loose, fair to good porosity, no show, trace mineral fluorescence.

2592 - 2595	100	Sandstone: As above, clean, predominantly coarse to medium, angular, very poorly sorted, moderate sideritic cement in part, trace lithic grains, predominantly loose quartz, hard when well cemented, fair to good porosity, locally nil.
2595 - 2598	100	Sandstone: As above, predominantly coarse to very coarse, occasionally angular, no show.
2598 - 2601	10	Coal: Black, dull to subvitreous, hard, brittle, conchoidal fracture.
	90	Sandstone: As above, very fine to very coarse, very poorly sorted, angular, trace lithic fragments and chert, quartzose, no show.
2601 - 2604	60	Sandstone: As above.
	40	Claystone: Brown, light brown, grey brown, soft to firm, non calcareous, micromicaceous, silty to very silty in part, common carbonaceous detritus, dispersive in part, commonly grading to argillaceous Siltstone.
2604 - 2607	40	Sandstone: As above.
LAT	50	Claystone: As above.
	10	Siltstone: Brown to grey brown, argillaceous, non calcareous, carbonaceous, micromicaceous, soft to firm, dispersive in part, grading to Claystone.
2607 - 2610	10	Siltstone: As above.
	50	Claystone: As above.
	40	Sandstone: White, colourless, very fine to coarse, predominantly medium to coarse, moderately to poorly sorted, subround to angular, moderate siliceous cement, common calcareous/sideritic cement in part, common white interstitial clay, friable to hard, trace to poor visual porosity, no show, orange mineral fluorescence.
2610 - 2613	10	Coal: As above.
	30	Sandstone: As above.
	60	Claystone: Light to dark brown, grey brown, occasionally grey, non calcareous, micromicaceous in part, silty in part, laminated, trace pyrite nodules, soft to firm, blocky to subfissile.
2613 - 2616	10	Coal: Black, dull to predominantly subvitreous, hard, blocky, conchoidal fracture, angular.
	30	Sandstone: As above.
	60	Claystone: As above.
2616 - 2619	20	Coal: As above.
	50	Claystone: As above.
	10	Siltstone: As above.
	20	Sandstone: As above.
2619 - 2622	30	Claystone: As above.
	70	Sandstone: White to colourless, translucent, fine to coarse,

		predominantly medium, angular to subround, subspherical, well sorted, weak siliceous cement, trace secondary calcareous cement, trace white argillaceous matrix, trace mica, quartzose, fair to good porosity, no show, trace mineral fluorescence.
	Tr	Coal: As above.
2622 - 2625	50	Claystone: Pale brown, tan, soft, dispersive, silty in part, calcareous in part, occasionally brown to dark brown and carbonaceous in part.
	10	Coal: As above.
	40	Sandstone: White to light brown, medium to very fine grained, subround to angular, poorly sorted, white calcareous/argillaceous matrix/cement, very hard, no porosity, no show, dull orange mineral fluorescence.
2625 - 2628	20	Coal: Black to brown black, firm to hard, dull to subvitreous, splintery, argillaceous, grading to carbonaceous Shale, amber resin fluorescing gold to bright yellow, with a slow streaming cut.
	80	Sandstone: Colourless to white, fine to very coarse, poorly sorted, angular to subround, spherical to elongated, weak to moderate siliceous cement, trace white and brown matrix in part, common altered feldspars, trace to common mica, friable to loose (fractured grains), fair porosity, no show, trace to 10% mineral fluorescence.
2628 - 2631	100	Sandstone: As above.
	Tr	Coal: As above.
2631 - 2634	80	Sandstone: As above.
	20	Claystone: Brown to dark brown, micromicaceous, carbonaceous and coaly microlaminations, non calcareous, firm, subfissile, grading to carbonaceous Shale.
2634 - 2637	20	Claystone: As above, very carbonaceous grading to Coal.
	80	Sandstone: Colourless, translucent to transparent, white, very fine to coarse, angular to subround, poorly sorted, predominantly fine to coarse, trace white matrix, weak siliceous cement, trace feldspars, friable to predominantly loose, good inferred porosity, no show.
2637 - 2640	10	Coal: Black to brown black, dull to earthy, firm, subfissile, argillaceous, grading to carbonaceous Shale.
	40	Claystone: As above, grading to carbonaceous Shale.
	50	Sandstone: As above.
2640 - 2643	30	Claystone: As above.
	70	Sandstone: As above, with common chert and lithic grains.
2643 - 2646	10	Claystone: As above.
	90	Sandstone: Colourless, white, very fine to very coarse, predominantly fine to medium, poor to very poorly sorted, subangular to subround, subspherical, weak siliceous cement, trace white interstitial clay and common clay coating on grains, friable to loose, good inferred porosity,

no show.

2646 - 2649	40	Claystone: As above.
	60	Sandstone: As above.
2649 - 2652	50	Claystone: As above.
	40	Sandstone: As above.
	10	Siltstone: Brown, mottled light brown, dolomitic, sandy, firm to hard, blocky to splintery.
2652 - 2655	10	Coal: Black, dull, firm to hard, angular, brittle, argillaceous in part, trace resin with white cut.
	30	Claystone: Light to medium brown, non calcareous, carbonaceous detritus and microlaminations, firm, subfissile to fissile.
	60	Sandstone: Colourless translucent to transparent, fine to very coarse, predominantly fine to medium, subangular to subround, weak siliceous cement, trace to common white clay matrix and clay coatings on grains, friable, fair to good porosity, no show.
2655 - 2658	10	Claystone: As above.
	90	Sandstone: Colourless to light brown, very fine to very coarse, very poorly sorted, angular to subangular,subspherical to elongate, weak siliceous cement with quartz overgrowths, strong sideritic cement of fine grained aggregates,trace brown and white interstitial clay, common fractured quartz grains, quartzose, trace chert and lithic grains, trace white feldspars, trace mica, friable, fair porosity, no show, common orange to yellow green mineral fluorescence.
2658 - 2661	60	Sandstone: As above, becoming predominantly fine to medium grained, well sorted, with strong sideritic cement and white matrix, friable to hard, poor to fair porosity, no show.
	40	Claystone: As above.
2661 - 2664	10	Coal: Black, dull to subvitreous, hard, brittle, angular.
	40	Claystone: As above.
	50	Sandstone: As above.
2664 - 2667	10	Coal: As above.
	30	Sandstone: As above, predominantly fine grained, very fine to very coarse, moderately sorted, white argillaceous matrix, trace lithic grains, moderate calcareous cement in part, dull yellow orange mineral fluorescence.
	40	Claystone: As above.
	20	Siltstone: Off white to light brown, argillaceous, firm to friable, slightly calcareous.
2667 - 2670	30	Claystone: Predominantly brown, coaly, firm, subfissile, grading to carbonaceous Shale and Coal.
	30	Siltstone: As above.
	40	Sandstone: Colourless to white, translucent to opaque, very fine to very

coarse, poorly sorted, angular to subround, spherical to elongated with increasing grain size, weak siliceous cement with quartz overgrowths, trace to moderate secondary calcareous cement, trace to common white interstitial matrix, trace to common lithic grains, friable to hard, trace to poor porosity, occasionally fair, no show, orangey green mineral fluorescence.

2670 - 2673	50	Claystone: As above, predominantly light brown to brown, occasionally tan, carbonaceous specks and microlaminations, micromicaceous and silty in part, pyrite nodules, soft to firm, becoming hard in part.
	10	Siltstone: As above.
	40	Sandstone: As above.
2673 - 2676	20	Claystone: As above.
	80	Sandstone: As above, 10% dull yellow green **Fluorescence**, no cut, very weak crush cut, trace to thin colourless ring residue.
2676 - 2679	70	Shale: Dark brown to brown black, very carbonaceous, soft to firm, fissile, grading to argillaceous Coal.
	20	Coal: Black to brown black, earthy to subvitreous, hard to firm, blocky to splintery, argillaceous in part.
	10	Sandstone: As above.
2679 - 2682	10	Coal: As above.
	80	Shale: As above.
	10	Sandstone: As above.
2682 - 2685	10	Coal: As above.
	70	Shale: As above.
	20	Sandstone: As above.
	Tr	Siltstone: Off white to light brown, argillaceous, soft, dispersive, **Fluorescence** spotty dull yellow green, very weak crush cut, trace residue.
2685 - 2688	20	Coal: Black, dull, earthy, firm to hard, angular to blocky, argillaceous, grading to carbonaceous Shale.
	20	Sandstone: As above.
	50	Shale: As above, becoming predominantly light brown to tan, trace mica.
	10	Siltstone: Light brown to brown, carbonaceous specks, sandy, firm to moderately hard, trace mica.
2688 - 2691	10	Siltstone: As above.
	10	Shale: As above.
	80	Sandstone: Off white, translucent, fine to coarse, predominantly medium grained, subangular to subround, spherical to elongate with increasing grain size, well to moderately sorted, weak siliceous cement, trace calcareous cement in part, white argillaceous matrix, quartzose, common pink and grey chert, trace feldspars and lithic grains, friable to hard, poor porosity, no show.

2691 - 2694	10	Coal: As above.
	10	Shale: As above.
	80	Sandstone: As above, moderately sorted, poor porosity, no show.
2694 - 2697	10	Coal: As above.
	10	Shale: As above, very carbonaceous.
	20	Sandstone: As above.
	60	Claystone: Tan to light brown to brown, carbonaceous specks, silty in part, laminated, occasionally micromicaceous, soft to firm, moderately hard in part, blocky to subfissile.
2697 - 2700	20	Coal: As above.
	30	Shale: As above, brown to dark brown, very carbonaceous.
	20	Sandstone: As above.
	30	Claystone: As above.
2700 - 2703	20	Coal: Black to brownish black, firm to hard, dull to subvitreous, blocky to platey, argillaceous in part, grading to carbonaceous Shale in part.
	20	Shale: Brown, carbonaceous and coaly, firm, subfissile to fissile.
	40	Claystone: Off white to light brown, tan, silty, non calcareous, carbonaceous specks, laminated, soft to firm, moderately hard in part, blocky.
	20	Sandstone: As above, predominantly medium, no show.
2703 - 2706	10	Coal: As above.
	50	Shale: As above.
	10	Claystone: As above.
	30	Sandstone: Off white, very fine to coarse, predominantly medium, subangular to subround, moderately sorted, weak siliceous cement, quartz overgrowths, white clay matrix, trace chert and lithic grains, friable to occasionally hard in aggregates, fair porosity, no show.
2706 - 2709	10	Coal: As above.
	10	Sandstone: As above.
	40	Claystone: As above, grading to Shale.
	40	Shale: As above.
2709 - 2712	10	Coal: As above.
	90	Shale: As above, becoming light brown to tan, brown to dark brown.
2712 - 2715	10	Coal: As above.
	20	Shale: As above.
	70	Sandstone: Off white, cream, fine to very coarse, poorly sorted, angular to subangular, bit fractured grains, spherical to elongate, weak siliceous cement, quartz overgrowths, common light brown argillaceous matrix, off white in part, trace mica, trace chert and lithic grains, friable to loose, poor to occasionally fair porosity, no show.
2715 - 2718	10	Shale: As above.

	20	Claystone: As above.
	70	Sandstone: As above, very fine to very coarse, very poorly sorted, common quartz overgrowths, common lithic grains, trace feldspars, brown and white matrix, poor porosity, no show.
2718 - 2721	20	Shale: As above.
	20	Claystone: As above.
	60	Sandstone: As above, no show.
2721 - 2723TD	20	Coal: Black, subvitreous, hard, brittle, conchoidal fracture, blocky to splintery.
	20	Sandstone: As above.
	60	Shale: As above, dark brown, very carbonaceous and coaly, hard, brittle, subfissile.

2 ULTRA LOG INTERPRETATION

291182

Company	:	SAGASCO RESOURCES LTD.
Well	:	FLINDERS-1
Field	:	EXPLORATION
Province	:	BASS BASIN
State	:	TASMANIA
Date	:	17th December 1992.

ULTRA COMPLEX LITHOLOGY ANALYSIS

PRELIMINARY RESULTS AND COMMENTS

Data Availability and Log Quality

The following services were run on the Flinders-1 well:

High Resolution Induction (HRI)
Microspherical (MSFL)
Sonic
Spectral Density (SDL)
Dual Spaced Neutron (DSN)
Compensated Spectral Gamma (CSNG)

Firstly, the data was depth-matched to the HRI curves and then environmental and borehole corrections were applied. Since virtually no borehole correction was required for the HRI data the HRI deep reading curve was taken as Rt and the MSFL as Rxo.

Log quality of the pad devices was good due to excellent hole conditions. There was some washout (2" to 3") in the coals.

Parameter Selection - General

Study of the mud log indicated that the principal formation components would be claystones and sandstones interbedded with thin dolomite streaks and siltstones. Also indicated was a certain amount of igneous activity and a massive dolerite sill between 2208m and 2272m.

The Indonesian Saturation Equation was chosen with the following parameters:

a = 0.81
m = 2.15
n = 2.0

The ULTRA minimisation technique confirmed these values as reasonable.

Parameter Selection - Formation Water Resistivity (Rw)

An initial value of 0.05 Ohmm at 242 degrees F (approx. 42,000 ppm NaCl equivalent) was estimated from the SP and Rwa plots. This value was confirmed by ULTRA's multi-dimensional crossplot technique, giving least error in the minimisation. This value was chosen for the whole of the interpreted interval.

Parameter Selection - Clay.

Selection of the clay parameters was made from the Thorium versus Potasium crossplot. This suggested mixed clays bordering on Kaolinite. Two types of clays were chosen for use in the model, one kaolinitic (of fixed value) to help accomodate the erratically high gamma ray values and the other variable depending on the quality of fit between the raw and theoretical curves.

Parameter Selection - Zoning

The well was considered as one zone of sandstone and claystone (broken by the dolerite sill) with coal beds and dolomite streaks. The Pe values in the sandstones suggested sideritic cementation and lignite was included in the model as the carbonaceous material.

The mud log indicated that the sandstone ocasionally varied to siltstone and this has been included in the model where appropriate.

The mudlog also suggested a certain amount of volcanic and igneous activity. Apart from the obvious dolerite sill it was difficult to identify igneous zones and so this was left out of the model.

The fit of raw to theoretical curves in the sandstones is good. However, the fit in the claystones requires more work in order to accomodate the erratic high gamma ray values.

Mineral Parameter Selection

	GR (API)	Rhob (gm/cc)	PhiN (%)	Uma ---	DT (usec/f)	Rt (Ohmm)	Rxo (Ohmm)
Sandstone	14.00	2.65	-	4.78	56.00	-	-
Siltstone	70.00	2.72	10.00	12.00	60.00	-	-
Dolomite	0.00	2.87	-	9.00	43.50	-	-
Siderite	0.00	3.89	12.00	57.14	47.00	-	-
Carb.Mat'l.	0.00	1.19	50.00	0.24	160.00	-	-
Clay 1			(See following table)				
Clay 2	300.00	2.61	36.00	3.89	200.00	-	-

Clay 1 Parameters

Depths (meters)	GR (API)	Rhob (gm/cc)	PhiN (%)	Uma ---	DT (usec/f)	Rt (Ohmm)	Rxo (Ohmm)
1547-1617	95.40	2.33	32.00	9.00	98.00	1.00	3.00
1617-1740	85.00	2.38	29.30	6.93	94.34	1.20	5.00
1740-1775	95.40	2.38	29.30	6.93	105.00	4.00	4.00
1775-1875	100.00	2.38	29.30	6.93	94.34	1.20	5.00
1875-1912	95.40	2.38	29.30	6.93	94.34	1.20	5.00
1912-2208	95.40	2.38	29.30	6.93	94.34	2.70	6.00
2208-2272			(Dolerite Sill)				
2272-2705	95.40	2.43	29.30	6.93	94.34	2.70	6.00

Density of Dry Clay = 3.003 gm/cc

Appendix 2.

291186

5 cm

OR-0298

HALLIBURTON LOGGING SERVICES, INC.

"ULTRA"

COMPLEX LITHOLOGY

ANALYSIS 1:200

Company SAGASCO RESOURCES LTD.

Well FLINDERS-1

Field EXPLORATION

County BASS BASIN

State / Province TASMANIA Country AUSTRALIA

API Well Number Filing Number

Location:

LAT : 40 22 51.810 S

LONG: 145 40 18.690 E

LSD: SEC: TWP: RGE:

Latitude : 0 deg. 0 min. 0 sec. N

Longitude: 0 deg. 0 min. 0 sec. W

Other Services

HRI-DFL-MSFL-LSS

SDL-DSN-CSNG

SED-GR

Permanent Datum MSL Elev. 0.00

Log Measured from DF , 22.30 Above P.D.

Drilling Measured from DF

KB: 0.00 M

DF: 22.30 M

GL: -69.25 M

CBF: 0.00 M

Date	12-17-92			
Run Number	2	2	3	4
Job Ticket Number				
First Recorded Depth	2716.10 M			
Last Recorded Depth	1243.20 M			
Bottom Depth Logger	2718.80 M			
Bottom Depth Driller	2723.00 M			
Casing size	9.625 IN			
Casing shoe Driller	1520.000 M			
Bitsize	8.500 IN			
Fluid type in well	POLYMER			
Source of sample	FLOWLINE			
Fluid Density	1.12			
Fluid Viscosity	52.00			
Mud pH	9.50			
Fluid loss	6.00			
Rm @ Meas. Temp.	1.300 @ 22	@	@	@
Rmc @ Meas. Temp.	1.750 @ 22	@	@	@
Rmf @ Meas. Temp.	1.260 @ 22	@	@	@
Rm @ BHT	0.380 @ 116	@	@	@
Source Rmf	MEAS			
Source Rmc	MEAS			
Max. Recorded Temp.	117			
Time End Circulation	18:39 HR	HR	HR	HR
Time logger at TD	7:39 HR	HR	HR	HR
Equipment number	10598	10598	10598	10598
Equipment location	SALE			
Recorded by	L.JONES			
Witnessed by	J.REEVE			

REMARKS: Rw = 0.05 Ohmm @ 242 degF.

a = 0.81, m = 2.15, n = 2.0.

Indonesian Saturation Equation and Raymer Hunt for Sonic.

HALLIBURTON LOGGING SERVICES, INC. (HLS) does not guarantee the accuracy of any interpretation of log data, conversion of log data to physical rock parameters, or recommendations which may be given by HLS personnel or which may appear on the log or in any other form. Any user of such data, interpretations, conversions, or recommendations agrees that HLS is not responsible, except where due to gross negligence or willful misconduct, for any loss, damages, or expenses resulting thereof.

HALLIBURTON LOGGING SERVICES, INC.

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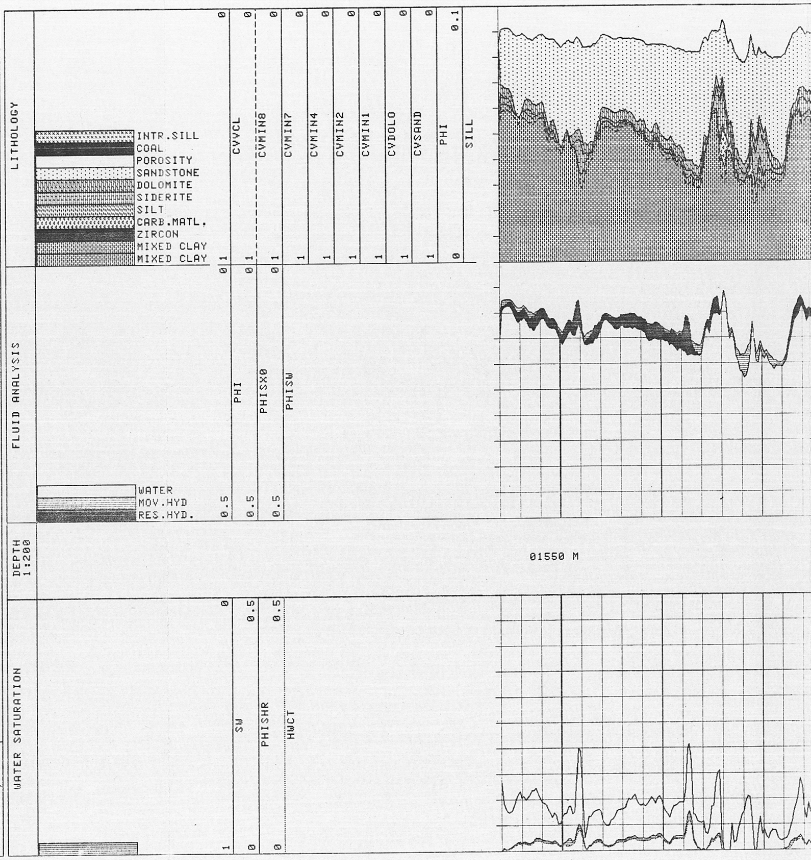

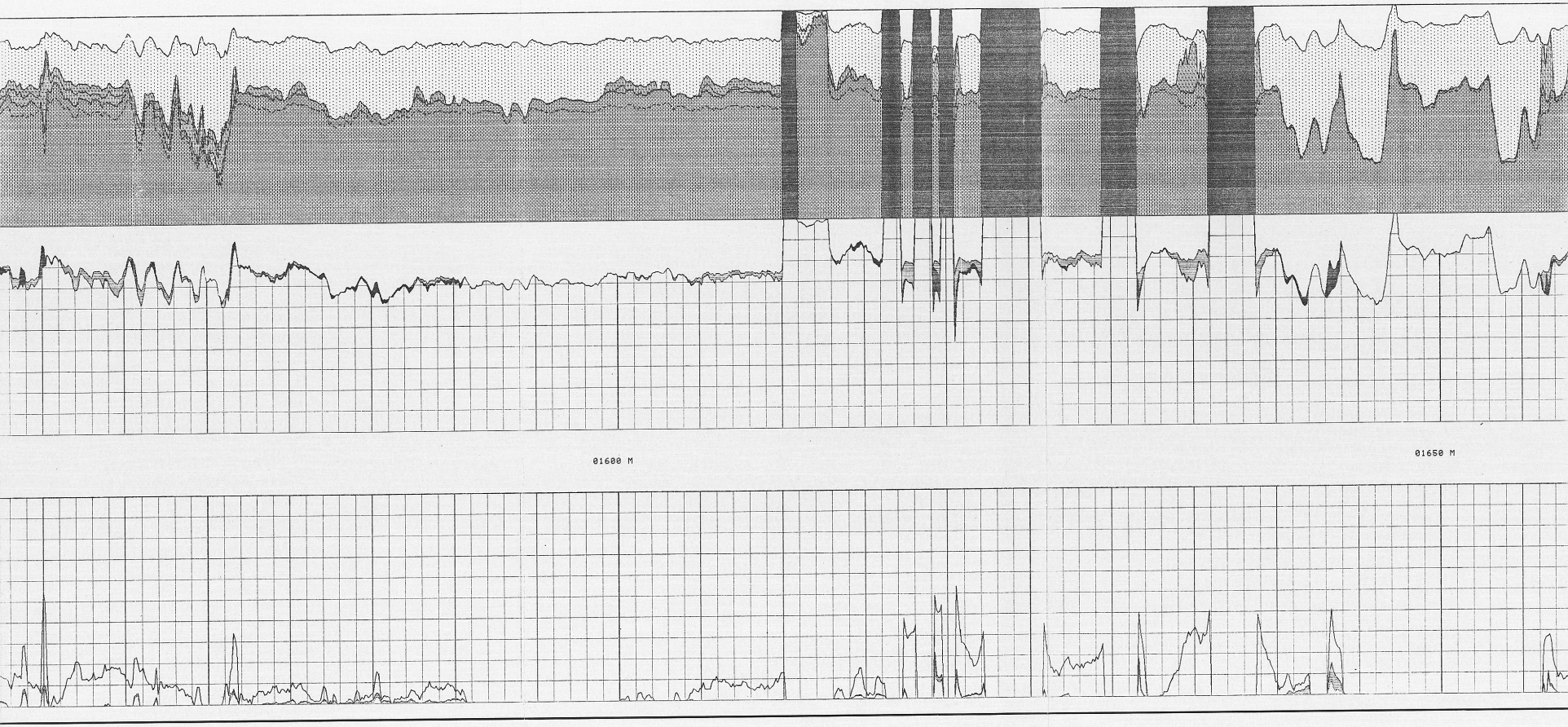

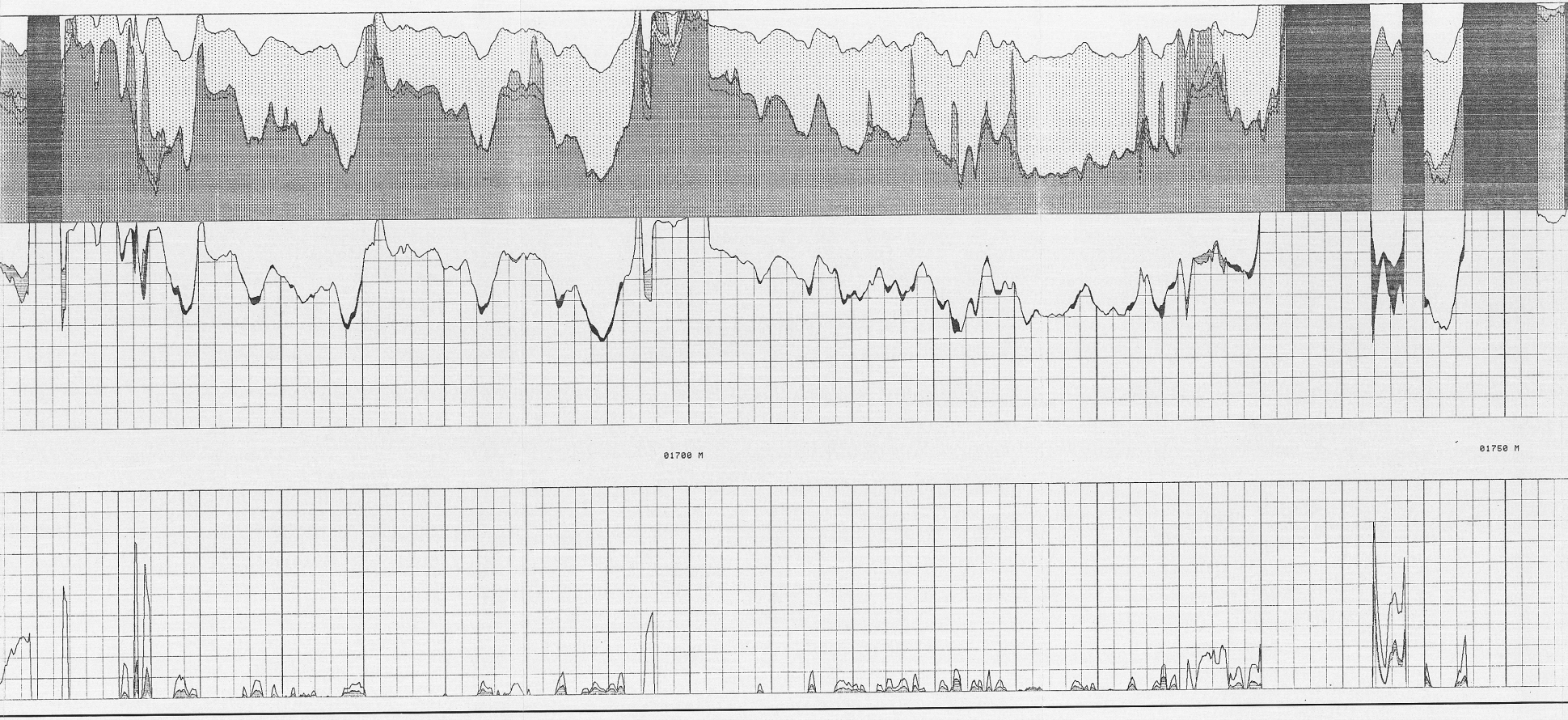

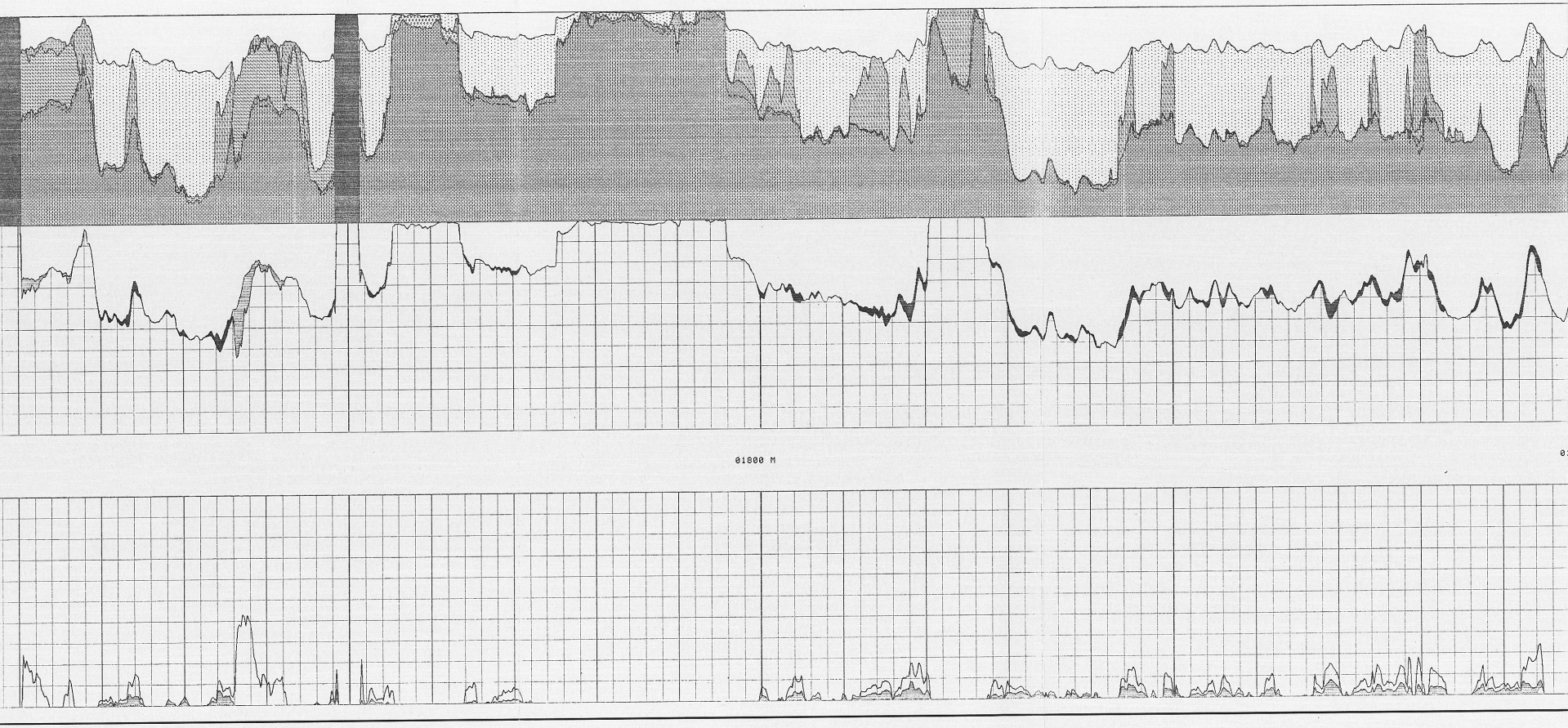

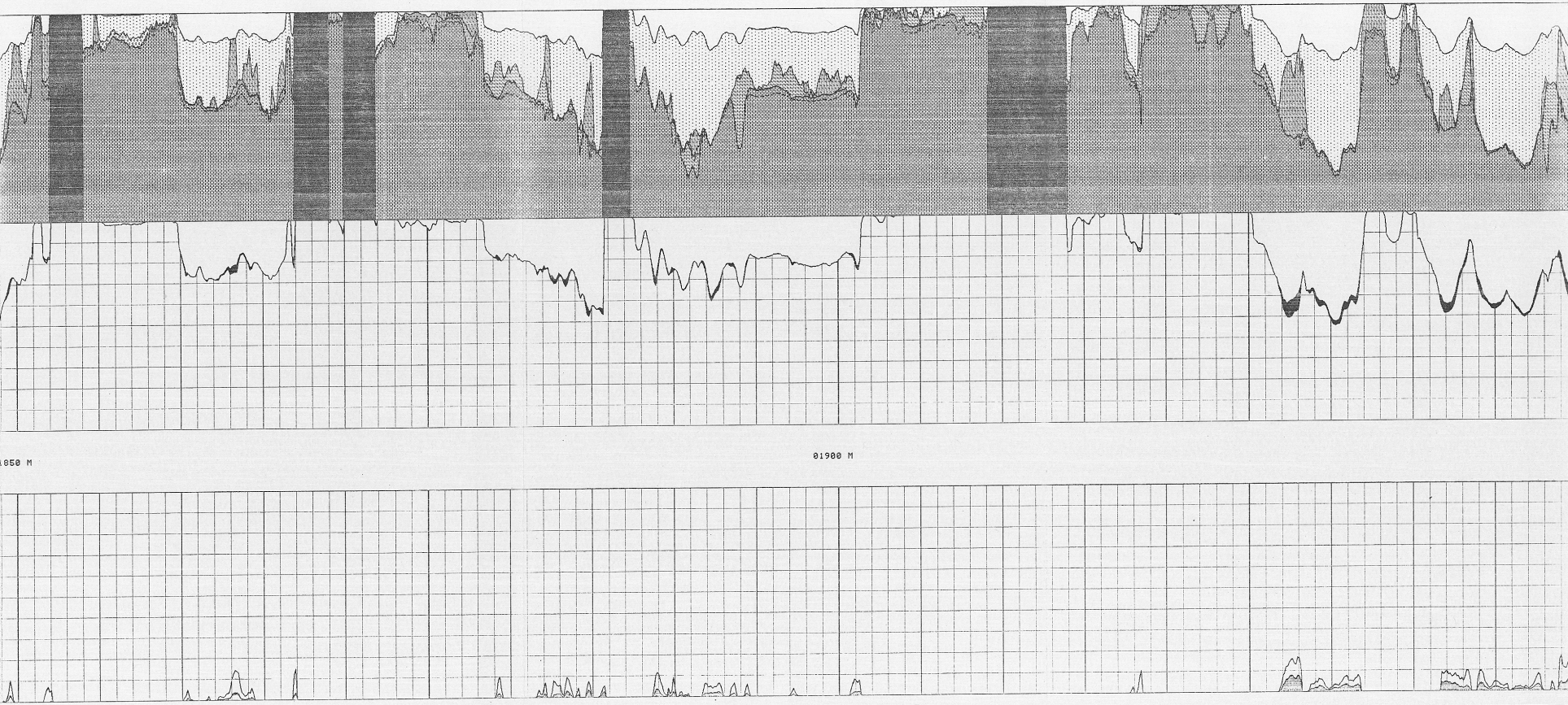

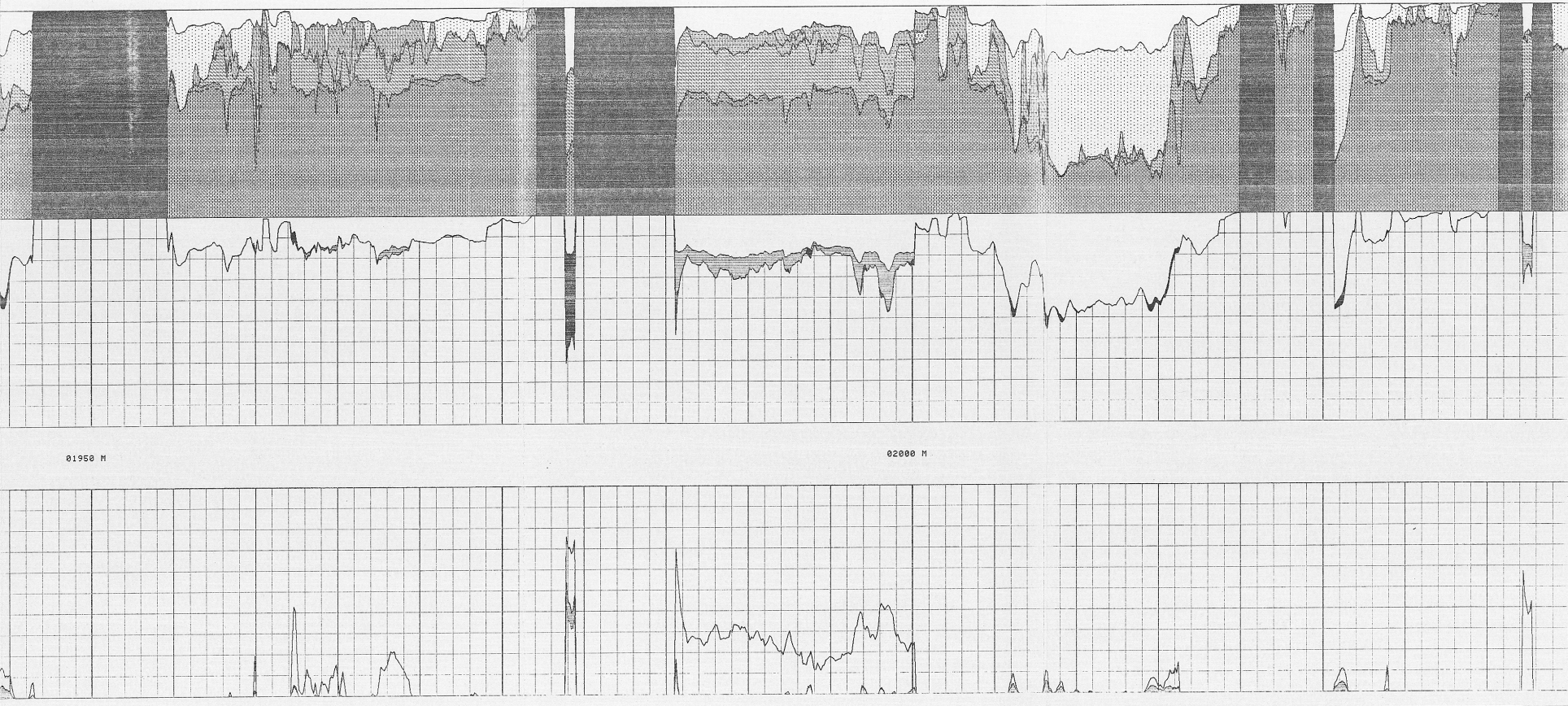

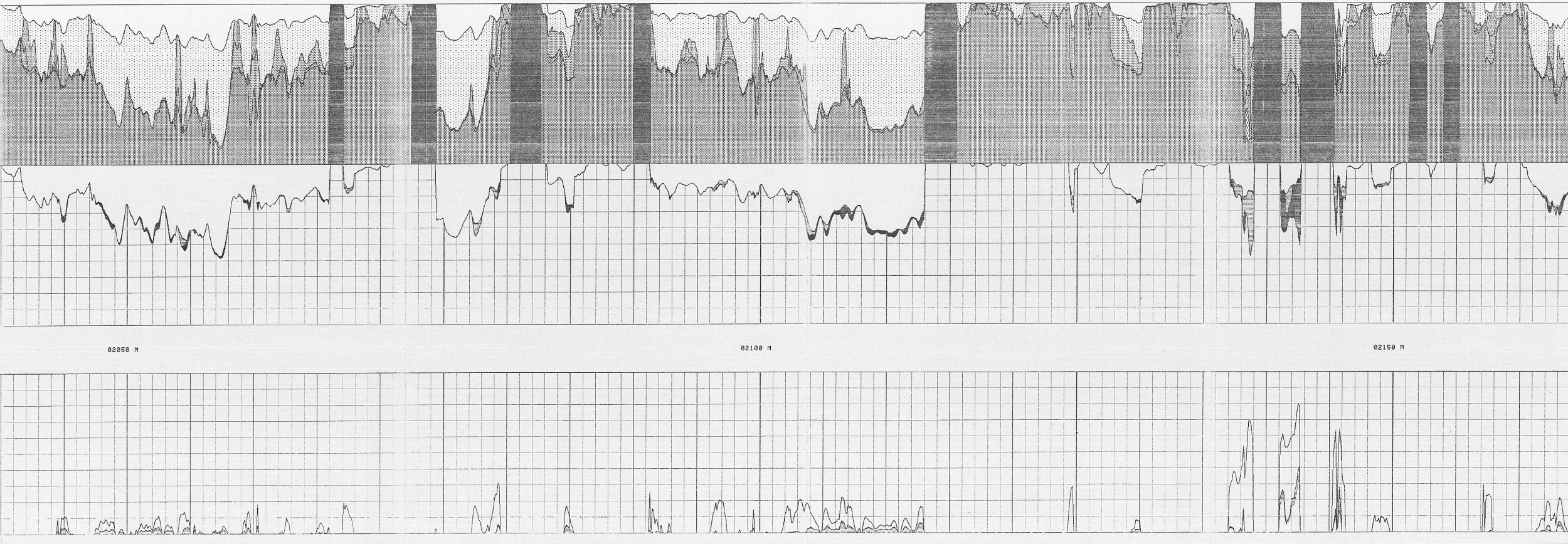

3 VSP

i) **VELOCITY LOG CALIBRATION REPORT**

291189

SAGASCO RESOURCES LTD.

WELL: FLINDERS-1

LOG CALIBRATION REPORT

Seismograph Service
A **Raytheon** Company

291190

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* Well Geophone Data Curve
* Time-Depth Curve
* Description of Shifts used in Velocity Log Calibration
* Log Calibration Curve
* Listing of Calibrated Velocity Log Data
* Sectional Display of Well Geophone Signals (MISSING)

SAGASCO RESOURCES LTD. **FLINDERS-1**

COMMENT

Well Geophone Survey

A static rig source check shot survey was conducted in the above well on 18th December, 1993 using a Bolt 1500C airgun source positioned 47m from the well head. The airgun was suspended 5m below MSL with a MP8D hydrophone placed 3.5m below MSL to monitor the airgun signature.

A total of 103 levels were recorded between 2705.0m and 350.0m below DF. In order to monitor the consistency of the depth measuring device, and to check for any cable stretch, shots were taken as the tool descended the borehole at 1000.0m, 2000.0m and 2500.0m. The tool was then lowered to 2705.0m and data was recorded at selected depths as the tool ascended the borehole.

The first arrival times for the repeated levels showed a small time discrepency of 2ms or less which confirms there were no depth errors during the course of the survey. The recorded well geophone data was generally of reasonable quality with well defined first arrival break, allowing the preliminary times to be obtained by timing from the first break on the gun hydrophone signal to the first break of the well geophone signal.

The 97 check levels within the depth of the velocity log were used for the log calibration, while 2 levels were used in calculating the velocity model above the sonic log.

For the calculation of reliable interval velocities check levels here been combined at an average of not less than 100.0m vertical depth intervals. Similarly only those levels used in the calculation of the interval velocities have been included in the sectional display.

Log Calibration

The sonic logs are generally well recorded.

The calibration curve is generally well controlled by the check level data. The shifts have been chosen according to changes in formation.

Processed by: **ALI ALMURTADHA**

Supervised by: **PETER HEKMEIJER**

FEBRUARY 1993.

291192

BOREHOLE SEISMIC SURVEY

FIELD REPORT

WELL: FLINDERS-1

SAGASCO RESOURCES LTD.

291193

Well Survey Division
Seismograph Service Limited

service order

Survey No. _____

Company: SAGASCO RESOURCES LT.D. / HALLIBURTON LOGGING SERVICES INC

Address: _____

has ordered a Well Velocity Survey in the well Name: FLINDERS - 1

Location: BASS BASIN (AUSTRALIA) Survey date: 18th DEC. 92

to be carried out in accordance with S.S.L.'s standard terms and conditions currently in force.

Survey type: STANDARD VSP Intermediate/Final FINAL

Special requirements: 25M Depth interval.

	Hour	Date
Equipment left base:		
Equipment arrived well site:		
Equipment departed well site:	CONTRACT	
Equipment returned base:	/	

	Hour	Date
Personnel left base:	1800	16-12-92
Personnel arrived well site:	1530	17-12-92
Personnel departed well site:	1220	19-12-92
Personnel returned base:	2300	20-12-92

Well available:	1120	18-12-92
Cable available:	1130	18-12-92
Tool in hole:	1140	18-12-92
Tool on cable:	1130	18-12-92
Tool out of hole:	2250	18-12-92
Tool off cable:	2300	18-12-92
Well finally released:	2300	18-12-92

Total well shutdown:	11HRS 40 MINS
Tool time on cable:	11 HRS 30 MINS
Time lost S.S.L. :	NIL
Time lost other causes:	NIL

Mileage: —

Deepest level shot: 2705 M Depth control type: PLS SYSTEM

No. of levels shot: 95 plus 8 check shots Status: OPERATION

Run No. 1 from 350 ft/m to 2705 ft/m Depth error −0.2 ft/m on pull out

Signed S.S.L. Engineer: _____ Date: 19-12-92

Accepted by Client Representative at well site: Date: 19-12-92

Name: D Roberts

Position: Chief Geophysicist

M.5406

FLINDERS-1 **Survey Report**

SAGASCO RESOURCES LTD.

Seismograph Service

Survey Date:	18TH DEC. 1992
Job Reference:	
Country:	AUSTRALIA
Well Location East:	145 40' 18.69"
Well Location North:	40 22' 51.81"
Rig Name:	OCEAN EPOCH
Rig Heading:	250 degrees
Survey Datum:	MSL
Well Reference Level:	DF
Reference Level Elevation:	22.3m above MSL
Water Velocity:	1524m/s
Well Deviation:	NO
Casing Details:	13 3/8" @403m 9 5/8" @ 1520M
Liner Details:	
Wireline Contractor:	H.L.S.
Observer:	HENG T.K. /TAN C.C.
Client Representative:	DOUG ROBERTS

Downhole Geophone 1:

Geophone Description:	GCH 100 3D
Geophone Serial No:	118
Geophone Pregain:	46 dB
Depth Offset from Zero:	0m

Surface Equipment:

Acquisition System:	PDAQ-1
Sample Interval:	1000 us
Geo Channel Record Length:	5000 samples
Ref Channel Record Length:	1000 samples
Aux Channel Record Length:	1000 samples
Channel 1:	Geo1 VZ
Channel 2:	Geo1 HX
Channel 3:	Geo1 HY
Channel 4:	Ref
Channel 5:	Off
Channel 6:	Off
Channel 7:	Off
Channel 8:	Off

Source 1: (Marine)

Observer:	
Source:	BOLT 1500C 140 CU. IN.
Monitor:	MP8D
Source Offset:	47m
Source Bearing:	340 degrees
Source Control System:	DAQ
External Delay:	0ms
Air Supply:	RIG AIR
Fire Control:	INTERNAL
Trip Source Channel:	4
Source Reference Channel:	4
Source Depth below Surface:	5m
Monitor Depth below Surface:	3.5m
Water Depth:	69.25m

FLINDERS-1 **Field Computations** **Source 1**

SAGASCO RESOURCES LTD.
Seismograph Service
Delta-t DAQSYS Release 5.05

Survey date: 18TH DEC. 1992

Reference level:	DF	Survey datum:	MSL
Ref. elevation:	22.3m	Source offset:	47.0m
Source depth:	5m	Monitor depth:	3.5m
Surface elevation:	0m	Water velocity:	1524m/s

MD = Geophone measured depth below DF
TVDSD = Geophone vertical depth below MSL
Tpick = Reference break to geophone break
Tt = Tpick + external reference delay(0ms) + source to monitor delay
SGO = Source to geophone lateral offset
Tv = Vertical time from source to geophone
Ts = Static correction from source to MSL
Tcorr = Vertical time from MSL to geophone (Tv+Ts)
Vave = Average velocity from MSL to geophone
Vint = Interval velocity between indicated depths

Level No	MD (m)	TVDSD (m)	Tpick (ms)	Tt (ms)	SGO (m)	Tv (ms)	Ts (ms)	Tcorr (ms)	Vave (m/s)	Vint (m/s)
* indicates a doubtful Tpick										
										1837
103	350.0	327.7	176.0	177.0	47.0	175.1	3.3	178.4	1837	------
102	375.0	352.7	187.0	188.0	47.0	186.3	3.3	189.6	1861	
										2244
101	400.0	377.7	198.0	199.0	47.0	197.4	3.3	200.7	1882	------
100	425.0	402.7	209.0	210.0	47.0	208.5	3.3	211.8	1901	
99	450.0	427.7	218.0	219.0	47.0	217.6	3.3	220.9	1936	
98	475.0	452.7	228.0	229.0	47.0	227.7	3.3	231.0	1960	
										2476
97	500.0	477.7	238.0	239.0	47.0	237.8	3.3	241.1	1981	------
96	525.0	502.7	248.0	249.0	47.0	247.9	3.3	251.2	2001	
95	550.0	527.7	257.0	258.0	47.0	256.9	3.3	260.2	2028	
94	575.0	552.7	266.0	267.0	47.0	266.0	3.3	269.3	2052	
										2548
93	600.0	577.7	277.0	278.0	47.0	277.1	3.3	280.3	2061	------
92	625.0	602.7	286.0	287.0	47.0	286.1	3.3	289.4	2083	
91	650.0	627.7	296.0	297.0	47.0	296.1	3.3	299.4	2096	
90	675.0	652.7	308.0	309.0	47.0	308.2	3.3	311.5	2096	
										2372
89	700.0	677.7	319.0	320.0	47.0	319.2	3.3	322.5	2101	------
88	725.0	702.7	329.0	330.0	47.0	329.2	3.3	332.5	2113	
87	750.0	727.7	340.0	341.0	47.0	340.3	3.3	343.5	2118	
86	775.0	752.7	351.0	352.0	47.0	351.3	3.3	354.6	2123	
										2320
85	800.0	777.7	362.0	363.0	47.0	362.3	3.3	365.6	2127	------
84	825.0	802.7	372.0	373.0	47.0	372.3	3.3	375.6	2137	
83	850.0	827.7	382.0	383.0	47.0	382.4	3.3	385.6	2146	
82	875.0	852.7	392.0	393.0	47.0	392.4	3.3	395.7	2155	
										2558
81	900.0	877.7	401.0	402.0	47.0	401.4	3.3	404.7	2169	------
80	925.0	902.7	412.0	413.0	47.0	412.4	3.3	415.7	2172	
79	950.0	927.7	421.0	422.0	47.0	421.4	3.3	424.7	2184	
78	975.0	952.7	430.0	431.0	47.0	430.5	3.3	433.7	2196	
										2496
77	1000.0	977.7	441.0	442.0	47.0	441.5	3.3	444.8	2198	------
1	1000.0	977.7	439.0*	440.0	47.0	439.5	3.3	442.8	2208	
76	1025.0	1002.7	453.0	454.0	47.0	453.5	3.3	456.8	2195	
75	1050.0	1027.7	465.0	466.0	47.0	465.5	3.3	468.8	2192	

FLINDERS-1 **Field Computations** **Source 1**

Level No	MD (m)	TVDSD (m)	Tpick (ms)	Tt (ms)	SGO (m)	Tv (ms)	Ts (ms)	Tcorr (ms)	Vave (m/s)	Vint (m/s)
* indicates a doubtful Tpick										
74	1075.0	1052.7	475.0	476.0	47.0	475.5	3.3	478.8	2199	
										2220
73	1100.0	1077.7	486.0	487.0	47.0	486.5	3.3	489.8	2200	------
72	1125.0	1102.7	498.0	499.0	47.0	498.5	3.3	501.8	2197	
71	1150.0	1127.7	509.0	510.0	47.0	509.5	3.3	512.8	2199	
70	1175.0	1152.7	520.0	521.0	47.0	520.5	3.3	523.8	2201	
										2271
69	1200.0	1177.7	530.0	531.0	47.0	530.6	3.3	533.8	2206	------
68	1225.0	1202.7	541.0	542.0	47.0	541.6	3.3	544.8	2207	
67	1250.0	1227.7	552.0	553.0	47.0	552.6	3.3	555.9	2209	
66	1275.0	1252.7	562.0	563.0	47.0	562.6	3.3	565.9	2214	
										2437
65	1300.0	1277.7	571.0	572.0	47.0	571.6	3.3	574.9	2223	------
64	1325.0	1302.7	580.0	581.0	47.0	580.6	3.3	583.9	2231	
63	1350.0	1327.7	590.0	591.0	47.0	590.6	3.3	593.9	2236	
62	1375.0	1352.7	599.0	600.0	47.0	599.6	3.3	602.9	2244	
										2629
61	1400.0	1377.7	609.0	610.0	47.0	609.6	3.3	612.9	2248	------
60	1425.0	1402.7	618.0	619.0	47.0	618.6	3.3	621.9	2255	
59	1432.0	1409.7	620.0	621.0	47.0	620.6	3.3	623.9	2259	
58	1450.0	1427.7	627.0	628.0	47.0	627.6	3.3	630.9	2263	
57	1475.0	1452.7	638.0	639.0	47.0	638.6	3.3	641.9	2263	
										2562
56	1500.0	1477.7	648.0	649.0	47.0	648.7	3.3	651.9	2267	------
55	1525.0	1502.7	660.0	661.0	47.0	660.7	3.3	663.9	2263	
54	1546.0	1523.7	669.0	670.0	47.0	669.7	3.3	672.9	2264	
53	1550.0	1527.7	671.0	672.0	47.0	671.7	3.3	674.9	2263	
52	1575.0	1552.7	678.0	679.0	47.0	678.7	3.3	682.0	2277	
										2499
51	1600.0	1577.7	688.0	689.0	47.0	688.7	3.3	692.0	2280	------
50	1625.0	1602.7	696.0	697.0	47.0	696.7	3.3	700.0	2290	
49	1650.0	1627.7	706.0	707.0	47.0	706.7	3.3	710.0	2293	
48	1675.0	1652.7	713.0	714.0	47.0	713.7	3.3	717.0	2305	
										3028
47	1700.0	1677.7	721.0	722.0	47.0	721.7	3.3	725.0	2314	------
46	1725.0	1702.7	729.0	730.0	47.0	729.7	3.3	733.0	2323	
45	1750.0	1727.7	737.0	738.0	47.0	737.7	3.3	741.0	2332	
44	1775.0	1752.7	747.0	748.0	47.0	747.7	3.3	751.0	2334	
										3029
43	1800.0	1777.7	754.0	755.0	47.0	754.7	3.3	758.0	2345	------
42	1825.0	1802.7	764.0	765.0	47.0	764.7	3.3	768.0	2347	
41	1850.0	1827.7	771.0	772.0	47.0	771.7	3.3	775.0	2358	
40	1875.0	1852.7	779.0	780.0	47.0	779.7	3.3	783.0	2366	
										2940
39	1900.0	1877.7	788.0	789.0	47.0	788.7	3.3	792.0	2371	------
38	1925.0	1902.7	796.0	797.0	47.0	796.7	3.3	800.0	2378	
37	1950.0	1927.7	802.0	803.0	47.0	802.7	3.3	806.0	2392	
36	1975.0	1952.7	811.0	812.0	47.0	811.7	3.3	815.0	2396	
										3123
35	2000.0	1977.7	820.0	821.0	47.0	820.8	3.3	824.0	2400	------
2	2000.0	1977.7	819.0*	820.0	47.0	819.8	3.3	823.0	2403	
34	2025.0	2002.7	827.0	828.0	47.0	827.8	3.3	831.0	2410	
33	2050.0	2027.7	837.0	838.0	47.0	837.8	3.3	841.0	2411	
32	2075.0	2052.7	844.0	845.0	47.0	844.8	3.3	848.0	2421	
										3029
31	2100.0	2077.7	853.0	854.0	47.0	853.8	3.3	857.0	2424	------
30	2125.0	2102.7	861.0	862.0	47.0	861.8	3.3	865.0	2431	
29	2142.0	2119.7	866.0	867.0	47.0	866.8	3.3	870.1	2436	
28	2150.0	2127.7	868.0	869.0	47.0	868.8	3.3	872.1	2440	
27	2175.0	2152.7	877.0	878.0	47.0	877.8	3.3	881.1	2443	

291198

FLINDERS-1 **Field Computations** **Source 1**

Level No	MD (m)	TVDSD (m)	Tpick (ms)	Tt (ms)	SGO (m)	Tv (ms)	Ts (ms)	Tcorr (ms)	Vave (m/s)	Vint (m/s)
* indicates a doubtful Tpick										
										3332
26	2200.0	2177.7	883.0	884.0	47.0	883.8	3.3	887.1	2455	------
25	2207.0	2184.7	884.0	885.0	47.0	884.8	3.3	888.1	2460	
24	2225.0	2202.7	887.0	888.0	47.0	887.8	3.3	891.1	2472	
23	2250.0	2227.7	892.0	893.0	47.0	892.8	3.3	896.1	2486	
21	2272.0	2249.7	897.0	898.0	47.0	897.8	3.3	901.1	2497	
22	2275.0	2252.7	897.0	898.0	47.0	897.8	3.3	901.1	2500	
										4543
20	2300.0	2277.7	905.0	906.0	47.0	905.8	3.3	909.1	2506	------
19	2325.0	2302.7	913.0	914.0	47.0	913.8	3.3	917.1	2511	
18	2350.0	2327.7	919.0	920.0	47.0	919.8	3.3	923.1	2522	
17	2375.0	2352.7	929.0	930.0	47.0	929.8	3.3	933.1	2521	
										3124
16	2400.0	2377.7	937.0	938.0	47.0	937.8	3.3	941.1	2527	------
15	2425.0	2402.7	944.0	945.0	47.0	944.8	3.3	948.1	2534	
14	2450.0	2427.7	951.0	952.0	47.0	951.8	3.3	955.1	2542	
13	2475.0	2452.7	958.0	959.0	47.0	958.8	3.3	962.1	2549	
										3570
12	2500.0	2477.7	965.0	966.0	47.0	965.8	3.3	969.1	2557	------
3	2500.0	2477.7	965.0	966.0	47.0	965.8	3.3	969.1	2557	
11	2525.0	2502.7	976.0	977.0	47.0	976.8	3.3	980.1	2554	
10	2550.0	2527.7	982.0	983.0	47.0	982.8	3.3	986.1	2563	
9	2575.0	2552.7	985.0	986.0	47.0	985.8	3.3	989.1	2581	
										3570
8	2600.0	2577.7	993.0	994.0	47.0	993.8	3.3	997.1	2585	------
7	2625.0	2602.7	1001.0	1002.0	47.0	1001.8	3.3	1005.1	2589	
6	2650.0	2627.7	1008.0	1009.0	47.0	1008.8	3.3	1012.1	2596	
5	2675.0	2652.7	1015.0	1016.0	47.0	1015.8	3.3	1019.1	2603	
										3280
4	2705.0	2682.7	1025.0	1026.0	47.0	1025.8	3.3	1029.1	2607	------

(35)

291199

DAQ INSTRUMENT TEST

Seismograph Service

Delta-t ITEST Release 5.05

Date recorded: 19:12:1992

Time recorded: 01:54

Summary of results:

Chan No	Calib Error	Pregain Error	Distortion 0dB	Distortion -24dB	Delay 30Hz	Dynamic Range	DC Offset	Chan Status
1:	0.03%	0.04%	0.03%	0.05%	2.3ms	112dB	10uV	PASS
2:	0.03%	0.12%	0.02%	0.05%	2.3ms	114dB	-1uV	PASS
3:	0.00%	0.02%	0.03%	0.05%	2.3ms	111dB	6uV	PASS
4:	0.03%	0.08%	0.04%	0.05%	2.3ms	113dB	2uV	PASS
5:	0.05%	0.11%	0.04%	0.04%	2.3ms	113dB	5uV	PASS
6:	0.01%	0.17%	0.02%	0.05%	2.3ms	114dB	8uV	PASS
7:	0.02%	0.04%	0.02%	0.05%	2.3ms	112dB	-1uV	PASS
8:	0.04%	0.14%	0.02%	0.05%	2.3ms	112dB	-8uV	PASS

Specifications:

Gain Calibration error : less than 0.1%
Pregain Calibration error : less than 0.2%
Total Harmonic Distortion : better than 0.07%
Channel Delay at 30Hz : 2.3ms within 0.1ms
Dynamic Range : greater than 102dB
DC offset : less than 100uV

Note: DC offset is self calibrating..

291200

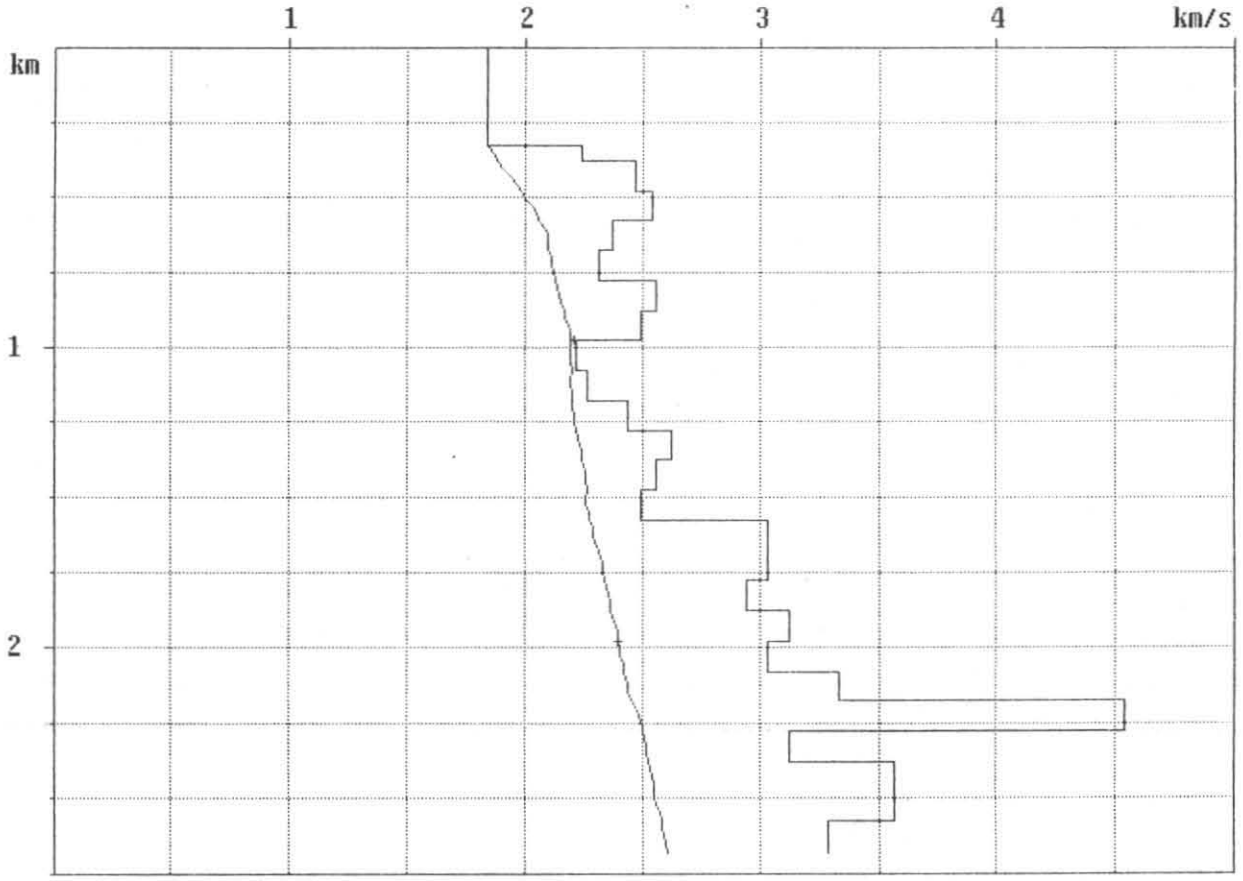
FLINDERS-1 **Field Computations** **Source 1**

SAGASCO RESOURCES LTD.
Seismograph Service
Delta-t DAQSYS Release 5.05

Survey date: 18TH DEC. 1992

Reference level:	DF	Survey datum:	MSL
Ref. elevation:	22.3m	Source offset:	47.0m
Source depth:	5m	Monitor depth:	3.5m
Surface elevation:	0m	Water velocity:	1524m/s

AVERAGE and INTERVAL VELOCITY / DEPTH



Depths and times are vertical below datum of MSL
Velocities are calculated from vertical depths and times below datum of MSL

5 cm

291201

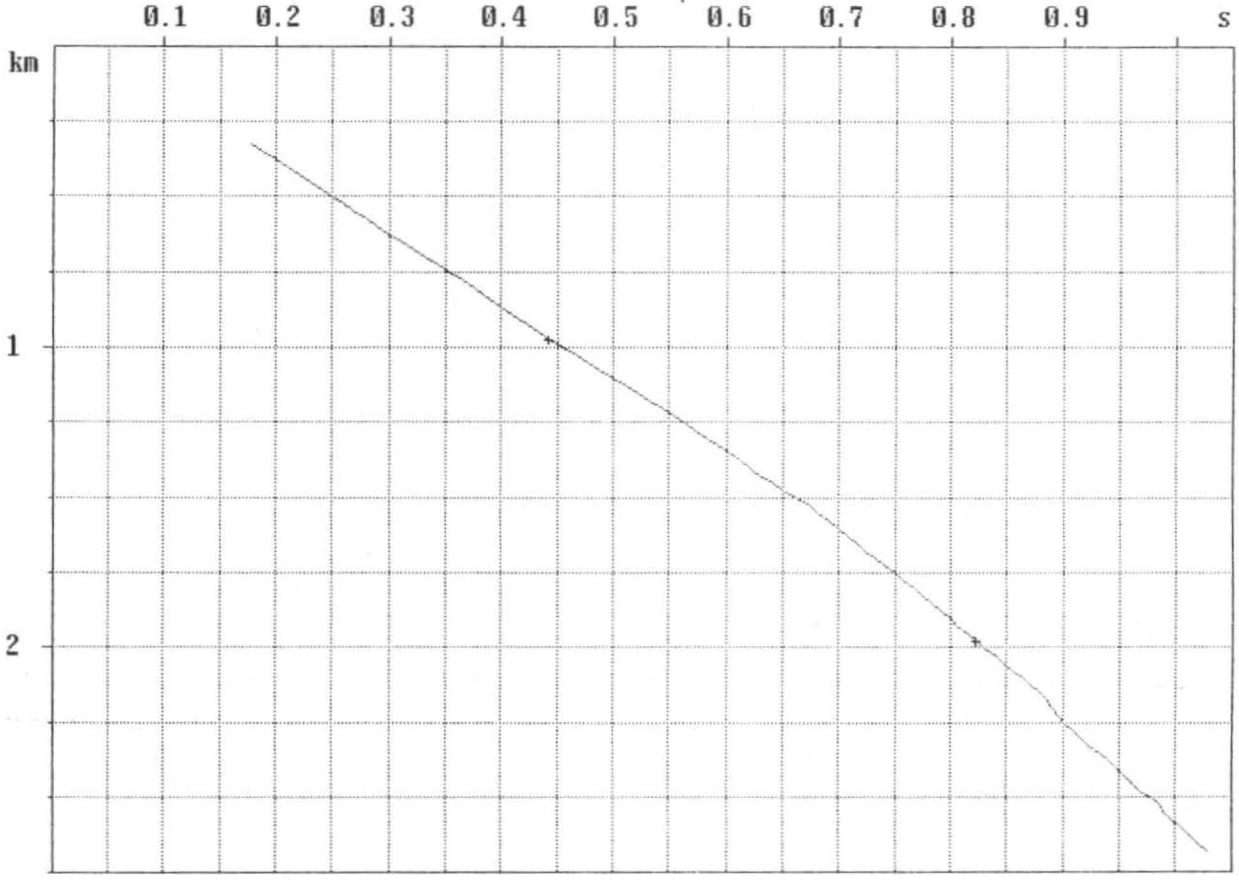
FLINDERS-1 **Field Computations** **Source 1**

SAGASCO RESOURCES LTD.
Seismograph Service
Delta-t DAQSYS Release 5.05

Survey date: 18TH DEC. 1992

Reference level:	DF	Survey datum:	MSL
Ref. elevation:	22.3m	Source offset:	47.0m
Source depth:	5m	Monitor depth:	3.5m
Surface elevation:	0m	Water velocity:	1524m/s

TIME / DEPTH



Depths and times are vertical below datum of MSL

5 cm

291202

FLINDERS-1 Filtered Stack (Source 1) Phase 1

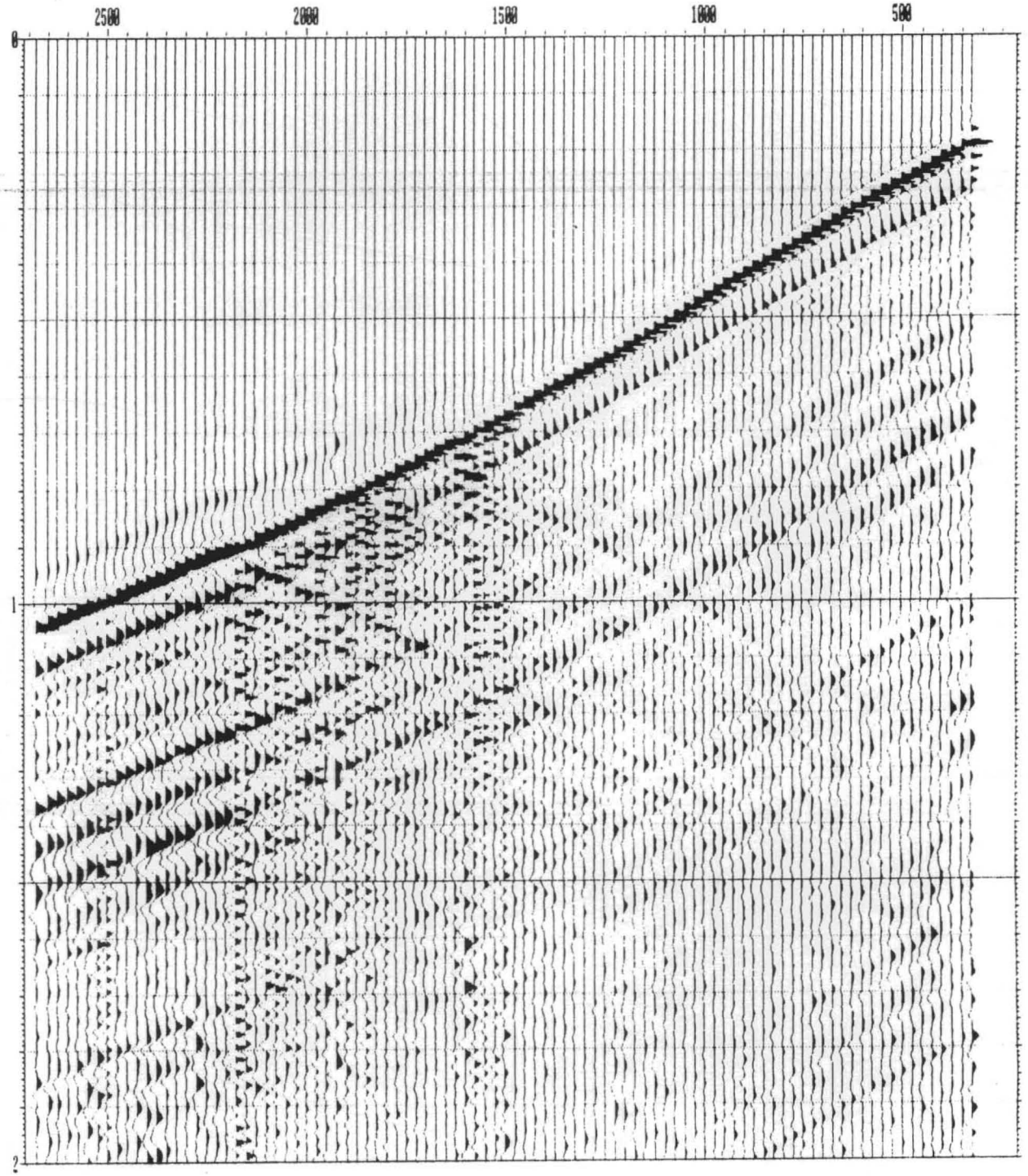
SAGASCO RESOURCES LTD.
Seismograph Service
Delta-t RIGPRO Release 5.05
19/12/1992 02:08

Designature: 500ms window
Filter: 5,10,80,100Hz
Amplitude recovery: t(1.3)

Plot polarity: SEG normal
Plot filter: 5,10,40,60Hz

Line scale: 3.75in/s
One-way time from MSL

Depth scale: 1:15000
Depth m below MSL



5 cm

291203

5 cm

FLINDERS-1 Upwave (Source 1) Phase 5

SAGASCO RESOURCES LTD.

