T.D.C FINAL REPORT

SHELL 31/2-4

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T.D.C REPORT

1) Proposal and Objectives
2) Summary
   - Progress chart and hole profile diagram
   - Deviation print out and plots
3) General well discussion by intervals:
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   b) 26" hole (17.5" bit + 26" H/O)
   c) 17.5" hole (opened to 26" , 20" casing)
      17.5" hole (opened to 22" , 16" liner)
   d) 12.25" hole(opened to 15.75",13.375"casing)
      12.25" hole(9.625" casing)
   e) 8.5" hole to TD;
4) Pressure regime in the reservoir
   - RFT report
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1/ Proposal and Objectives :

To drill an exploration well on Block 31/2 approximately 117 kms NW of Bergen on the eastern side of the Norwegian Trench at location 60° 51' 23.5" N , 03° 30' 45.6" E positioned with a diametric tolerance of 75 m .

Six objectives were proposed for the well :

a) To test for the presence of hydrocarbons in the Paleozoic and /or early Triassic formations in the structurally highest fault block of a deep structure in Block 31/2.

b) To test reservoirs,seals and source rocks of pre-Jurassic age.

c) To determine the age of the mapped 'D' horizon for a better understanding of the regional geological setting.

d) To test the Jurassic gas accumulation at a location of nearly maximum gross hydrocarbon column.

e) To test lateral variations in Jurassic reservoir characteristics.

f) To test the level where oil shows were observed in well 31/2-1 in a potentially better reservoir section.

Spud to T.D was expected to take 120 days including an extensive coring program commencing in the Lower Cretaceous-Upper Jurassic shales and continuing until at least one core had been taken below the hydrocarbon/water contact,additional coring to be carried out on occurence of good hydrocarbon shows elsewhere in the well,and one 18 m core to be taken at T.D.

A further 46 days were allocated for a production testing and abandonment programme.

The structure drilled is a tilted fault block lying between the Norwegian Platform and the Viking Graben .

The general axis of the structure lies NNW - SSE with subsequent NW-SE fault patterns.

Movement took place during the Kimmerian tectonic phase and post Jurassic sediments are relatively undisturbed.

A thick Tertiary and Quaternary sequence was expected to overlay a thin or possibly absent Cretaceous, with Kimmeridge clay covering the main Upper Jurassic reservoir.

Geological Prognosis

Formation Tops	Lithology	Depth TVBDF	Seismic Tolerance
Seabed (Quaternary-Eocene)	Clay, claystones with thin sands	360	
Eocene	Tuffaceous claystones	1195	+/-30
Palaeocene	Silty claystones	1225	+/-20
Late Kimmerian Unconformity		1355	+/-20
L.Cretaceous	Organic shales	1355	
Jurassic Sandstone Group			
Interval 4	Coarse, unconsolidated sandstones	1360	
Interval 3	Fine-medium, micaceous sandstones	1425	
Seismic Flatspot		1587	
Interval 2	Fine-coarse, massive sands	1660	+/-50
Interval 1	Sands, marls, claystones	1810	
Dunlin Unit Equivalent	Claystones with thin sandstones/siltstones	1905	
Statfjord Unit Equivalent	Fine medium sandstones thin claystones Coals at base	2095	
Statfjord Coals Marker Horizon		2255	+/-50
Triassic Red Beds	Claystones/thinsand-stones	2255	
Palaeozoic ?		3425	+/-150

TD 5025m BDF if Palaeozoic not penetrated before.

2) Summary

The semi- submersible drilling rig "Borgny Dolphin"(Aker H3) was positioned at the location on the 29th August 1980, and 31/2-4 was spudded on the 1st of September.

The well was suspended between the 10th of September and the 4th of October whilst the "Borgny Dolphin" killed 34/10-10 for Statoil.

A total depth of 5035m was reached on the 23rd of March 1981, and the well took atotal of 180 days to drill.

54 bits were used

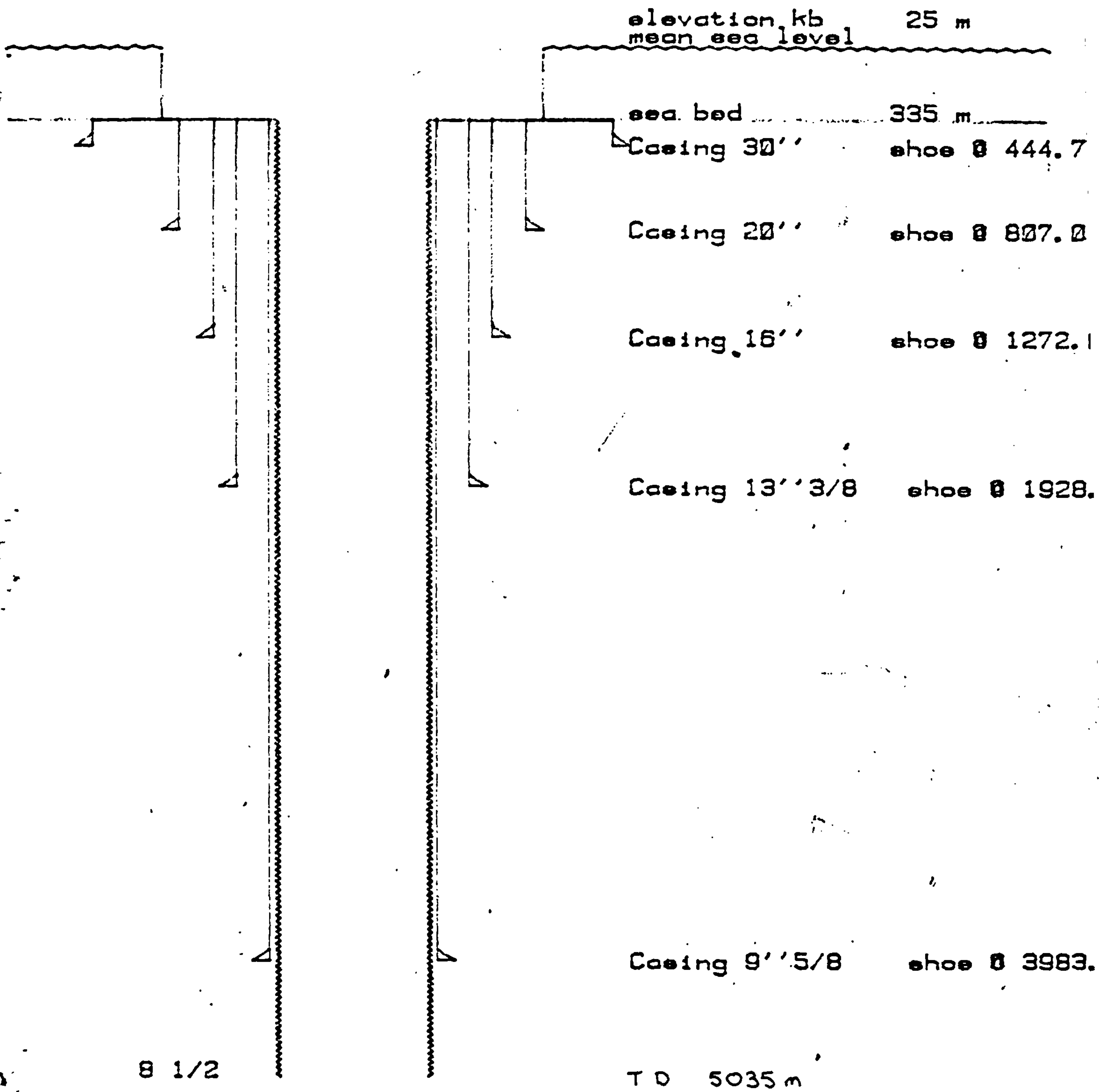
3 RFT's were taken

169 CST samples were recovered from 8 runs

The prediction of the formation tops from the seismic showed a fairly good degree of accuracy:

	(actual depths)	(seismic depths)
Balder (tuff)	1203m	1195m
top Jurassic sandstone	1365m	1360m
top Statfjord Unit equivalent	2126m	2095m
Statfjord Coal marker horizon	2261m	2255m
top Triassic(picked on palaeo)	2406m	non-reflective
Total Depth	5035m	

WELL : SHELL 31/2-4

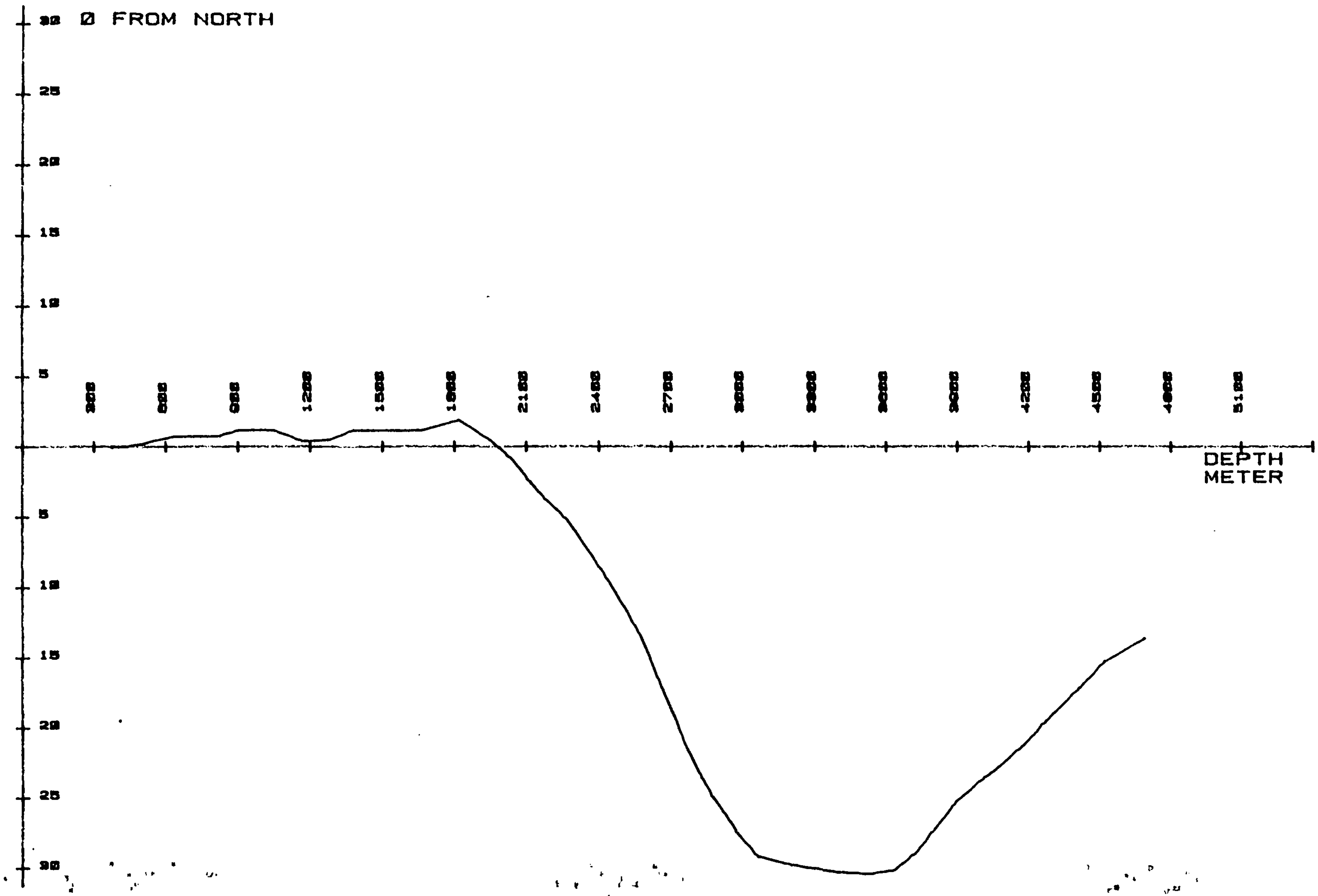


DEVIATION

The vertical depth, hole co-ordinates at the corresponding depth and dog-leg in degrees per 30 metres are computed using the "radius of curvature" method when the radius of curvature is not too large (ie: if drift is greater than 1.5°) and the "average angle" method otherwise. This is to avoid large errors when drift angles and bearing angles are equal or nearly equal for two consecutive survey points (ie: in those cases where the radius of curvature is infinite or at least extremely large.)

SHELL 31/2-4

DEPTH	DRIFT	BEARING	Vertical Depth	HOLE BOTTOM COORDINATES NORTH	SOUTH	WEST	EAST	Dog Leg o/30m
meter	degree	degree	meter	meter				
378.0	0.00	0.0	378.00	0.00		0.00		0.00
407.0	0.00	0.0	407.00	0.00		0.00		0.00
435.0	0.00	0.0	435.00	0.00		0.00		0.00
450.0	0.50	296.5	450.00	0.06		0.03		1.00
637.0	0.50	48.5	637.00	0.75		0.46		0.08
721.0	0.25	308.5	721.00	0.75		0.46		0.00
815.0	0.00	0.0	815.00	0.75		0.46		0.00
908.0	1.00	115.5	907.99	1.18			0.22	0.32
1050.0	0.50	67.5	1049.98	1.13			2.08	0.16
1167.0	0.50	212.0	1166.98	0.38			2.77	0.24
1280.0	0.00	0.0	1279.98	0.50			2.29	0.13
1380.0	0.75	13.5	1379.97	1.15			2.37	0.22
1558.0	0.50	168.5	1557.96	1.11			4.21	0.21
1666.0	0.00	0.0	1665.96	1.16			4.78	0.14
1820.0	1.00	118.5	1819.96	1.85			5.93	0.19
1950.0	0.75	151.5	1949.94	0.44			7.34	0.13
2040.0	1.00	176.5	2039.93		0.88		7.72	0.15
2124.0	1.50	205.5	2123.91		2.67		7.37	0.28
2185.0	1.25	231.5	2184.89		3.82		6.40	[illegible]
2273.0	1.50	223.5	2272.87		5.25		4.90	0.11
2442.0	1.50	163.5	2441.81		9.55		3.87	0.27
2573.0	2.75	225.5	2572.73		13.40		2.11	0.56
2668.0	4.00	228.5	2667.57		17.21	1.98		0.40
2763.0	3.50	233.5	2762.36		21.12	6.81		0.19
2835.0	3.00	231.5	2834.25		23.61	10.05		0.21
2885.0	2.25	230.5	2884.20		25.05	11.83		0.45
2931.0	2.25	236.5	2930.16		26.12	13.28		0.15
2990.0	1.75	208.5	2989.12		27.64	14.67		0.55
3072.0	1.00	225.5	3071.10		29.21	15.85		0.31
3212.0	0.75	281.5	3211.08		29.82	17.90		0.18
3301.0	0.75	233.5	3300.08		30.07	19.04		0.21
3402.0	1.00	288.5	3405.06		30.32	20.62		0.24
3516.0	0.75	243.5	3519.05		30.44	22.36		0.19
3639.0	1.00	313.5	3638.04		30.17	24.16		0.26
3731.0	1.00	326.5	3730.02		28.94	25.19		0.07
3811.0	1.50	10.5	3810.00		27.23	25.54		0.39
3904.0	1.00	11.5	3902.98		25.24	25.15		0.16
4021.0	0.75	308.5	4019.97		23.56	25.76		0.24
4049.0	0.75	4.0	4047.97		23.26	25.97		0.48
4179.0	1.00	348.5	4177.95		21.33	26.45		0.06
4280.0	1.50	303.5	4278.93		19.51	27.68		0.32
4419.0	1.75	308.5	4417.87		17.19	30.87		0.06
4528.0	2.50	298.0	4526.80		15.28	34.43		0.29
4694.0	3.50	273.5	4692.57		13.66	42.96		0.23



