3.2 FMT summary

Two runs with the FMT tool was made in the interval 2876 - 2933 m RKB. The first run was performed in the chalk and gave no results due to tight formation. The second FMT run in Oxfordian sandstone gave 12 pressure readings out of 27 attempts. One sample was taken at 2935.5 m MDRKB. The FMT sample contained a mixture of mudfiltrate and formation water with traces of hydrocarbons. It was not possible to separate the formation water from the mudfiltrate or to determine the composition of the oil.

An oil gradient of 8.6 kPa/m (0.879 g/cc) is established from the pressure plot. The results of the pressure readings are listed and plotted below.

Depth m TVDRKB	Formation pressure kPa	Comments
2860.5	34110	Very good permeability
2864.0	34143	Very good permeability
2868.5	34185	Very good permeability
2871.5	34177	Low permeability
2874.5	34230	Very good permeability
2877.5	34256	Very good permeability
2893.7	34758	Supercharge
2902.4	34461	Good permeability
2906.9	34515	Good permeability
2913.1	34570	Low permeability
2916.7	34756	Good permeability
2917.2	34761	Good permeability

Pressure readings from HP gauge.

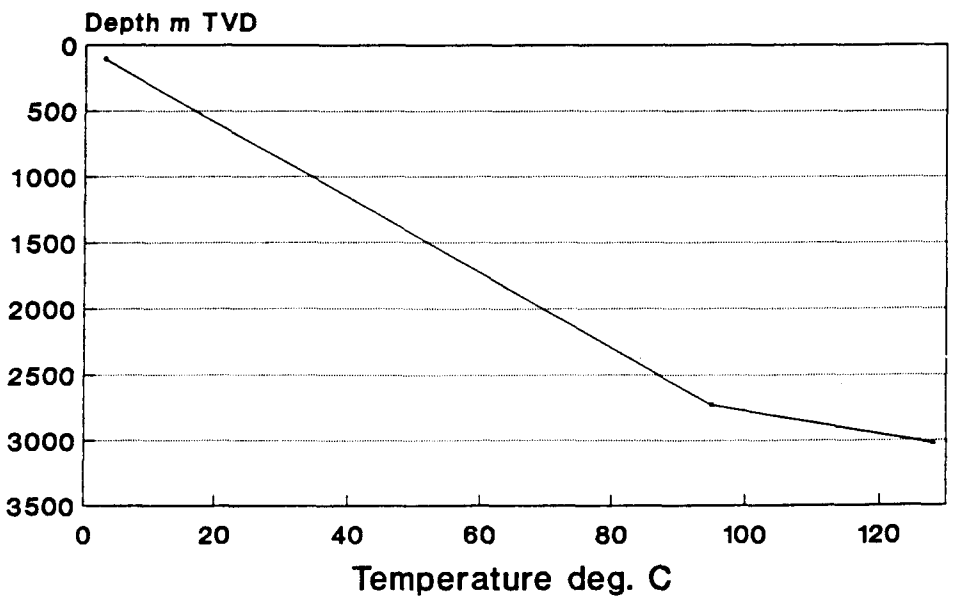
3.3 Temperature data

The table below shows extrapolated temperatures using temperature observations from the wireline logs. A seabed temperature of 4 °C is used. Reservoir temperature from the tests gave 127.5 °C.

EXTRAPOLATED BOTTOM HOLE TEMPERATURES

Logs	Run	Depth	Method	Extrapolated temp. °C
DIFL-ACL-GR	1H	2744	HORNER (1)	95
DIPLOG	1A			
CDL-CNL-GR	1A			
COREGUN	1A			
DIFL-ACL-GR	2I	3040	HORNER	128
ZDL-CN-GR	2B			
DIPLOG	2B			
DLL-MLL-GR	2B			
COREGUN	2B			

(1) The Horner method is based on temperature observations from logging suites. The method depends on the circulation time and time since stop circulating.



3.5 Well testing

Two tests were performed. Both tests produced oil with a bubble point of 160 bar and a density of 0.687 g/cm3 at bubble point.

3.5.1 Test No.1

PERFORATION INTERVAL: 2922 - 2930 m MD RKB
(2883 - 2891 m TVD MSL)

RESERVOIR PROPERTIES (BEFORE BREAKTHROUGH):

Initial reservoir pressure: 34533 kPa at 2887 m TVD MSL
Reservoir temperature: 127 + deg.C (still increasing)
Productivity index: 0.010 Sm3/d/kPa (1.0 Sm3/d/bar)
Permeability: 0.0084 micro-m2 (8.6 mD)
Skin factor: - 3.
(Based on gauge TQ100144, sensing depth: 2870.02 m MD RKB.)