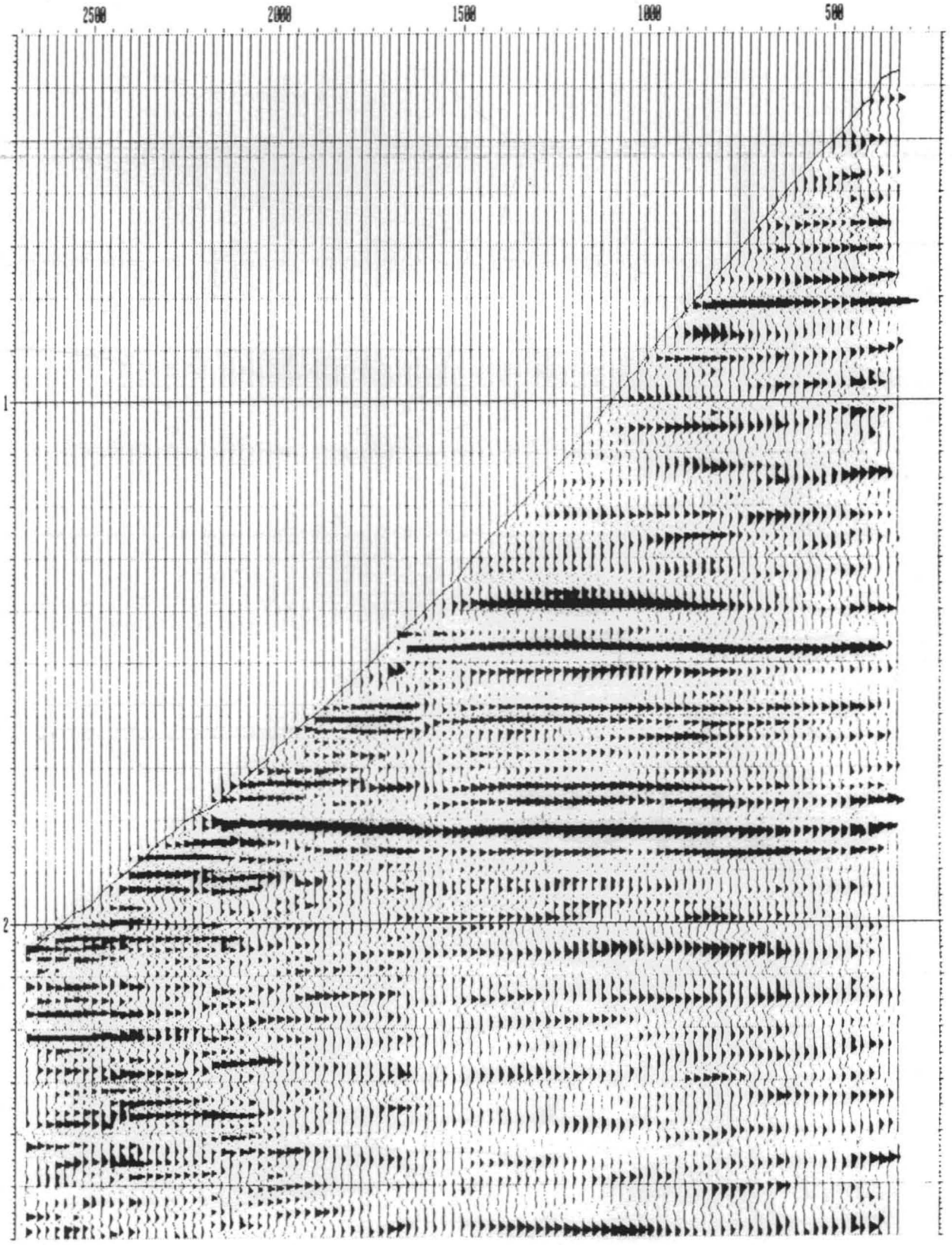
Seismograph Service
Delta-t RIGPRO Release 5.05
19/12/1992 03:15

Designature: 500ms window
Filter: 5,10,80,100Hz
Amplitude recovery: t(1.3)
Downwave median: 9:1
Multiple suppression: 600ms window
Tracking filter median: 9:1
Search: -4,2 Accept: -2,0 ms

Plot polarity: SEG normal
Plot filter: 5,10,40,60Hz

Line scale: 3.75in/s
Two-way time from MSL

Depth scale: 1:15000
Depth m below MSL



291204

5 cm

FLINDERS-1 Upwave (Source 1) Phase 5

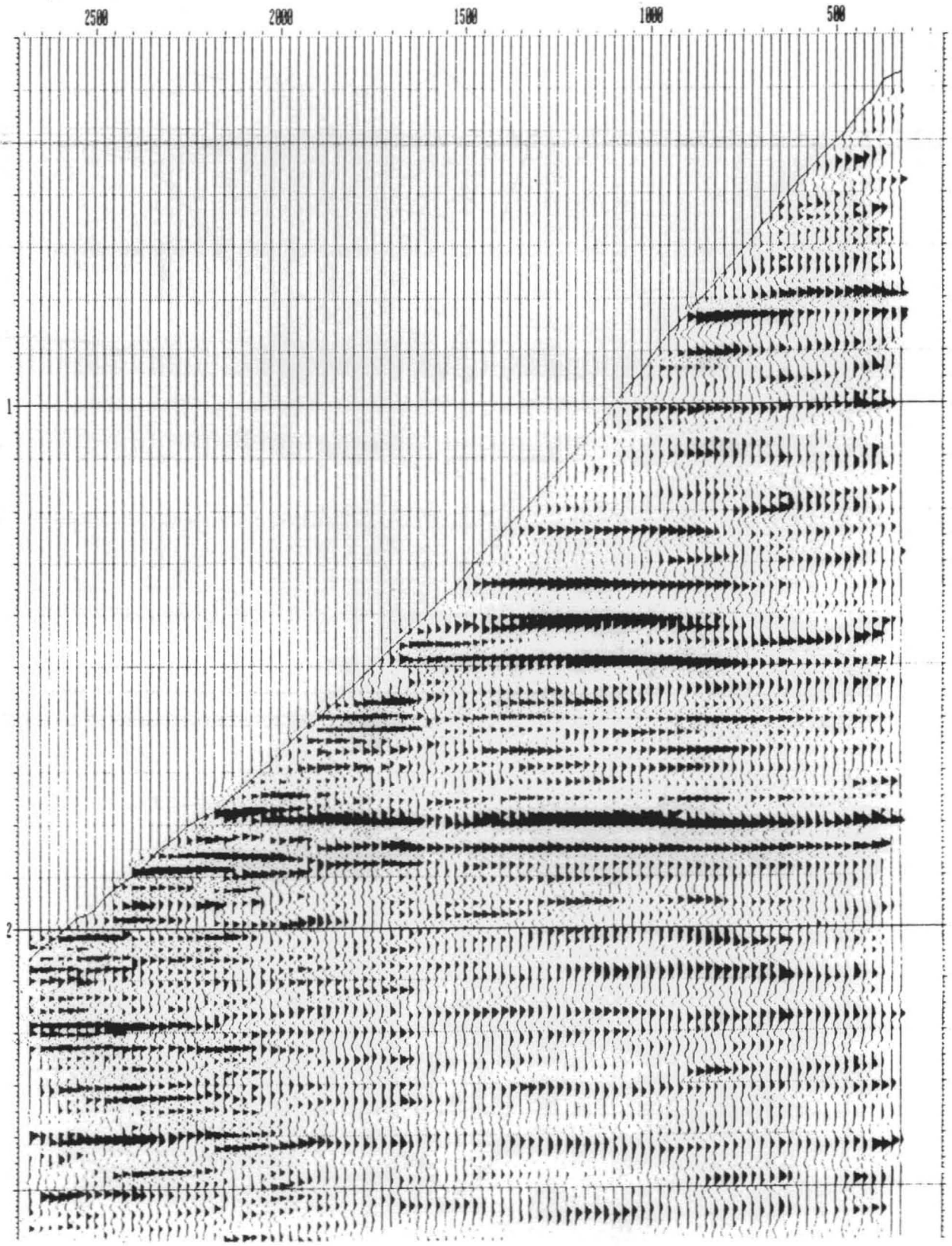
SAGASCO RESOURCES LTD.
Seismograph Service
Delta-t RIGPRO Release 5.05
19/12/1992 03:24

Designature: 500ms window
Filter: 5,10,80,100Hz
Amplitude recovery: t(1.3)
Downwave median: 9:1
Multiple suppression: 600ms window
Tracking filter median: 9:1
Search: -4,2 Accept: -2,0 ms

Plot polarity: SEG reverse
Plot filter: 5,10,40,60Hz

Time scale: 3.75in/s
Two-way time from MSL

Depth scale: 1:15000
Depth m below MSL



5 cm

291205

FLINDERS-1 — **Trace Inversion (Source 1)** — **Phase 7**

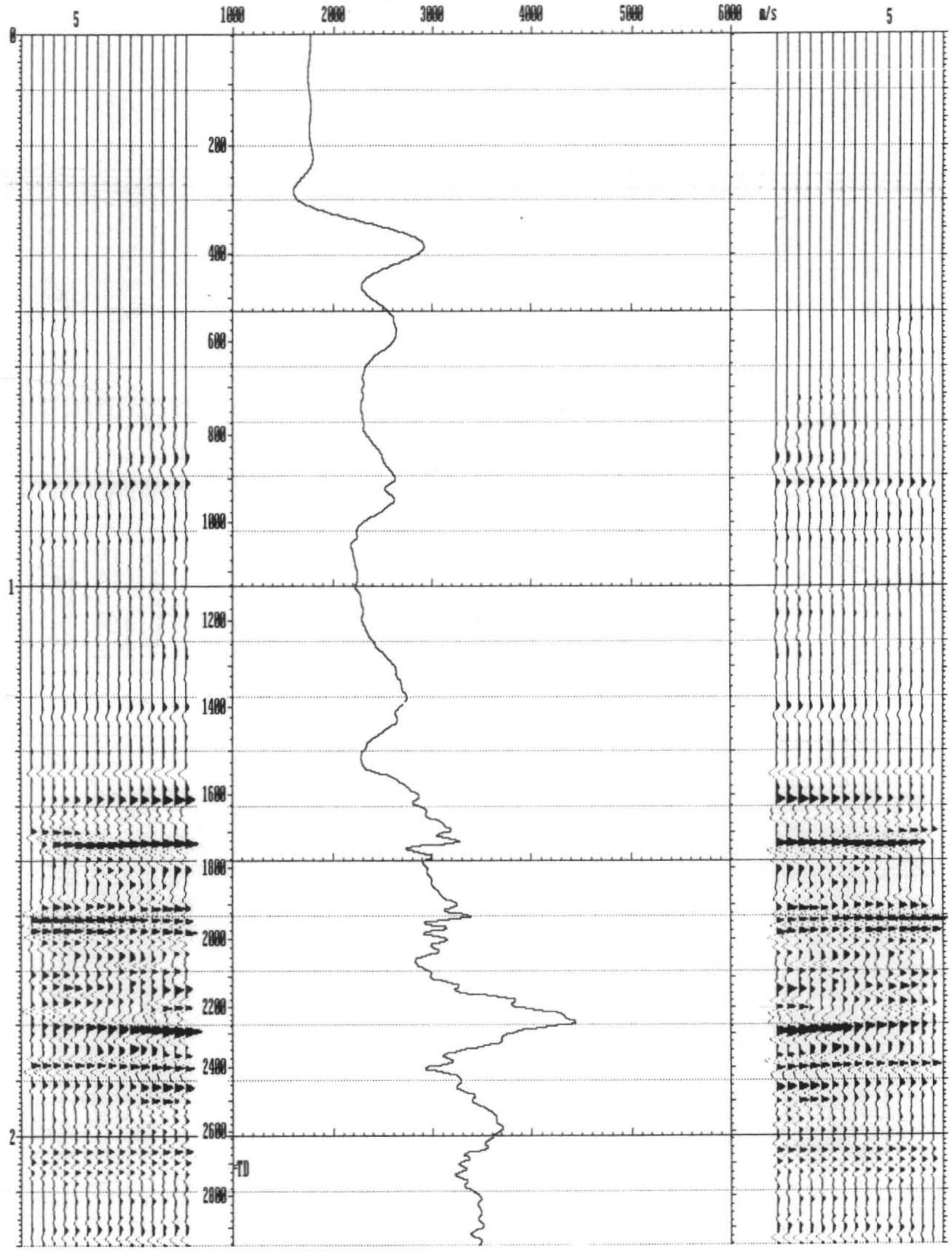
SAGASCO RESOURCES LTD.
Seismograph Service
Delta-t INVERT Release 5.05
19/12/1992 05:28

Designature: 500ms window
Filter: 5,10,80,100Hz
Amplitude recovery: t(1.3)
Downwave median: 9:1
Multiple suppression: 600ms window
Tracking filter median: 9:1
Search: 0,0 Accept: 0,0 ms
Inversion filter: 5,10,50,70Hz

Plot polarity: SEG normal
Plot filter: 5,10,50,70Hz

Time scale: 10.00cm/s
Two-way time from MSL

Depth m below DF



5 cm

291206

FLINDERS-1 Trace Inversion (Source 1) Phase 7

SAGASCO RESOURCES LTD.

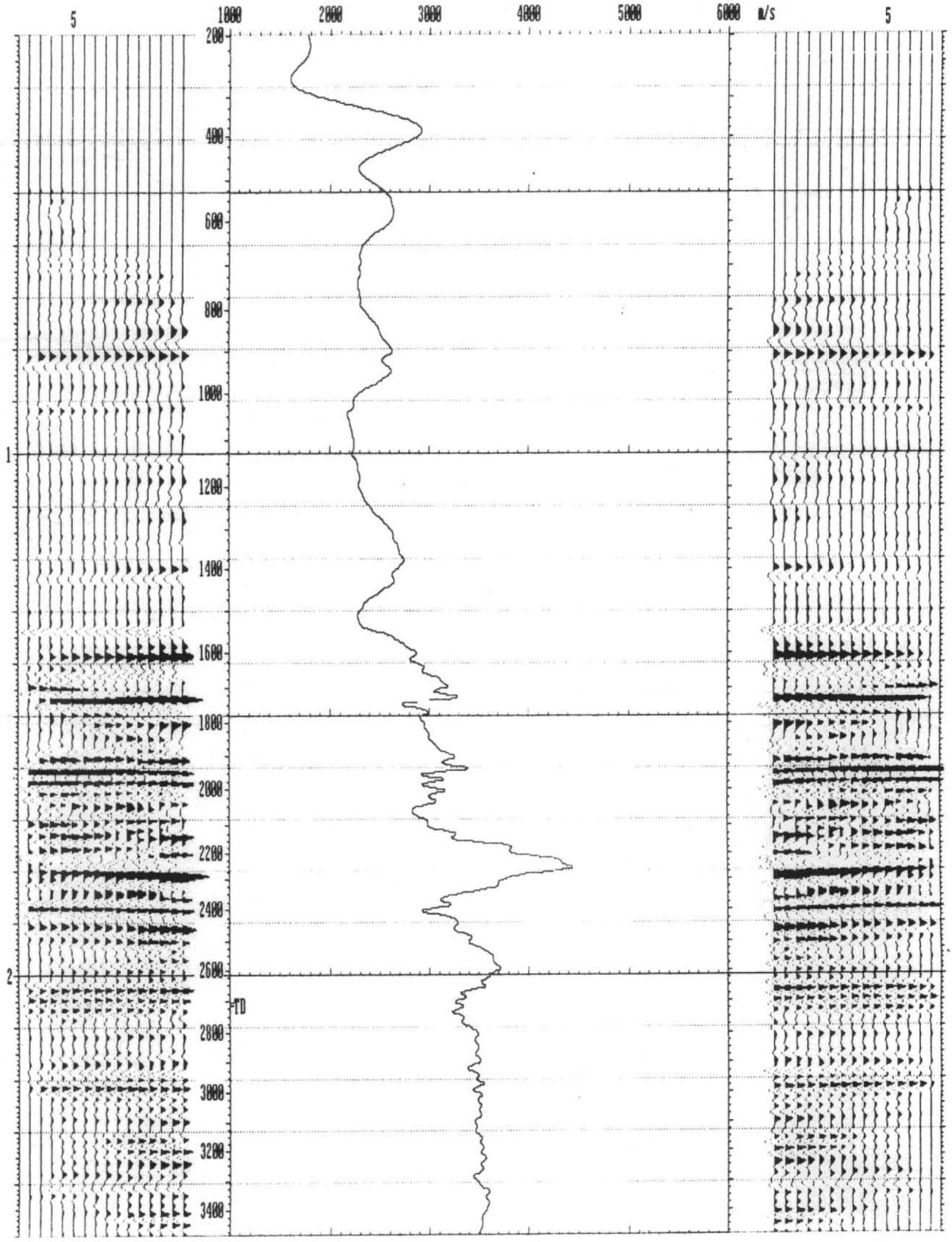
Seismograph Service
Delta-t INVERT Release 5.05
19/12/1992 05:39

Designature: 500ms window
Filter: 5,10,80,100Hz
Amplitude recovery: t(1.3)
Downwave median: 9:1
Multiple suppression: 600ms window
Tracking filter median: 9:1
Search: 0,0 Accept: 0,0 ms
Inversion filter: 5,10,50,70Hz

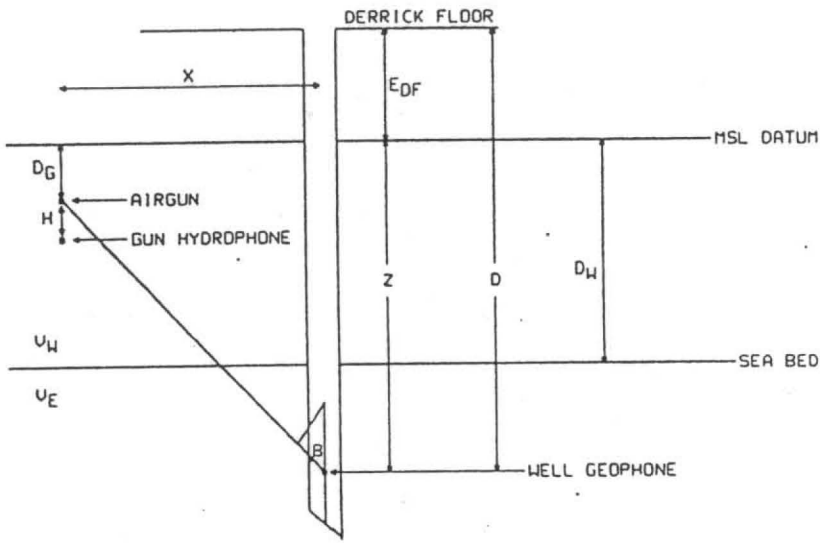
Plot polarity: SEG normal
Plot filter: 5,10,50,70Hz

Time scale: 3.75in/s
Two-way time from MSL

Depth m below DF



SCHEMATIC CROSS-SECTION



KEY

DF - DERRICK FLOOR

E_{DF} - ELEVATION OF DF ABOVE DATUM

D' - MEASURED DEPTH OF WELL GEOPHONE BELOW DF

D - VERTICAL DEPTH OF WELL GEOPHONE BELOW DF

Z - VERTICAL DEPTH OF WELL GEOPHONE BELOW DATUM

D_G - DEPTH OF GUN BELOW M.S.L.

H - DISTANCE BETWEEN GUN AND GUN HYDROPHONE

X - HORIZONTAL DISTANCE BETWEEN WELL GEOPHONE AND GUN

β - INCIDENT ANGLE AT WELL GEOPHONE LEVELS

T - TRAVEL-TIME FROM GUN HYDROPHONE TO WELL GEOPHONE

T_U - TIME FROM GUN TO WELL GEOPHONE CORRECTED TO VERTICAL
(1) BY ASSUMING STRAIGHT LINE TRAVEL PATHS $\left[\left[1 + \frac{H}{V_W}\right]\cos\beta\right]$

OR (2) BY ESTIMATING THE TRUE REFRACTED TRAVEL PATHS

T_E - TIME CORRECTION FROM GUN TO DATUM $\left[= \frac{\text{GUN DEPTH}}{V_W}\right]$

T_C - CORRECTED TRAVEL-TIME BETWEEN DATUM AND WELL GEOPHONE = $T_U + T_E$

V_A - Z/T_C (AVERAGE VELOCITY)

V_I - $\Delta Z/\Delta T_C$ (INTERVAL VELOCITY)

D_W - DEPTH OF WATER

V_W - WATER VELOCITY

V_E - ELEVATION VELOCITY

291207

SEISMOGRAPH SERVICE (ENGLAND) LTD.

BOREHOLE GEOPHYSICS DIVISION

COMPANY: SAGASCO RESOURCES LIMITED

WELL: FLINDERS-1 EDF= 22.3 M DF= 22.3 M AMSL GUN DEPTH 5.0 M

AIRGUN COMPUTATION VW= 1524 M/S ED= MSL GUN HYDROPHONE DEPTH 3.5 M

GUN OFFSET 47.0 M

RIG SOURCE SURVEY

T IS THE TIME MEASURED FROM THE FIRST BREAK ON THE GUN HYDROPHONE SIGNAL TO THE FIRST BREAK ON THE WELL GEOPHONE SIGNAL.

A TIME CORRECTION FOR THE DISTANCE BETWEEN THE GUN AND GUN HYDROPHONE AT WATER VELOCITY IS ADDED TO T BEFORE CORRECTION TO THE VERTICAL

TV IS THE TIME FROM THE GUN TO THE WELL GEOPHONE CORRECTED TO THE VERTICAL.

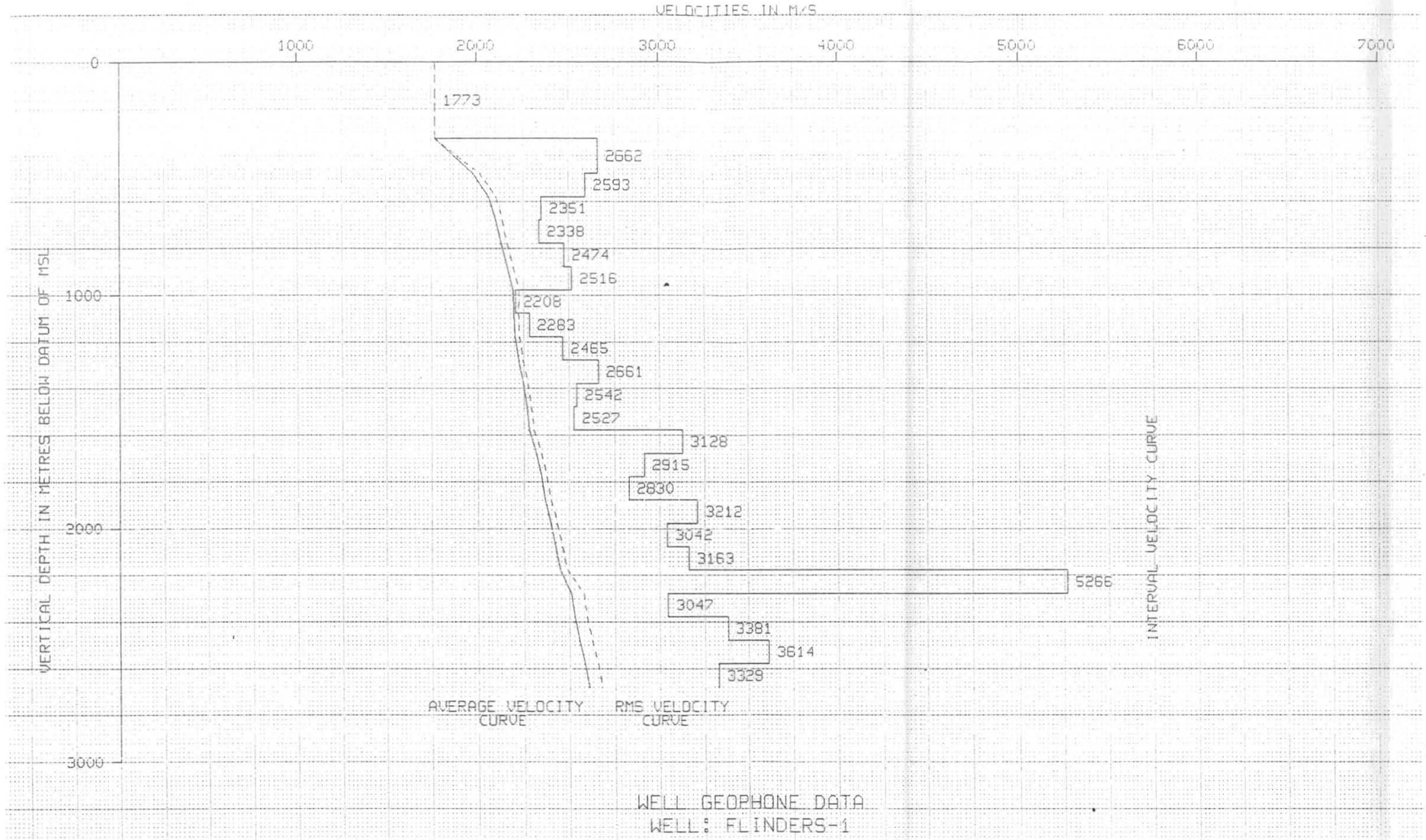
TE = GUN DEPTH/VW

RECORD NO	D' M	D M	L M	X M	T S	TV S	TE S	TC S	AVERAGE VELOCITY M/S	INTERVAL DEPTH M	INTERVAL TIME S	INTERVAL VELOCITY M/S
100	350.0	350.0	327.7	47.0	0.1824	0.1815	0.0033	0.1848	1773			
99	375.0	375.0	352.7	47.0	0.1892	0.1885	0.0033	0.1918	1839			
98	400.0	400.0	377.7	47.0	0.2010	0.2004	0.0033	0.2037	1854			
97	425.0	425.0	402.7	47.0	0.2086	0.2082	0.0033	0.2115	1904			
96	450.0	450.0	427.7	47.0	0.2179	0.2175	0.0033	0.2208	1937			
95	475.0	475.0	452.7	47.0	0.2284	0.2281	0.0033	0.2314	1957			
										150.0	0.0564	2662
94	500.0	500.0	477.7	47.0	0.2380	0.2378	0.0033	0.2411	1981			
93	525.0	525.0	502.7	47.0	0.2472	0.2471	0.0033	0.2504	2008			
92	550.0	550.0	527.7	47.0	0.2565	0.2565	0.0033	0.2598	2031			
91	575.0	575.0	552.7	47.0	0.2659	0.2659	0.0033	0.2692	2053			
										100.0	0.0386	2593
90	600.0	600.0	577.7	47.0	0.2764	0.2764	0.0033	0.2797	2065			
89	625.0	625.0	602.7	47.0	0.2867	0.2868	0.0033	0.2901	2078			
88	650.0	650.0	627.7	47.0	0.2973	0.2974	0.0033	0.3007	2087			
87	675.0	675.0	652.7	47.0	0.3079	0.3081	0.0033	0.3114	2096			

								100.0	0.0425	2351
86	700.0	700.0	677.7	47.0	0.3187	0.3189	0.0033	0.3222	2103
85	725.0	725.0	702.7	47.0	0.3293	0.3296	0.0033	0.3329	2111
84	750.0	750.0	727.7	47.0	0.3404	0.3406	0.0033	0.3439	2116
83	775.0	775.0	752.7	47.0	0.3509	0.3512	0.0033	0.3545	2123
								100.0	0.0428	2338
82	800.0	800.0	777.7	47.0	0.3614	0.3617	0.0033	0.3650	2131
81	825.0	825.0	802.7	47.0	0.3716	0.3719	0.0033	0.3752	2139
80	850.0	850.0	827.7	47.0	0.3819	0.3823	0.0033	0.3856	2147
79	875.0	875.0	852.7	47.0	0.3919	0.3923	0.0033	0.3956	2155
								100.0	0.0404	2474
78	900.0	900.0	877.7	47.0	0.4017	0.4021	0.0033	0.4054	2165
77	925.0	925.0	902.7	47.0	0.4115	0.4119	0.0033	0.4152	2174
76	950.0	950.0	927.7	47.0	0.4211	0.4215	0.0033	0.4248	2184
75	975.0	975.0	952.7	47.0	0.4306	0.4311	0.0033	0.4344	2193
								100.0	0.0397	2516
74	1000.0	1000.0	977.7	47.0	0.4414	0.4419	0.0033	0.4452	2196
73	1025.0	1025.0	1002.7	47.0	0.4526	0.4530	0.0033	0.4563	2197
72	1050.0	1050.0	1027.7	47.0	0.4637	0.4642	0.0033	0.4675	2198
71	1075.0	1075.0	1052.7	47.0	0.4752	0.4757	0.0033	0.4790	2198
								100.0	0.0453	2208
70	1100.0	1100.0	1077.7	47.0	0.4867	0.4872	0.0033	0.4905	2197
69	1125.0	1125.0	1102.7	47.0	0.4981	0.4986	0.0033	0.5019	2197
68	1150.0	1150.0	1127.7	47.0	0.5091	0.5097	0.0033	0.5130	2198
67	1175.0	1175.0	1152.7	47.0	0.5196	0.5202	0.0033	0.5235	2202
								100.0	0.0438	2283
66	1200.0	1200.0	1177.7	47.0	0.5304	0.5310	0.0033	0.5343	2204
65	1225.0	1225.0	1202.7	47.0	0.5410	0.5416	0.0033	0.5449	2207
64	1250.0	1250.0	1227.7	47.0	0.5513	0.5518	0.0033	0.5551	2212
63	1275.0	1275.0	1252.7	47.0	0.5614	0.5619	0.0033	0.5652	2216
								100.0	0.0406	2465
62	1300.0	1300.0	1277.7	47.0	0.5709	0.5715	0.0033	0.5748	2223
61	1325.0	1325.0	1302.7	47.0	0.5802	0.5808	0.0033	0.5841	2230
60	1350.0	1350.0	1327.7	47.0	0.5895	0.5902	0.0033	0.5935	2237
59	1375.0	1375.0	1352.7	47.0	0.5991	0.5998	0.0033	0.6031	2243
								100.0	0.0376	2661
58	1400.0	1400.0	1377.7	47.0	0.6085	0.6091	0.0033	0.6124	2250
57	1425.0	1425.0	1402.7	47.0	0.6179	0.6185	0.0033	0.6218	2256
56	1432.0	1432.0	1409.7	47.0	0.6202	0.6208	0.0033	0.6241	2259
55	1450.0	1450.0	1427.7	47.0	0.6271	0.6278	0.0033	0.6311	2262
54	1475.0	1475.0	1452.7	47.0	0.6375	0.6382	0.0033	0.6415	2265
								100.0	0.0393	2542
53	1500.0	1500.0	1477.7	47.0	0.6478	0.6484	0.0033	0.6517	2267
52	1525.0	1525.0	1502.7	47.0	0.6600	0.6607	0.0033	0.6640	2263
51	1546.0	1546.0	1523.7	47.0	0.6679	0.6686	0.0033	0.6719	2268
50	1550.0	1550.0	1527.7	47.0	0.6696	0.6703	0.0033	0.6736	2268
49	1575.0	1575.0	1552.7	47.0	0.6789	0.6796	0.0033	0.6829	2274
								100.0	0.0396	2527
48	1600.0	1600.0	1577.7	47.0	0.6873	0.6880	0.0033	0.6913	2282
47	1625.0	1625.0	1602.7	47.0	0.6960	0.6967	0.0033	0.7000	2290
46	1650.0	1650.0	1627.7	47.0	0.7064	0.7071	0.0033	0.7104	2291
45	1675.0	1675.0	1652.7	47.0	0.7123	0.7130	0.0033	0.7163	2307
								100.0	0.0320	3128
44	1700.0	1700.0	1677.7	47.0	0.7193	0.7200	0.0033	0.7233	2320
43	1725.0	1725.0	1702.7	47.0	0.7286	0.7293	0.0033	0.7326	2324
42	1750.0	1750.0	1727.7	47.0	0.7367	0.7374	0.0033	0.7407	2332
41	1775.0	1775.0	1752.7	47.0	0.7472	0.7479	0.0033	0.7512	2333
								100.0	0.0343	2915

40	1800.0	1800.0	1777.7	47.0	0.7536	0.7543	0.0033	0.7576	2347			
39	1825.0	1825.0	1802.7	47.0	0.7640	0.7648	0.0033	0.7681	2347			
38	1850.0	1850.0	1827.7	47.0	0.7707	0.7714	0.0033	0.7747	2359			
	1875.0	1875.0	1852.7	47.0	0.7802	0.7809	0.0033	0.7842	2363			
										100.0	0.0353	2830
36	1900.0	1900.0	1877.7	47.0	0.7889	0.7896	0.0033	0.7929	2368			
35	1925.0	1925.0	1902.7	47.0	0.7960	0.7967	0.0033	0.8000	2378			
34	1950.0	1950.0	1927.7	47.0	0.8020	0.8027	0.0033	0.8060	2392			
33	1975.0	1975.0	1952.7	47.0	0.8110	0.8117	0.0033	0.8150	2396			
										100.0	0.0311	3212
32	2000.0	2000.0	1977.7	47.0	0.8200	0.8207	0.0033	0.8240	2400			
31	2025.0	2025.0	2002.7	47.0	0.8270	0.8278	0.0033	0.8311	2410			
30	2050.0	2050.0	2027.7	47.0	0.8373	0.8380	0.0033	0.8413	2410			
29	2075.0	2075.0	2052.7	47.0	0.8445	0.8453	0.0033	0.8486	2419			
										100.0	0.0329	3042
28	2100.0	2100.0	2077.7	47.0	0.8529	0.8536	0.0033	0.8569	2425			
27	2125.0	2125.0	2102.7	47.0	0.8604	0.8612	0.0033	0.8645	2432			
26	2142.0	2142.0	2119.7	47.0	0.8645	0.8652	0.0033	0.8685	2441			
25	2150.0	2150.0	2127.7	47.0	0.8675	0.8683	0.0033	0.8716	2441			
24	2175.0	2175.0	2152.7	47.0	0.8770	0.8778	0.0033	0.8811	2443			
										100.0	0.0316	3163
23	2200.0	2200.0	2177.7	47.0	0.8845	0.8852	0.0033	0.8885	2451			
22	2207.0	2207.0	2184.7	47.0	0.8836	0.8843	0.0033	0.8876	2461			
21	2225.0	2225.0	2202.7	47.0	0.8873	0.8881	0.0033	0.8914	2471			
20	2250.0	2250.0	2227.7	47.0	0.8939	0.8946	0.0033	0.8979	2481			
19	2272.0	2272.0	2249.7	47.0	0.8982	0.8990	0.0033	0.9023	2493			
18	2275.0	2275.0	2252.7	47.0	0.8984	0.8992	0.0033	0.9025	2496			
										100.0	0.0190	5266
17	2300.0	2300.0	2277.7	47.0	0.9034	0.9042	0.0033	0.9075	2510			
	2325.0	2325.0	2302.7	47.0	0.9132	0.9140	0.0033	0.9173	2510			
15	2350.0	2350.0	2327.7	47.0	0.9184	0.9192	0.0033	0.9225	2523			
14	2375.0	2375.0	2352.7	47.0	0.9291	0.9299	0.0033	0.9332	2521			
										100.0	0.0328	3047
13	2400.0	2400.0	2377.7	47.0	0.9362	0.9370	0.0033	0.9403	2529			
12	2425.0	2425.0	2402.7	47.0	0.9449	0.9457	0.0033	0.9490	2532			
11	2450.0	2450.0	2427.7	47.0	0.9496	0.9504	0.0033	0.9537	2546			
10	2475.0	2475.0	2452.7	47.0	0.9589	0.9597	0.0033	0.9630	2547			
										100.0	0.0296	3381
9	2500.0	2500.0	2477.7	47.0	0.9658	0.9666	0.0033	0.9699	2555			
8	2525.0	2525.0	2502.7	47.0	0.9739	0.9747	0.0033	0.9780	2559			
7	2550.0	2550.0	2527.7	47.0	0.9802	0.9810	0.0033	0.9843	2568			
6	2575.0	2575.0	2552.7	47.0	0.9856	0.9864	0.0033	0.9897	2579			
										100.0	0.0277	3614
5	2600.0	2600.0	2577.7	47.0	0.9935	0.9943	0.0033	0.9976	2584			
4	2625.0	2625.0	2602.7	47.0	1.0012	1.0020	0.0033	1.0053	2589			
3	2650.0	2650.0	2627.7	47.0	1.0075	1.0083	0.0033	1.0116	2598			
2	2675.0	2675.0	2652.7	47.0	1.0137	1.0145	0.0033	1.0178	2606			
										105.0	0.0315	3329
1	2705.0	2705.0	2682.7	47.0	1.0250	1.0258	0.0033	1.0291	2607			

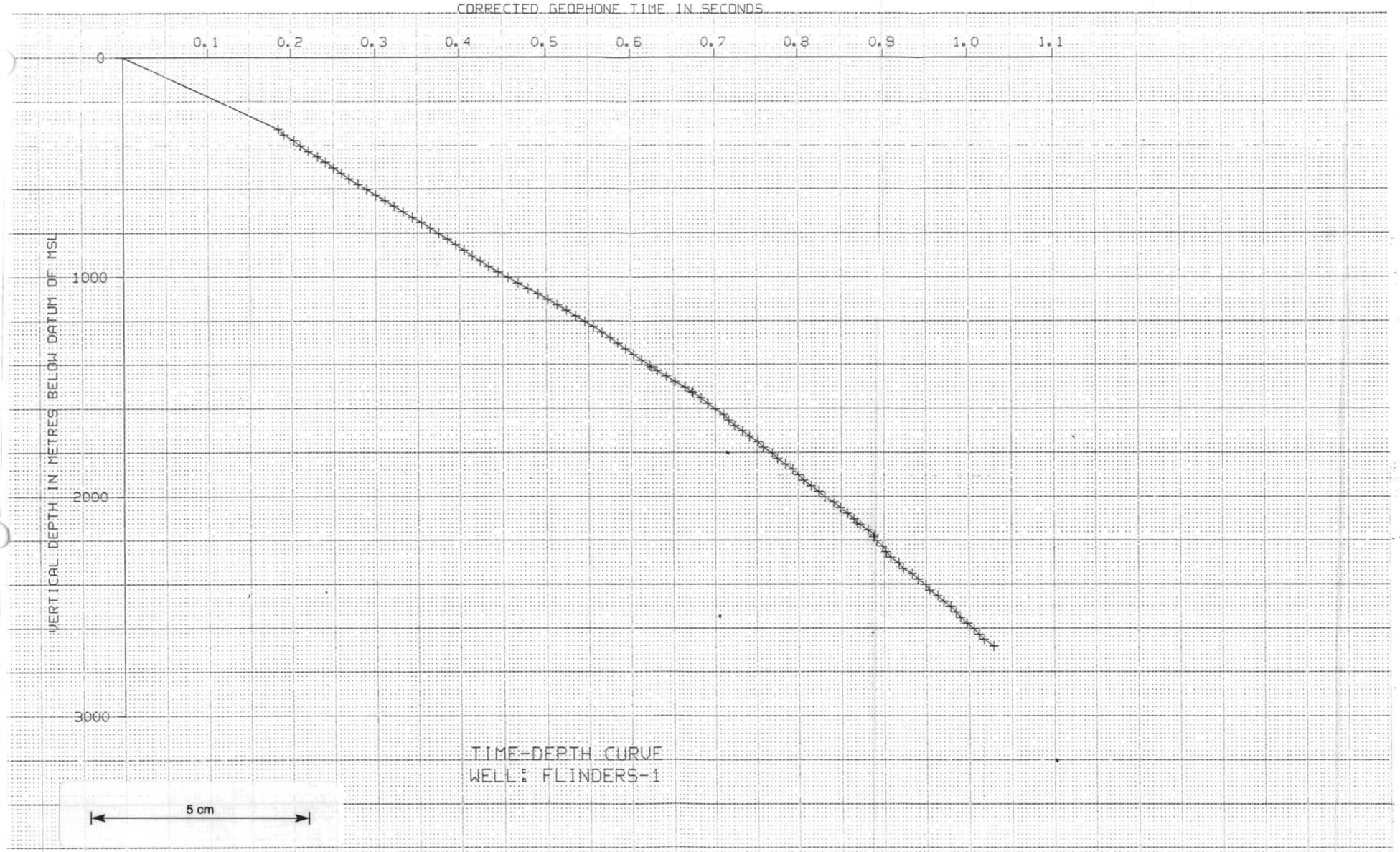
291211



WELL GEOPHONE DATA
WELL: FLINDERS-1

5 cm

291212


CORRECTED GEOPHONE TIME IN SECONDS
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
0
1000
2000
3000
VERTICAL DEPTH IN METRES BELOW DATUM OF MSL
TIME-DEPTH CURVE
WELL: FLINDERS-1
5 cm

DESCRIPTION OF SHIFTS USED IN VELOCITY LOG CALIBRATION

TWO TYPES OF SHIFT MAY BE APPLIED :

(1) SHIFTS TO LOWER VELOCITIES WHICH ARE APPLIED LINEARLY.
THESE SHIFTS ARE CALCULATED USING THE FORMULA :-

$$\frac{(T_L - T_C)_2 - (T_L - T_C)_1}{Z_2 - Z_1} \times 10^3$$

WHERE TL AND TC ARE THE TRAVEL TIMES TO A GIVEN CHECK LEVEL.
MEASURED FROM THE VELOCITY LOG AND WELL GEOPHONE DATA RESPECTIVELY;
AND WHERE Z IS THE DEPTH OF THE CHECK LEVEL BELOW DATUM.
(TL -TC) IS EXPRESSED IN MS (AS ON THE CALIBRATION CURVE) AND THE
RESULTING LINEAR SHIFT IS EXPRESSED IN µS/FT.

(2) SHIFTS TO HIGHER VELOCITIES WHICH ARE APPLIED DIFFERENTIALLY
IN ORDER TO APPLY LARGER CORRECTIONS TO LOWER VELOCITY SECTIONS OF LOG.
THIS IS BASED ON THE ASSUMPTION THAT LOWER VELOCITY SECTIONS
OF LOG CONTRIBUTE MORE TRANSIT TIME ERRORS THAN HIGHER VELOCITY
SECTIONS DUE TO CAVING AND OTHER BOREHOLE EFFECTS.
ADDITIONALLY. THIS TYPE OF SHIFT MAY BE RESTRICTED BY DEFINING A
BASELINE VALUE SUCH THAT SECTIONS OF LOG RECORDED AT A HIGHER
VELOCITY THAN THAT OF THE BASELINE WILL RECEIVE NO SHIFT.

RESTRICTED DIFFERENTIAL SHIFTS (UNRESTRICTED SHIFTS WILL HAVE
A BASELINE VALUE OF ZERO) ARE CALCULATED USING THE FORMULA :-

$$\left[\frac{(T_{C_2} - T_{C_1}) - (Z_2 - Z_1) \times \text{BASELINE VALUE} \times 10^{-6}}{(T_{L_2} - T_{L_1}) - (Z_2 - Z_1) \times \text{BASELINE VALUE} \times 10^{-6}} \right] \times 100\%$$

WHERE TC AND TL ARE EXPRESSED IN SECONDS AND THE BASELINE VALUE
IS EXPRESSED IN µS/FT.

291214

$T_L - T_C$ IN MILLISECONDS

T_L = TOTAL TRAVEL TIME FROM VERTICAL UNCORRECTED LOG

-40 -30 -20 -10 0 10 20 30 40

VERTICAL DEPTH IN METRES BELOW DATUM OF MSL

0

1000

2000

3000

3.4 US/FT LINEAR

CHANGE OF SHIFT AT 1225.4 M BELOW DF

99.6 % DIFFERENTIAL (0 US/FT BASELINE)

CHANGE OF SHIFT AT 1532.8 M BELOW DF

2.2 US/FT LINEAR

T_L	T_C	$T_L - T_C$
0.2115	0.2115	0.0000
0.2215	0.2205	0.0010
0.2315	0.2311	0.0004
0.2355	0.2361	-0.0006
0.2357	0.2364	-0.0007
0.2380	0.2386	-0.0006
0.2385	0.2501	-0.0116
0.2485	0.2592	-0.0107
0.2585	0.2685	-0.0100
0.2685	0.2721	-0.0036
0.2705	0.2745	-0.0040
0.2805	0.2847	-0.0042
0.2907	0.2950	-0.0043
0.3008	0.3052	-0.0044
0.3108	0.3153	-0.0045
0.3208	0.3254	-0.0046
0.3308	0.3355	-0.0047
0.3408	0.3456

291215

1

SEISMOGRAPH SERVICE (ENGLAND) LTD.

BOREHOLE GEOPHYSICS DIVISION

COMPANY: SAGASCO RESOURCES LIMITED

WELL: FLINDERS-1

LISTING OF CALIBRATED VELOCITY LOG DATA
AT 0.0020 SECONDS TWO-WAY TIME INTERVALS

LISTING SHOWS :

TWO-WAY TRAVEL TIME IN SECONDS BELOW DATUM OF MSL

MEASURED DEPTH(D') IN METRES BELOW REFERENCE LEVEL, DF AT 22.3M ABOVE DATUM OF MSL

VERTICAL DEPTH(D) IN METRES BELOW REFERENCE LEVEL, DF AT 22.3M ABOVE DATUM OF MSL

VERTICAL DEPTH(Z) IN METRES BELOW DATUM OF MSL

INTERVAL,AVERAGE AND RMS VELOCITIES IN M/SEC

REFLECTION COEFFICIENTS

TWO-WAY TRANSMISSION LOSS

NOTE : THE FIRST INTERVAL VELOCITY IS CALCULATED BETWEEN DATUM AND THE FIRST TIME SAMPLE. SUBSEQUENT INTERVAL VELOCITIES ARE CALCULATED BETWEEN THE CURRENT TIME SAMPLE AND THE PRECEDING TIME SAMPLE.

291216

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
0.4160	416.0	416.0	393.7	1892.8	1892.8	1892.8		
0.4180	418.5	418.5	396.2	2501.0	1895.7	1896.1	0.1384	0.0192
0.4200	421.0	421.0	398.7	2519.4	1898.6	1899.6	0.0037	0.0192
0.4220	423.5	423.5	401.2	2509.4	1901.5	1902.9	-0.0020	0.0192
0.4240	426.0	426.0	403.7	2492.5	1904.3	1906.2	-0.0034	0.0192
0.4260	428.4	428.4	406.1	2429.2	1906.8	1908.9	-0.0128	0.0194
0.4280	430.8	430.8	408.5	2396.8	1909.1	1911.5	-0.0067	0.0194
0.4300	433.3	433.3	411.0	2416.0	1911.4	1914.2	0.0040	0.0194
0.4320	435.7	435.7	413.4	2464.7	1914.0	1917.1	0.0100	0.0195
0.4340	438.2	438.2	415.9	2460.5	1916.5	1919.9	-0.0008	0.0195
0.4360	440.7	440.7	418.4	2481.3	1919.1	1922.9	0.0042	0.0195
0.4380	443.1	443.1	420.8	2404.3	1921.3	1925.4	-0.0157	0.0198
0.4400	445.6	445.6	423.3	2499.9	1924.0	1928.4	0.0195	0.0201
0.4420	447.9	447.9	425.6	2352.7	1925.9	1930.5	-0.0303	0.0210
0.4440	450.4	450.4	428.1	2499.0	1928.5	1933.4	0.0302	0.0219
0.4460	452.9	452.9	430.6	2457.5	1930.8	1936.1	-0.0084	0.0220
0.4480	455.3	455.3	433.0	2404.2	1933.0	1938.4	-0.0110	0.0221
0.4500	457.7	457.7	435.4	2435.1	1935.2	1940.9	0.0064	0.0222
0.4520	460.2	460.2	437.9	2531.1	1937.8	1943.9	0.0193	0.0225
0.4540	462.7	462.7	440.4	2471.9	1940.2	1946.6	-0.0118	0.0227
0.4560	465.3	465.3	443.0	2559.7	1942.9	1949.7	0.0174	0.0230
0.4580	467.9	467.9	445.6	2570.4	1945.6	1952.8	0.0021	0.0230
0.4600	470.4	470.4	448.1	2585.0	1948.4	1956.0	0.0028	0.0230
0.4620	473.0	473.0	450.7	2580.8	1951.2	1959.1	-0.0008	0.0230
0.4640	475.6	475.6	453.3	2602.6	1954.0	1962.4	0.0042	0.0230
0.4660	478.3	478.3	456.0	2636.4	1956.9	1965.8	0.0064	0.0230
0.4680	480.9	480.9	458.6	2669.0	1959.9	1969.3	0.0061	0.0231
0.4700	483.4	483.4	461.1	2493.9	1962.2	1971.8	-0.0339	0.0242
0.4720	486.0	486.0	463.7	2558.1	1964.7	1974.7	0.0127	0.0244
0.4740	488.6	488.6	466.3	2618.7	1967.5	1977.8	0.0117	0.0245
0.4760	491.2	491.2	468.9	2570.6	1970.0	1980.7	-0.0093	0.0246
0.4780	493.7	493.7	471.4	2561.5	1972.5	1983.5	-0.0018	0.0246
0.4800	496.3	496.3	474.0	2595.6	1975.1	1986.4	0.0066	0.0246
0.4820	499.0	499.0	476.7	2653.6	1977.9	1989.6	0.0111	0.0247
0.4840	501.6	501.6	479.3	2586.0	1980.4	1992.5	-0.0129	0.0249
0.4860	504.2	504.2	481.9	2595.3	1983.0	1995.3	0.0018	0.0249
0.4880	506.8	506.8	484.5	2627.8	1985.6	1998.3	0.0062	0.0249
0.4900	509.4	509.4	487.1	2602.2	1988.1	2001.2	-0.0049	0.0250
0.4920	512.0	512.0	489.7	2572.7	1990.5	2003.8	-0.0057	0.0250
0.4940	514.5	514.5	492.2	2517.5	1992.6	2006.2	-0.0108	0.0251
0.4960	517.1	517.1	494.8	2641.8	1995.2	2009.1	0.0241	0.0257
0.4980	519.8	519.8	497.5	2648.6	1997.9	2012.1	0.0013	0.0257
0.5000	522.5	522.5	500.2	2732.9	2000.8	2015.5	0.0157	0.0259
0.5020	525.2	525.2	502.9	2653.0	2003.4	2018.4	-0.0148	0.0261
0.5040	527.8	527.8	505.5	2647.9	2006.0	2021.3	-0.0010	0.0261
0.5060	530.5	530.5	508.2	2653.5	2008.5	2024.2	0.0011	0.0261
0.5080	533.1	533.1	510.8	2655.6	2011.1	2027.1	0.0004	0.0261
0.5100	535.8	535.8	513.5	2677.9	2013.7	2030.0	0.0042	0.0261
0.5120	538.3	538.3	516.0	2532.0	2015.7	2032.3	-0.0280	0.0269
0.5140	540.9	540.9	518.6	2607.8	2018.0	2034.8	0.0147	0.0271
0.5160	543.6	543.6	521.3	2638.9	2020.4	2037.5	0.0059	0.0272
0.5180	546.1	546.1	523.8	2568.2	2022.5	2039.8	-0.0136	0.0273
0.5200	548.8	548.8	526.5	2627.7	2024.9	2042.4	0.0115	0.0275
0.5220	551.4	551.4	529.1	2611.0	2027.1	2044.9	-0.0032	0.0275
0.5240	554.0	554.0	531.7	2581.7	2029.2	2047.2	-0.0057	0.0275
0.5260	556.5	556.5	534.2	2564.3	2031.3	2049.4	-0.0034	0.0275
0.5280	559.1	559.1	536.8	2538.1	2033.2	2051.5	-0.0051	0.0275
0.5300	561.6	561.6	539.3	2542.4	2035.1	2053.5	0.0008	0.0275

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
0.5320	564.1	564.1	541.8	2525.7	2036.9	2055.5	-0.0033	0.0276
0.5340	566.6	566.6	544.3	2517.2	2038.7	2057.4	-0.0017	0.0276
0.5360	569.2	569.2	546.9	2513.7	2040.5	2059.3	-0.0007	0.0276
0.5380	571.6	571.6	549.3	2489.1	2042.2	2061.1	-0.0049	0.0276
0.5400	574.1	574.1	551.8	2470.5	2043.8	2062.8	-0.0037	0.0276
0.5420	576.6	576.6	554.3	2515.7	2045.5	2064.6	0.0091	0.0277
0.5440	579.1	579.1	556.8	2500.5	2047.2	2066.4	-0.0030	0.0277
0.5460	581.6	581.6	559.3	2476.4	2048.8	2068.0	-0.0048	0.0277
0.5480	584.0	584.0	561.7	2426.2	2050.1	2069.5	-0.0102	0.0278
0.5500	586.5	586.5	564.2	2474.2	2051.7	2071.1	0.0098	0.0279
0.5520	588.9	588.9	566.6	2423.5	2053.0	2072.5	-0.0104	0.0280
0.5540	591.4	591.4	569.1	2426.8	2054.4	2073.9	0.0007	0.0280
0.5560	593.8	593.8	571.5	2400.3	2055.6	2075.1	-0.0055	0.0280
0.5580	596.2	596.2	573.9	2452.1	2057.0	2076.6	0.0107	0.0281
0.5600	598.7	598.7	576.4	2459.2	2058.5	2078.1	0.0015	0.0281
0.5620	601.2	601.2	578.9	2486.3	2060.0	2079.7	0.0055	0.0282
0.5640	603.6	603.6	581.3	2474.1	2061.5	2081.2	-0.0025	0.0282
0.5660	606.1	606.1	583.8	2449.9	2062.8	2082.6	-0.0049	0.0282
0.5680	608.5	608.5	586.2	2409.9	2064.1	2083.9	-0.0082	0.0283
0.5700	610.9	610.9	588.6	2420.0	2065.3	2085.1	0.0021	0.0283
0.5720	613.3	613.3	591.0	2411.4	2066.5	2086.4	-0.0018	0.0283
0.5740	615.8	615.8	593.5	2459.2	2067.9	2087.8	0.0098	0.0284
0.5760	618.2	618.2	595.9	2374.0	2069.0	2088.8	-0.0176	0.0287
0.5780	620.5	620.5	598.2	2349.2	2069.9	2089.8	-0.0052	0.0287
0.5800	622.9	622.9	600.6	2426.9	2071.2	2091.1	0.0163	0.0290
0.5820	625.4	625.4	603.1	2454.2	2072.5	2092.4	0.0056	0.0290
0.5840	627.8	627.8	605.5	2434.0	2073.7	2093.7	-0.0041	0.0290
0.5860	630.2	630.2	607.9	2339.8	2074.6	2094.6	-0.0197	0.0294
0.5880	632.5	632.5	610.2	2288.7	2075.3	2095.3	-0.0110	0.0295
0.5900	634.8	634.8	612.5	2341.6	2076.2	2096.1	0.0114	0.0296
0.5920	637.2	637.2	614.9	2448.6	2077.5	2097.4	0.0223	0.0301
0.5940	639.7	639.7	617.4	2489.1	2078.9	2098.9	0.0082	0.0302
0.5960	642.1	642.1	619.8	2402.2	2080.0	2100.0	-0.0178	0.0305
0.5980	644.5	644.5	622.2	2374.7	2081.0	2100.9	-0.0058	0.0305
0.6000	646.9	646.9	624.6	2422.5	2082.1	2102.1	0.0100	0.0306
0.6020	649.2	649.2	626.9	2316.3	2082.9	2102.8	-0.0224	0.0311
0.6040	651.7	651.7	629.4	2431.9	2084.0	2104.0	0.0243	0.0317
0.6060	654.0	654.0	631.7	2352.1	2084.9	2104.9	-0.0167	0.0319
0.6080	656.4	656.4	634.1	2339.1	2085.8	2105.7	-0.0028	0.0320
0.6100	658.7	658.7	636.4	2374.6	2086.7	2106.6	0.0075	0.0320
0.6120	661.2	661.2	638.9	2501.3	2088.1	2108.1	0.0260	0.0327
0.6140	663.7	663.7	641.4	2411.0	2089.1	2109.1	-0.0184	0.0330
0.6160	666.0	666.0	643.7	2331.4	2089.9	2109.9	-0.0168	0.0333
0.6180	668.4	668.4	646.1	2369.4	2090.8	2110.8	0.0081	0.0333
0.6200	670.8	670.8	648.5	2464.1	2092.0	2112.0	0.0196	0.0337
0.6220	673.2	673.2	650.9	2394.8	2093.0	2113.0	-0.0143	0.0339
0.6240	675.6	675.6	653.3	2382.3	2093.9	2113.9	-0.0026	0.0339
0.6260	678.0	678.0	655.7	2355.2	2094.7	2114.7	-0.0057	0.0339
0.6280	680.3	680.3	658.0	2311.9	2095.4	2115.4	-0.0093	0.0340
0.6300	682.6	682.6	660.3	2308.2	2096.1	2116.0	-0.0008	0.0340
0.6320	685.0	685.0	662.7	2427.6	2097.2	2117.1	0.0252	0.0346
0.6340	687.3	687.3	665.0	2319.6	2097.9	2117.7	-0.0227	0.0351
0.6360	689.6	689.6	667.3	2276.9	2098.4	2118.2	-0.0093	0.0352
0.6380	692.2	692.2	669.9	2615.2	2100.0	2120.0	0.0692	0.0398
0.6400	695.0	695.0	672.7	2764.3	2102.1	2122.3	0.0277	0.0406
0.6420	697.3	697.3	675.0	2289.0	2102.7	2122.8	-0.0941	0.0490
0.6440	699.5	699.5	677.2	2219.8	2103.1	2123.1	-0.0153	0.0493
0.6460	701.8	701.8	679.5	2282.7	2103.6	2123.7	0.0139	0.0495

1 TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
0.6480	704.1	704.1	681.8	2367.3	2104.4	2124.5	0.0182	0.0498
0.6500	706.7	706.7	684.4	2524.0	2105.7	2125.8	0.0320	0.0507
0.6520	709.1	709.1	686.8	2468.4	2106.8	2126.9	-0.0111	0.0509
0.6540	711.5	711.5	689.2	2374.0	2107.7	2127.7	-0.0195	0.0512
0.6560	713.8	713.8	691.5	2264.8	2108.1	2128.2	-0.0235	0.0518
0.6580	716.0	716.0	693.7	2245.8	2108.5	2128.5	-0.0042	0.0518
0.6600	718.6	718.6	696.3	2567.2	2109.9	2130.0	0.0668	0.0560
0.6620	721.2	721.2	698.9	2587.3	2111.4	2131.5	0.0039	0.0560
0.6640	723.7	723.7	701.4	2578.6	2112.8	2133.0	-0.0017	0.0560
0.6660	726.0	726.0	703.7	2297.1	2113.3	2133.5	-0.0577	0.0592
0.6680	728.4	728.4	706.1	2349.7	2114.0	2134.2	0.0113	0.0593
0.6700	730.7	730.7	708.4	2286.6	2114.6	2134.7	-0.0136	0.0595
0.6720	733.1	733.1	710.8	2387.1	2115.4	2135.5	0.0215	0.0599
0.6740	735.3	735.3	713.0	2239.3	2115.7	2135.8	-0.0320	0.0609
0.6760	737.6	737.6	715.3	2269.8	2116.2	2136.2	0.0068	0.0609
0.6780	739.8	739.8	717.5	2268.6	2116.6	2136.6	-0.0003	0.0609
0.6800	742.1	742.1	719.8	2252.0	2117.0	2136.9	-0.0037	0.0609
0.6820	744.4	744.4	722.1	2261.8	2117.5	2137.3	0.0022	0.0609
0.6840	746.4	746.4	724.1	2084.8	2117.4	2137.2	-0.0407	0.0625
0.6860	748.7	748.7	726.4	2223.5	2117.7	2137.4	0.0322	0.0634
0.6880	751.0	751.0	728.7	2303.0	2118.2	2137.9	0.0176	0.0637
0.6900	753.1	753.1	730.8	2167.9	2118.4	2138.0	-0.0302	0.0646
0.6920	755.3	755.3	733.0	2168.6	2118.5	2138.1	0.0002	0.0646
0.6940	757.6	757.6	735.3	2343.9	2119.2	2138.7	0.0389	0.0660
0.6960	760.1	760.1	737.8	2406.5	2120.0	2139.5	0.0132	0.0662
0.6980	762.3	762.3	740.0	2278.3	2120.4	2140.0	-0.0274	0.0669
0.7000	764.4	764.4	742.1	2112.3	2120.4	2139.9	-0.0378	0.0682
0.7020	766.6	766.6	744.3	2194.0	2120.6	2140.0	0.0190	0.0685
0.7040	769.0	769.0	746.7	2336.1	2121.2	2140.6	0.0314	0.0694
0.7060	771.3	771.3	749.0	2285.1	2121.7	2141.0	-0.0110	0.0696
0.7080	773.6	773.6	751.3	2324.5	2122.3	2141.6	0.0086	0.0696
0.7100	776.1	776.1	753.8	2527.0	2123.4	2142.8	0.0417	0.0712
0.7120	778.6	778.6	756.3	2491.0	2124.5	2143.8	-0.0072	0.0713
0.7140	781.0	781.0	758.7	2402.6	2125.2	2144.6	-0.0181	0.0716
0.7160	783.4	783.4	761.1	2398.1	2126.0	2145.3	-0.0009	0.0716
0.7180	785.9	785.9	763.6	2532.0	2127.1	2146.5	0.0271	0.0723
0.7200	788.2	788.2	765.9	2233.2	2127.4	2146.8	-0.0627	0.0759
0.7220	790.5	790.5	768.2	2281.7	2127.8	2147.1	0.0108	0.0760
0.7240	792.8	792.8	770.5	2319.9	2128.4	2147.6	0.0083	0.0761
0.7260	795.1	795.1	772.8	2348.6	2129.0	2148.2	0.0061	0.0761
0.7280	797.6	797.6	775.3	2450.9	2129.9	2149.1	0.0213	0.0766
0.7300	800.0	800.0	777.7	2478.6	2130.8	2150.1	0.0056	0.0766
0.7320	802.6	802.6	780.3	2552.0	2132.0	2151.3	0.0146	0.0768
0.7340	805.2	805.2	782.9	2608.4	2133.3	2152.7	0.0109	0.0769
0.7360	807.7	807.7	785.4	2483.8	2134.2	2153.6	-0.0245	0.0774
0.7380	810.0	810.0	787.7	2334.5	2134.8	2154.1	-0.0310	0.0783
0.7400	812.1	812.1	789.8	2109.6	2134.7	2154.0	-0.0506	0.0807
0.7420	814.5	814.5	792.2	2370.1	2135.3	2154.6	0.0582	0.0838
0.7440	816.9	816.9	794.6	2378.7	2136.0	2155.3	0.0018	0.0838
0.7460	819.2	819.2	796.9	2316.3	2136.5	2155.7	-0.0133	0.0840
0.7480	821.6	821.6	799.3	2405.8	2137.2	2156.4	0.0189	0.0843
0.7500	824.0	824.0	801.7	2430.3	2138.0	2157.2	0.0051	0.0843
0.7520	826.6	826.6	804.3	2600.5	2139.2	2158.5	0.0338	0.0854
0.7540	828.9	828.9	806.6	2230.9	2139.4	2158.7	-0.0765	0.0907
0.7560	831.4	831.4	809.1	2530.9	2140.5	2159.8	0.0630	0.0943
0.7580	833.8	833.8	811.5	2420.5	2141.2	2160.5	-0.0223	0.0948
0.7600	836.3	836.3	814.0	2459.7	2142.1	2161.3	0.0080	0.0948
0.7620	838.7	838.7	816.4	2420.0	2142.8	2162.1	-0.0081	0.0949

I	TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
	0.7640	841.1	841.1	818.8	2357.7	2143.3	2162.6	-0.0130	0.0951
	0.7660	843.5	843.5	821.2	2465.0	2144.2	2163.4	0.0222	0.0955
	0.7680	846.0	846.0	823.7	2436.0	2144.9	2164.2	-0.0059	0.0955
	0.7700	848.4	848.4	826.1	2403.7	2145.6	2164.8	-0.0067	0.0956
	0.7720	850.8	850.8	828.5	2402.2	2146.3	2165.5	-0.0003	0.0956
	0.7740	853.0	853.0	830.7	2228.0	2146.5	2165.7	-0.0376	0.0969
	0.7760	855.4	855.4	833.1	2377.2	2147.1	2166.2	0.0324	0.0978
	0.7780	857.7	857.7	835.4	2361.7	2147.6	2166.8	-0.0033	0.0978
	0.7800	860.3	860.3	838.0	2576.5	2148.7	2167.9	0.0435	0.0995
	0.7820	862.8	862.8	840.5	2538.1	2149.7	2168.9	-0.0075	0.0996
	0.7840	865.2	865.2	842.9	2382.8	2150.3	2169.5	-0.0316	0.1005
	0.7860	867.6	867.6	845.3	2343.4	2150.8	2170.0	-0.0083	0.1005
	0.7880	870.0	870.0	847.7	2447.9	2151.6	2170.7	0.0218	0.1010
	0.7900	872.3	872.3	850.0	2240.7	2151.8	2170.9	-0.0442	0.1027
	0.7920	875.0	875.0	852.7	2726.6	2153.3	2172.5	0.0978	0.1113
	0.7940	877.7	877.7	855.4	2693.3	2154.6	2173.9	-0.0061	0.1113
	0.7960	880.2	880.2	857.9	2517.2	2155.5	2174.9	-0.0338	0.1123
	0.7980	882.7	882.7	860.4	2530.8	2156.5	2175.8	0.0027	0.1123
	0.8000	885.5	885.5	863.2	2724.4	2157.9	2177.4	0.0369	0.1136
	0.8020	888.1	888.1	865.8	2632.4	2159.1	2178.6	-0.0172	0.1138
	0.8040	890.8	890.8	868.5	2697.9	2160.4	2180.1	0.0123	0.1139
	0.8060	893.4	893.4	871.1	2662.6	2161.7	2181.4	-0.0066	0.1140
	0.8080	896.2	896.2	873.9	2733.6	2163.1	2182.9	0.0132	0.1141
	0.8100	899.0	899.0	876.7	2786.7	2164.6	2184.6	0.0096	0.1142
	0.8120	901.7	901.7	879.4	2694.5	2165.9	2186.0	-0.0168	0.1145
	0.8140	904.3	904.3	882.0	2643.2	2167.1	2187.3	-0.0096	0.1146
	0.8160	906.9	906.9	884.6	2618.8	2168.2	2188.4	-0.0046	0.1146
	0.8180	909.5	909.5	887.2	2574.7	2169.2	2189.5	-0.0085	0.1146
	0.8200	911.9	911.9	889.6	2425.8	2169.8	2190.1	-0.0298	0.1154
	0.8220	914.3	914.3	892.0	2396.3	2170.4	2190.6	-0.0061	0.1155
	0.8240	916.7	916.7	894.4	2360.5	2170.8	2191.0	-0.0075	0.1155
	0.8260	918.9	918.9	896.6	2221.8	2171.0	2191.1	-0.0303	0.1163
	0.8280	921.2	921.2	898.9	2297.7	2171.3	2191.4	0.0168	0.1166
	0.8300	923.8	923.8	901.5	2586.9	2172.3	2192.4	0.0592	0.1197
	0.8320	926.2	926.2	903.9	2385.7	2172.8	2192.9	-0.0405	0.1211
	0.8340	928.5	928.5	906.2	2311.7	2173.1	2193.2	-0.0157	0.1213
	0.8360	931.1	931.1	908.8	2578.6	2174.1	2194.2	0.0546	0.1239
	0.8380	933.7	933.7	911.4	2601.4	2175.1	2195.3	0.0044	0.1240
	0.8400	936.2	936.2	913.9	2562.3	2176.0	2196.2	-0.0076	0.1240
	0.8420	939.1	939.1	916.8	2895.5	2177.7	2198.1	0.0611	0.1273
	0.8440	942.0	942.0	919.7	2838.0	2179.3	2199.9	-0.0100	0.1274
	0.8460	944.7	944.7	922.4	2711.9	2180.6	2201.2	-0.0227	0.1278
	0.8480	947.5	947.5	925.2	2824.0	2182.1	2202.9	0.0203	0.1282
	0.8500	950.3	950.3	928.0	2764.2	2183.4	2204.4	-0.0107	0.1283
	0.8520	953.1	953.1	930.8	2867.6	2185.0	2206.2	0.0184	0.1286
	0.8540	956.0	956.0	933.7	2828.2	2186.6	2207.8	-0.0069	0.1286
	0.8560	958.8	958.8	936.5	2796.0	2188.0	2209.4	-0.0057	0.1286
	0.8580	961.6	961.6	939.3	2845.0	2189.5	2211.1	0.0087	0.1287
	0.8600	964.4	964.4	942.1	2753.6	2190.8	2212.5	-0.0163	0.1289
	0.8620	967.1	967.1	944.8	2781.2	2192.2	2214.0	0.0050	0.1290
	0.8640	969.7	969.7	947.4	2542.5	2193.0	2214.8	-0.0448	0.1307
	0.8660	972.7	972.7	950.4	2977.7	2194.8	2216.9	0.0788	0.1361
	0.8680	975.1	975.1	952.8	2473.4	2195.5	2217.5	-0.0925	0.1435
	0.8700	977.9	977.9	955.6	2761.2	2196.8	2218.9	0.0550	0.1461
	0.8720	980.3	980.3	958.0	2386.0	2197.2	2219.3	-0.0729	0.1506
	0.8740	982.8	982.8	960.5	2562.7	2198.0	2220.1	0.0357	0.1517
	0.8760	985.0	985.0	962.7	2184.9	2198.0	2220.1	-0.0796	0.1571
	0.8780	987.4	987.4	965.1	2410.8	2198.5	2220.5	0.0491	0.1591

1 TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
0.8800	989.6	989.6	967.3	2129.5	2198.3	2220.3	-0.0620	0.1623
0.8820	991.8	991.8	969.5	2263.6	2198.5	2220.4	0.0305	0.1631
0.8840	994.0	994.0	971.7	2179.1	2198.4	2220.3	-0.0190	0.1634
0.8860	996.3	996.3	974.0	2299.6	2198.7	2220.5	0.0269	0.1640
0.8880	998.5	998.5	976.2	2224.5	2198.7	2220.5	-0.0166	0.1643
0.8900	1000.7	1000.7	978.4	2173.6	2198.7	2220.4	-0.0116	0.1644
0.8920	1002.9	1002.9	980.6	2231.4	2198.7	2220.4	0.0131	0.1645
0.8940	1005.2	1005.2	982.9	2251.7	2198.8	2220.5	0.0045	0.1645
0.8960	1007.4	1007.4	985.1	2186.6	2198.8	2220.4	-0.0147	0.1647
0.8980	1009.5	1009.5	987.2	2159.2	2198.7	2220.3	-0.0063	0.1647
0.9000	1011.8	1011.8	989.5	2298.5	2199.0	2220.5	0.0312	0.1656
0.9020	1013.9	1013.9	991.6	2075.6	2198.7	2220.2	-0.0509	0.1677
0.9040	1016.2	1016.2	993.9	2304.6	2198.9	2220.3	0.0523	0.1700
0.9060	1018.3	1018.3	996.0	2137.6	2198.8	2220.2	-0.0376	0.1712
0.9080	1020.5	1020.5	998.2	2132.6	2198.6	2220.0	-0.0012	0.1712
0.9100	1022.6	1022.6	1000.3	2126.6	2198.5	2219.8	-0.0014	0.1712
0.9120	1024.8	1024.8	1002.5	2211.4	2198.5	2219.8	0.0195	0.1715
0.9140	1027.1	1027.1	1004.8	2240.0	2198.6	2219.8	0.0064	0.1715
0.9160	1029.3	1029.3	1007.0	2258.1	2198.7	2219.9	0.0040	0.1715
0.9180	1031.5	1031.5	1009.2	2178.3	2198.7	2219.8	-0.0180	0.1718
0.9200	1033.8	1033.8	1011.5	2271.1	2198.8	2219.9	0.0209	0.1722
0.9220	1035.8	1035.8	1013.5	2048.8	2198.5	2219.6	-0.0515	0.1744
0.9240	1037.9	1037.9	1015.6	2120.0	2198.3	2219.3	0.0171	0.1746
0.9260	1040.1	1040.1	1017.8	2116.9	2198.2	2219.1	-0.0007	0.1746
0.9280	1042.2	1042.2	1019.9	2134.3	2198.0	2218.9	0.0041	0.1746
0.9300	1044.3	1044.3	1022.0	2118.2	2197.9	2218.7	-0.0038	0.1746
0.9320	1046.4	1046.4	1024.1	2088.6	2197.6	2218.5	-0.0070	0.1747
0.9340	1048.5	1048.5	1026.2	2124.3	2197.5	2218.3	0.0085	0.1747
0.9360	1050.6	1050.6	1028.3	2097.8	2197.3	2218.0	-0.0063	0.1748
0.9380	1052.8	1052.8	1030.5	2199.0	2197.3	2218.0	0.0236	0.1752
0.9400	1054.9	1054.9	1032.6	2103.3	2197.1	2217.7	-0.0222	0.1756
0.9420	1057.1	1057.1	1034.8	2144.8	2196.9	2217.6	0.0098	0.1757
0.9440	1059.2	1059.2	1036.9	2099.6	2196.7	2217.3	-0.0106	0.1758
0.9460	1061.4	1061.4	1039.1	2214.5	2196.8	2217.3	0.0266	0.1764
0.9480	1063.5	1063.5	1041.2	2120.0	2196.6	2217.1	-0.0218	0.1768
0.9500	1065.7	1065.7	1043.4	2188.5	2196.6	2217.1	0.0159	0.1770
0.9520	1067.9	1067.9	1045.6	2231.3	2196.7	2217.1	0.0097	0.1771
0.9540	1070.1	1070.1	1047.8	2232.7	2196.7	2217.1	0.0003	0.1771
0.9560	1072.3	1072.3	1050.0	2191.0	2196.7	2217.1	-0.0094	0.1771
0.9580	1074.6	1074.6	1052.3	2246.1	2196.8	2217.1	0.0124	0.1773
0.9600	1076.8	1076.8	1054.5	2205.0	2196.9	2217.1	-0.0092	0.1773
0.9620	1079.0	1079.0	1056.7	2220.1	2196.9	2217.1	0.0034	0.1773
0.9640	1081.2	1081.2	1058.9	2196.9	2196.9	2217.1	-0.0053	0.1774
0.9660	1083.4	1083.4	1061.1	2179.7	2196.9	2217.0	-0.0039	0.1774
0.9680	1085.6	1085.6	1063.3	2194.9	2196.9	2217.0	0.0035	0.1774
0.9700	1087.8	1087.8	1065.5	2220.0	2196.9	2217.0	0.0057	0.1774
0.9720	1089.9	1089.9	1067.6	2146.1	2196.8	2216.8	-0.0169	0.1776
0.9740	1092.1	1092.1	1069.8	2119.1	2196.6	2216.6	-0.0063	0.1777
0.9760	1094.3	1094.3	1072.0	2212.8	2196.7	2216.6	0.0216	0.1781
0.9780	1096.4	1096.4	1074.1	2139.5	2196.6	2216.5	-0.0168	0.1783
0.9800	1098.6	1098.6	1076.3	2138.7	2196.4	2216.3	-0.0002	0.1783
0.9820	1100.6	1100.6	1078.3	2084.8	2196.2	2216.1	-0.0127	0.1784
0.9840	1102.7	1102.7	1080.4	2064.0	2195.9	2215.8	-0.0050	0.1784
0.9860	1104.8	1104.8	1082.5	2062.0	2195.7	2215.5	-0.0005	0.1784
0.9880	1106.9	1106.9	1084.6	2171.3	2195.6	2215.4	0.0258	0.1790
0.9900	1109.1	1109.1	1086.8	2204.5	2195.6	2215.3	0.0076	0.1790
0.9920	1111.3	1111.3	1089.0	2153.8	2195.6	2215.2	-0.0116	0.1792
0.9940	1113.5	1113.5	1091.2	2193.4	2195.6	2215.2	0.0091	0.1792