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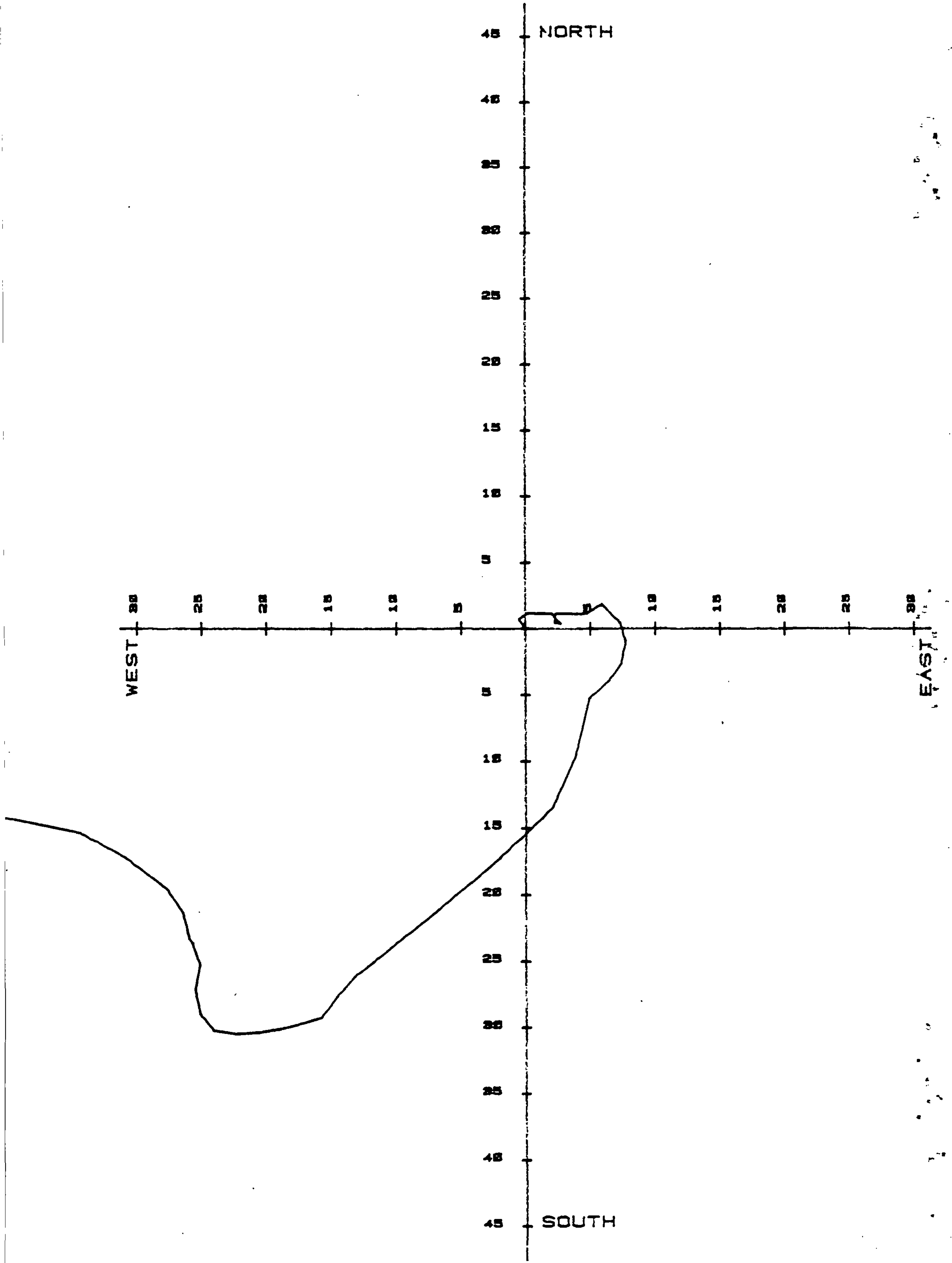
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BIT PERFORMANCE (GRAPHIC REPORT)

As well as the bit report printed out at the end of each bit run, a cost performance graph is plotted to enable a quick look interpretation of the bit's actual performance down hole.

Two curves are plotted for cost versus depth, one standard and including the total time that the bit was in the hole- drilling plus connections. The other based on the actual on-bottom rotating hours only.

The rate of penetration is also plotted to determine whether a decrease in the drilling rate is due to bit wear or formation change. The minimum cost point for each curve is determined and noted with the time and depth at which it occurred.

The data is obtained directly from the on-line data tapes with the bit cost/ metre being computed according to the formula

$$C = \frac{RC\ (TT+RT)+BC}{M}$$

Where:- C : cost per metre in $US

BC: bit cost in $US

RC: rig cost overall in $US/ hour

TT: average time for the round trip at drilling depth in decimalised hours

RT: rotary time or elapsed time in decimalised hours

M : metrage drilled after elapsed time in metres

The cost per metre versus time follows a curve passing through a minimum. The assumed cost of the rig has been taken as $2708/hour.

3) General well discussion by intervals:-

The rig is equipped with two Continental Emsco triplex pumps fitted with 6½" liners. Pressure rating 3981 psi at a maximum of 120 spm. Output is 5.158 gallons/stroke at 100% efficiency, measured efficiency: 95%.

a) 36" Phase (359-450m)

Well 31/2-4 was spudded on the first of September 1980. This phase was drilled in one pass using a 26" OSC 3AJ bit with 3 22/32" jets, ahead of a 36" hole opener.

Spud Assembly:-

Bit
H/O
9½"Monel DC
26"Stabilizer
5 9½" DC
X-O
12 8" DC
X-O
12 5"HWDP
total length: 278.71m

Sea bed was tagged at 359m B.D.F.

Five magnetic single shot surveys were taken during the run.

The final survey result at 450m was ½° N57°W.

Mud: This section was drilled using seawater with high viscosity slugs of prehydrated bentonite pumped before each survey. The hole was displaced to mud prior to pulling out to run the 30" conductor.

Hole Problems: No hole problems were encountered whilst drilling this section. The penetration rate slowed down at 424m from an average of 1.5 minutes/metre to 38mn/m at 424m and 14mn/m thereafter, this was probably due to a lithological variation in the formation as the cuttings were seen to change from a soft clay to a grey micaceous siltstone at approximately this depth.

Casing: Seven joints of 30"X 1" wall conductor were run. The shoe was set at 444.7m, and the top housing at 358m.

Cement: 838 sacks of class G with 0.36 gal/sack Econolite was used, with a slurry density of 13.2ppg. This was tailed in with 659 sacks of class G +3% calcium chloride, at a density of 15.8ppg. The whole was displaced with 72 bbls of seawater.

b) <u>26" Phase</u> (450-455m)

The shoe of the 30" conductor and 17½" pilot hole were drilled out using a 17½" OSC 3AJ (bit no.2) and a 26" hole opener on the third of September. The riser was run to a diverter and tensioned up on the fourth of September.

c) <u>17½" Phase</u> (455-815m)

This phase was completed in one pass using bit number 2 again fitted with 2 x 18 and one 22/32" jets.

Assembly:-

Bit
Bit sub
9½" DC
9½"Monel DC
Stabilizer
9½" DC
Stabilizer
3 9½" DC
X-O
12 8" DC
X-O
12 5"HWDP

total length:278.69m

<u>Mud</u>:This section was drilled using seawater with prehydrated bentonite viscous slugs.

<u>Hole Problems</u>: No problems were encountered whilst drilling this section of the hole.

<u>Deviation</u>: Four magnetic single shot surveys were run at 552 m, 637m , 721m and 815 m.The results of all of them were 0°.

17½" HOLE LOGGING(before 26" enlarging)

From the results of the caliper log this 17½" hole can be divided into 4 parts:

From	to	
445	693	caliper completely open(Ø> 23")
693	760	≅ 21"
760	790	≅ 20"
790	815	≅ 19"

From this it can be seen that the hole was washed out over it's entire lenght which would explain the ease with which it was drlled; it also shows the increasing compaction of the formation with depth.

Comparison of the other logs gives more interesting information; it demonstrates a good correlation with results obtained from the cuttings.

This is a table showing comparative average values

	Depth met	γ Ray API un.	Resistivity Ωm	Sonic Δt	Bulk density gr/cm3
a)	450-490	45-50	≃ 2	160	≃ 1.65
b)	490-530	10-20	≃ 0.7	210	≃ 1.50
c)	530-715	55-70	≃ 2.5	140	≃ 2.10
d)	715-815	45-50	≃ 1.5	160	≃ 1.75

From the cuttings these four sections were :
a) Claystone
b) Sandy - silty claystone
c) Silty Claystone
d) Claystone

Resistivity log values of ≃ 2Ωm are Typical of claystone whilst a value of 0.7Ωm is typical of sand or a very sandy claystone. The Gamma Ray results agree with this(ie 10-20 API units are typical of a sand and 45-50 denotes a claystone)whilst the sonic log indicates in interval b) an increase in t so less velocity therefore a less compact formation(e;g; sand).

It is interesting to note that SFL<IDL in some points of the first intervl (450-490m)so there is a crossing of curves which also occurs in some points of the 3rd interval(530-715m). This crossing is the typical result of the presence of salt water in the formation.

This may explain the gas shows in drilling.

The most interesting thing revealed from these logs is the presence of a remarkable shift at +/- 715mt.

This tells us that the interpretation of the "d"exponent is correct. As it is explained better in the proper section "d" exponent shows a remarkable shift at +/-724mt and this shift is typical of a change in the litology of the formation.

Opening 17½" hole to 26":- (455-815m)

The 17½" hole was opened out to 26" on 8/9/80 using a 26" hole-opener behind Bit no.2 (OSC 3AJ) fitted with 24-24-22 jets. The opening was completed in one run ~~and~~ with reaming at each connection.

Assembly:-

17½"Bit
26"H/O
9½" float sub
9½"Monel
26"stab
9½"DC
26"stab
4 9½"DC
X-O
9 8"DC
mech jar
hydr jar
5 8"DC
X-O
12 5"HWDP
total length 311.27m

Mud:- As with the 17½" pilot hole seawater was used with 20 bbl prehydrated bentonite slugs pumped at each connection.
Casing:- 36 joints of 20" Vetco 133lbs/ft K55 casing were run. The shoe was setv at 807m. The casing was pulled back from 768m to surface to remove rigid centralizer which was damaged when entering the wellhead. The casing stood up at 778m and was worked and circulated down to 807m.
Cement:- 1931 sacks of Class G with 14.6gals/10 bbls econolite were used with an average slurry density of 13.4 ppg. This was tailed in with 762 sacks of cement +2% calcium chloride at a density of 15.8ppg. The whole was displaced with 88.5 bbls of seawater.

After cementing the casing the riser was rerun,before landing the BOP operations were suspended at 12.30 10/9/80 to move to block 34 to kill 34/10-10 for Statoil.
Borgny Dolphin returned to Block 31 and re-entered 31/2-4 on Monday 6th October.

17½" Hole (815 - 1280 m)

Bit no 3 was used to drill the casing shoe and formation from 815 - 818 m. The bit was then pulled to be replaced by a 12.25" bit because of the possibility of shallow gas.

Bit no 3 (OSC 3AJ) was run with no jets.

Assembly:

Bit
Bit sub
Float sub
X-O
18 8" DC
Down Jar
Up Jar
2 8" DC
X-O
12 5" HWDP
total length : 307.89 m

Mud :

This section was drilled using a KCl polymer system.

Average mud properties were : PV : 25
YP ; 20
Gel: 3
MW : 1.28 Sg

At 818 m a leak -off test was performed, the result of which was 1.71 Sg equivalent mud density .

12.25" Pilot Hole:

Bit no 4 was a 12.25" X3A with 3 22/32" jets. This bit drilled a pilot hole for the 17½" bit in one pass from 818m to 1050 m.

Remarks: No drilling data was recorded between 842 m to 937 m due to the geolograph cable being broken.

Assembly:

Bit
Bit sub
8" Monel
1 8"DC
12" Stab
1 8" DC
12" Stab
16 8"DC
Down Jar

Up Jar
2 8" DC
X-O
12 5" HWDP
Dart Sub
total length: 318.36 m

A survey was carried out at 909 m, the result was 1° S 58° E.
The bit was pulled at 1050 m. However on pulling four stands the hole began swabbing necessitating running back to bottom and circulating bottoms up, 22% C1 was circulated out.
The penetration rate was 3 mn/m with an average weight on bit of 17000 lbs and rotary speed of 126 RPM.
Streaks of harder silstone slowed down the drilling rate at 1000 m although a soft marly element may have increased the drilling rate from 950 m to 1050 m.

The hole was enlarged to 17½" using Bit no3 (OSC 3AJ) again with 2 22/32" and 1 20/32" nozzles. This bit opened the hole from 818 m to 1050 m and drilled to 1280 m.
Remarks: No drilling data was recorded between 853 -971 m due to the geolograph cable being broken.

Assembly:

Bit
Bit sub
9½" Monel
1 9½" DC
17½" Stab
1 8½" DC
17½" Stab
X-O
10 8" DC
Jar
2 8" DC
X-O
9 5" HWDP
Dart Sub
total lenghh : 237.06 m

At 1131 m the gas rose to 36% so drilling was interrupted until this gas was circulated out. The gas rose at 1140 m to 80% and was again circulated out.

Surveys were taken at 1167 m (½° S 34° W) and at 1280 m (0°)

Mud: Average values for mud properties for this section were:

PV: 25

YP: 24

Gel 4

MW: 1.28 Sg

Hole Problems:

Overpull of 96000 lbs was experienced at 1200 m and 125000 lbs between 968 - 921 m so this section was reamed and also the section 1260 m 1280 m prior to finally pulling out for logging.

LOGGING:

17½" hole prior to opening to 22"

Caliper :

From the results of the caliper log this hole section can be divaded into 6 parts;

1_	810-910	17½"
2_	910-912	22"
3_	914-966	18"-20"
4_	966-1146	17½"-18"
5_	1146-1158	18"-20"
6_	1158-1270	17½"-18"

From this it can be seen that the hole was in guage over most of it's length, beeing only slightly oversize over three short lengths.

Gamma ray :

810-910	70 api
910-1025	80-100
1025-1205	60-70
1205-1233	50-60
1233-1270	60-70

These resuts suggest that the formation is claystone over most of it's length with a varing silt content. The relatively high values between 910-1025 are probably the result of the claystone in this section being micaceous

SONIC:

810-1180	140-150 μsec/ft
1180-1230	110-130

1230 -1270 140-160 sec/ft

Evidence of a harder formation was seen between 1180 m and 1230 m from data derived from the cuttings this appeared to be a Limestone Marl found around 1200 m.

RESISTIVITY :

For the most part both shallow and deep resistivity logs follow approximately the same trace.

Occasionally a brief divergence occurs indicating the possi--bility of the presence of small quantities of hydrocarbon.

DENSITY :

This follows a normal compaction trend to 1033 where it decreases from 2.25 g/cc to 2 until 1165 m.At 1165 m the trace comes back to 2.25 g/cc,for a short section between 1199 -1208 m the density decreases to 2.1 g/cc which correlates with the 140000 lbs overpull experienced at 1200 m whilst pulling out of the hole after runs no 5 and no 8 possibly due to a slight overpressure in this section .

POROSITY :

Porosity values from the neutron log of 30 to 50 remain constant through the logged section.

Opening 17½" hole to 22" (807-1280m)

The hole was enlarged to22" using bit n°5 OSC IGJ, as pilot bit with a 22" underreamer from 807-1280m.

Assembly:

Bit
22" under reamer
bit sub
9½" monel
2-9½"DC
X-O
10-8"DC
down jar
up jar
2-8"DC
X-O
12-5"HWDP
dart sub

total length:264.62m

average drilling parameters:

WOB: 10 KLBS
RPM: 125
FR :985gpm
SPP:2600psi

The maximum gas reading whilst drilling was 5.5%

Hole problems:

The bit opened the hole from 807m to 1184m. After pulling one stand overpull of 44KLBS was experienced due to the under reamer being jammed in an open position by cuttings, this problem occured again at the shoe .

The hole was reamed from 934-1184m then under reaming continued to1278m when the bit was pulled. During pulling out overpull of 140KLBS occured at 1200m.

A survey was carried out at 1167m, the result of which was ½° S34°W.

Liner:

44 joints of 16" 109 lbs/ft K55 CASING were run on the 22nd of October. The string stood up at 1269m and was washed down to 1272m. The top of the liner was set at 719.6m and the shoe at 1272m.