A breakthrough, possibly through a fault, occured at the end of the cleanup, and this totally changed well productivity and also altered the flowing temperature.

RESERVOIR PROPERTIES (AFTER BREAKTHROUGH):

Estimated reservoir pressure: 34490 kPa at 2887 m TVD MSL
Reservoir temperature: 123.5 deg.C
Productivity index: 0.125 Sm3/d/kPa (12.5 Sm3/d/bar)
Ideal productivity index: 0.172 Sm3/d/kPa (17.2 Sm3/d/bar)
Permeability-thickness: 3.465 micro-m2*m (3511 mD*m)
Skin factor: + 5.
(Based on gauge TQ100144, sensing depth: 2870.02 m MD RKB.)

3.5.2 Test No.2

PERFORATION INTERVAL: 2875 - 2895 m MD RKB
(2836 - 2856 m TVD MSL)

RESERVOIR PROPERTIES:

Initial reservoir pressure: 34428 kPa at 2846 m TVD MSL
Reservoir temperature: 127.5 deg.C
Productivity index: 0.136 Sm3/d/kPa (13.6 Sm3/d/bar)
Permeability: 0.3113 micro-m2 (315 mD)
Skin factor: - 1.
(Based on gauge TQ100144, sensing depth: 2804.69 m MD RKB.)

4.10 Drilling Fluid Summary

36 " HOLE

Details

30" casing at:	167.0	m
36" hole drilled from:	107.0	m
to:	168.0	m

Comments

Prior to spudding, spud mud was made by pre-hydrating bentonite. This was used as sweeps on connection. The hole was displaced to bentonite spud mud prior to casing. Casing run and cemented pr. program.

26 " HOLE

Details

20" casing at:	599.0	m
26" hole drilled from:	167.0	m
to:	615.0	m

Comments

Due to possible shallow gas, the pilot-hole was drilled with seawater and hi-vis pills to 300 m, then from 300 to 500 m with CMC-seawater mud at 1.10 SG with return to the sea, and then with seawater pills to 615 m (TD). Pump-output was 1000 liter/min. when using 1.10 SG CMC-mud.

By mixing with separate mixing-systems the necessary volumes were mixed without excessive fish-eyes.

The pilot-hole was drilled to TD without problems. On hole-opening, seawater and CMC hi-vis pills were used.

17 1/2 " HOLE

Details

13 3/8" casing at:	1700.0	m
17 1/2" hole drilled from:	615.0	m
to:	1715.0	m

Comments

Prior to drilling the 17 1/2" hole, 277 m^3 1.15 SG gyp/PAC polymer was prepared. The initial mixup was biocid-treated seawater, 13 kg/m^3 Propol Superlo and 6 kg/m^3 Gypsum. Raised the pH to 9.0 using lime. All volumes were sheared three times with a 80 bars pressure drop. Drilled out cement, rathole and 3 m of new formation with seawater. Pumped a 10 m^3 CMC hi-vis pill followed by seawater to clean the hole for cement. When the returns was clean, the hole was displaced to mud and a LOT eq. to 1.56 SG was performed.

This section was drilled with a ROP 50 m/hr and a pumprate of 3.8 m^3/min. The VMS 100 shakers became totally overloaded of sticky cuttings and were functioning unsatisfactory throughout this section. All through utilizing coarse screens (10/40) and high pressure hoses in combination with scrapers, the mud losses was assumed to be up to 25% of pumped volume. This required very fast mixing of new mud. Mixing one sack of the PAC polymer Staflo Exlo each minute into the hopper gave no excessive fisheyes. The low mudweight also helped in the fast mixing to replace the lost volume.

Started with mudweight 1.15 SG, increased to 1.25 SG at 1355 m and weighted up to 1.30 SG when circulated at TD at 1715 m.

Periodically the shakers could handle flow, but heavy dilution was needed to reduce the build-up of solids/MBT due to the coarse shaker-screens.

When pulling out from TD, the hole had to be backreamed to shoe where the mud again was circulated clean. Lost 190 m^3 during these operations. The 13 3/8" casing hanger/landing string was made up before a wipertrip was performed. This time the hole and the mud was found to be in good condition.