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
0.9960	1115.7	1115.7	1093.4	2189.1	2195.5	2215.1	-0.0010	0.1792
0.9980	1117.8	1117.8	1095.5	2136.4	2195.4	2215.0	-0.0122	0.1793
1.0000	1120.0	1120.0	1097.7	2193.5	2195.4	2214.9	0.0132	0.1795
1.0020	1122.2	1122.2	1099.9	2144.2	2195.3	2214.8	-0.0114	0.1796
1.0040	1124.3	1124.3	1102.0	2147.0	2195.2	2214.7	0.0007	0.1796
1.0060	1126.5	1126.5	1104.2	2177.5	2195.2	2214.6	0.0071	0.1796
1.0080	1128.6	1128.6	1106.3	2150.1	2195.1	2214.5	-0.0063	0.1797
1.0100	1130.8	1130.8	1108.5	2159.7	2195.0	2214.3	0.0022	0.1797
1.0120	1132.9	1132.9	1110.6	2112.5	2194.9	2214.1	-0.0110	0.1798
1.0140	1135.4	1135.4	1113.1	2471.6	2195.4	2214.7	0.0783	0.1848
1.0160	1137.9	1137.9	1115.6	2509.4	2196.0	2215.3	0.0076	0.1848
1.0180	1140.3	1140.3	1118.0	2408.9	2196.4	2215.7	-0.0204	0.1852
1.0200	1142.6	1142.6	1120.3	2314.6	2196.7	2215.9	-0.0200	0.1855
1.0220	1144.8	1144.8	1122.5	2231.4	2196.7	2215.9	-0.0183	0.1858
1.0240	1147.1	1147.1	1124.8	2260.9	2196.9	2216.0	0.0065	0.1858
1.0260	1149.2	1149.2	1126.9	2137.8	2196.8	2215.9	-0.0280	0.1865
1.0280	1151.5	1151.5	1129.2	2226.6	2196.8	2215.9	0.0203	0.1868
1.0300	1153.8	1153.8	1131.5	2290.5	2197.0	2216.0	0.0142	0.1870
1.0320	1156.1	1156.1	1133.8	2390.9	2197.4	2216.4	0.0214	0.1873
1.0340	1158.5	1158.5	1136.2	2404.5	2197.8	2216.8	0.0029	0.1873
1.0360	1160.9	1160.9	1138.6	2380.2	2198.1	2217.1	-0.0051	0.1874
1.0380	1163.2	1163.2	1140.9	2258.8	2198.2	2217.2	-0.0262	0.1879
1.0400	1165.5	1165.5	1143.2	2293.6	2198.4	2217.3	0.0076	0.1880
1.0420	1167.9	1167.9	1145.6	2412.8	2198.8	2217.7	0.0253	0.1885
1.0440	1170.3	1170.3	1148.0	2448.4	2199.3	2218.2	0.0073	0.1885
1.0460	1172.7	1172.7	1150.4	2349.2	2199.6	2218.4	-0.0207	0.1889
1.0480	1175.0	1175.0	1152.7	2335.8	2199.9	2218.7	-0.0029	0.1889
1.0500	1177.4	1177.4	1155.1	2348.6	2200.1	2218.9	0.0027	0.1889
1.0520	1179.7	1179.7	1157.4	2328.6	2200.4	2219.1	-0.0043	0.1889
1.0540	1182.0	1182.0	1159.7	2280.5	2200.5	2219.3	-0.0104	0.1890
1.0560	1184.5	1184.5	1162.2	2490.6	2201.1	2219.8	0.0440	0.1906
1.0580	1186.9	1186.9	1164.6	2438.7	2201.5	2220.2	-0.0105	0.1907
1.0600	1189.4	1189.4	1167.1	2460.0	2202.0	2220.7	0.0043	0.1907
1.0620	1191.8	1191.8	1169.5	2388.7	2202.4	2221.0	-0.0147	0.1908
1.0640	1194.1	1194.1	1171.8	2343.0	2202.6	2221.3	-0.0096	0.1909
1.0660	1196.3	1196.3	1174.0	2236.2	2202.7	2221.3	-0.0233	0.1914
1.0680	1198.8	1198.8	1176.4	2407.3	2203.1	2221.7	0.0369	0.1925
1.0700	1200.9	1200.9	1178.6	2166.7	2203.0	2221.6	-0.0526	0.1947
1.0720	1203.2	1203.2	1180.9	2288.6	2203.2	2221.7	0.0273	0.1953
1.0740	1205.7	1205.7	1183.4	2472.4	2203.7	2222.2	0.0386	0.1965
1.0760	1208.0	1208.0	1185.7	2280.6	2203.8	2222.3	-0.0403	0.1978
1.0780	1210.3	1210.3	1188.0	2346.2	2204.1	2222.5	0.0142	0.1980
1.0800	1212.7	1212.7	1190.4	2431.4	2204.5	2222.9	0.0178	0.1982
1.0820	1215.1	1215.1	1192.8	2356.7	2204.8	2223.2	-0.0156	0.1984
1.0840	1217.4	1217.4	1195.1	2292.0	2205.0	2223.3	-0.0139	0.1986
1.0860	1219.7	1219.7	1197.4	2349.7	2205.2	2223.6	0.0124	0.1987
1.0880	1222.0	1222.0	1199.7	2311.2	2205.4	2223.7	-0.0083	0.1987
1.0900	1224.4	1224.4	1202.1	2386.7	2205.7	2224.0	0.0161	0.1990
1.0920	1226.9	1226.9	1204.6	2439.8	2206.2	2224.4	0.0110	0.1990
1.0940	1229.4	1229.4	1207.1	2550.5	2206.8	2225.1	0.0222	0.1994
1.0960	1232.0	1232.0	1209.7	2550.5	2207.4	2225.7	0.0000	0.1994
1.0980	1234.5	1234.5	1212.2	2550.4	2208.1	2226.4	0.0000	0.1994
1.1000	1237.1	1237.1	1214.8	2550.5	2208.7	2227.0	0.0000	0.1994
1.1020	1239.6	1239.6	1217.3	2550.5	2209.3	2227.6	0.0000	0.1994
1.1040	1242.2	1242.2	1219.9	2550.5	2209.9	2228.3	0.0000	0.1994
1.1060	1244.7	1244.7	1222.4	2550.5	2210.5	2228.9	0.0000	0.1994
1.1080	1247.3	1247.3	1225.0	2550.5	2211.1	2229.5	0.0000	0.1994
1.1100	1249.8	1249.8	1227.5	2550.5	2211.8	2230.1	0.0000	0.1994

I	TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
	1.1120	1252.4	1252.4	1230.1	2550.5	2212.4	2230.7	0.0000	0.1994
	1.1140	1254.9	1254.9	1232.6	2550.5	2213.0	2231.4	0.0000	0.1994
	1.1160	1257.5	1257.5	1235.2	2550.5	2213.6	2232.0	0.0000	0.1994
	1.1180	1260.0	1260.0	1237.7	2550.5	2214.2	2232.6	0.0000	0.1994
	1.1200	1262.6	1262.6	1240.3	2550.4	2214.8	2233.2	0.0000	0.1994
	1.1220	1265.1	1265.1	1242.8	2550.7	2215.4	2233.8	0.0000	0.1994
	1.1240	1267.7	1267.7	1245.4	2550.4	2216.0	2234.4	0.0000	0.1994
	1.1260	1270.2	1270.2	1247.9	2550.7	2216.6	2235.0	0.0000	0.1994
	1.1280	1272.8	1272.8	1250.5	2550.4	2217.2	2235.6	0.0000	0.1994
	1.1300	1275.3	1275.3	1253.0	2550.7	2217.8	2236.2	0.0000	0.1994
	1.1320	1277.9	1277.9	1255.6	2550.4	2218.3	2236.8	0.0000	0.1994
	1.1340	1280.4	1280.4	1258.1	2550.5	2218.9	2237.4	0.0000	0.1994
	1.1360	1283.0	1283.0	1260.7	2550.5	2219.5	2238.0	0.0000	0.1994
	1.1380	1285.5	1285.5	1263.2	2550.5	2220.1	2238.6	0.0000	0.1994
	1.1400	1288.1	1288.1	1265.8	2550.5	2220.7	2239.1	0.0000	0.1994
	1.1420	1290.6	1290.6	1268.3	2550.5	2221.3	2239.7	0.0000	0.1994
	1.1440	1293.2	1293.2	1270.9	2550.5	2221.8	2240.3	0.0000	0.1994
	1.1460	1295.7	1295.7	1273.4	2550.5	2222.4	2240.9	0.0000	0.1994
	1.1480	1298.3	1298.3	1276.0	2550.4	2223.0	2241.5	0.0000	0.1994
	1.1500	1300.8	1300.8	1278.5	2550.7	2223.5	2242.0	0.0000	0.1994
	1.1520	1303.4	1303.4	1281.1	2550.4	2224.1	2242.6	0.0000	0.1994
	1.1540	1305.9	1305.9	1283.6	2550.7	2224.7	2243.2	0.0000	0.1994
	1.1560	1308.5	1308.5	1286.2	2550.4	2225.2	2243.7	0.0000	0.1994
	1.1580	1311.0	1311.0	1288.7	2550.5	2225.8	2244.3	0.0000	0.1994
	1.1600	1313.6	1313.6	1291.3	2550.5	2226.4	2244.9	0.0000	0.1994
	1.1620	1316.1	1316.1	1293.8	2550.5	2226.9	2245.4	0.0000	0.1994
	1.1640	1318.7	1318.7	1296.4	2550.5	2227.5	2246.0	0.0000	0.1994
	1.1660	1321.2	1321.2	1298.9	2550.5	2228.0	2246.6	0.0000	0.1994
	1.1680	1323.8	1323.8	1301.5	2550.5	2228.6	2247.1	0.0000	0.1994
	1.1700	1326.3	1326.3	1304.0	2550.5	2229.1	2247.7	0.0000	0.1994
	1.1720	1328.9	1328.9	1306.6	2550.4	2229.7	2248.2	0.0000	0.1994
	1.1740	1331.4	1331.4	1309.1	2550.7	2230.2	2248.8	0.0000	0.1994
	1.1760	1334.0	1334.0	1311.7	2550.4	2230.8	2249.3	0.0000	0.1994
	1.1780	1336.5	1336.5	1314.2	2550.7	2231.3	2249.9	0.0000	0.1994
	1.1800	1339.1	1339.1	1316.8	2550.4	2231.9	2250.4	0.0000	0.1994
	1.1820	1341.6	1341.6	1319.3	2550.7	2232.4	2250.9	0.0000	0.1994
	1.1840	1344.2	1344.2	1321.9	2550.4	2232.9	2251.5	0.0000	0.1994
	1.1860	1346.7	1346.7	1324.4	2550.5	2233.5	2252.0	0.0000	0.1994
	1.1880	1349.3	1349.3	1327.0	2550.5	2234.0	2252.6	0.0000	0.1994
	1.1900	1351.8	1351.8	1329.5	2550.5	2234.5	2253.1	0.0000	0.1994
	1.1920	1354.4	1354.4	1332.1	2550.5	2235.1	2253.6	0.0000	0.1994
	1.1940	1356.9	1356.9	1334.6	2550.5	2235.6	2254.1	0.0000	0.1994
	1.1960	1359.5	1359.5	1337.2	2550.7	2236.1	2254.7	0.0000	0.1994
	1.1980	1362.1	1362.1	1339.8	2550.4	2236.6	2255.2	0.0000	0.1994
	1.2000	1364.6	1364.6	1342.3	2550.4	2237.2	2255.7	0.0000	0.1994
	1.2020	1367.2	1367.2	1344.9	2550.7	2237.7	2256.2	0.0000	0.1994
	1.2040	1369.7	1369.7	1347.4	2550.4	2238.2	2256.8	0.0000	0.1994
	1.2060	1372.3	1372.3	1350.0	2550.7	2238.7	2257.3	0.0000	0.1994
	1.2080	1374.8	1374.8	1352.5	2550.4	2239.2	2257.8	0.0000	0.1994
	1.2100	1377.4	1377.4	1355.1	2550.7	2239.8	2258.3	0.0000	0.1994
	1.2120	1379.9	1379.9	1357.6	2550.4	2240.3	2258.8	0.0000	0.1994
	1.2140	1382.5	1382.5	1360.2	2550.5	2240.8	2259.3	0.0000	0.1994
	1.2160	1385.0	1385.0	1362.7	2550.5	2241.3	2259.9	0.0000	0.1994
	1.2180	1387.6	1387.6	1365.3	2550.5	2241.8	2260.4	0.0000	0.1994
	1.2200	1390.1	1390.1	1367.8	2550.7	2242.3	2260.9	0.0000	0.1994
	1.2220	1392.7	1392.7	1370.4	2550.4	2242.8	2261.4	0.0000	0.1994
	1.2240	1395.2	1395.2	1372.9	2550.7	2243.3	2261.9	0.0000	0.1994
	1.2260	1397.8	1397.8	1375.5	2550.4	2243.8	2262.4	0.0000	0.1994

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
1.2280	1400.3	1400.3	1378.0	2550.4	2244.3	2262.9	0.0000	0.1994
1.2300	1402.9	1402.9	1380.6	2550.7	2244.8	2263.4	0.0000	0.1994
1.2320	1405.4	1405.4	1383.1	2550.4	2245.3	2263.9	0.0000	0.1994
1.2340	1408.0	1408.0	1385.7	2550.7	2245.8	2264.4	0.0000	0.1994
1.2360	1410.5	1410.5	1388.2	2550.4	2246.3	2264.9	0.0000	0.1994
1.2380	1413.1	1413.1	1390.8	2550.5	2246.8	2265.3	0.0000	0.1994
1.2400	1415.6	1415.6	1393.3	2550.7	2247.3	2265.8	0.0000	0.1994
1.2420	1418.2	1418.2	1395.9	2550.4	2247.8	2266.3	0.0000	0.1994
1.2440	1420.7	1420.7	1398.4	2550.7	2248.3	2266.8	0.0000	0.1994
1.2460	1423.3	1423.3	1401.0	2550.4	2248.7	2267.3	0.0000	0.1994
1.2480	1425.8	1425.8	1403.5	2550.7	2249.2	2267.8	0.0000	0.1994
1.2500	1428.4	1428.4	1406.1	2550.4	2249.7	2268.3	0.0000	0.1994
1.2520	1430.9	1430.9	1408.6	2550.4	2250.2	2268.7	0.0000	0.1994
1.2540	1433.5	1433.5	1411.2	2550.7	2250.7	2269.2	0.0000	0.1994
1.2560	1436.0	1436.0	1413.7	2550.4	2251.1	2269.7	0.0000	0.1994
1.2580	1438.6	1438.6	1416.3	2550.7	2251.6	2270.2	0.0000	0.1994
1.2600	1441.1	1441.1	1418.8	2550.4	2252.1	2270.6	0.0000	0.1994
1.2620	1443.7	1443.7	1421.4	2550.7	2252.6	2271.1	0.0000	0.1994
1.2640	1446.2	1446.2	1423.9	2550.5	2253.0	2271.6	0.0000	0.1994
1.2660	1448.8	1448.8	1426.5	2550.4	2253.5	2272.0	0.0000	0.1994
1.2680	1451.3	1451.3	1429.0	2550.7	2254.0	2272.5	0.0000	0.1994
1.2700	1453.9	1453.9	1431.6	2550.4	2254.4	2273.0	0.0000	0.1994
1.2720	1456.4	1456.4	1434.1	2550.7	2254.9	2273.4	0.0000	0.1994
1.2740	1459.0	1459.0	1436.7	2550.4	2255.4	2273.9	0.0000	0.1994
1.2760	1461.5	1461.5	1439.2	2550.7	2255.8	2274.4	0.0000	0.1994
1.2780	1464.1	1464.1	1441.8	2550.4	2256.3	2274.8	0.0000	0.1994
1.2800	1466.6	1466.6	1444.3	2550.4	2256.8	2275.3	0.0000	0.1994
1.2820	1469.2	1469.2	1446.9	2550.7	2257.2	2275.7	0.0000	0.1994
1.2840	1471.7	1471.7	1449.4	2550.5	2257.7	2276.2	0.0000	0.1994
1.2860	1474.3	1474.3	1452.0	2550.5	2258.1	2276.6	0.0000	0.1994
1.2880	1476.8	1476.8	1454.5	2550.5	2258.6	2277.1	0.0000	0.1994
1.2900	1479.4	1479.4	1457.1	2550.5	2259.0	2277.5	0.0000	0.1994
1.2920	1481.9	1481.9	1459.6	2550.5	2259.5	2278.0	0.0000	0.1994
1.2940	1484.5	1484.5	1462.2	2550.4	2259.9	2278.4	0.0000	0.1994
1.2960	1487.0	1487.0	1464.7	2550.7	2260.4	2278.9	0.0000	0.1994
1.2980	1489.6	1489.6	1467.3	2550.4	2260.8	2279.3	0.0000	0.1994
1.3000	1492.1	1492.1	1469.8	2550.7	2261.3	2279.8	0.0000	0.1994
1.3020	1494.7	1494.7	1472.4	2550.4	2261.7	2280.2	0.0000	0.1994
1.3040	1497.2	1497.2	1474.9	2550.7	2262.2	2280.6	0.0000	0.1994
1.3060	1499.8	1499.8	1477.5	2550.4	2262.6	2281.1	0.0000	0.1994
1.3080	1502.3	1502.3	1480.0	2550.5	2263.0	2281.5	0.0000	0.1994
1.3100	1504.9	1504.9	1482.6	2550.5	2263.5	2281.9	0.0000	0.1994
1.3120	1507.4	1507.4	1485.1	2550.5	2263.9	2282.4	0.0000	0.1994
1.3140	1510.0	1510.0	1487.7	2550.5	2264.4	2282.8	0.0000	0.1994
1.3160	1512.5	1512.5	1490.2	2550.5	2264.8	2283.2	0.0000	0.1994
1.3180	1515.1	1515.1	1492.8	2550.4	2265.2	2283.7	0.0000	0.1994
1.3200	1517.6	1517.6	1495.3	2550.7	2265.7	2284.1	0.0000	0.1994
1.3220	1520.2	1520.2	1497.9	2550.4	2266.1	2284.5	0.0000	0.1994
1.3240	1522.7	1522.7	1500.4	2550.7	2266.5	2285.0	0.0000	0.1994
1.3260	1525.3	1525.3	1503.0	2550.4	2266.9	2285.4	0.0000	0.1994
1.3280	1527.8	1527.8	1505.5	2550.7	2267.4	2285.8	0.0000	0.1994
1.3300	1530.4	1530.4	1508.1	2550.4	2267.8	2286.2	0.0000	0.1994
1.3320	1532.9	1532.9	1510.6	2540.0	2268.2	2286.6	-0.0020	0.1994
1.3340	1535.3	1535.3	1513.0	2375.1	2268.4	2286.8	-0.0336	0.2003
1.3360	1537.6	1537.6	1515.3	2320.3	2268.4	2286.8	-0.0117	0.2005
1.3380	1540.0	1540.0	1517.7	2374.3	2268.6	2286.9	0.0115	0.2006
1.3400	1542.4	1542.4	1520.1	2377.8	2268.8	2287.1	0.0007	0.2006
1.3420	1544.8	1544.8	1522.5	2450.6	2269.0	2287.3	0.0151	0.2007

I	TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
	1.3440	1547.4	1547.4	1525.1	2611.1	2269.5	2287.8	0.0317	0.2015
	1.3460	1550.4	1550.4	1528.1	3010.1	2270.6	2289.1	0.0710	0.2056
	1.3480	1553.5	1553.5	1531.2	3060.5	2271.8	2290.4	0.0083	0.2056
	1.3500	1556.6	1556.6	1534.3	3049.8	2273.0	2291.7	-0.0018	0.2056
	1.3520	1559.6	1559.6	1537.3	3091.7	2274.2	2293.1	0.0068	0.2057
	1.3540	1562.6	1562.6	1540.3	2978.4	2275.2	2294.3	-0.0187	0.2059
	1.3560	1565.5	1565.5	1543.2	2862.8	2276.1	2295.2	-0.0198	0.2063
	1.3580	1568.3	1568.3	1546.0	2784.8	2276.8	2296.0	-0.0138	0.2064
	1.3600	1571.1	1571.1	1548.8	2834.6	2277.7	2296.9	0.0089	0.2065
	1.3620	1574.1	1574.1	1551.8	2985.4	2278.7	2298.1	0.0259	0.2070
	1.3640	1577.2	1577.2	1554.9	3127.3	2279.9	2299.5	0.0232	0.2074
	1.3660	1580.0	1580.0	1557.7	2821.0	2280.7	2300.4	-0.0515	0.2095
	1.3680	1582.9	1582.9	1560.6	2848.0	2281.6	2301.3	0.0048	0.2095
	1.3700	1585.7	1585.7	1563.4	2765.5	2282.3	2302.0	-0.0147	0.2097
	1.3720	1588.4	1588.4	1566.1	2762.5	2283.0	2302.7	-0.0006	0.2097
	1.3740	1591.2	1591.2	1568.9	2818.8	2283.7	2303.6	0.0101	0.2098
	1.3760	1594.1	1594.1	1571.8	2834.7	2284.5	2304.4	0.0028	0.2098
	1.3780	1596.9	1596.9	1574.6	2840.7	2285.4	2305.3	0.0011	0.2098
	1.3800	1599.7	1599.7	1577.4	2804.2	2286.1	2306.1	-0.0065	0.2098
	1.3820	1602.5	1602.5	1580.2	2749.1	2286.8	2306.8	-0.0099	0.2099
	1.3840	1605.2	1605.2	1582.9	2729.5	2287.4	2307.5	-0.0036	0.2099
	1.3860	1607.9	1607.9	1585.6	2708.3	2288.0	2308.1	-0.0039	0.2099
	1.3880	1610.6	1610.6	1588.3	2703.2	2288.6	2308.7	-0.0009	0.2099
	1.3900	1613.4	1613.4	1591.1	2841.6	2289.4	2309.6	0.0249	0.2104
	1.3920	1616.4	1616.4	1594.1	2905.5	2290.3	2310.5	0.0111	0.2105
	1.3940	1619.0	1619.0	1596.7	2616.5	2290.8	2311.0	-0.0523	0.2127
	1.3960	1621.6	1621.6	1599.3	2632.4	2291.3	2311.5	0.0030	0.2127
	1.3980	1623.9	1623.9	1601.6	2325.4	2291.3	2311.5	-0.0619	0.2157
	1.4000	1626.3	1626.3	1604.0	2420.3	2291.5	2311.7	0.0200	0.2160
	1.4020	1629.3	1629.3	1607.0	2980.3	2292.5	2312.8	0.1037	0.2245
	1.4040	1631.7	1631.7	1609.4	2335.0	2292.5	2312.8	-0.1214	0.2359
	1.4060	1634.7	1634.7	1612.4	3040.2	2293.6	2314.0	0.1312	0.2490
	1.4080	1637.3	1637.3	1615.0	2548.1	2294.0	2314.4	-0.0881	0.2549
	1.4100	1640.0	1640.0	1617.7	2771.5	2294.6	2315.1	0.0420	0.2562
	1.4120	1643.1	1643.1	1620.8	3121.0	2295.8	2316.4	0.0593	0.2588
	1.4140	1646.2	1646.2	1623.9	3095.7	2296.9	2317.7	-0.0041	0.2588
	1.4160	1649.4	1649.4	1627.1	3205.9	2298.2	2319.2	0.0175	0.2590
	1.4180	1652.7	1652.7	1630.4	3272.1	2299.6	2320.8	0.0102	0.2591
	1.4200	1656.0	1656.0	1633.7	3258.9	2301.0	2322.4	-0.0020	0.2591
	1.4220	1658.8	1658.8	1636.5	2866.9	2301.7	2323.2	-0.0640	0.2622
	1.4240	1661.4	1661.4	1639.1	2512.0	2302.0	2323.5	-0.0660	0.2654
	1.4260	1664.5	1664.5	1642.2	3118.4	2303.2	2324.8	0.1077	0.2739
	1.4280	1668.2	1668.2	1645.9	3757.9	2305.2	2327.5	0.0930	0.2802
	1.4300	1671.3	1671.3	1649.0	3069.3	2306.3	2328.7	-0.1009	0.2875
	1.4320	1674.3	1674.3	1652.0	3030.2	2307.3	2329.8	-0.0064	0.2875
	1.4340	1677.4	1677.4	1655.1	3078.1	2308.4	2331.0	0.0079	0.2876
	1.4360	1680.4	1680.4	1658.1	3039.6	2309.4	2332.1	-0.0063	0.2876
	1.4380	1683.6	1683.6	1661.3	3139.8	2310.6	2333.4	0.0162	0.2878
	1.4400	1686.7	1686.7	1664.4	3098.9	2311.6	2334.7	-0.0066	0.2878
	1.4420	1689.7	1689.7	1667.4	3019.9	2312.6	2335.8	-0.0129	0.2879
	1.4440	1692.7	1692.7	1670.4	3011.1	2313.6	2336.8	-0.0015	0.2879
	1.4460	1695.7	1695.7	1673.4	2973.0	2314.5	2337.8	-0.0064	0.2880
	1.4480	1698.6	1698.6	1676.3	2892.3	2315.3	2338.7	-0.0138	0.2881
	1.4500	1701.5	1701.5	1679.2	2909.8	2316.1	2339.6	0.0030	0.2881
	1.4520	1704.5	1704.5	1682.2	3018.2	2317.1	2340.7	0.0183	0.2883
	1.4540	1707.6	1707.6	1685.3	3078.9	2318.1	2341.8	0.0100	0.2884
	1.4560	1710.7	1710.7	1688.4	3082.5	2319.2	2343.0	0.0006	0.2884
	1.4580	1713.7	1713.7	1691.4	3013.2	2320.1	2344.1	-0.0114	0.2885

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
1.4600	1716.8	1716.8	1694.5	3102.5	2321.2	2345.3	0.0146	0.2887
1.4620	1719.9	1719.9	1697.6	3080.7	2322.3	2346.4	-0.0035	0.2887
1.4640	1723.0	1723.0	1700.7	3149.7	2323.4	2347.7	0.0111	0.2888
1.4660	1726.2	1726.2	1703.9	3163.7	2324.5	2349.0	0.0022	0.2888
1.4680	1729.2	1729.2	1706.9	3021.7	2325.5	2350.1	-0.0230	0.2891
1.4700	1732.5	1732.5	1710.2	3342.2	2326.9	2351.7	0.0504	0.2909
1.4720	1736.0	1736.0	1713.7	3435.9	2328.4	2353.5	0.0138	0.2911
1.4740	1738.5	1738.5	1716.2	2519.5	2328.6	2353.7	-0.1539	0.3079
1.4760	1740.8	1740.8	1718.5	2291.3	2328.6	2353.7	-0.0474	0.3094
1.4780	1743.4	1743.4	1721.1	2574.8	2328.9	2354.0	0.0583	0.3118
1.4800	1746.2	1746.2	1723.9	2844.5	2329.6	2354.7	0.0498	0.3135
1.4820	1748.9	1748.9	1726.6	2662.5	2330.1	2355.2	-0.0331	0.3142
1.4840	1751.3	1751.3	1729.0	2376.1	2330.1	2355.2	-0.0568	0.3164
1.4860	1754.1	1754.1	1731.8	2882.0	2330.9	2356.0	0.0962	0.3228
1.4880	1756.9	1756.9	1734.6	2772.1	2331.5	2356.6	-0.0194	0.3230
1.4900	1760.0	1760.0	1737.7	3071.7	2332.5	2357.7	0.0513	0.3248
1.4920	1763.0	1763.0	1740.7	3019.4	2333.4	2358.7	-0.0086	0.3248
1.4940	1766.0	1766.0	1743.7	3036.1	2334.3	2359.7	0.0028	0.3248
1.4960	1768.9	1768.9	1746.6	2852.7	2335.0	2360.5	-0.0312	0.3255
1.4980	1771.8	1771.8	1749.5	2884.0	2335.7	2361.2	0.0055	0.3255
1.5000	1774.8	1774.8	1752.5	2981.8	2336.6	2362.2	0.0167	0.3257
1.5020	1777.7	1777.7	1755.4	2977.1	2337.5	2363.1	-0.0008	0.3257
1.5040	1780.7	1780.7	1758.4	2951.7	2338.3	2364.0	-0.0043	0.3257
1.5060	1783.7	1783.7	1761.4	3024.4	2339.2	2365.0	0.0122	0.3258
1.5080	1786.7	1786.7	1764.4	3007.3	2340.1	2365.9	-0.0028	0.3258
1.5100	1789.8	1789.8	1767.5	3063.0	2341.0	2367.0	0.0092	0.3259
1.5120	1792.7	1792.7	1770.4	2950.4	2341.8	2367.9	-0.0187	0.3261
1.5140	1795.7	1795.7	1773.4	2951.3	2342.6	2368.7	0.0001	0.3261
1.5160	1798.6	1798.6	1776.3	2931.9	2343.4	2369.6	-0.0033	0.3261
1.5180	1801.6	1801.6	1779.3	2945.8	2344.2	2370.4	0.0024	0.3261
1.5200	1804.6	1804.6	1782.3	3008.1	2345.1	2371.4	0.0105	0.3262
1.5220	1807.5	1807.5	1785.2	2952.5	2345.9	2372.2	-0.0093	0.3263
1.5240	1810.5	1810.5	1788.2	2964.7	2346.7	2373.1	0.0021	0.3263
1.5260	1814.1	1814.1	1791.8	3572.6	2348.3	2375.1	0.0930	0.3321
1.5280	1817.0	1817.0	1794.7	2958.4	2349.1	2375.9	-0.0941	0.3380
1.5300	1820.0	1820.0	1797.7	2944.7	2349.9	2376.8	-0.0023	0.3380
1.5320	1822.9	1822.9	1800.6	2952.5	2350.7	2377.6	0.0013	0.3380
1.5340	1825.9	1825.9	1803.6	3013.9	2351.5	2378.5	0.0103	0.3381
1.5360	1828.9	1828.9	1806.6	3016.1	2352.4	2379.5	0.0004	0.3381
1.5380	1832.0	1832.0	1809.7	3019.3	2353.3	2380.4	0.0005	0.3381
1.5400	1835.0	1835.0	1812.7	3033.6	2354.1	2381.4	0.0024	0.3381
1.5420	1838.0	1838.0	1815.7	3017.1	2355.0	2382.3	-0.0027	0.3381
1.5440	1841.2	1841.2	1818.9	3218.8	2356.1	2383.6	0.0323	0.3388
1.5460	1844.2	1844.2	1821.9	2966.9	2356.9	2384.4	-0.0407	0.3399
1.5480	1847.3	1847.3	1825.0	3058.2	2357.8	2385.4	0.0152	0.3400
1.5500	1850.3	1850.3	1828.0	3075.0	2358.7	2386.5	0.0027	0.3400
1.5520	1853.3	1853.3	1831.0	2992.1	2359.6	2387.3	-0.0137	0.3401
1.5540	1856.4	1856.4	1834.1	3118.5	2360.5	2388.4	0.0207	0.3404
1.5560	1859.5	1859.5	1837.2	3050.7	2361.4	2389.4	-0.0110	0.3405
1.5580	1862.5	1862.5	1840.2	3045.0	2362.3	2390.3	-0.0009	0.3405
1.5600	1865.6	1865.6	1843.3	3078.2	2363.2	2391.4	0.0054	0.3405
1.5620	1868.4	1868.4	1846.1	2748.7	2363.7	2391.8	-0.0566	0.3426
1.5640	1871.3	1871.3	1849.0	2937.0	2364.4	2392.6	0.0331	0.3434
1.5660	1874.4	1874.4	1852.1	3073.1	2365.3	2393.6	0.0226	0.3437
1.5680	1877.5	1877.5	1855.2	3084.6	2366.3	2394.6	0.0019	0.3437
1.5700	1880.6	1880.6	1858.3	3124.4	2367.2	2395.7	0.0064	0.3437
1.5720	1883.7	1883.7	1861.4	3108.8	2368.2	2396.7	-0.0025	0.3437
1.5740	1886.7	1886.7	1864.4	2977.5	2369.0	2397.6	-0.0216	0.3440

I	TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
	1.5760	1889.8	1889.8	1867.5	3130.9	2369.9	2398.6	0.0251	0.3445
	1.5780	1893.1	1893.1	1870.8	3348.5	2371.2	2400.1	0.0336	0.3452
	1.5800	1896.3	1896.3	1874.0	3131.1	2372.1	2401.1	-0.0336	0.3459
	1.5820	1899.4	1899.4	1877.1	3121.6	2373.1	2402.2	-0.0015	0.3459
	1.5840	1902.5	1902.5	1880.2	3081.2	2374.0	2403.2	-0.0065	0.3460
	1.5860	1905.6	1905.6	1883.3	3073.7	2374.8	2404.1	-0.0012	0.3460
	1.5880	1908.7	1908.7	1886.4	3127.2	2375.8	2405.2	0.0086	0.3460
	1.5900	1911.2	1911.2	1888.9	2533.1	2376.0	2405.3	-0.1050	0.3532
	1.5920	1913.5	1913.5	1891.2	2324.8	2375.9	2405.2	-0.0429	0.3544
	1.5940	1916.7	1916.7	1894.4	3185.8	2376.9	2406.4	0.1562	0.3702
	1.5960	1920.0	1920.0	1897.7	3304.9	2378.1	2407.7	0.0184	0.3704
	1.5980	1923.2	1923.2	1900.9	3205.0	2379.1	2408.9	-0.0154	0.3705
	1.6000	1926.5	1926.5	1904.2	3240.6	2380.2	2410.1	0.0055	0.3705
	1.6020	1929.6	1929.6	1907.3	3149.0	2381.2	2411.2	-0.0143	0.3707
	1.6040	1932.7	1932.7	1910.4	3118.7	2382.1	2412.2	-0.0048	0.3707
	1.6060	1936.0	1936.0	1913.7	3276.6	2383.2	2413.4	0.0247	0.3711
	1.6080	1939.1	1939.1	1916.8	3098.8	2384.1	2414.4	-0.0279	0.3716
	1.6100	1942.2	1942.2	1919.9	3092.4	2385.0	2415.4	-0.0010	0.3716
	1.6120	1945.4	1945.4	1923.1	3239.9	2386.0	2416.6	0.0233	0.3719
	1.6140	1948.2	1948.2	1925.9	2711.5	2386.4	2417.0	-0.0888	0.3768
	1.6160	1950.4	1950.4	1928.1	2263.7	2386.3	2416.8	-0.0900	0.3819
	1.6180	1952.7	1952.7	1930.4	2284.8	2386.2	2416.6	0.0046	0.3819
	1.6200	1955.4	1955.4	1933.1	2733.9	2386.6	2417.0	0.0895	0.3869
	1.6220	1958.8	1958.8	1936.5	3330.2	2387.8	2418.4	0.0983	0.3928
	1.6240	1962.1	1962.1	1939.8	3370.0	2389.0	2419.8	0.0059	0.3928
	1.6260	1965.7	1965.7	1943.4	3532.6	2390.4	2421.5	0.0236	0.3931
	1.6280	1969.2	1969.2	1946.9	3486.9	2391.7	2423.1	-0.0065	0.3932
	1.6300	1972.5	1972.5	1950.2	3315.1	2392.9	2424.4	-0.0253	0.3936
	1.6320	1975.8	1975.8	1953.5	3296.8	2394.0	2425.6	-0.0028	0.3936
	1.6340	1978.7	1978.7	1956.4	2908.9	2394.6	2426.3	-0.0625	0.3959
	1.6360	1980.9	1980.9	1958.6	2246.9	2394.4	2426.1	-0.1284	0.4059
	1.6380	1983.2	1983.2	1960.9	2290.5	2394.3	2425.9	0.0096	0.4059
	1.6400	1985.5	1985.5	1963.2	2279.7	2394.1	2425.7	-0.0024	0.4060
	1.6420	1988.5	1988.5	1966.2	3007.4	2394.9	2426.5	0.1377	0.4172
	1.6440	1991.5	1991.5	1969.2	2985.5	2395.6	2427.3	-0.0037	0.4172
	1.6460	1994.9	1994.9	1972.6	3432.0	2396.9	2428.7	0.0696	0.4200
	1.6480	1998.0	1998.0	1975.7	3103.5	2397.7	2429.7	-0.0503	0.4215
	1.6500	2001.1	2001.1	1978.8	3116.2	2398.6	2430.6	0.0020	0.4215
	1.6520	2004.6	2004.6	1982.3	3490.0	2399.9	2432.2	0.0566	0.4234
	1.6540	2007.8	2007.8	1985.5	3146.2	2400.8	2433.2	-0.0518	0.4249
	1.6560	2011.0	2011.0	1988.7	3202.6	2401.8	2434.3	0.0089	0.4249
	1.6580	2014.3	2014.3	1992.0	3312.0	2402.9	2435.5	0.0168	0.4251
	1.6600	2017.7	2017.7	1995.4	3428.0	2404.1	2436.9	0.0172	0.4253
	1.6620	2020.8	2020.8	1998.5	3097.0	2405.0	2437.8	-0.0507	0.4268
	1.6640	2023.9	2023.9	2001.6	3085.7	2405.8	2438.7	-0.0018	0.4268
	1.6660	2027.1	2027.1	2004.8	3207.6	2406.7	2439.8	0.0194	0.4270
	1.6680	2030.4	2030.4	2008.1	3327.0	2407.8	2441.1	0.0183	0.4272
	1.6700	2033.8	2033.8	2011.5	3334.2	2409.0	2442.3	0.0011	0.4272
	1.6720	2036.7	2036.7	2014.4	2944.6	2409.6	2443.0	-0.0621	0.4294
	1.6740	2039.8	2039.8	2017.5	3047.1	2410.4	2443.8	0.0171	0.4295
	1.6760	2043.2	2043.2	2020.9	3427.5	2411.6	2445.2	0.0587	0.4315
	1.6780	2046.5	2046.5	2024.2	3263.7	2412.6	2446.3	-0.0245	0.4319
	1.6800	2049.7	2049.7	2027.4	3212.6	2413.5	2447.4	-0.0079	0.4319
	1.6820	2052.8	2052.8	2030.5	3164.3	2414.4	2448.4	-0.0076	0.4319
	1.6840	2056.0	2056.0	2033.7	3148.7	2415.3	2449.3	-0.0025	0.4319
	1.6860	2059.1	2059.1	2036.8	3162.1	2416.2	2450.3	0.0021	0.4319
	1.6880	2062.4	2062.4	2040.1	3280.8	2417.2	2451.4	0.0184	0.4321
	1.6900	2065.6	2065.6	2043.3	3168.5	2418.1	2452.4	-0.0174	0.4323

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
1.6920	2068.8	2068.8	2046.5	3254.6	2419.1	2453.5	0.0134	0.4324
1.6940	2072.2	2072.2	2049.9	3308.3	2420.1	2454.7	0.0082	0.4324
1.6960	2075.1	2075.1	2052.8	2944.8	2420.8	2455.3	-0.0581	0.4343
1.6980	2078.3	2078.3	2056.0	3231.7	2421.7	2456.4	0.0464	0.4356
1.7000	2081.5	2081.5	2059.2	3147.2	2422.6	2457.3	-0.0132	0.4357
1.7020	2084.4	2084.4	2062.1	2907.0	2423.1	2457.9	-0.0397	0.4366
1.7040	2087.6	2087.6	2065.3	3238.5	2424.1	2459.0	0.0539	0.4382
1.7060	2090.7	2090.7	2068.4	3106.9	2424.9	2459.8	-0.0207	0.4384
1.7080	2094.0	2094.0	2071.7	3276.9	2425.9	2460.9	0.0266	0.4388
1.7100	2097.4	2097.4	2075.1	3420.4	2427.1	2462.3	0.0214	0.4391
1.7120	2100.8	2100.8	2078.5	3390.6	2428.2	2463.6	-0.0044	0.4391
1.7140	2104.1	2104.1	2081.8	3275.1	2429.2	2464.7	-0.0173	0.4393
1.7160	2107.3	2107.3	2085.0	3204.6	2430.1	2465.7	-0.0109	0.4393
1.7180	2110.6	2110.6	2088.3	3251.0	2431.0	2466.7	0.0072	0.4394
1.7200	2113.7	2113.7	2091.4	3118.2	2431.8	2467.6	-0.0209	0.4396
1.7220	2116.4	2116.4	2094.1	2684.8	2432.1	2467.8	-0.0747	0.4427
1.7240	2119.5	2119.5	2097.2	3183.8	2433.0	2468.8	0.0850	0.4468
1.7260	2122.9	2122.9	2100.6	3356.7	2434.1	2470.0	0.0264	0.4472
1.7280	2126.2	2126.2	2103.9	3328.1	2435.1	2471.2	-0.0043	0.4472
1.7300	2129.3	2129.3	2107.0	3117.2	2435.9	2472.0	-0.0327	0.4478
1.7320	2132.5	2132.5	2110.2	3187.7	2436.8	2473.0	0.0112	0.4478
1.7340	2135.8	2135.8	2113.5	3266.6	2437.7	2474.0	0.0122	0.4479
1.7360	2138.8	2138.8	2116.5	3021.2	2438.4	2474.7	-0.0390	0.4487
1.7380	2141.3	2141.3	2119.0	2530.5	2438.5	2474.8	-0.0884	0.4531
1.7400	2143.8	2143.8	2121.5	2495.6	2438.6	2474.8	-0.0069	0.4531
1.7420	2146.5	2146.5	2124.2	2658.0	2438.8	2475.0	0.0315	0.4536
1.7440	2149.8	2149.8	2127.5	3252.9	2439.7	2476.1	0.1007	0.4592
1.7460	2152.9	2152.9	2130.6	3168.7	2440.6	2477.0	-0.0131	0.4593
1.7480	2156.0	2156.0	2133.7	3108.4	2441.3	2477.8	-0.0096	0.4593
1.7500	2159.5	2159.5	2137.2	3440.7	2442.5	2479.1	0.0507	0.4607
1.7520	2162.7	2162.7	2140.4	3272.5	2443.4	2480.1	-0.0251	0.4610
1.7540	2166.0	2166.0	2143.7	3235.4	2444.3	2481.1	-0.0057	0.4610
1.7560	2169.2	2169.2	2146.9	3215.8	2445.2	2482.1	-0.0030	0.4611
1.7580	2172.4	2172.4	2150.1	3251.5	2446.1	2483.1	0.0055	0.4611
1.7600	2175.6	2175.6	2153.3	3107.9	2446.9	2483.9	-0.0226	0.4613
1.7620	2178.3	2178.3	2156.0	2726.6	2447.2	2484.2	-0.0654	0.4636
1.7640	2181.2	2181.2	2158.9	2892.1	2447.7	2484.7	0.0295	0.4641
1.7660	2184.4	2184.4	2162.1	3231.0	2448.6	2485.7	0.0553	0.4658
1.7680	2187.4	2187.4	2165.1	2997.8	2449.2	2486.3	-0.0374	0.4665
1.7700	2190.7	2190.7	2168.4	3302.5	2450.2	2487.4	0.0484	0.4677
1.7720	2194.1	2194.1	2171.8	3393.3	2451.2	2488.6	0.0136	0.4678
1.7740	2197.7	2197.7	2175.4	3602.5	2452.5	2490.1	0.0299	0.4683
1.7760	2201.2	2201.2	2178.9	3539.6	2453.8	2491.6	-0.0088	0.4684
1.7780	2204.7	2204.7	2182.4	3463.9	2454.9	2492.9	-0.0108	0.4684
1.7800	2208.5	2208.5	2186.2	3769.5	2456.4	2494.7	0.0423	0.4694
1.7820	2213.6	2213.6	2191.3	5128.4	2459.4	2499.2	0.1527	0.4818
1.7840	2218.4	2218.4	2196.1	4816.9	2462.0	2503.0	-0.0313	0.4823
1.7860	2223.0	2223.0	2200.7	4629.2	2464.4	2506.4	-0.0199	0.4825
1.7880	2227.6	2227.6	2205.3	4584.5	2466.8	2509.7	-0.0048	0.4825
1.7900	2232.1	2232.1	2209.8	4481.7	2469.1	2512.7	-0.0113	0.4825
1.7920	2236.8	2236.8	2214.5	4698.7	2471.6	2516.2	0.0236	0.4828
1.7940	2241.7	2241.7	2219.4	4853.8	2474.2	2520.0	0.0162	0.4830
1.7960	2246.9	2246.9	2224.6	5251.2	2477.3	2524.7	0.0393	0.4838
1.7980	2252.2	2252.2	2229.9	5328.1	2480.5	2529.6	0.0073	0.4838
1.8000	2257.4	2257.4	2235.1	5184.1	2483.5	2534.1	-0.0137	0.4839
1.8020	2262.6	2262.6	2240.3	5120.6	2486.4	2538.4	-0.0062	0.4839
1.8040	2267.7	2267.7	2245.4	5193.6	2489.4	2542.9	0.0071	0.4839
1.8060	2272.6	2272.6	2250.3	4824.7	2492.0	2546.5	-0.0368	0.4846

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
1.8080	2276.4	2276.4	2254.1	3821.3	2493.5	2548.3	-0.1161	0.4916
1.8100	2280.0	2280.0	2257.7	3603.8	2494.7	2549.7	-0.0293	0.4920
1.8120	2283.5	2283.5	2261.2	3546.1	2495.8	2551.0	-0.0081	0.4920
1.8140	2287.0	2287.0	2264.7	3466.8	2496.9	2552.2	-0.0113	0.4921
1.8160	2290.4	2290.4	2268.1	3352.1	2497.9	2553.2	-0.0168	0.4923
1.8180	2293.6	2293.6	2271.3	3238.0	2498.7	2554.1	-0.0173	0.4924
1.8200	2296.8	2296.8	2274.5	3223.1	2499.5	2554.9	-0.0023	0.4924
1.8220	2300.0	2300.0	2277.7	3209.5	2500.3	2555.7	-0.0021	0.4924
1.8240	2303.0	2303.0	2280.7	3014.4	2500.8	2556.3	-0.0313	0.4929
1.8260	2306.0	2306.0	2283.7	2915.3	2501.3	2556.7	-0.0167	0.4931
1.8280	2309.0	2309.0	2286.7	3076.9	2501.9	2557.3	0.0270	0.4934
1.8300	2312.3	2312.3	2290.0	3233.4	2502.7	2558.1	0.0248	0.4937
1.8320	2315.6	2315.6	2293.3	3317.6	2503.6	2559.1	0.0129	0.4938
1.8340	2318.9	2318.9	2296.6	3315.9	2504.5	2560.0	-0.0003	0.4938
1.8360	2322.3	2322.3	2300.0	3380.1	2505.4	2561.1	0.0096	0.4939
1.8380	2325.7	2325.7	2303.4	3381.6	2506.4	2562.1	0.0002	0.4939
1.8400	2329.1	2329.1	2306.8	3460.4	2507.4	2563.3	0.0115	0.4939
1.8420	2332.6	2332.6	2310.3	3488.5	2508.5	2564.4	0.0040	0.4939
1.8440	2335.8	2335.8	2313.5	3191.2	2509.2	2565.2	-0.0445	0.4949
1.8460	2339.4	2339.4	2317.1	3583.3	2510.4	2566.5	0.0579	0.4966
1.8480	2342.7	2342.7	2320.4	3358.9	2511.3	2567.5	-0.0323	0.4972
1.8500	2346.1	2346.1	2323.8	3317.4	2512.2	2568.5	-0.0062	0.4972
1.8520	2349.5	2349.5	2327.2	3445.8	2513.2	2569.6	0.0190	0.4974
1.8540	2352.6	2352.6	2330.3	3135.3	2513.9	2570.2	-0.0472	0.4985
1.8560	2355.8	2355.8	2333.5	3201.4	2514.6	2571.0	0.0104	0.4985
1.8580	2358.8	2358.8	2336.5	2983.6	2515.1	2571.5	-0.0352	0.4992
1.8600	2362.5	2362.5	2340.2	3640.9	2516.3	2572.9	0.0992	0.5041
1.8620	2365.5	2365.5	2343.2	3060.1	2516.9	2573.4	-0.0867	0.5078
1.8640	2368.7	2368.7	2346.4	3135.7	2517.6	2574.1	0.0122	0.5079
1.8660	2372.3	2372.3	2350.0	3644.5	2518.8	2575.5	0.0750	0.5107
1.8680	2375.2	2375.2	2352.9	2855.0	2519.1	2575.8	-0.1215	0.5179
1.8700	2378.7	2378.7	2356.4	3501.5	2520.2	2577.0	0.1017	0.5229
1.8720	2382.0	2382.0	2359.7	3334.0	2521.0	2577.9	-0.0245	0.5232
1.8740	2385.6	2385.6	2363.3	3627.0	2522.2	2579.3	0.0421	0.5240
1.8760	2389.6	2389.6	2367.3	3972.7	2523.8	2581.1	0.0455	0.5250
1.8780	2393.3	2393.3	2371.0	3693.8	2525.0	2582.6	-0.0364	0.5256
1.8800	2396.6	2396.6	2374.3	3281.3	2525.8	2583.4	-0.0592	0.5273
1.8820	2398.8	2398.8	2376.5	2244.9	2525.5	2583.1	-0.1875	0.5439
1.8840	2401.6	2401.6	2379.3	2737.5	2525.8	2583.3	0.0989	0.5484
1.8860	2404.6	2404.6	2382.3	3066.9	2526.3	2583.8	0.0567	0.5498
1.8880	2407.9	2407.9	2385.6	3283.7	2527.1	2584.7	0.0341	0.5503
1.8900	2411.4	2411.4	2389.1	3518.3	2528.2	2585.8	0.0345	0.5509
1.8920	2414.9	2414.9	2392.6	3481.9	2529.2	2586.9	-0.0052	0.5509
1.8940	2418.4	2418.4	2396.1	3495.1	2530.2	2588.1	0.0019	0.5509
1.8960	2422.1	2422.1	2399.8	3685.1	2531.4	2589.5	0.0265	0.5512
1.8980	2425.6	2425.6	2403.3	3465.6	2532.4	2590.5	-0.0307	0.5516
1.9000	2429.1	2429.1	2406.8	3526.9	2533.5	2591.7	0.0088	0.5517
1.9020	2432.5	2432.5	2410.2	3425.8	2534.4	2592.7	-0.0145	0.5518
1.9040	2436.2	2436.2	2413.9	3670.9	2535.6	2594.1	0.0345	0.5523
1.9060	2439.8	2439.8	2417.5	3649.9	2536.8	2595.4	-0.0029	0.5523
1.9080	2443.6	2443.6	2421.3	3815.4	2538.1	2597.0	0.0222	0.5525
1.9100	2447.2	2447.2	2424.9	3585.0	2539.2	2598.2	-0.0311	0.5529
1.9120	2450.9	2450.9	2428.6	3631.1	2540.3	2599.5	0.0064	0.5530
1.9140	2454.8	2454.8	2432.5	3964.4	2541.8	2601.3	0.0439	0.5538
1.9160	2457.4	2457.4	2435.1	2621.3	2541.9	2601.4	-0.2039	0.5724
1.9180	2461.1	2461.1	2438.8	3665.3	2543.1	2602.7	0.1661	0.5842
1.9200	2464.8	2464.8	2442.5	3658.2	2544.2	2604.0	-0.0010	0.5842
1.9220	2467.8	2467.8	2445.5	3006.8	2544.7	2604.5	-0.0977	0.5881

I TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
1.9240	2471.4	2471.4	2449.1	3630.9	2545.8	2605.7	0.0940	0.5918
1.9260	2475.1	2475.1	2452.8	3644.0	2547.0	2607.0	0.0018	0.5918
1.9280	2478.5	2478.5	2456.2	3433.1	2547.9	2608.0	-0.0298	0.5921
1.9300	2482.1	2482.1	2459.8	3650.6	2549.1	2609.3	0.0307	0.5925
1.9320	2485.7	2485.7	2463.4	3590.3	2550.1	2610.5	-0.0083	0.5926
1.9340	2489.1	2489.1	2466.8	3328.1	2550.9	2611.4	-0.0379	0.5931
1.9360	2492.3	2492.3	2470.0	3224.9	2551.6	2612.1	-0.0158	0.5932
1.9380	2495.7	2495.7	2473.4	3402.1	2552.5	2613.0	0.0267	0.5935
1.9400	2499.2	2499.2	2476.9	3552.0	2553.5	2614.2	0.0216	0.5937
1.9420	2502.9	2502.9	2480.6	3680.2	2554.7	2615.5	0.0177	0.5939
1.9440	2506.6	2506.6	2484.3	3712.4	2555.9	2616.8	0.0044	0.5939
1.9460	2510.1	2510.1	2487.8	3467.8	2556.8	2617.9	-0.0341	0.5943
1.9480	2513.0	2513.0	2490.7	2927.2	2557.2	2618.2	-0.0845	0.5972
1.9500	2516.8	2516.8	2494.5	3744.6	2558.4	2619.6	0.1225	0.6033
1.9520	2520.5	2520.5	2498.2	3699.0	2559.6	2620.9	-0.0061	0.6033
1.9540	2524.2	2524.2	2501.9	3772.9	2560.8	2622.4	0.0099	0.6033
1.9560	2527.8	2527.8	2505.5	3526.1	2561.8	2623.5	-0.0338	0.6038
1.9580	2531.3	2531.3	2509.0	3546.4	2562.8	2624.6	0.0029	0.6038
1.9600	2535.0	2535.0	2512.7	3660.2	2563.9	2625.8	0.0158	0.6039
1.9620	2538.9	2538.9	2516.6	3923.3	2565.3	2627.5	0.0347	0.6044
1.9640	2543.0	2543.0	2520.7	4110.8	2566.9	2629.4	0.0233	0.6046
1.9660	2546.7	2546.7	2524.4	3713.9	2568.1	2630.7	-0.0507	0.6056
1.9680	2550.4	2550.4	2528.1	3696.0	2569.2	2632.0	-0.0024	0.6056
1.9700	2554.0	2554.0	2531.7	3566.9	2570.2	2633.2	-0.0178	0.6057
1.9720	2557.6	2557.6	2535.3	3590.8	2571.3	2634.3	0.0033	0.6057
1.9740	2561.3	2561.3	2539.0	3729.7	2572.4	2635.7	0.0190	0.6059
1.9760	2565.0	2565.0	2542.7	3696.3	2573.6	2636.9	-0.0045	0.6059
1.9780	2568.5	2568.5	2546.2	3487.5	2574.5	2637.9	-0.0291	0.6062
1.9800	2572.1	2572.1	2549.8	3643.3	2575.6	2639.1	0.0218	0.6064
1.9820	2575.7	2575.7	2553.4	3554.7	2576.6	2640.2	-0.0123	0.6065
1.9840	2579.4	2579.4	2557.1	3750.0	2577.8	2641.6	0.0267	0.6067
1.9860	2583.1	2583.1	2560.8	3622.1	2578.8	2642.8	-0.0174	0.6069
1.9880	2586.5	2586.5	2564.2	3464.6	2579.7	2643.7	-0.0222	0.6070
1.9900	2590.0	2590.0	2567.7	3488.3	2580.6	2644.7	0.0034	0.6071
1.9920	2593.9	2593.9	2571.6	3851.1	2581.9	2646.2	0.0494	0.6080
1.9940	2597.7	2597.7	2575.4	3794.4	2583.1	2647.6	-0.0074	0.6080
1.9960	2601.6	2601.6	2579.3	3996.1	2584.5	2649.3	0.0259	0.6083
1.9980	2605.3	2605.3	2583.0	3640.6	2585.6	2650.5	-0.0465	0.6091
2.0000	2608.9	2608.9	2586.6	3613.0	2586.6	2651.6	-0.0038	0.6092
2.0020	2612.5	2612.5	2590.2	3565.4	2587.6	2652.7	-0.0066	0.6092
2.0040	2616.0	2616.0	2593.7	3547.4	2588.5	2653.7	-0.0025	0.6092
2.0060	2619.5	2619.5	2597.2	3488.8	2589.4	2654.7	-0.0083	0.6092
2.0080	2622.7	2622.7	2600.4	3207.5	2590.1	2655.3	-0.0420	0.6099
2.0100	2626.6	2626.6	2604.3	3882.3	2591.3	2656.8	0.0952	0.6134
2.0120	2630.5	2630.5	2608.2	3859.6	2592.6	2658.2	-0.0029	0.6134
2.0140	2633.8	2633.8	2611.5	3299.6	2593.3	2659.0	-0.0782	0.6158
2.0160	2637.3	2637.3	2615.0	3507.6	2594.2	2659.9	0.0306	0.6162
2.0180	2641.0	2641.0	2618.7	3711.2	2595.3	2661.2	0.0282	0.6165
2.0200	2644.2	2644.2	2621.9	3218.5	2595.9	2661.8	-0.0711	0.6184
2.0220	2647.9	2647.9	2625.6	3728.8	2597.1	2663.1	0.0734	0.6205
2.0240	2651.6	2651.6	2629.3	3684.6	2598.1	2664.3	-0.0060	0.6205
2.0260	2655.4	2655.4	2633.1	3843.8	2599.4	2665.7	0.0211	0.6206
2.0280	2658.9	2658.9	2636.6	3462.2	2600.2	2666.6	-0.0522	0.6217
2.0300	2663.2	2663.2	2640.9	4266.8	2601.8	2668.6	0.1041	0.6258
2.0320	2667.2	2667.2	2644.9	3989.3	2603.2	2670.3	-0.0336	0.6262
2.0340	2671.0	2671.0	2648.7	3818.4	2604.4	2671.6	-0.0219	0.6264
2.0360	2673.7	2673.7	2651.4	2710.0	2604.5	2671.7	-0.1698	0.6371
2.0380	2677.3	2677.3	2655.0	3603.3	2605.5	2672.7	0.1415	0.6444

TIME	DEPTH(D')	DEPTH(D)	DEPTH(Z)	INT.VEL.	AVG.VEL.	RMS.VEL.	REF.CFT.	TRN.LOSS
2.0400	2681.0	2681.0	2658.7	3722.7	2606.6	2674.0	0.0163	0.6445
2.0420	2683.8	2683.8	2661.5	2750.7	2606.7	2674.0	-0.1501	0.6525
2.0440	2687.0	2687.0	2664.7	3255.6	2607.4	2674.7	0.0841	0.6550
2.0460	2690.5	2690.5	2668.2	3502.4	2608.2	2675.6	0.0365	0.6554
2.0480	2694.5	2694.5	2672.2	3976.1	2609.6	2677.2	0.0633	0.6568
2.0500	2698.5	2698.5	2676.2	3974.6	2610.9	2678.8	-0.0002	0.6568
2.0520	2702.6	2702.6	2680.3	4079.6	2612.3	2680.5	0.0130	0.6569

291231

SEISMOGRAPH SERVICE (ENGLAND) LTD.

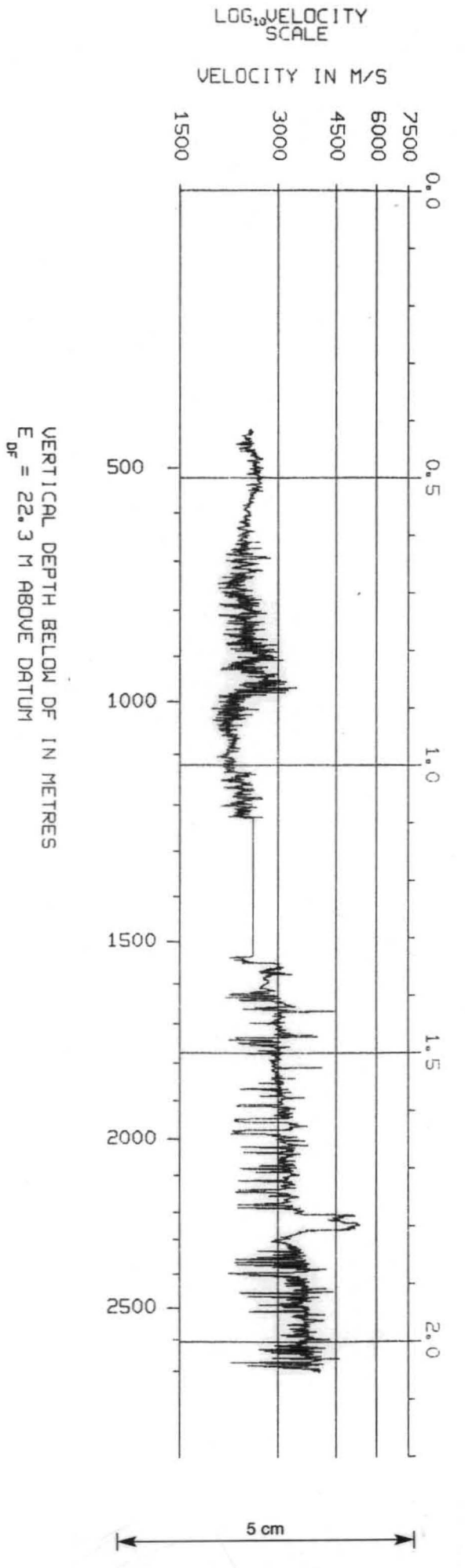
BOREHOLE GEOPHYSICS DIVISION

TWO-WAY TRAVEL TIME LOG

COMPANY: SAGASCO RESOURCES LIMITED

WELL: FLINDERS-1

1 S = 3.75 INS



OR-0298 Appendix 3.i) ①

Seismograph Service

291232

BOREHOLE GEOPHYSICS DIVISION

RIG SOURCE SURVEY

WELL	: FLINDERS-1
COMPANY	: SAGASCO RESOURCES LTD.
LOCATION	:040° 22′ 51.81″ N 145° 40′ 18.69″ E
FIELD	:
COUNTRY	: AUSTRALIA

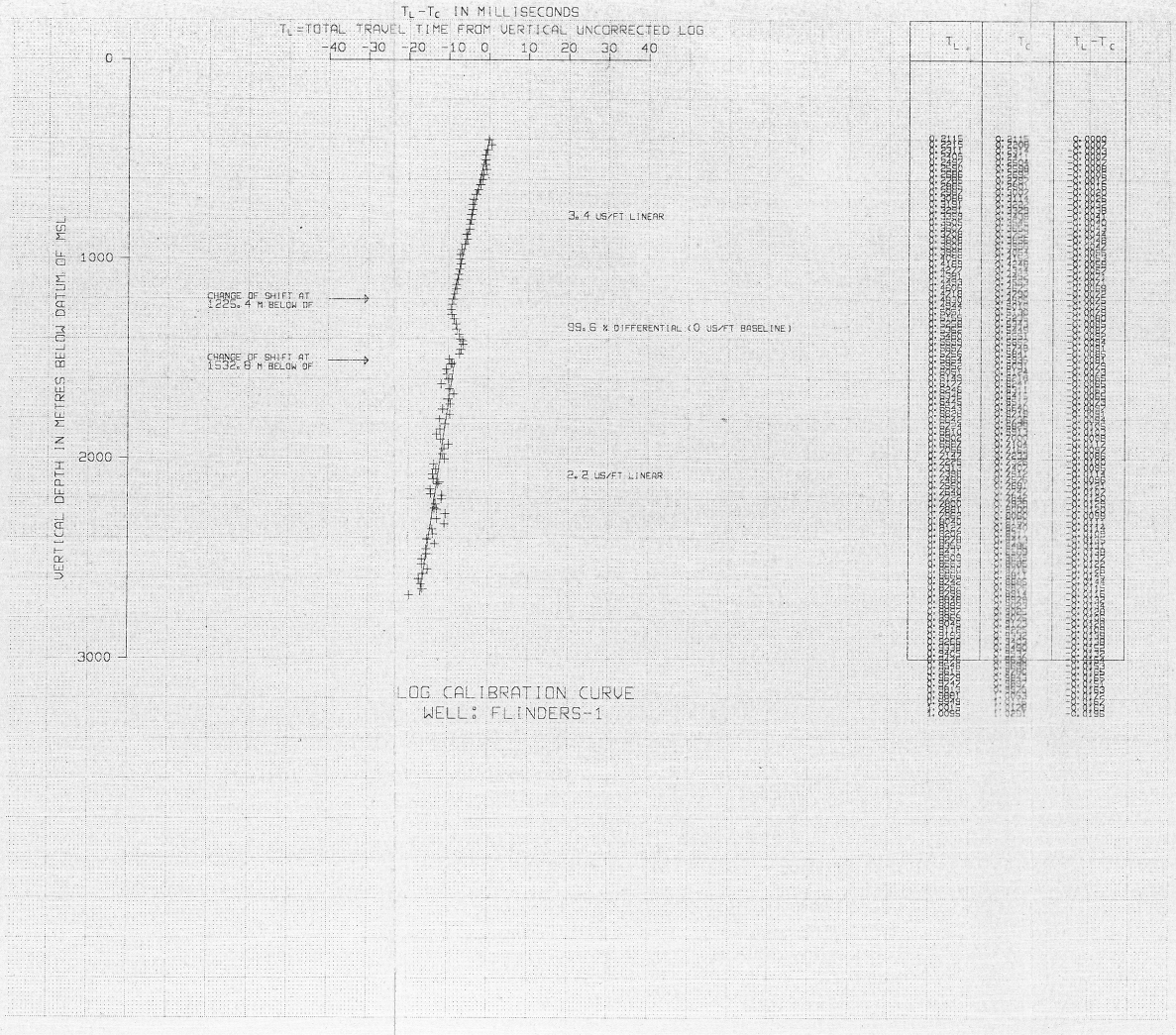
CALIBRATED VELOCITY LOG
DEPTH SCALE 1:500

SEISMIC DATUM	: MSL	REFERENCE LEVEL	: DF
ELEVATION OF GL	:	ELEVATION OF DF	: 22.3M
SURVEY DATE	: 18TH DEC. 1992	DATE PROCESSED	: FEB. 1993

REMARKS

CORRECTIONS APPLIED; PLEASE REFER TO LOG CALIBRATION CURVE.