Cement:

2448 sacks of class 'G' mixed with 406 bbls of seawater were used with 490 gollons of ecolonite and 245 gallons of HR6L giving a slurry density of 14.5ppg.No losses occured during the cement job.THE cement was displaced with 407bbls of mud.

Comments:

Whilst running the liner hang up at 912m due to the setting sleeve being larger than the BOP hanger.

Setting sleeve: 17.75"
BOP : 17.625"

The collar on the liner was damaged when trying to break out the setting setting sleeve.An attempt to back off the running tool was uncesful.After having washed the string the jumped in the rotary table and backed off at a HWDP connection leaving one stand of HWDP plus X-O,16" running tool and 16" liner in the hole .This was succesfully fished at the first attempt with an overshot.The liner was pulled and rerun and finally landed at 1272m

During displacment 180bbls of mud were lost;150bbls while chasing cement and a further 30 bbls had to be dumped

The dart was dropped when displacing started,but there was no sign of the dart hitting the plug after 43 bbls as it should.At the end of displacement the was pulled clear of the casing and reverse circulation was attempt without succes The pipe was pulled wet and the dart was found in the running tool.Some cement was on top of the running tool and the stinger below the running tool was full of cement.

Drilling the cement:

Bit n°3 OSC 3AJ,was used again to drill the cement from 603-720m where t the top of the liner was tagged.

Assembly:

17½"Bit
bit sub
2 9"DC
X-O
4 8"DC
X-O
12 5"HWDP
total length: 167.8m

Average drilling parameters:

WOB:9 KLBS
RPM:100
FR :465 gpm
SPP:565psi

After testing the pressure for the seal between the 20" casing and the 16" liner top to1000psi for 15 mn the bit was pulled out.

Mud:average values for mud properties:

PV:40
YP:17
Gel: 5
MW: 1.35

12¼" phase (1280-1285m)

Bit n°6, a HTC XV? was used to drill out the cement, 16" liner shoe and formation to 1285 m which all took approximately 9 hours.

Assembly:

Bit 12¼"
junk sub
bit sub
9 8"DC
down jar
up jar
2 8"DC
X-O
12 5"HWDP

total length: 225.63m

Average drilling parameters:

WOB:20 KLBS
RPM:50
FR :695gpm
SPP:1400 psi

Mud:
Average values for the mud properties in this section were

PV:33
YP:17
Gel: 8
MW: 1.32sg

Bit n°6 was replaced by new bit n°7 a 14" Smith F2 with a 14½" mill. this was used to ream out to 14½".

Assembly:

Bit
X-O
junk sub
bit sub
14½"mill
9 8"DC
down jar
up jar
2 8"DC
X-O
12 5" HWDP

total length:227.70m

Average drilling parameters:

WOB:20KLBS
RPM:110
FR ;860gpm
SPP:1700psi

Leak off test was performed prior to pulling out ,the result of which was 1.51sg,expressed as an equivalent mud density.

Squeeze Cementation:-

After pulling Bit no.7 a Cement Bond L^Og was run which showed that the cementation of the 16" liner was inadequate necessitating the performance of a squeeze job.

On the 26th of October 400 sacks of neat Class'G' cement were pumped and displaced with 65 bbls of mud. The string was pulled to 1073m and reverse circulkated out. The cement was squeezed to 750psi for 4 hours after whmich the pressure was bled off. After pulling out and running in with a 14" gbit soft cement was tagged at 1235m. The ce -ment was left a further 4½ hours to harden, and was then drilled out to 1280m. 23 bbls were lost over the whole cementing operation.

New bit no.8 was run on the 27th of October to drill down to coring point. The bit was a 12.25" HTC X3A fitted with 3 14/32" jets and drilled down to 1320m before being pulled for coring.

Assembly:-

Bit
junk sub
bit sub
8"monel
12.25"stab
2 8"DC
12.25"stab
9 8"DC
up jar
down jar
5 8"DC
X-O
12 5"HWDP
dart sub

total length: 292.64m

Average drilling parameters: WOB:35-40klbs
RPM:102
FR:600gpm
SPP:2400psi

At 1280m aleak off test was carried out,the result of which was 2.0 sg equivalent mud weight.(See on-line file,12;25" hole sextion.)

Average values for mud properties/ PV:35
YP:23
Gel:9
Mud weight:1.32sg

CORING

Core n°1 (1320-1326)

Core n°1 was cut with a CB 303 core head in a conventinnal barrel, giving an average penetration rate of 32.5mins/m. It was decided that the barrel be pulled after a remarkable drop in pump pressure from 1340 -700psi, and an increase in torque at 1326m. After atemptying the core fram the core barrel a large quantity of junk fell out, consisting mostly of bit teeth and casing shoe fragments. 96% of the core was recovered.

Assembly:

- 8.42" core head
- core barrel
- X-O
- 8"monel
- 12.25stab
- 2 8"DC
- 12.25stab
- 9 8"DC
- down jar
- up jar
- 5 8"DC
- X-O
- 12 5"HWDP
- dart sub

Average parameters whilst coring:

WOB:22 KLBS
RPM:93
FR :265gpm
SPP:1340psi

Comments: The core head showed significant junk damage, primarily tothe shank of the bit but also to the diamonds.

Core no.2:(1326-1334m)

A CB 17 core head was run which cut 8m of which half a metre was recovered. The barrel was pulled due to the core he ad having ceased to cut.

Core no.3 (1338-1347):

Three attempts were made at cutting core no.3. The first time a CB 303 was run but no core was cut so this run was disregarded. The second time a Stratapax core head was run, a supposedly more aggressive bit ,in an attempt to cut the shaly formation. The barrel was pulled due to the bit not cutting,several of the stratapax themselves being found to be junk damaged. On pulling the barrel was empty. Again this run was disregarded.

A reverse circulation junk basket was run next in an attempt to clean up the hole because of the significant amount of shoe fragments and bit teeth which came up with the first two cores and the junk damage to each core head.

On pulling the junk basket was empty so a 12.25" bit was run to clean the hole.

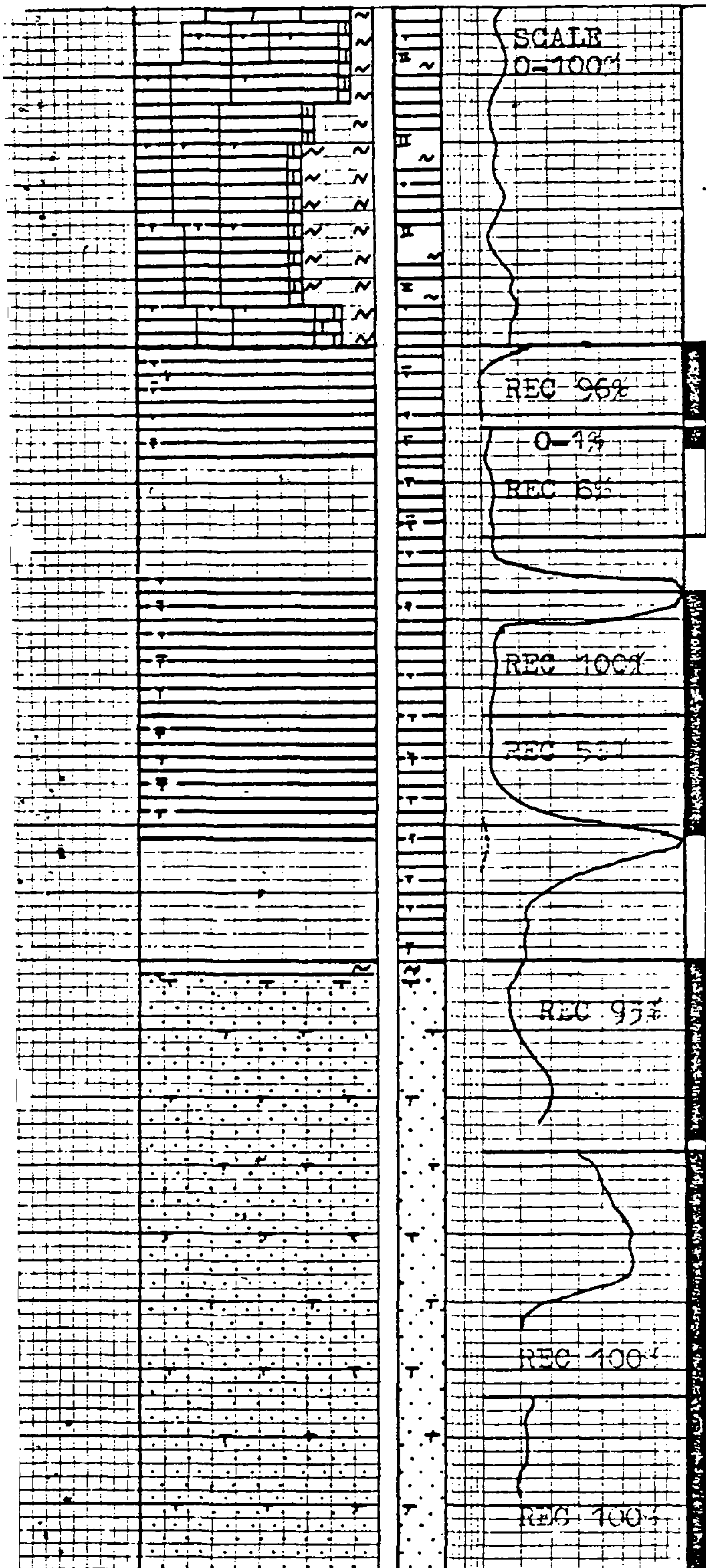
Core no.3 was finally cut from 1338m to 1347m with a CB 303.

Cores number 2 -21 were cut in a glass fibre sleeve. From core number 4 to the end of the cored interval no significant problems were encountered,usually the barrel was pulled due to bands of strongly cemented sandstone or "doggers" preventing the core head from cutting.

Cores number 22-28 were cut in a conventional barrel.

A Navi drill was used for cores number 10 and 26. Coring was interrupted between cores 4 and 5 for a day and a half to wait on weather.

Core	C B	C H	Interval In	Out	Cored	%	Hours	ROP mn/m	Drilling comments
1	303	1	1320	1326	6	96	3.25	32.5	
2	17	2	1326	1334	8	6.5	11.5	86.1	
3	303	4	1338	1347	9	100	4.87	32.5	
4	303	5	1347	1365	18	55.5	8.66	28.9	
5	303	5	1365	1379	14	93	3.64	15.6	
6	STPX	4	1379	1397	18	100	2.46	8.2	Glass fibre sleeve
7	STPX	4	1397	1410.5	13.5	100	5.63	25	
8	17	6	1410	1415.5	5.5	91	4.16	45.4	
9	303	7	1415.5	1426.5	11	86	9.13	49.8	
10	STPX	8	1426.5	1443.5	17	1	11	38.8	Navi Drill
11	303	9	1443.5	1452.5	9	100	4.3	28	
12	17	10	1452.5	1454.5	2	90	3.14	94	n0 progress rop Poh
13	303	9RR	1454.5	1472.5	18	77	11.6	39	
14	303	9RR	1472.5	1482.5	10	70	5.31	31.9	
15	303	9RR	1482.5	1484.5	2	33	2.23	69	
16	303	9RR	1484.5	1490	5.5	100	3.17	34.6	
17	303	7RR	1490	1508	18	91	6.56	21.9	Fibre glass sleeve
18	303	7RR	1508	1526	18	92	7.63	25.4	
19	303	7RR	1526	1544	18	96	8.45	28.2	
20	303	7RR	1544	1562	18	100	10.5	35	
21	303	7RR	1562	1567	5	97	3.66	43.9	
22	303	7RR	1567	1585	18	87	10.3	34.4	Taken out of fiber
23	303	7RR	1585	1603	18	79	11	36.7	
24	303	7RR	1603	1607	4	89	5.75	86.3	
25	STRX	11	1607	1621	14	100	6	25.7	Steel barrel
26	STPX	11	1621	1627	6	85	2.97	29.7	Navi Drill
27	303	12	1627	1645	18	86.5	10.28	34.3	
28	303	12RR	1645	1663	18	99	8.75	29.2	



Clst gy-grn slt non swl non calc sft-mod hd occ py mmic lam
Clst gy-brn(slt) non calc sft-mod hd lam fis
Mrl wh-gy sft
Lst mod hd micrxln
Clst gy non calc-(calc) mod hd fis

Clst/Sh(dk)gy-gn slt non swl non calc mod hd mmic (carb)v pygy/grn lam

Clst/Sh dk gn slt non swl non calc mod hd mmic (carb)v py

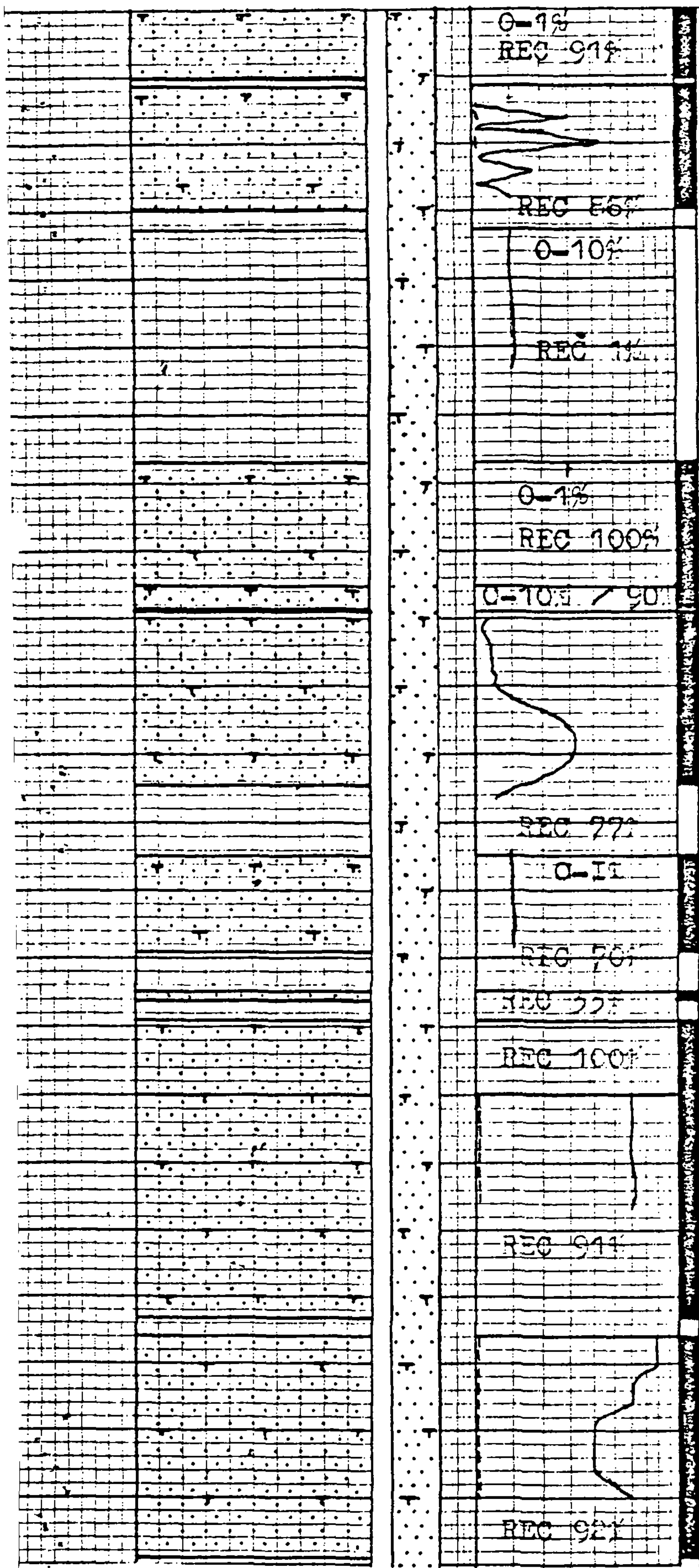
Clst/Sh dk grn((slt))-(slt)non swl non calc-((calc))mod hd mmic (carb)lam