The casing was run without problems to 1670 m where it took weight and had to be pumped down to 1700 m. Circulated and cemented casing with no losses. The mud remaining behind the casing was treated with Zinkcarbonate to protect from hydrogen sulphide.

12 1/4 " HOLE

Details

9 5/8" casing at:	2743.0	m
12 1/4" hole drilled from:	1715.0	m
to:	2757.0	m

Comments

The 12 1/4" section was drilled with the same Gyp/PAC mud system used in 17 1/2" section. Drilled out cement, rathole and 3 m of new formation. The mudweight was increased from 1.30 SG to 1.40 SG while drilling cement. Performed LOT eq. to 1.82 SG. Drilled from 1718 m to the chalk formation with a ROP of 20 to 30 m/hr and a pumprate of 2.8 m^3/min. some dilution was needed to control MBT and Gels. The shakers performed well with screen sizes from 145 to 200 mesh. A Mach II DTV was used for steering in the claystone.

The chalk formation was drilled with lower ROP 3 m/hr down to 2550 m. Bit trip was made and rotary drilled until MWD-tool was twisted off at 2561 m. A cement plug was set from 2550 to 2445. The cement was drilled to kick-off point at 2495 m, with continues Bicarbonate treatment. Approx. 106 m^3 mud had to be dumped to reduce cement contamination and replaced with fresh gyp/polymer mud. At 2495 m the mud weight was increased to 1.55 RD to reduce cavings.

Drilling then continued through chalk to 2557 m, TD for this section. The centrifuge was run continuously to control gels generated by fine drill solids. Premix was added to control mud properties. On pulling out after reaching TD, there were several tight spots. Several wiper trips were required before the logging program was completed.

The 9 5/8" casing was run and cemented without any problems.

8 1/2 " HOLE

Details

7" liner at:	3046.0	m
8 1/2" hole drilled from:	2757.0	m
to:	3050.0	m

Comments

The cement and 9 5/8" casing shoe were drilled using the Gyp/polymer mud from the previous section. At 2757 meters, the hole was displaced to 1,32 SG Bentonite/Lignosulfonate mud. A FIT was performed to 1,97 SG EMW at 2760 meters.

Drilling commenced with premixes containing Lignosulfonate, Caustic Lignite, and Miltemp being added to control mud properties. The MBT was raised from 43 kg/m^3 to 57 kg/m^3 to improve rheological properties.

At 2838 coring was started. A total of 6 cores were cut to 2966 meters. A bit was run to 2980 meters where core #7 was cut to 2988,5 meters. The hole was then drilled to TD at 3050 meters.

The mud system remained stable throughout the entire well. There were no problems with temperature degradation due to the fact that Miltemp was used to provide control of rheological properties and HTHP fluid loss.

Prior to each test a Miltemp pill was spotted in the test sone during the testing phase. The pill consisted of the exsisting fluid with an increased concentration of Miltemp (6 kg/m^3) to tolerate long periods of static conditions.

The testing program was completed without problems, and the well plugged and abandoned.

For this section Caustic Soda was programmed to be used for pH control. However, it was discussed if possible to use a combination of Lime/Soda Ash to maintain pH. Laboratory tests showed that Lime/Soda Ash in a 1/1.4 ratio would provide necessary pH control. Lime and Soda Ash were used in the above ratio for this section and pH was maintained at specifications without problems during drilling and testing operations.

TOTAL MATERIALS

Well: #15/12-6 **Operator:** Statoil
From/to: 107,0 m 3050,0 m

Quantity:	Material:	Units:	Unit Price:	Total Cost NOK:
50	Bentonite	mt	1 750,00	87 500,00
10	Caustic Soda	25 kg	122,00	1 220,00
28	Prodefoamer	25 l	640,00	17 920,00
1398	Barite	ton	530,00	740 940,00
291	Prothin	25 kg	100,00	29 100,00
129	Prolignite Caus.	25 kg	100,00	12 900,00
648	CMC HV	50 lb	300,00	194 400,00
66	Soda Ash	25 kg	110,00	7 260,00
155	Bicarbonate Sod.	25 kg	110,00	17 050,00
1183	Propol SL	25 kg	644,00	761 852,00
17	Propol reg	25 kg	644,00	10 948,00
59	Probio II	25 l	470,00	27 730,00
263	Gypsum	40 kg	60,00	15 780,00
14	Milgard	25 kg	511,25	7 157,50
60	Lime	40 kg	85,00	5 100,00
102	Miltemp	50 lb	2 360,00	240 720,00
6	Proplug F	25 kg	150,00	900,00
	VOLUME m3			4111,00