5 cm



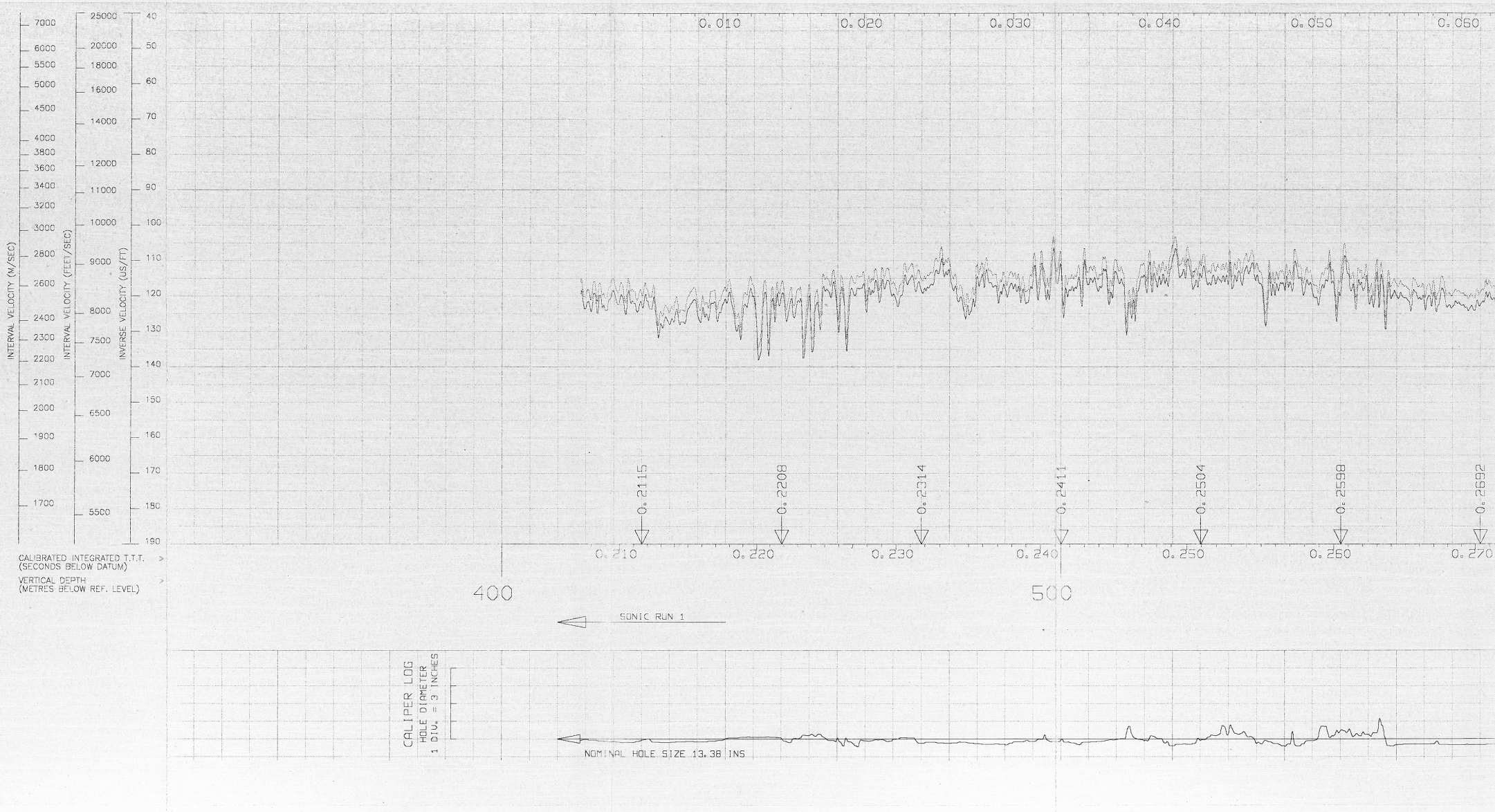
LOG CALIBRATION CURVE
WELL: FLINDERS-1

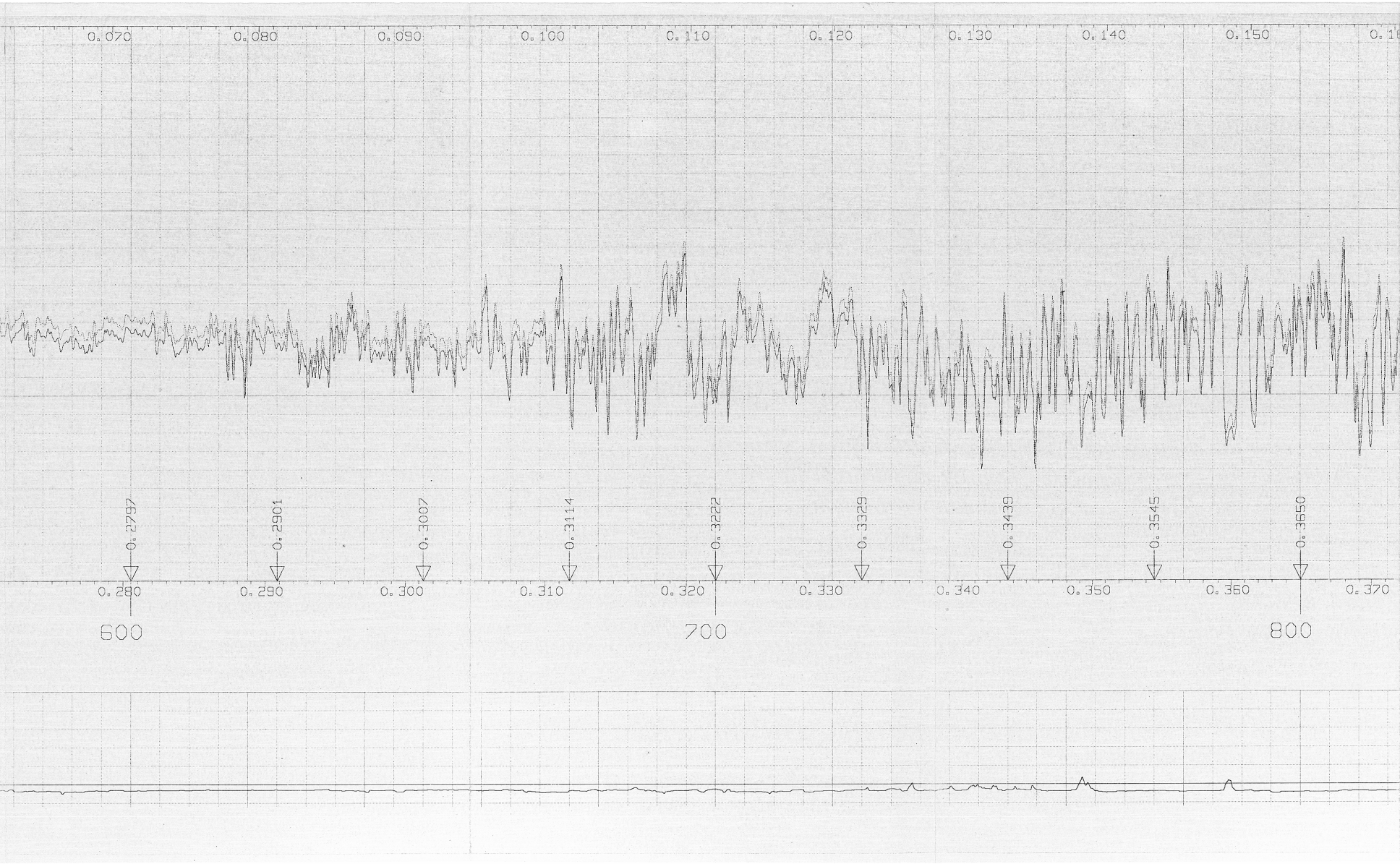
EDITED LOG

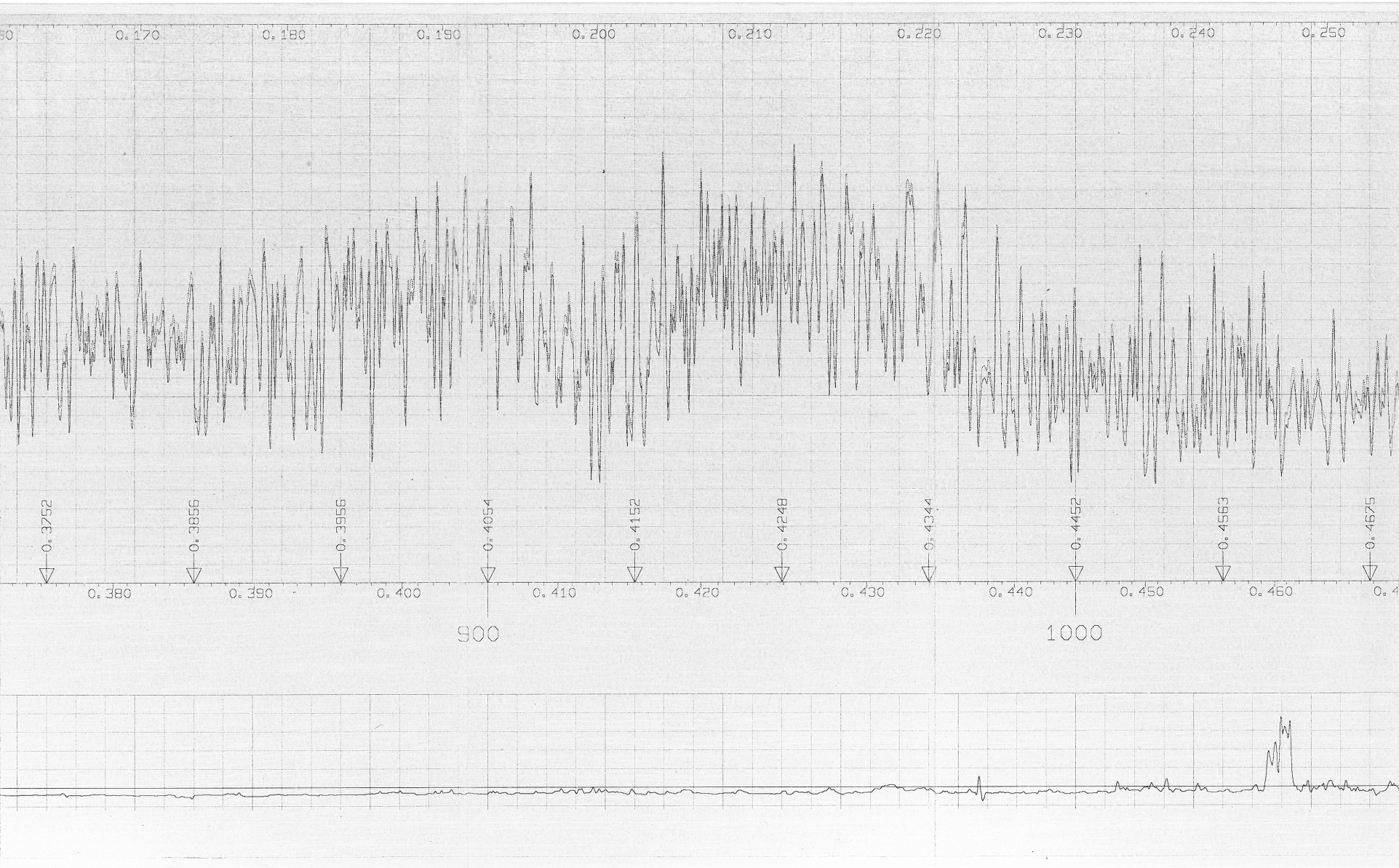
CALIBRATED LOG

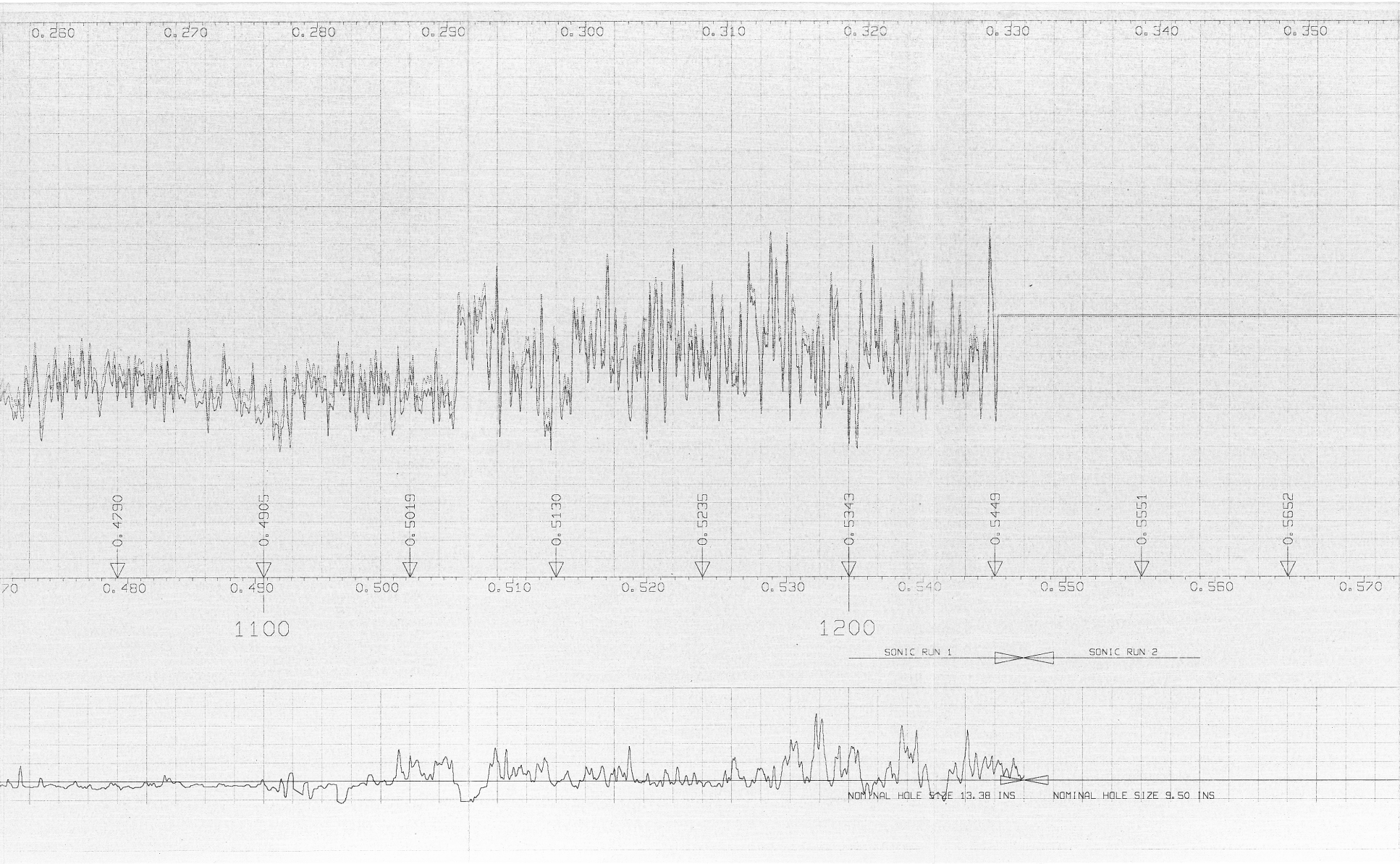
UNCALIBRATED LOG

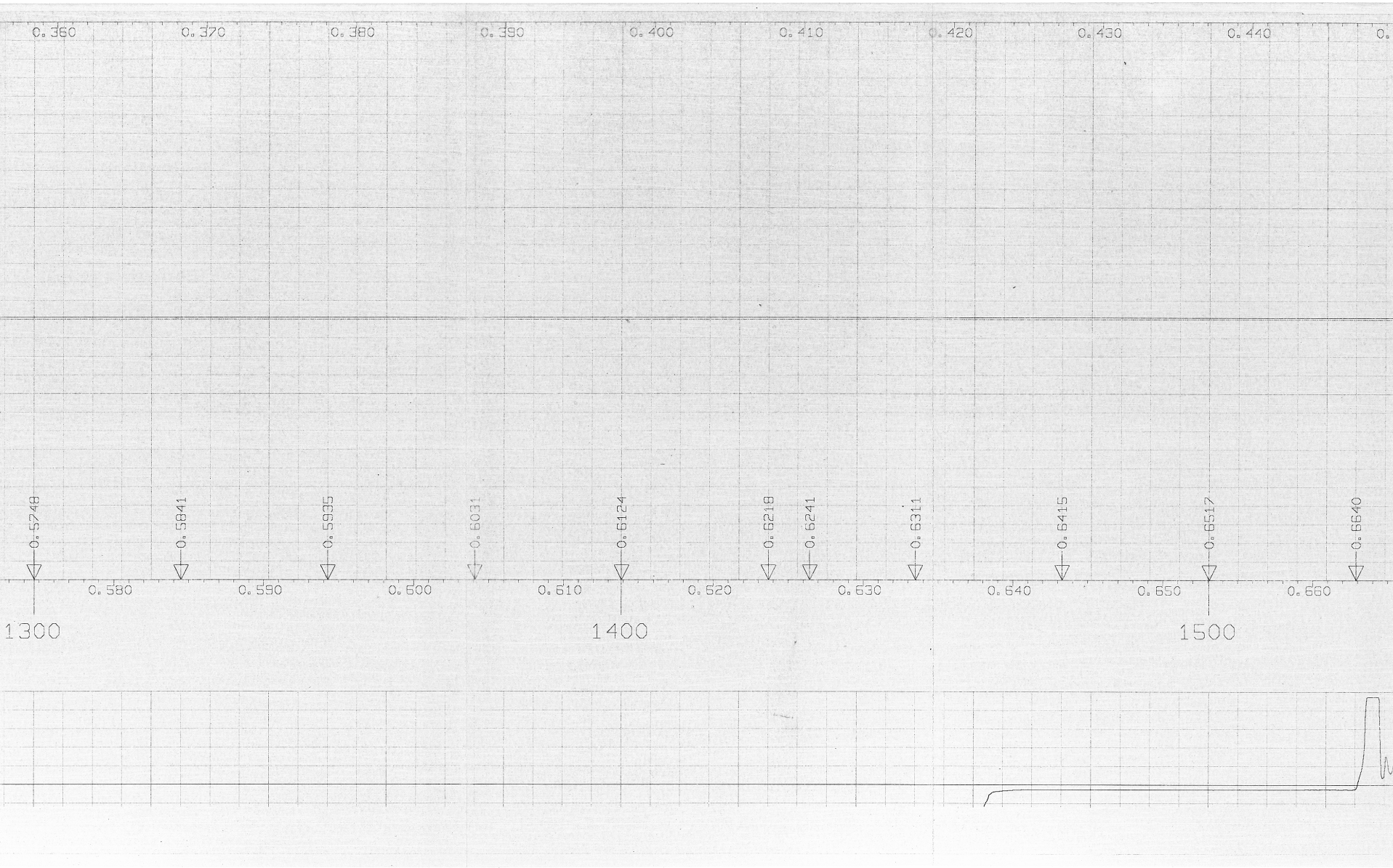
CHECK LEVELS

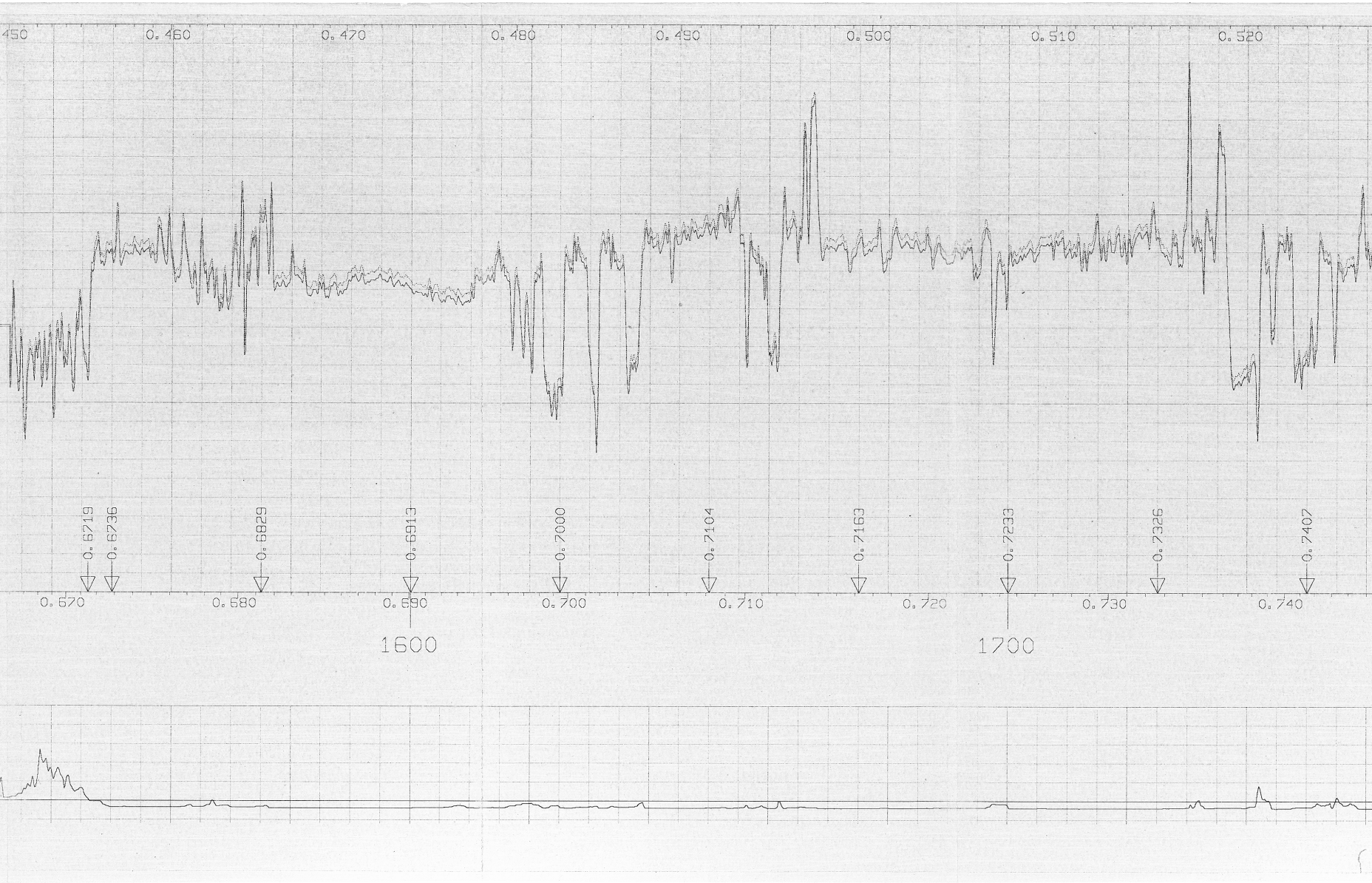


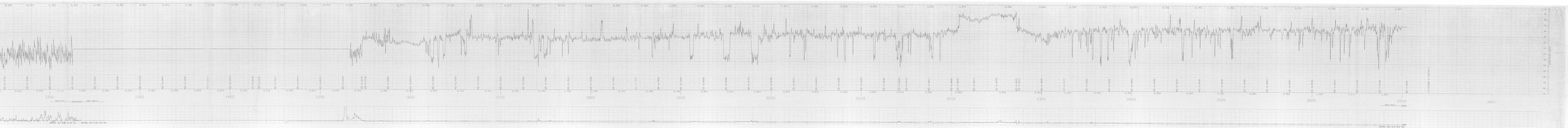








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1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800

OR-0298 Appendix 3.i) ②

Seismograph Service

291233

BOREHOLE GEOPHYSICS DIVISION

RIG SOURCE SURVEY

WELL : FLINDERS-1
COMPANY : SAGASCO RESOURCES LTD.
LOCATION : 040° 22' 51.81" N
145° 40' 18.69" E
FIELD :
COUNTRY : AUSTRALIA

CALIBRATED VELOCITY LOG
DEPTH SCALE 1:1000

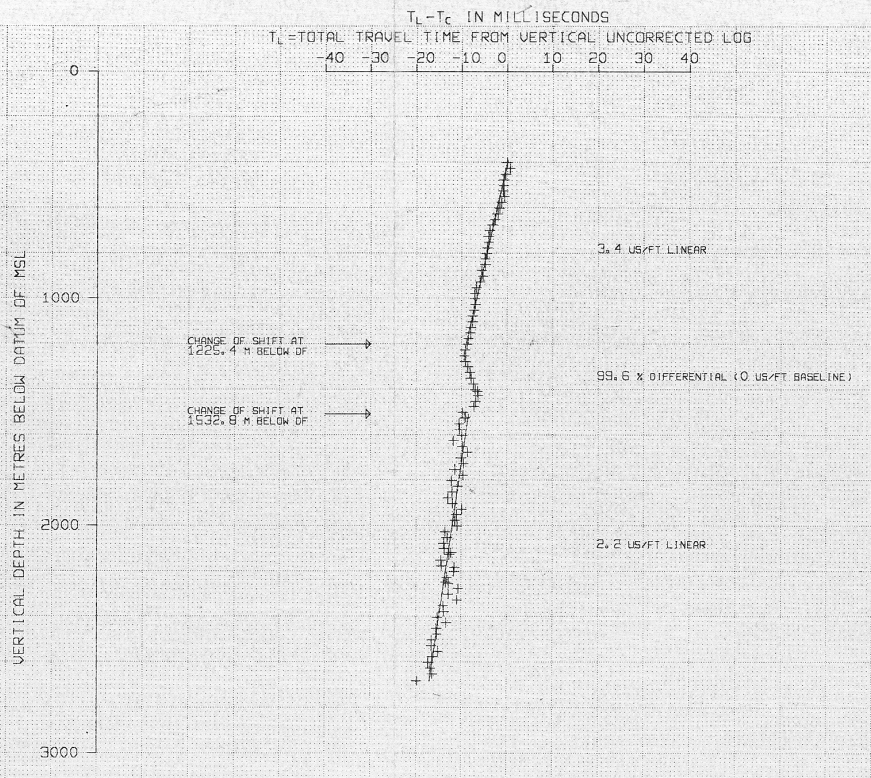
SEISMIC DATUM : MSL
ELEVATION OF GL :
SURVEY DATE : 18TH DEC. 1992

REFERENCE LEVEL : DF
ELEVATION OF DF : 22.3M
DATE PROCESSED : FEB. 1993

REMARKS

CORRECTIONS APPLIED; PLEASE REFER TO LOG CALIBRATION CURVE.

5 cm



LOG CALIBRATION CURVE
WELL: FLINDERS-1

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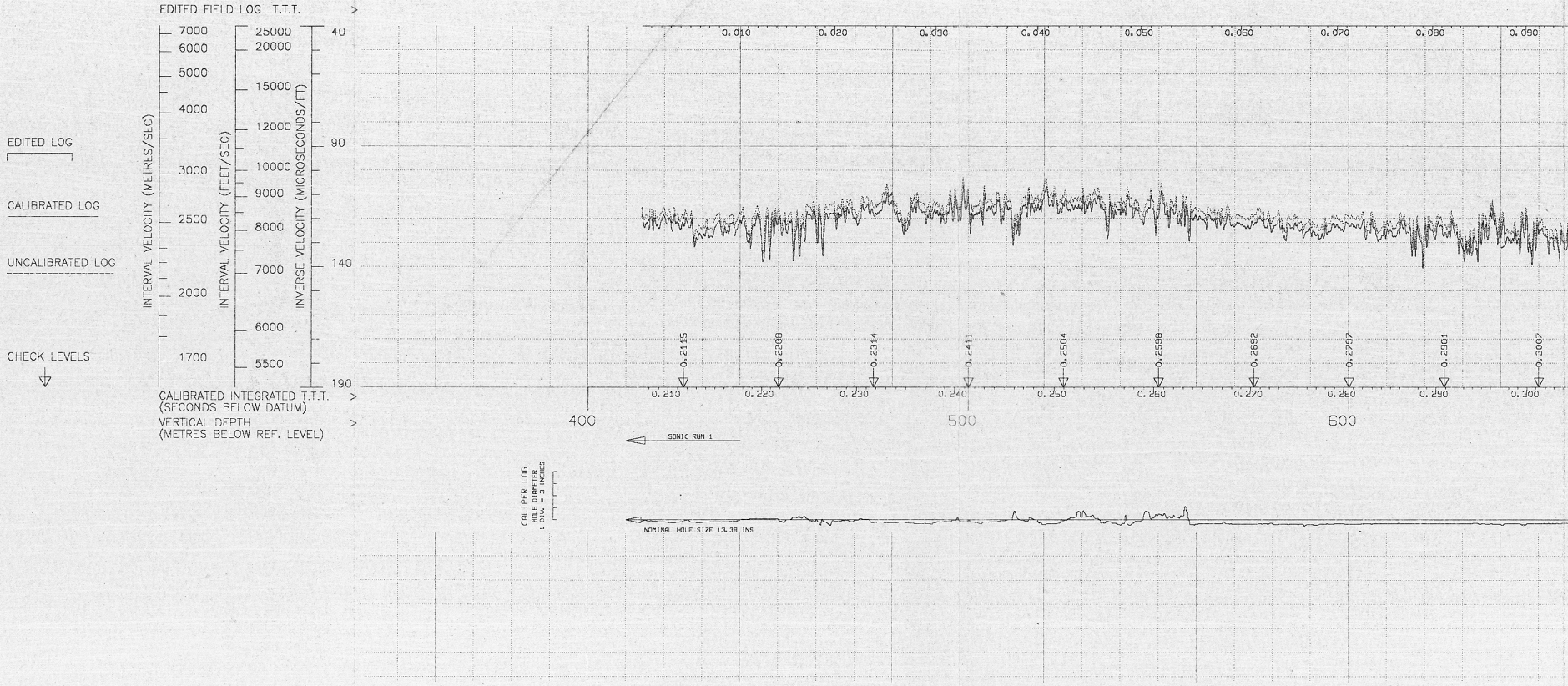
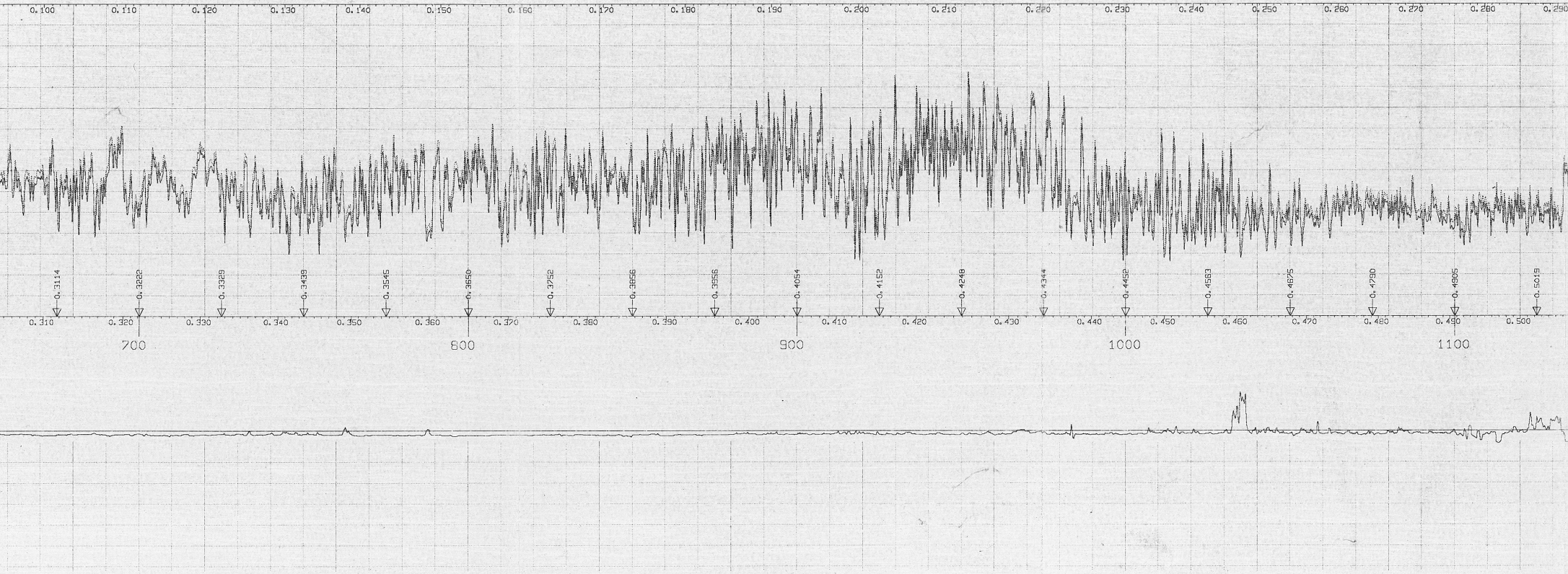
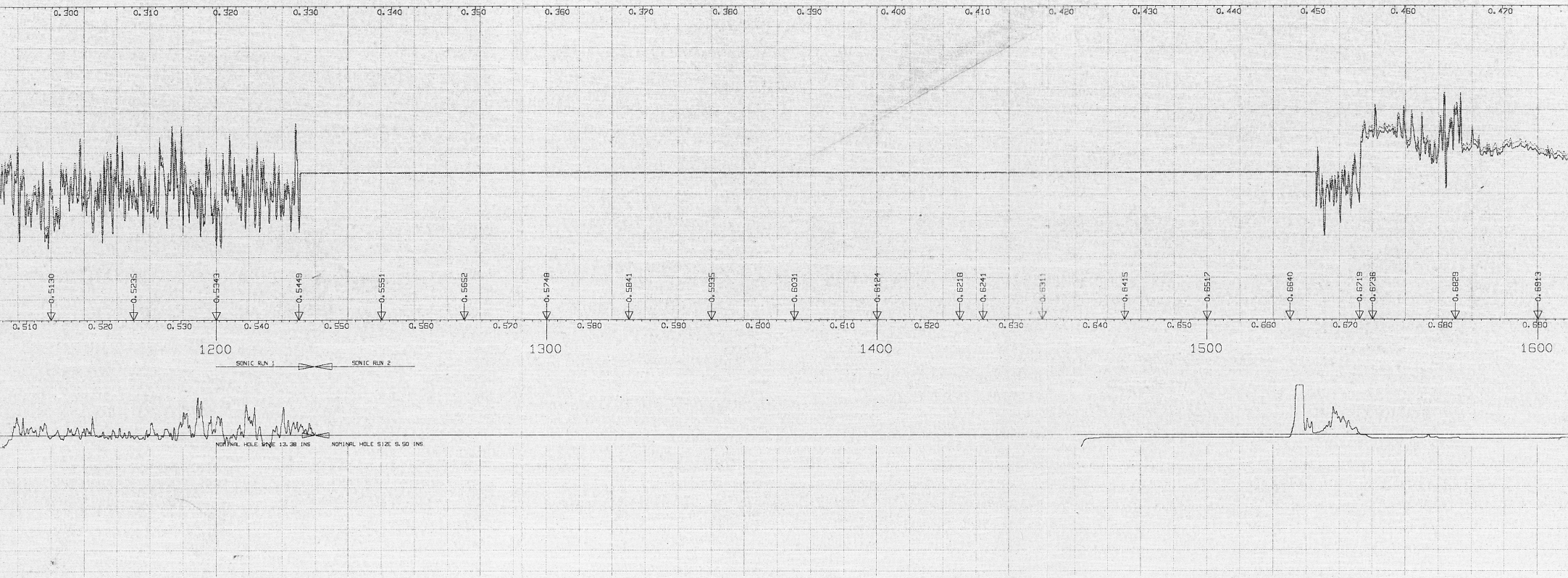
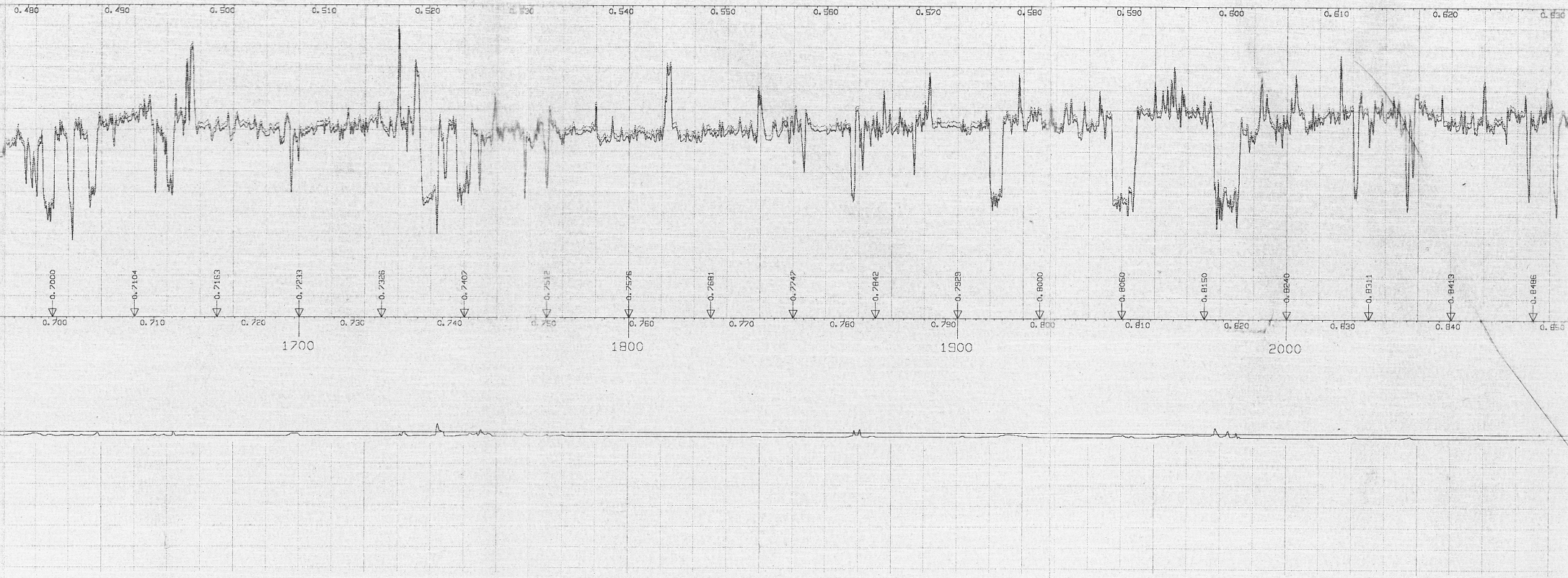
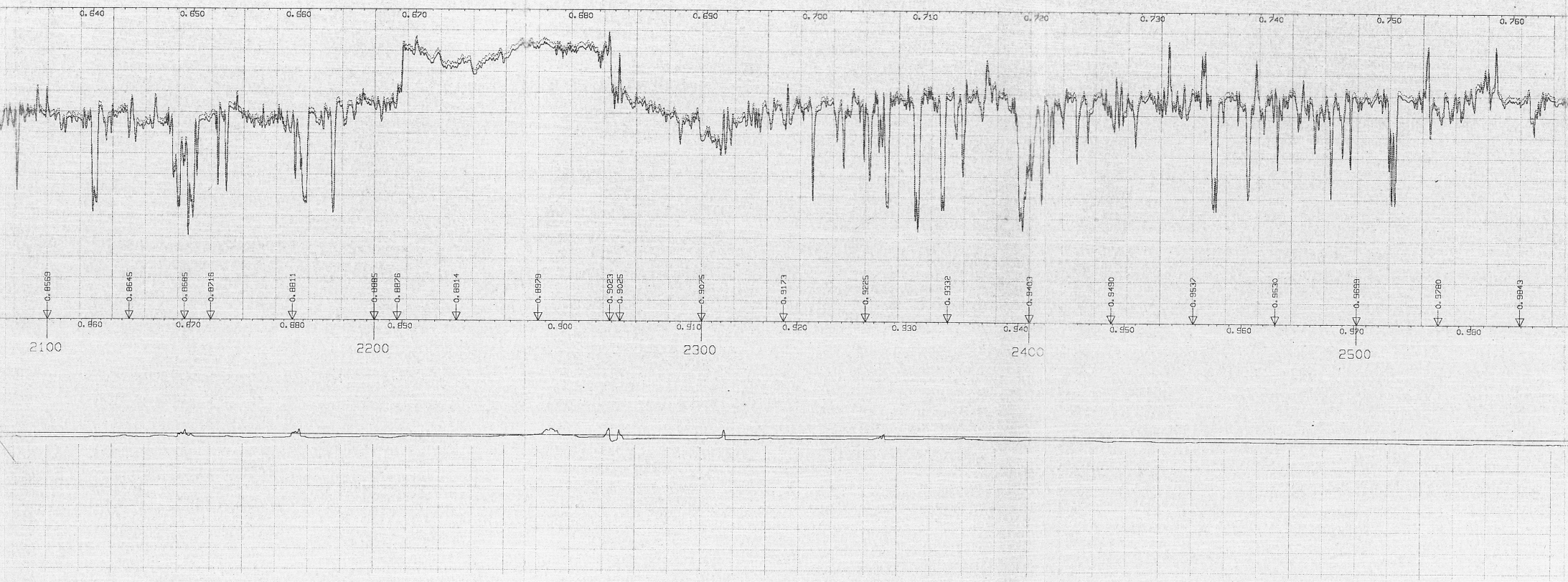
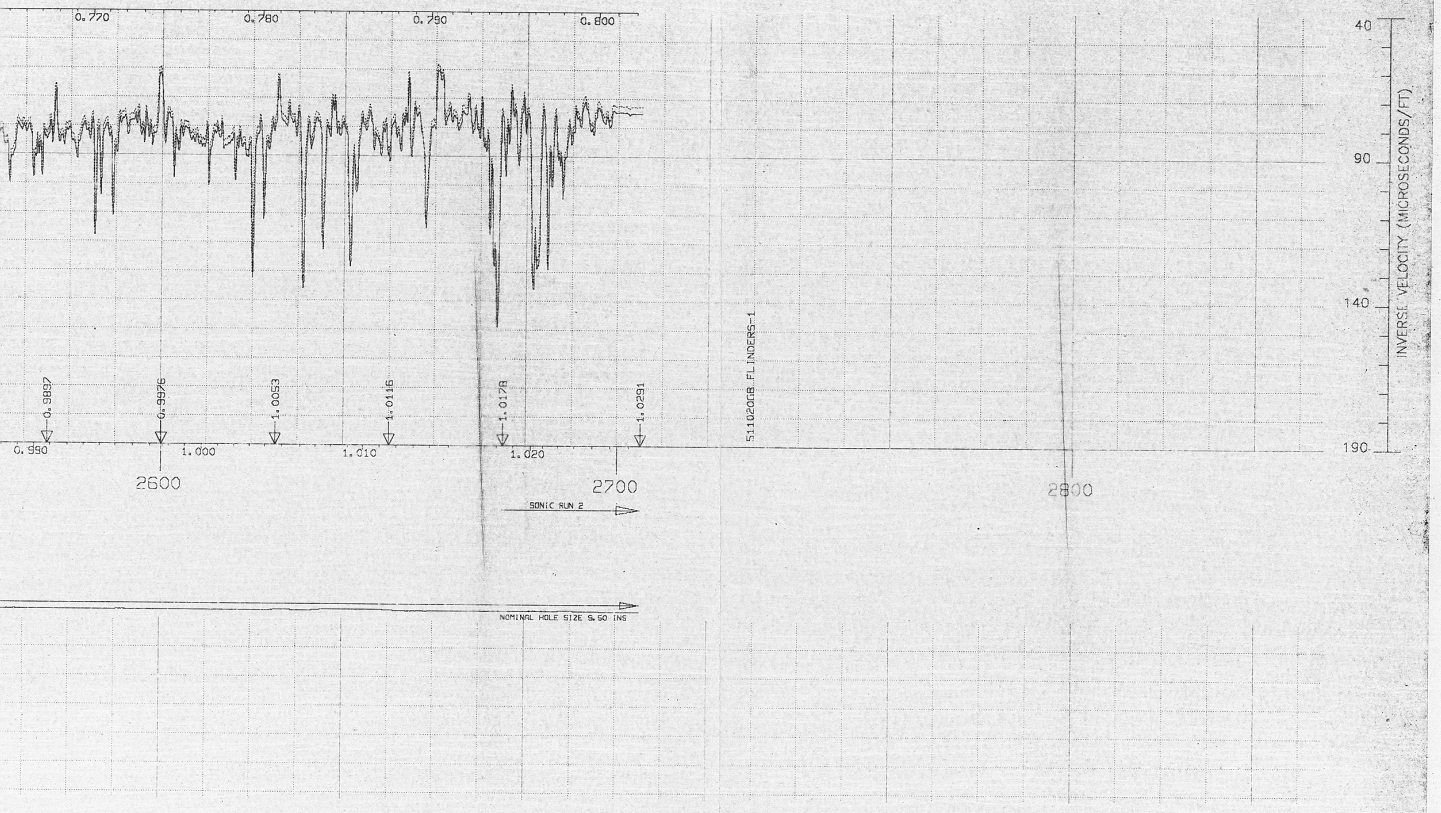












291234

(ii) **SYNTHETIC SEISMOGRAM**

OR-0298 Appendix 3. ii) ① 291235

WELL : FLINDERS-1

LOCATION : 40° 22' 51.81" N
145° 40' 18.69" E

COMPANY : SAGASCO RESOURCES LTD.

SYNTHETIC SEISMOGRAM (MARINE)

DISPLAY S
INPUT DATA

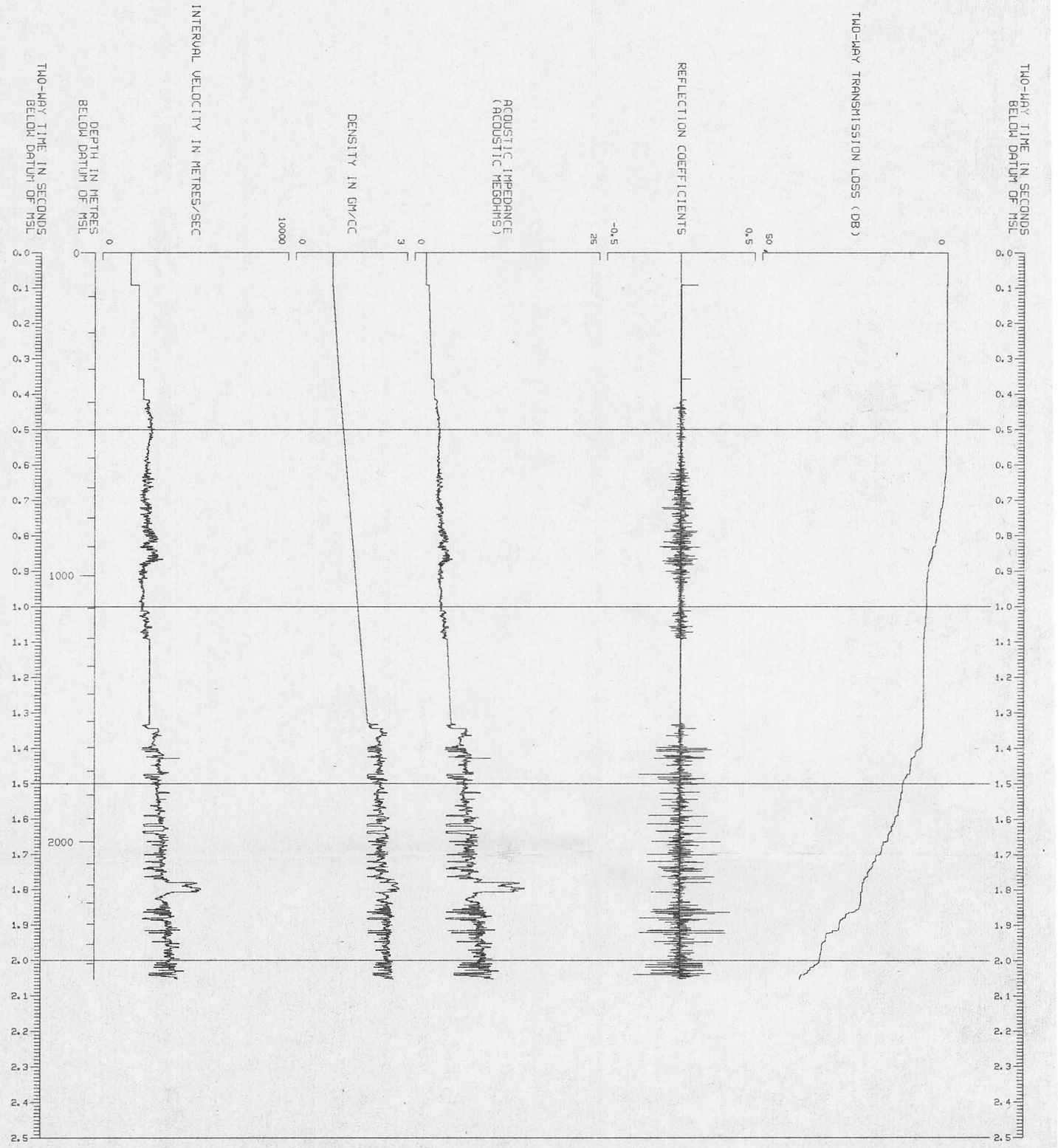
TIME SCALE : 3.75 IN/S

SYNTHETIC SEISMOGRAM PARAMETERS

PRINCIPAL DATA	: CALIBRATED VELOCITY LOG
SUPPLEMENTARY DATA	: DENSITY, CALIPER LOGS : S92A-117
LOG DATA DIGITISING	: CONTINUOUSLY IN DEPTH
SOURCE TYPE (SEISMIC)	: LITTON LOW PRESSURE AIRGUN
SOURCE DEPTH (SEISMIC)	: 6 +/- 0.5 M
DETECTOR DEPTH (SEISMIC)	: 10 +/- 1.5 M
SYNTHETIC TIME-LAYER INTERVAL	: 1 MS (TWO-WAY)
DEPTH SCALE	: NON-LINEAR IN M
DATUM	: MSL
SURFACE REFLECTION COEFFICIENT	: 0.18
VELOCITY MODEL	: DEPTH (M) VELOCITY (M/S) 0 - 69.3 1524 69.3 - 327.7 1943 327.7 - TOL* 2216 VERTICAL DEPTHS BELOW DATUM * DENOTES UNREALISTIC REFLECTION COEFFICIENT OMITTED DURING CALCULATIONS
REMARKS	:

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



OR-0298 Appendix 3. ii) (2) 291236

WELL : FLINDERS-1

LOCATION : 40° 22′ 51.81″ N
145 40 18.69 E

COMPANY : SAGASCO RESOURCES LTD.

SYNTHETIC SEISMOGRAM (MARINE)

DISPLAY S1
CONVOLVED RESPONSES
(ZERO PHASE)

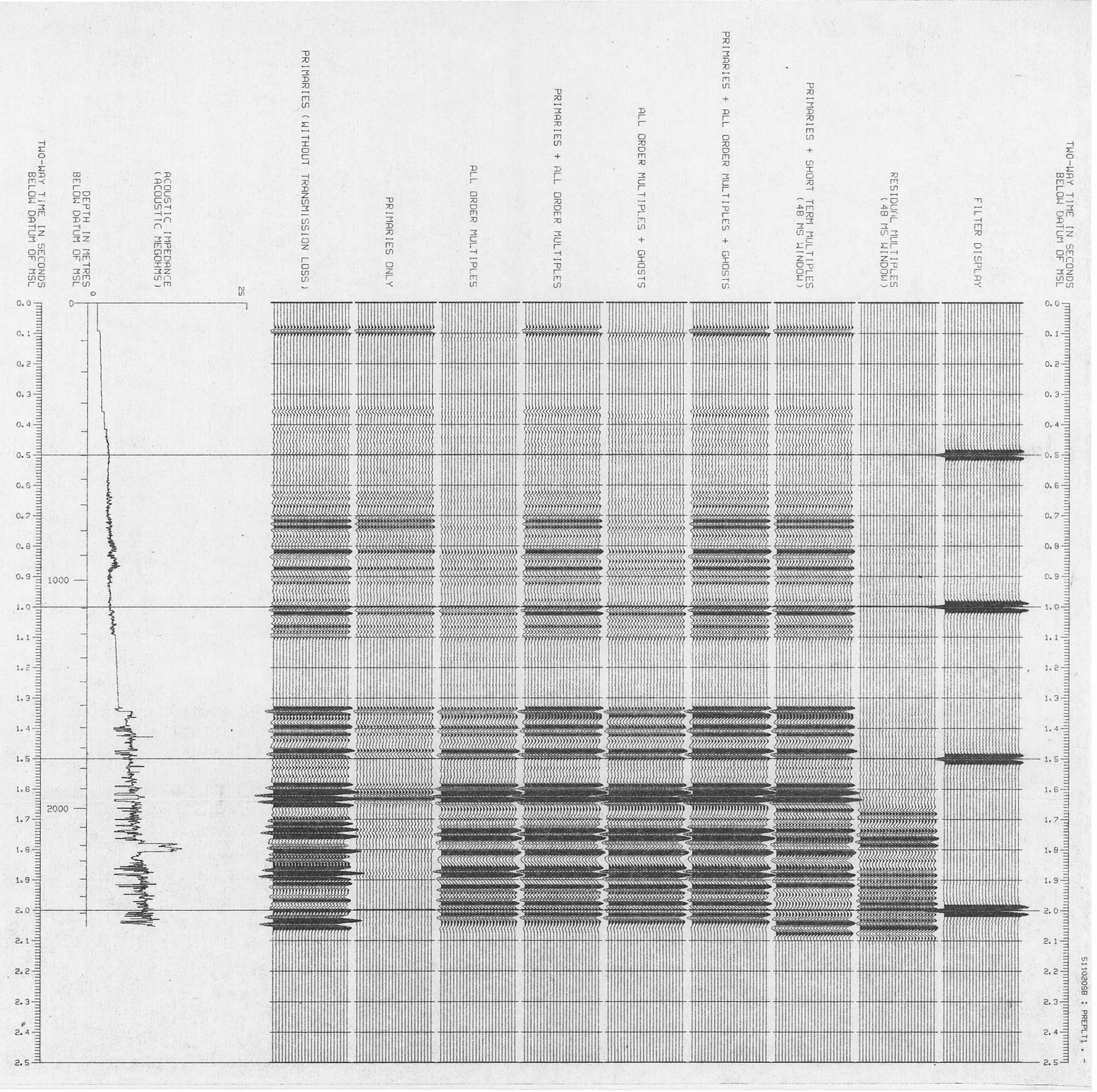
POLARITY : SEG NORMAL
TIME SCALE : 3.75 IN/S

SYNTHETIC SEISMOGRAM PARAMETERS

PRINCIPAL DATA	: CALIBRATED VELOCITY LOG
SUPPLEMENTARY DATA	: DENSITY, CALIPER LOGS : S92A-117
LOG DATA DIGITISING	: CONTINUOUSLY IN DEPTH
SOURCE TYPE (SEISMIC)	: LITTON LOW PRESSURE AIRGUN
SOURCE DEPTH (SEISMIC)	: 6 +/- 0.5 M
DETECTOR DEPTH (SEISMIC)	: 10 +/- 1.5 M
SYNTHETIC TIME-LAYER INTERVAL	: 1 MS (TWO-WAY)
DEPTH SCALE	: NON-LINEAR IN M
DATUM	: MSL
SURFACE REFLECTION COEFFICIENT	: 0.18
VELOCITY MODEL	: DEPTH (M) VELOCITY (M/S) 0 - 69.3 1524 69.3 - 327.7 1943 327.7 - TOL* 2216 VERTICAL DEPTHS BELOW DATUM * DENOTES UNREALISTIC REFLECTION COEFFICIENT OMITTED DURING CALCULATIONS
REMARKS	:
CONVOLUTION WAVELET	: 35 HZ ZERO PHASE RICKER & TIME VARIANT BAND PASS FILTER : 0.0 S - 1.0 S 8, 12-70, 80 1.0 S - 2.0 S 8, 12-70, 80 2.0 S - 3.0 S 8, 10-60, 70 LINEAR OVERLAP BETWEEN FILTERS
POLARITY	: SEG NORMAL (INCREASE IN ACOUSTIC IMPEDANCE REPRESENTED BY A WHITE TROUGH)

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



OR-0098 Appendix 3.ii) ③ 291237

WELL : FLINDERS-1

LOCATION : 40° 22' 51.81" N
145° 40' 18.69" E

COMPANY : SAGASCO RESOURCES LTD.

SYNTHETIC SEISMOGRAM (MARINE)

DISPLAY S1
CONVOLVED RESPONSES
(ZERO PHASE)

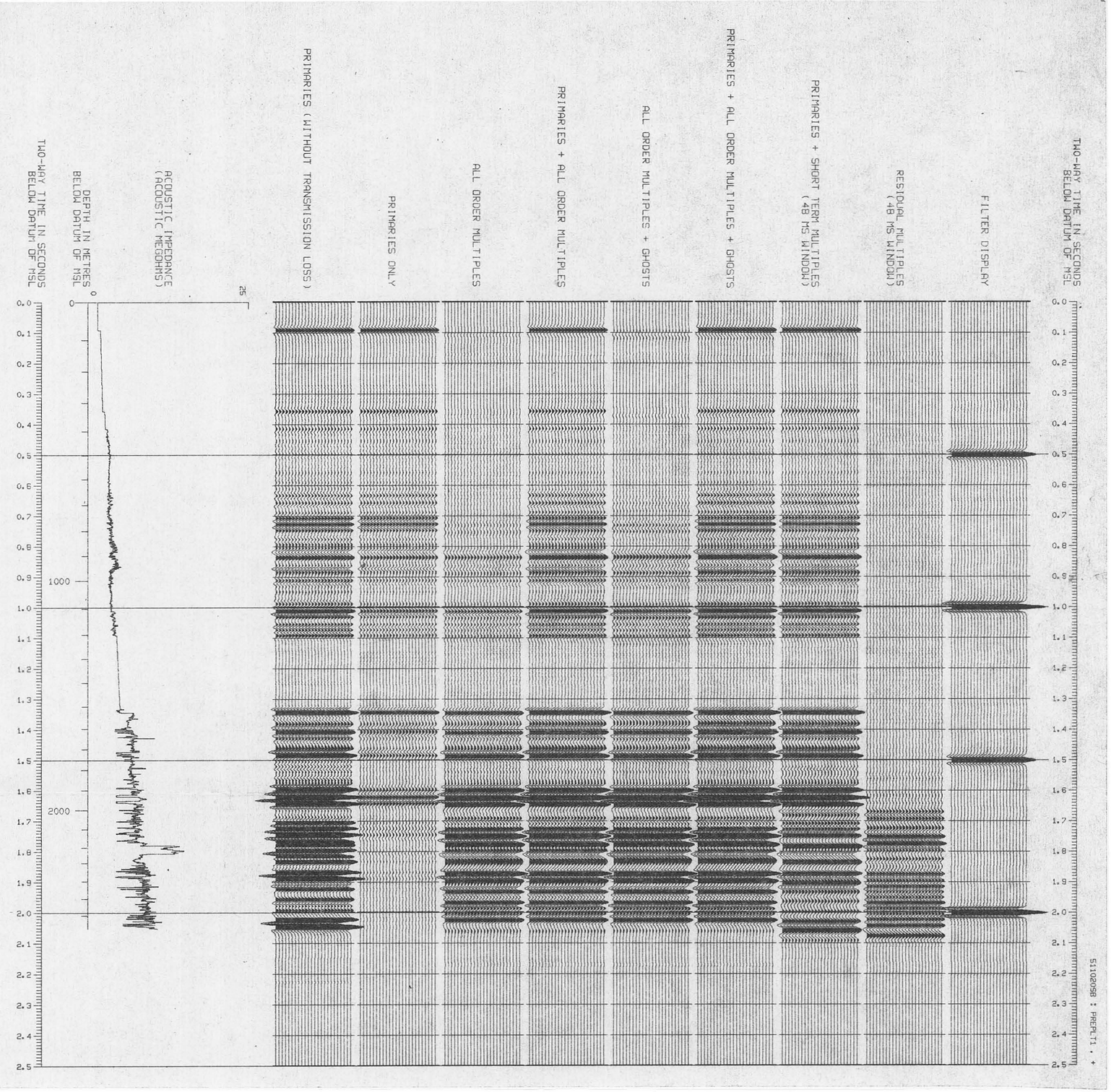
POLARITY : SEG REVERSE
TIME SCALE : 3.75 IN/S

SYNTHETIC SEISMOGRAM PARAMETERS

PRINCIPAL DATA	: CALIBRATED VELOCITY LOG
SUPPLEMENTARY DATA	: DENSITY, CALIPER LOGS : S92A-117
LOG DATA DIGITISING	: CONTINUOUSLY IN DEPTH
SOURCE TYPE (SEISMIC)	: LITTON LOW PRESSURE AIRGUN
SOURCE DEPTH (SEISMIC)	: 6 +/- 0.5 M
DETECTOR DEPTH (SEISMIC)	: 10 +/- 1.5 M
SYNTHETIC TIME-LAYER INTERVAL	: 1 MS (TWO-WAY)
DEPTH SCALE	: NON-LINEAR IN M
DATUM	: MSL
SURFACE REFLECTION COEFFICIENT	: 0.18
VELOCITY MODEL	: DEPTH (M) VELOCITY (M/S) 0 - 69.3 1524 69.3 - 327.7 1943 327.7 - TOL* 2216 VERTICAL DEPTHS BELOW DATUM * DENOTES UNREALISTIC REFLECTION COEFFICIENT OMITTED DURING CALCULATIONS
REMARKS	:
CONVOLUTION WAVELET	: 35 HZ ZERO PHASE RICKER & TIME VARIANT BAND PASS FILTER : 0.0 S - 1.0 S 8,12-70,80 1.0 S - 2.0 S 8,12-70,80 2.0 S - 3.0 S 8,10-60,70 LINEAR OVERLAP BETWEEN FILTERS
POLARITY	: SEG REVERSE (INCREASE IN ACOUSTIC IMPEDANCE REPRESENTED BY A BLACK PEAK)

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



OR-0298 Appendix 3. ii) (4) 291238

WELL : FLINDERS-1

LOCATION : 40° 22' 51.81" N
145° 40' 18.69" E

COMPANY : SAGASCO RESOURCES LTD.

SYNTHETIC SEISMOGRAM (MARINE)

DISPLAY S2
CONVOLVED RESPONSES
(MINIMUM PHASE)

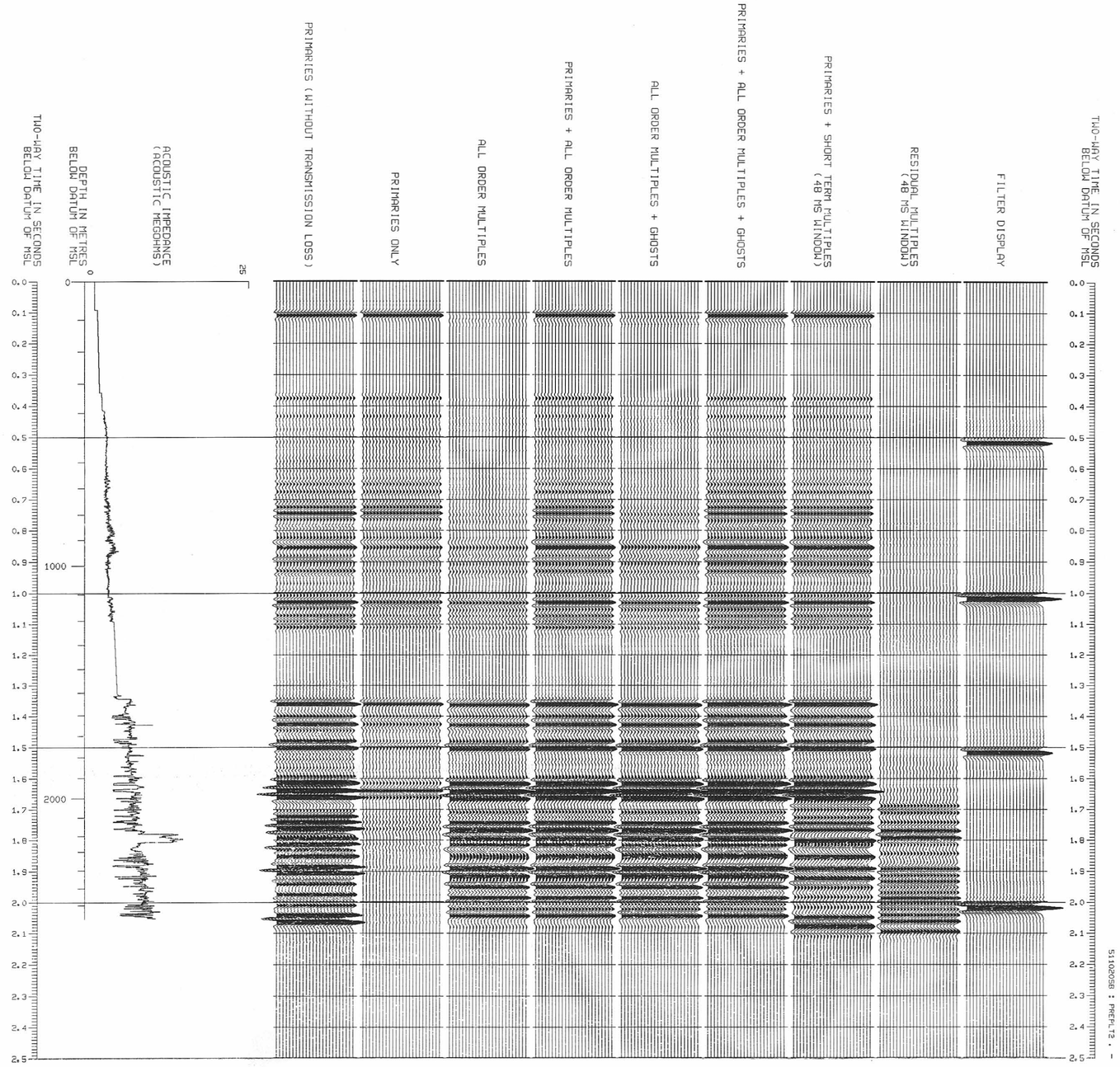
POLARITY : SEG NORMAL
TIME SCALE : 3.75 IN/S

SYNTHETIC SEISMOGRAM PARAMETERS

PRINCIPAL DATA	: CALIBRATED VELOCITY LOG
SUPPLEMENTARY DATA	: DENSITY, CALIPER LOGS : S92A-117
LOG DATA DIGITISING	: CONTINUOUSLY IN DEPTH
SOURCE TYPE (SEISMIC)	: LITTON LOW PRESSURE AIRGUN
SOURCE DEPTH (SEISMIC)	: 6 +/- 0.5 M
DETECTOR DEPTH (SEISMIC)	: 10 +/- 1.5 M
SYNTHETIC TIME-LAYER INTERVAL	: 1 MS (TWO-WAY)
DEPTH SCALE	: NON-LINEAR IN M
DATUM	: MSL
SURFACE REFLECTION COEFFICIENT	: 0.18
VELOCITY MODEL	: DEPTH (M) VELOCITY (M/S) 0 - 69.3 1524 69.3 - 327.7 1943 327.7 - TOL* 2216 VERTICAL DEPTHS BELOW DATUM * DENOTES UNREALISTIC REFLECTION COEFFICIENT OMITTED DURING CALCULATIONS
REMARKS	:
CONVOLUTION WAVELET	: 35 HZ MINIMUM PHASE RICKER & TIME VARIANT BAND PASS FILTER : 0.0 S - 1.0 S 8,12-70,80 1.0 S - 2.0 S 8,12-70,80 2.0 S - 3.0 S 8,10-60,70 LINEAR OVERLAP BETWEEN FILTERS
POLARITY	: SEG NORMAL (INCREASE IN ACOUSTIC IMPEDANCE REPRESENTED BY A WHITE TROUGH)

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



5110205B : PREPLT2 . -

OR: 0398 , Appendix 3.ii) (5)

291239

WELL : FLINDERS-1

LOCATION : 40° 22′ 51.81″ N
145° 40′ 18.69″ E

COMPANY : SAGASCO RESOURCES LTD.

SYNTHETIC SEISMOGRAM (MARINE)

DISPLAY S2
CONVOLVED RESPONSES
(MINIMUM PHASE)

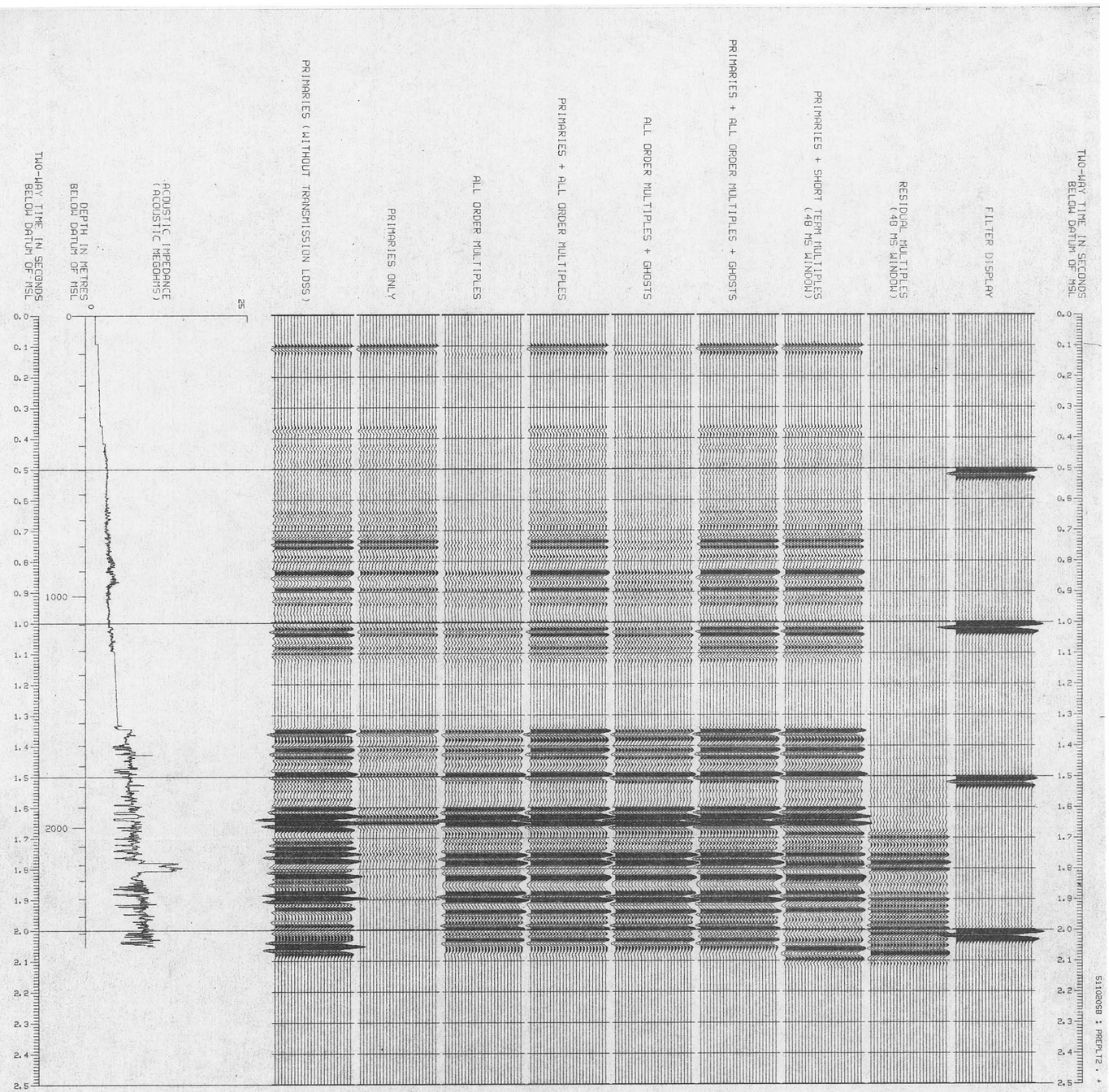
POLARITY : SEG REVERSE
TIME SCALE : 3.75 IN/S

SYNTHETIC SEISMOGRAM PARAMETERS

PRINCIPAL DATA	: CALIBRATED VELOCITY LOG
SUPPLEMENTARY DATA	: DENSITY, CALIPER LOGS : S92A-117
LOG DATA DIGITISING	: CONTINUOUSLY IN DEPTH
SOURCE TYPE (SEISMIC)	: LITTON LOW PRESSURE AIRGUN
SOURCE DEPTH (SEISMIC)	: 6 +/- 0.5 M
DETECTOR DEPTH (SEISMIC)	: 10 +/- 1.5 M
SYNTHETIC TIME-LAYER INTERVAL	: 1 MS (TWO-WAY)
DEPTH SCALE	: NON-LINEAR IN M
DATUM	: MSL
SURFACE REFLECTION COEFFICIENT	: 0.18
VELOCITY MODEL	: DEPTH (M) VELOCITY (M/S) 0 - 69.3 1524 69.3 - 327.7 1943 327.7 - TOL* 2216 VERTICAL DEPTHS BELOW DATUM * DENOTES UNREALISTIC REFLECTION COEFFICIENT OMITTED DURING CALCULATIONS
REMARKS	:
CONVOLUTION WAVELET	: 35 HZ MINIMUM PHASE RICKER & TIME VARIANT BAND PASS FILTER : 0.0 S - 1.0 S 8,12-70,80 1.0 S - 2.0 S 8,12-70,80 2.0 S - 3.0 S 8,10-60,70 LINEAR OVERLAP BETWEEN FILTERS
POLARITY	: SEG REVERSE (INCREASE IN ACOUSTIC IMPEDANCE REPRESENTED BY A BLACK PEAK)

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



iii) **VSP (STATIC RIG SOURCE)**

291241

SAGASCO RESOURCES LTD.

WELL: FLINDERS-1

VSP REPORT

Seismograph Service
A **Raytheon** Company

WELL: FLINDERS-1

RIG SOURCE VSP

LIST OF CONTENTS

Field Acquisition Details
VSP Processing Comment
VSP Depth Stack List
Processing Sequence
Figure 1: Transformation From T-X To F-K Space

Displays (SEG Normal Polarity)

VA1.....Stacked Geophone Data (Before Spectral Smoothing)
VA1(FK).....Stacked Geophone Data in F-K Space
VA.....Stacked Geophone Data (After Spectral Smoothing)
VA(FK).....Stacked Geophone Data in F-K Space
VB1.....Downgoing Wavefield (Preliminary Filter)
VC.....Upgoing Wavefield
VC(FK).....Upgoing Wavefield in F-K Space
VD.....Upgoing Wavefield (Enhanced)
VE.....Deconvolved Upgoing Wavefield
VE(FK).....Deconvolved Upgoing Wavefield in F-K Space
VF.....Deconvolved Upgoing Wavefield (Enhanced)
VH.....Deconvolved Downgoing Wavefield
VI.....Residual Wavefield

Description of Standard Seismic Scale Displays
Figure 2: Derivation of Transposed Displays
Description of Optional Seismic Scale Displays
Appendix: Calculation of dip and offset diffraction points from VSP Data

SEPARATE DISPLAYS AT SEISMIC SCALE

(3.75 INC/SEC; SEG Normal & Reverse Polarities)

VI.....Residual Wavefield :....Preliminary filter (SEG Normal Polarity only
VB2.....Downgoing Wavefield :....Seismic Match Filter
VG1.....Interpreter's Composite :....Maximum Bandwith filter X2
VJ....Trace Inversion Composite...Optimum Frequency Filter

291243

WELL : FLINDERS-1

LOCATION : 40° 22′ 51.810″ N
145° 40′ 18.690″ E

COMPANY : SAGASCO RESOURCES LTD.

RIG SURVEY
VERTICAL SEISMIC PROFILE

FIELD ACQUISITION

SURVEY DATE	: 18TH DECEMBER 1992
SOURCE	: "BOLT" AIRGUN 140 CU INCH
SOURCE DEPTH	: 5.0M BELOW MSL
SOURCE OFFSET	: 47.0M
SOURCE DIRECTION	: 340 DEG. NORTH
SOURCE MONITOR	: NEAR FIELD HYDROPHONE
MONITOR DEPTH	: 3.5M BELOW MSL
SAMPLE RATE	: 1 MS
VSP DATUM	: MSL
WATER DEPTH	: 69.25M BELOW MSL
REFERENCE LEVEL	: DF AT 22.3M ABOVE MSL

291244

SAGASCO RESOURCES LIMITED

WELL : FLINDERS-1

VSP PROCESSING COMMENT — RIG SOURCE SURVEY

DATA ACQUISITION

Rig Source VSP survey was acquired in the above well on 18th December 1992. The source a 140 cubic inch "Bolt" airgun was located at a depth of 5.0M below MSL at a bearing of 340 degrees North, with a hydrophone positioned 1.5M vertically above the source.

A total of 100 levels were recorded at mainly 25.0M depth intervals, between the depth of 350.0M and 2705.0M measured depth below DF.

DATA_PREPARATION

Preliminary times were picked from the first break on the gun hydrophone signal to the first break on the well geophone signal. These manually picked times were then modified using an automated trace alignment procedure, for improved timing accuracy and alignment in the VSP processing . The data quality was good throughout the survey with all levels having well defined first arrival troughs.

The levels shot at depths of 1546.0M and 2272.0M measured depth below DF were omitted from the final VSP as the depth spacing is too small, 98 levels were used in the final VSP processing.

SOURCE SIGNATURE DECONVOLUTION

Due to the variability in the hydrophone times, source signature deconvolution was carried out on a trace by trace basis prior to stack. This removes the effect of the bubble from the geophone data and the effect of any slight variation in the source output. The operator was designed from 360 ms of the hydrophone signature.
A post deconvolution filter was required after source signature deconvolution in order to align the data.

SPECTRAL SMOOTHING

Two spectral smoothing operators were carried out on the raw VSP data. The first operator applied spectral smoothing across the VSP traces. This type of operator is designed to remove noise effecting some traces. An 8 trace median spectral smoothing operator was applied over the full frequency range of the raw VSP data. The second operator applied spectral smoothing across a frequency range from 40-45 Hz and had a median length of 7 Hz, this was designed to remove a consistent band of noise in F-K domain. Test shows that the application of this operator gave the optimum improvement in the VSP upwave without significantly reducing the amplitude of the signal present.

STACKED GEOPHONE DATA

Display VA1 shows the stacked geophone data before spectral smoothing. The levels from 7-24 show a general noise burst. This energy was not considered to be detrimental to the final VSP image. Display VA1 also shows that certain levels are affected by low-frequency noise. This is due to noisy condition in the open borehole, most of the low-frequency noise was succesfully removed by application of spectral smoothing, it can be seen in the display VA (stacked geophone data after spectral smoothing). Display VA(FK) shows the stacked geophone data in the frequency/wave number space. This shows the different wavefields present in the data and the extent of their frequency bandwidths. The preliminary filter (3,6-100,150 Hz) has been derived from an examination of this data in F-K space.

DOWNGOING WAVEFIELD

The estimate of the downwave was obtained by aligning the first arrivals and enhancing this data in such a way as to show the continuity of the downgoing wavefield from trace to trace without distorting any real variations due to differences in structure. A plot of the downgoing wavefield is supplied filtered with the seismic match upwave filter 3,6-40,60 Hz (Display VB2); this can be used for the identification of multiples.

UPGOING WAVEFIELD

The enhanced downgoing wavefield has been used in a subtraction process to remove the downgoing wavefield from the data leaving an estimate of the upgoing wavefield (Display VC).

A deterministic deconvolution has then been applied to the upgoing wavefield using a 1000 ms operator derived from the downgoing wavefield on a trace by trace basis. The consistent portion of the downwave data has been used to derive the deconvolution operators. A comparison of Displays VE (upwave after deconvolution) and VC shows how successful the deconvolution has been in removing reverberants from the upgoing wavefield.

In order to enhance events in the upgoing wavefields median test were performed, a 9 sample median and horizontal dip filter was chosen as best displaying events in the bottom part of the well.

FILTER DETERMINATION

To help design filters for the displays the data has been transffered into F-K space at three stages during the processing sequence and preliminary and final bandpass filters have been designed accordingly. The optimum filter is chosen such that it is the least restrictive filter that can be applied to the upgoing wavefield to remove noise whilst retaining good resolution of the events present. A filter of 5,10-40,60 Hz is considered optimum for this data set.

RESIDUAL WAVEFIELD

In order to show any side waves or diffraction hyperbola present within the data set, the undeconvolved data with both upwaves and downwaves subtracted is displayed.

BRIEF DESCRIPTION OF DISPLAYS SUPPLIED

The VSP displays supplied are essentially of 2 types. Displays included in the VSP book report are intended for use as quality control displays showing each major stage in the processing.

Loose leaf displays are intended as working copies and are produced at a time scale to match the seismic line supplied (3.75 inc/sec). A detailed description of each display is contained in the appendices at the back of this book.

Display VG1 shows the VSP's convolved with the zero phase maximum frequency filter designed for the VSP.

Approved by

D.J. Dushman

Processed by

Ardiek Mahargono

January 1993

COMPANY: SAGASCO RESOURCES LTD.