Clst/Sh dk gy-grn slt-((slt))non swl non calc-(calc)mod hd mmic(carb) (lam)

Clst/Mrl lt gy-grn slt non swl-(hturg)calc mod hd mmic((carb))(lam)

Clst/Mrl lt gy-grn slt (hturg)calc sft-mod hd mmic carb gn min lam fos
Sst gy qtz transp&with incl sltfsl-crssu(srt)-srt ang-(rnd)elong-(sph) cons fri non calc-(calc) mic carb py & gn mins
Sst gy qtz transp occ incl slt fsu-crssu srt ang-(rnd)elong-(sph)cons ((calc))-calc fri(mic) (carb)

Sst gy qtz clr occ incl fsl-msu occ crssu ang-(ang)(elong)-(sph)cons non calc-calc fri-hd (mic)carb shell frags



Sst gy qtz clr fsl-msl srt-srt ang-(ang)cons ((calc))fri mic carb
Sst lt gy qtz clr lithic frags slt fsu-crssu occ gran srt ang-(rnd)elong -(sph)(cons)-cmt non calc -calc lse-hd((mic))py ((carb))

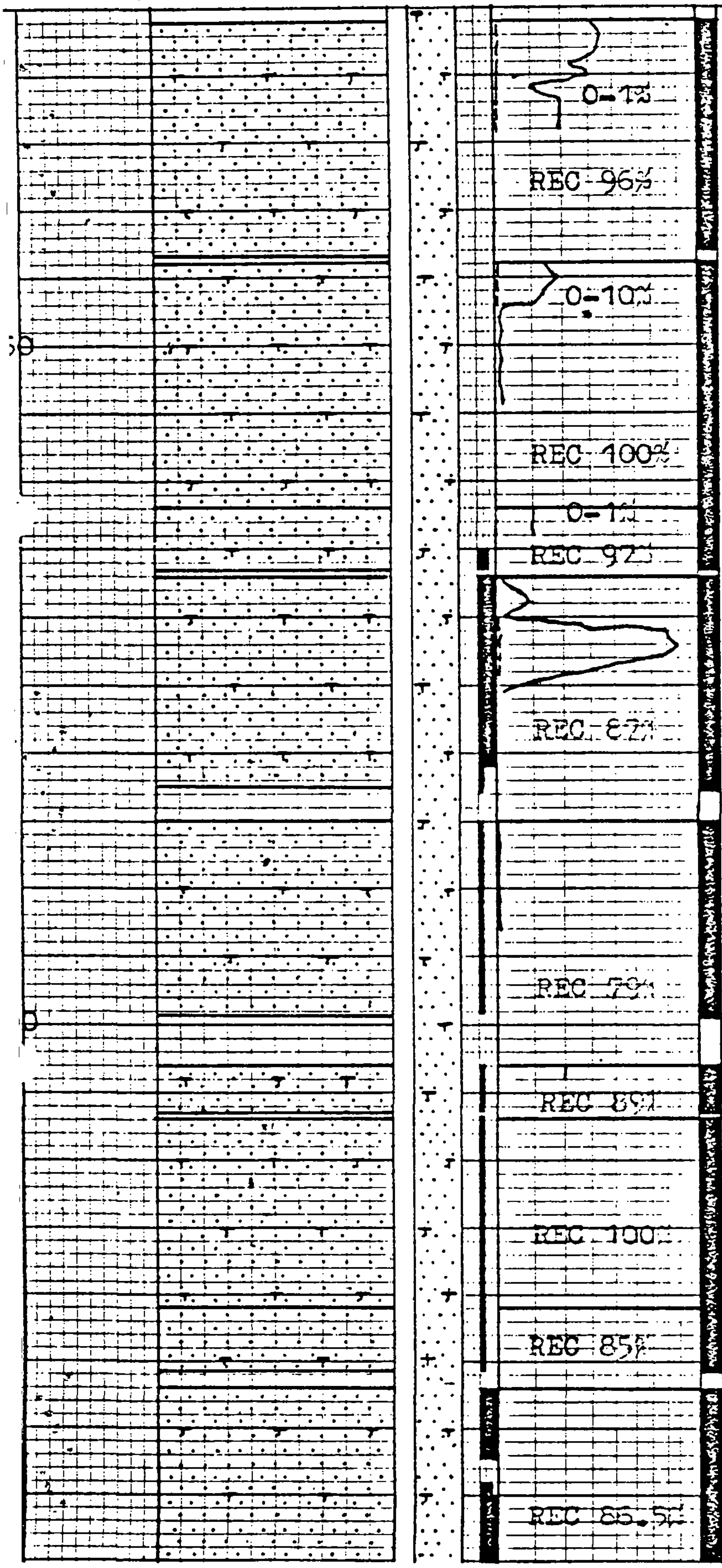
Sst limy gy fsu(fsu-gran) (ang)-(rnd)(sph)calc hd ((mic))mostly transllus qtz

Sst/S gy fsu-msu(fsu-gran) srt-srt(ang)-(rnd)(elong) -(sph)mainlytranslusc qtz(smokeqtz))((fsp)) ((rseqtz))(((mic))) (((calc)))-calc lse-fri
Sst gy ms srt cons-fri
Sst gy ms(fsl-crssu srt dom transl qtz((fsp)) (calc)(((mic))) mostly cons-fri
Sst gy fsl/fsu srt mic (carb)(calc)fri-modhd (lam)

Sst(dk)gy fsu(slt-fsl) srt mic carb(calc)mod hd lam Coarser(slt-gran) shelly deposit in middle
Sst(dk)gy fsu/fsl srt mic carb mod hd wavy bedding
Sst(dk)gy fsl/fsu(slt-fsl)srt mic carb cons mod hd lam calcified at btm

Sst(dk)gy fsl/fsu(slt-fsl)srt mic carb fri-mod hd((calc))-(calc) lam calc at top

Sst(dk)gy fsl/fsu(slt-fsl)srt-srt mic carb fri-mod hd((calc)) lam occ limy just above btm bec Sst gy fs-ms srt ((mic))lse-cons qtz ((fsp))



Sst gy fs srt-srt mic carb in top&btm gy fs-ms lse-fri srt((mic)) in mdle occ calc bands

Sst fsu/fsl(slt-fsu)srt mic carb((calc))

Sst/S gy fs-ms srt((calc)) -calc

Sst gy fsu/fsl srt mic py carb

occ calc bands throout

Sst fsu mic fri-mod hd

Sst fs-ms lse-fri

Sst dom fs-ms with occ fs mic layers Sst fsl/ms slt gy(brn)srt(lse)-fri occ calc cmt

Sst/S gy dom fs-ms srt-srt(elong)-(sph)(ang)-(rnd)dom transl qtz (((fsp)))(((mic))) (((calc)))(lse)-fri occ limy bands

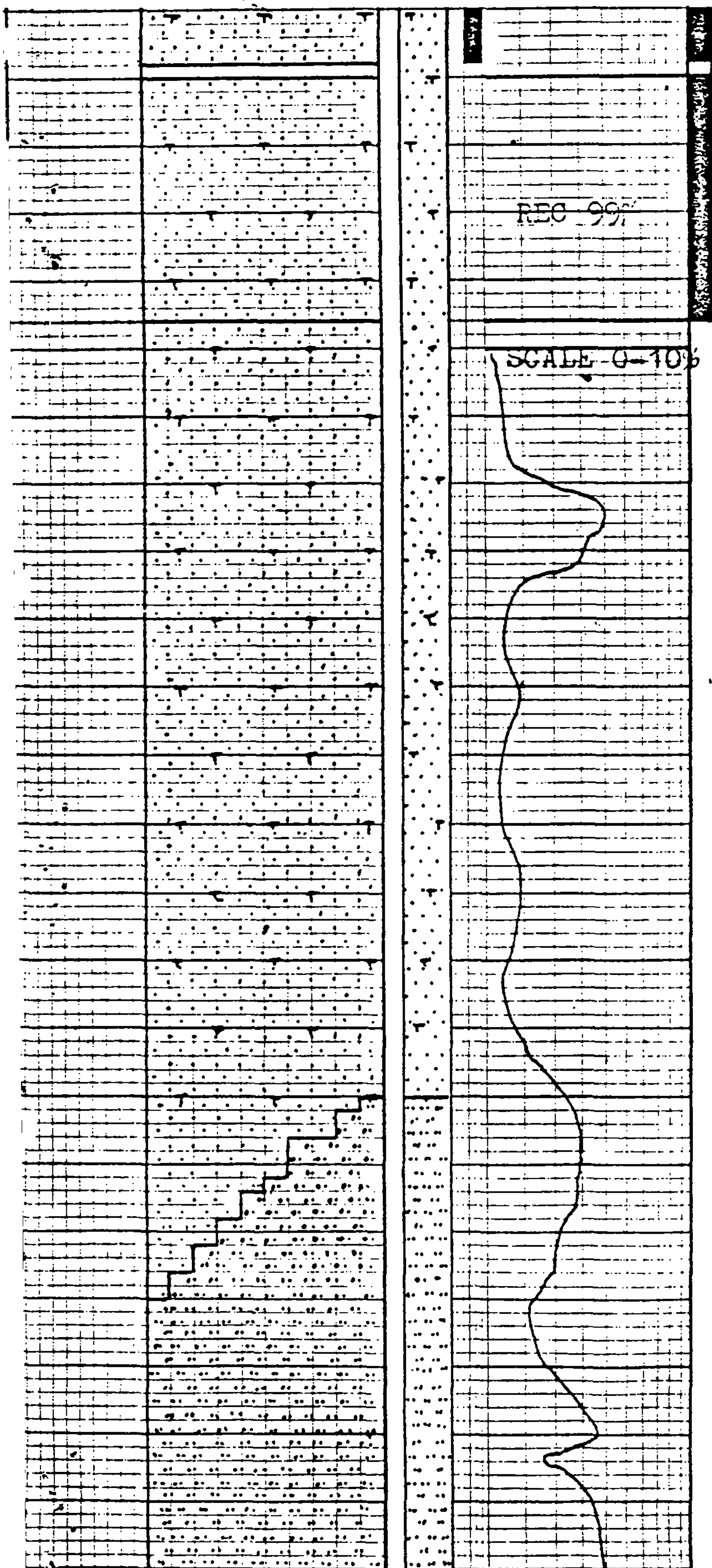
Sst gy fsl-msl srt-srt (((mic)))non calc(((rose qtz)))(((smokyqtz))) (((fsp)))v fri calc in middle

Sst gy fsl-msl qtz non calc-(((calc)))((fsp)) (((kaolinite)))(mic)-((mic))fri

Sst(dk)gy fsu/fsl mic (calc)-((calc))(carb)lam

Sst(dk)gy srt fsl/fsl mic((calc))-(calc)fri-mod hd carb

Sst gy((brn))fsu/msl srt ((calc))(((mic))) v fri in middle of core 1-2m mic sst & 2m calc sst



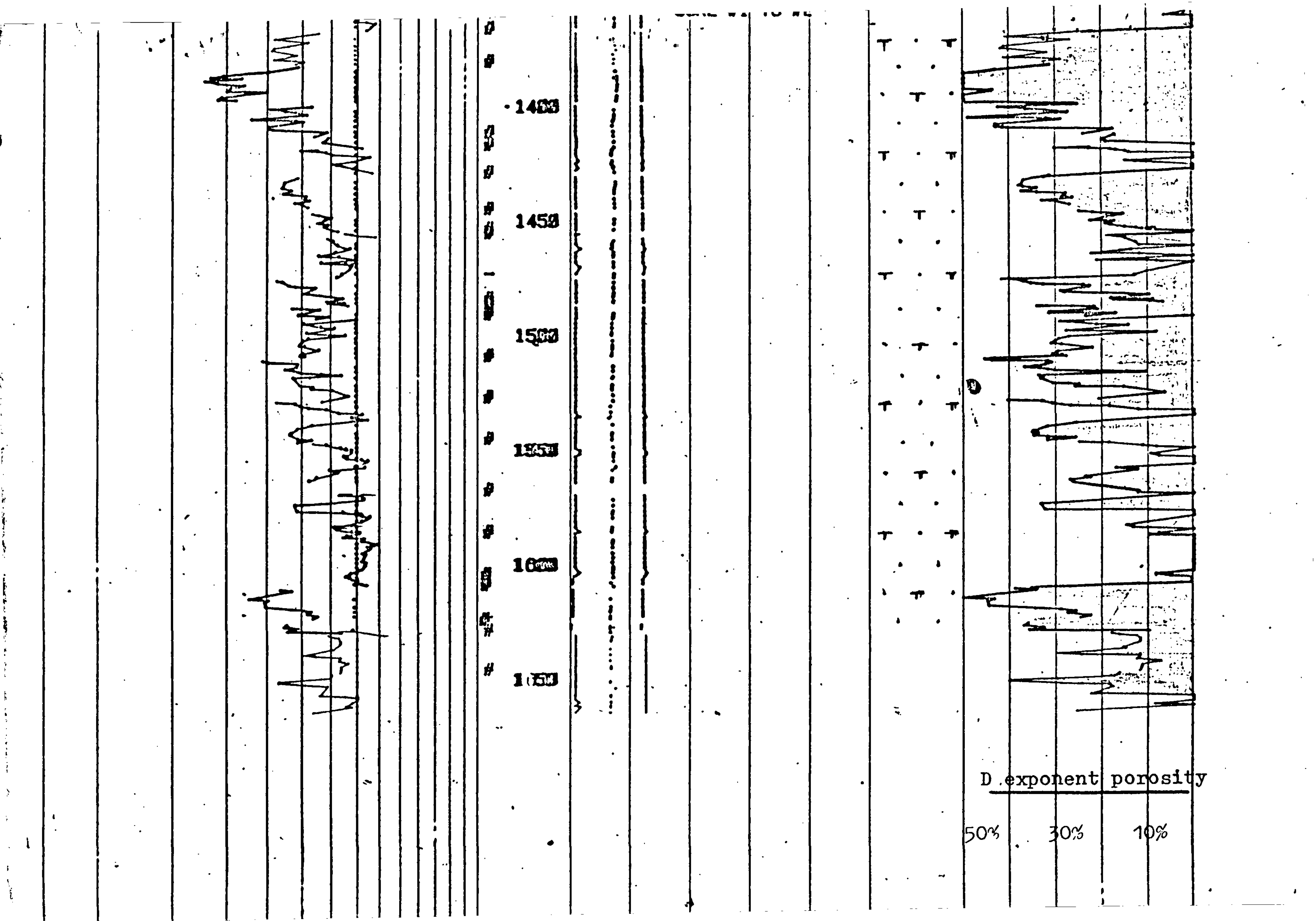
Sst gy((brn))fsu/msl srt
((calc))(((mic)))v fri

Sst fs-ms srt occ calc

tr yel fluor.