Total Cost for Well:	2 178 477,50
Cost per meter:	740,22
Cost per m3:	529,91

Drilling days:

MUD VOLUME SUMMARY

WELL: #15/12-6 **OPERATOR:** Statoil
RIG: Deep Sea Bergen

Section:	36"	26"	17 1/2"	12 1/4"	8 1/2"	
Hole from [m]	107	168	615	1715	2757	
Hole to [m]	168	615	1715	2757	3050	
Hole length [m]	61	447	1100	1042	293	
Mud Type	Bentonite	CMC	Gyp/polymer	Gyp/polymer	Gel/Ligno.	
Vol buildt	195	1617	1374	511	414	
Vol transfered to external	0	0	0	0	0	
Vol behind casing [m3]	0	0	45	50	108	left in hole
Vol dumped	195	1617	304	751	286	
Vol lost to formation	0	0	0	0	0	
Vol lost on solids equipment	0	0	548	187	20	
Vol transferred to next interval			477,0	0,0	0,0	
Vol cuttings drilled [cub. m]	34,0	149,0	175,0	83,0	12,0	

TOTALS			
mud buildt	4111,0	**total buildt**	**4111**
mud dumped	3153,0	**total dumped**	**3908**
mud lost to formation	0,0	**total left in hole**	**203**
mud lost on solids cont.	755,0		
mud behind csg	95,0		
mud left in hole	108,0		
total mud left in hole	203,0		
total vol cuttings drilled	453,0		