WELL: FLINDERS-1

DEPTH/STACK_LIST

LEVEL NO.	MEASURED DEPTH IN M BELOW KB	VERTICAL DEPTH IN M BELOW MSL	STACK
1	2705.0	2682.7	3
2	2675.0	2652.7	3
3	2650.0	2627.7	5
4	2625.0	2602.7	3
5	2600.0	2577.7	4
6	2575.0	2552.7	5
7	2550.0	2527.7	4
8	2525.0	2502.7	5
9	2500.0	2477.7	3
10	2475.0	2452.7	4
11	2450.0	2427.7	4
12	2425.0	2402.7	5
13	2400.0	2377.7	4
14	2375.0	2352.7	4
15	2350.0	2327.7	3
16	2325.0	2302.7	4
17	2300.0	2277.7	4
18	2275.0	2252.7	4
19	2250.0	2227.7	4
20	2225.0	2202.7	4
21	2207.0	2184.7	3
22	2200.0	2177.7	4
23	2175.0	2152.7	5

LEVEL NO.	MEASURED DEPTH IN M BELOW KB	VERTICAL DEPTH IN M BELOW MSL	STACK
24	2150.0	2127.7	3
25	2142.0	2119.7	4
26	2125.0	2102.7	4
27	2100.0	2077.7	4
28	2075.0	2052.7	5
29	2050.0	2027.7	3
30	2025.0	2002.7	4
31	2000.0	1977.7	5
32	1975.0	1952.7	5
33	1950.0	1927.7	4
34	1925.0	1902.7	3
35	1900.0	1877.7	4
36	1875.0	1852.7	4
37	1850.0	1827.7	4
38	1825.0	1802.7	3
39	1800.0	1777.7	4
40	1775.0	1752.7	4
41	1750.0	1727.7	4
42	1725.0	1702.7	4
43	1700.0	1677.7	4
44	1675.0	1652.7	4
45	1650.0	1627.7	3
46	1625.0	1602.7	2
47	1600.0	1577.7	3
48	1575.0	1552.7	4
49	1550.0	1527.7	4
50	1525.0	1502.7	4
51	1500.0	1477.7	5

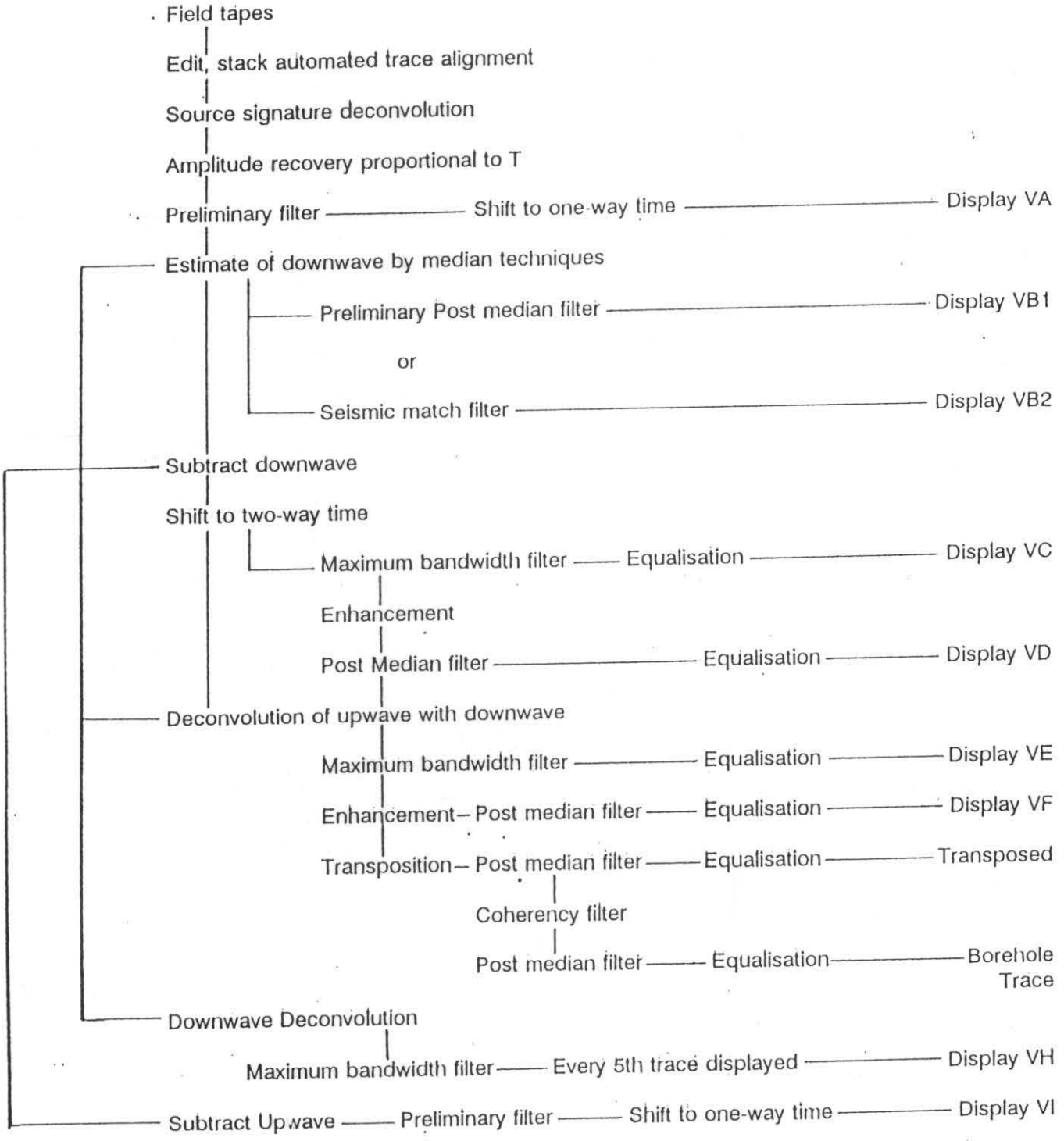
LEVEL NO.	MEASURED DEPTH IN M BELOW KB	VERTICAL DEPTH IN M BELOW MSL	STACK
52	1475.0	1452.7	4
53	1450.0	1427.7	3
54	1432.0	1409.7	3
55	1425.0	1402.7	4
56	1400.0	1377.7	5
57	1375.0	1352.7	4
58	1350.0	1327.7	5
59	1325.0	1302.7	3
60	1300.0	1277.7	4
61	1275.0	1252.7	4
62	1250.0	1227.7	3
63	1225.0	1202.7	4
64	1200.0	1177.7	4
65	1175.0	1152.7	3
66	1150.0	1127.7	4
67	1125.0	1102.7	3
68	1100.0	1077.7	4
69	1075.0	1052.7	4
70	1050.0	1027.7	4
71	1025.0	1002.7	4
72	1000.0	977.7	3
73	975.0	952.7	4
74	950.0	927.7	4
75	925.0	902.7	4
76	900.0	877.7	4
77	875.0	852.7	4
78	850.0	827.7	4
79	825.0	802.7	4
80	800.0	777.7	4
81	775.0	752.7	4
82	750.0	727.7	4

LEVEL NO.	MEASURED DEPTH IN M BELOW KB	VERTICAL DEPTH IN M BELOW MSL	STACK
83	725.0	702.7	4
84	700.0	677.7	4
85	675.0	652.7	4
86	650.0	627.7	4
87	625.0	602.7	4
88	600.0	577.7	4
89	575.0	552.7	4
90	550.0	527.7	4
91	525.0	502.7	4
92	500.0	477.7	4
93	475.0	452.7	4
94	450.0	427.7	5
95	425.0	402.7	4
96	400.0	377.7	4
97	375.0	352.7	4
98	350.0	327.7	4

SEISMOGRAPH SERVICE

A Raytheon Company

PROCESSING SEQUENCE



Seismograph Service
A Raytheon Company

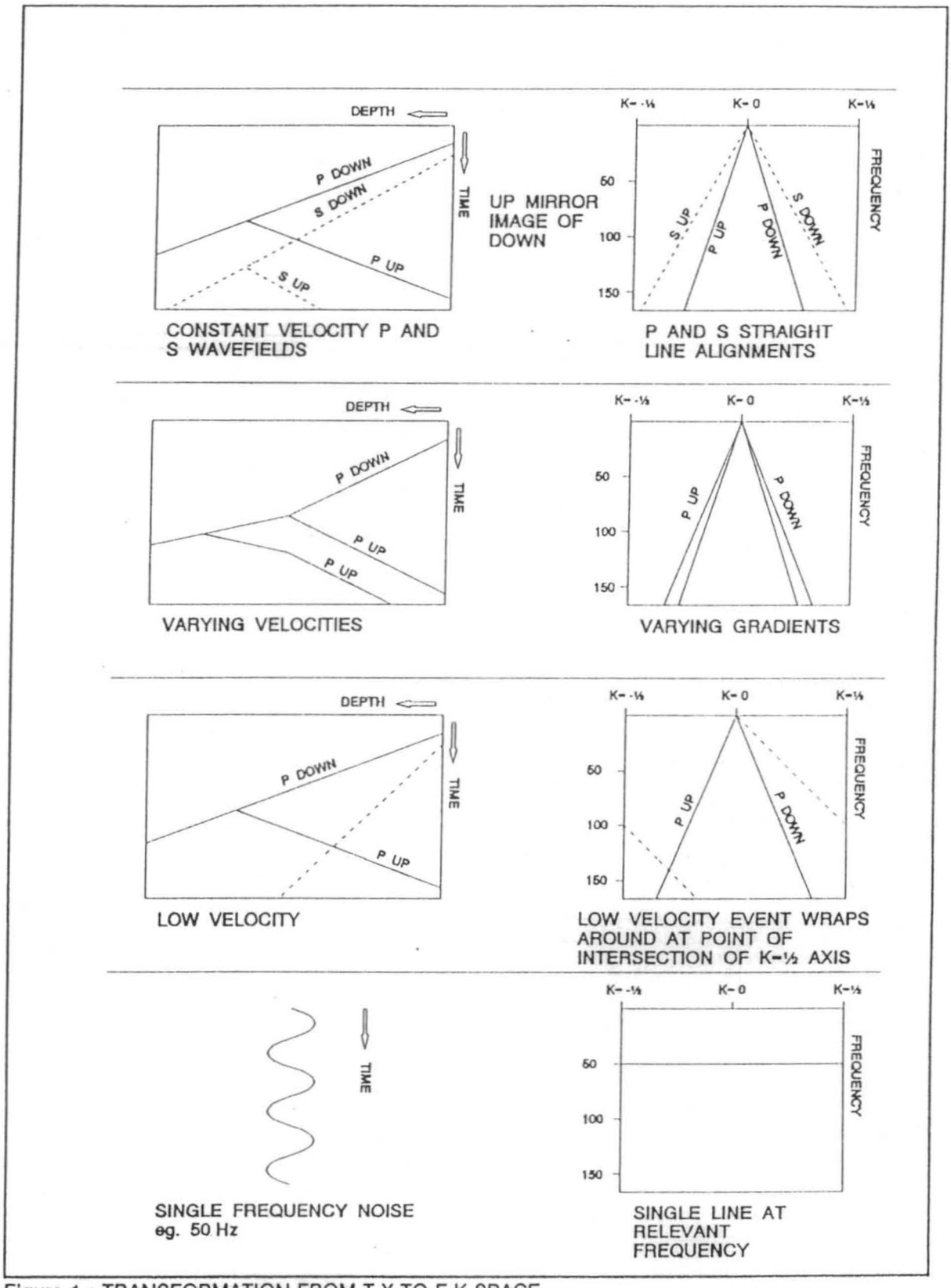
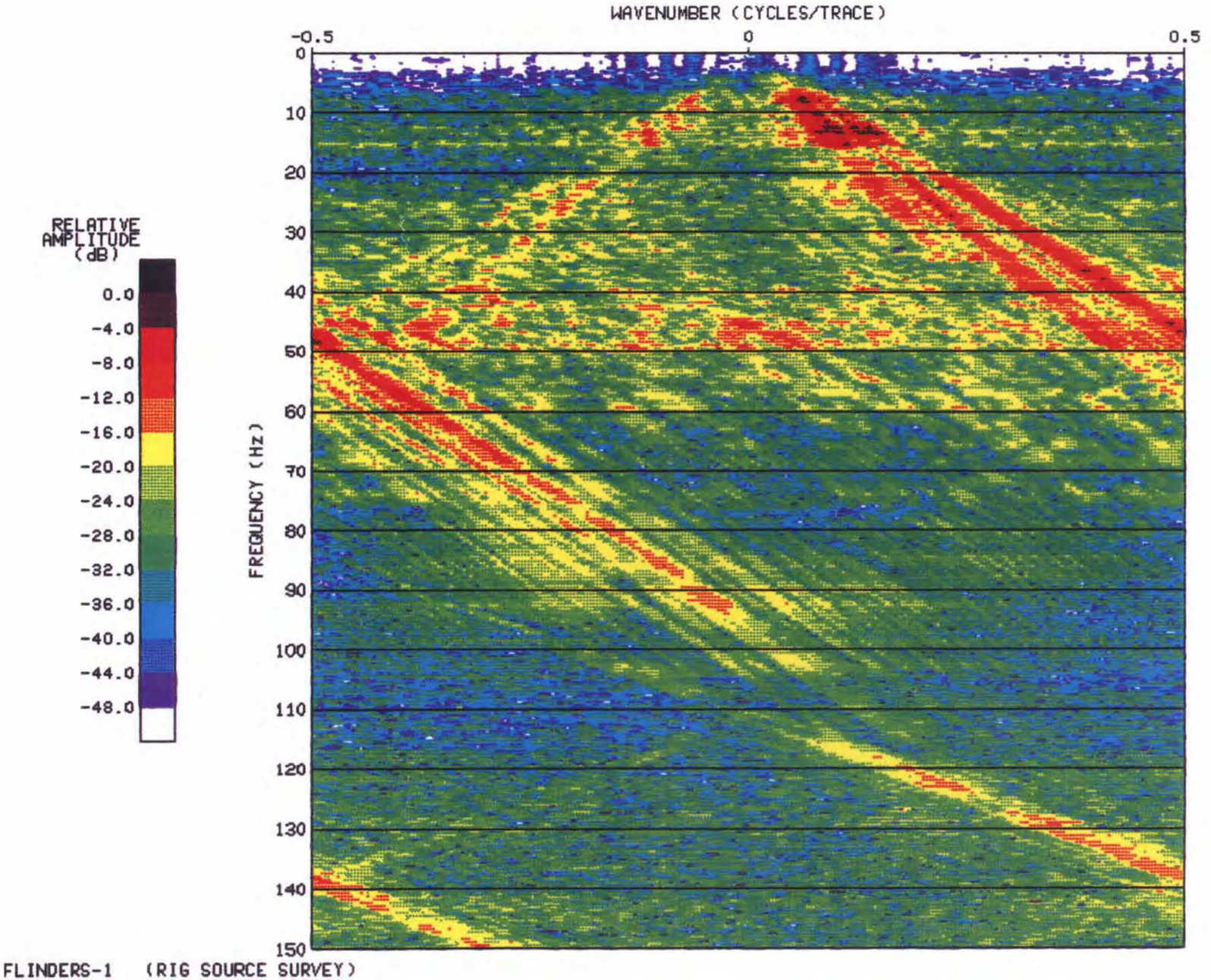


Figure 1 : TRANSFORMATION FROM T-X TO F-K SPACE

5 cm



DISPLAY : VA1 (FK)
INPUT : FK ANALYSIS
: STACKED GEOPHONE DATA (ONE-WAY TIME)
: (BEFORE SPECTRAL SMOOTHING)
LEVELS : 1-100
WINDOW : 0.0 - 2.5 SEC
FILTER : NONE

5 cm

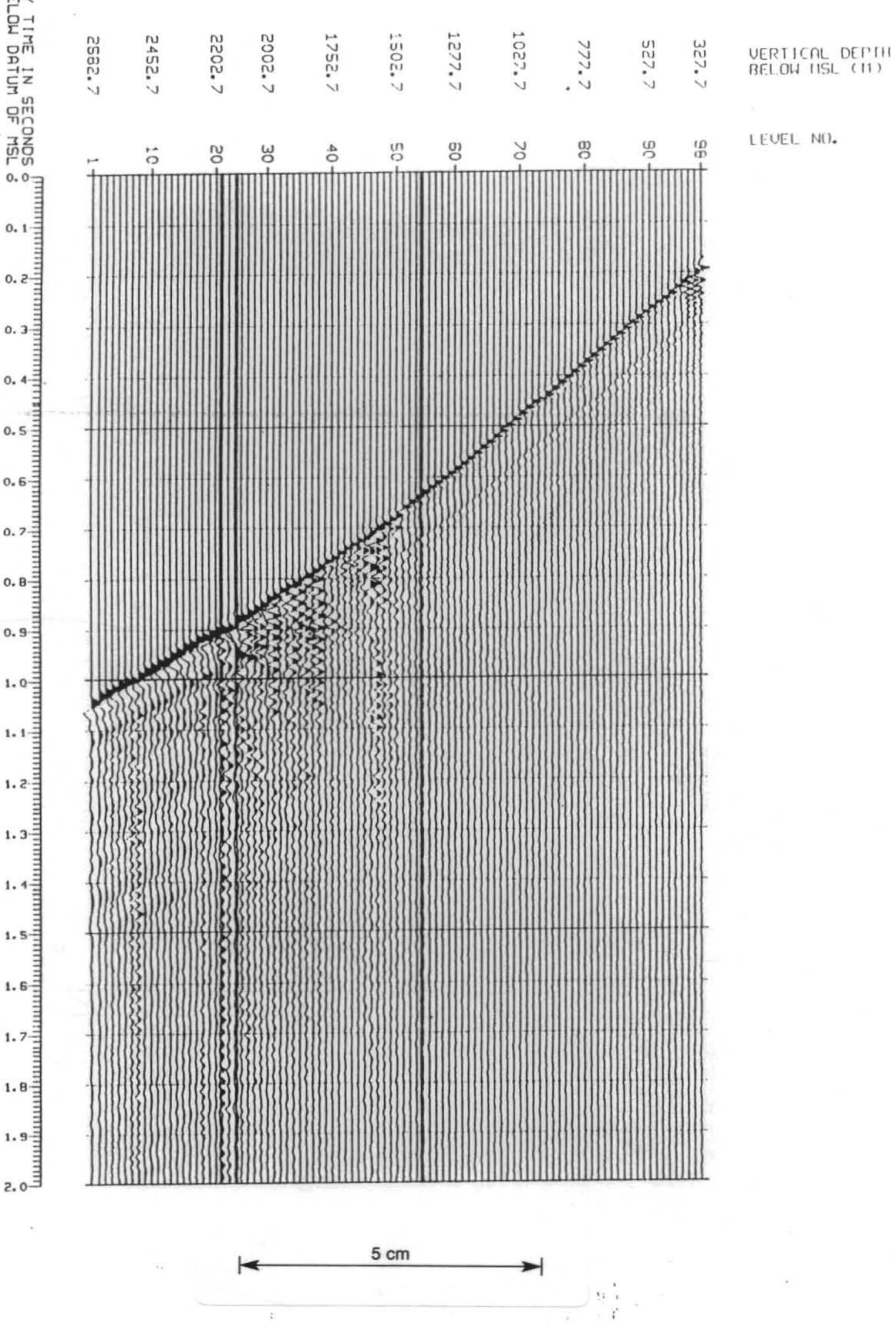
FLINDERS-1 (RIG SOURCE SURVEY)

WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VA1

291254

PRELIMINARY FILTER 3,6-100,150 HZ



DISPLAY VA Stacked Geophone Data at one-way time

This display indicates the quality of data used in the VSP processing.

The edited data is aligned accurately, using cross correlation methods, prior to summation of common depth traces.

Unless otherwise stated, source signature deconvolution is applied to marine data using the source monitor signal as source signature in order to remove the source bubble and to account for any slight variation in source output.

A broad band (preliminary) filter is applied in order to remove noise without compromising the usable bandwidth of the data.

DISPLAY VA(FK) F-K Transformation of Stacked Geophone data at one-way time

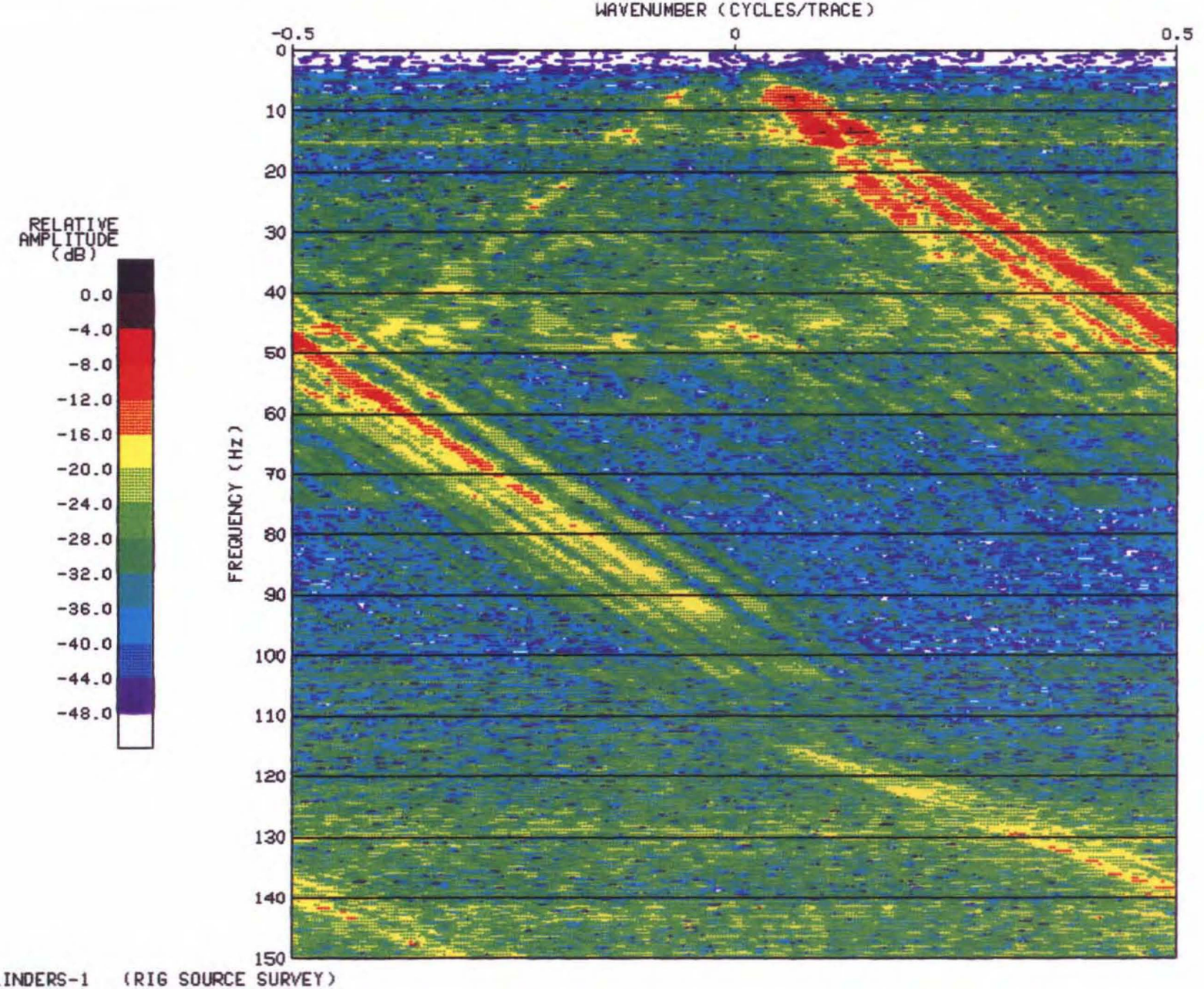
This display is used for analysis of the frequency bandwidth of the data, to aid design of the preliminary filter.

The stacked geophone data (after source signature deconvolution, if appropriate) at one-way time, is transformed into F-K space. It is displayed as wavenumber (K) against frequency, with colour variation indicating amplitude in dB below peak amplitude.

A velocity alignment in T-X space transforms to an alignment in F-K space, rotated through 90° ; the various wavefields (velocity alignments) commonly observed in T-X space transform into F-K space as illustrated in Figure 1.

The strongest wavefield will normally be the downgoing wavefield and this transforms into an alignment from zero wave number, zero frequency, sloping in the positive wavenumber direction.

Significant velocity changes in a wavefield will result in multiple alignments in F-K space; it may not be possible to differentiate between the different alignments and the resulting event may be smeared.



DISPLAY : VA(FK)
INPUT : FK ANALYSIS
: STACKED GEOPHONE DATA (ONE-WAY TIME)
(AFTER SPECTRAL SMOOTHING)
LEVELS : 1-100
WINDOW : 0.0 - 2.5 SEC
FILTER : NONE

5 cm

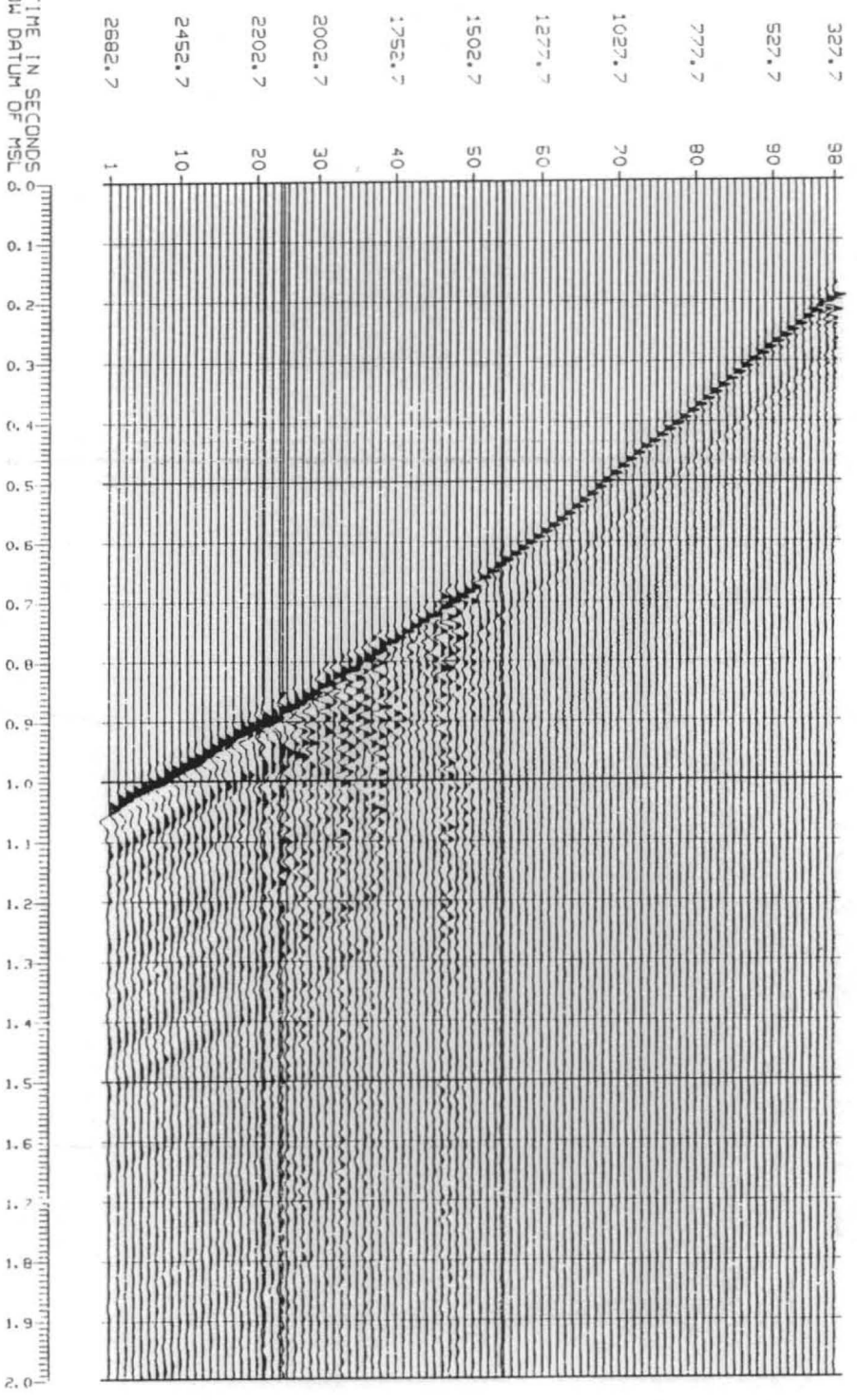
FLINDERS-1 (RIG SOURCE SURVEY)

WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VA

291257

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3,6-100,150 HZ



5 cm

291258

Seismograph Service
A Raytheon Company

DISPLAY VB1 **Downgoing Wavefield**

This display shows the data from which the deconvolution operators are derived.

The data shown in Display **VA** is shifted so that the direct arrivals are aligned in time. A spatial filter is applied to remove random noise and crossing wavefields.

A broad band filter is applied to the data.

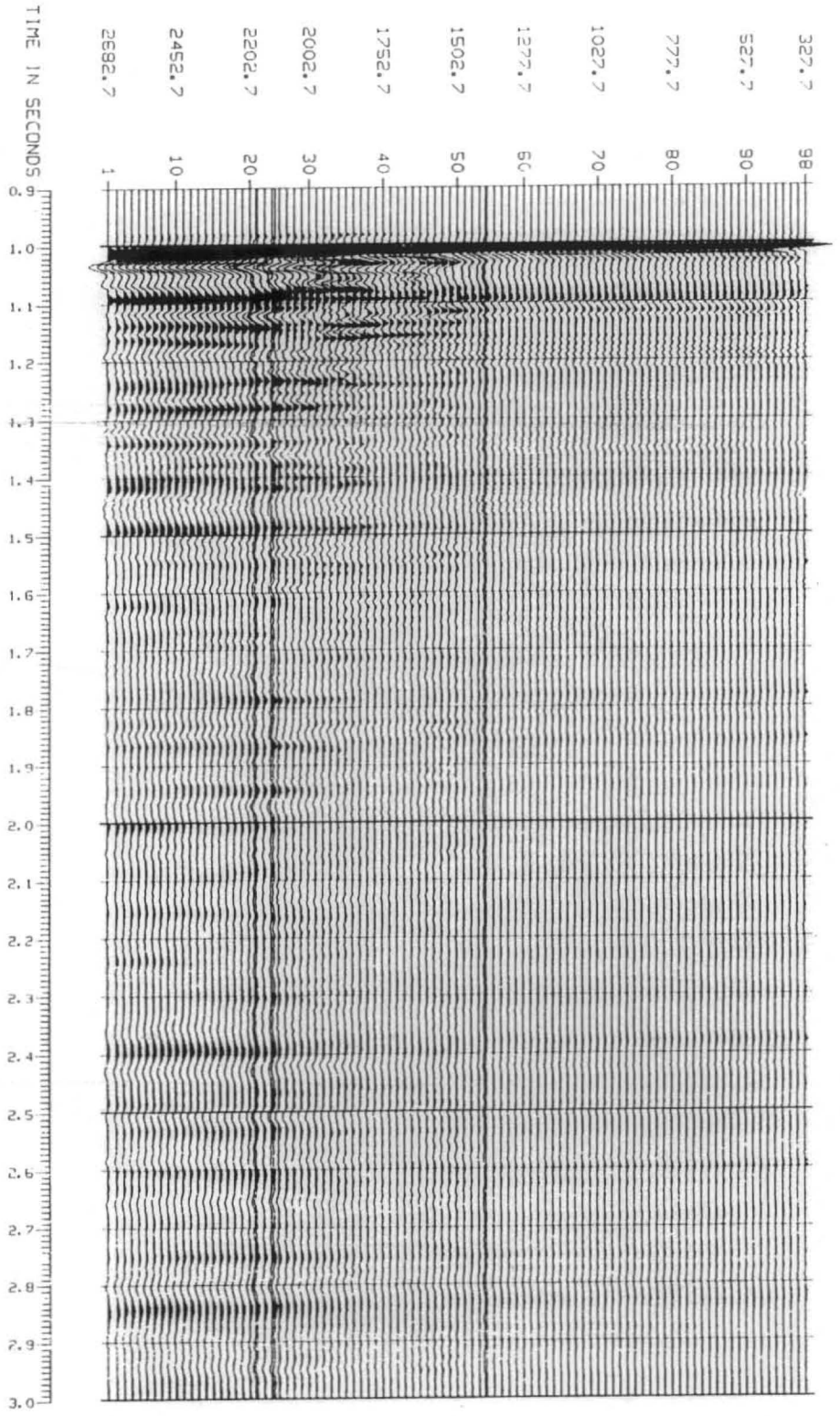
The result represents the downgoing wavefield observed at successive geophone positions and describes fully the multiple systems that will occur as a tail to a reflector at or near that geophone position.

WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VB1

291259

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3,6-100,150 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, OMS/TRACE DIP)
POST MEDIAN FILTER 1,3-110,160 HZ



5 cm

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DISPLAY VC Upgoing Wavefield at two-way time before enhancement

This display describes the primary and multiple reflection responses of the subsurface at the borehole location, within and below the depth range of the VSP.

This data is filtered using the 'maximum bandwidth' filter designed after F-K analysis to determine the usable bandwidth of the upgoing wavefield.

In marine data, if source signature deconvolution has been applied, then the input wavelet is zero phase and the wavelet contained in the data is zero phase modified by earth absorption and transmission loss effects (ie mixed phase).

Events that reach the time-depth curve are primary and their lithologic significance can be established unequivocally by reference to the calibrated velocity log. Multiples having their last bounce from a primary within the range of the VSP may be identified by observing their termination in the data at the same depth point at which the primary cuts the time-depth curve.

From this display, any dip across the well location can be recognised by moveout of the primary event to shorter time, as the geophone moves up the well and away from the lithology creating the reflection. No azimuth of dip can be computed from this display but true dip can be computed from a measurement of the ΔT against vertical depth increment.

Unconformities may be recognised by an abrupt change of moveout of adjacent primary events. Topographical features up-dip away from the well may be recognised by an increase in the ΔT or in the termination of an event away from the time-depth curve. Dip increasing up-dip away from the well can be observed in the data; however, if dip is decreasing up-dip (ie crest of an anticline) then the event in question will disappear from the data. Dip can be calculated using the method described in the Appendix contained in this report.

DISPLAY VC(FK) F-K Display of Upgoing Wavefield at two-way time before enhancement

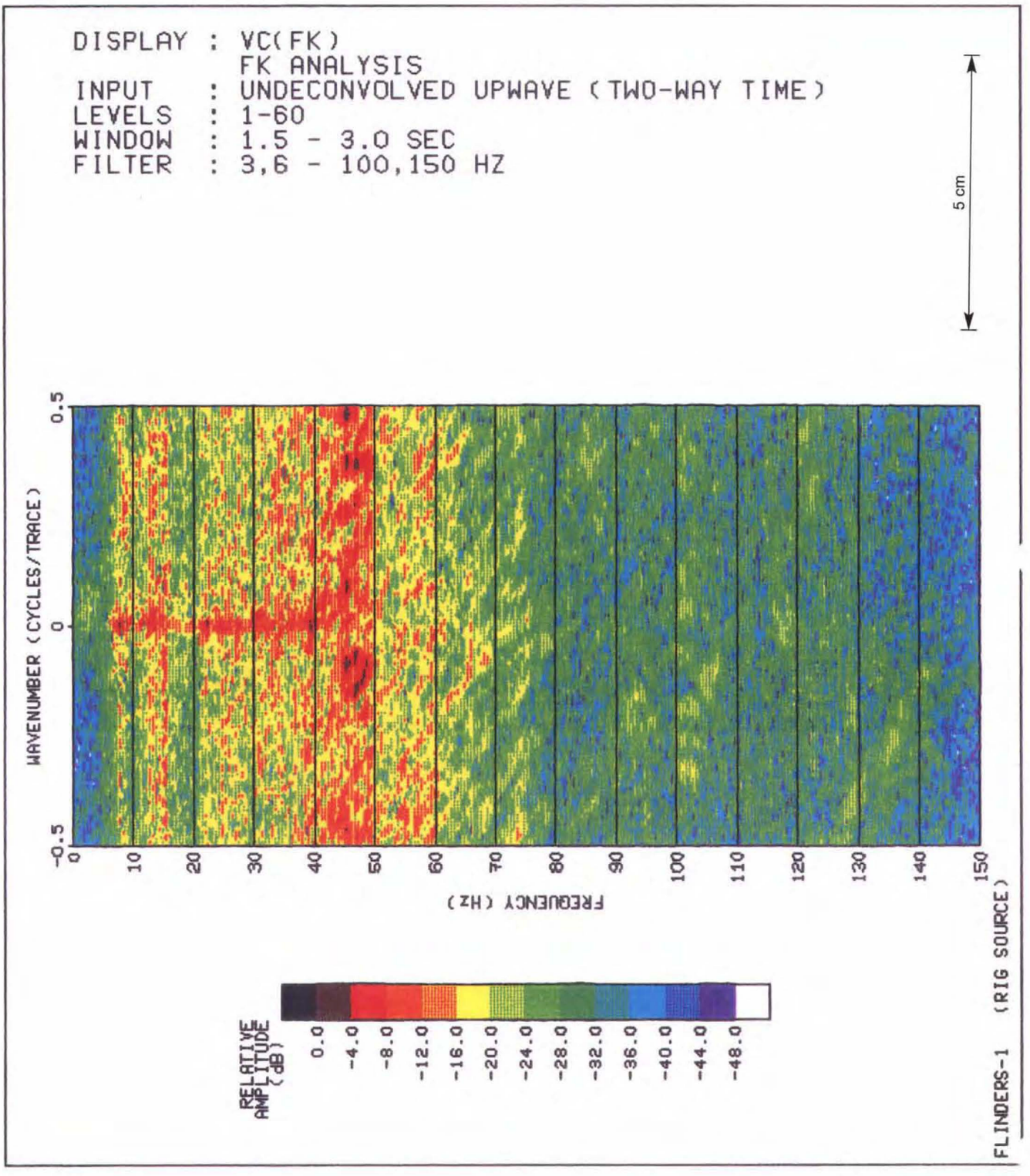
This display is used in the design of the 'maximum bandwidth' filter in conjunction with the F-K display of the deconvolved upgoing wavefield and filter trials. It shows the data from the upgoing wavefield at two-way time transformed into F-K space. Any filter applied to the data before transformation is noted on the display.

Since the upgoing wavefield is aligned horizontally, or near horizontally, in T-X space (unless there is steep dip across the well location) it is aligned vertically, through zero wavenumber, in F-K space.

The 'maximum bandwidth' filter is the least restrictive filter that can be applied to the upgoing wavefield to remove noise whilst retaining resolution of the data in the zone of interest. The F-K analysis is therefore performed on data within a window around the zone of interest. Additionally, the data is windowed in time so that data analysed is close to the time-depth curve, where we would expect better resolution.

If the zone of interest is not known, it is assumed to be just above T.D. of the well.

291261


DISPLAY : VC(FK)
FK ANALYSIS
INPUT : UNDECONVOLVED UPWAVE (TWO-WAY TIME)
LEVELS : 1-60
WINDOW : 1.5 - 3.0 SEC
FILTER : 3,6 - 100,150 HZ
5 cm
WAVENUMBER (CYCLES/TRACE)
0.5
0
-0.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
FREQUENCY (HZ)
RELATIVE AMPLITUDE (dB)
0.0
-4.0
-8.0
-12.0
-16.0
-20.0
-24.0
-28.0
-32.0
-36.0
-40.0
-44.0
-48.0
FLINDERS-1 (RIG SOURCE)

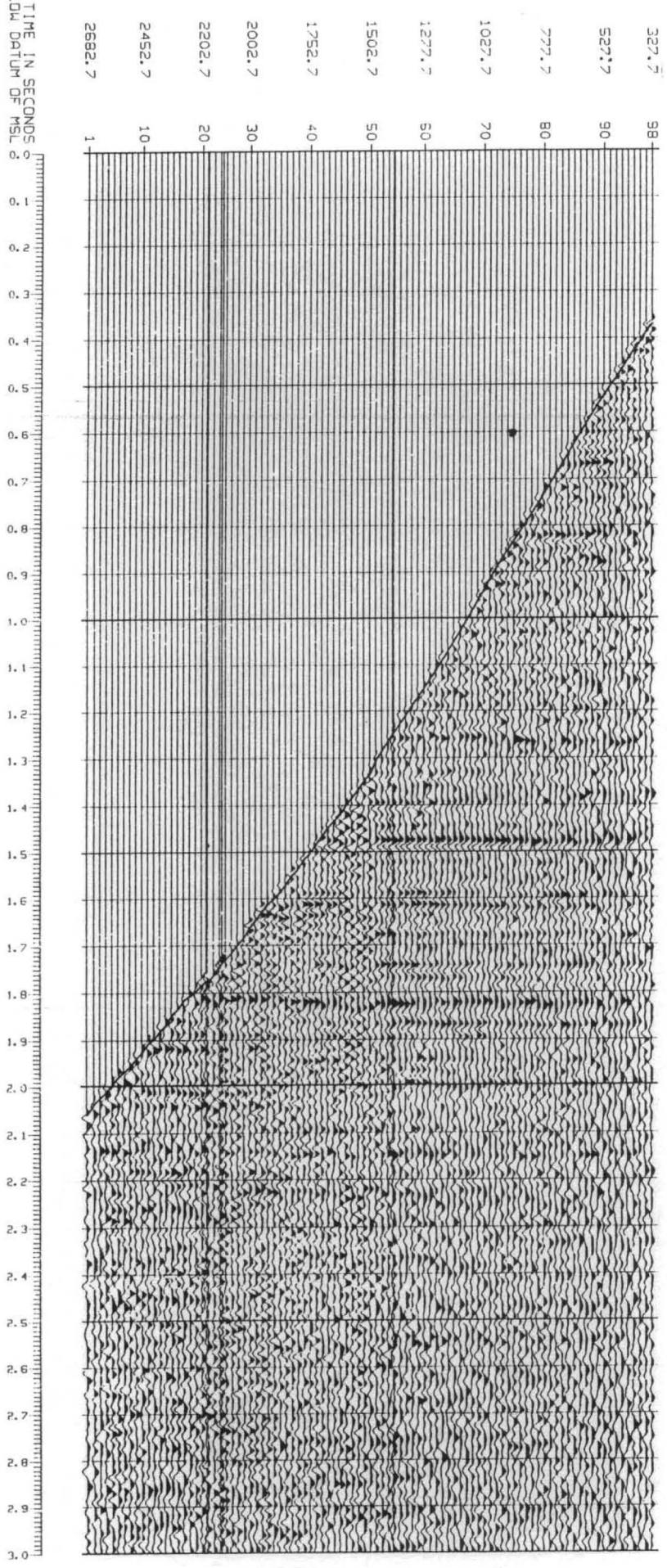
WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VC

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3,6-100,150 HZ
DOWNWAVE SUBTRACTION
MAXIMUM BANDWIDTH FILTER 5,10-40,60 HZ

5 cm

291262



Seismograph Service
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DISPLAY VD **Enhanced Upgoing Wavefield at two-way time**

This display describes the primary and multiple reflection responses of the subsurface at the borehole location, within and below the depth range of the VSP.

The data from Display VC is spatially filtered; this spatial filter is the result of various trials and is chosen to give the best enhancement of the upgoing events (horizontal and/or dipping) observed in the data.

The data is filtered with the 'maximum bandwidth' filter.

Dip can be recognised from this display as described for Display VC and can be calculated using the method described in the Appendix contained in this report.

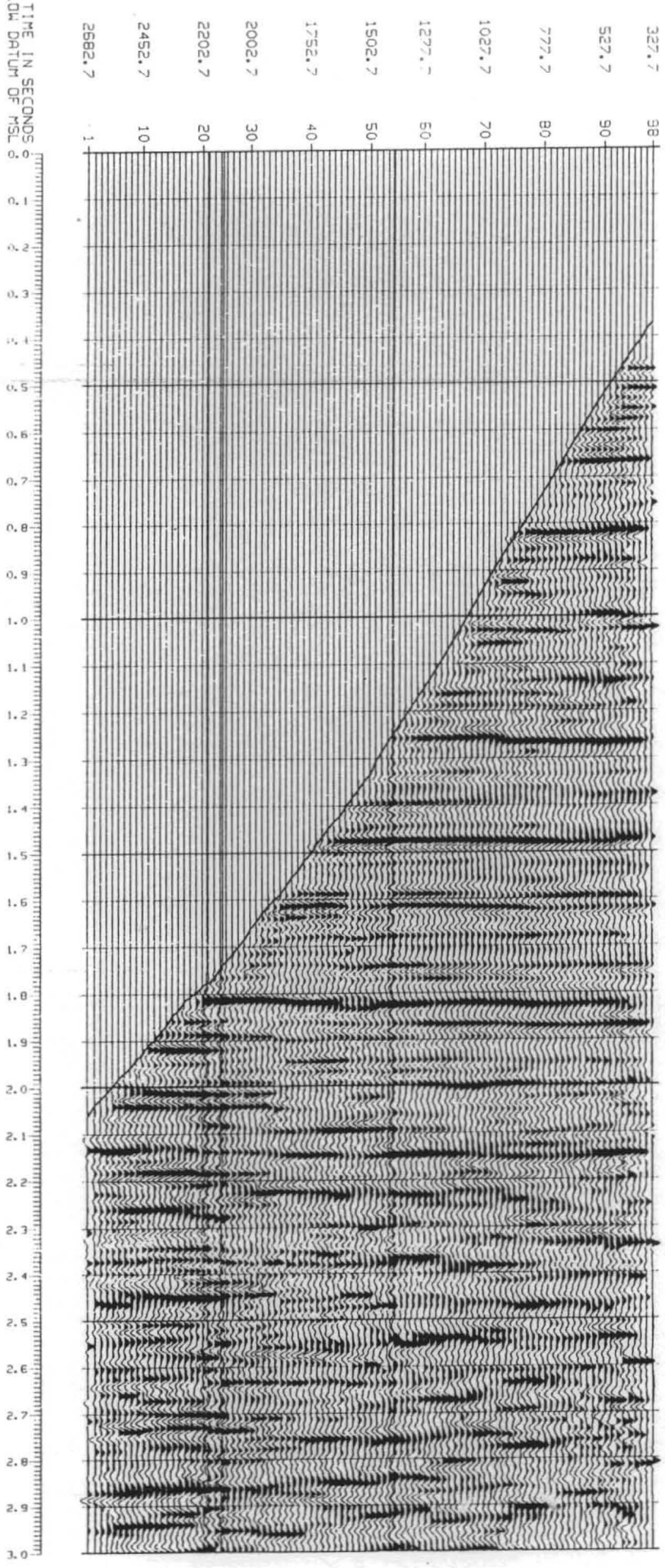
WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VD

5 cm

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3, 6-100, 150 HZ
DOWNWAVE SUBTRACTION
MAXIMUM BANDWIDTH FILTER 5, 10-40, 60 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, OMS/TRACE DIP)
POST MEDIAN FILTER 3, 6-50, 70 HZ

291264



DISPLAY VE — **Deconvolved Upgoing Wavefield at two-way time before enhancement**

This display describes the primary reflection response of the subsurface at the borehole location, within the depth range of the VSP, and below the deepest VSP level to the limit of the deconvolution window.

It shows the data from Display VC after application of deterministic deconvolution using operators derived from the downgoing wavefield on a trace by trace basis.

The effect of the deconvolution is to remove all reverberants associated with at least one reflector above the geophone position from which the downgoing wavefield has been extracted.

The deconvolution is applied in spiking mode, unless otherwise stated, and the phase of the resulting data will be a function of the filter applied after deconvolution. This is normally a zero phase filter giving a zero phase result and maximum resolution of the lithology within the band limits.

This data is filtered using the 'maximum bandwidth' filter.

Dip can be recognised from this display as described for Display VC and can be calculated using the method described in the Appendix contained in this report.

DISPLAY VE(FK) — **F-K Display of Deconvolved Upgoing Wavefield at two-way time before enhancement**

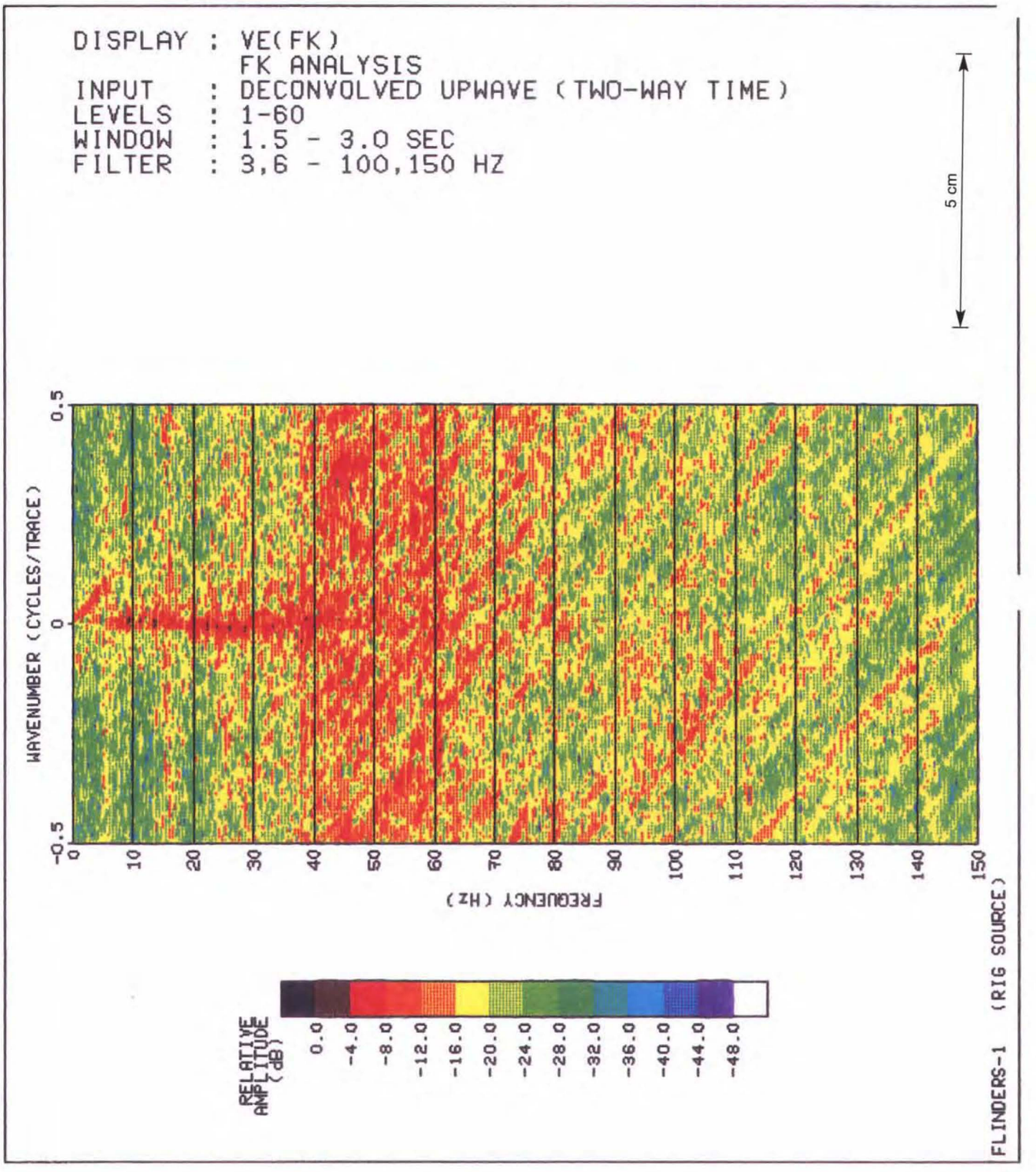
This display is used in the design of the 'maximum bandwidth' filter in conjunction with the F-K display of the upgoing wavefield and filter trials.

It shows the data from the deconvolved upgoing wavefield at two-way time transformed into F-K space.

Any filter applied to the data before transformation is noted on the display.

The same analysis window is used as in the production of VC(FK). VC(FK) and VE(FK) will differ mainly in areas of low amplitude on VC(FK) which will be boosted during deconvolution.

291266


DISPLAY : VE(FK)
FK ANALYSIS
INPUT : DECONVOLVED UPWAVE (TWO-WAY TIME)
LEVELS : 1-60
WINDOW : 1.5 - 3.0 SEC
FILTER : 3,6 - 100,150 HZ
5 cm
WAVENUMBER (CYCLES/TRACE)
0.5
0
-0.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
FREQUENCY (HZ)
RELATIVE AMPLITUDE (dB)
0.0
-4.0
-8.0
-12.0
-16.0
-20.0
-24.0
-28.0
-32.0
-36.0
-40.0
-44.0
-48.0
FLINDERS-1 (RIG SOURCE)

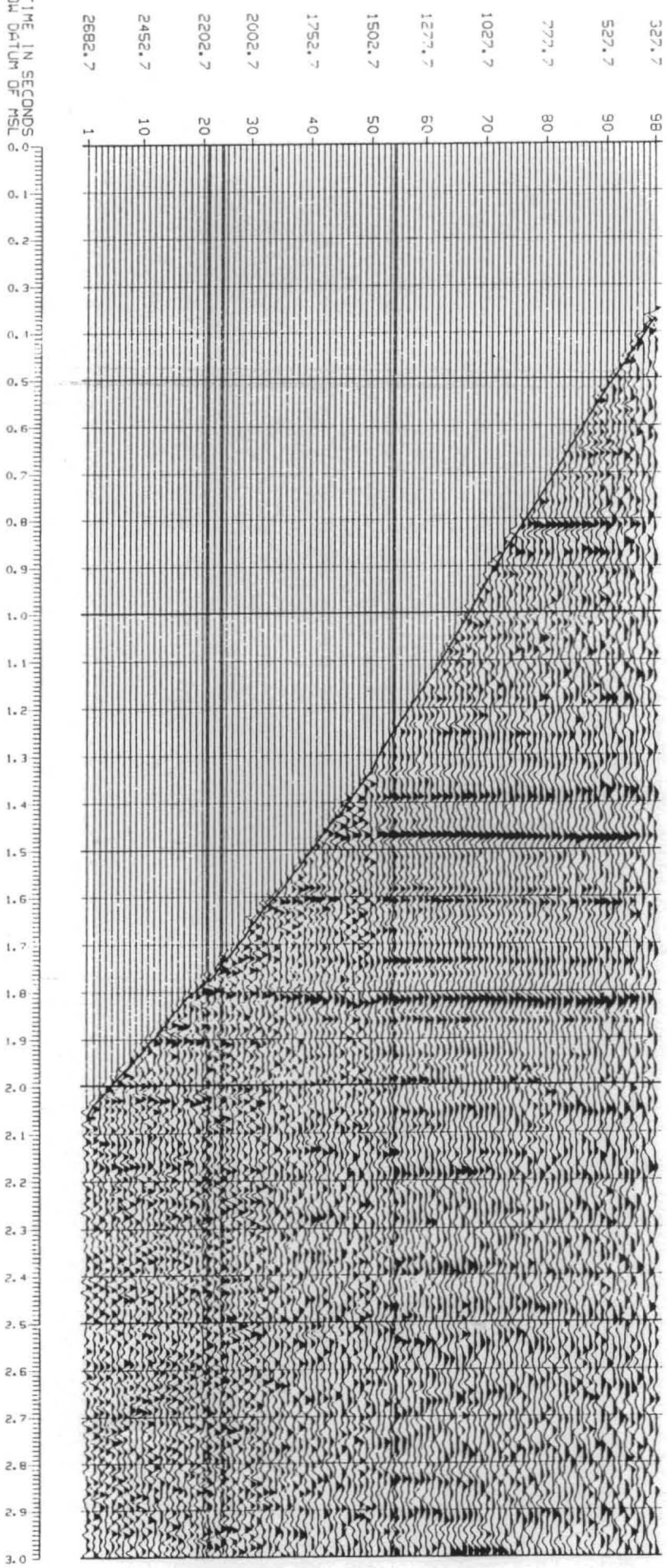
WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VE

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3, 6-100, 150 HZ
DOWNWAVE SUBTRACTION
DETERMINISTIC DECONVOLUTION (1000 MS WINDOW)
MAXIMUM BANDWIDTH FILTER 5, 10-40, 60 HZ

5 cm

291267



DISPLAY VF **Deconvolved Upgoing Wavefield at two-way time after enhancement**

This display describes the primary reflection response of the subsurface at the borehole location, within the depth range of the VSP, and below the deepest VSP level to the limit of the deconvolution window.

The data from Display **VE** is spatially filtered; this spatial filter is the result of various trials and is chosen to give the best enhancement of the upgoing events (horizontal and/or dipping) observed in the data.

This data is filtered using the 'maximum bandwidth' filter.

Dip can be recognised from this display as described for Display **VC** and can be calculated using the method described in the Appendix contained in this report.

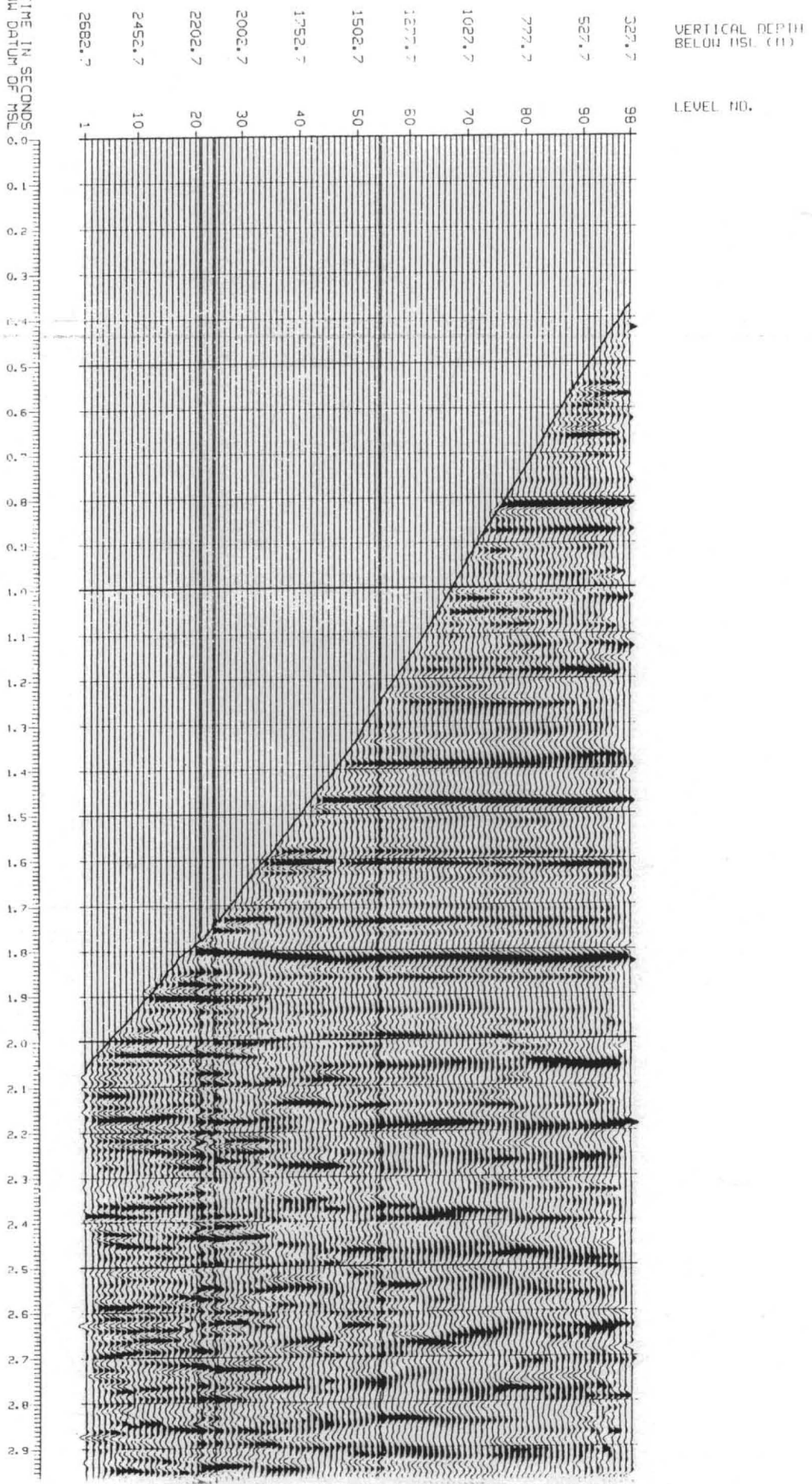
WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VF

5 cm

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3,6-100,150 HZ
DOWNWAVE SUBTRACTION
DETERMINISTIC DECONVOLUTION (1000 MS WINDOW)
MAXIMUM BANDWIDTH FILTER 5,10-40,60 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0MS/TRACE DIP)
POST MEDIAN FILTER 3,6-50,70 HZ

291269



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DISPLAY VH Deconvolved Downgoing Wavefield

This display indicates the quality and consistency of the zero phase wavelet residing in the deconvolved upgoing wavefield.

The inverse operator is used to deconvolve the data from which it has been designed. Selected traces only are displayed.

The data is filtered using the 'maximum bandwidth' filter.

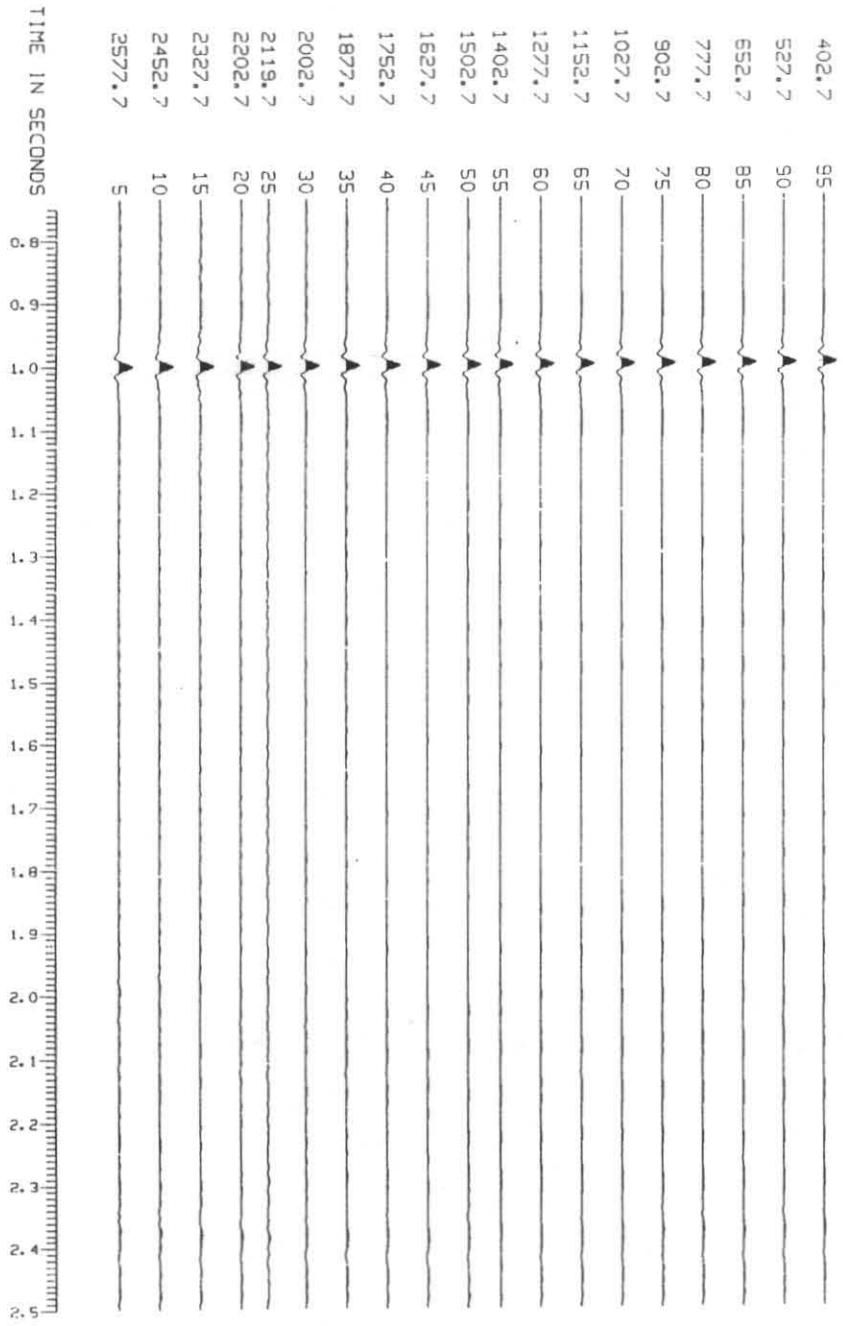
Reverberants with periods longer than the operator length used will remain in this data and will indicate some of the multiples that will be retained in Displays VE and VF.

291271

WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VH

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3,6-100,150 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0MS/TRACE DIP)
DETERMINISTIC DECONVOLUTION (1000 MS WINDOW)
MAXIMUM BANDWIDTH FILTER 5,10-40,60 HZ



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DISPLAY VI · Residual Wavefield at one-way time

This display shows data remaining after removal of up and downgoing wavefields and may show diffraction hyperbolae and fault plane reflections.

The data is filtered with the preliminary filter.

Most VSP data contains many other events in addition to the vertical upgoing and downgoing wavefields. Reflections from fault planes, diffraction energy from point diffractors near the borehole, mode-converted shear (SV) energy and residual tube wave energy are some of the possible events which will be revealed by this display. The interpretation of these types of events is difficult except for diffraction hyperbolae and some fault plane reflectors.

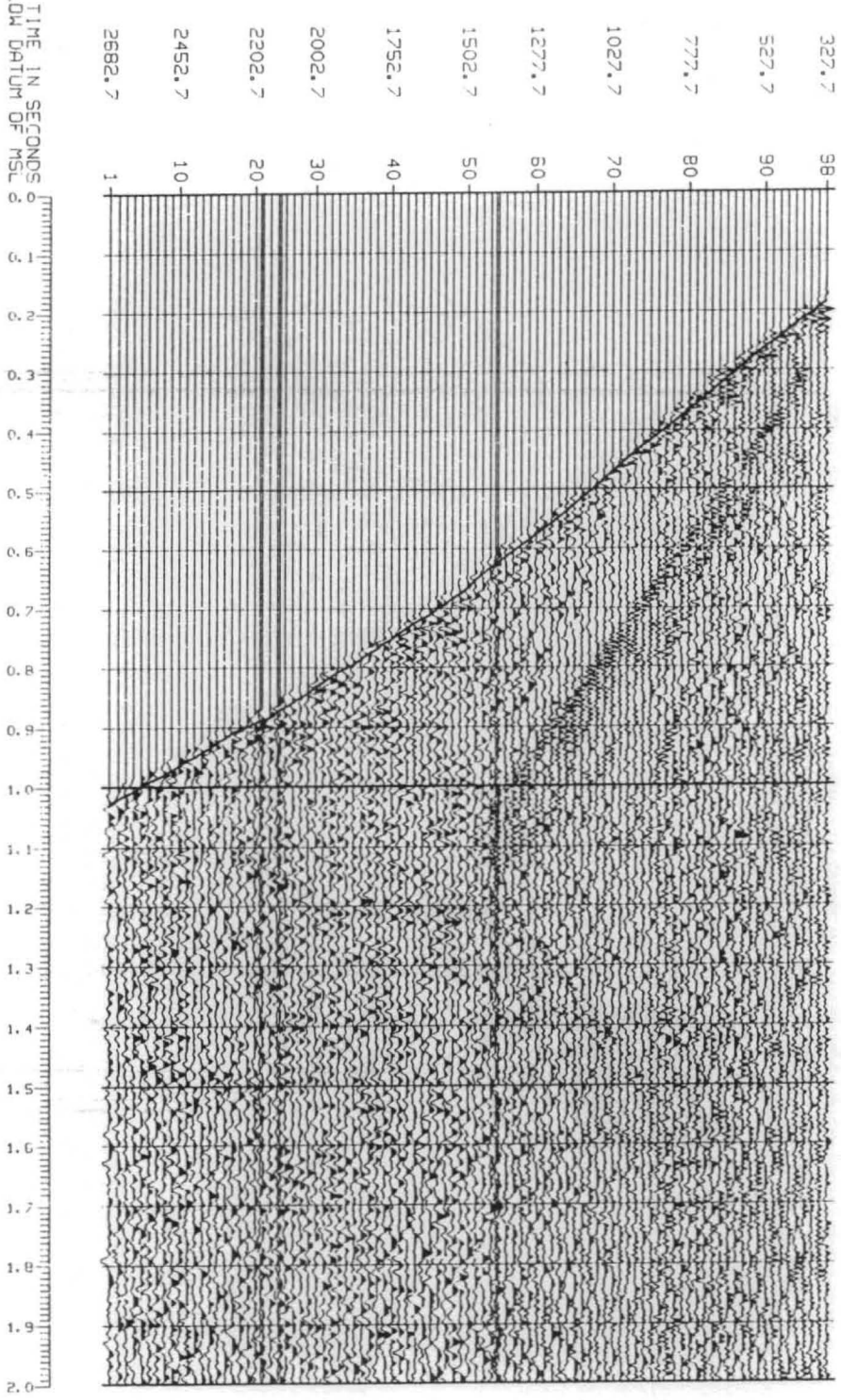
The method for calculation of the distance of diffraction points from the well is described in the Appendix contained in this report.

WELL: FLINDERS-1 RIG SURVEY

DISPLAY - VI
POLARITY - SEG NORMAL

291273

SPECTRAL SMOOTHING
PRELIMINARY FILTER 3,6-100,150 HZ
DOWNWAVE SUBTRACTION
UPWAVE SUBTRACTION
POST MEDIAN FILTER 3,6-50,70 HZ



5 cm

291274

SEISMOGRAPH SERVICE
A Raytheon Company

STANDARD SEISMIC SCALE DISPLAYS

DISPLAY VB2 Downgoing Wavefield

This display enables identification of residual multiples in the surface seismic data.

The data shown in Display VA is shifted so that the direct arrivals are aligned in time. A spatial filter is applied to remove random noise and crossing wavefields.

The data is filtered to match the bandwidth of the surface seismic data in the zone of interest.

The data is presented at the scale(s) of the seismic data and at both polarities.

Comparison of the downgoing wavefield with a reflection occuring at the same depth on the seismic section at the well, will reveal any residual multiple activity on the seismic section associated with that particular reflector. For this exercise, the observed polarity of the reflection on the seismic section should be matched with the same polarity first arrival on the VSP downgoing wavefield; white trough matched to white trough or black peak to black peak.

The downgoing wavefield can also be correlated with the upgoing wavefields in Displays VC and VD to establish the presence and origin of multiples within the VSP data.

DISPLAY VG1 Interpreter's Composite (maximum bandwidth)

These displays are designed for use in interpretation and are therefore presented at seismic scale(s) and at both polarities.

All data is filtered using the "maximum bandwidth" filter.

The displays contain:

Enhanced, deconvolved upgoing wavefield,
Transposed, deconvolved upgoing wavefield (see explanation)

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BGD/VSP/FIG2.1

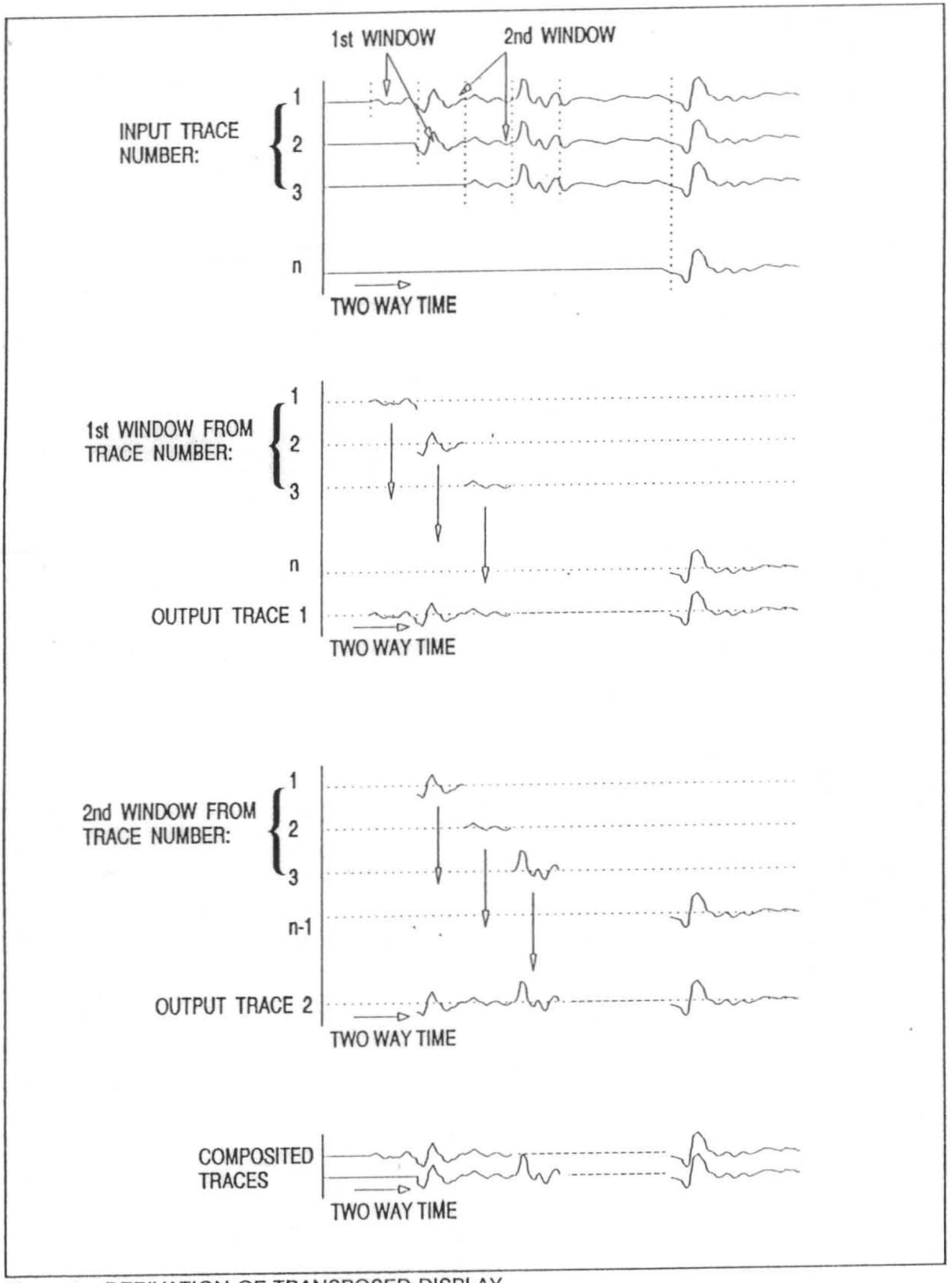


Figure 2 : DERIVATION OF TRANSPOSED DISPLAY

5 cm

291276

Tranposed Deconvolved Upgoing Wavefield

The transposition of the deconvolved, upgoing data ensures that all primary reflections appear at true times and depths along the left (or right) hand edge of the display enabling easier comparison with the seismic section.

The transposed display is obtained by producing a number of output traces (typically 24) from a number of corridor scans of the deconvolved upgoing wavefield as illustrated in Figure 2.

Each trace is composed of a series of small windown, one from each input trace, taken along the slope of the first arrival curve.

The first scan on each trace is from the first arrival time to the time of the first arrival on the next (deeper) trace. Second and subsequent corridors are composed of a series of windows parallel to the first arrival curve. The number of corridors is the same as the number of output traces requested. The last window for trace 1 extends to the end of data on the deepest input trace; for output trace 2 extends to the end of data on next deepest input trace and so on. Trace 1 can be positioned at either the left or right edge of the display and both versions are always presented.

Changes of dip, indicated by changes of Δ T from trace to trace on an event on the deconvolved upgoing wavefield display are retained visually on this display, but the amount of Δ T between traces is altered slightly; any dip calculations should be made from the deconvolved upgoing wavefield only.

201677

291278

Vertical well : Rig Source VSP

APPENDIX

Calculation of dip and offset of diffraction points from VSP data

Calculation of the angle of dip

The computation of the angle of dip is very straightforward, but involves making two assumptions:

(1) The dipping reflector is a planar, uniform surface.

(2) The velocity of the material above the reflector can be regarded as constant.

The first assumption is reasonably secure in regions of "well behaved" structure, and does not significantly affect the accuracy of the calculations. The second assumption may not be as reliable particularly in regions where there may be significant velocity changes in the near surface. If the dips are generally below 30°, however, the errors introduced are again minimal; the basic consideration here is that the reflection points remain reasonably close to the well location. Even in areas of great structural variation and high dip, accurate calculations can be performed if geophone stations close to the reflector are chosen for the calculations.