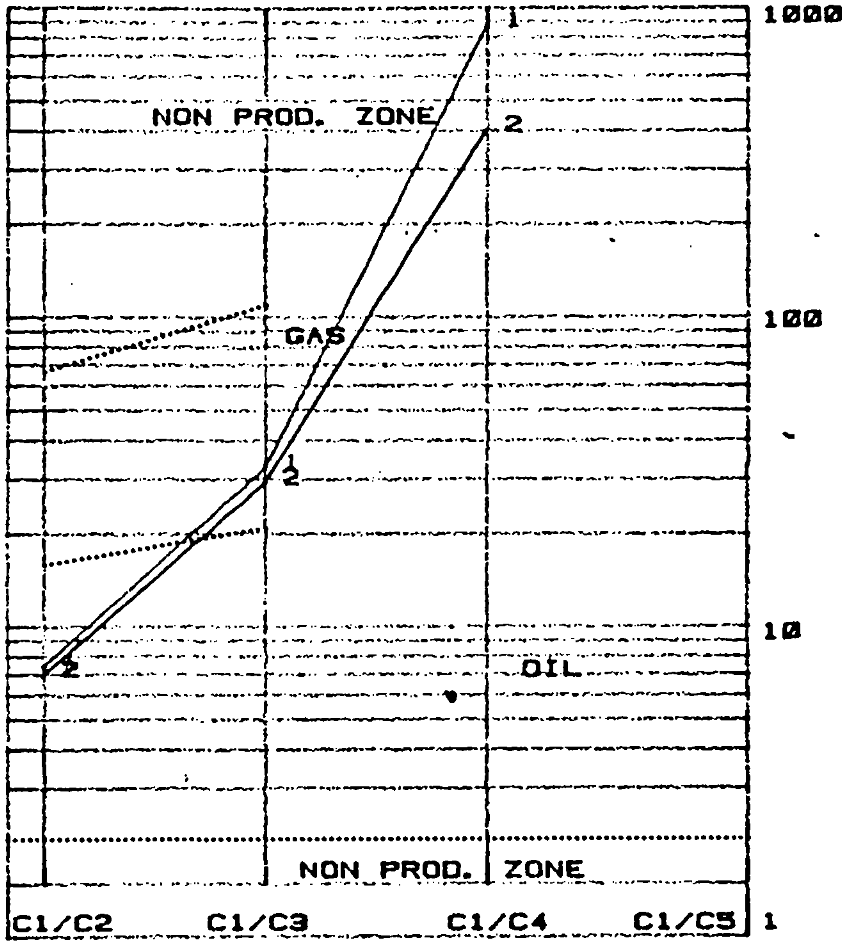
Sst gy-pred,occ wh-brn
and calc,hd,fsu/crs sl
(mic)

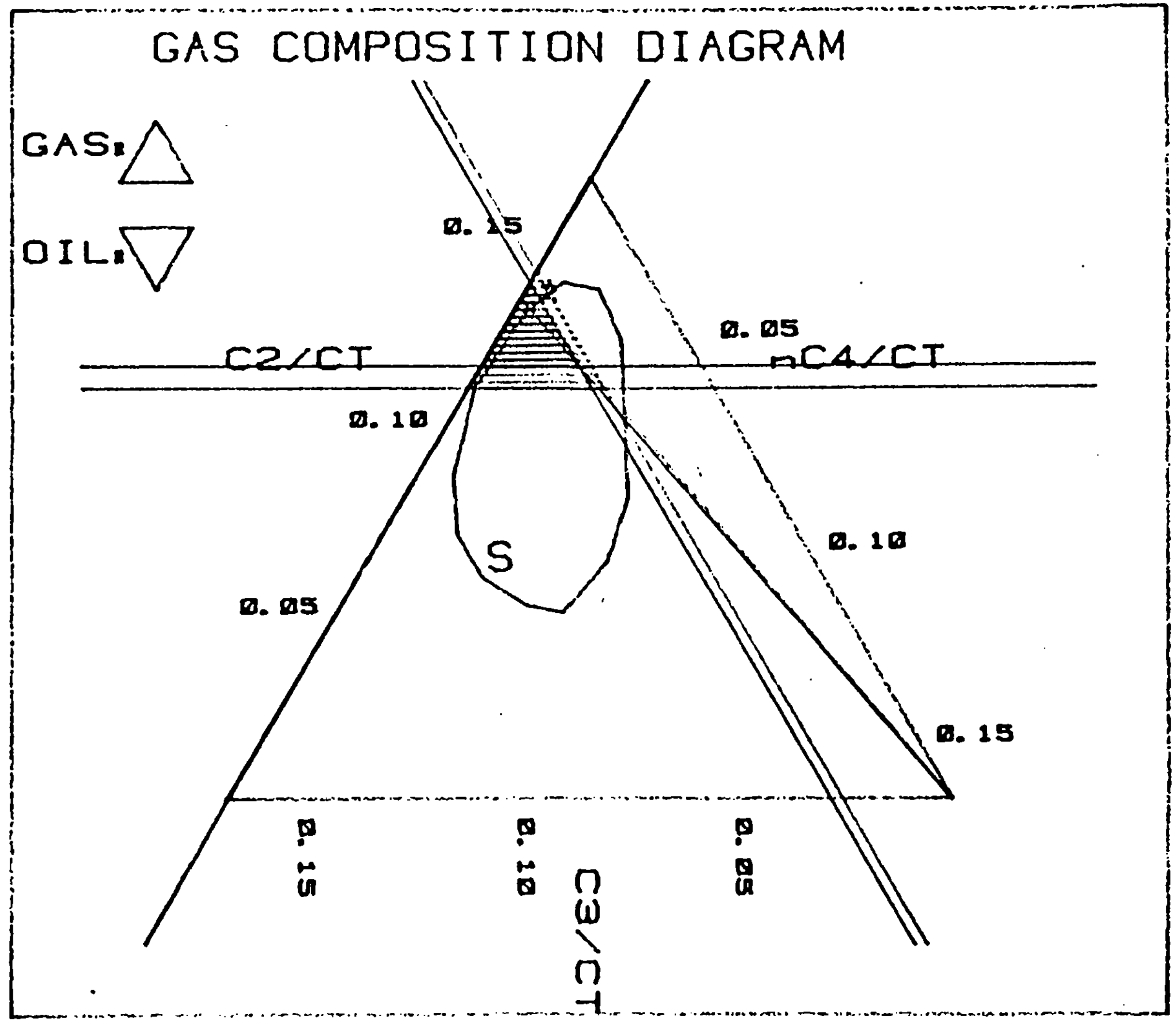
Slst low est por,lt gy
stky hyprotur[illegible] sft s
(glc) mic-mic


1400
1450
1500
1550
1600
1650
D.exponent porosity
50%
30%
10%

Geoservices

WELL: SHELL 31/2-4

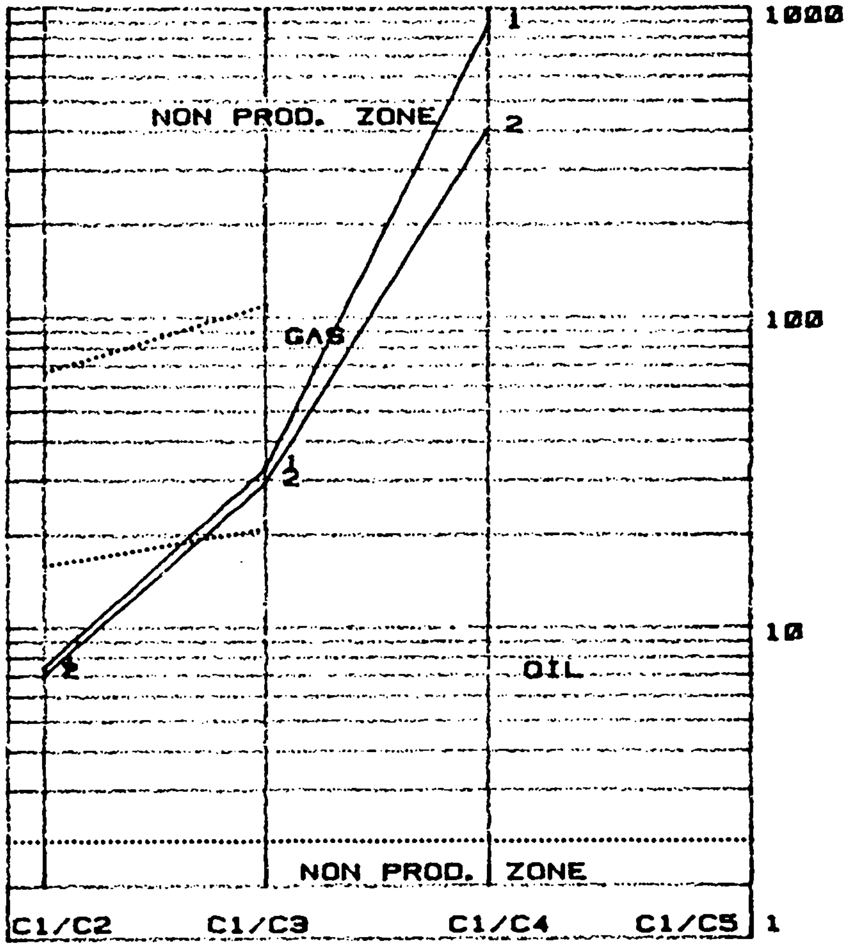


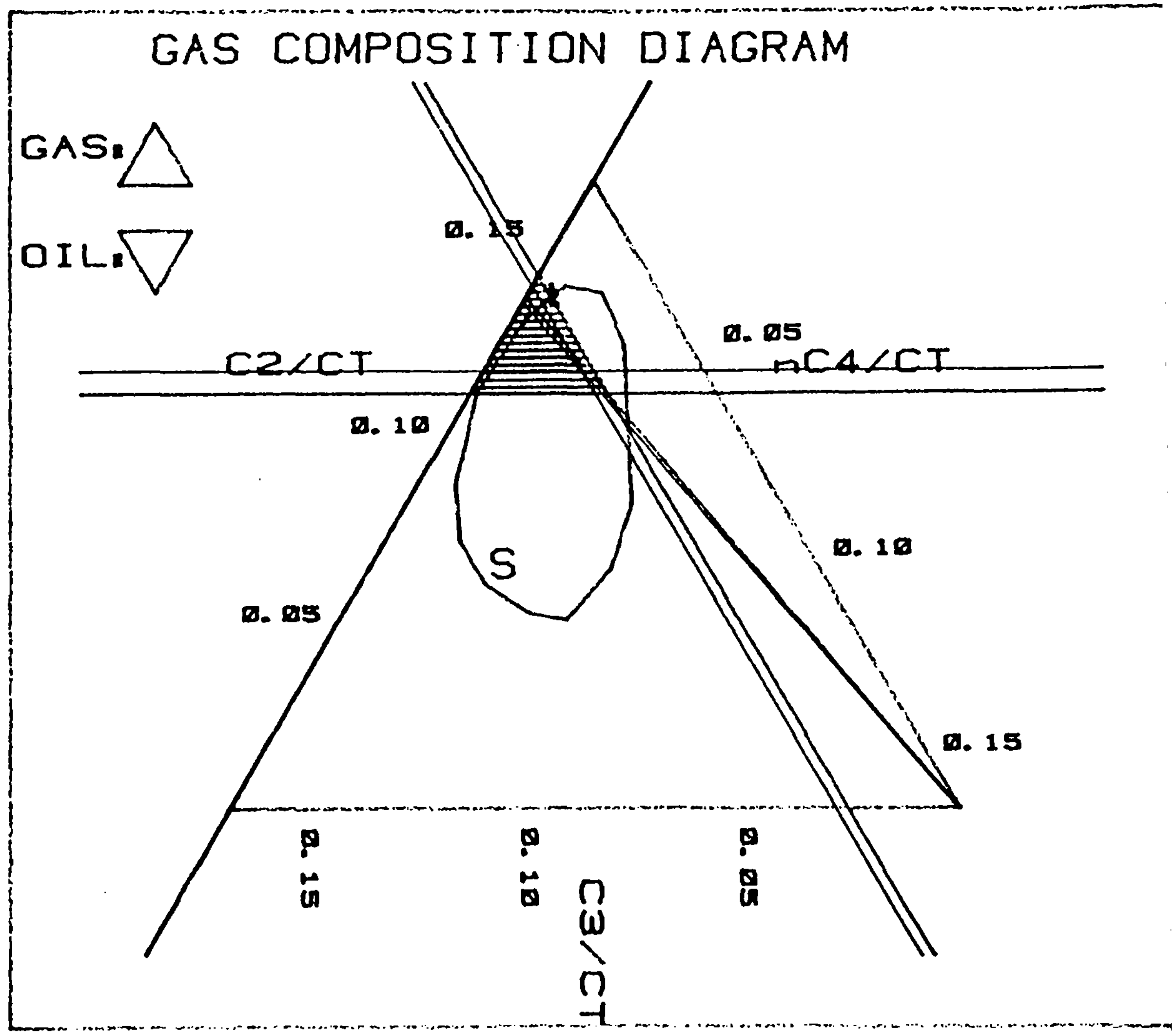


NO	Depth	C1	C2	C3	iC4	nC4	iC5	nC5	CT	C1/C2	C1/C3	C1/C4	C1/C5
1	1380	26.000	3.500	0.800	0.030	0.000	0.000	0.000	30.330	7	33	867	
2	1395	32.000	4.600	1.100	0.060	0.020	0.000	0.000	37.780	7	29	400	

Geoservices

WELL: SHELL 31/2-4





NO	Depth	C1	C2	C3	iC4	nC4	iC5	nC5	CT	C1/C2	C1/C3	C1/C4	C1/C5
1	1380	26.000	3.500	0.800	0.030	0.000	0.000	0.000	30.330	7	33	867	
2	1395	32.000	4.600	1.100	0.080	0.020	0.000	0.000	37.780	7	29	400	

Reaming hole to 12.25" and drilling 12.25" hole:

After coring the hole was reamed out from 1338-1663m to 12.25" and then drilled to 1950m using four bits in four passes. The hole was noticed to be tight between 1443-1446m after the first bit run with overpull of 88-99,000 lbs,and tight between 1522-1776m after the third bit run with 80-100,000 lbs of overpull.

assembly used for reaming:

bit

bit sub

8"Monel

8"DC

12.25"Stab

8"DC

12.25"Stab

13 8"DC

down jar

up jar

3 8"DC

X-O

12 5"HWDP

dart sub

Bit number 10 (HTC X1G) and bit number 11 (HTC J22) were used for reaming, the average drilling parameters were:

WOB: 10-18,000 lbs

RPM: 122-126

FR: 600 g/m

SPP: 2700 psi

Assembly used for drilling:

The same as for reaming except each stabiliser was moved down the assembly by one collar.

Bit number 12 (Smith SDGH) and bit number 13 (HTC XV) were used for drilling, the average drilling parameters were:

WOB: 60-65,000 lbs

RPM: 120-130

FR: 550-590 g/m

SPP: 2850-3100 psi

For this section average mud properties were:

PV: 26

YP: 15

gel: 2

mud weight: 1.32 sg

A check trip was made prior to pulling out of the hole for logging.

Deviation :

Surveys were run at

1380 m	3/4°	N	20	E
1558 m	1/2°	S	5	E
1820 m	1°	S	55	E
1950 m	3/4°	S	22	E

LOGGING (prior to opening hole to 15.75")

Caliper: Down to 1360m the hole is overguage showing signs of caving. From 1360m to 1938m the hole is in guage.

FDC/CNL and ISF/Sonic/GR:

The low GR reading,high itt and cuttings evidence show a small marly horizon between 1360 and 1365m.

At 1365m the deep resistivity increase sharply indicating the presence of hydrocarbon. The GR also increases,this does not indicate a shale because a shale is unlikely to be hydrocarbon bearing so it is probably due to the sand stone being micaceous. By looking at the FDC/CNL log this hydrocarbon can be identified as gas, the FDC shows a sharp decrease in density yet the CNL shows a decrease in porosity. The mica content of the sandstone varies ,shown by the fluctuations of the gamma ray trace.

Deeper into the reservoir porosity decreses due to compaction and the presence of mica so hydrocarbon saturation is poorer therefore resistivity is lower, at 1460m the resistivity base-line drops, simultaneously the GR increases due to an increase in the mica content.

In many cases the high resistivity peaks are due to limestone stringers,that is, where the peak coincides with a low GR and a high Sonic reading, for example at; 1550,1554,1565,1587m etc. Many of these limestone stringers occur at the base of sandstone sections.

The gas/fluid contact can be seen at 1567m, the FDC shows a decrease in density wheras the CNL shows a decrease in porosity due to their being less hydrogen molecules in gas than in water or oil. Below 1567m the FDC/CNL traces follow each other more closely, they are slightly offset due to the CNL being calibrated to read limestone porosity.

At 1582m the GR is fairly constant but the resistivity trace dives,also the Sonic shows a significant shift all of which denote the oil/water contact.

At 1668m the GR increases probably due to the sandstone becoming more argillaceous, perhaps a sandy siltstone, and micaceous with frequent limestone stringers.

The sandstone becomes cleaner at 1784m shown by a decrease in gamma ray,resistivity and sonic.

The very high GR readings at 1727,1738,1757,and 1817m are due to the presence of glauconite in the formation.

Between 1809 and 1814m, and 1856-1864m the FDC values are very low coinciding with very low Sonic and low GR which is due to the occurrence of coal bands up to a metre wide interspersed with shales.