DAILY DRILLING MUD PROPERTIES

Property:		Mud Density	Funnel Viscosity	Plastic Viscosity	Yield Point	10 sec gel	10 min gel	PH	API Filtrate	HTHP Filtrate	Chloride Content in	Mud (Pm)	Alkalinity Filtrate	Alkalinity Filtrate	Calcium in	Sand Content	Solids Content	Water Content	Excess Gyp	Methylene Blue Capac
Unit:		sg	sec/qt	cp	Pa	Pa	Pa		ml/30 min	ml/30 min	ppm	ml	(Pf) ml	(Mf) ml	mg/l	% vol	corr %vol	corr % vol	kg/m3	kg/m3
Date:	Depth:																			
18-08-90		1,03	100																	
19-08-90	166	1,10			5															
20-08-90	217	1,10	60		5															
21-08-90	504	1,04	100																	
22-08-90	325	1,10	100																	
23-08-90	615	1,04	100																	
24-08-90	615	1,15	55	15	6,0	1	1	9,0	5,5		22000	0,15	0,45	1,2	1600		6,0	94,0	4,5	
25-08-90	615	1,15	55	15	6,0	1	1	9,0	5,5		22000	0,15	0,45	1,2	1600		6,0	94,0	4,5	
26-08-90	1256	1,15	57	21	5,5	1	2	8,4	3,0		23000	0,05	0,05	1,4	1600	1,0	7,0	93,0	3,4	20,0
27-08-90	1715	1,30	50	21	5,5	1	5	8,0	3,2		22500			1,4	1520	1,0	9,0	91,0	3,5	45,0
28-08-90	1715	1,30	57	23	6,5	1	9	8,1	3,1		22500			1,5	1560	1,0	11,0	89,0	4,2	45,0
29-08-90	1715	1,30	55	23	6,0	1	8	8,0	3,1		22500			1,4	1560	1,0	11,0	89,0	3,6	43,0
30-08-90	1715	1,30	50	22	6,0	1	7	8,1	3,1		22500			1,4	1600	0,8	12,0	88,0	4,2	43,0
31-08-90	1765	1,40	48	20	6,0	2	6	8,5	3,2		22500	0,1		1,5	1540	0,7	15,0	85,0	4,0	43,0
01-09-90	2042	1,40	45	20	6,0	1	5	8,0	3,3		22000			0,8	1400	0,5	16,0	85,0	4,4	43,0
02-09-90	2427	1,50	54	22	6,5	2	10	8,0	3,3		22000			0,7	1400	0,3	18,0	82,0	4,5	53,0
03-09-90	2535	1,50	47	23	6,0	2	5	8,0	3,8		21000			0,6	1500	0,3	18,0	82,0	4,5	46,0
04-09-90	2550	1,50	47	23	6,0	2	5	7,9	3,8		21000			0,6	1500	0,3	18,0	82,0	4,3	46,0
05-09-90	2561	1,50	46	23	6,5	2	6	7,9	3,8		21000			0,6	1500	0,3	18,0	82,0	4,3	46,0
06-09-90	2495	1,55	50	23	6,5	2	7	8,0	4,0		21000			0,6	1500	0,3	19,0	81,0	4,2	46,0
07-09-90	2503	1,55	50	23	7,0	3	9	8,0	4,3		21000			0,6	1500	0,3	19,0	81,0	4,0	50,0
08-09-90	2511	1,55	50	23	6,0	2	4	8,3	4,0		21000			0,5	1600	0,3	19,0	81,0	4,0	43,0
09-09-90	2570	1,55	48	23	6,0	2	8	8,3	4,2		21000			0,4	1680	0,3	19,0	81,0	4,0	43,0
10-09-90	2616	1,55	49	22	7,0	2	10	8,3	4,2		21000			0,4	1800	0,3	19,0	81,0	4,0	43,0
11-09-90	2694	1,55	47	24	7,5	2	13	8,2	4,4		21000	0,2		0,4	1800	0,3	19,0	81,0	4,0	43,0
12-09-90	2757	1,55	45	23	7,0	2	12	8,3	4,8		21000	0,5		0,4	1800	0,3	19,0	81,0	4,0	43,0
13-09-90	2757	1,58	51	23	8,0	2	13	8,0	4,9		21500			0,4	1760	0,3	20,0	80,0	4,0	43,0
14-09-90	2757	1,61	61	25	10,0	4	21	7,9	4,2		23000			0,4	1920	0,5	21,0	79,0	4,0	50,0
15-09-90	2757	1,61	60	26	10,0	4	19	7,9	4,5		23000			0,4	1880	0,5	21,0	79,0	4,0	50,0
16-09-90	2757	1,61	58	26	9,5	4	20	8,0	4,6		23000			0,4	1800	0,5	21,0	79,0	4,0	50,0
17-09-90	2757	1,61	60	24	10	4	20	7,8	4,5		23000			0,4	1800	0,5	21,0	79,0	4,0	50,0
18-09-90	2757	1,61	62	25	10	4	20	7,7	4,4		23000			0,4	1840	0,5	21,0	79,0	4,0	50,0
19-09-90	2757	1,61	62	25	10	4	20	7,7	4,4		23000			0,4	1840	0,5	21,0	79,0	4,0	50,0
20-09-90	2757	1,61	62	25	10	4	20	7,9	4,4		23000			0,4	1840	0,5	21,0	79,0	4,0	50,0
21-09-90	2757	1,61	62	25	10	4	20	8,0	4,4		23000			0,4	1840	0,5	21,0	79,0	4,0	50,0
22-09-90	2686	1,61	62	25	10	4	20	8,1	4,4		23000			0,4	1840	0,5	21,0	79,0	4,0	50,0
23-09-90	2800	1,32	43	15	4	1	10	10,4	5,1		2200	1,3	0,3	0,6	80	0,6	11,0	89,0		63,0
24-09-90	2851	1,32	59	23	5	1	12	9,5	5,0	22	2200	1,1	0,1	0,6	80	0,6	12,0	88,0		57,0
25-09-90	2892	1,32	59	24	5	2	12	10,3	5,0	21	2200	1,5	0,1	0,6	120	0,3	12,0	88,0		60,0
26-09-90	2937	1,32	59	22	5	1	8	9,5	5,0	19	2200	1	0,1	0,7	120	0,3	12,0	88,0		57,0
27-09-90	2966	1,32	59	24	4	1	2	9,5	5,0	19	2200	0,8	0,1	0,8	120	0,4	12,0	88,0		57,0
28-09-90	2980	1,32	62	28	5	2	4	9,6	4,9	19	2100	1,4	0,25	1,3	120	0,3	11,0	89,0		64,0
29-09-90	2986	1,32	62	28	5	2	4	9,6	4,9	19	2100	1,4	0,25	1,3	120	0,3	11,0	89,0		64,0
30-09-90	2986	1,32	62	28	5	2	4	9,6	4,9	19	2100	1,4	0,25	1,3	120	0,3	11,0	89,0		64,0
01-10-90	2986	1,32	62	28	5	2	4	9,6	4,9	19	2100	1,4	0,25	1,3	120	0,3	11,0	89,0		64,0
02-10-90	3019	1,32	60	26	4	2	4	9,1	4,8	19	2200	1,5	0,2	1,3	200	0,3	11,0	89,0		64,0
03-10-90	3050	1,32	60	26	4	2	4	9,1	4,8	19	2200	1,5	0,2	1,3	200	0,3	11,0	89,0		64,0
04-10-90	3050	1,32	60	26	4	2	4	9,1	4,8	19	2200	1,5	0,2	1,3	200	0,3	11,0	89,0		64,0
05-10-90	3050	1,32	60	26	4	2	4	9,1	4,8	19	2200	1,5	0,2	1,3	200	0,3	13,0	87,0		64,0
06-10-90	3050	1,32	60	26	4	2	4	9,1	4,8	19	2200	1,5	0,2	1,3	200	0,3	13,0	87,0		64,0
07-10-90	3050	1,32	60	26	4	2	4	9,1	4,8	19	2200	1,5	0,2	1,3	200	0,3	13,0	87,0		64,0
08-10-90	3050	1,32	57	28	4	2	4	9,3	4,5	19	2300	1,6	0,2	1,3	280	0,3	13,0	87,0		65,0
09-10-90	3050	1,32	60	32	4	2	4	11,5	4,0	20	2000	1,8	1,8	3,5	600	0,3	13,0	87,0		65,0
10-10-90	3050	1,32	48	28	4	2	4	11,4	4,1	20	2000	5,8	2	4	640	0,3	13,0	87,0		57,0
11-10-90	3050	1,32	48	28	4	2	4	11,4	4,1	20	2000	5,8	2	4	640	0,3	13,0	87,0		57,0
12-10-90	3050	1,32	48	28	4	2	4	11,4	4,1	20	2000	5,8	2	4	640	0,3	13,0	87,0		57,0
13-10-90	3050	1,32	48	28	4	2	4	11,4	4,1	20	2000	5,8	2	4	640	0,3	13,0	87,0		57,0
14-10-90	3050	1,32	48	28	4	2	4	11,4	4,1	20	2000	5,8	2	4	640	0,3	13,0	87,0		57,0
15-10-90	3050	1,32	49	24	4	2	3	11,5	3,9	20	2700	6	1,5	3,8	600	0,3	13,0	87,0		57,0
16-10-90	2920	1,32	54	25	4	2	6	11,4	4,0		2800	5,8	1,4	3,9	640	0,3	13,0	87,0		57,0
17-10-90	2960	1,32	50	22	5	2	4	11,4	4,0		2700	6	1,5	3,8	600	0,1	13,0	87,0		57,0
18-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
19-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
20-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
21-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0