If one considers the two geophone stations in figure 1, it can be seen that an image point can be generated such that

$$SO = OI \quad \text{and} \quad SR = RI$$

Where :

S is the source

I is the image point

α is the angle of dip

G1 is geophone 1

G2 is geophone 2

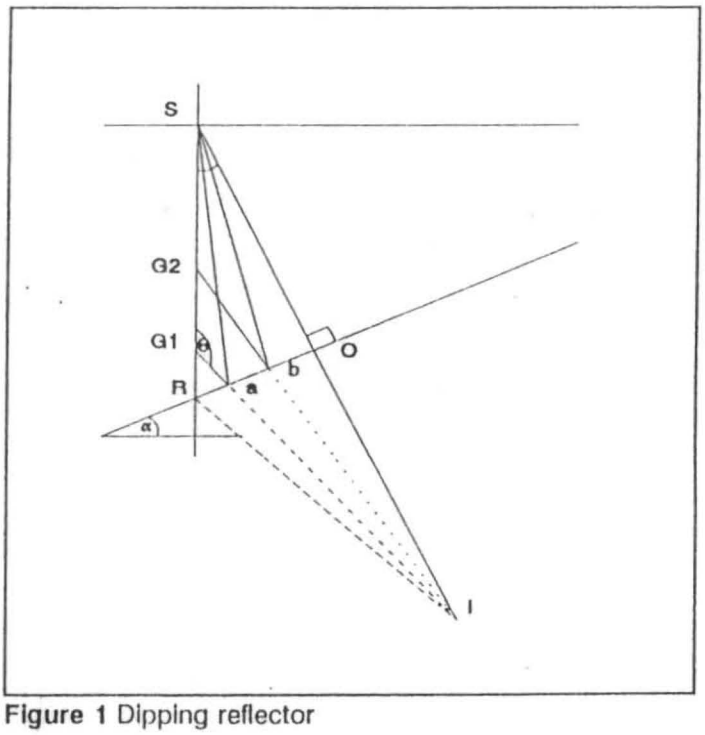


Figure 1 Dipping reflector

5 cm

With the velocity considered constant, the lengths of the sides of the triangles can be expressed in terms of the respective arrival times such that:

t_1 is the one-way first arrival time at G1

t_2 is the one-way first arrival time at G2

t_3 is the arrival time of the reflection from the dipping interface at G1 (equivalent to path G1-I)

t_4 is the arrival time of the reflection from the dipping interface at G2 (equivalent to path G2-I)

t_5 is the travel time over the distance S-I

Using the cosine rule in triangle G1-G2-I, gives

$$\cos\theta = \frac{t_3^2 + (t_1 - t_2)^2 - t_4^2}{2\,t_3\,(t_1 - t_2)}$$

Hence the angle θ may be calculated.

Using the cosine rule in triangle S-G1-I, gives

$$t_5^2 = t_1^2 + t_3^2 - 2\,t_1\,t_3\cos\theta$$

Hence t_5 may be calculated.

Using the sine rule in triangle S-G1-I gives

$$\frac{t_3}{\sin\alpha} = \frac{t_5}{\sin\theta}$$

Therefore the angle of dip is

$$\alpha = \sin^{-1}\left(\frac{t_3 \sin\theta}{t_5}\right)$$

Method of calculation

To calculate the dip of any primary reflection observed on VSP data times t_1, t_2, t_3 and t_4 are required. These values can be obtained from a combination of the computation sheet (supplied with the Log Calibration report if available, or alternatively with the VSP report) and deconvolved upgoing wavefield display.

Given a dipping primary reflection observed on the deconvolved upgoing wavefield, choose a pair of geophone traces to be used in the dip calculation.

It is advisable that the estimate be made as close to the time-depth curve as possible as the Δt due to dip is at its greatest for any given geophone spacing when the geophone is closest to the reflector in question.

t_1: the one-way first arrival time at the deeper of the chosen geophone positions can be obtained from the computation sheet (corrected time, t_c, at relevant depth). Alternatively, if the computation sheet is not available, the equivalent two-way time can be measured from the deconvolved upgoing wavefield display (time at time-depth curve on relevant trace) and halved; this method is, of course, less accurate.

t_2: the one-way first arrival time at the shallower of the chosen geophone positions.

t_3: the time of the arrival of the reflection from the dipping horizon in question at the deeper of the chosen geophone positions. This can be obtained from the deconvolved upgoing wavefield by measuring the two-way time to the reflection being examined, on the relevant trace, and subtracting the one-way first arrival time at the same geophone (i.e. t_1).

Similarly,

t_4: can be obtained from the deconvolved upgoing wavefield by the same process as t_3, but using the shallower geophone trace.

By substituting the values for these variables in the equations above, the angle of dip α, can be calculated. It is suggested that dip be calculated for a number of geophone pairs to provide an indication of the scatter on the dip estimate.

If the beds are not plane-dipping, then shorter segments of the reflector have to be used to determine the dip at any point, with an increased likelihood of error. Alternatively, the Δt can be smoothed by hand to give an "average" dip estimate. Note that the azimuth of dip cannot be calculated from this data.

Calculation of the offset of the termination of dipping reflectors

If the dipping reflection terminates within the data, it is possible to calculate the offset of the termination, hence inferring the offset of a possible fault or "turn over" of the bed. As before, the calculation provides a reasonably accurate assessment of the size of the offset but no indication as to the azimuth. The assumptions made are the same as for the calculation of the angle of dip, and hence the same limitations will apply. If one considers figure 2, it can be quite easily (if tediously) shown that

$$RP = \frac{(x-g)\,x\,\sin(2\alpha)}{(2x-g)\,\cos\alpha}$$

Where: RP is the distance along the dipping horizon to the termination of the event

r is the depth of the geophone where the dipping horizon cuts the well

g is the depth of the shallowest geophone for which the reflector has an expression

α is the angle of dip

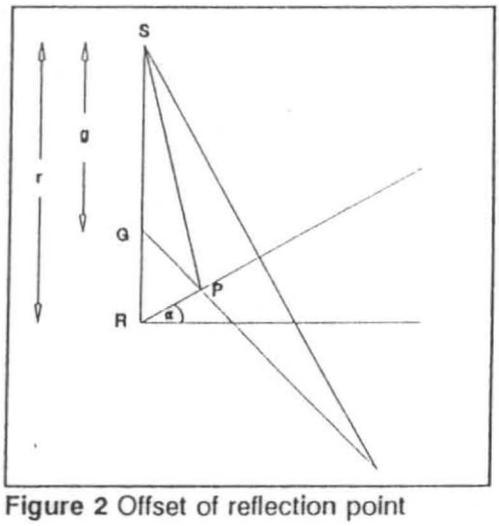


Figure 2 Offset of reflection point

Calculation of the offset of diffraction points from the well

Figure 3 shows a normal fault close to a vertical borehole with diffraction points associated with the upper and lower discontinuities of the inclined bed. The diffraction points will scatter energy in both the S- and P-wave modes and these events may be detected by the array of geophone stations. The right hand panel of this figure, illustrates the ray propagation paths for either of the wave modes assuming a constant velocity profile. Figure 4 illustrates the alignment of both P- and S-wave diffractions within the data. P-wave arrivals form event hyperbolae that are asymptotic to the first arrival curve in one direction and P-wave horizontal reflections in the other. S-wave diffractions display a sharper curvature and in fact are asymptotic to the equivalent S-wavefields.

It should be obvious from figures 3 and 4, that the shortest travel path for the energy is that of direct p-wave propagation to the diffracting point followed by horizontal travel back from here to the geophone array. This means that the geophone that records the shortest time of the diffraction is positioned at the same depth as the diffracting point; the depth of the discontinuity can therefore be inferred by observing the apex of the hyperbola. The offset of discontinuity can be calculated quite simply by considering the diagram shown at the bottom of figure 4.

If t_g is the one-way first arrival time to the geophone level at the depth of the apex of the diffraction hyperbola.

T is the travel time from source to diffraction point to geophone, i.e. the shortest travel time on the VSP display to the apex of the diffraction hyperbola.

t_o is the horizontal travel time from the diffraction point to the geophone (unknown).

v_a is the average velocity of the section between the source and the geophone.

v_i is the interval velocity (either P- or S-wave) between the diffraction point and the well.

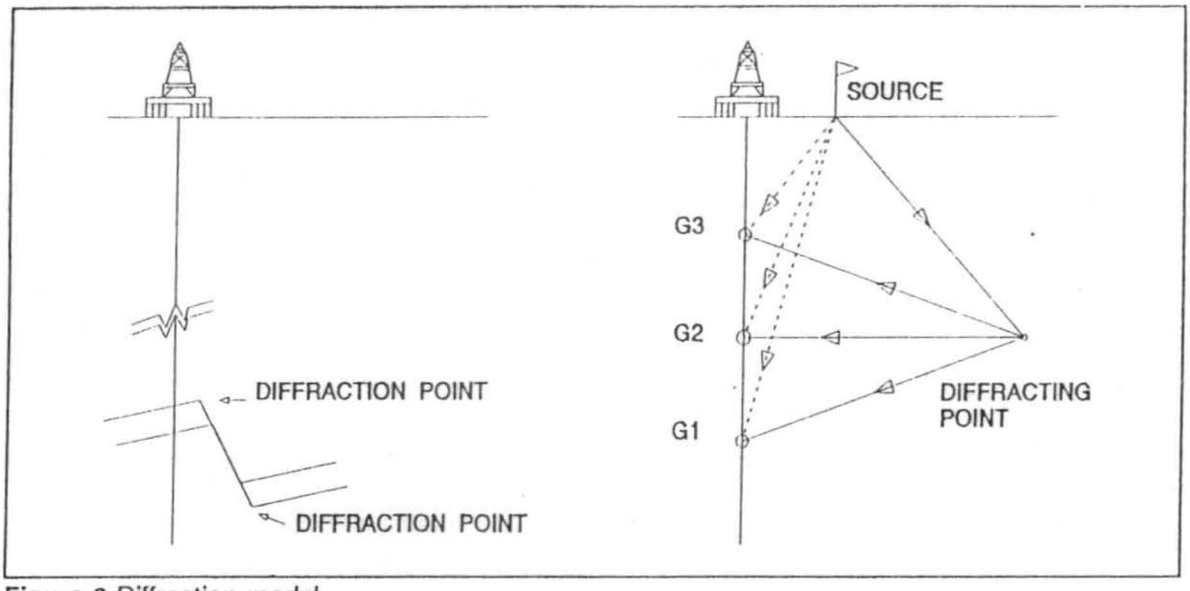


Figure 3 Diffraction model

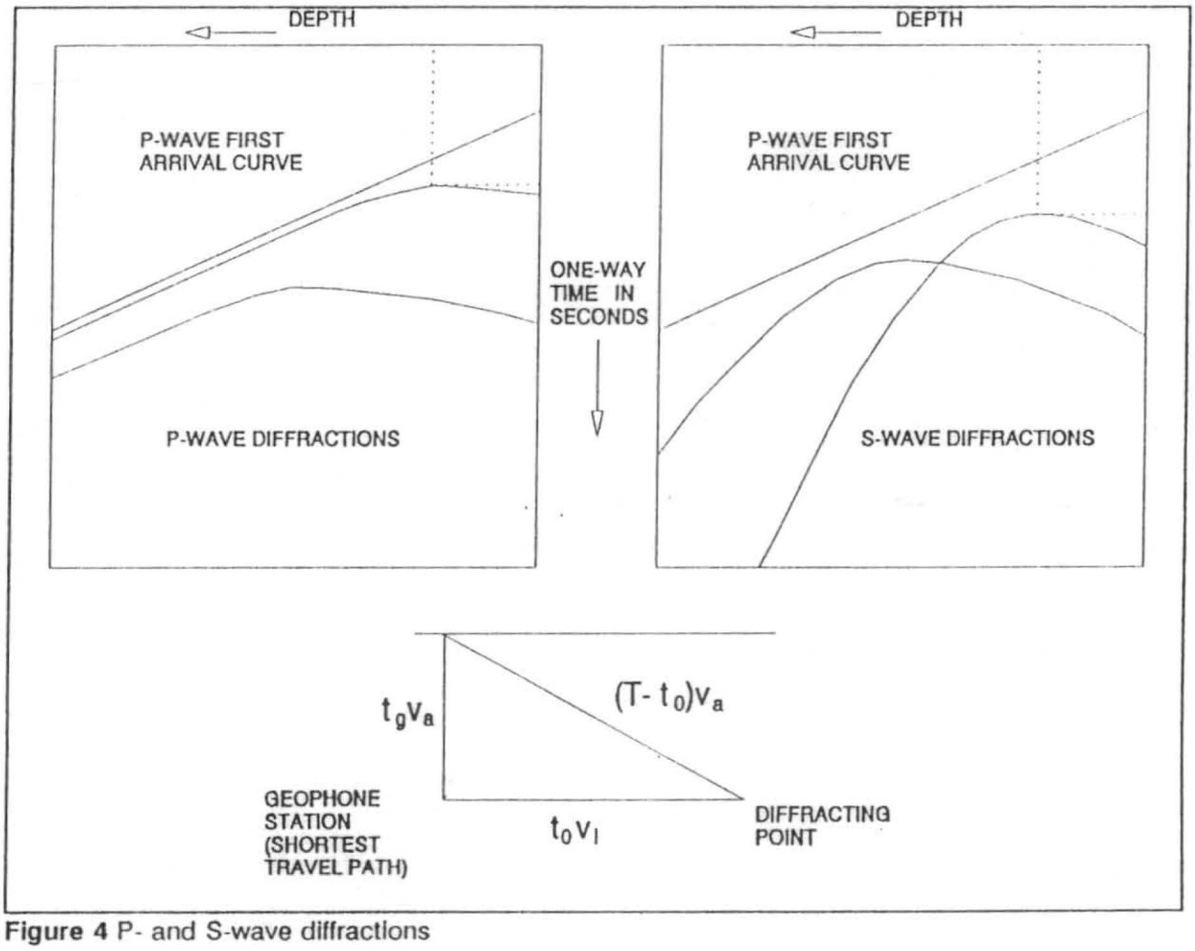


Figure 4 P- and S-wave diffractions

5 cm

then by using pythagoras it can be inferred that

$$(t_g v_a)^2 + (t_0 v_i)^2 = (T - t_0)^2 v_a^2$$

This is a quadratic equation in t_o, the unknown travel time element from the diffraction point, of the form

$$a(t_0)^2 + b t_0 + c = 0$$

whose coefficients are

$$a = \left(\frac{v_i^2}{v_a^2}\right) - 1$$

$$b = 2T$$

$$c = (t_g^2 - T^2)$$

The equation can be solved for t_o and the offset distance calculated ($t_o v_i$).

291284

RESIDUAL WAVEFIELD

VI

291285

OR-0298

WELL : FLINDERS-1

LOCATION : 40° 22' 51.810" N
145 40 18.690 E

COMPANY : SAGASCO RESOURCES LTD.

RIG SURVEY
VERTICAL SEISMIC PROFILE

DISPLAY VI
RESIDUAL WAVEFIELD

POLARITY	: SEG NORMAL
TIME SCALE	: 3.75 INC/SEC
DEPTH SCALE	: 1 : 19,700 (VSP)

FIELD ACQUISITION

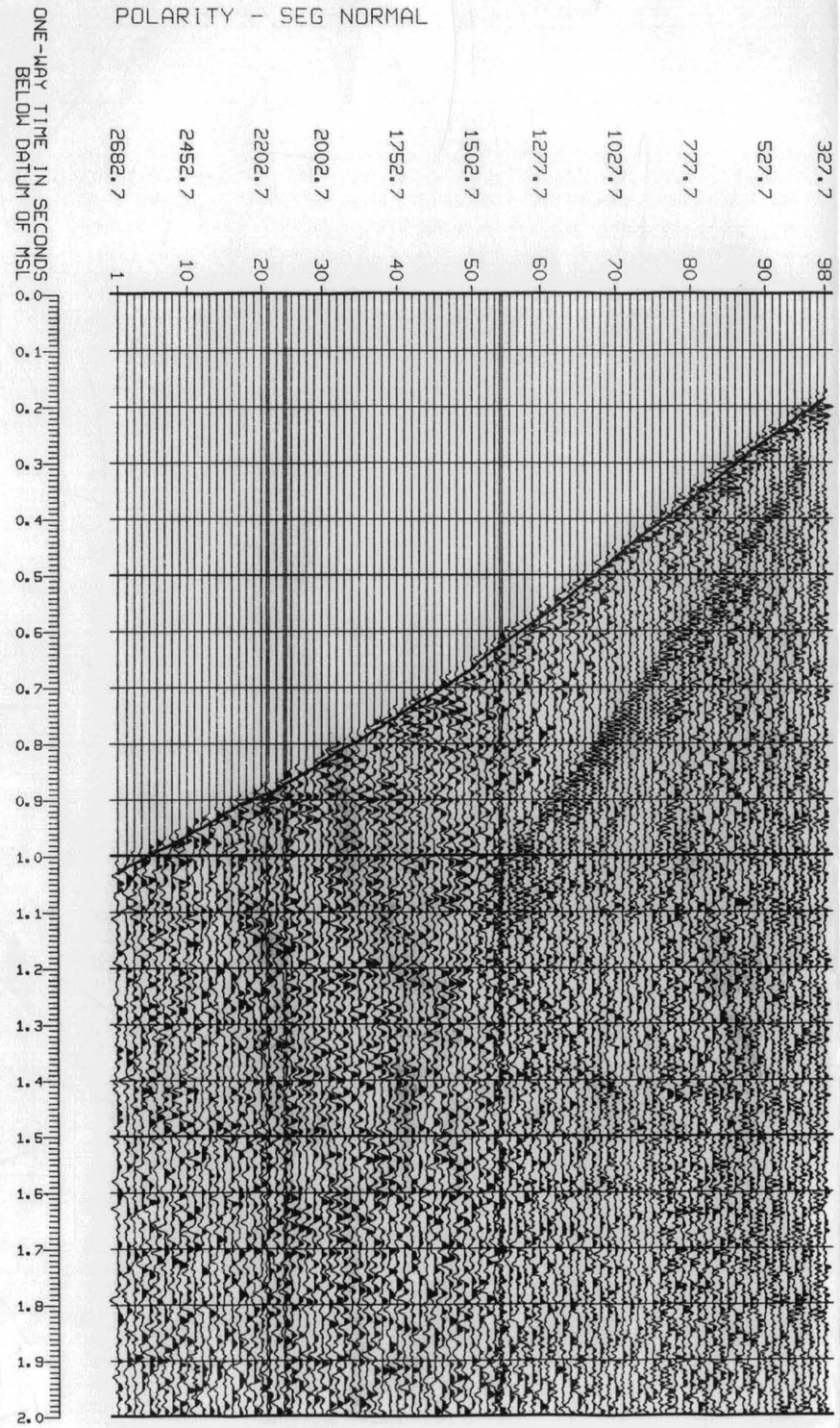
SURVEY DATE	: 18TH DECEMBER 1992
SOURCE	: "BOLT" AIRGUN 140 CU INCH
SOURCE DEPTH	: 5.0M BELOW MSL
SOURCE OFFSET	: 47.0M
SOURCE DIRECTION	: 340 DEG. NORTH
SOURCE MONITOR	: NEAR FIELD HYDROPHONE
MONITOR DEPTH	: 3.5M BELOW MSL
SAMPLE RATE	: 1 MS
VSP DATUM	: MSL
WATER DEPTH	: 69.25M BELOW MSL
REFERENCE LEVEL	: DF AT 22.3M ABOVE MSL

VERTICAL COMPONENT VSP PROCESSING SEQUENCE

DATA PROCESSED JANUARY 1993
EDIT
AUTOMATED TRACE ALIGNMENT
STACK OF CONSTANT DEPTH TRACES
SOURCE SIGNATURE DECONVOLUTION (360 MS WINDOW)
AMPLITUDE RECOVERY PROPORTIONAL TO T
SPECTRAL SMOOTHING
PRELIMINARY BANDPASS FILTER 3,6-100,150 HZ
DOWNGOING WAVE SUBTRACTION
UPGOING WAVE SUBTRACTION
POST BANDPASS FILTER 1,3-110,160 HZ
FIRST ARRIVALS SHIFTED TO ONE-WAY TIME SUB DATUM
TRACE EQUALISATION (250 MS WINDOW)

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



511020VM : VI . -

291286

DOWNGOING WAVEFIELD

VB2

OR-0298 (1)

291287

WELL : FLINDERS-1

LOCATION : 40° 22′ 51.810″ N
145° 40′ 18.690″ E

COMPANY : SAGASCO RESOURCES LTD.

RIG SURVEY
VERTICAL SEISMIC PROFILE

DISPLAY VB2
DOWNGOING WAVEFIELD
SEISMIC MATCH FILTER

POLARITY	: SEG NORMAL AND REVERSE
TIME SCALE	: 3.75 INC/SEC
DEPTH SCALE	: 1 : 19,700 (VSP)

FIELD ACQUISITION

SURVEY DATE	: 18TH DECEMBER 1992
SOURCE	: "BOLT" AIRGUN 140 CU INCH
SOURCE DEPTH	: 5.0M BELOW MSL
SOURCE OFFSET	: 47.0M
SOURCE DIRECTION	: 340 DEG. NORTH
SOURCE MONITOR	: NEAR FIELD HYDROPHONE
MONITOR DEPTH	: 3.5M BELOW MSL
SAMPLE RATE	: 1 MS
VSP DATUM	: MSL
WATER DEPTH	: 69.25M BELOW MSL
REFERENCE LEVEL	: DF AT 22.3M ABOVE MSL

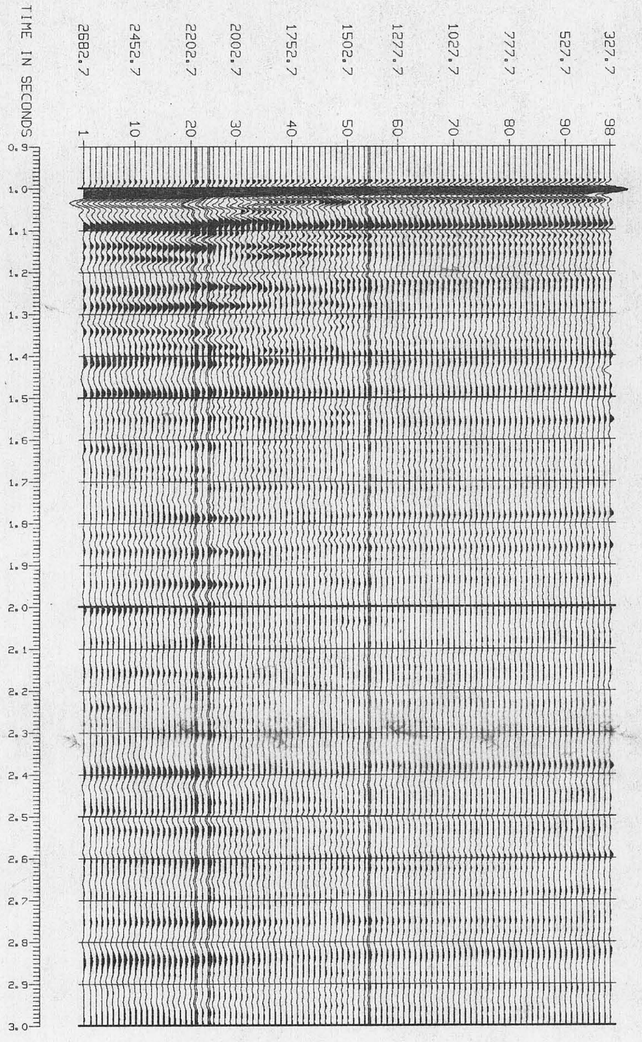
VERTICAL COMPONENT VSP PROCESSING SEQUENCE

DATA PROCESSED JANUARY 1993
EDIT
AUTOMATED TRACE ALIGNMENT
STACK OF CONSTANT DEPTH TRACES
SOURCE SIGNATURE DECONVOLUTION (360 MS WINDOW)
AMPLITUDE RECOVERY PROPORTIONAL TO T
SPECTRAL SMOOTHING
PRELIMINARY BANDPASS FILTER 3,6-100,150 HZ
FIRST ARRIVALS SHIFTED TO ALIGN AT 1S
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0 MS/TRACE DIP)
SEISMIC MATCH FILTER 3,6-40,50 HZ

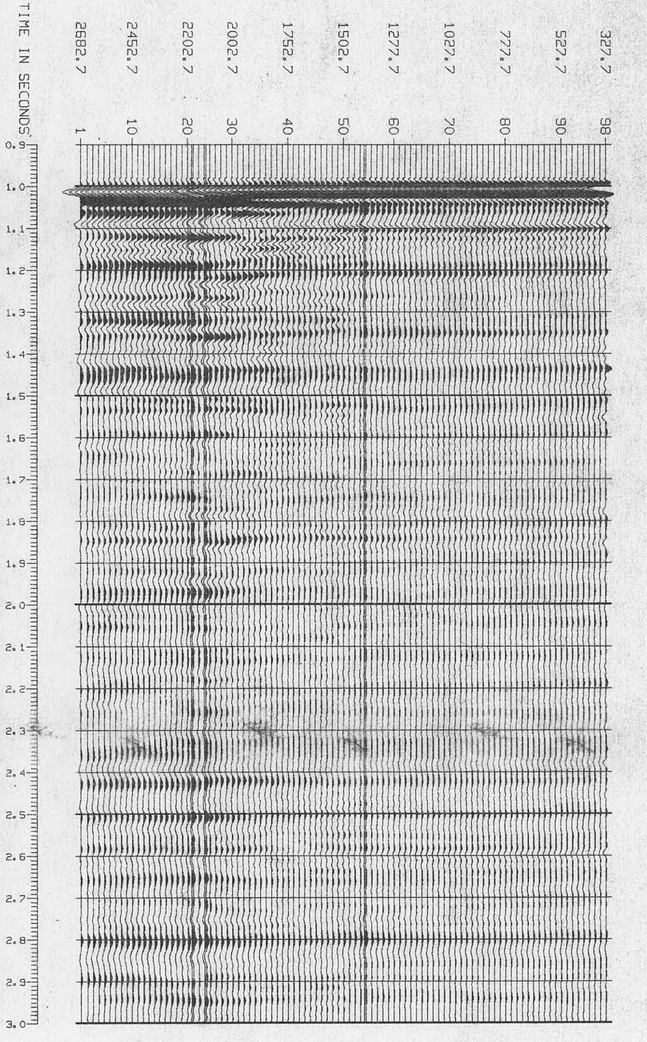
SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm

POLARITY - SEG NORMAL



POLARITY - SEG REVERSE



291288

INTERPRETERS COMPOSITE DISPLAY (OPTIMUM FREQUENCY FILTER)

VG1

5 cm

OR-0098 (1)

291289

Seismograph Service

DISPLAY VG1

BOREHOLE GEOPHYSICS DIVISION

RIG SOURCE SURVEY
VERTICAL SEISMIC PROFILE

WELL	:	FLINDERS-1
COMPANY	:	SAGASCO RESOURCES LTD
LOCATION	:	40° 22′ 51.810″ N 145° 40′ 18.690″ E

INTERPRETERS COMPOSITE
ZERO PHASE MAXIMUM BANDWIDTH FILTER

POLARITY	:	SEG NORMAL
TIME SCALE	:	3.75 IN/SEC
DEPTH SCALE	:	1:12500 (VSP)

VSP PROCESSING PARAMETERS

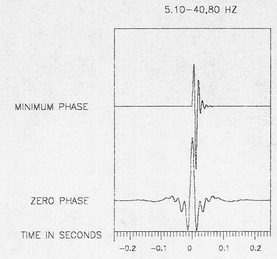
BANDPASS FILTER 3,6-100,150 HZ
DOWNWAVE SUBTRACTION
DETERMINISTIC DECONVOLUTION (100p MS WINDOW)
MAXIMUM BANDWIDTH FILTER 5,10-40,60 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0 MS/TRACE DIP)
DATA TRANSPOSED WHERE APPLICABLE
POST MEDIAN FILTER 3,6-50,70 HZ

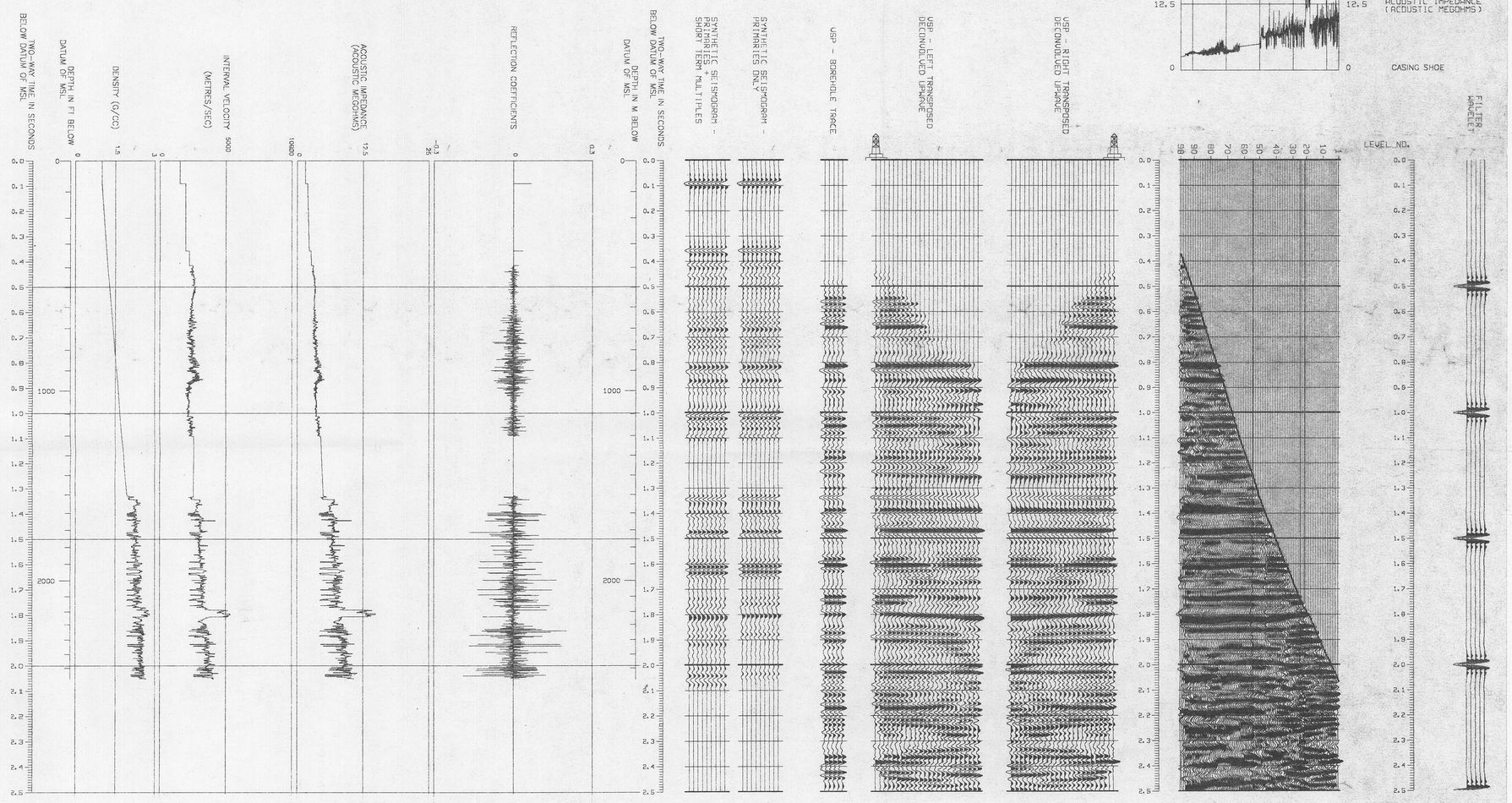
BOREHOLE TRACE:
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0 MS/TRACE DIP)
APPLIED TO TRANSPOSED DATA, THEN FIVE TRACE REPEAT OF TRACE 5.
TRACE EQUALISATION APPLIED TO ALL PANELS

SYNTHETIC SEISMOGRAM PROCESSING PARAMETERS

SYNTHETIC SEISMOGRAM DERIVED FROM THE ACOUSTIC IMPEDANCE LOG.
DETAILS OF THE VELOCITY MODEL USED BETWEEN SEA BED AND THE TOP OF THE RECORDED LOG MAY BE OBTAINED FROM THE SYNTHETIC SEISMOGRAM REPORT.
MAXIMUM BANDWIDTH FILTER (AS ABOVE).
TRACE EQUALISATION

REMARKS





5 cm

291290

OR-0098 (3)

Seismograph Service

DISPLAY VG1

BOREHOLE GEOPHYSICS DIVISION

RIG SOURCE SURVEY
VERTICAL SEISMIC PROFILE

WELL : FLINDERS-1
COMPANY : SAGASCO RESOURCES LTD
LOCATION : 40° 22′ 51.810″ N
145 40 18.690 E

INTERPRETERS COMPOSITE
ZERO PHASE MAXIMUM BANDWIDTH FILTER

POLARITY : SEG REVERSE
TIME SCALE : 3.75 IN/SEC
DEPTH SCALE : 1:12500 (VSP)

VSP PROCESSING PARAMETERS

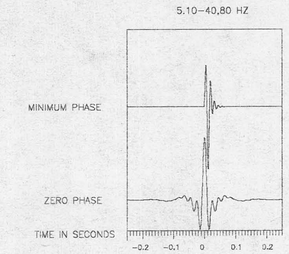
BANDPASS FILTER 3,6-100,150 HZ
DOWNWAVE SUBTRACTION
DETERMINISTIC DECONVOLUTION (1000 MS WINDOW)
MAXIMUM BANDWIDTH FILTER 5,10-40,60 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0 MS/TRACE DIP)
DATA TRANSPOSED WHERE APPLICABLE
POST MEDIAN FILTER 3,6-50,70 HZ

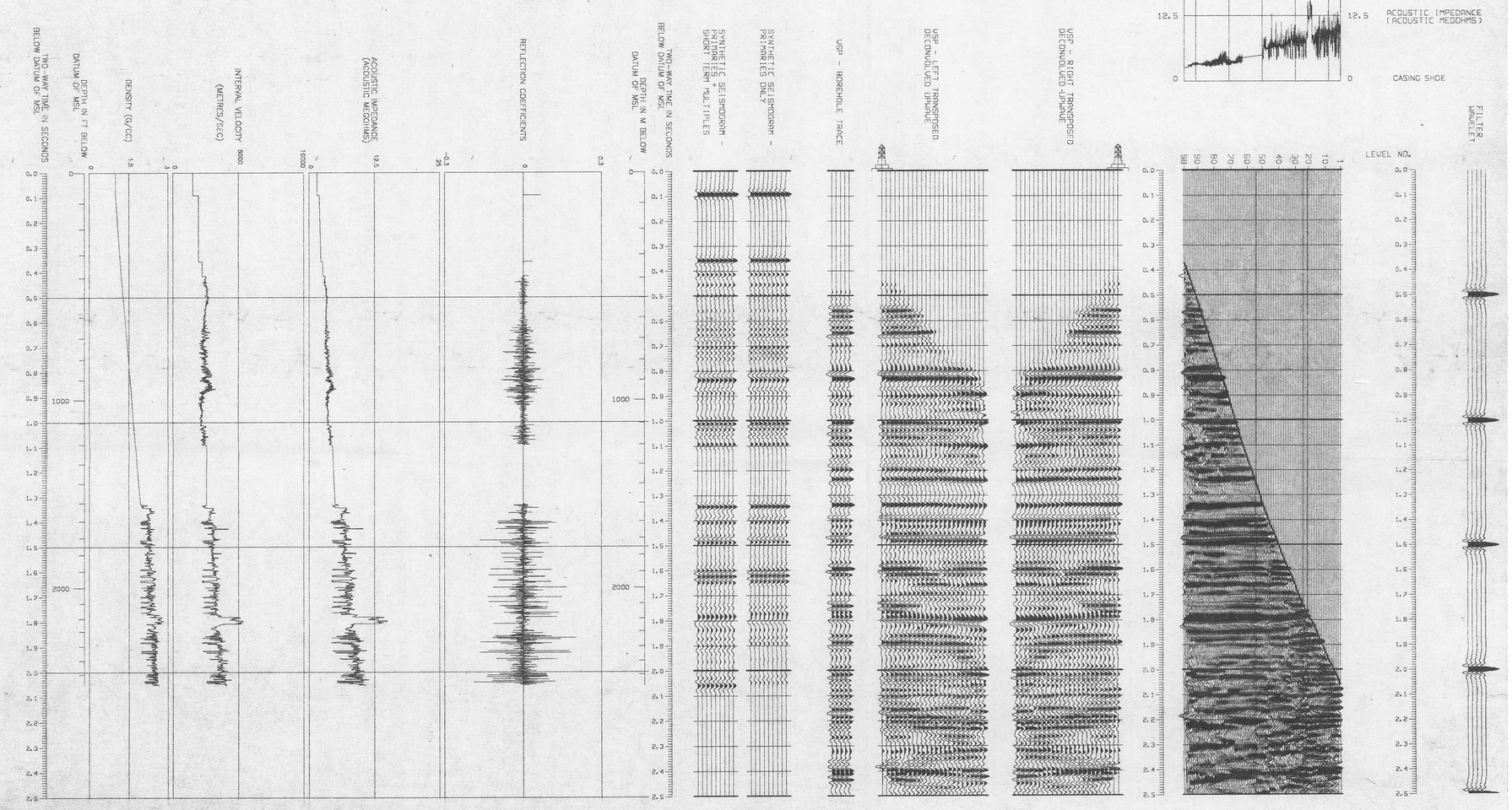
BOREHOLE TRACE:
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0 MS/TRACE DIP)
APPLIED TO TRANSPOSED DATA, THEN FIVE TRACE REPEAT OF TRACE 5.
TRACE EQUALISATION APPLIED TO ALL PANELS

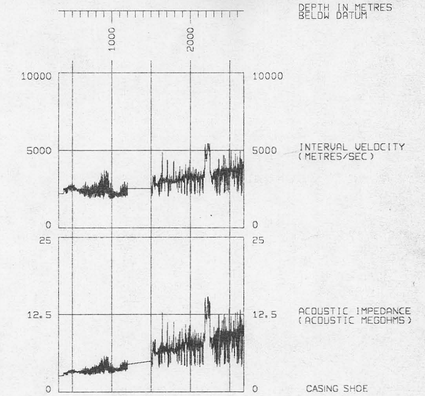
SYNTHETIC SEISMOGRAM PROCESSING PARAMETERS

SYNTHETIC SEISMOGRAM DERIVED FROM THE ACOUSTIC IMPEDANCE LOG.
DETAILS OF THE VELOCITY MODEL USED BETWEEN SEA BED AND THE TOP OF THE RECORDED LOG MAY BE OBTAINED FROM THE SYNTHETIC SEISMOGRAM REPORT.
MAXIMUM BANDWIDTH FILTER (AS ABOVE).
TRACE EQUALISATION

REMARKS







291291

TRACE INVERSION COMPOSITE

VJ

OR-0098 (2)

291292

WELL : FLINDERS-1

LOCATION : 40° 22′ 51.81″ N
145° 40′ 18.69″ E

COMPANY : SAGASCO RESOURCES LTD.

RIG SURVEY
VSP TRACE INVERSION

DISPLAY VJ
TRACE INVERSION COMPOSITE
OPTIMUM FREQUENCY FILTER

POLARITY : SEG NORMAL
TIME SCALE : 3.75 IN/S

VSP PROCESSING PARAMETERS

BANDPASS FILTER 3,6-100,150 HZ
DOWNWAVE SUBTRACTION
DETERMINISTIC DECONVOLUTION (1000 MS WINDOW)
MAXIMUM BANDWIDTH FILTER 5,10-40,60 HZ
DIP FILTER (9 SAMPLE MEDIAN OPERATOR, 0 MS/TRACE DIP)
DATA TRANSPOSED WHERE APPLICABLE
POST MEDIAN FILTER 3,6-50,70 HZ
TRACE EQUALISATION APPLIED

TRACE INVERSION

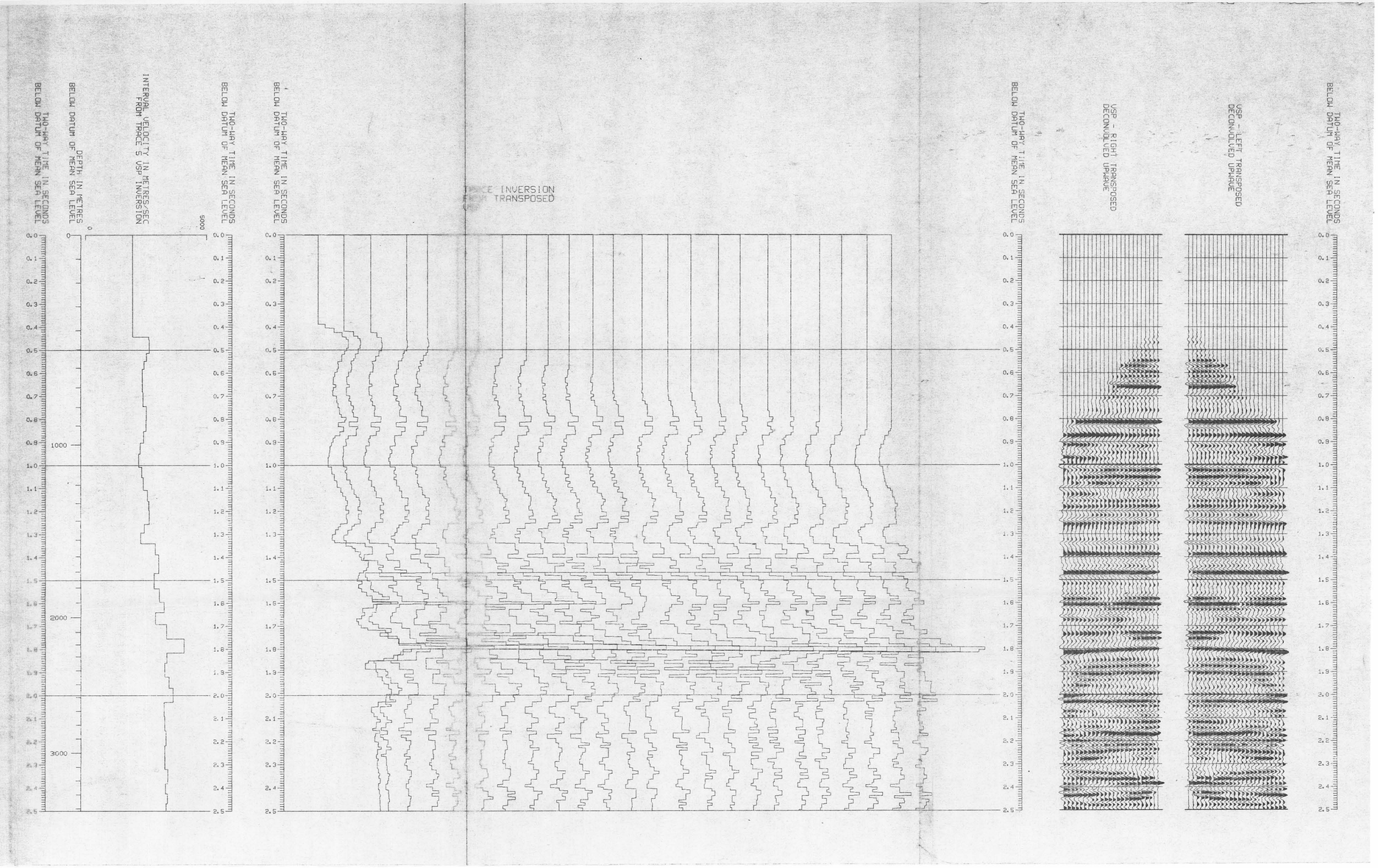
STRUCTURAL CONVOLUTION
RECOVERY OF LOW FREQUENCIES
COMBINATION OF HIGH AND LOW FREQUENCIES

INTERVAL VELOCITY CURVE

INTERVAL VELOCITIES DERIVED FROM VSP TRACE INVERSION
(TRACE 5 OF INVERSION USED)

SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

5 cm



4 GEOCHEMICAL DATA

291294

SOURCE ROCK CHARACTERISATION STUDY

FLINDERS-1

Prepared for:

Sagasco Resources Ltd

March 1993

GEOTECH GEOTECHNICAL SERVICES PTY LTD
125 Burswood Road, Victoria Park, Western Australia 6100

Telephone (09) 362 5222
Facsimile (09) 362 5908

SOURCE ROCK CHARACTERISATION STUDY

FLINDERS-1

Twenty-seven cuttings samples from the well Flinders-1, drilled by Sagasco Resources Ltd in permit T-25P in the Bass Basin, were analysed geochemically in order to assess source potential and maturity level of the interval between 1624m and 2688.5m.

All samples were air dried, pulped and analysed for total organic carbon. Those sediments with TOC values in excess of 0.5% were further submitted for Rock-Eval pyrolysis.

With the exception of samples at 2155m and 2547m, V_R measurements were performed on all sediments and their maceral distributions were determined.

Results obtained are presented in the following figures and tables:

Type of Analysis	Figure	Table
TOC/Rock-Eval pyrolysis	1,2	1
V_R/maceral description	3	2

Analytical procedures applied are presented in the Theory and Methods Chapter in the back of this report.

General Information

Two copies of this report have been sent to Neil Tupper from Sagasco Resources Ltd. Any queries related to it may be directed to Dr. Birgitta Hartung-Kagi of Geotechnical Services Pty Ltd.

All data and information are proprietary to Sagasco Resources Ltd and regarded as highly confidential by all Geotech personnel.

Geotechnical Services Pty Ltd shall not be responsible or liable for the results of any actions taken on the basis of the information contained in this study, nor for any errors or omissions in it.

291297

TABLE 1

ROCK-EVAL PYROLYSIS DATA (one run)

FLINDERS 1 Feb-93

DEPTH (m)	TMAX	S1	S2	S3	S1 + S2	S2/S3	PI	PC	TOC	HI	OI
1624.0	452	1.57	6.75	0.66	8.32	10.23	0.19	0.69	10.90	62	6
1651.0	434	0.14	0.38	0.39	0.52	0.97	0.27	0.04	1.20	32	33
1739.0	548	0.51	1.23	0.44	1.74	2.80	0.29	0.14	15.80	8	3
1911.5	549	1.93	5.27	0.98	7.20	5.38	0.27	0.60	58.90	9	2
1981.0	520	1.38	3.84	1.10	5.22	3.49	0.26	0.43	9.50	40	12
2081.0	530	0.52	1.10	0.52	1.62	2.12	0.32	0.13	2.60	42	20
2125.0	479	0.65	1.12	0.88	1.77	1.27	0.37	0.15	2.10	53	42
2143.0	539	1.07	2.29	1.01	3.36	2.27	0.32	0.28	8.20	28	12
2155.0	493	0.48	0.89	1.40	1.37	0.64	0.35	0.11	2.60	34	54
2178.0	411	0.57	0.54	0.37	1.11	1.46	0.51	0.09	11.00	5	3
2304.5	485	0.71	1.14	0.36	1.85	3.17	0.38	0.15	2.35	49	15
2344.0	457	3.80	6.03	1.72	9.83	3.51	0.39	0.82	6.60	91	26
2363.0	449	2.06	5.04	5.17	7.10	0.97	0.29	0.59	5.10	99	101
2397.5	434	1.58	11.22	1.58	12.80	7.10	0.12	1.06	6.00	187	26
2417.0	440	1.12	6.19	2.34	7.31	2.65	0.15	0.61	3.95	157	59
2456.0	439	0.35	2.07	1.54	2.42	1.34	0.14	0.20	1.40	148	110
2461.0	433	1.16	11.57	1.67	12.73	6.93	0.09	1.06	5.55	208	30
2504.0	436	4.95	62.27	1.68	67.22	37.07	0.07	5.58	24.90	250	7
2511.0	436	0.61	4.46	1.35	5.07	3.30	0.12	0.42	2.50	178	54
2547.0	440	0.44	1.61	2.38	2.05	0.68	0.21	0.17	2.10	77	113
2553.0	441	0.31	1.16	1.63	1.47	0.71	0.21	0.12	1.45	80	112
2599.0	434	0.37	3.77	1.30	4.14	2.90	0.09	0.34	2.55	148	51
2607.0	437	0.31	2.73	2.22	3.04	1.23	0.10	0.25	2.05	133	108
2672.5	436	1.33	6.63	3.73	7.96	1.78	0.17	0.66	4.05	164	92
2675.5	436	1.15	6.46	2.89	7.61	2.24	0.15	0.63	4.05	160	71
2681.5	439	4.80	39.02	2.13	43.82	18.32	0.11	3.64	17.00	230	13
2688.5	442	0.14	0.90	1.97	1.04	0.46	0.13	0.09	0.74	122	266

TMAX = Max. temperature S2 S1 = Volatile hydrocarbons (HC) S2 = HC generating potential
S1 + S2 = Potential yield S3 = Organic carbon dioxide PI = Production index
PC = Pyrolysable carbon TOC = Total organic carbon HI = Hydrogen index

291298

GEOTECH–LOG

WELL FLINDERS–1

FIGURE–1

FILE No LRD1908A
DATE MARCH 1993

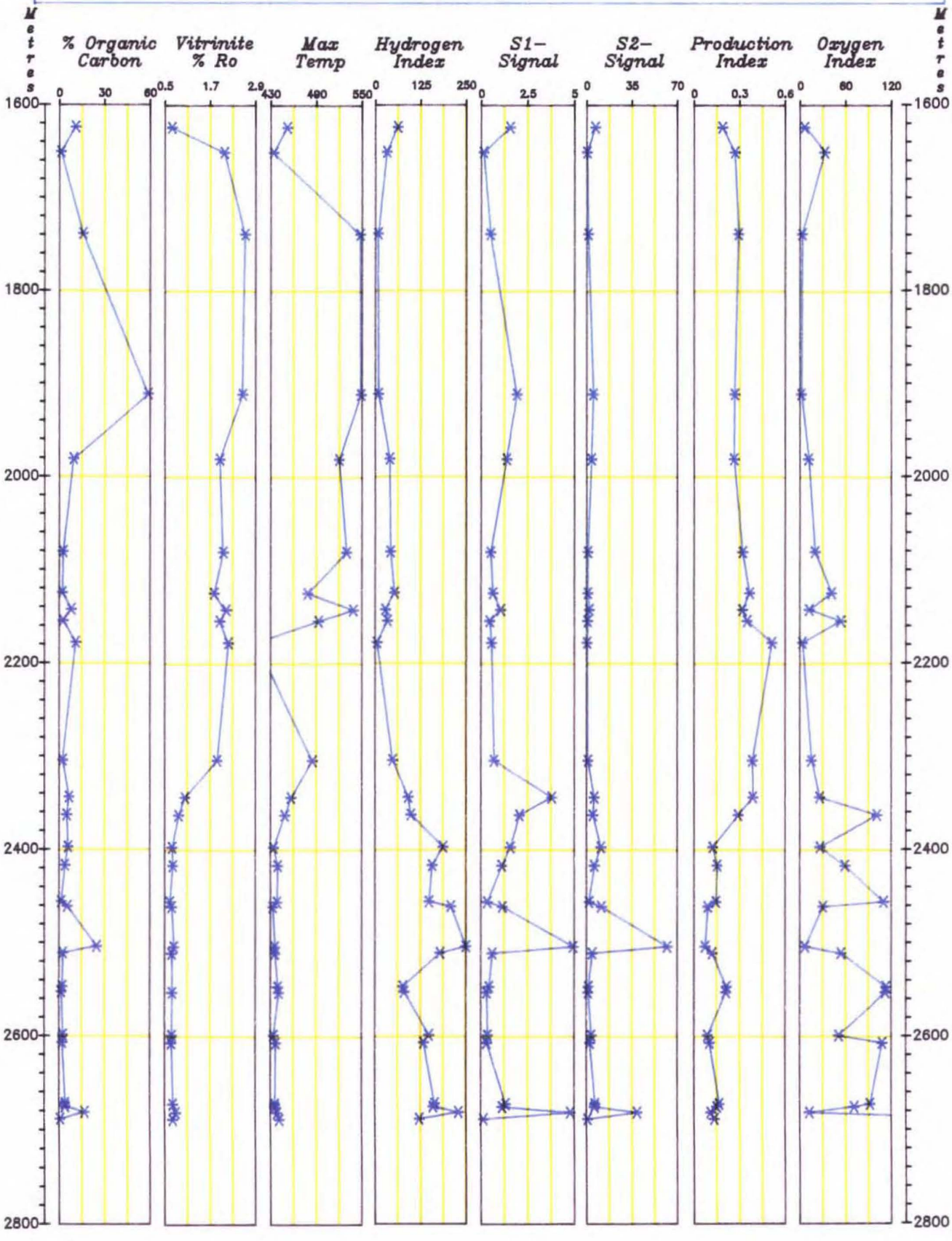
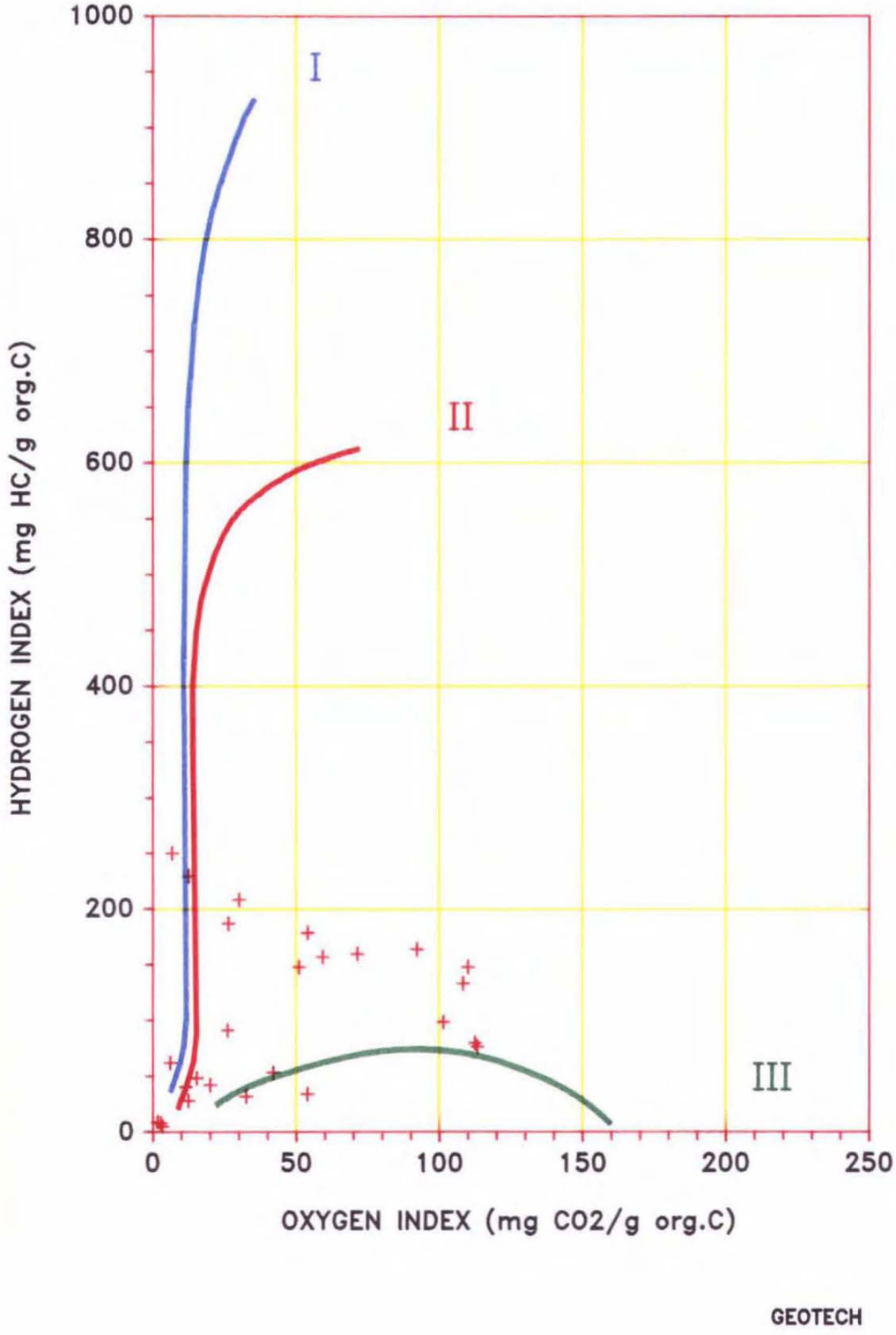


FIGURE 2

FLINDERS-1



5 cm

GEOTECH GEOTECHNICAL SERVICES PTY LTD
125 Burswood Road, Victoria Park, Western Australia 6100

291300

Telephone (09) 362 5222
Facsimile (09) 362 5908

Flinders-1

Vitrinte Reflectance / Maceral Descriptions

The Flinders sequence is altered from contact metamorphism. An attempt was made to distinguish the population from the horizon nominated from cavings and these distinctions are shown in the written descriptions. Some intervals may have more than one population present within the nominated interval because the zones affected by contact alteration can be relatively thin. The intrusions occurred after most compaction had occurred but before the coals had achieved a rank of about vitrinite reflectance of 0.5%. Coke structures are present but are only weakly developed. The deepest samples are probably representative of the level of regional metamorphism at that depth. The data are of good quality but the extensive nature of altered coals means that they are also complex. Three populations are distinguished. "I" refers to coals at, or close to, the regional level of coalification. "II" refers to the less altered contact metamorphosed population. "III" refers to the most severely altered population.

JOB NO, 1908, FLINDERS-1

Sample No(s)	Depth(m)/ Sample	type	$\bar{R}_v$ max (%)	Range (%)	N	Description Including Liptinite Fluorescence Characteristics
v7398	1624 Ctgs	I	0.69	0.50-1.08	33	Fluorescing liptinite absent. (Siltstone>sandstone>carbonate> coal. Coal abundant, V>>I. Vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite -<0.1%, liptinite - absent. Dom abundant, V>>I. vitrinite abundant, inertinite rare, liptinite absent. Two vitrinite populations present, either may represent cavings. The higher reflectance population is the result of contact alteration but no igneous rocks were seen in this sample. Mineral fluorescence pervasive, weak green. Iron oxides abundant. Pyrite common.)
		II	1.50	1.23-1.76	36	
v7399	1651 Ctgs	I	0.68	0.61-0.75	2	Fluorescing liptinite absent. (Sandstone>>coal. Coal common, V only. Vitrite. Dom rare, V>I. Vitrinite and inertinite rare, liptinite absent. Two vitrinite populations present, either may represent cavings. The higher reflectance population is the result of contact alteration but no igneous rocks were seen in this sample. The absence of the lower reflectance populations from the next sample suggests that the lower population may be cavings. Mineral fluorescence pervasive, faint green. Iron oxides rare. Pyrite rare.)
		II	2.08	1.69-2.41	8	
v7400	1739 Ctgs	II	2.63	2.43-2.86	29	Rare sporinite, non fluorescence. (Sandstone>coal> claystone. Coal abundant, vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - tr., liptinite - tr.%. Dom rare, V>I. Vitrinite and inertinite rare, liptinite absent. Mineral fluorescence pervasive, faint green to weak orange. Iron oxides sparse. Pyrite abundant.)
v7401	1911.5 Ctgs	II	2.56	2.31-2.82	27	Rare resinite and sporinite, non fluorescing. (Sandstone>coal> siltstone>carbonate. Coal major, vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - tr., liptinite - tr.%. Dom sparse, V>>I. vitrinite sparse, inertinite rare, liptinite absent. Mineral fluorescence pervasive, green to weak orange. Iron oxides rare. Pyrite sparse.)
v7402	1981 Ctgs	I	0.56	0.46-0.70	7	Rare sporinite orange to non fluorescing. (Siltstone>sandstone> coal>shaly coal>carbonate. Coal abundant, vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - tr., liptinite - tr%. Shaly coal common, vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - tr., liptinite - tr. Dom abundant, V>>I>L. Vitrinite abundant, inertinite sparse, liptinite rare. Two vitrinite populations present, either may represent cavings. Mineral fluorescence pervasive, faint green to weak orange. Iron oxides sparse. Pyrite common.)
		II	1.96	1.70-2.42	30	

JOB NO, 1908, FLINDERS-1

Sample No(s)	Depth(m)/ Sample type	$\bar{R}_v$ max (%)	Range (%)	N	Description Including Liptinite Fluorescence Characteristics
v7403	2081 Ctgs	2.05	1.80-2.14	27	Fluorescing liptinite absent. (Sandstone>carbonate>altered igneous rock fragments>siltstone>coal=shaly coal. Coal common, vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - tr., liptinite - 0.0%. Shaly coal common, vitrite only. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - tr., liptinite - tr. Dom abundant, V>>I. Vitrinite abundant, inertinite sparse, liptinite absent. Mineral fluorescence pervasive, faint green to weak orange. Iron oxides sparse. Glauconite sparse. Pyrite common.)
v7442	2125 I Ctgs II * probably cavings	*1.02 1.81	0.68-1.35 1.64-2.09	12 28	Fluorescing liptinite absent. (Sandstone>siltstone>carbonate> coal. Coal abundant, V>>I. Vitrite. Mineral-free maceral group composition of the coal: vitrinite - 100%, inertinite - <0.1%, liptinite - absent. Dom sparse, V>I. Vitrinite sparse, inertinite rare, liptinite absent. Mineral fluorescence pervasive, faint green to dull orange. Iron oxides common. Pyrite rare.)
v7404	2143 Ctgs	2.13	1.76-2.33	30	Fluorescing liptinite absent. (Siltstone>sandstone>coal>shaly coal. Coal common, V>>I. Vitrite. Shaly coal sparse, V>>I. Vitrite. Dom common, V>>I. Vitrinite common, inertinite rare. Mineral fluorescence pervasive, faint green to dull orange. Iron oxides abundant. Pyrite sparse.)
v7443	2155 I Ctgs II * probably cavings	*0.61 1.96	0.42-0.78 1.62-2.58	8 31	Fluorescing liptinite absent. (Siltstone>claystone>carbonate> coal. Coal sparse, V>>I. Vitrite. Dom common, V>I. Vitrinite common, inertinite rare, liptinite absent. Mineral fluorescence patchy, orange to dull orange. Iron oxides abundant. Pyrite sparse.)
v7405	2178 II Ctgs III	2.19 4.49	1.85-2.57 3.20-5.70	18 18	Fluorescing liptinite absent. (Sandstone>siltstone>"semi coke"> coal. "Semi coke" abundant, showing some vesicles but mosaic structures weakly developed or absent. Coal sparse, V>>I. Vitrite. Dom common, V>>I. Vitrinite common, inertinite rare. Population III includes some semi-coke and high rank but nearly isotropic vitrinite that has been proximal to an intrusion. Mineral fluorescence pervasive, faint green. Iron oxides abundant. Pyrite sparse.)
v7444	2304.5 Ctgs	1.89	1.65-2.15	28	Fluorescing liptinite absent. (Siltstone>claystone>carbonate> sandstone>coal. Coal sparse, I>V. Inertite>vitrite. Dom abundant, I>>V. Inertinite abundant, vitrinite common, liptinite absent. Mineral fluorescence patchy, yellow to dull orange. Iron oxides sparse. Pyrite abundant.)

JOB NO, 1908, FLINDERS-1

Sample No(s)	Depth(m)/ Sample type	$\bar{R}_v$ max (%)	Range (%)	N	Description Including Liptinite Fluorescence Characteristics
v7406	2344 I Ctgs II III * probably cavings	1.04 2.30* *	0.84-1.24 1.67-2.62 4.17-6.96	27 10 ?	Rare sporinite and cutinite, dull orange to brown. (Calcareous silty sandstone>carbonate>coal>shaly coal. Coal abundant, vitrite>vitrinertite. Mineral-free maceral group composition of the coal: vitrinite - 90%, inertinite - 10%, liptinite - tr. Shaly coal abundant, vitrite>vitrinertite. Mineral-free maceral group composition of the shaly coal: vitrinite - 95%, inertinite - 5%, liptinite - tr. Dom abundant, V>I. Vitrinite and inertinite abundant, liptinite absent. High rank coals and semi-coke rare, R_v max = 4.17% - 6.96%. ?Coal cavings abundant. The population with reflectances in the range 1.67 to 2.62% is the most abundant but that in the range 0.83 to 1.24% generally occurs as larger fragments. For this reason, it is thought to be more likely to be from the nominated horizon. Mineral fluorescence pervasive, faint green to dull orange. Iron oxides common. Pyrite common.)
v7407	2363 I Ctgs II * probably cavings	0.87 1.80*	0.67-1.06 1.30-2.23 3.98-8.45	26 7 5	Sparse sporinite and cutinite, dull orange to brown. (Calcareous silty sandstone>carbonate>coal. Coal abundant, vitrite> vitrinertite>clarite. Mineral-free maceral group composition of the coal: vitrinite - 95%, inertinite - 4%, liptinite - 1%. Coke rare, R_v max = 4.49% - 8.45%. ?Coal cavings abundant. Mineral fluorescence pervasive, faint green to dull orange. Iron oxides common. Pyrite common.)
v7408	2397.5 I Ctgs	0.70	0.60-0.77	28	Sparse sporinite, orange to dull orange, rare cutinite, resinite, liptodetrinite and Botryococcus-related telalginite, orange to dull orange. (Calcareous sandstone>carbonate>igneous rock fragments>calcareous siltstone>coal>shaly coal. Coal abundant, V>>I>L. Vitrite>>vitrinertite>clarite>duroclarite. Mineral-free maceral group composition of the coal: vitrinite - 94%, inertinite - 5%, liptinite - 1%. Shaly coal common, V>>I>L. Vitrite>> clarite. Dom abundant, V>I>>L. Vitrinite abundant, inertinite common, liptinite rare. Mineral fluorescence patchy, yellow to dull orange. Coal cavings rare, R_v ranges from 1.89 to 2.04%. Iron oxides common. Pyrite common.)
v7445	2417 I Ctgs II	0.72 2.03	0.60-0.86	26 1	Sparse cutinite, orange to dull orange, rare resinite, dull orange, rare sporinite and liptodetrinite, yellow to orange. (Siltstone>carbonate>sandstone>coal>igneous rock fragments. Coal common, V>I>L. Vitrite>duroclarite>inertite. Dom abundant, I>V>L. Inertinite and vitrinite common, liptinite sparse. Rare cavings Rv approximately 2.0%. Mineral fluorescence pervasive, faint green to dull orange. Iron oxides abundant. Pyrite common.)
v7409	2456.0 I Ctgs	0.64	0.53-0.81	27	Sparse sporinite, orange to dull orange, rare cutinite, resinite and liptodetrinite, orange to dull orange. (Calcareous sandstone>>carbonate>calcareous siltstone>coal. Coal sparse, V>>I>L. Vitrite>>vitrinertite>clarite>duroclarite. Dom sparse, V>L>I. Vitrinite and liptinite sparse, inertinite rare. Bitumen rare, orange to dull orange. Mineral fluorescence patchy, yellow to dull orange. Coal cavings rare, R_v ranges from 0.90 to 2.53%. Iron oxides abundant. Glauconite rare. Pyrite sparse.)

JOB NO, 1908, FLINDERS-1

Sample No(s)	Depth(m)/ Sample type		$\bar{R}_v$ max (%)	Range (%)	N	Description Including Liptinite Fluorescence Characteristics
v7446	2461 Ctgs	I	0.69	0.54-0.82	27	Sparse sporinite, orange to dull orange, rare cutinite and resinite, yellow to dull orange, rare lamalginite yellow to orange. (Sandstone>siltstone>igneous rock fragments>carbonate>coal>shaly coal. Coal abundant, vitrite>clarite=inertinite. Mineral-free maceral group composition of the coal: vitrinite - 80%, inertinite - 18%, liptinite - 2%. Shaly coal sparse, V>>I>L. Vitrite=clarite. Dom abundant, V>>I>L. Vitrinite abundant, inertinite sparse, liptinite sparse. Bitumen rare, orange. Iron oxides common. Glauconite sparse. Pyrite common.)
v7447	2504 Ctgs	I II	0.75 4.35	0.63-0.85 4.21-4.74	26 4	Common sporinite, cutinite, resinite and liptodetrinite, yellow to dull orange. (Sandstone>siltstone>igneous rock fragments>coal=shaly coal>claystone. Coal abundant, Mineral-free maceral group composition of the coal: vitrinite - 78%, inertinite - 11%, liptinite - 11%. Vitrite>clarite>inertite. Shaly coal abundant, Mineral-free maceral group composition of the shaly coal: vitrinite - 80%, inertinite - 6%, liptinite - 14%. Vitrite>clarite>inertite. Dom abundant, V>L>I. Vitrinite abundant, liptinite common, inertinite sparse. Semi-coke rare, R_{max} = 4.21 - 4.74%. Oil drops rare, green. Mineral fluorescence pervasive, faint green to dull orange. Iron oxides sparse. Pyrite common.)
v7410	2511.0 Ctgs	I	0.69	0.54-0.77	28	Sparse sporinite and liptodetrinite, orange to dull orange, rare cutinite and resinite, orange to dull orange. (Calcareous siltstone>calcareous sandstone>carbonate>>coal. Coal rare, V>>I>L. Vitrite>>clarite. Dom abundant, V>I>L. Vitrinite abundant, inertinite common, liptinite sparse. Bitumen rare, dull orange to brown. Oil drops rare, yellow. Mineral fluorescence pervasive, faint green to dull orange. Coal cavings rare, R_v of about 1.90%. Iron oxides common. Pyrite abundant.)
v7448	2553 Ctgs	I II	0.70 1.92	0.59-0.93 1.74-2.22	25 11	Rare sporinite, cutinite and lamalginite, yellow to dull orange, rare resinite, yellow. (Sandstone>igneous rock fragments>siltstone> carbonate>coal>shaly coal. Coal common, V>>I>L. Vitrite>clarite>duroclarite>inertite. Shaly coal sparse, V>>I=L. Vitrite>clarite>duroclarite. Dom abundant, V>>I>L. Vitrinite abundant, inertinite sparse, liptinite rare. Mineral fluorescence pervasive, moderate green to dull orange. Iron oxides abundant. Pyrite common.)
v7411	2599.0 Ctgs	I	0.69	0.60-0.82	26	Sparse sporinite, orange to dull orange, rare cutinite , resinite and liptodetrinite orange to dull orange. (Sandstone> igneous rock fragments>carbonate>>coal. Coal common, V>>I>L. Vitrite>>clarite. Dom sparse, V>L>I. Vitrinite and liptinite sparse, inertinite rare. Mineral fluorescence patchy, yellow to dull orange. Coal cavings rare, R_v of about 1.93%. Iron oxides common. Pyrite sparse.)

JOB NO, 1908, FLINDERS-1(CONT'D)

Sample No(s)	Depth(m)/ Sample type		$\bar{R}_v$ max (%)	Range (%)	N	Description Including Liptinite Fluorescence Characteristics
v7449	2607 Ctgs	I	0.68	0.51-0.89	28	Sparse sporinite and lamalginite yellow to dull orange, rare cutinite and resinite yellow to dull orange, rare Botryococcus related telalginite, orange. (Siltstone>igneous rock fragments> carbonate>coal>shaly coal. Coal sparse, V>>I>>L. Vitrite> duroclarite>vitrinertite. Shaly coal rare, V>>I=L. Vitrite> clarite. Dom abundant, V>I>L. Vitrinite and inertinite common, liptinite sparse. Mineral fluorescence pervasive, moderate green to dull orange. Iron oxides common. Pyrite common.)
v7412	2672.5 Ctgs	I	0.72	0.63-0.82	27	Sparse sporinite and liptodetrinite, yellow to orange, sparse cutinite, dull orange to weak brown, rare resinite, yellow to orange. (Sandstone>siltstone>igneous rock fragments>carbonate> coal>shaly coal. Coal common, V>>L>I. Vitrite>clarite. Shaly coal sparse, V>>L>I. Clarite. Dom abundant, V>L>I. Vitrinite and liptinite common, inertinite rare. Bitumen sparse, orange to dull orange. Mineral fluorescence pervasive, faint green to orange. Iron oxides abundant. Pyrite common.)
v7413	2681.5 Ctgs	I	0.80	0.67-0.92	30	Sparse sporinite and liptodetrinite, yellow to orange, sparse cutinite, orange to weak brown, sparse resinite, dull orange. (Clayey siltstone>coal>shaly coal. Coal major, V>>L>I. Vitrite>clarite. Mineral-free maceral group composition of the coal: vitrinite - 95%, inertinite - <0.1%, liptinite - 5%. Shaly coal common, V>>L>I. Clarite. Dom abundant, V>L>I. Vitrinite common, liptinite and inertinite sparse. Bitumen rare, orange. Mineral fluorescence patchy, orange. Iron oxides common. Pyrite abundant.)
v7450	2688.5 Ctgs	I	0.72	0.56-0.85	27	Sparse sporinite, yellow to dull orange, rare resinite, lamalginite and liptodetrinite, yellow to dull orange. (Sandstone>siltstone>igneous rock fragments>carbonate>coal>shaly coal. Coal common, V>>L=I. Vitrite>clarite>duroclarite. Shaly coal sparse, V>>L>I. Vitrite>clarite. Dom abundant, V>>I>L. Vitrinite abundant, inertinite sparse, liptinite rare. Mineral fluorescence pervasive, moderate green to dull orange. Iron oxides abundant. Pyrite common.)

NOTE: Two, or three populations of vitrinite are present in many of the samples examined from Flinders No. 1. These result from contact alteration by igneous rocks and igneous rocks fragments were found in many of the samples. However, igneous rocks are not always present in the sample with high reflectances and they are present in some samples showing only low vitrinite reflectances. It is concluded that hole conditions are such as to give significant cavings populations. The shallowest sample examined contains both the medium and low vitrinite reflectance populations so there must be an intrusion that has affected the rank of coals above that interval. A large part of the section shows thermally altered coals in the range 1.65 to 2.8%. This is a surprisingly low range for contact alteration. However, the samples over the interval from 2178 m to 2363 m show a gradual decrease suggesting that this interval represents the outer part of a contact metamorphic aureole. Samples such as that from 2553 m contain two modes but it is possible that both come from the nominated interval, igneous rock fragments being noted in the sample. Contact metamorphic aureoles can be restricted in thickness so that it would be possible to intersect altered and unaltered coals within a 5 m sampling interval. The same comment applies to a number of other samples. The reflectance level near the base of the section appears likely to be about 0.66 to 0.72% where contact alteration is not present.

A small proportion of samples in the interval 2178 m to 2363 m include coals that must have been proximal to intrusions and some of these samples have semi-coke structures such as small vesicles and poorly developed mosaic structure.