The top of the Dunlin can be seen at approximately 1902m by a marked increase in the GR due to the Dunlin shales, this is supported by cuttings evidence. These shales are interspersed by limestone stringers, shown by the Sonic peaks, resistivity peaks and fluctuations of the GR trace.

Reaming 12.25" hole to 15.75"(1280-1944m)

This section was completed in 13 passes with a Servco hydraulic under reamer.

The hole was initially reamed to 1944m using seven under reamer. A subsequent BGT showed that the hole was underguage along its complete length necessitating re-reaming.

Assembly:

Bit
15.75" under reamer
bit sub
shock sub
8" monel
8"DC
12.25stab
14 8"DC
12.25stab
14 8"DC
12.25STab
down jar
up jar
3 8"DC
X-O
9 HWDP
dart sub

total length: 278.91m

The second time the hole was reamed, three under reamers were used and the subsequent BGT showed that the hole was again under guage in a few spots. It had been reamed too fast causing the hole to be corkscrewed open.

Two under reamer were used the third time, theBGT showed that it was opened satisfactorily, only a few spots at the bottom being down to 14.25"so 22joints of casing were run before new orders; necessary for the hole to be reamed for a fourth time, this was done wtith an under reamer, the following BGT showed the hole to be over 15" all the way down.

Casing:

134 joints of 13 3/8" OD L-80 72lbs/ft casing were run on the 14th December. The shoe was set at 1928m.

Cementation:

A 75bbl cushion of 1.1sg mud was pumped to reduce the annular hydrostatic head. The casing was cemented with 85 sacks of Class 'G' "scavenger slurry" and 1034 sacks of "main slurry", both being mixed with freshwater. An extra 155 sacks were mixed because the weight of the first part of the cement slurry was too low.

Average "scavenger slurry" weight : 13.5ppg (1.62sg)
" "main slurry" " : 15.2ppg (1.82sg)

Cement Additives:

16.6gals/10bbl CFR-2L (cement friction reducing liquid)
7.5gals/10bbl econolite
34gals/10bbl HLX -248 (Halliburton experimental liquid)

Comments:

The cement was left for 9½ hours, the top was tagged at 1859m and drilled out to 1920m before a CBL was run.

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* The CBL log run was followed by a 12.25" bit (bit no.15 re-run HTC X3) with a junk sub which was used to drill out the rest of the cement and to ream on junk down to 1950m. Between 5 and 10lbs of junk were recovered from this run. The junk was run again, this time approximately 3 lbs of junk were recovered.

After a break of several days to work on the stack and pods bit no.15 was run again with a junk sub, and used to drill from 1950-1980m. Ten pounds of junk were recovered from this run.

BHA:

Bit
junk sub
bit sub
17 8"DC
down jar
up jar
2 8"DC
X-O
12 joints HWDP
dart sub
total length: 306.47m

Average drilling parameters:

WOB 25-30 klbs
RPM 135
FR 650 g/m
SPP 2800 psi

The mud weight was cut back during this run to 1.26sg.

For the next bit run (bit no.16,Smith SDGH) three stabilisers were added to give a stiff assembly. The junk sub was run again and a furtherv five pounds of junk were recovered.

Assembly:

Bit
junk sub
12.25" stabiliser
8"Monel DC
12.25" stabiliser
8"DC
12.25" stabiliser
19 8"DC
down jar
up jar
2 8"DC
X-O
12 joints HWDP
dart sub
total length: 337.17m

Average drilling parameters used during this run:

WOB 50 klbs
RPM 130
FR 640 g/m
SPP 2950 psi

Comments:

On running in the hole was found to be tight at 1950m so was reamed down to 1980m. Adrilling break at 2012m indicated the top of the Cook Sand Unit of the Dunlin Formation. The bit bit was pulled due to the torque becoming excessive.

For the next run another Smith SDGH was used with the same assembly. This bit was pulled due to excessive torque too after cutting 122m.

This milled tooth bit was followed by an insert bit,a Smith 3JS, which cut only 9m due to junk in the hole, as a result of which a 12 3/16" mill and junk sub were run. Five and a half hours were spent milling on junk before the string was pulled. Once the

24 runs using 18 bits. T.D. for the 12.25" hole was originally 3991m but it was decided that as a wiper trip was being made it would be more economical to drill with the bit that was run in. Bit No. 37, an XV, was used to drill to 4027m before being pulled due to a suspected washout.

Average drilling parameters:

WOB: 48 klbs

RPM: 106

FR: 580 g/m

SPP: 3020 psi

Mud Properties:

PV: 25

YP: 12

Gel: 2

MW: 1.23 sg

Deviation:

22 Magnetic Single Shot surveys were run in this hole section. The maximum drift angle was 4° at 2668m. The last survey at 3904m gave a result of 1° N18°E.

Comments:

Before running Bit No.37 the hole was logged (see following page).

LOGGING (12.25" hole)

Logs Run:-

- ISF/BHCS
- FDC/CNL
- HDT
- RFT
- CST (3 runs- 60 shots)
- CBL (misrun)
- Casing Caliper

These runs were made between the 11th and 17th of February.

LOGGING (12.25" hole)

The Gamma Ray shows the Dunlin to be sand and shale with a few tight limestone stringers which stand out due to their low porosity and high density readings on the FDC and CNL logs. and fast Δt, for example at 1935m and 1947m.

At 2008m the Gamma Ray and the FDC drop suddenly and the porosity from the CNL increase as the formation changes to a sandstone, probably the top of the Cook Sand. This appears from the Gamma Ray to be divisible into three fining downward sequences which are also discernable to some extent on the increasing divergence of the FDC and CNL traces as the porosity

decreases and the density increases with the increasing shaliness whilst passing down through each of the sequences. The Cook Sand also has scattered limestone stringers through it.

At 2126m there is another formation change where the traces of the GR, FDC, and resistivity all show marked shifts. This is probably the top of the Statfjord, a clean sand with limestone stringers which remains clean down to 2190m at which point it can be seen from the GR, FDC, and CNL that the sand begins a finin g downwards interval until 2250m.

At 2190m there is a thin horizon,a pproximately 1-2m thick, which shows very high density and low porosity and a relatively high sonic reading with a low GR which is probably caused by a very tight stringer of limestone or maybe dolomite.

From 2250-2260m the formation appears to revert rapidly to a clean sand before a sudden change at 2260-61m. The sonic, GR, FDC and resistivity all increase suddenly at this point which looks like a shaly formation, probably caused by the seat-earth of the Statfjord Coal marker horizon which showed up in the cuttings as a slightly carbonaceous kaolinitic claystone but there was no actual coal and none appears here on the logs. This seat-earth has sand directly above and below it.

Below this marker the formation becomes a continuous series of alternating sands and shales which from the cuttings can be seen to be multicoloured in the upper part, beginning to become red from approximately 2315m.

In the cuttings the sands occasionally contained a black heavy mineral which produces an exceptionally high GR reading, for example at: 2562-67m, 2725-26m, 3727-32m. From the logs it can be seen that this heavy mineral is often occurring in the bottom of the sand beds possibly suggesting channel sand deposits.

From 3200 m the cuttings showed an increase in potash feldspar content which has made the Gamma Ray produce a trace which is less easy to distinguish between claystone and sand.

From the cuttings evidence it is quite possible that below the Statfjord the resistivity peaks associated with high sonic and relatively low Gamma Ray readings are due to concretions or tight cemented sands rather than to limestone stringers.

SIDEWALL SAMPLES

DEPTH	RECOVERY(mm)	DESCRIPTION
3976.8	25	SANDSTONE:light grey,fine grained
3969.4	35	CLAYSTONE:red brown,with SST:grey-orange,arkose
3961.4	30	CLAYSTONE:red-brown,micaceous
3941.8	35	CLAYSTONE:red brown-grey green,mottled, sandy
3884.2	20	SANDSTONE:red-brown,fine grained,argillaceous
3856.2	40	CLAYSTONE:red-brown,silty
3832.0	20	SANDSTONE:mottled, -medium grained,arkosic, argillaceous
3810.8	30	SANDSTONE:mottled,fine-medium grained,arkosic, argillaceous
3756.5	20	CONGLOMERATE:mottled,arkosic,abundant claystone grains
3649.4	15	CLAYSTONE:red-brown, sandy
3590.0	15	CLAYSTONE:red-brown,occasionally grey green,silty
3538.5	15	SILTSTONE:red-brown,argillaceous
3471.6	15	CLAYSTONE:red-brown,silty,micaceous
3419.4	20	CLAYSTONE:red-brown,micaceous
3327.4	20	CLAYSTONE: as above
3323.0	15	CLAYSTONE: a/a
3323.1	10	CLAYSTONE: a/a
3313.8	20	CLAYSTONE: a/a
3308.2	20	CLAYSTONE:red-brown,mottled,grey green,silty
3296.4	15	CLAYSTONE:red-brown,silty,micaceous
3289.6	20	CLAYSTONE:red-brown,grey green spots,micaceous
3255.2	15	CLAYSTONE:red-brown,silty,micaceous
3219.4	20	CLAYSTONE:red-brown,micaceous
3202.0	20	SILTSTONE:red brown-grey green,mottled
3184.8	15	CLAYSTONE:red brown,silty
3120.2	25	SILTSTONE:red brown,micaceous,argillaceous
3071.8	30	CLAYSTONE:red brown,silty,micaceous
3054.0	25	CLAYSTONE:light red brown
3033.2	40	CLAYSTONE:red brown,micaceous
3011.6	35	CLAYSTONE:red brown,very micaceous
2983.8	30	CLAYSTONE:red brown,micaceous
2963.8	30	CLAYSTONE:red brown,occasionally grey green spots, silty,very micaceous
2950.8	20	CLAYSTONE:red brown,silty,micaceous
2931.4	30	CLAYSTONE:light red brown,silty,micaceous
2905.2	40	CLAYSTONE:red brown,micaceous
2887.7	25	CLAYSTONE:red brown,grey green spots,micaceous, silty

(Sidewall Samples continued)

2870.0	30	SILTSTONE:red brown,micaceous,very argillaceous
2843.8	35	CLAYSTONE:red brown,micaceous,with silty laminations
2808.6	40	CLAYSTONE:red brown,occasional concretions
2782.4	50	CLAYSTONE:red brown,silty,micaceous,occasional concretions
2766.0	40	CLAYSTONE:red brown,silty,micaceous,with concretions
2751.8	50	SHALE:red brown,micaceous
2728.0	50	CLAYSTONE:red brown;micaceous
2675.6	50	CLAYSTONE: as above
2642.6	50	CLAYSTONE:red brown,occasionally mottled grey green micaceous
2609.4	60	CLAYSTONE:redbrown,grey green spots,abundant concretions
2591.7	40	CLAYSTONE:red brown,micaceous
2569.5	55	CLAYSTONE: as above
2545.0	35	CLAYSTONE: a/a
2529.5	50	CLAYSTONE: a/a
2439.0	65	CLAYSTONE:red brown,mottled grey green,micaceous
2418.0	35	SILTSTONE:grey green,micaceous,sandy
2413.4	50	SILTSTONE:grey green,very argillaceous,micaceous
2398.8	45	CLAYSTONE:red brown,mottled grey green,micaceous
2343.4	20	CLAYSTONE:grey green-yellow green,mottled,hard fragments in soft matrix
2330.0	45	SANDSTONE:light grey green,fine grained,kaolinitic
2322.5	60	CLAYSTONE:red brown,dark grey,dark yellow brown,grey green,mottled,micaceous
2308.2	65	CLAYSTONE:mottled,grey green,yellow brown,red,red brown in places,hard fragments in a soft matrix
2296.9	30	CLAYSTONE:dark grey,carbonaceous
2260.2	25	SILTSTONE:light grey brown,micaceous,slightly carbonaceous
2246.6	30	CLAYSTONE:medium grey,sandy
2124.0	30	CLAYSTONE:medium grey with sandy laminations
2114.7	35	CLAYSTONE: as above
2075.5	35	SHALE:medium grey,pyritic,with sandy laminations
2059.5	30	SANDSTONE: [illegible] fine grained,argillaceous,laminated, bioturbated

(Sidewall Samples continued)

2028.5	25	CLAYSTONE:medium grey with sandy cross laminations
2005.9	25	SHALE:medium grey,micaceous
1999.7	30	SHALE: as above
1991.8	50	CLAYSTONE:medium grey,micaceous
1982.5	35	CLAYSTONE:medium grey,micaceous,sandy
1968.0	40	CLAYSTONE: as above
1942.5	25	CLAYSTONE:medium grey,micaceous
1929.4	45	CLAYSTONE:medium grey,micaceous,sandy laminations

9 5/8" CASING

Casing:

276 joints of 9 5/8" OD C-95, 53.5 lbs/ft casing were run on the 18th and 19th of February. The shoe was set at 3982.6 m.

Cementation:

The casing was cemented with a lead slurry composed of 817 sacks of class'G' mixed with 6916 gallons of freshwater giving an average slurry density of 13.5 ppg (1.62sg).
Lead slurry additives: 245 gallons of Econolite, 123 gallons of CFR-2L, 57 gallons of HR-12L.

The tail slurry was made up of 534 sacks of class'G' mixed with 1981 gallons of freshwater giving an average slurry weight of 15.8 ppg(1.89sg).
Tail slurry additives: 155 gallons of CFR-2L, 480 gallons of HLX C248, 91 gallons of HR-12L.

Comments:

The tail slurry had to be made 22 bbls less than programmed (108 sacks of cement) due to a problem with the bulk supply system.

The cement was displaced with 925 bbls of mud.

8 ½" Phase (3983m-5034m)

This section was completed in 19 passes using 17 bits, two runs were fishing operations. The first bit, an HTC X1G, was used to drill out the cement and 9 5/8" casing shoe and to drill formation to 4034m. This was followed by a formation leak-off test which gave a result of 1.8 g/cc expressed as an equivalent mud weight. Bit number 40, an HTC W7R2DJ, also a tooth bit was used to drill to 4059m. Bit number 41, an HTC J44, drilled 125m but on pulling was found to have only two cones necessitating a fishing run with a reverse circulation junk basket which was unsuccesful. An HTC WR7 was used to drill on junk and cut 6m to ensure that the hole was clear for the diamond bit and turbine which was to follow. 41m were cut and on pulling the diamond bit showed excessive wear so it was followed by ani nsert bit,another HTC J44. Another turbine run was attempted after the J44 but only 33m were made. This was followed by another insert bit, a J33, which cut 106m. A third diamond bit and turbine were run next but only 42m were made. The bit was pulled due to high torque and replaced by a Diamond Boart SD01 which cut 74m.

This last turbine run was followed by a J22 which only had two cones when pulled out necessitating another run with a reverse circulation junk basket, the cone was successfully retrieved.

The section was completed with 5 insert bits and one core head; one J33,one J44 ,one J55, two F4's and a CB 303 core head.

Prior to the last bit run the pipe sheared just below the rotary table and the string dropped 16m to the bottom of the hole making it necessary to change out a large proportion of the drill-string due to bent pipe.

Average Drilling Assembly:

Bit
junk sub
stabiliser
shock sub
stabiliser
monel drill collar
stabiliser
1 6½" drill collar
stabiliser
19 6½" drill collars
down jar
up jar
2 6½" drill collars
6 joints HWDP
dart sub

Hole problems:

The hole was found to be tight at 4534m when running in with bit number 48 so it was reamed from 4518m to 4547m before drilling ahead.

Deviation:

Magnetic single shot surveys were taken at:

4021m	0.75° drift	308.5° bearing
4049m	0.75°	4°
4179m	1.0°	348.5°
4280m	1.5°	303.5°
4419m	1.75°	308.5°
4528m	2.5°	288°
4694m	3.5°	273.5°

Mud:

The lower part of the 12 1/4" hole was seen from the caliper log to be extensively washed out, so in anticipation of active shale sections in the 8½" hole it was decided that the mud system be changed to a Gypsum-Lignosulphonate system to inhibit any possible shale hydration.