DAILY DRILLING MUD PROPERTIES

	Property:	Mud	Funnel	Plastic	Yield Point	10 sec gel	10 min gel	PH	API	HTHP	Chloride	Mud (Pm)	Alkalinity	Alkalinity	Calcium in	Sand	Solids	Water	Excess	Methylene
		Density	Viscosity	Viscosity					Filtrate	Filtrate	Content in		Filtrate	Filtrate		Content	Content	Content	Gyp	Blue Capac
	Unit:	sg	sec/qt	cp	Pa	Pa	Pa		ml/30 min	ml/30 min	ppm	ml	(Pf) ml	(Mf) ml	mg/l	% vol	corr %vol	corr % vol	kg/m3	kg/m3
Date:	Depth:																			
22-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
23-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
24-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
25-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
26-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
27-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
28-10-90	2918	1,32	50	20	4	2	4	11,5	4,2		2800	7	1,8	4	600		13,0	87,0		57,0
29-10-90	2917	1,32	57	18	4	1	3	11,7	4,1		2700	7,1	1,80	4,1	560		13,0	87,0		57,0
30-10-90	2917	1,32	56	18	3	1	3	11,8	4,2		2700	7,1	1,80	4,1	560		13,0	87,0		57,0
31-10-90	2917	1,32	56	18	3	1	3	11,8	4,2		2700	7,1	1,80	4,1	560		13,0	87,0		57,0