Probable volatile matter yields (similar to S2+S3) of the coals are about 4% for the coal with reflectances over 3%, about 10 to 15% for the coals with reflectances about 2.5% and about 35 to 45% for the coals with vitrinite reflectances of about 0.7%. The pyrolysis yields for most of the samples would be weighted averages of two or three populations.

291307

5 cm

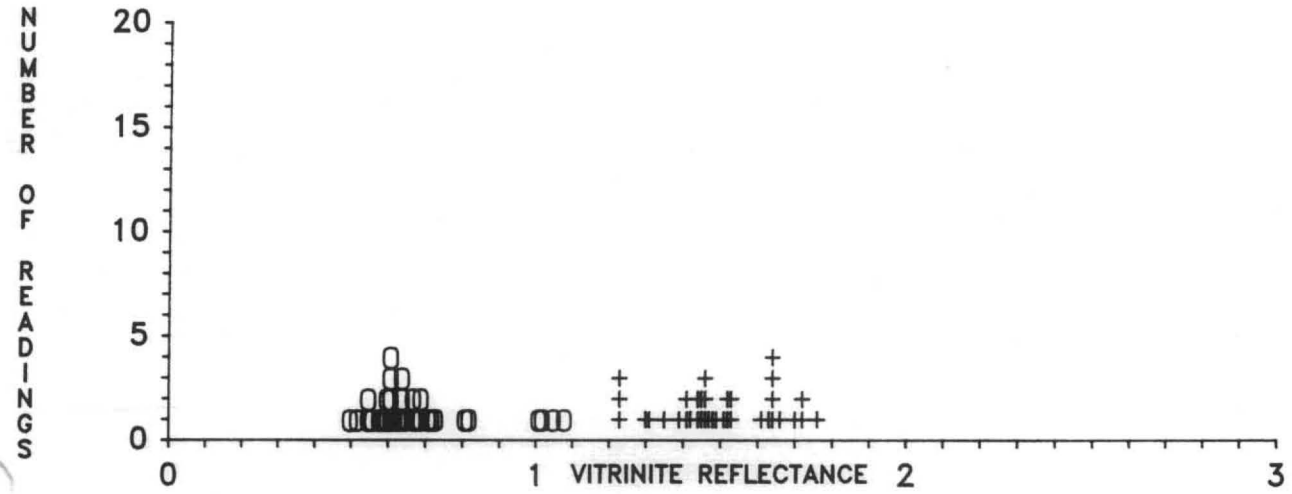
FIGURE a
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 1624.0 METRES DATE: MARCH 1993

(Total No. of Readings=69) 0.50 0.52 0.55 0.55 0.56 0.58 0.59 0.60 0.60 0.61 0.61 0.61 0.61 0.62 0.63 0.64 0.64 0.64 0.65 0.67 0.67 0.68 0.69 0.69 0.71 0.72 0.73 0.81 0.82 1.01 1.02 1.05 1.08 1.23 1.23 1.23 1.30 1.31 1.35 1.39 1.41 1.41 1.42 1.44 1.44 1.45 1.45 1.46 1.46 1.46 1.47 1.48 1.49 1.51 1.52 1.52 1.53 1.53 1.61 1.63 1.64 1.64 1.64 1.64 1.66 1.70 1.72 1.72 1.76

VITRINITE REFLECTANCE — MACERAL IDENTIFICATION

POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	52.2	36	1.50	1.23	1.76	0.14	INDIGENOUS(+)	98.00	2.00	0.00	0.00
2	47.8	33	0.69	0.50	1.08	0.15	CAVINGS(O)				

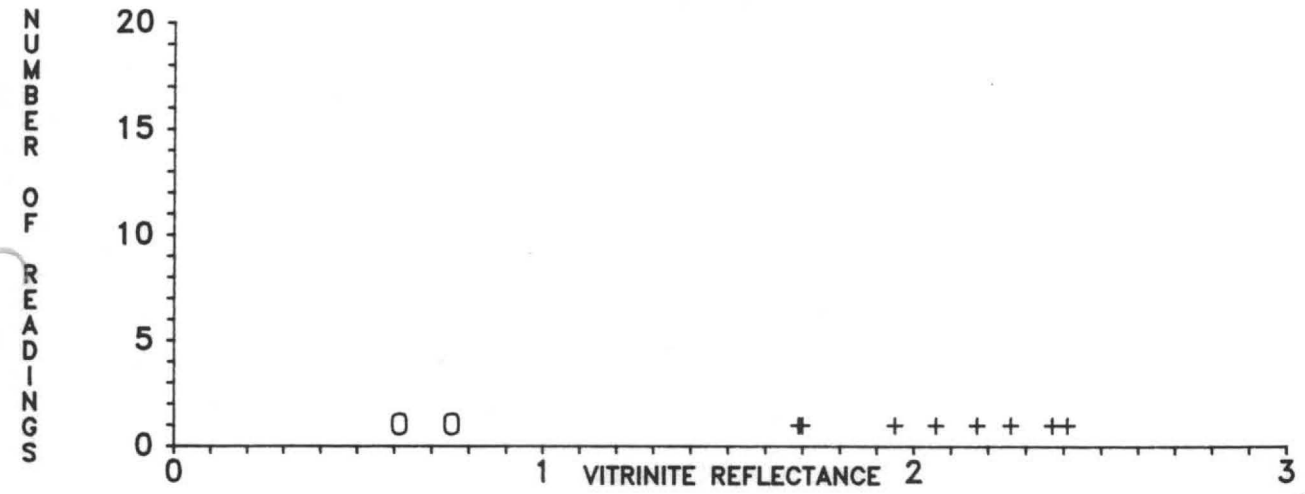


SAMPLE ID: 1651.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=10) 0.61 0.75 1.69 1.70 1.95 2.06 2.17 2.26 2.37 2.41

VITRINITE REFLECTANCE — MACERAL IDENTIFICATION

POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	80.0	8	2.08	1.69	2.41	0.28	INDIGENOUS(+)	83.30	16.70	0.00	0.00
2	20.0	2	0.68	0.61	0.75	0.10	CAVINGS(O)				



GEOTECH

291308

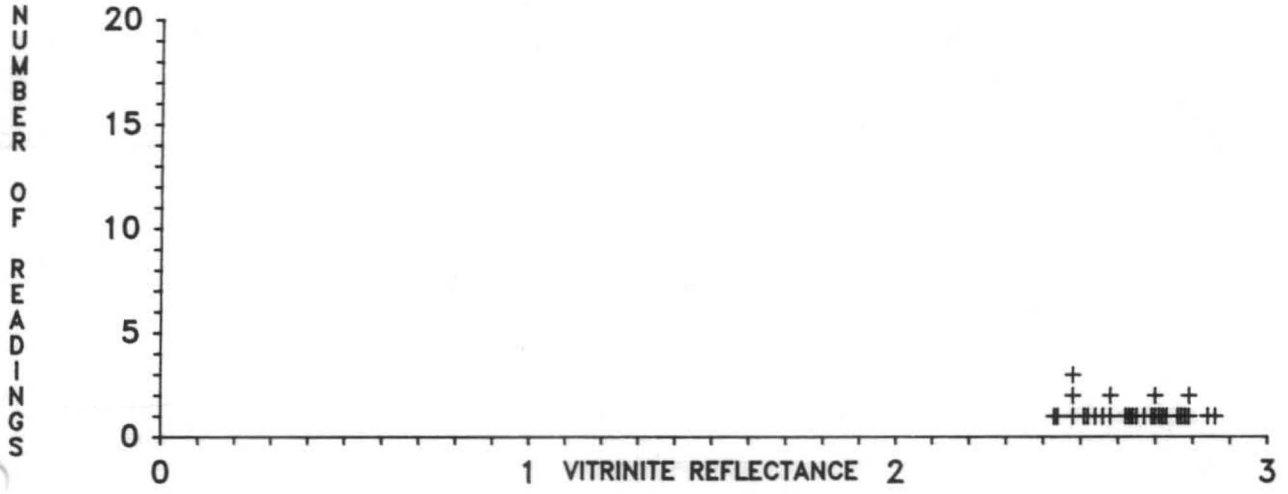
5 cm

FIGURE b
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1
SAMPLE ID: 1739.0 METRES
CLIENT: SAGASCO RESOURCES
DATE: MARCH 1993
SAMPLE TYPE: CUTTINGS

(Total No. of Readings=29) 2.43 2.44 2.48 2.48 2.48 2.51 2.52 2.54 2.56 2.58 2.58 2.62 2.63 2.64 2.65 2.67 2.69 2.70 2.70 2.71 2.72 2.73 2.76 2.77 2.78 2.79 2.79 2.84 2.86

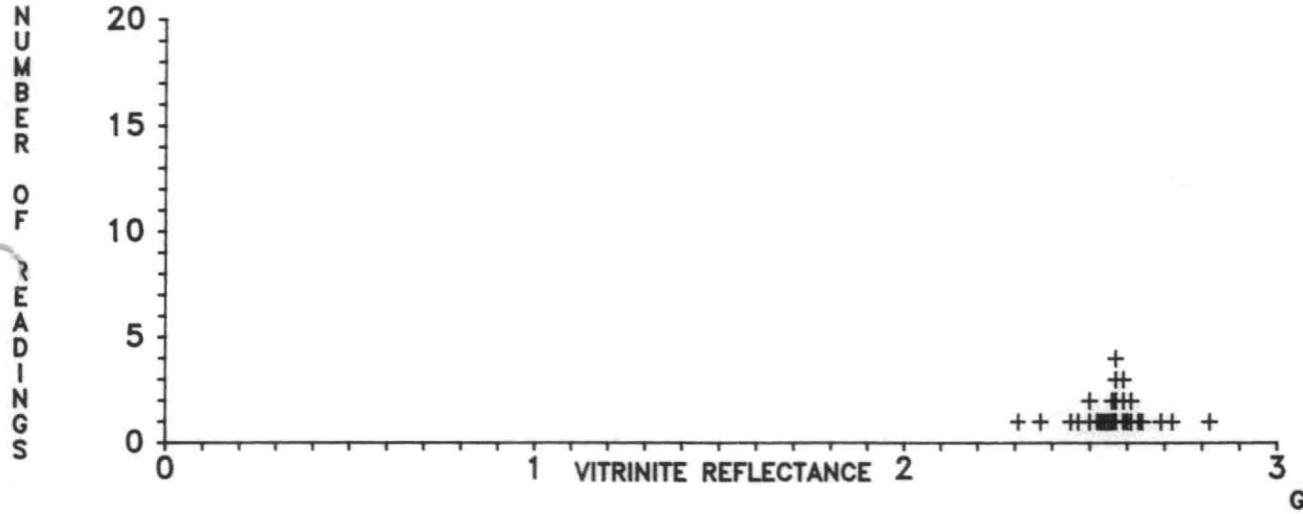
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	29	2.63	2.43	2.86	0.13	INDIGENOUS(+)	98.00	1.00	1.00	0.00



SAMPLE ID: 1911.5 METRES
SAMPLE TYPE: CUTTINGS

(Total No. of Readings=27) 2.31 2.37 2.45 2.47 2.50 2.50 2.52 2.53 2.54 2.55 2.56 2.56 2.57 2.57 2.57 2.57 2.59 2.59 2.59 2.60 2.61 2.61 2.63 2.64 2.69 2.72 2.82

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	27	2.56	2.31	2.82	0.10	INDIGENOUS(+)	99.30	0.30	0.40	0.00



GEOTECH

291309

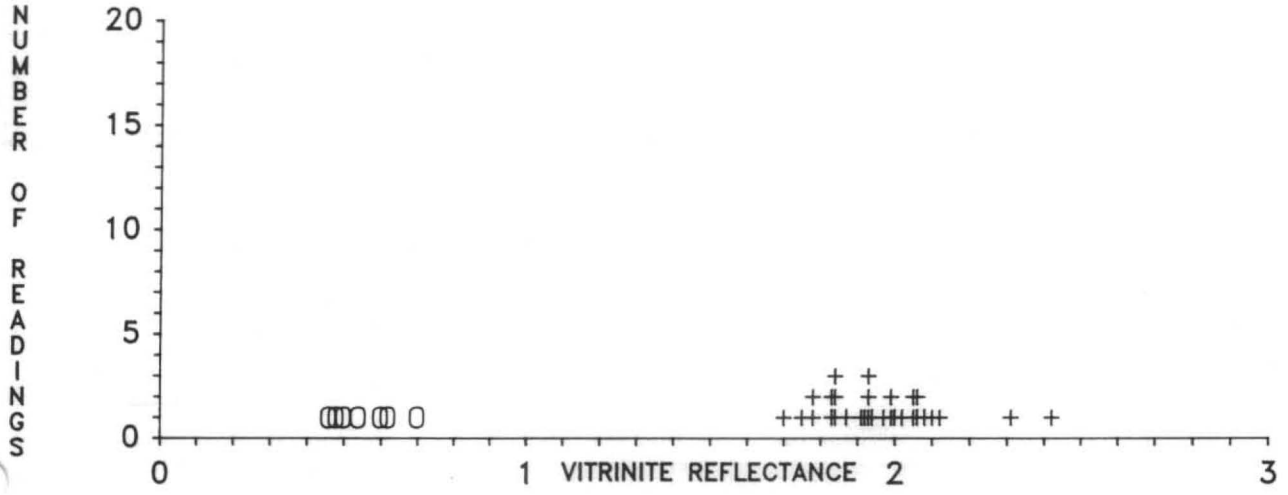
5 cm

FIGURE c
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 1981.0 METRES DATE: MARCH 1993

(Total No. of Readings=37) 0.46 0.48 0.50 0.54 0.60 0.62 0.70 1.70 1.75 1.78 1.78 1.83 1.83 1.84 1.84 1.84 1.87 1.91 1.92 1.93 1.93 1.93 1.94 1.97 1.99 1.99 2.00 2.02 2.05 2.05 2.06 2.06 2.08 2.10 2.12 2.31 2.42

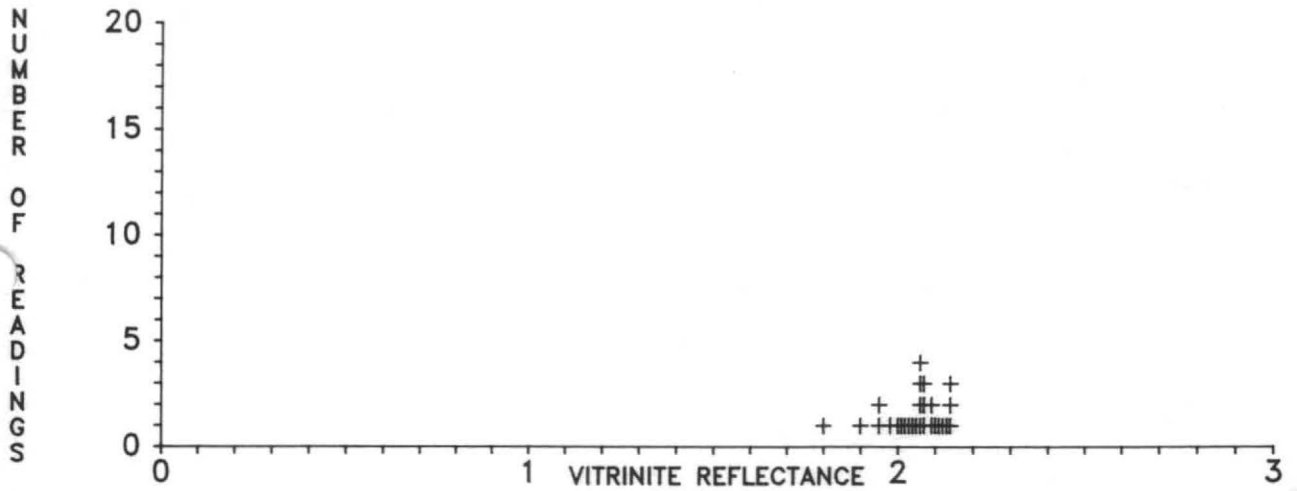
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	81.1	30	1.96	1.70	2.42	0.16	INDIGENOUS(+)	97.60	1.20	1.20	0.00
2	18.9	7	0.56	0.46	0.70	0.09	CAVINGS(O)				



SAMPLE ID: 2081.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=27) 1.80 1.90 1.95 1.95 1.98 2.00 2.01 2.02 2.03 2.04 2.05 2.06 2.06 2.06 2.06 2.07 2.07 2.07 2.09 2.09 2.10 2.11 2.12 2.13 2.14 2.14 2.14

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	27	2.05	1.80	2.14	0.08	INDIGENOUS(+)	97.60	2.40	0.00	0.00



GEOTECH

291310

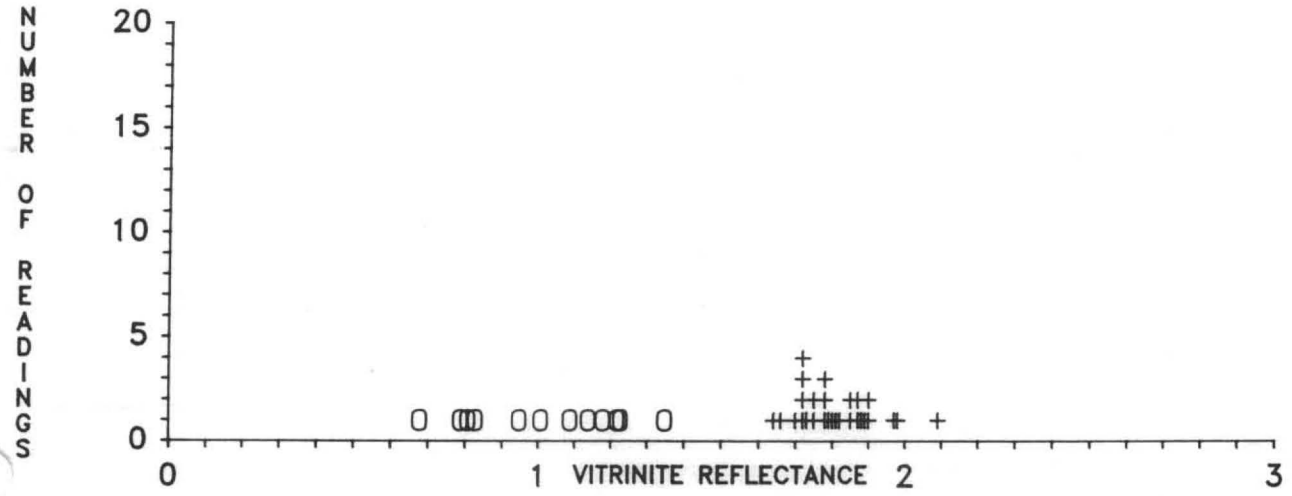
5 cm

FIGURE d
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2125.0 METRES DATE: MARCH 1993

(Total No. of Readings=40) 0.68 0.79 0.81 0.83 0.95 1.01 1.09 1.14 1.18 1.22 1.23 1.35 1.64 1.66 1.70 1.72 1.72 1.72 1.72 1.73 1.75 1.75 1.78 1.78 1.78 1.79 1.80 1.81 1.82 1.85 1.85 1.87 1.87 1.88 1.89 1.90 1.90 1.97 1.98 2.09

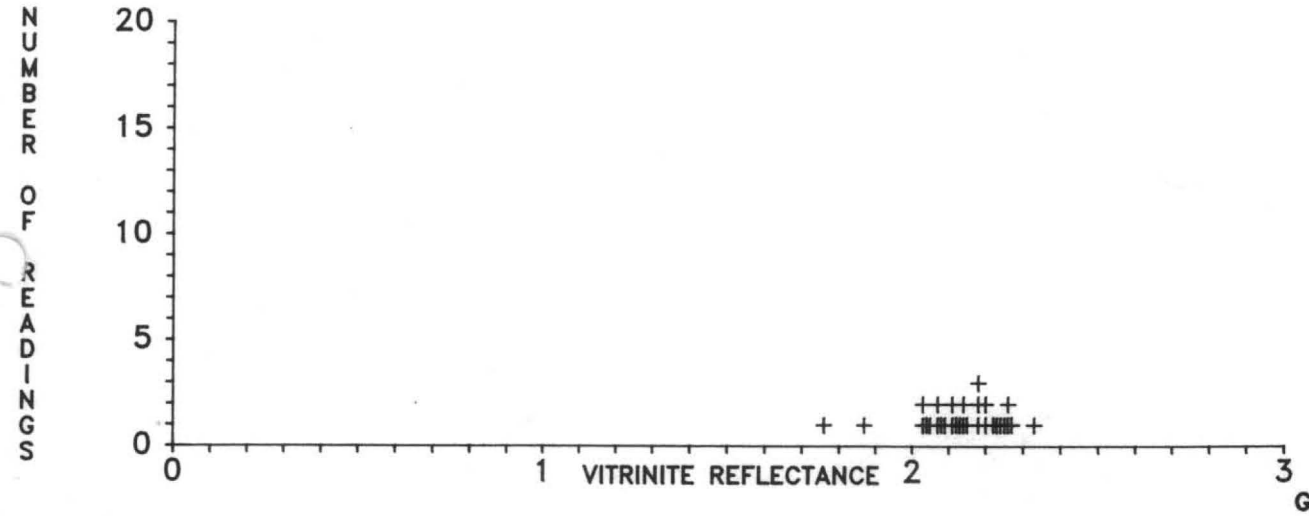
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	70.0	28	1.81	1.64	2.09	0.10	INDIGENOUS(+)	98.10	1.90	0.00	0.00
2	30.0	12	1.02	0.68	1.35	0.21	CAVINGS(O)				



SAMPLE ID: 2143.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=30) 1.76 1.87 2.03 2.03 2.04 2.05 2.07 2.07 2.08 2.09 2.11 2.11 2.12 2.13 2.14 2.14 2.15 2.18 2.18 2.18 2.20 2.20 2.22 2.23 2.24 2.25 2.26 2.26 2.27 2.33

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	30	2.13	1.76	2.33	0.12	INDIGENOUS(+)	95.20	4.80	0.00	0.00



GEOTECH

291311

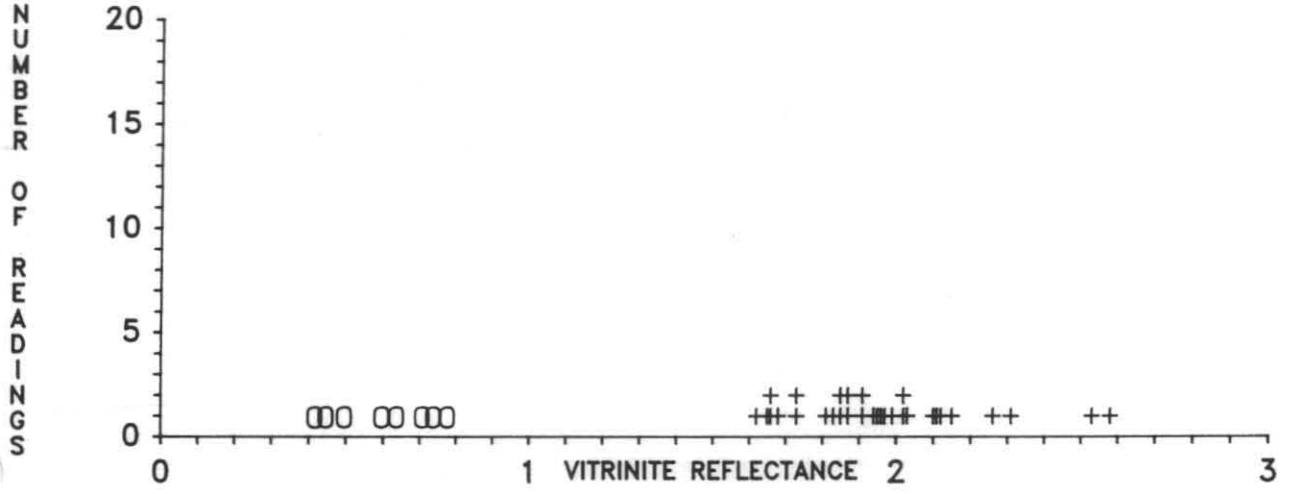
5 cm

FIGURE e
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2155.0 METRES DATE: MARCH 1993

(Total No. of Readings=39) 0.42 0.45 0.50 0.60 0.64 0.71 0.74 0.78 1.62 1.65 1.66 1.66 1.68 1.73 1.73 1.81 1.83 1.85 1.85 1.87 1.87 1.91 1.91 1.94 1.95 1.96 1.97 1.99 2.02 2.02 2.03 2.10 2.11 2.12 2.15 2.26 2.31 2.53 2.58

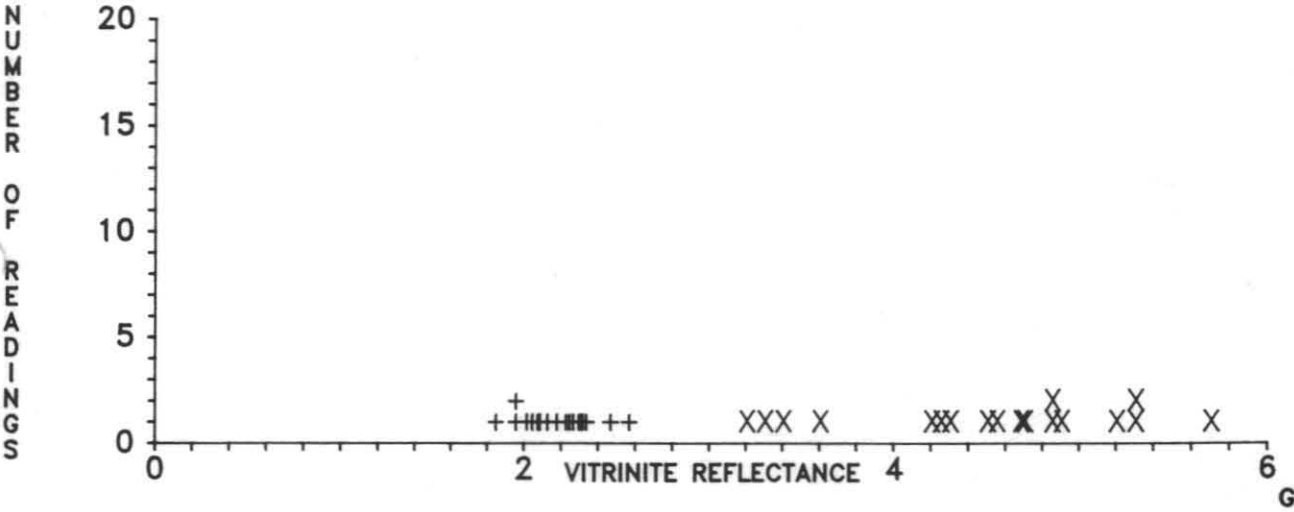
VITRINITE REFLECTANCE							MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	79.5	31	1.96	1.62	2.58	0.24	INDIGENOUS(+)	93.80	6.20	0.00	0.00
2	20.5	8	0.61	0.42	0.78	0.14	CAVINGS(O)				



SAMPLE ID: 2178.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=36) 1.85 1.96 1.96 2.02 2.05 2.08 2.09 2.13 2.18 2.23 2.25 2.27 2.30 2.31 2.32 2.34 2.47 2.57 3.20 3.30 3.40 3.60 4.20 4.25 4.30 4.50 4.55 4.68 4.70 4.85 4.85 4.90 5.20 5.30 5.30 5.70

VITRINITE REFLECTANCE							MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	50.0	18	2.19	1.85	2.57	0.19	INDIGENOUS(+)	93.80	6.20	0.00	0.00
2	50.0	18	4.49	3.20	5.70	0.73	VITRINITE(X)				



GEOTECH

291312

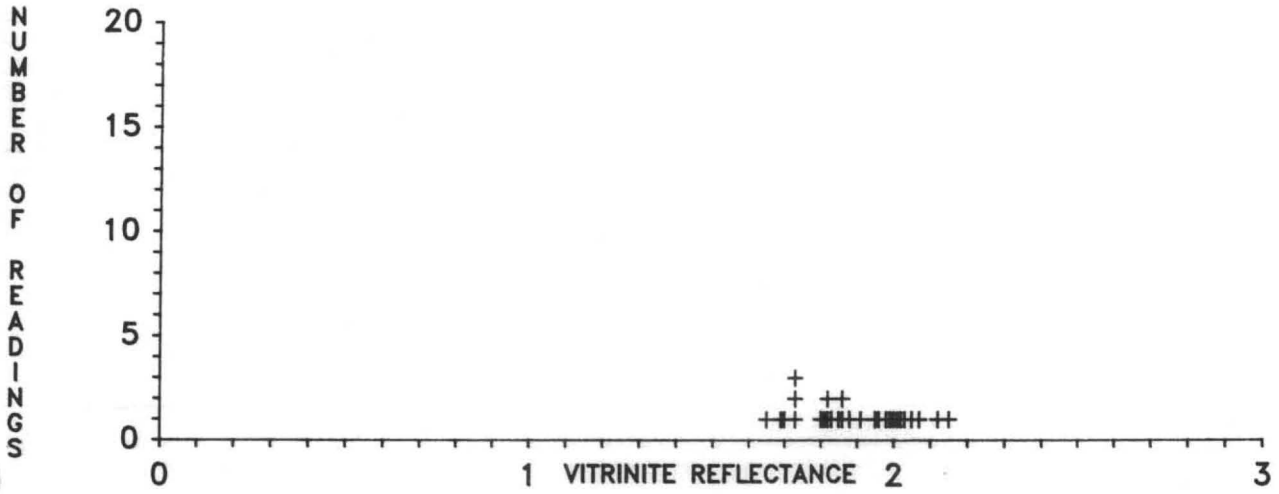
5 cm

FIGURE f
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2304.5 METRES DATE: MARCH 1993

(Total No. of Readings=28) 1.65 1.69 1.70 1.73 1.73 1.73 1.80 1.81 1.82 1.82 1.83 1.85 1.86 1.86 1.88 1.91 1.95 1.96 1.98 1.99 2.00 2.01 2.02 2.03 2.05 2.07 2.12 2.15

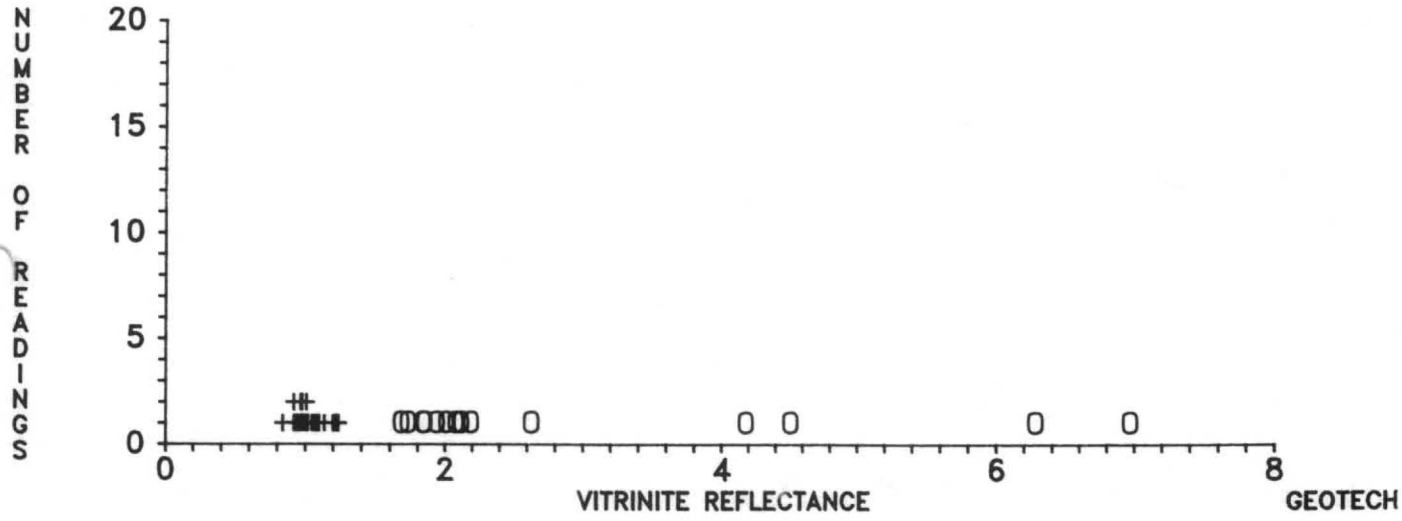
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	28	1.89	1.65	2.15	0.14	INDIGENOUS(+)	16.70	83.30	0.00	0.00



SAMPLE ID: 2344.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=37) 0.84 0.92 0.92 0.93 0.94 0.95 0.96 0.97 0.97 0.98 0.98 0.99 1.00 1.01 1.01 1.02 1.05 1.06 1.08 1.09 1.10 1.14 1.20 1.21 1.22 1.23 1.24 1.67 1.72 1.83 1.84 1.93 2.00 2.07 2.11 2.18 2.62 4.17 4.50 6.27 6.96

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	73.0	27	1.04	0.84	1.24	0.11	INDIGENOUS(+)	79.60	19.90	0.50	0.00
2	27.0	10	2.30	1.67	2.62	0.28	CAVINGS(O)				



291313

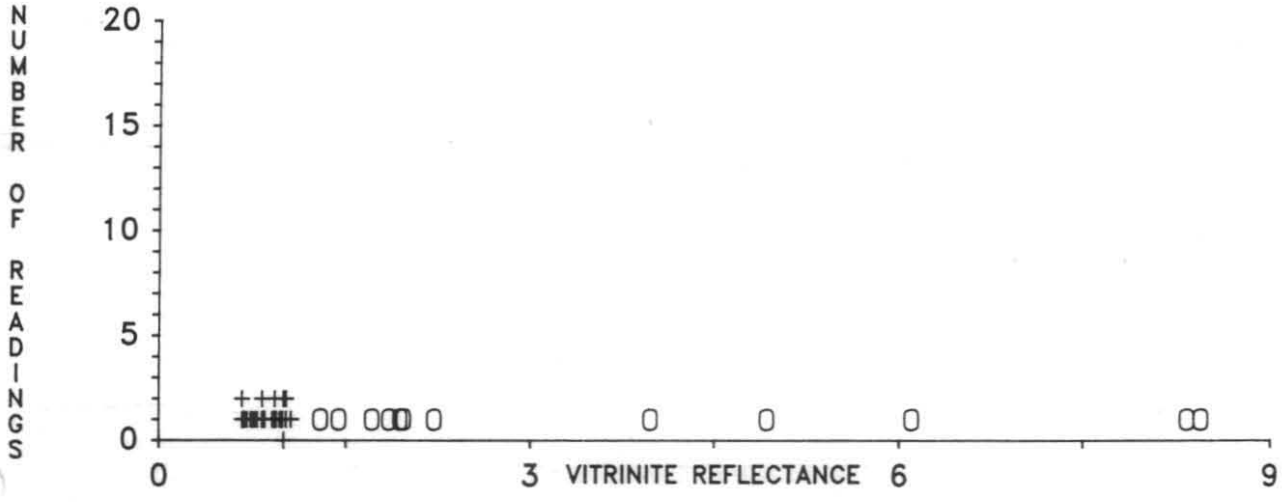
5 cm

FIGURE g
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2363.0 METRES DATE: MARCH 1993

(Total No. of Readings=38) 0.67 0.67 0.68 0.69 0.71 0.74 0.75 0.77 0.79 0.83 0.83 0.84 0.85 0.91 0.92 0.93 0.93 0.94 0.97 0.98 0.99 1.00 1.00 1.02 1.02 1.06 1.30 1.45 1.72 1.86 1.95 1.98 2.23 3.98 4.94 6.11 8.34 8.45

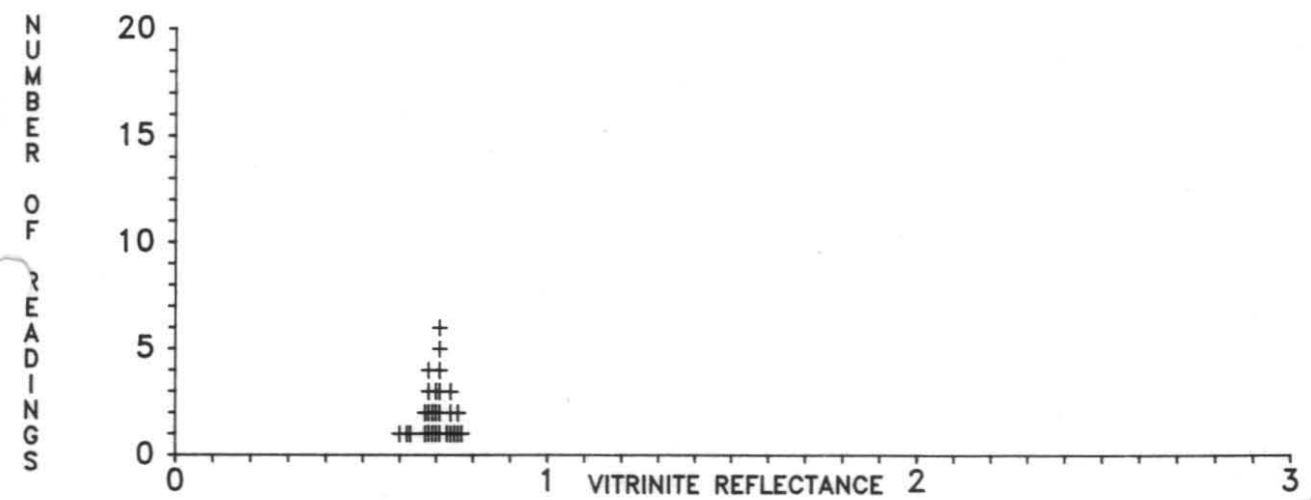
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	68.4	26	0.87	0.67	1.06	0.13	INDIGENOUS(+)	79.60	19.30	1.10	0.00
2	31.6	12	1.80	1.30	2.23	0.31	CAVINGS(O)				



SAMPLE ID: 2397.5 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=28) 0.60 0.62 0.63 0.67 0.67 0.68 0.68 0.68 0.68 0.69 0.69 0.70 0.70 0.70 0.71 0.71 0.71 0.71 0.71 0.71 0.73 0.74 0.74 0.74 0.75 0.76 0.76 0.77

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	28	0.70	0.60	0.77	0.04	INDIGENOUS(+)	85.20	14.10	0.70	0.00



GEOTECH

291314

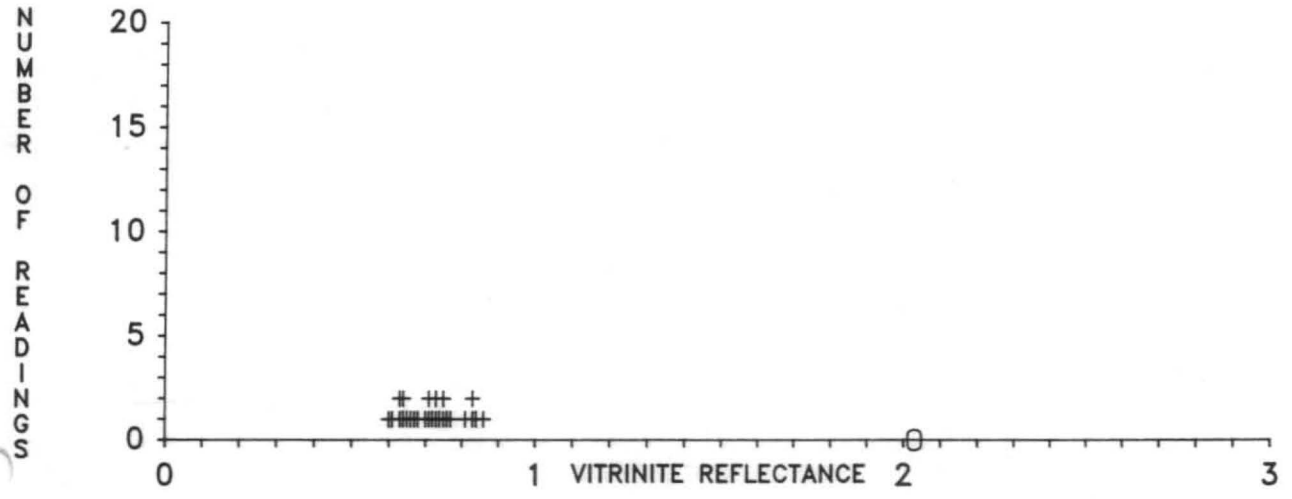
5 cm

FIGURE h
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2417.0 METRES DATE: MARCH 1993

(Total No. of Readings=27) 0.60 0.61 0.63 0.63 0.64 0.64 0.65 0.66 0.67 0.68 0.70 0.71 0.71 0.72 0.73 0.73 0.74 0.75 0.75 0.76 0.77 0.81 0.83 0.83 0.84 0.86 2.03

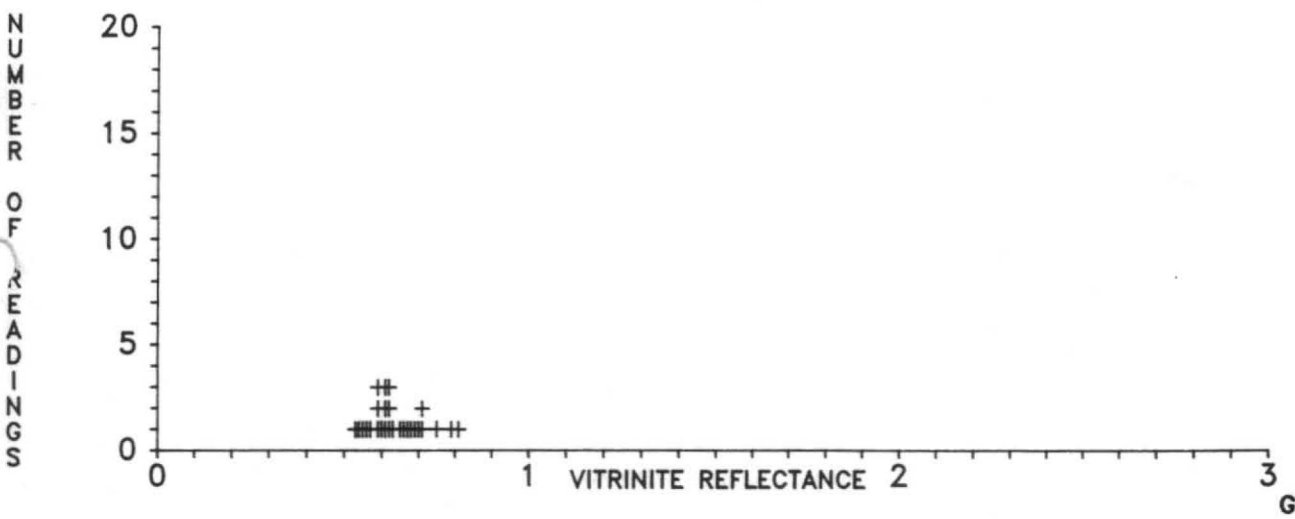
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	96.3	26	0.72	0.60	0.86	0.08	INDIGENOUS(+)	45.50	48.50	6.00	0.00
2	3.7	1	2.03	2.03	2.03	0.00	CAVINGS(O)				



SAMPLE ID: 2456.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=27) 0.53 0.54 0.55 0.56 0.57 0.59 0.59 0.59 0.60 0.61 0.61 0.61 0.62 0.62 0.62 0.63 0.65 0.66 0.67 0.68 0.69 0.70 0.71 0.71 0.75 0.79 0.81

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	27	0.64	0.53	0.81	0.07	INDIGENOUS(+)	57.10	14.30	14.30	14.30



GEOTECH

291315

5 cm

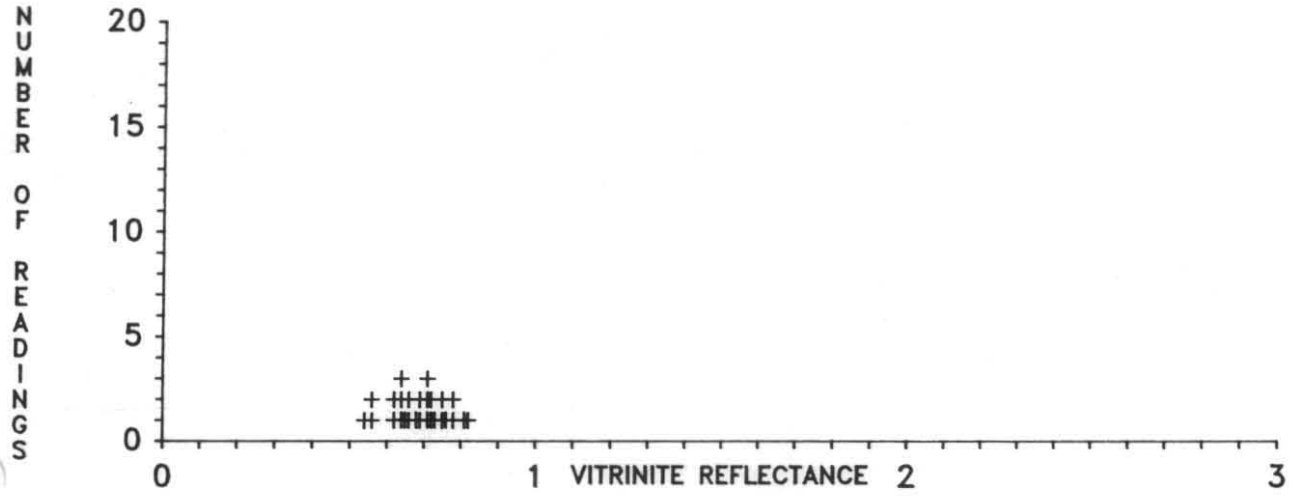
FIGURE i

VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2461.0 METRES DATE: MARCH 1993

(Total No. of Readings=27) 0.54 0.56 0.56 0.62 0.62 0.64 0.64 0.64 0.65 0.66 0.66 0.68 0.69 0.69 0.71 0.71 0.71 0.72 0.72 0.73 0.75 0.75 0.76 0.78 0.78 0.81 0.82

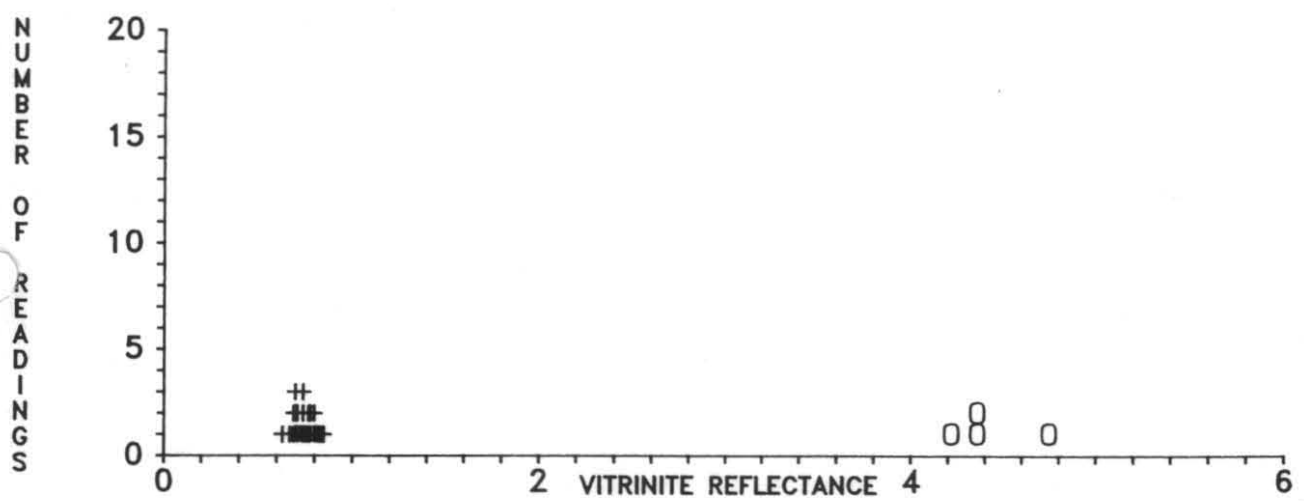
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	27	0.69	0.54	0.82	0.07	INDIGENOUS(+)	81.50	16.30	1.10	1.10



SAMPLE ID: 2504.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=30) 0.63 0.67 0.69 0.69 0.70 0.70 0.70 0.71 0.71 0.73 0.74 0.74 0.74 0.75 0.76 0.77 0.77 0.78 0.78 0.80 0.80 0.81 0.82 0.83 0.84 0.85 4.21 4.33 4.33 4.74

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Oil Drops
1	86.70	26	0.75	0.63	0.85	0.06	INDIGENOUS(+)	58.10	5.80	34.90	1.20
2	13.30	4	4.35	4.21	4.74	0.23	CAVINGS(O)				



GEOTECH

291316

5 cm

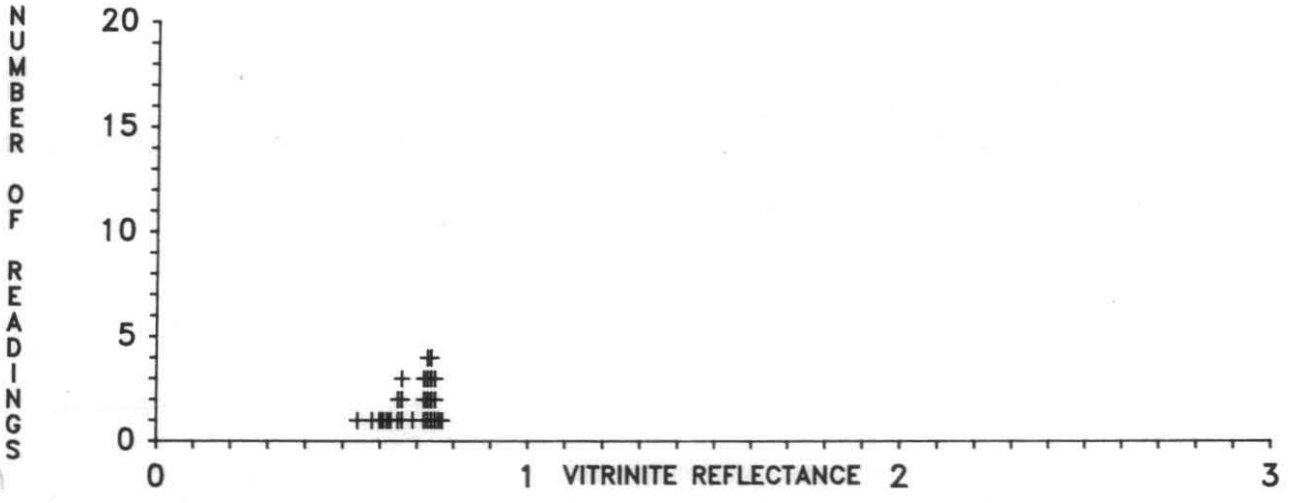
FIGURE j

VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2511.0 METRES DATE: MARCH 1993

(Total No. of Readings=28) 0.54 0.58 0.60 0.61 0.62 0.63 0.65 0.65 0.66 0.66 0.66 0.69 0.72 0.72 0.72 0.73 0.73 0.73 0.73 0.74 0.74 0.74 0.74 0.75 0.75 0.75 0.76 0.77

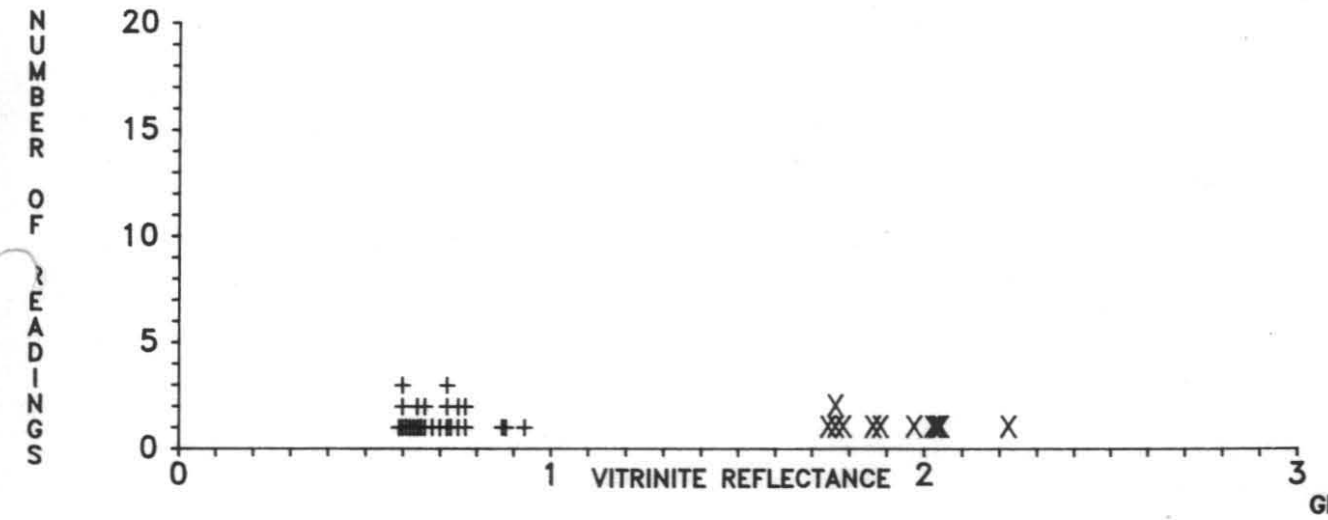
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	28	0.69	0.54	0.77	0.06	INDIGENOUS(+)	62.00	30.00	6.00	2.00



SAMPLE ID: 2553.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=36) 0.59 0.60 0.60 0.60 0.61 0.62 0.63 0.64 0.64 0.65 0.66 0.66 0.68 0.70 0.72 0.72 0.72 0.73 0.75 0.75 0.77 0.77 0.87 0.88 0.93 1.74 1.76 1.76 1.78 1.86 1.88 1.97 2.02 2.03 2.04 2.22

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	69.40	25	0.70	0.59	0.93	0.09	INDIGENOUS(+)	90.00	8.00	2.00	0.00
2	30.60	11	1.92	1.74	2.22	0.15	VITRINITE(X)				



GEOTECH

291317

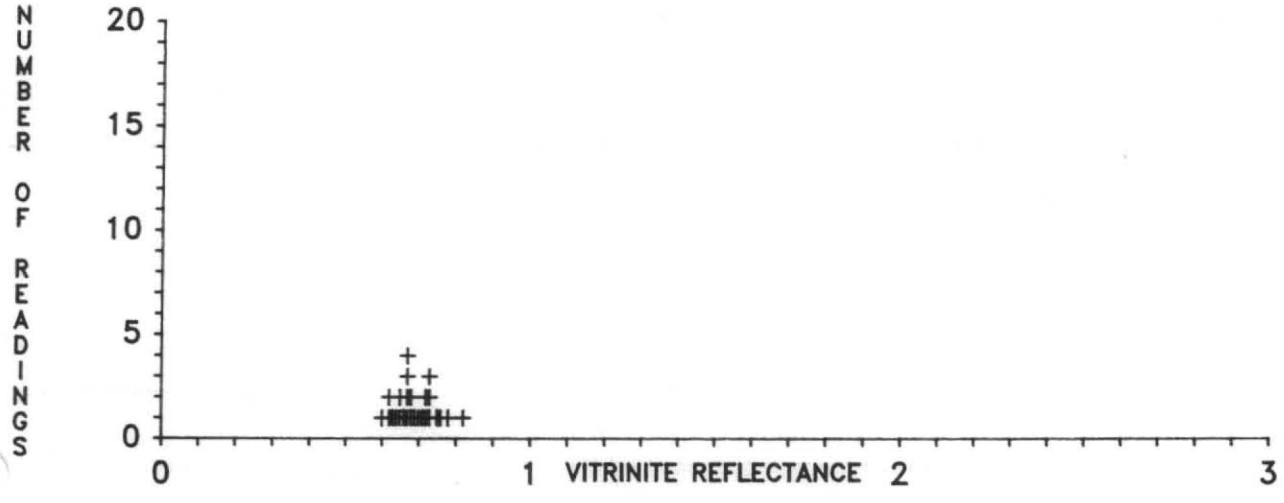
5 cm

FIGURE k
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2599.0 METRES DATE: MARCH 1993

(Total No. of Readings=26) 0.60 0.62 0.62 0.63 0.64 0.65 0.65 0.66 0.67 0.67 0.67 0.67 0.68 0.68 0.69 0.70 0.71 0.72 0.72 0.73 0.73 0.73 0.75 0.76 0.78 0.82

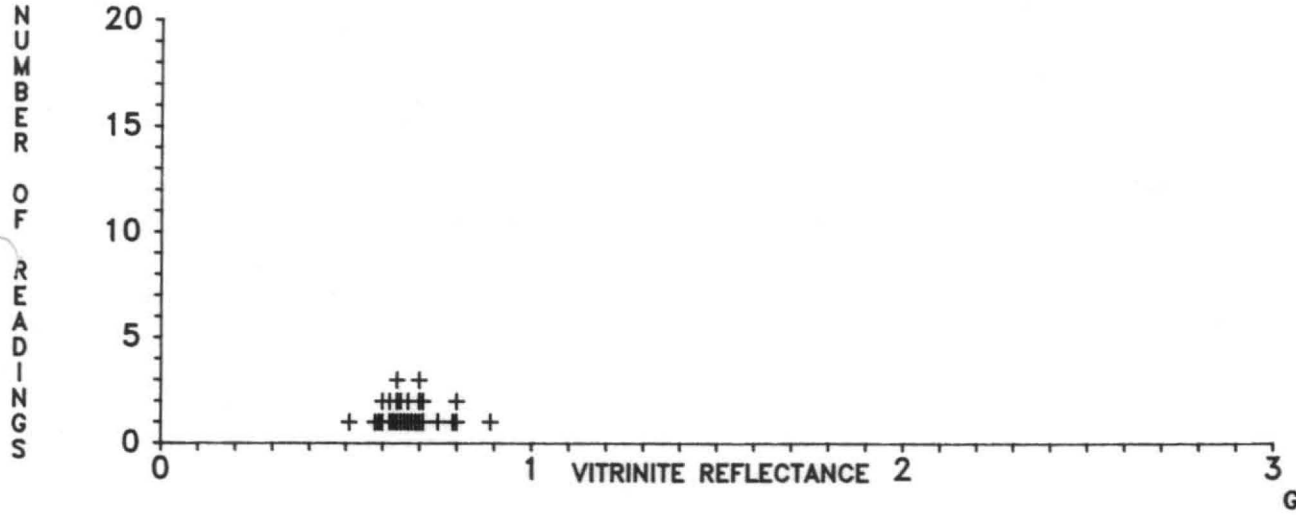
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	26	0.69	0.60	0.82	0.05	INDIGENOUS(+)	86.70	6.60	6.70	0.00



SAMPLE ID: 2607.0 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=28) 0.51 0.58 0.59 0.60 0.60 0.62 0.62 0.63 0.64 0.64 0.64 0.65 0.65 0.66 0.67 0.67 0.68 0.69 0.70 0.70 0.70 0.71 0.71 0.75 0.79 0.80 0.80 0.89

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	28	0.68	0.51	0.89	0.08	INDIGENOUS(+)	70.00	20.00	10.00	0.00



GEOTECH

291318

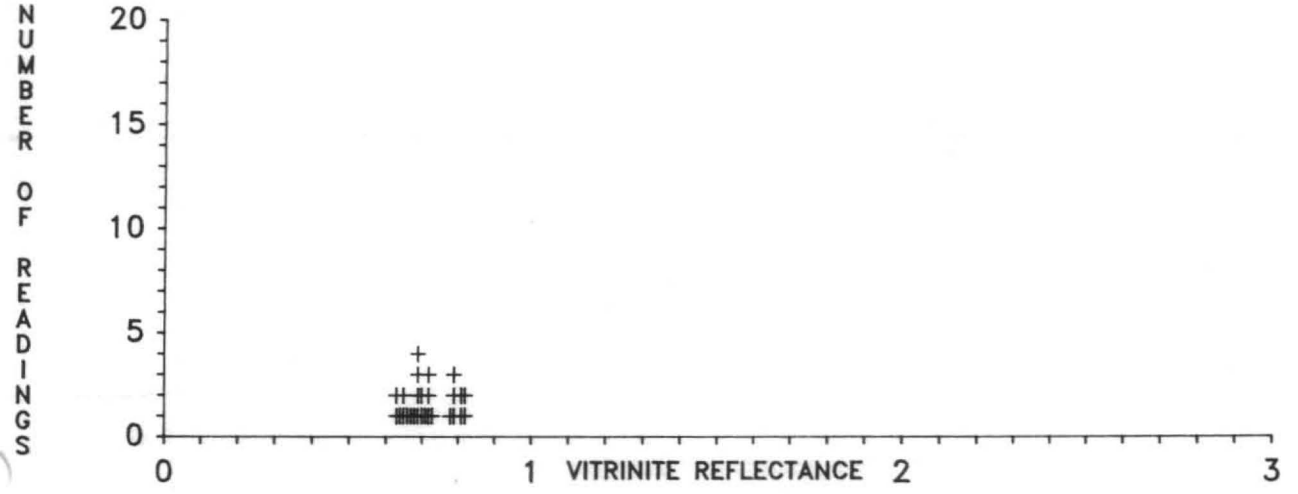
5 cm

FIGURE 1
VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2672.5 METRES DATE: MARCH 1993

(Total No. of Readings=27) 0.63 0.63 0.64 0.65 0.65 0.66 0.67 0.68 0.69 0.69 0.69 0.69 0.70 0.70 0.71 0.72 0.72 0.72 0.73 0.78 0.79 0.79 0.79 0.81 0.81 0.82 0.82

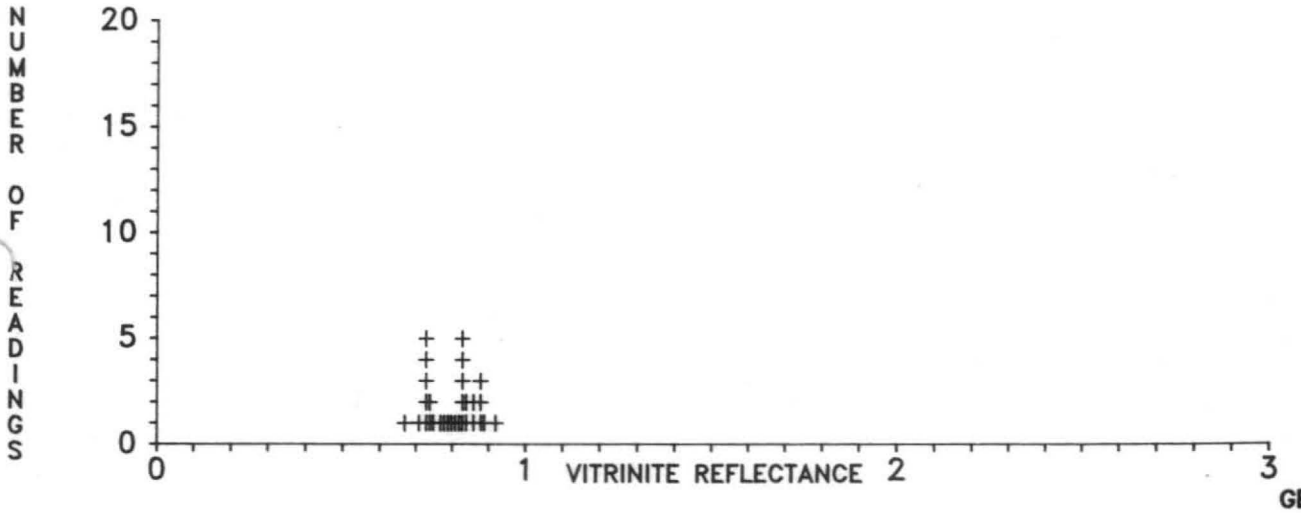
VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	27	0.72	0.63	0.82	0.06	INDIGENOUS(+)	77.80	2.70	16.70	2.80



SAMPLE ID: 2681.5 METRES SAMPLE TYPE: CUTTINGS

(Total No. of Readings=30) 0.67 0.71 0.73 0.73 0.73 0.73 0.73 0.74 0.74 0.75 0.77 0.78 0.79 0.80 0.81 0.82 0.83 0.83 0.83 0.83 0.83 0.84 0.84 0.86 0.86 0.88 0.88 0.88 0.89 0.92

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	30	0.80	0.67	0.92	0.06	INDIGENOUS(+)	92.00	1.60	5.60	0.80



GEOTECH

291319

5 cm

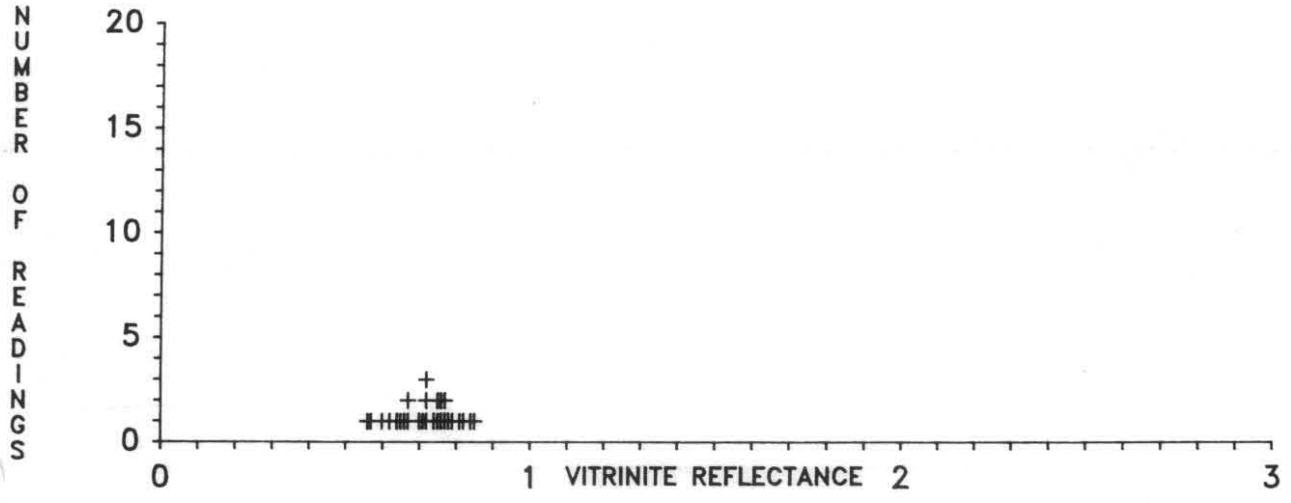
FIGURE m

VITRINITE REFLECTANCE AND COAL MACERAL INDENTIFICATION

WELL: FLINDERS-1 CLIENT: SAGASCO RESOURCES SAMPLE TYPE: CUTTINGS
SAMPLE ID: 2688.5 METRES DATE: MARCH 1993

(Total No. of Readings=27) 0.56 0.57 0.60 0.62 0.64 0.65 0.66 0.67 0.67 0.70 0.71 0.72 0.72 0.72 0.74 0.75 0.75 0.76 0.76 0.77 0.77 0.78 0.79 0.81 0.82 0.84 0.85

VITRINITE REFLECTANCE								MACERAL IDENTIFICATION			
POPULATION Number	%	No. of Readings	Mean Ro (%)	Min Ro (%)	Max Ro (%)	STD Dev (%)	Comments	% Vitrinite	% Inertinite	% Liptinite	% Bitumen
1	100.0	27	0.72	0.56	0.85	0.08	INDIGENOUS(+)	89.30	8.90	1.80	0.00



GEOTECH

PETROLEUM GEOCHEMISTRY

1.0 INTRODUCTION

Petroleum geochemistry is primarily concerned with the application of organic chemistry to samples of geological interest in hydrocarbon exploration.

Analyses can be carried out on cuttings, sidewall cores, conventional cores, relatively unweathered outcrop samples and fluid hydrocarbons (oil, condensate, gas).

Source rock evaluation is best performed on sidewall cores, since cuttings are more susceptible to contamination from both cavings and organic additives in the mud system. In petroleum geochemical studies it is vitally important for the geochemist/geologist to be aware of the type of mud additives used and the stage at which they are used during the drilling program. Any anomalous results must be carefully considered in conjunction with mud system records.

Petroleum geochemistry in exploration is applied for three major purposes:

1. First identification of richness, maturity and type of kerogen in (a large number of) whole rock samples by screening analyses.

2. Semi-detailed characterisation of kerogen in sediments from selected source intervals, to determine maturity, source type and genetic potential.

3. Detailed characterisation of petroleum fluids (extracts, oils and condensates) by assessment of thermal maturity, source type and depositional environment to enable oil-to-oil and oil-to-source rock correlation studies.

2.0 THEORY & METHODS

Samples are analysed according to the scheme illustrated in Figure 1 which shows the order and type of analysis for both screening and detailed tests.

2.1 Screening Analyses of Whole Rock Samples

2.1.1 Headspace/Cuttings Gas Analysis

The headspace sample is usually provided in a sealed tin can which holds both cuttings and water to approximately three quarters capacity. This allows the volatile hydrocarbons to diffuse easily into an appreciable headspace.

The gas is taken into a syringe through a silicone seal on the lid of the container and analysed by packed column gas chromatography using the following conditions:

Instrument:	Shimadzu GC-8APF
Column:	6'x ⅛" Chromosorb 102
Injector/Detector Temperature:	120°C
Column Temperature:	110°C
Carrier Gas:	Nitrogen

Cuttings gas analysis is performed in the same manner but on samples which do not liberate volatile gases readily. These sediments are subjected to very vigorous agitation prior to sampling.

Values are given as volume of gas per million volumes of sediment (ppm) for each hydrocarbon (methane, ethane, propane, iso- and n-butane), as composite values including C_5-C_7, and as ratios.

Headspace/cuttings gas analyses are used as a screening technique to identify zones of significant gas generation and out-of-place gas (Letran et al, 1974). The classification for gas content is listed below:

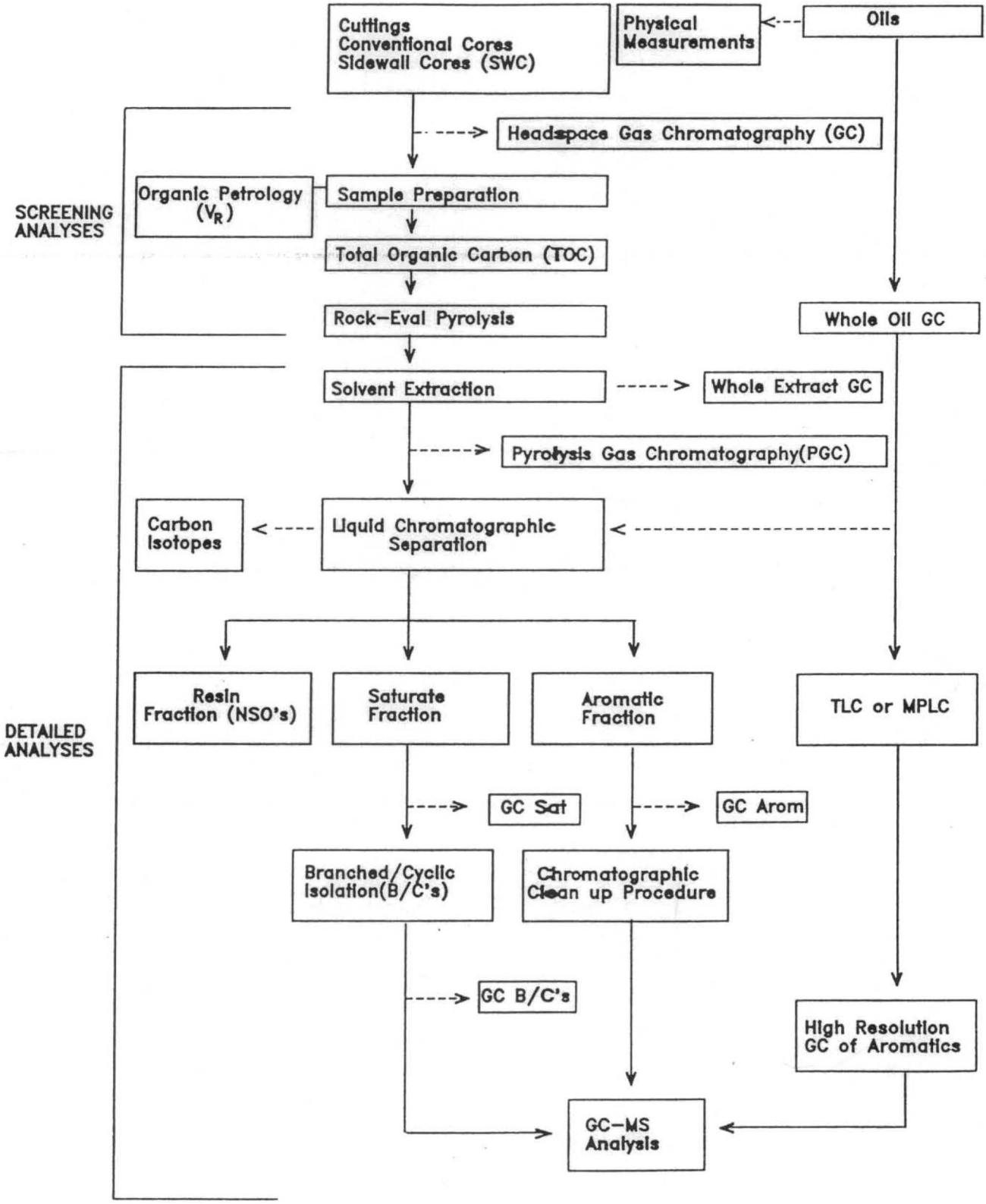
Total gas content (C_1; C_2-C_4; or C_5-C_7)	Description
10 - 100ppm	very lean - lean
100 - 1,000	lean - moderate
1,000 - 10,000	moderate - rich
10,000 - 100,000	rich - very rich

The abundance of C_2-C_4 components (wet gas) is used to locate the zone of oil generation, since wet gas is commonly associated with petroleum (Fuex, 1977).

It is important to ensure that the gases analysed are not of a biogenic origin, so an anti-bacterial agent must be added to the cuttings when they are stored in water.

FIGURE 1

FLOW DIAGRAM FOR PETROLEUM GEOCHEMICAL ANALYSES



2.1.2 Sample Preparation

Depending on drilling mud content, cuttings samples may be water washed before they are air dried, picked free of contaminants and cavings, and then crushed to 0.1mm using a ring pulveriser.

Sidewall cores are freed of mud cake and other visible contaminants, sampled according to homogeneity, air dried and hand crushed to 0.1mm grain size.

Conventional core and outcrop samples are inspected for visible contaminants and crushed to 1/8" chips using a jaw crusher. After air drying, the chips are crushed with a ring pulveriser to small particle size (0.1mm).