Average mud properties for the section were:

Mud Weight:	1.2sg	pH:	10.7
PV:	23-25	Calcium:	800ppm
YP:	12-15	Chlorides:	11000-17000ppm
Gel:	2-6	Solids:	11%

Drilling was stopped at 5025m and an 18m core barrel with a CB 303 core head was run into the hole for the TD core. 10m were cut of which 8.4m were recovered.

Coring Assembly:

Core head
core barrel
2 6½" drill collars
stabiliser
9 6½" drill collars
16 joints HWDP
down jar
up jar
6 joints HWDP
dart sub

A total depth of 5035m was reached on the 23rd of March 1981.

4°) Pressure regime in the reservoir

Repeat formation test

RFT run 1 (26/11/1980)

RUN 1	Depth m	Corrected final build up pressure (psi)	Corrected hydrostatic pressure (psi) before	after
1.1	1396.5	2244	2638	2639
1.2	1420	2249	2682	2685
1.3	1455.5	2255	2751	2751
1.4	1486.5	2262	2810	2813
1.5	1551.5	2273	2933	2934
1.6	1548.5	2273	2928	2928
1.7	1568.5	2277	2964	2966
1.8	1566	2277	2962	2964
1.9	1573.5	2282	2978	2977
1.10	1578	2289	2983	2986
1.11	1581.5	2292	2991	2992
1.12	1585.5	2301	3000	3002
1.13	1595	3214	3018	3019
1.14	1585.5	2301	3001	3002
1.15	1590.5	3208	3011	3012
1.16	1606	2329	3037	3040

no hole problems during logging

anomaly repeated : Formation slightly supercharged .

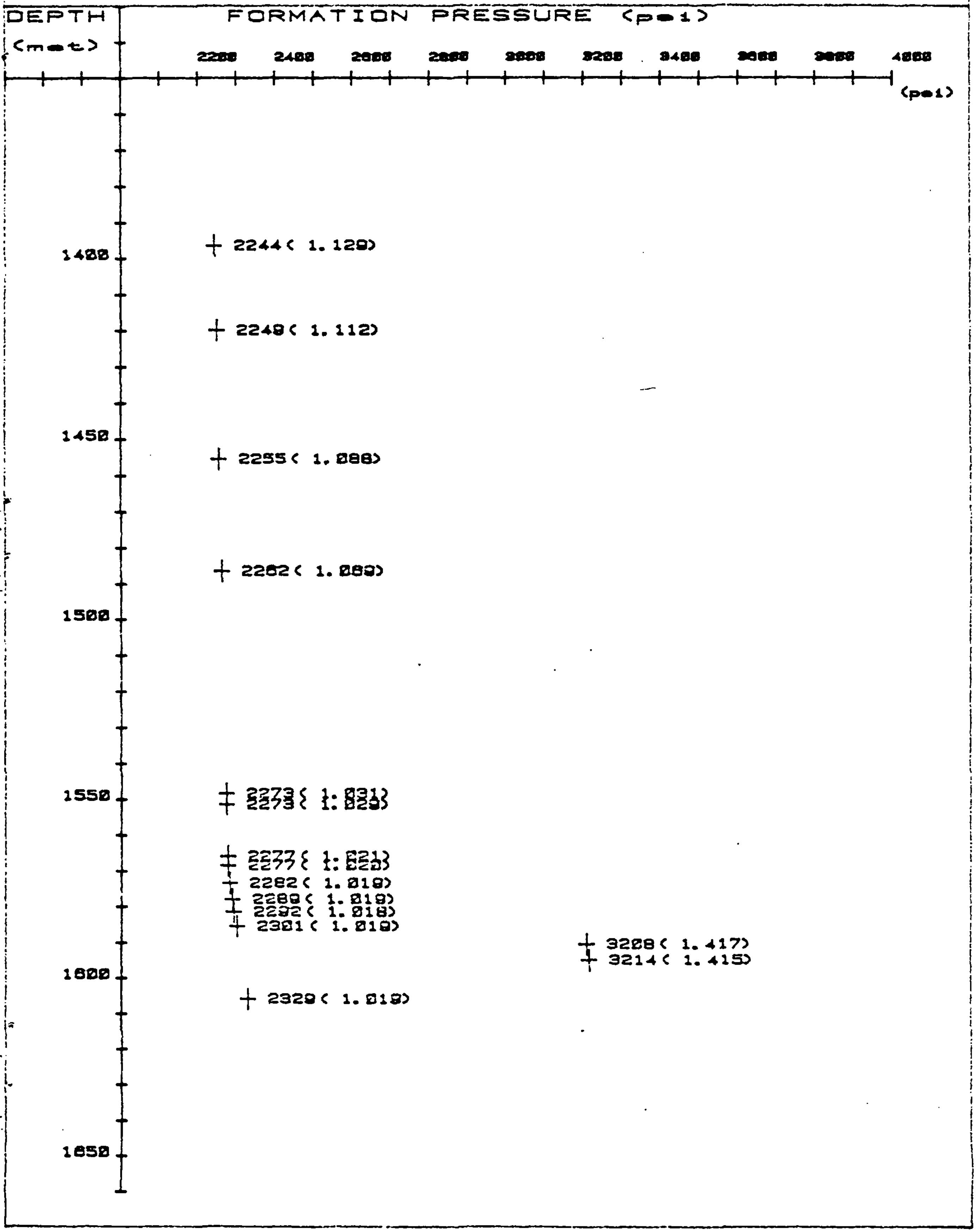
tool: Violet RFT modified

probe: long

chokes : 8 x 0.015

SHELL 31/2-4

REPEAT FORMATION TEST REPORT (RESERVOIR)



Repeat formation test

Pretest results (13/2/1981)

RUN	Depth m	Corrected final build up pressure (psi)	Corrected hydrostatic pressure (psi) BEFORE	AFTER
1.1	2142	3112	3809	3809
1.2	2277	3310	4046	4047
1.3	2389	3474	4245	4245
1.4	2467	3589	4383	4384
1.5	2686	3937	4771	4771
1.6	2713	3691	4817	4819
1.7	3262	4424	5779	5779
1.8	3402	5146	6026	6027
1.9	3585.5	5413	6339	6340

tool : RFT 2 x blue
standard probe
standard filter
strain gauge 51349.1
spacers for 11 inch to 13.5 inches ;hole diameter: 14.1"

Repeat Formation Test

Pretest results (24/3/81)

RUN	Depth m	Corrected final build up pressure (psi)	Corrected hydrostatic pressure (psi)	
			BEFORE	AFTER
1.3	4303	6528	7500	7503
1.4	4423.3	6702	7704	7707
1.8°	4966.8	7545	8610	8619

tool: RFT 2 x blue

° Formation collapsing

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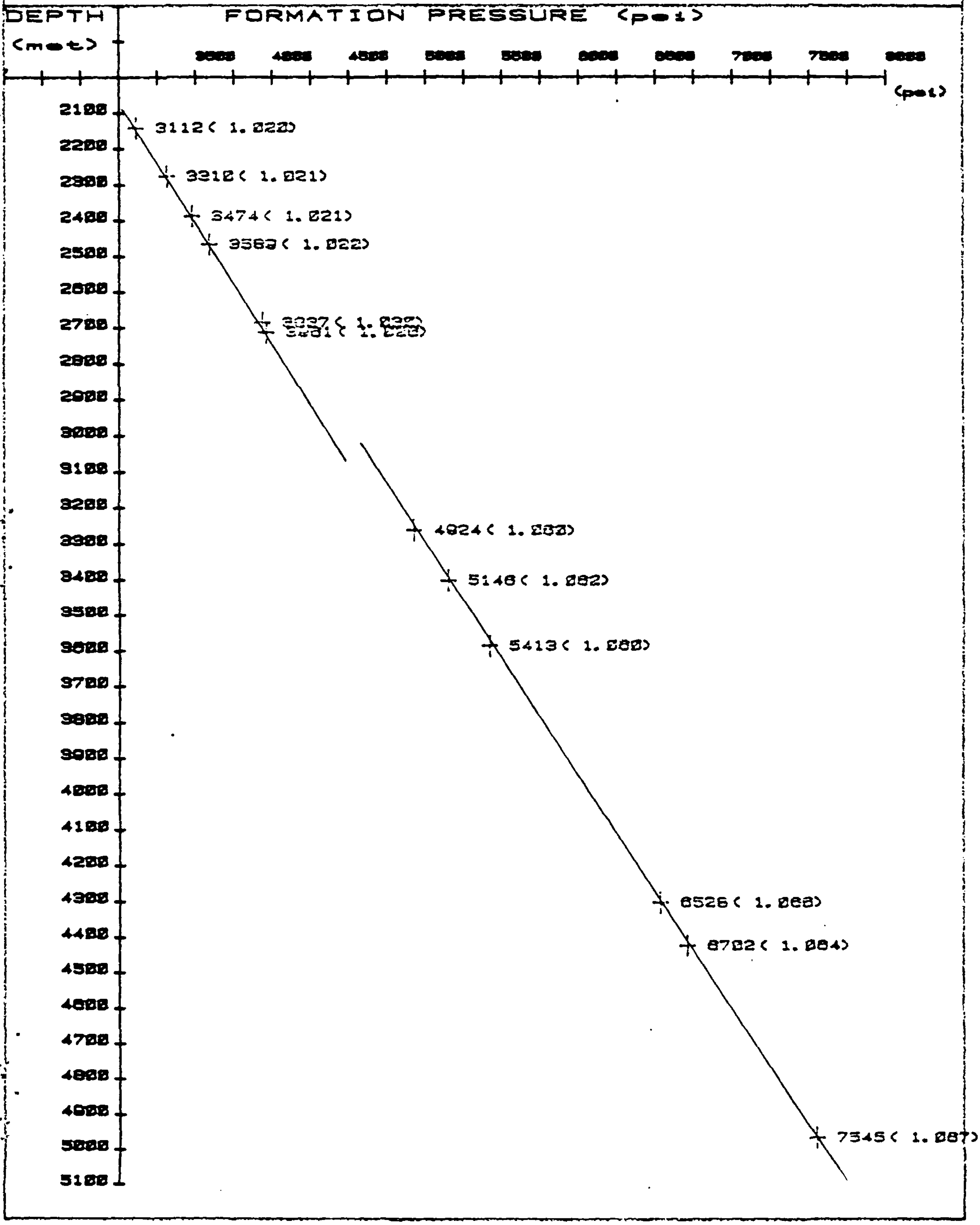
REPEAT FORMATION TEST REPORT



5) Overpressure Survey:

General information:

In addition to hole conditions, gas shows and other physical indicators of overpressure, two statistical methods were used to quantatively define formation pore pressure. D-exponent is the prime driver for the On-line system and has been used in the main to assign values to the pore pressure. Sigmalog has been used off-line as a back up, with data stored at 1m intervals on magnetic cartridge.

Theory:

Sigmalog is based on a method of processing drilling parameters to calculate the formation pressure gradient. The calculated Sigmalog is in effect a rock strength parameter.

New interpretation procedures can overcome such traditional probhems as changes in lithology, faulting and the effects of poor bit efficiency and hydraulics. Only the measurable drilling parameters are used for Sigmalog, such factors as bit wear and type are not taken into account. Determination of overpressure, as with d-exponent is by comparing the measured value with a reference value, the difference between the two representing the amplitude of the formation pressure.

If a right envelope of the raw curve were to be drawn (ie: passing through the average maximum values), the difference between this envelope and the reference (trend) line shows overpressure, and the difference between the envelope and the raw data indicates porosity.

Equations (metric):

$$\sqrt{\sigma_t} = \frac{WOB^{0.5} \times RPM^{0.25}}{Dh \times ROP^{0.25}} - 0.028(7 - 0.001 \times TVD)$$

Where WOB=weight on bit in tonnes

RPM=rotary speed

Dh=bit diameter

ROP=rate of penetration in m/hr

TVD=true vertical depth

Where $\sqrt{\sigma_t} \leq 1 \quad n = 3.25/640\sqrt{\sigma_t}$

$\sqrt{\sigma_t} > 1 \quad n = 1/640\left(4 - \frac{.75}{\sqrt{\sigma_t}}\right)$

n is a function of the time required to equalize the differential pressure between mud and the formation to cutting height.

Rock strength parameter(plotted value):

$$\sqrt{\sigma_o} = F \times \sqrt{\sigma_t} \qquad F = 1 + \frac{1 - \sqrt{(1 + n^2\Delta p^2)}}{n\Delta p}$$

Where Δp=differential pressure between mud and formation=.1(MW-H)Depth

MW=mud weight in kg/l

H=normal hydrostatic gradient in kg/l

D-exponent:

Used is the Geoservices development of the d-exponent which computes a normalized rate of penetration to highlight anomalies in formation compaction.

An expression may be found for a compaction trend in normally pressured shales. Negative departures from this trend will indicate undercompaction and potential overpressures.

Equations:

The original equation for d-exponent was developed by Jordan and Shirley in 1966, mud weight correction applied by REHM and McClendon and bit wear/type correction applied by Geoservices.

$$dcs = \frac{\log\left(\frac{a^p\,ROP}{60\,RPM}\right)}{\log\left(\frac{12\,WOB}{10^6\,Dh}\right)} \times \frac{H}{ECD}$$

Where ECD=the equivalent circulating density and a^p a bit wear correction

$a=.93T^2+6T+1$

$T = x\,\frac{.31\,FBW^2+3FBW+1}{.31x^2+3x+1}$

x=FBW((TD-ID)/L)

p=a parameter of bit type (diamond to soft mill tooth)

TD=total depth

ID=initial run depth

L=run length

FBW=final bit wear(n/8)

The dcs trend line may be expressed as a straight line with an equation such as:

$$\log(dx)=a2+b$$

The trend may be given manually through the CRT keyboard or the computer may find it's own trend within predetermined limits over a particular interval.

When the observed dcs is lower than the trend:

$$Pf+S=(S-H)\left(\frac{dcs}{ndcs}\right)^{1.2}$$

Where S=overburden gradient

Equivalent circulating density is the effective pressure of the mud in circulation, taking into account the back pressure of the mud in the annulus.

FRACTURE GRADIENT DETERMINATION

To estimate local fracture gradient, appropriate values of vertical (overburden) and horizontal stress coefficients must be found.

The variation of overburden with depth may be approximated by the third order polynomial:

$$S = a \ln^2 Z + b \ln Z + c$$

where S = overburden

Z = depth

a, b, c = coefficients computed using a curve fitting regression from local density or sonic data.

Similarly, the horizontal stress components of the fracture gradient may be approximated by the 2nd order polynomial:

$$K = \frac{nu}{1 - nu}$$

$$= a \ln Z + b$$

(nu/1-nu) is known as Poisson's Ratio, and

$$nu = \frac{Frac - Pf}{Frac + S - 2Pf}$$

where Pf = formation pore pressure

Frac = fracture gradient from leak off test

a and b are derived from a best fit regression curve of the variation of poissons coefficients with depth.

The overburden coefficients used inthis well were:

a =0.01304

b =-0.017314

c =1.435

These coefficients are standard soft rock (Gulf Coast)

However, local coefficients were derived using both sonic and

FDC data . The following results were obtained:

SONIC	FDC
a = -0.04117	a = -0.03292
b = 0.86935	b = 0; 7555
c = -3.57759	c = -3.26652

These three curves are plotted in the mainfile, the latter curves illustrate the influence of the water column.
Also drawn are three curves representing Poissons Ratio versus depth;thier coefficients are given below.

(1) North Sea	(2) Local (from L.O.T's)	(3) Conventional Soft
a = 0.277	a = -0.02579	a = 0.266
b =-2.977	b = 2.06819	b =-2.667

The regression curve computed from sonic derived overburden is apparently anomalous.Which is due to an integration of low density (from high sonic transit time in the wet tertiary shales) and high leak off pressure fracture values in these plastic sediments. With increasing formation competence, the shales will have a lower sonic transit time, but at the same time will fracture more readily than the immature sediments above.
The local coefficients of the curve fitting equation of Poissons "nu" with depth also reflect the anomaly of low density Tertiary plastic shales as discussed above.