Petroleum aqueous mixtures are separated into oil and water/mud fractions by decanting off the oil layer and producing a clean separation by gently centrifuging the oil. If separation by this method is not effective, the petroleum is solvent extracted.

2.1.3 Total Organic Carbon (TOC)

The TOC value is determined on crushed sediment. The minimum sample requirement is one gram, however, results may be obtained from as little as 0.2gm in very rich samples. Carbonate minerals are first removed by acid digest (HCl) and the remaining sample heated to 1700°C (Leco Induction Furnace) in an atmosphere of pure oxygen. The CO_2 produced is measured with an infra-red detector, and values calculated according to standard calibration.

TOC is expressed as % of rock and is used as a screening procedure to classify source rock richness:

Classification	Clastics	Carbonates
Poor	0.00 - 0.50	0.00 - 0.25
Fair	0.50 - 1.00	0.25 - 0.50
Good	1.00 - 2.00	0.50 - 1.00
Very Good	2.00 - 4.00	1.00 - 2.00
Excellent	> 4.00	> 2.00

2.1.4 Rock-Eval Pyrolysis

Although a preliminary source rock classification is made using TOC data, a more accurate assessment of organic source type and maturity is possible by Rock-Eval pyrolysis. Two types of Rock-Eval analyses are offered: "one run" which involves pyrolysis of the crushed but otherwise untreated sediment and "two run" which involves pyrolysis of both the crushed, untreatment sediment and the decarbonated sediment. The "two run" method provides more accurate S_3 values than the "one run" method. S_1 and S_2 values are of the same accuracy in both methods.

The method requires 0.4g of sample material, although reliable results can often be obtained from smaller amounts.

The crushed sediment is heated in an inert atmosphere of helium over a programmed temperature range. The resulting pyrogram is shown in Figure 2.

Hydrocarbons present in the free or adsorbed state (S_1) are thermally distilled at 300°C and measured by a flame ionisation detector (FID). Hydrocarbons are then cracked from the kerogen (S_2) during a temperature ramp from 300° to 550°C and also measured by FID. CO_2 released during the kerogen cracking process (S_3) is trapped and subsequently measured by a thermal conductivity detector.

The amount of free hydrocarbons in the sediment (S_1) represents milligrams of hydrocarbons distilled from one gram of rock and is a measure of both in situ and out-of-place petroleum.

Free hydrocarbon richness is described by the following:

S_1 (mg/g or kg/tonne)	
0.20 - 0.40	fair
0.40 - 0.80	good
0.80 - 1.60	very good
> 1.60	excellent

The total amount of hydrocarbons present in the free state and as kerogen is a measure of the potential yield (genetic potential) of the sample ($S_1 + S_2$) and is expressed as mg/g of rock.

Source rocks are classified accordingly:

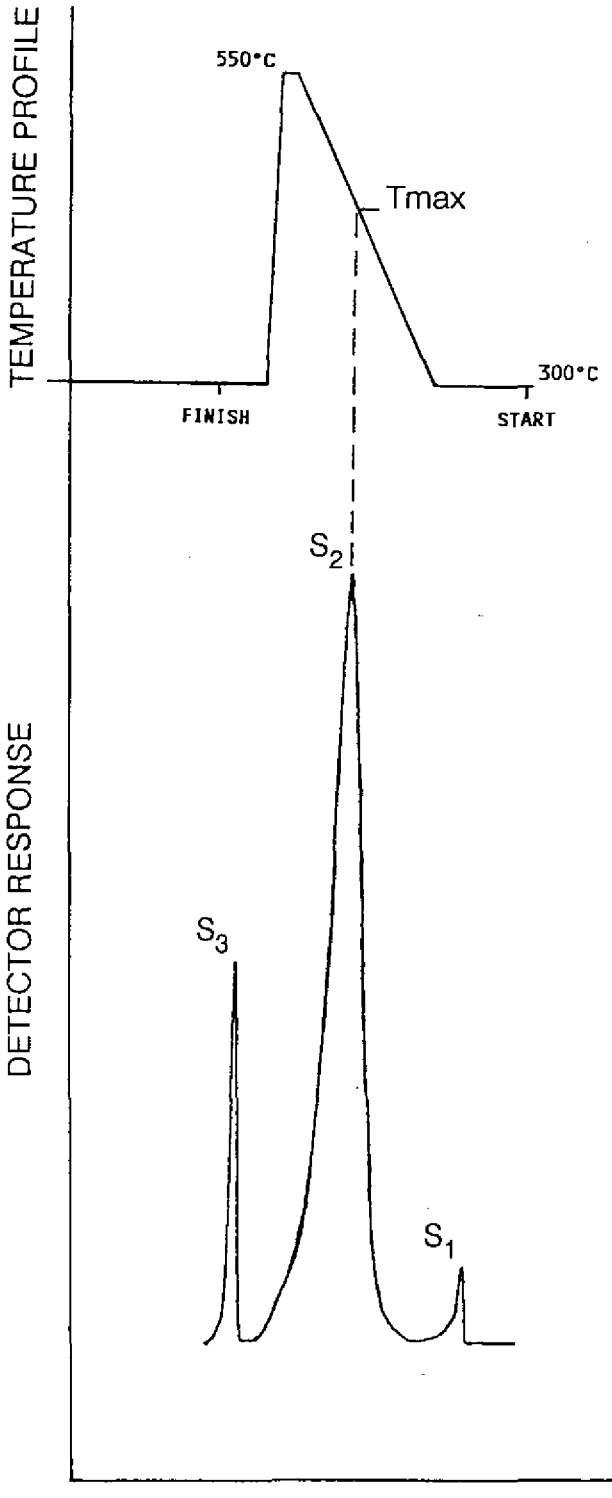
$S_1 + S_2$ (mg/g)	Source Rock Quality
0.00 - 1.00	poor
1.00 - 2.00	marginal
2.00 - 6.00	moderate
6.00 - 10.00	good
10.00 - 20.00	very good
> 20.00	excellent

The Production Index (PI) represents the amount of petroleum generated relative to the total amount of hydrocarbons present ($S_1/(S_1 + S_2)$). It is a measure of the level of maturity of the sample. For oil prone sediments PI ranges from 0.1 at the onset of oil generation to 0.4 at peak oil generation. For gas prone sediments, PI shows only a small change with increasing maturity.

The temperature at which the maximum amount of S2 hydrocarbons is generated is called Tmax (Figure 2). This temperature increases with the increasing maturity of sediments.

FIGURE 2

SCHEMATIC PYROGRAM OF ROCK-EVAL PYROLYSIS



The variation of Tmax is summarised as

< 430°C	immature
430/435° - 460°C	mature (oil window)
> 460°C	overmature

Hydrogen Index (HI = S2 x 100/TOC) and Oxygen Index (OI = S3 x 100/TOC), when plotted against one another, provide information about the type of kerogen and the maturity of the sample. Both parameters decrease in value with increasing maturity. Samples with high HI and low OI are dominantly oil prone and samples with low HI and high OI are gas prone.

2.2 Analysis of Kerogen

2.2.1 Organic Petrology - Vitrinite Reflectance

Vitrinite is a coal maceral which responds to increasing levels of thermal maturity. This response is measured microscopically by the percent of light reflected off the polished surface of a vitrinite particle immersed in oil.

Measurement of vitrinite reflectance can be carried out on uncrushed, washed and dried cuttings (10-50gms of sample material required), sidewall cores (2-10gms), conventional cores (2-10gms) or outcrop samples (2-10gms).

The values given are for standard lower size limits. In special cases, however, useful data may be obtained from as little as 0.1gm.

For each sample a minimum of 25 fields is measured in order to establish a range and mean for reflectance values.

Maturity classifications according to vitrinite reflectance values are:

% V_R (approx)	Maturity
0.2 - 0.55	immature
0.55 - 1.2	mature
1.2 - 1.8	overmature
> 1.8	severely altered

Following vitrinite reflectance measurements, microscopic examination in fluorescence mode allows the description of liptinite macerals and an estimate of their abundances. The amount of dispersed organic matter is reported and its composition described.

Vitrinite reflectance results and maceral descriptions are best obtained from coals or rocks deposited in environments which received large influxes of terrestrially derived organic matter. Vitrinite reflectance cannot be measured in rocks older than Devonian age, since land plants had not evolved prior to this time.

2.2.2 Pyrolysis Gas Chromatography

Pyrolysis gas chromatography (PGC) is performed on solvent extracted source rocks or isolated kerogens. The sample is pyrolysed by an SGE pyrojector which is coupled directly to a Hewlett Packard 5890 gas chromatograph. The operating conditions are:

Pyrolysis temperature:	600°C
Column:	25m x 0.22mm ID BP-1 (SGE)
Carrier gas:	helium
Oven conditions:	-20° to 280°C @ 4°/min

Data are collected and recovered using DAPA scientific software.

Pyrolysis GC allows the examination of kerogen on the molecular level and thereby a better classification of source rocks with regard to source type and generative capacity than conventional bulk pyrolysis (ie. Rock-Eval). Two analytical procedures are possible:

1. Semi quantitative (with yield related to S_2 of Rock-Eval)

2. Fully quantitative (with the inclusion of an internal standard)

Samples are characterised according to the amounts of aliphatic, aromatic and phenolic components in the kerogen. The aliphatic carbon content of a kerogen is the critical factor in determining catagenic hydrocarbon yields in the earth's crust, while the gas/oil ratio is dictated by the distribution of the various structural elements in the kerogen (Larter, 1985). Using pyrogram fingerprint data, it is possible to distinguish substantial variations between kerogens, even those of the same bulk chemical type.

A major strength of pyrolysis methods is that, while quantitative yields of kerogens are maturity related, the qualitative pyrogram fingerprints obtained are relatively rank independent over much of the oil window (Espitatlie et al, 1977; Van Graas et al, 1980; Larter, 1985). At high maturities (>1.2% V_R) characteristics for all kerogen types tend to converge (Horstfield, 1984).

Data are presented by percentage and mg/g of individual substances as well as groups of compounds.

Significant parameters are:

$(C_1 - C_5)/C_6$ + abundance	gas/oil ratio
$C_9 - C_{31}$ (alkenes + alkanes)	oil yield
Type Index R:	aromaticity

(Larter & Douglas 1979, Larter and Senftle, 1985).

2.3 Detailed Analyses of Petroleum Fluids

2.3.1 Solvent Extraction of Sediment

The finely crushed sample (up to 100g) is extracted with dichloromethane (300mL) using sonic vibration. After Buchner flask filtration, the filtrate is re-vibrated with activated copper powder (1g) to remove elemental sulphur. The extractable organic matter (EOM) is afforded by further filtration and fractional distillation of the solvent.

Source rock richness based upon EOM is classified accordingly:

Yield	ppm
Poor	< 500
Fair/Good	500 - 2000
Very Good	2000 - 4000
Excellent	> 4000

2.3.2 Liquid Chromatography Separation

Sediment extracts, crude oil and condensate samples are separated into fractions corresponding to three structural types:

saturated hydrocarbons	(SAT)
aromatic hydrocarbons	(AROM)
resins plus ashphaltenes	(NSO)

This separation is achieved by liquid column chromatography using activated silicic acid adsorbent and eluting solvents of varying polarity. Saturated, aromatic and NSO concentrates are recovered by fractional distillation/evaporation of the solvent and quantitative transfer to a small vial.

The amount of hydrocarbons (SAT plus AROM) can be used to classify source rock richness and the amount of saturates to classify oil source potential, according to the following criteria:

Classification	ppm HC	ppm SAT
Poor	0 - 300	0 - 200
Fair	300 - 600	200 - 400
Good	600 - 1200	400 - 800
Very Good	1200 - 2400	800 - 1600
Excellent	>2400	>1600

The composition of the extracts can also provide information about their levels of maturity and/or source type (LeTran et. al., 1974; Philippi, 1974). Generally, marine extracts have relatively low concentrations of saturated and NSO compounds at low levels of maturity, but these concentrations increase with increasing maturation. Terrestrially derived organic matter often has a low level of saturates and large amount of aromatic and NSO compounds, irrespective of the level of maturity.

Specific ratios are measured from solvent extraction and liquid chromatography data which give an indication of source type and maturity. EOM (mg)/TOC(g) can be used as a maturation indicator when plotted against depth for a given sedimentary sequence. Generally an EOM/TOC value of >100 indicates high maturity. If such a sample has a SAT (mg)/TOC (g) ratio <20, it is likely that the organic matter is gas prone. A value for SAT (mg)/TOC (g) >40 suggests an oil prone source type.

2.3.3 Capillary Gas Chromatography (GC)

C_{12}+ gas chromatography is most commonly carried out on saturate fractions, but in certain instances it is used to examine whole extracts/oils, aromatic or branched/cyclic fractions. It is also used as a tool to identify contamination. The analyses are performed under the following conditions:

Instruments:	Hewlett Packard 5890 Gas Chromatography
Injector:	SGE OCI-3 on column
Column:	25m x 0.2mm ID BP-1
Injector Temp:	280°C
Detector Temp:	320°C
Column Temp:	45°C to 280°C at 4°/min
Carrier Gas:	hydrogen

Data are collected using an IBM compatible PC and DAPA scientific software.

2.3.3.1 C_{12}+ Saturate Gas Chromatography

Saturate GC results provide information pertaining to source type, maturity and depositional environment.

The n-alkane distribution from n-C_{12} to n-C_{31} is determined from the area under the peaks representing each of these n-alkanes. The profile can yield information about maturity and source type and is quantified in the C_{21} + C_{22}/C_{28} + C_{29} ratio and Carbon Preference Indices (CPI 1 and 2).

$$CPI\ (1) = \frac{(C_{23} + C_{25} + C_{27} + C_{29})\ wt\% + (C_{25} + C_{27} + C_{29} + C_{31})\ wt\%}{2 \times (C_{25} + C_{26} + C_{28} + C_{30})\ wt\%}$$

$$CPI\ (2) = \frac{(C_{23} + C_{25} + C_{27})\ wt\% + (C_{25} + C_{27} + C_{29})\ wt\%}{2 \times (C_{24} + C_{26} + C_{28})\ wt\%}$$

- carbon preference indices are approximately 1 for marine samples, regardless of maturity
- decrease from 20 --> 1 for terrestrial samples as maturity increases

The $C_{21} + C_{22}/C_{28} + C_{29}$ ratio is generally >1.5 for aquatic source material and <1.2 for terrestrial organic matter, however, the values increase with maturity.

Pristane/phytane (Pr/Ph) ratios can indicate depositional environments:

. <3.0 - relatively reducing depositional environments;
. 3.0-4.5 - mixed (reducing/oxidising) environments;
. >4.5 - relatively oxidising depositional environments.

2.3.3.2 C_1 - C_{31} Whole Oil Gas Chromatography

This analytical method is applied to oil and condensate samples. It provides a picture of the whole oil up to n-C_{31} and allows quantitation of components with more than 4 carbons atoms. Several parameters are measured which illustrate changes in the degree of biodegradation and water washing in the reservoir. Because these measurements are performed on very volatile components in the oil, care should be taken during sampling, transportation and storage of the fluid to minimise evaporation.

Whole oil analytical conditions are listed below:

Instrument:	Shimadzu GC-9A
Column:	25m x 0.2mm ID BP-1
Injector/Detector Temperature:	290°C
Column Temperature:	-20°C to 280°C at 4°/min
Carrier Gas:	hydrogen

2.3.4 Carbon Isotope Analysis

This measurement is normally carried out on one or more of the following mixtures: topped oil, saturate fraction, aromatic fraction, NSO fraction. The organic matter is combusted in oxygen to produce carbon dioxide which is purified and transferred to an isotope mass spectrometer. The carbon isotope ratio ($\delta C_{13}/\delta C_{12}$) is measured and compared to an international standard (the Peedee Belemnite Limestone - PDB).

Carbon isotope analysis is most commonly used to identify the source of methane according to the following criteria (Fuex 1977):

$\delta^{13}C$ ‰ PDB	
-75 to -55	Biogenic methane
-58 to -40	Methane associated with oil
-40 to -25	Thermal methane

Source rock-crude oil correlations have been attempted by observing the change in $\delta^{13}C$ values of components of oils and rocks (Stahl 1977). Source rock extracts are usually isotopically heavier than the corresponding crude oil but are lighter than the asphaltenes of the oil and the kerogen of the rock (Hunt 1979). It has also been observed that marine organic carbon is generally isotopically heavier than contemporaneous terrestrial organic carbon (Tissot & Welte 1978). However, it should be noted that increasing maturity and biodegradation produce a shift toward heavier isotope values.

2.3.5 Gas Chromatography - Mass Spectrometry (GC/MS)

GC/MS analysis is normally performed on the branched and cyclic alkane fraction and/or the aromatic fraction of oils, condensates and sediment extracts. The specific fraction is first isolated and then injected into a gas chromatograph which is linked in series with a mass spectrometer. As compounds are eluted from the chromatography column they are bombarded with high energy electrons. This causes them to fragment into a number of ions each with a molecular weight less than that of the parent molecule. Individual compounds give a characteristic fragmentation pattern (mass spectrum), the major ions of which are presented in a series of mass fragmentograms [ie. plots of ion concentration against GC retention time].

GC/MS analysis can be carried out using one of the following modes of operation:

(i) Acquire mode - in which all ions (within a broad range) in each mass spectrum are memorised by the data system.

(ii) Selective Ion Monitoring (SIM) mode - in which only selected ions of interest are memorised by the data system.

2.3.5.1 GC/MS Analysis of Branched/Cyclic Alkanes

The group of compounds to be analysed is first isolated from the saturate fraction by refluxing the sample with activated 5Å molecular sieves in cyclohexane for 24 hours. Branched/cyclic alkanes, including alkylcyclohexanes, are recovered from the solvent by fractional distillation.
For condensates, and samples where information about alkylcyclochexanes is not required, the saturate fraction is passed through a small column packed with silicalite adsorbent. The branched/cyclic alkanes are recovered from the eluting solvent by fractional distillation.

Analysis is carried out in the SIM mode with a total of 33 ions being recorded over different time spans.

Operating conditions are:

Instrument:	5987HP GC mass spec data system
Column:	60m x 0.25mm ID cross linked methyl-silicone DB-1 (J&W) column of 0.25 micron film thickness connected directly to the ion source
Injector:	OCI-3 (SGE)
Carrier gas:	hydrogen
Oven Conditions:	50° to 274°C at 8°/min 274° to 280°C at 1°/min
EM Voltage:	2,000 - 2,300V
Electron Energy:	70eV
Source temperature:	250°C

GC/MS mass fragmentograms are examined for particular 'biomarker' compounds which can be related to biological precursors. These allow the characterisation of petroleum with regard to thermal maturity, source, depositional environment and biodegradation.

The significance of selected parameters from branched/cyclic GC/MS analysis is outlined below:

1. 18α (H)-hopane/17α (H)-hopane (Ts/Tm)

   Maturity indicator. The ratio of 18α (H) trisnorhopane to 17α (H) trisnorhopane increases exponentially with increasing maturity from approximately 0.2 at the onset to approximately 1.0 at the peak of oil generation, ie. Tm decreases with maturity. This parameter is not reliable in very immature samples.

2. C_{30} hopane/C_{30} moretane

   Maturity indicator. The conversion of C_{30} 17β, 21β hopane to 17β, 21α moretane is maturity dependent. Values increase from approximately 2.5 at the onset of oil generation to approximately 10. Once the hopane/moretane ratio has reached 10, no further changes occur. A value of 10 is believed to represent a maturity stage just after the onset of oil generation and hopane/moretane ratios are therefore useful mainly as indicators of immaturity in a qualitative sense.

3&4. C_{31} and C_{32} 22S/22R hopanes

   Maturity indicator. An equilibrium between the biological R- and the geological S- configuration occurs on mild thermal maturation. A ratio of S:R = 60:40, ie, a value of 1.5, characterises this equilibrium which occurs before the onset of oil generation. The C_{32} hopane pair is often more reliable for this purpose since co-elution sometimes affects the C_{31} ratio.

5. C_{29} 20S $\alpha\alpha\alpha/C_{29}$ 20R $\alpha\alpha\alpha$ steranes

Maturity indicator. Upon maturation, the biologically produced 20R stereoisomer is diminished relative to the 20S form and a stabilisation is reached at approximately 55% 20R and 45% 20S compounds. V_R equivalents are approximately 0.45% for a 20S/20R value of 0.2 and 0.8% for a 20S/20R value of 0.75. This parameter is most useful between maturity ranges equivalent to 0.4% to 1.0% V_R.

6. C_{29} 20S $\alpha\alpha\alpha/C_{29}$ 20R $\alpha\alpha\alpha$ + C_{29} 20S $\alpha\alpha\alpha$ steranes

Maturity indicator. This ratio is a different way of expressing the relative abundance of the biological 20R to the geological 20S normal sterane (see parameter 5). Expressed as a percentage, a value of about 25% indicates the onset of oil generation, and of about 50% the peak of oil generation.

7. C_{29} $\alpha\beta\beta/C_{29}$ $\alpha\alpha\alpha$ + C_{29} $\alpha\beta\beta$ steranes

Maturity indicator. The $\alpha\alpha$ form is produced biologically. Its abundance diminishes upon maturation until a mixture of 65% $\beta\beta$ (iso) steranes and 35% $\alpha\alpha$ (normal) steranes is reached, which is equivalent to approximately 0.9% V_R.

8&9. C_{27}/C_{29} diasteranes and steranes

Source indicator. It has been suggested that marine phytoplankton is characterised by a dominance of C_{27} steranes and diasteranes whereas a preponderance of C_{29} compounds indicates strong terrestrial contributions. Values smaller than 0.85 for C_{27}/C_{29} diasterane and sterane ratios are believed to be indicative for terrestrial organic matter, values between 0.85 and 1.43 for mixed organic material, and values greater than 1.43 for an input of predominantly marine organic matter.

It has been suggested, however, that marine sediments can also contain a predominance of C_{29} steranes, so the above rules have to be applied with caution. Any simplistic interpretation of C_{27}/C_{29} steranes and diasteranes can be dangerous and the interpretation of these data should be consistent with other geological evidence.

10. 18α (H) - oleanane/C_{30} hopane

Source indicator. Oleanane is a triterpenoid compound which has often been reported from deltaic sediments of Late Cretaceous to Tertiary age. It is thought to be derived from certain angiosperms which developed in the late Cretaceous. If the 18α (H) - oleanane/C_{30} hopane ratio is below 10, no significant proportions of oleanane are present. At higher values, it can be used as indicator for a reducing environment during deposition of land plant-derived organic matter.

11. C_{29} diasteranes/C_{29} $\alpha\alpha\alpha$ steranes + C_{29} $\alpha\beta\beta$ steranes

    Source indicator. This parameter is used to characterise the oxidity of depositional environments. High values (up to 10) indicate oxic conditions, low values (down to 0.1) indicate reducing environments.

12. C_{30} (hopanes + moretanes)/C_{29} (steranes + diasteranes)

    Source indicator. Triterpanes are believed to be of prokariotic (bacterial) origin, whereas steranes are derived from eukariotic organisms. This ratio reflects the preservation of primary organic matter derived from eukariots, relative to growth and preservation of bacteria in the sediment after deposition.

13. C_{15} drimane/C_{16} homodrimane

    Drimanes and homodrimanes are ubiquitous compounds most likely derived from microbial activity in sediments. The C_{15} drimane/C_{16} homodrimane ratio is a useful parameter for correlation purposes in the low molecular weight region, especially for condensates which lack most conventional biomarkers. Drimanes are also useful to assess the degree of biodegradation as the removal of C_{15} to C_{16} bicyclics characterises an extensive level of biodegradation.

14. Rearranged/normal drimanes

    Like parameter 13, this ratio can be used for correlation purposes in samples without conventional biomarkers, and to assess levels of biodegradation.

15. C_{15} alkylcyclohexane/C_{16} homodrimane

    Like parameters 13 and 14, this ratio is useful for correlation purposes.

2.3.5.2 GC/MS Analysis of Aromatics

The aromatic fraction or the oil to be analysed is first subjected to thin layer chromatography (TLC) or medium pressure liquid chromatography (MPLC), depending upon the analytical requirements.

1. Di- and tri- nuclear aromatic compounds are isolated by TLC. To effect this separation, the sample is applied to an alumina coated glass plate (0.6mm thickness). The plate is developed with hexane and the required band located using short wavelength UV light. The fraction is recovered by extraction and fractional distillation.

   This aromatic fraction may be analysed by GC-FID, but GC/MS is recommended because of possible co-elution problems during GC.

   Samples are analysed by GC/MS in the aquire mode scanning from 50 to 450 atomic mass units (amu).

Analytical conditions are:

Instrument: HP5970 MSD
Column: 60m x 0.25mm ID, 0.25 micron film thickness, 5% phenylmethyl silicone column DB-5 (J&W) connected directly to the ion source
Injector: automatic on-column
Carrier Gas: helium
Oven Conditions: 70°C for 1min
70°C --> 300°C at 3°/min
Data collection commences at 10 mins
Mass Spectrometry
Em Voltage 1500 - 1800V
Electron Energy 70eV

Mass fragmentograms are presented for alkylbiphenyls, alkylnaphthalenes, alkylfluorenes and alkylphenanthrenes from a comprehensive data base. Aromatic compounds provide valuable information concerning thermal maturity since they can be applied outside the dynamic range of saturate biomarker indicators and are particularly useful when conventional biomarkers are present in low amounts (Radke & Welte, 1983; Alexander et al, 1985). Maturity ratios are tabled below:

Aromatic Maturity Indicators

Abbrev.	Definition	Range oil onset	Range wet gas
DNR 1	(2,6DMN + 2,7DMN)/1,5DMN	1.5	10
DNR 2	2,7DMN/1,8DMN	50	2500
DNR 5	1,6DMN/1,8DMN	50	>3000
DNR 6	(2,6DMN + 2,7DMN)/(1,4DMN + 2,3 DMN)	0.8	2
TNR 1	(1,4,6TMN + 1,3,5TMN)/2,3,6TMN	0.5	4
MPR 1	(2MP + 3MP)/1MP	1.5	3
MPI 1	1.5 x (2MP + 3MP)/(PH + 1MP + 9MP)	0.3	1
MPI 2	(3 x 2MP)/(PH + 1MP + 9MP)	0.3	2
Rc(a)	0.6 (MPI-1) + 0.4 (for % Rm <1.35)		
Rc(b)	-0.6 (MPI-1) + 2.3 (for % Rm ≥1.35)		

(from Radke et al, 1982; Radke & Welte, 1983; Alexander et al, 1985)

Some aromatic marker compounds have specific natural product precursors and can be used as signatures for sediments of a particular source, depositional environment or geological age:

TNR 5	1,2,5TMN/1,3,6TMN	
TNR 6	1,2,7TMN/1,3,7TMN	(Strachan et al, 1988)
1,7/X	1,7DMP/(1,3 + 3,9 + 2,10 + 3,10 DMP)	
Retene/9MP		
1MP/9MP		(Alexander et al, 1988)

2. Mono- and triaromatic steranes are analysed by GC/MS under the same analytical conditions as used for di- and tri-nuclear aromatics. However, isolation of this fraction is performed by MPLC. To achieve this, the saturate plus aromatic mixture is injected onto a Merck Si60 column. The separation is monitored with a refractive index detector for saturates and a UV absorbance detector for aromatics.

   As aromatic steranes are generally present in low abundances, especially in oils, samples are analysed in the SIM mode and 16 ions are recorded.

   The conversion of monoaromatic steranes to triaromatic steranes and the dimethylation of triaromatic steranes in sediments are considered to be maturity dependent (Mackenzie et al, 1981; Mackenzie, 1984). The triaromatic sterane maturity indicator should, however, not be applied to crude oils because migration effects appear to selectively deplete the triaromatic steranes.

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5 PALYNOLOGICAL DATA REPORT

291341

PALYNOLOGICAL ANALYSIS OF CUTTINGS SAMPLES FROM FLINDERS-1, BASS BASIN

by

ALAN D. PARTRIDGE
and
ROGER MORGAN

BIOSTRATA REPORT 1993/7

24 MARCH 1993

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INTRODUCTION

Nineteen cuttings samples from the Eastern View Coal Measures sequence in Flinders-1 have been analysed for palynological age dating. Three samples were initially examined and age dated by Roger Morgan (letter 16 December 1993) while the remainder were examined by Alan Partridge and results given in a provisional report (3 March 1993). Full details of analyses are here presented in this final report which is divided into Interpreted and Basic Data sections.

The cuttings samples, which were preferentially collected from shales (letter from R.J. Willink, 27 January 1993) gave mostly high residue yields, but unfortunately palynomorph concentrations on the palynological slides were only moderate to low and occasionally very low. Palynomorph preservation overall was very poor. The poorest preservation and lowest yields are from the samples between 1702-2304m from which the interpreted *insitu* palynomorphs are all carbonised or thermally mature, presumably due to heating associated with the volcanic intrusion identified between 2207-2272m. The well preserved palynomorphs from the seven samples over this carbonised interval are all interpreted as caved.

Spore-pollen diversity overall was moderate averaging 17+ species per sample while total diversity was 85+ species including 5+ reworked species. Microplankton diversity was very low with an average of less than 3 species per sample. Although a total of 18 microplankton species are recorded on the range chart most specimens are caved from higher in the sequence. Because caved palynomorphs were recorded in all samples it is likely that the *insitu* diversity is somewhat lower than is apparent from the assemblages recorded on the range chart.

The spore-pollen zones identified in Flinders-1 are given in the following summary and on the Palynology Data Sheet. Interpretive data consisting of zone identification, confidence ratings, ages and comments are given in Table-1 and the basic data on residue yields, preservation and diversity for individual samples is given in Table-2. All species identified with binomial names are tabulated on the range chart. The chart is sorted firstly by highest appearance, then by spore-pollen not carbonised (1-73); spore-pollen "dark" or carbonised (74-97); reworked spore-pollen (98-102) and finally microplankton (103-120).

PALYNOLOGICAL SUMMARY OF FLINDERS-1

AGE	UNIT	SPORE-POLLEN ZONES	DEPTHS (mKB)
MIDDLE EOCENE	EASTERN VIEW COAL MEASURES	Lower *N. asperus*	1602
EOCENE		(Indeterminate)	(1702-2304)
EARLY EOCENE		Lower *M. diversus*	2365.5-2417
PALEOCENE		Upper *L. balmei*	2461
PALEOCENE		Lower *L. balmei*	2504-2688.5

GEOLOGICAL COMMENTS

1. The most notable feature of the sequence analysed by palynology in Flinders-1 is the carbonised interval between 1702-2304m. Assemblages from this interval could only be assigned a broad Eocene age. Although the sample at 1906m is no older than the Middle *M. diversus* it is most likely a zone or two younger. The thermal maturity of the kerogen, including the palynomorphs, through this section probably relates to heating associated with the igneous intrusion identified between 2207-2272m.

   A similar thermally mature interval within the Eocene part of the Eastern View Coal Measures was recorded in Pipipa-1 drilled in 1982 to the west of the Pelican field to a T.D. (total depth) of 2115m. The carbonised interval in Pipipa-1 was analysed by palynology from 18 sidewall cores between 1668-2105m. None of the samples could be assigned to a zone but a very limited assemblage recorded at 1999m suggested an Eocene age no older than the Lower *M. diversus* Zone (Stacy, Partridge & Stevens, 1982).

2. The deepest sample at 2688.5m analysed in Flinders-1 is no older than the Early Paleocene Lower *L. balmei* Zone. Although no index species for the Lower subdivision of the *L. balmei* Zone were recorded in the seven deepest samples they can be referred to this zone on their stratigraphic position **below** the confident identification of the Lower *L. balmei* Zone at 2504m.

3. Although microplankton were recorded from a majority of samples only the shallowest at 1602m contained a suite of dinoflagellates which could be interpreted as indicating a marine incursion. Eight species were recorded with *Cordosphaeridium inodes* the commonest. Unfortunately the assemblage lacks the index species diagnostic of the Gippsland Basin zones of Partridge (1976). In the underlying samples the majority of specimens recorded were considered caved from higher levels in the well. Interpreted *insitu* forms principally comprised species typical of interbedded coal measure facies such as

Apectodinium spp. and *Paralecaniella indentata* whose environment distribution probably extends into brackish water facies, and probable freshwater forms such as *Saeptodinium* sp., *Morkallacysta* sp. and *Pseudoschizea circula*.

4. A possible "mangrove" spore-pollen association was recorded from 2417m. The diagnostic forms were several specimens of *Spinizonocolpites prominatus* whose recent affinity is with the *Nypa* palm associated with the spore *Polypodiaceoisporites varus* ms whose affinity is with the spore genus *Pteris*. Within the Lower *M. diversus* Zone in the Gippsland Basin both species are typically recorded from the *Apectodinium hyperacanthum* dinoflagellate Zone incursion of Partridge (1976). A possible correlation to this horizon is suggested for the sample at 2417m in Flinders-1.

BIOSTRATIGRAPHY

Zone and age determinations are based on the Gippsland Basin spore-pollen zonation scheme proposed by Stover & Partridge (1973), partially modified by Stover & Partridge (1982) and Helby, Morgan & Partridge (1987). Other modifications to this scheme and local spore-pollen ranges applicable to the Bass Basin are provided by Partridge (1973). Although dinoflagellates were recorded in the samples none of the assemblages could be confidently correlated to any of the dinoflagellate zones recognised in the adjacent Gippsland Basin (Partridge 1975, 1976).

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), Partridge (1973), or Helby, Morgan & Partridge (1987). For the other rarer species as well as most of the new genus/species name combinations the principal references are Dettmann & Jarzen (1988), Germeraad, Hopping & Muller (1968), Harris (1965) and Mildenhall & Pocknall (1989). Author citations for the dinoflagellates can be found in the indexes of Lentin & Williams (1985, 1989).

Species names followed by "ms" are unpublished manuscript names, most of which can be found in Partridge (1973). For some species there are dual entries on the range chart. Those species tagged as "dark" are considered to be *insitu* in the carbonised interval between 1702-2304m.

Lower *Nothofagidites asperus* Zone: 1602 metres **Middle Eocene.**

Because all samples are cuttings it is particularly difficult in the shallowest sample at 1602m to be confident which species recorded are caved and which are *insitu*. A Lower *N. asperus* Zone age is preferred because of the relative high numbers of *Haloragacidites harrisii* which occur in equal

or greater numbers than *Nothofagidites* spp. in the assemblage. Negative evidence supporting the zone assignment is the absence of key species of the Middle *N. asperus* Zone. Although *Proteacidites tuberculatus* is known to range as low as the Middle *N. asperus* Zone in the Bass Basin (Partridge, 1973) it is more typical of younger zones. At 1602m it is almost certainly caved. Also caved is the rare species *Corsinipollenites epilobioides* Krutzsch 1968 (see Mildenhall & Pocknall, 1989) which is more typical of Oligocene age strata.

Species suggesting an age no older than the Lower *N. asperus* Zone are *Nothofagidites falcatus, Proteacidites recavus* and *P. scitus.*

The dinoflagellates recorded support a Middle Eocene age but are not diagnostic of currently defined zones.

Indeterminate Interval: 1702-2304 metres **Eocene.**

The seven samples over this interval contained mixed assemblages of "light" and "dark" fossils. Only the "dark" carbonised palynomorphs are considered to be *insitu* and representative of the age of this interval. The total assemblage of "dark" palynomorphs supports an Eocene age but there were few species identified which allow any possible zone assignment. Those are the pollen *Polycolporopollenites esobalteus* at 1906m which indicates a zone assignment no older than the Middle *M. diversus* Zone whilst the dinoflagellate *Apectodinium homomorphum* (long spined variety) suggests a spore-pollen equivalent age no younger than the *P. asperopolus* Zone. As the limits of these species ranges creates a contradiction a broader Eocene age is preferred.

Lower *Malvacipollis diversus* Zone: 2365.5-2417 metres **Early Eocene.**

Of the two samples assigned to the Lower *M. diversus* Zone the shallowest is no younger based on the LAD (Last Appearance Datum) of *Peninsulapollis gillii* which ranges no younger than this zone according to the synthesised range chart in Partridge (1973). The deeper sample is assigned to the zone on the occurrence of frequent *Proteacidites grandis*, frequent *Spinizonocolpites prominatus* and *Polypodiaceoisporites varus* ms. The last two species are considered indicative of a mangrove association and suggest the presence of mangrove environments in this part of the Early Eocene. The presence of rare *Lygistepollenites balmei* is consistent with a position near the base of the Lower *M. diverus* Zone.

Upper *Lygistepollenites balmei* Zone: 2461 metres Late Paleocene.

The top of the Paleocene and top of the Upper *L. balmei* Zone is identified on the youngest frequent to common occurrence of *Lygistepollenites balmei* which occurs in cuttings at 2461m. The sample also contains *Polycolpites langstonii* which occurs no younger than this zone, whilst the presence of *Cyathidites gigantis* and *Proteacidites incurvatus* suggest an age no older than this zone.

Lower *Lygistepollenites balmei* Zone: 2504-2688.5 metres Early Paleocene.

Only the shallowest cuttings at 2504m can be assigned with confidence to the Lower subdivision of the *L. balmei* Zone based on the presence of *Tetracolporites verrucosus*. The other seven samples only contain indicator species indicative of the broader *L. balmei* Zone. They can however be considered no younger than the Lower subdivision based on superposition and are certainly no older. Distinctive spore-pollen from this interval include *Lygistepollenites balmei, Gambierina rudata, Peninsulapollis gillii* and *Polycolpites langstonii*.

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TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA FOR FLINDERS-1, BASS BASIN.

SAMPLE TYPE	DEPTH (M)	SPORE-POLLEN ZONE	*CR RTG	AGE	COMMENTS
Cuttings	1602	Lower *N. asperus*	3	Middle Eocene	Maximum age.
Cuttings	1702	Indeterminate		Eocene	*Insitu* fossils carbonised.
Cuttings	1790	Indeterminate		Eocene	*Insitu* fossils carbonised.
Cuttings	1906	Middle *M. diversus* or younger		Eocene	Oldest occurrence *Polycolporopollenites esobalteus*.
Cuttings	2071	Indeterminate		Eocene	Dark *Pseudoschizea circula*.
Cuttings	2125	Indeterminate		Eocene	
Cuttings	2155	Indeterminate		Early Eocene	LAD *Apectodinium homomorphum* (long spines).
Cuttings	2304	Indeterminate		Indeterminate	Very poor sample.
Cuttings	2365.5	Lower *M. diversus*	3	Early Eocene	LAD *Peninsulapollis gillii*.
Cuttings	2417	Lower *M. diversus*	3	Early Eocene	Frequent *Proteacidites grandis*.
Cuttings	2461	Upper *L. balmei*	3	Paleocene	LAD *Polycolpites langstonii*.
Cuttings	2504	Lower *L. balmei*	3	Paleocene	LAD *Tetracolporites verrucosus*.
Cuttings	2547	*L. balmei*	3	Paleocene	*Gambierina rudata* present.
Cuttings*	2559	*L. balmei*	3	Paleocene	
Cuttings*	2568	*L. balmei*	3	Paleocene	
Cuttings*	2583	*L. balmei*	3	Paleocene	*P. langstonii* present.
Cuttings	2607	*L. balmei*	3	Paleocene	*P. langstonii* present.
Cuttings	2675.5	*L. balmei*	3	Paleocene	Common *Lygistepollenites balmei*.
Cuttings	2688.5	*L. balmei*	3	Paleocene	Not older than Lower *L. balmei*.

* Microscope examination by Roger Morgan

*CR RTG = Confidence Ratings
FAD = First Appearance Data
LAD = Last Appearance Data

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PALYNOLOGY DATA SHEET

BASIN: BASS **ELEVATION:** **KB:** _____ **GL:** _____

WELL NAME: FLINDERS-1 **TOTAL DEPTH:** _____

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA				LOWEST DATA			
		Preferred Depth	Rtg	Alternate Depth	Rtg	Alternate Depth	Rtg	Preferred Depth	Rtg
NEOGENE	*T. pleistocenicus*								
	M. lipsis								
	C. bifurcatus								
	T. bellus								
	P. tuberculatus								
PALEOGENE	Upper *N. asperus*								
	Middle *N. asperus*								
	Lower *N. asperus*	1602	3					1602	3
	P. asperopolus								
	Upper *M. diversus*								
	Middle *M. diversus*								
	Lower *M. diversus*	2365.5	3					2417	3
	Upper *L. balmei*	2461	3					2461	3
	Lower *L. balmei*	2504	3					2688.5	3
LATE CRETACEOUS	Upper *T. longus*								
	Lower *T. longus*								
	T. lilliei								
	N. senectus								
	T. apoxyexinus								
	P. mawsonii								
	A. distocarinatus								
EARLY CRET.	*P. pannosus*								
	C. paradoxa								
	C. striatus								
	C. hughesii								
	F. wonthaggiensis								
	C. australiensis								

COMMENTS: Carbonised samples between 1702-2304m are Eocene in age but assemblages cannot be confidently assigned to zones.

All depths in metres.

CONFIDENCE RATING:

0: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.

1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.

2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen and/or microplankton.

4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE:

If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: A.Partridge **DATE:** 24 March 1993

DATA REVISED BY: _____ **DATE:** _____

BASIC DATA

TABLE 2: BASIC PALYNOLOGICAL DATA

PALYNOLOGY RANGE CHART
(ATTACHMENT)

TABLE-2: BASIC PALYNOLOGICAL DATA FOR FLINDERS-1, BASS BASIN.

SAMPLE TYPE	DEPTH (M)	YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	No S/P SPECIES*	MICROPLANKTON ABUNDANCE	No. MP SPECIES	COMMENTS
Cuttings	1602	High	Moderate	Fair-good	29	Frequent	8	Significant cavings.
Cuttings	1702	High	Low	Fair-good	12	Very rare	1	Highest carbonised fossils.
Cuttings	1790	High	Moderate	Poor-good	21	Rare	4	Mostly caved fossils.
Cuttings	1906	High	Low	Poor-good	15	Rare	3	Mixed light & dark fossils.
Cuttings	2071	Moderate	Low	Poor-good	10	Rare	4	Mostly caved fossils.
Cuttings	2125	High	Low	Poor	11	Very rare	2	Mostly caved fossils.
Cuttings	2155	Moderate	Very low	Very poor-fair	10	Very rare	2	Mainly carbonised fossils.
Cuttings	2304	High	Very low	Very poor	2	Very rare	1	Base of carbonised fossils.
Cuttings	2365.5	High	Moderate	Poor-good	23	Rare	5	Incoming of new assemblage.
Cuttings	2417	High	Moderate	Poor-fair	24	Very rare	3	Sample approximately *insitu*.
Cuttings	2461	High	Moderate	Poor-fair	27	Very rare	1	Some Eocene cavings.
Cuttings	2504	High	Moderate	Fair	24	Very rare	1	Frequent *L. balmei*.
Cuttings	2547	High	Moderate	Poor-fair	26	Rare	2	Obvious Eocene cavings.
Cuttings*	2559	High	Moderate	Poor-fair	13	Rare	1	
Cuttings*	2568	High	Moderate	Poor-fair	21	Rare	2	Some Eocene cavings.
Cuttings*	2583	High	Moderate	Poor-fair	14	Rare	2	
Cuttings	2607	High	Low	Poor	23	Very rare	1	
Cuttings	2675.5	High	Low	Poor	16	Very rare	1	Some fossils caved.
Cuttings	2688.5	High	Moderate	Poor-fair	13	NR		*Cyath. splendens* common.

* Microscope analysis by Roger Morgan.

* Diversity:
Very Low = 1- 5 species
Low = 6-10 species
Moderate = 11-25 species
High = 26-74 species
Very High = 75+ species

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TABLE 1

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ROCK-EVAL PYROLYSIS DATA (one run)

FLINDERS 1 Feb-93

DEPTH (m)	TMAX	S1	S2	S3	S1 + S2	S2/S3	PI	PC	TOC	HI	OI
1624.0	452	1.57	6.75	0.66	8.32	10.23	0.19	0.69	10.90	62	6
1651.0	434	0.14	0.38	0.39	0.52	0.97	0.27	0.04	1.20	32	33
1739.0	548	0.51	1.23	0.44	1.74	2.80	0.29	0.14	15.80	8	3
1911.5	549	1.93	5.27	0.98	7.20	5.38	0.27	0.60	58.90	9	2
1981.0	520	1.38	3.84	1.10	5.22	3.49	0.26	0.43	9.50	40	12
2081.0	530	0.52	1.10	0.52	1.62	2.12	0.32	0.13	2.60	42	20
2125.0	479	0.65	1.12	0.88	1.77	1.27	0.37	0.15	2.10	53	42
2143.0	539	1.07	2.29	1.01	3.36	2.27	0.32	0.28	8.20	28	12
2155.0	493	0.48	0.89	1.40	1.37	0.64	0.35	0.11	2.60	34	54
2178.0	411	0.57	0.54	0.37	1.11	1.46	0.51	0.09	11.00	5	3
2304.5	485	0.71	1.14	0.36	1.85	3.17	0.38	0.15	2.35	49	15
2344.0	457	3.80	6.03	1.72	9.83	3.51	0.39	0.82	6.60	91	26
2363.0	449	2.06	5.04	5.17	7.10	0.97	0.29	0.59	5.10	99	101
2397.5	434	1.58	11.22	1.58	12.80	7.10	0.12	1.06	6.00	187	26
2417.0	440	1.12	6.19	2.34	7.31	2.65	0.15	0.61	3.95	157	59
2456.0	439	0.35	2.07	1.54	2.42	1.34	0.14	0.20	1.40	148	110
2461.0	433	1.16	11.57	1.67	12.73	6.93	0.09	1.06	5.55	208	30
2504.0	436	4.95	62.27	1.68	67.22	37.07	0.07	5.58	24.90	250	7
2511.0	436	0.61	4.46	1.35	5.07	3.30	0.12	0.42	2.50	178	54
2547.0	440	0.44	1.61	2.38	2.05	0.68	0.21	0.17	2.10	77	113
2553.0	441	0.31	1.16	1.63	1.47	0.71	0.21	0.12	1.45	80	112
2599.0	434	0.37	3.77	1.30	4.14	2.90	0.09	0.34	2.55	148	51
2607.0	437	0.31	2.73	2.22	3.04	1.23	0.10	0.25	2.05	133	108
2672.5	436	1.33	6.63	3.73	7.96	1.78	0.17	0.66	4.05	164	92
2675.5	436	1.15	6.46	2.89	7.61	2.24	0.15	0.63	4.05	160	71
2681.5	439	4.80	39.02	2.13	43.82	18.32	0.11	3.64	17.00	230	13
2688.5	442	0.14	0.90	1.97	1.04	0.46	0.13	0.09	0.74	122	266

TMAX = Max. temperature S2 S1 = Volatile hydrocarbons (HC) S2 = HC generating potential

S1 + S2 = Potential yield S3 = Organic carbon dioxide PI = Production index

PC = Pyrolysable carbon TOC = Total organic carbon HI = Hydrogen index

OI = Oxygen Index nd = no data

GEOTECHNICAL SERVICES PTY LTD

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Rock-Eval Pyrolysis Data (One Run)

Flinders 1

DEPTH (m)	TMAX	S1	S2	S3	S1 + S2	S2/S3	PI	PC	TOC	HI	OI
1623-1626	452	1.57	6.75	0.66	8.32	10.23	0.19	0.69	10.90	62	6
1650-1653	434	0.14	0.38	0.39	0.52	0.97	0.27	0.04	1.20	32	33
1737-1740	548	0.51	1.23	0.44	1.74	2.80	0.29	0.14	15.80	8	3
1911-1914	549	1.93	5.27	0.98	7.20	5.38	0.27	0.60	58.90	9	2
1980-1983	520	1.38	3.84	1.10	5.22	3.49	0.26	0.43	9.50	40	12
2079-2082	530	0.52	1.10	0.52	1.62	2.12	0.32	0.13	2.60	42	20
2124-2127	479	0.65	1.12	0.88	1.77	1.27	0.37	0.15	2.10	53	42
2142-2145	539	1.07	2.29	1.01	3.36	2.27	0.32	0.28	8.20	28	12
2154-2157	493	0.48	0.89	1.40	1.37	0.64	0.35	0.11	2.60	34	54
2178-2181	411	0.57	0.54	0.37	1.11	1.46	0.51	0.09	11.00	5	3
2304-2307	485	0.71	1.14	0.36	1.85	3.17	0.38	0.15	2.35	49	15
2343-2346	457	3.80	6.03	1.72	9.83	3.51	0.39	0.82	6.60	91	26
61-2364	449	2.06	5.04	5.17	7.10	0.97	0.29	0.59	5.10	99	101
2397-2400	434	1.58	11.22	1.58	12.80	7.10	0.12	1.06	6.00	187	26
2415-2418	440	1.12	6.19	2.34	7.31	2.65	0.15	0.61	3.95	157	59
2454-2457	439	0.35	2.07	1.54	2.42	1.34	0.14	0.20	1.40	148	110
2460-2463	433	1.16	11.57	1.67	12.73	6.93	0.09	1.06	5.55	208	30
2502-2505	436	4.95	62.27	1.68	67.22	37.07	0.07	5.58	24.90	250	7
2511-2514	436	0.61	4.46	1.35	5.07	3.30	0.12	0.42	2.50	178	54
2547-2550	440	0.44	1.61	2.38	2.05	0.68	0.21	0.17	2.10	77	113
2553-2556	441	0.31	1.16	1.63	1.47	0.71	0.21	0.12	1.45	80	112
2598-2601	434	0.37	3.77	1.30	4.14	2.90	0.09	0.34	2.55	148	51
2607-2610	437	0.31	2.73	2.22	3.04	1.23	0.10	0.25	2.05	133	108
2670-2673	436	1.33	6.63	3.73	7.96	1.78	0.17	0.66	4.05	164	92
2673-2676	436	1.15	6.46	2.89	7.61	2.24	0.15	0.63	4.05	160	71
2679-2682	439	4.80	39.02	2.13	43.82	18.32	0.11	3.64	17.00	230	13
2688-2691	442	0.14	0.90	1.97	1.04	0.46	0.13	0.09	0.74	122	266

TMAX = Max temperature S2
S1 = Volatile hydrocarbons (HC)
S2 = HC generating potential
S1 + S2 = Potential yield
S3 = Organic carbon dioxide
PI = Production index
PC = Pyrolysable carbon
TOC = Total organic carbon
HI = Hydrogen index

OR-0298 Appendix 5

PALYNOLOGY RANGE CHART FOR FLINDERS-1, BASS BASIN.

29135

Format: Relative Abundance By Highest Appearance

Key to Symbols

W = REWORKING
D = CONTAMINATION
X = PRESENT
R = RARE
F = FREQUENT
C = COMMON
A = ABUNDANT
? = Questionably Present
. = Not Present

SPECIES LOCATION INDEX

CHART COLUMN	SPECIES
116	APECTODINIUM HOMOMORPHUM (dark)
117	APECTODINIUM SP. INDENT.
1	ARAUCARIACITES AUSTRALIS
86	ARAUCARIACITES AUSTRALIS (dark)
111	AREOSPHAERIDIUM SP. AFF. CAPRICORNUM
46	AUSTRALOPOLLIS OBSCURUS
2	BACULATISPORITES SPP.
3	BEAUPREAIDITES TRIGONALIS MS
4	BEAUPREAIDITES VERRUCOSUS
91	CLAVIFERA TRIPLEX (dark)
103	CORDOSPHAERIDIUM INODES
5	CORSINIPOLLENITES EPILOBIOIDES
55	CRASSIRETITRILETES VANRAADSHOOVENII
78	CUPANIEIDITES ORTHOTEICHUS (dark)
102	CYATHIDITES AUSTRALIS
47	CYATHIDITES GIGANTIS
6	CYATHIDITES PALEOSPORA
7	CYATHIDITES SPLENDENS
80	CYATHIDITES SPLENDENS (dark)
39	DACRYCARPITES AUSTRALIENSIS
104	DEFLANDREA PHOSPHORITICA
105	DEFLANDREA SPP.
8	DICOTETRADITES CLAVATUS
9	DILWYNITES GRANULATUS
87	DILWYNITES GRANULATUS (dark)
92	DILWYNITES TUBERCULATUS (dark)
120	DISTATODINIUM SP.
42	DRYPTOPOLLENITES SEMILUNATUS
106	DYPHES COLLIGERUM
32	ERICIPITES CRASSIEXINUS
63	GAMBIERINA RUDATA
10	GLEICHENIIDITES CIRCINIDITES
93	GLEICHENIIDITES CIRCINIDITES (dark)
101	GRANULATISPORITES TRISINUS
11	HALORAGACIDITES HARRISII
74	HALORAGACIDITES HARRISII (dark)
64	HERKOSPORITES ELLIOTTII
48	INTEGRICORPUS ANTIPODUS MS
56	ISCHYOSPORITES GREMIUS
12	ISCHYOSPORITES IRREGULARIS MS
13	KUYLISPORITES WATERBOLKI
14	LAEVIGATOSPORITES MAJOR
15	LAEVIGATOSPORITES OVATUS
88	LAEVIGATOSPORITES OVATUS (dark)
68	LATROBOSPORITES AMPLUS
57	LATROBOSPORITES CRASSUS
114	LINGULODINIUM MACHAEROPHORUM
49	LYGISTEPOLLENITES BALMEI
16	LYGISTEPOLLENITES FLORINII
33	MALVACIPOLLIS DIVERSUS
89	MALVACIPOLLIS DIVERSUS (dark)
17	MALVACIPOLLIS SUBTILIS
65	MATONISPORITES ORNAMENTALIS
81	MICROALATIDITES PALEOGENICUS (dark)
94	MICROCACHRYIDITES ANTARCTICUS (dark)
119	MORKALLACYSTA SPP.
58	NOTHOFAGIDITES BRACHYSPINULOSUS
79	NOTHOFAGIDITES BRACHYSPINULOSUS (dark)
43	NOTHOFAGIDITES DEMINUTUS
18	NOTHOFAGIDITES EMARCIDUS/HETERUS
66	NOTHOFAGIDITES ENDURUS
19	NOTHOFAGIDITES FALCATUS
20	NOTHOFAGIDITES FLEMINGII
75	NOTHOFAGIDITES FLEMINGII (dark)
31	NOTHOFAGIDITES GONIATUS
21	NOTHOFAGIDITES VANSTEENISII
112	OPERCULODINIUM CENTROCARPUM
107	PARALECANIELLA INDENTATA
95	PENINSULAPOLLIS GILLII (dark)
34	PERIPOROPOLLENITES DEMARCATUS
72	PERIPOROPOLLENITES POLYORATUS
73	PEROMONOLITES BOWENII
59	PEROTRILITES MAJOR
108	PHTHANOPERIDINIUM COMATUM
22	PHYLLOCLADIDITES MAWSONII
71	PHYLLOCLADIDITES VERRUCOSUS
98	PLICATIPOLLENITES SPP.
23	PODOCARPIDITES SPP.
76	PODOCARPIDITES SPP. (dark)
35	PODOSPORITES MICROSACCATUS
90	PODOSPORITES MICROSACCATUS (dark)
60	POLYCOLPITES LANGSTONII
82	POLYCOLPOROPOLLENITES ESOBALTEUS (dark)
50	POLYPODIACEOISPORITES VARUS MS
24	PROTEACIDITES ADENANTHOIDES
44	PROTEACIDITES ANNULARIS
51	PROTEACIDITES GRANDIS
96	PROTEACIDITES GRANDIS (dark)
61	PROTEACIDITES INCURVATUS
25	PROTEACIDITES LEIGHTONII
83	PROTEACIDITES LEIGHTONII (dark)
40	PROTEACIDITES PACHYPOLUS
26	PROTEACIDITES RECAVUS
45	PROTEACIDITES RECTOMARGINIS
52	PROTEACIDITES RECTUS
27	PROTEACIDITES SCITUS
28	PROTEACIDITES SPP.
84	PROTEACIDITES SPP. (dark)
29	PROTEACIDITES TUBERCULATUS
36	PROTEACIDITES TUBERCULOTUMULATUS MS
115	PSEUDOSCHIZAEA CIRCULA (dark)
99	RETITRILETES CIRCUMLUMENUS
37	RETITRILETES SPP.
85	RETITRILETES SPP. (dark)
118	SAEPTODINIUM SP.
109	SCHEMATOPHORA SPECIOSUS
110	SPINIFERITES SPP.
53	SPINIZONOCOLPITES PROMINATUS
54	STEREISPORITES (TRIPUNCTISPORIS) SP.
77	STEREISPORITES (TRIPUNCTISPORIS) SPP. (dark)
69	STEREISPORITES ANTIQUISPORITES
100	STRIATOPODOCARPIDITES CANCELLATUS
113	SYSTEMATOPHORA PLACACANTHUM
67	TETRACOLPORITES VERRUCOSUS
38	TRICOLPORITES ADELAIDENSIS
62	TRICOLPORITES MARGINATUS MS
41	TRIORITES MAGNIFICUS
70	VERRUCATOSPORITES SPECIOSUS
30	VERRUCOSISPORITES KOPUKUENSIS
97	VERRUCOSISPORITES KOPUKUENSIS (dark)

		1602	1702	1790	1906	2071	2125	2155	2304	2365.5	2417	2461	2504	2547	2559	2568	2583	2607	2675.5	2688.5
		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
		CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS	CUTTINGS*	CUTTINGS*	CUTTINGS*	CUTTINGS	CUTTINGS	CUTTINGS
1	ARAUCARIACITES AUSTRALIS	R	.	.	.	.	.	.	.	D	.	.	.	.	.	.	.	.	.	R
2	BACULATISPORITES SPP.	R	.	.	.	.	D	D	.	.	.	.	.	.	.	.	.	.	.	R
3	BEAUPREAIDITES TRIGONALIS MS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
4	BEAUPREAIDITES VERRUCOSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
5	CORSINIPOLLENITES EPILOBIOIDES	R	.	.	D	.	D	D	D	D	D	D	D	D	D	D	D	D	D	C
6	CYATHIDITES PALEOSPORA	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
7	CYATHIDITES SPLENDENS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
8	DICOTETRADITES CLAVATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
9	DILWYNITES GRANULATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
10	GLEICHENIIDITES CIRCINIDITES	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	C
11	HALORAGACIDITES HARRISII	R	.	D	.	.	.	D	.	.	.	.	.	.	.	.	.	.	.	R
12	ISCHYOSPORITES IRREGULARIS MS	R	.	D	.	.	.	D	.	.	.	.	.	.	.	.	.	.	.	R
13	KUYLISPORITES WATERBOLKI	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
14	LAEVIGATOSPORITES MAJOR	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
15	LAEVIGATOSPORITES OVATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
16	LYGISTEPOLLENITES FLORINII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
17	MALVACIPOLLIS SUBTILIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
18	NOTHOFAGIDITES EMARCIDUS/HETERUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
19	NOTHOFAGIDITES FALCATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
20	NOTHOFAGIDITES FLEMINGII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
21	NOTHOFAGIDITES VANSTEENISII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
22	PHYLLOCLADIDITES MAWSONII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
23	PODOCARPIDITES SPP.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
24	PROTEACIDITES ADENANTHOIDES	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
25	PROTEACIDITES LEIGHTONII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
26	PROTEACIDITES RECAVUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
27	PROTEACIDITES SCITUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
28	PROTEACIDITES SPP.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
29	PROTEACIDITES TUBERCULATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
30	VERRUCOSISPORITES KOPUKUENSIS	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	C
31	NOTHOFAGIDITES GONIATUS	F	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	F
32	ERICIPITES CRASSIEXINUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
33	MALVACIPOLLIS DIVERSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
34	PERIPOROPOLLENITES DEMARCATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
35	PODOSPORITES MICROSACCATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
36	PROTEACIDITES TUBERCULOTUMULATUS MS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
37	RETITRILETES SPP.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
38	TRICOLPORITES ADELAIDENSIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
39	DACRYCARPITES AUSTRALIENSIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
40	PROTEACIDITES PACHYPOLUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
41	TRIORITES MAGNIFICUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
42	DRYPTOPOLLENITES SEMILUNATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
43	NOTHOFAGIDITES DEMINUTUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
44	PROTEACIDITES ANNULARIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
45	PROTEACIDITES RECTOMARGINIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
46	AUSTRALOPOLLIS OBSCURUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
47	CYATHIDITES GIGANTIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
48	INTEGRICORPUS ANTIPODUS MS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
49	LYGISTEPOLLENITES BALMEI	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
50	POLYPODIACEOISPORITES VARUS MS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
51	PROTEACIDITES GRANDIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
52	PROTEACIDITES RECTUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
53	SPINIZONOCOLPITES PROMINATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
54	STEREISPORITES (TRIPUNCTISPORIS) SP.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
55	CRASSIRETITRILETES VANRAADSHOOVENII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
56	ISCHYOSPORITES GREMIUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
57	LATROBOSPORITES CRASSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
58	NOTHOFAGIDITES BRACHYSPINULOSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
59	PEROTRILITES MAJOR	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
60	POLYCOLPITES LANGSTONII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
61	PROTEACIDITES INCURVATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
62	TRICOLPORITES MARGINATUS MS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
63	GAMBIERINA RUDATA	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
64	HERKOSPORITES ELLIOTTII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
65	MATONISPORITES ORNAMENTALIS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
66	NOTHOFAGIDITES ENDURUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
67	TETRACOLPORITES VERRUCOSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
68	LATROBOSPORITES AMPLUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
69	STEREISPORITES ANTIQUISPORITES	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
70	VERRUCATOSPORITES SPECIOSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
71	PHYLLOCLADIDITES VERRUCOSUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
72	PERIPOROPOLLENITES POLYORATUS	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
73	PEROMONOLITES BOWENII	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
74	HALORAGACIDITES HARRISII (dark)	F	C	C	R	R	R	C	F	F	.	.	.	.	.	.	.	.	.	F
75	NOTHOFAGIDITES FLEMINGII (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
76	PODOCARPIDITES SPP. (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
77	STEREISPORITES (TRIPUNCTISPORIS) SPP. (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
78	CUPANIEIDITES ORTHOTEICHUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
79	NOTHOFAGIDITES BRACHYSPINULOSUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
80	CYATHIDITES SPLENDENS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
81	MICROALATIDITES PALEOGENICUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
82	POLYCOLPOROPOLLENITES ESOBALTEUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
83	PROTEACIDITES LEIGHTONII (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
84	PROTEACIDITES SPP. (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
85	RETITRILETES SPP. (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
86	ARAUCARIACITES AUSTRALIS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
87	DILWYNITES GRANULATUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
88	LAEVIGATOSPORITES OVATUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
89	MALVACIPOLLIS DIVERSUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
90	PODOSPORITES MICROSACCATUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
91	CLAVIFERA TRIPLEX (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
92	DILWYNITES TUBERCULATUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
93	GLEICHENIIDITES CIRCINIDITES (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
94	MICROCACHRYIDITES ANTARCTICUS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
95	PENINSULAPOLLIS GILLII (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
96	PROTEACIDITES GRANDIS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
97	VERRUCOSISPORITES KOPUKUENSIS (dark)	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
98	PLICATIPOLLENITES SPP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
99	RETITRILETES CIRCUMLUMENUS	.	.	.	.	.	.	.	W	.	.	.	.	.	.	.	.	.	.	.
100	STRIATOPODOCARPIDITES CANCELLATUS	.	.	.	.	.	.	.	W	.	.	.	.	.	.	.	.	.	.	.
101	GRANULATISPORITES TRISINUS	.	.	.	.	.	.	.	W	.	.	.	.	.	.	.	.	.	.	.
102	CYATHIDITES AUSTRALIS	.	.	.	.	.	.	.	W	.	.	.	.	.	.	.	.	.	.	.
103	CORDOSPHAERIDIUM INODES	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C
104	DEFLANDREA PHOSPHORITICA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
105	DEFLANDREA SPP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	F
106	DYPHES COLLIGERUM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
107	PARALECANIELLA INDENTATA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
108	PHTHANOPERIDINIUM COMATUM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
109	SCHEMATOPHORA SPECIOSUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
110	SPINIFERITES SPP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R
111	AREOSPHAERIDIUM SP. AFF. CAPRICORNUM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D
112	OPERCULODINIUM CENTROCARPUM	.	.	D	.	.	.	D	.	D	.	.	.	.	.	.	.	.	.	.
113	SYSTEMATOPHORA PLACACANTHUM	.	.	D	.	.	.	.	.	D	.	.	.	.	.	.	.	.	.	.
114	LINGULODINIUM MACHAEROPHORUM	.	.	.	.	D	.	.	.	.	.	R	.	.	.	.	.	.	.	.
115	PSEUDOSCHIZAEA CIRCULA (dark)	.	.	.	.	R	.	.	R	.	.	.	.	.	.	.	.	.	.	.
116	APECTODINIUM HOMOMORPHUM (dark)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
117	APECTODINIUM SP. INDENT.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
118	SAEPTODINIUM SP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
119	MORKALLACYSTA SPP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
120	DISTATODINIUM SP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

* Samples analysed by Roger Morgan.

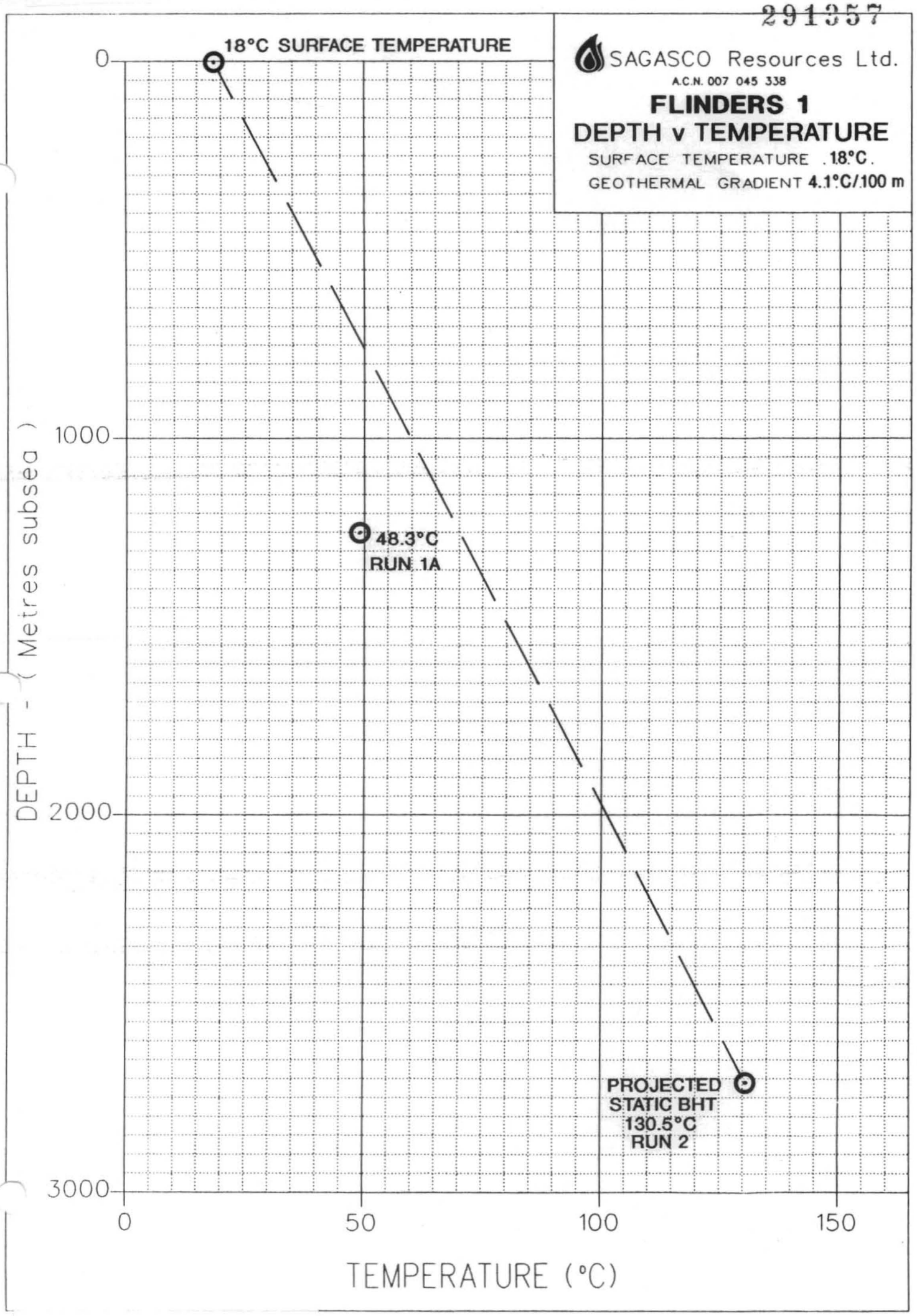
PREPARED BY:

Alan D. PARTRIDGE

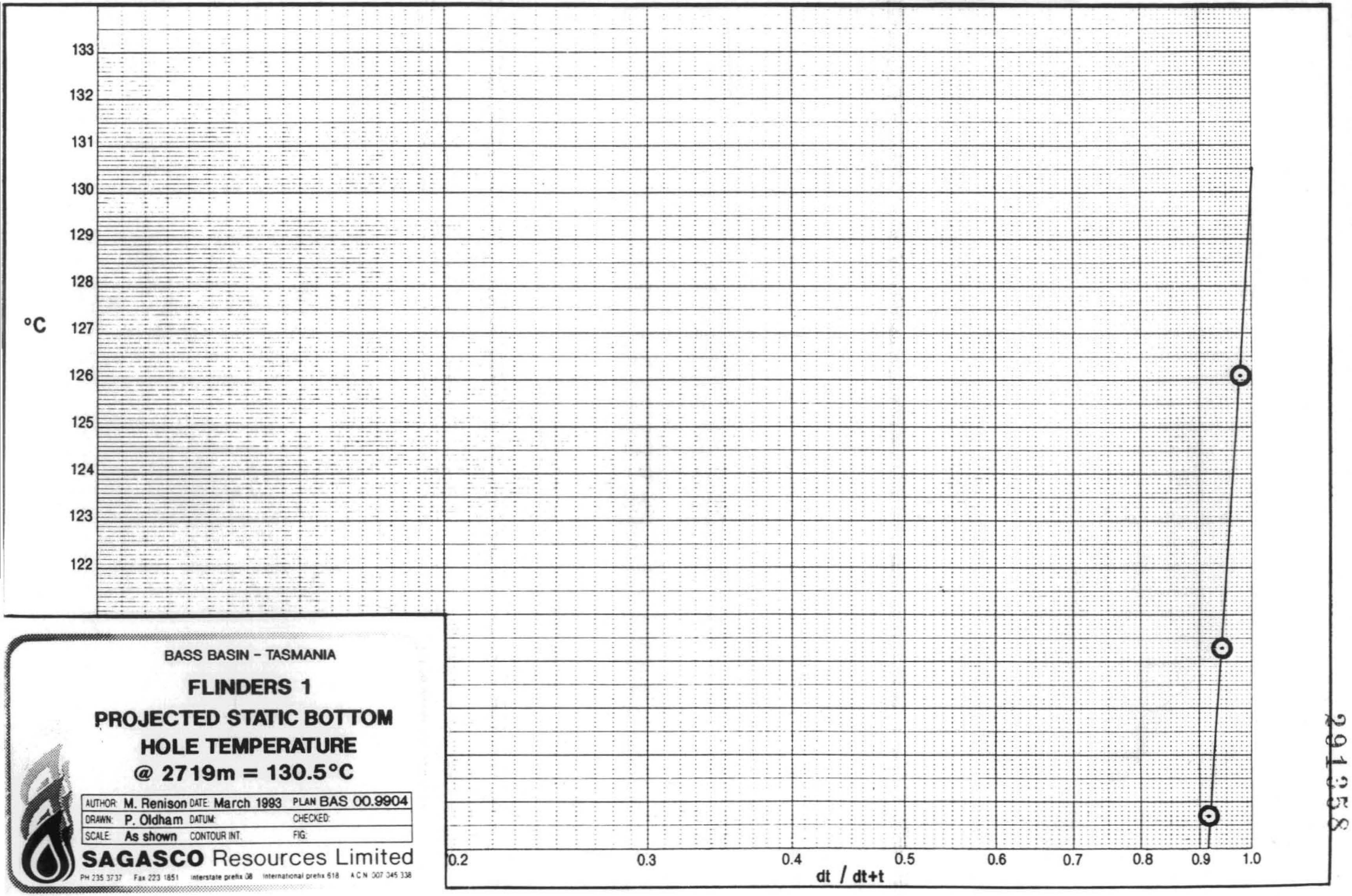
23 MARCH 1993

6 STATIC BHT EXTRAPOLATIONAL AND GEOTHERMAL GRADIENT

291357



BAS 00.9905



BASS BASIN - TASMANIA

FLINDERS 1

PROJECTED STATIC BOTTOM HOLE TEMPERATURE @ 2719m = 130.5°C

AUTHOR: M. Renison	DATE: March 1993	PLAN BAS 00.9904	
DRAWN: P. Oldham	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT.	FIG:	

SAGASCO Resources Limited

PH 235 3737 Fax 223 1851 Interstate prefix 08 International prefix 618 A.C.N. 007 045 338

291358

291359

7 SAMPLE COLLECTION AND STORAGE

RKY9301001-MJR

CATALOGUE OF WELLSITE SAMPLES

A 6 boxes of Washed and Dried, Split Samples.

Interval	Box No	Destination
408-2007m	1	SAGASCO
2007-2723m	2	SAGASCO
408-2007m	1	Bureau of Mineral Resources
2007-2723m	2	Bureau of Mineral Resources
408-2007m	1	Tasmanian Department of Mineral Resources
2007-2723m	2	Tasmanian Department of Mineral Resources

B 8 Boxes Washed and Dried Cutting Samples.

Interval	Box No	Destination
408-1010m	1	SAGASCO
1010-1608m	2	SAGASCO
1608-1842m	3	SAGASCO
1842-1980m	4	SAGASCO
1980-2160m	5	SAGASCO
2160-2340m	6	SAGASCO
2340-2550m	7	SAGASCO
2550-2723m	8	SAGASCO

C 2 Boxes of Unwashed Cutting Samples and Fission Track Samples

Interval	Box No	Destination
408-1840m	1	SAGASCO
1840-2723m	2	SAGASCO
Fission Track 8 x 1 kg	2	SAGASCO

D 1 Box of Flowline Mud Samples to SAGASCO.

E 1 Box of Samplex Trays to Gas and Fuel Exploration.
1 Box of Samplex Trays to Bridge Oil Ltd.