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
201	2410.0	90	2.34
202	2420.0	95	2.34
203	2430.0	102	2.25
204	2440.0	121	2.28
205	2450.0	90	2.20
206	2460.0	90	2.25
207	2470.0	96	2.27
208	2480.0	90	2.20
209	2490.0	105	2.30
210	2500.0	93	1.95
211	2510.0	90	2.33
212	2520.0	75	2.30
213	2530.0	87	2.50
214	2540.0	100	2.34
215	2550.0	90	2.34
216	2560.0	90	2.49
217	2570.0	110	2.42
218	2580.0	79	2.57
219	2590.0	85	2.45
220	2600.0	78	2.52
221	2610.0	115	2.30
222	2620.0	78	2.43
223	2630.0	110	2.46
224	2640.0	110	2.40
225	2650.0	108	2.20
226	2660.0	95	2.55
227	2670.0	80	2.55
228	2680.0	80	2.55
229	2690.0	140	2.31
230	2700.0	90	2.33
231	2710.0	90	2.38
232	2720.0	90	2.28
233	2730.0	100	2.42
234	2740.0	84	2.50
235	2750.0	65	2.51
236	2760.0	86	2.52
237	2770.0	80	2.58
238	2780.0	89	2.50
239	2790.0	82	2.44
240	2800.0	106	2.40
241	2810.0	80	2.52
242	2820.0	82	2.50
243	2830.0	87	2.51
244	2840.0	90	2.48
245	2881.0	81	2.50
246	2860.0	74	2.50
247	2870.0	85	2.55
248	2880.0	75	2.55
249	2890.0	80	2.53
250	2900.0	75	2.55

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
0	450.0	142	1.50
1	460.0	160	1.60
2	470.0	160	1.51
3	480.0	168	1.68
4	490.0	170	1.50
5	500.0	199	1.50
6	510.0	199	1.47
7	520.0	199	1.44
8	525.0	180	1.55
9	530.0	140	1.90
10	540.0	155	1.92
11	550.0	145	2.15
12	560.0	148	2.00
13	570.0	150	1.92
14	580.0	139	2.17
15	590.0	140	2.03
16	600.0	126	2.18
17	610.0	140	2.12
18	620.0	130	2.20
19	630.0	130	2.26
20	640.0	130	2.25
21	650.0	128	2.30
22	660.0	132	2.25
23	670.0	125	2.25
24	680.0	138	2.29
25	690.0	122	2.27
26	700.0	122	2.30
27	710.0	130	2.25
28	720.0	135	2.12
29	730.0	160	1.83
30	740.0	162	1.80
31	750.0	165	1.74
32	760.0	160	1.70
33	760.0	160	1.70
34	770.0	165	1.76
35	780.0	165	1.75
36	790.0	165	1.75
37	800.0	160	1.80
38	810.0	164	1.80
39	820.0	160	1.80
40	830.0	162	1.77
41	840.0	166	1.80
42	850.0	161	1.76
43	860.0	160	1.80
44	870.0	152	2.00
45	880.0	150	2.06
46	890.0	150	2.06
47	900.0	158	1.84
48	910.0	140	1.95
49	920.0	140	2.10
50	930.0	145	2.10

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
51	940.0	140	2.15
52	950.0	140	2.13
53	960.0	140	2.14
54	970.0	143	2.06
55	970.0	143	2.14
56	980.0	143	2.06
57	990.0	150	2.09
58	1000.0	150	2.50
59	1010.0	160	2.18
60	1020.0	150	2.17
61	1030.0	140	2.12
62	1030.0	140	2.12
63	1040.0	160	2.10
64	1050.0	161	2.05
65	1060.0	161	2.00
66	1070.0	161	1.97
67	1080.0	161	1.99
68	1080.0	162	1.99
69	1090.0	162	2.03
70	1100.0	160	2.01
71	1110.0	158	2.04
72	1120.0	155	2.00
73	1130.0	160	2.00
74	1140.0	140	2.00
75	1150.0	151	2.00
76	1160.0	160	1.97
77	1170.0	155	2.14
78	1180.0	150	2.18
79	1190.0	135	2.23
80	1200.0	140	2.15
81	1210.0	140	2.47
82	1220.0	120	2.25
83	1230.0	125	2.20
84	1240.0	150	2.12
85	1250.0	142	2.30
86	1260.0	160	2.12
87	1270.0	165	1.95
88	1280.0	172	1.92
89	1290.0	155	1.93
90	1300.0	165	1.95
91	1310.0	202	1.87
92	1320.0	175	1.95
93	1330.0	166	1.88
94	1340.0	114	1.95
95	1350.0	160	1.93
96	1360.0	132	1.98
97	1370.0	190	2.05
98	1380.0	140	2.20
99	1390.0	140	2.01
100	1400.0	130	2.05

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
101	1410.0	148	1.95
102	1420.0	132	2.04
103	1430.0	110	2.05
104	1440.0	126	2.05
105	1450.0	132	1.90
106	1460.0	121	2.15
107	1470.0	142	2.17
108	1480.0	141	2.15
109	1490.0	135	2.25
110	1500.0	140	2.20
111	1510.0	135	2.26
112	1520.0	86	2.53
113	1530.0	142	2.15
114	1540.0	135	2.25
115	1550.0	92	2.13
116	1560.0	138	2.17
117	1570.0	120	2.25
118	1580.0	116	2.15
119	1590.0	120	2.07
120	1600.0	110	2.20
121	1610.0	118	2.10
122	1620.0	111	2.22
123	1630.0	110	2.14
124	1640.0	110	2.13
125	1650.0	110	2.21
126	1660.0	110	2.23
127	1670.0	90	2.25
128	1680.0	112	2.35
129	1690.0	104	2.34
130	1700.0	104	2.32
131	1710.0	95	2.40
132	1720.0	103	2.34
133	1730.0	108	2.37
134	1740.0	100	2.40
135	1750.0	101	2.36
136	1760.0	94	2.44
137	1770.0	102	2.37
138	1780.0	100	2.36
139	1790.0	114	2.19
140	1800.0	115	2.32
141	1810.0	120	1.95
142	1820.0	130	2.05
143	1830.0	93	2.48
144	1840.0	100	2.13
145	1850.0	85	2.23
146	1860.0	100	2.25
147	1870.0	101	2.17
148	1880.0	90	2.25
149	1890.0	90	2.35
150	1500.0	65	2.59

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
151	1910.0	100	2.20
152	1920.0	103	2.35
153	1930.0	105	2.33
154	1940.0	135	2.33
155	1950.0	100	2.40
156	1960.0	105	2.37
157	1970.0	107	2.48
158	1980.0	105	2.40
159	1990.0	105	2.44
160	2000.0	94	2.53
161	2010.0	92	2.30
162	2020.0	113	2.28
163	2030.0	110	2.35
164	2040.0	75	2.31
165	2050.0	131	2.20
166	2060.0	125	2.37
167	2070.0	115	2.28
168	2080.0	110	2.35
169	2090.0	127	2.35
170	2100.0	120	2.35
171	2110.0	121	2.35
172	2120.0	121	2.40
173	2130.0	123	2.16
174	2140.0	104	2.12
175	2150.0	100	2.12
176	2160.0	95	2.16
177	2170.0	96	2.25
178	2180.0	108	2.35
179	2190.0	70	2.25
180	2200.0	117	2.30
181	2210.0	112	2.28
182	2220.0	112	2.31
183	2230.0	112	2.43
184	2240.0	112	2.43
185	2250.0	110	2.50
186	2260.0	80	2.52
187	2270.0	94	2.21
188	2290.0	92	2.25
189	2300.0	90	2.29
190	2310.0	147	2.29
191	2320.0	97	2.31
192	2330.0	93	2.20
193	2340.0	100	2.29
194	2350.0	95	2.35
195	2360.0	92	2.24
196	2370.0	92	2.21
197	2370.0	93	2.21
198	2380.0	92	2.27
199	2390.0	90	2.30
200	2400.0	171	2.26

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
251	2910.0	81	2.50
252	2920.0	75	2.55
253	2930.0	77	2.53
254	2940.0	80	2.55
255	2950.0	92	2.55
256	2950.0	92	2.45
257	2960.0	81	2.49
258	2970.0	74	2.61
259	2980.0	76	2.53
260	2990.0	80	2.43
261	3000.0	87	2.52
262	3010.0	81	2.47
263	3020.0	77	2.59
264	3030.0	96	2.40
265	3040.0	100	2.39
266	3050.0	92	2.59
267	3060.0	99	2.46
268	3070.0	80	2.45
269	3080.0	98	2.52
270	3090.0	74	2.45
271	3100.0	75	2.50
272	3110.0	97	2.50
273	3120.0	82	2.49
274	3130.0	88	2.51
275	3140.0	108	2.40
276	3150.0	96	2.57
277	3160.0	88	2.57
278	3170.0	95	2.55
279	3180.0	100	2.57
280	3190.0	103	2.49
281	3200.0	100	2.57
282	3210.0	95	2.57
283	3220.0	98	2.57
284	3230.0	78	2.50
285	3240.0	75	2.59
286	3250.0	89	2.47
287	3260.0	80	2.45
288	3270.0	72	2.45
289	3270.0	72	2.40
290	3280.0	72	2.45
291	3290.0	100	2.50
292	3300.0	87	2.60
293	3310.0	85	2.60
294	3320.0	85	2.61
295	3340.0	84	2.58
296	3340.0	85	2.63
297	3350.0	97	2.34
298	3360.0	99	2.35
299	3370.0	95	2.44
300	3380.0	85	2.52

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
301	3390.0	68	2.57
302	3400.0	80	2.40
303	3410.0	78	2.40
304	3420.0	78	2.40
305	3430.0	74	2.44
306	3450.0	75	2.45
307	3450.0	75	2.52
308	3460.0	75	2.45
309	3470.0	74	2.60
310	3480.0	74	2.56
311	3490.0	65	2.10
312	3500.0	98	2.57
313	3510.0	94	2.60
314	3520.0	98	2.58
315	3530.0	96	2.43
316	3540.0	95	2.57
317	3550.0	70	2.57
318	3560.0	73	2.58
319	3570.0	85	2.69
320	3580.0	95	2.47
321	3590.0	81	2.30
322	3600.0	81	2.39
323	3610.0	80	2.52
324	3620.0	89	2.38
325	3630.0	91	2.36
326	3640.0	84	2.60
327	3650.0	90	2.56
328	3660.0	95	2.46
329	3670.0	97	2.37
330	3680.0	91	2.56
331	3690.0	93	2.53
332	3700.0	93	2.55
333	3710.0	95	2.42
334	3720.0	100	2.46
335	3730.0	80	2.54
336	3740.0	89	2.57
337	3750.0	95	2.49
338	3760.0	80	2.50
339	3770.0	90	2.48
340	3780.0	90	2.46
341	3790.0	92	2.23
342	3800.0	85	2.42
343	3810.0	95	2.55
344	3820.0	90	2.47
345	3830.0	83	2.45
346	3840.0	86	2.50
347	3850.0	91	2.42
348	3860.0	90	2.48
349	3870.0	92	2.20
350	3880.0	81	2.55

SHELL 31/2-4 RAW LOG DATA

#	Depth,m	Sonic	Density
351	3890.0	102	1.67
352	3900.0	83	2.30
353	3910.0	88	1.77
354	3920.0	98	2.40
355	3930.0	80	2.57
356	3940.0	80	2.55
357	3950.0	70	2.68
358	3970.0	68	2.54
359	3980.0	64	2.45
360	3990.0	65	2.64

suspension of well 31/2-4

after completion of the t.d. logging programme in 31/2-4, (to be advised by separate telex) and assuming no hydrocarbons encountered in the 8 1/2'' hole section it is proposed to suspend well 31/2-4 for testing in 1981/82. the suspension procedure proposed is as follows:-

1. rih with ca. 250 m of 2 7/8'' tubing on 5'' dp to 5000 m. circulate and condition mud and then set a 200 m cement plug using the following slurry:

norcem class 'g' cement
+ 0.90 galls/sk hlx-c248 (5 0/0 solution)
+ 0.25 galls/sk hr-12l
+ 3.97 galls/sk fresh water
density 15.8 ppg
yield 1.16 cu. ft/sk
(thickening time +/- 2.75 hours at 287 deg f)
pump 10 bbls mix water ahead and 1 bbl mix water behind the cement slurry

2. set 4 additional cement plugs, using the same slurry as above, over the following intervals:-

4770-4570 m
4540-4340 m
4310-4110 m
4080-3880 m
(thickening time +/- 4.5 hours at 229 deg f)

note: the five cement plugs are to be set ''on the run''. pull back +/- 30 m above each cement plug and reverse circulate the 2 7/8'' tubing and 5'' dp clean, prior to setting the next plug. care should be taken not to exceed the equivalent mud gradient of 1.80 s.g. at the 9 5/8'' shoe as determined in the leak off test of 22.2.81.

3. woc for +/- 12 hours. meanwhile poh and rih with an 8 1/2'' bit and tag toc with 15-20,000 lbs. (if toc is below 3950 m, another plug will have to set to bring the toc to ca. 3880 m). if toc is ok, pull back one stand and pressure test the cement plug to 4500 psi surface pressure (this is 1000 psi above the 9 5/8'' shoe strength of 1.80 s.g., assuming 1.19 s.g. mud in the hole) if test is ok, poh.

4. rih with 9 5/8'' casing cutter. cut the 9 5/8'' casing at 1920 m and check for any equalizing flow due to gas trapped in the 9 5/8'' x 13 3/8'' annulus. if no increase in flow is observed then proceed and retrieve the casing, having the diverter closed when lifting the hanger/seal assy to divert possible trapped gas. if an increase in flow is observed when cutting the 9 5/8'' casing, then call base proceed as follows:-

4.1 close in the well and observe the pressure build up. allow the pressure to equalize and circulate out any gas cut mud. continue to circulate until the mud is conditioned to an uniform weight of 1.19 s.g., or increase the mud weight as required.

4.2 observe the well static for 10 mins and proceed as per then advised program.

5. rih with ca. 250 m, 2 7/8'' tubing on 5'' dp to 2100 m and spot a 35 bbls viscous mud pill (150 secs mf). poh to 2000 m. circulate and condition mud and then set a 200 m cement plug using the following slurry:

norcem class 'g' cement
+ 0.30 galls/sk hlx-c248 (5 0/0 solution)
+ 4.78 galls/sk fresh water

density 15.8 ppg
yield 1.15 cu.ft/sk
(thickening time +/- 3.0 hours)

pump 10 bbls mixwather ahead and 1 bbl mixwater behind the cement slurry. poh to +/- 30 m above the calculated toc and reverse circulate clean. poh.

6. woc for +/- 8 hours (or until surface samples are hard) meanwhile rih with an 8 1/2'' bit and tag toc with 15-20,000 lbs. (if toc is below 1890 m, another plug will have to be set to bring the toc to ca, 1800 m) if toc is ok. poh.

7. rih with a rtts packer on 5'' dp and set same at 1770 m. pressure test the cement plug to 2500 psi surface pressure (this is 1000 psi above 13 3/8'' shoe strength of 1.72 s.g., assuming 1.19 s.g. mud in the hole). if test is ok, poh.

8. rih with ca 250 m, 2 7/8'' tubing on 5'' dp to 1400 m and spot 75 bbls viscous mud pill (150 sec mf). poh to 1300 m. circulate and condition mud and then set a 150 m cement plug using the following slurry:-

norcem class ''g'' cement
+ 5.08 galls/sk fresh water

density 15.8 ppg
yield 1.15 cu.ft/sk
(thickening time +/- 3.0 hours)

pump 10 bbls freshwater ahead and 1 bbl freshwater behind the cement slurry. poh to +/- 30 m above the calculated toc and reverse circulate clean. poh.

9. woc for +/- 6 hrs (or until the surface samples are hard). then rih with an 12 1/4'' bit and tag toc with 15-20,000 lbs if toc is ok, poh, laying down dp and displacing the riser to seawater.

10. pull the bop stack and riser. jump divers and make a video record of the wellhead.

11. run and install cameron corrosion cap (with udi transponder and simrad beacon installed). check beacon and transponder operation.

12. jump divers and a make video record of the wellhead (with the corrosion cap installed) and surroundings. cut and retrieve guidelines.

13. commence pulling anchors