

DAILY MUD PROPERTIES

WELL: 31/4-4

1980/81 DATE	DEPTH	SP. GR. WT.	VIS SEC.	CORR. 120° F		GELS		PH BLACK STRIP	FLUID LOSS		CL CACL NACL MG/L	ALKALINITY			CA PPM	RETORT			BBL CEC
				PV	YP	PASCALS			100PSI API	500PSI 300°F HP HP		PF	PM	MF		% OIL	% SOL	% WATER	
						0	10												
10/12	-	1.04	100 <sup>+</sup>																
11/12	325	1.04	100 <sup>+</sup>																
12/12	325	1.04	100 <sup>+</sup>																
13/12	-	1.04	100 <sup>+</sup>																
14/12	-	1.04	100 <sup>+</sup>																
15/12	-	1.04	100 <sup>+</sup>																
16/12	-	1.05	100 <sup>+</sup>																
17/12	316	1.05	100 <sup>+</sup>																
18/12	325.5	1.05	100 <sup>+</sup>																
19/12	325	1.05	100 <sup>+</sup>																
20/12	660	1.11	38	9	22	12	13												
21/12	900	1.12	39	7	26	14	15												
22/12	900	1.11	36	6	28	15	18												
23/12	900	1.12	35	6	24	14	17												
24/12	900	1.18	40	7	31	18	22												
25/12	900	1.19	41	7	32														
26/12	900	1.18	35	5	24	10	12												
27/12	900	1.18	36																
28/12	900	1.15	34																
29/12	900	1.15	34																
30/12	900	1.15	34																
1/1	900	1.15	34																
2/1	900	1.15	36																
3/1	900	1.15	38																
4/1	900	1.15	38																
5/1	900	1.15	38																
6/1	900	1.15	39																

DATE SPUD:

DECEMBER 17 TH 1980

DATE T.D.:

FEBRUARY 12 TH 1981

DAILY MUD PROPERTIES

WELL: 31/4-3.

DATE	DEPTH	SP. GR. WT.	VIS SEC.	CORR.		GELS		PH BLACK STRIP	FLUID LOSS		CL CACL NACL MG/1	ALKALINITY			CA/MG PPM	RETORT			BBL CEC (MBT)
				PV	YP	0	10		100PSI API	500PSI 300°F HP HP		PF	FM	MF		% OIL	% SOL	% WATER	
7/1	938	1.16	50	10	16	2	6	9.8	6.2		82K/440 TH	1.3					7		
8/1	1298	1.27	53	15	24	6	9	9.7	6.8		84K/650	1.0					12		7.0
9/1	1706	1.30	58	20	20	4	10	10.0	7.3		82K/800	0.5					15		9.5
10/1	1822	1.30	51	17	16	2	7	10.0	6.6		72K/670	0.3					13		9.0
11/1	1918	1.40	66	30	22	4	9	10.0	6.5		68K/400	0.3					16		15.0
12/1	1918	1.40	59	28	2.0	4	9	9.8	6.7		68K/350	0.3					16		13.0
13/1	1918	1.40	53	19	16	4	6	9.7	7.4		64K	0.2			80/120		16		17.0
14/1	1918	1.40	53	19	16	2	6	9.7	7.6		63K	0.2			80/120		16		18.0
15/1	1918	1.40	52	18	16	2	6	9.6	7.8		62K	0.2			80/120		16		18.0
16/1	1918	1.40	53	19	18	2	6	9.5	8.0		62K	0.1			80/120		16		18.5
17/1	1418	1.41	54	19	18	4	8	9.5	8.2		62K	0.1			90/120		15		19.0
18/1	1481	1.41	55	28	19	4	6	9.5	4.7		62K	0.1			90/120		16		19.0
19/1	1481	1.40	58	28	19	4	6	9.5	4.7		62K	0.1			90/120		16		19.0
20/1	1453	1.40	55	23	15	6	10	9.8	5.5		65K	0.2			200/200		16		18.0
21/1	1929	1.40	56	18	16	4	8	11.5	6.0		65K	0.5			200/200		16		17.5
22/1	2001	1.40	57	24	19	6	24	11.0	5.0		64K	0.4			200/120		16		18.0
23/1	2166	1.37	57	22	17	6	24	11.0	5.0		64K	0.4			150/200		16		19.5
24/1	2270	1.33	58	24	16	8	26	11.0	5.0	19.0	64K	0.4			150/200		17		19.0
25/1	2388	1.33	59	22	16	4	22	11.0	4.8	17.5	68K	0.45			160/120		16		18.0
26/1	2424	1.31	58	20	18	4	20	10.9	5.0	18.0	65K	0.3			100/80		15		17.0
27/1	2465	1.31	58	20	18	4	24	11.0	4.8		67K	0.4			80/60		15		15.0
28/1	2490	1.30	62	21	18	4	20	11.0	4.9	18.0	67K	0.4			80/60		15		15.0
29/1	2510	1.31	65	24	19	4	14	11.0	3.8	17.5	67K	0.32			80/40		14		16.0
30/1	2579	1.30	57	23	17	4	14	10.8	4.0	17.0	67K	0.20			80/40		13		16.0
31/1	2652	1.30	58	20	16	2	12	10.8	4.0	17.2	72K	0.25			80/40		13		14.0
1/2	2669	1.30	60	22	17	4	10	11.0	3.9	16.8	71K	0.30			80/40		13		14.0
2/2	2669	1.30	65	22	19	2	8	10.8	3.2	13.5	71K	0.25			40/TR		12.5		13.4
3/2	2800	1.30	65	22	19	2	8	11.0	3.3	13.0	72K	0.25			80/TR		12.0		13.0

DATE SPUD:  
DECEMBER 17TH 1980

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FEBRUARY 12TH 1981

## DAILY MUD PROPERTIES

WELL: 31/4-4

DATE	DEPTH	SP. GR. WT.	VIS SEC.	CORR. 120° F		GELS PASCALS		PH BLACK STRIP	FLUID LOSS		CL CACL NACL MG/L	ALKALINITY			CA PPM	RETORT			BBL CEC (MBT)
				PV	YP	0	10		100psi API	500psi 250° F HP HP		PF	PM	MF		% OIL	% SOL	% WATER	
4/2	2827	1.30	63	21	19	2	8	10.8	3.6	13.4	72k	0.25		80	TR	12.0		13.0	
5/2	2848	1.30	60	20	18	2	6	11.0	3.2	12.5	72k	0.35		120	TR	12.0		13.0	
6/2	2878	1.30	58	19	17	2	6	10.7	3.2	12.2	69k	0.25		120	TR	12.0		13.0	
7/2	2921	1.30	64	20	22	4	8	11.0	3.0	11.9	74k	0.30		80	TR	11.5		12.0	
8/2	2931	1.30	62	19	19	2	8	10.5	3.3	12.4	72k	0.20		80	TR	11.5		12.5	
9/2	3045	1.30	61	22	20	4	10	10.4	3.2	11.5	72k	0.25		80	TR	12.0		12.0	
10/2	3115	1.30	61	23	21	4	12	10.9	3.6	12.5	74k	0.35		80	TR	12.0		12.5	
11/2	3150	1.30	63	23	21	4	10	10.6	3.8		73k	0.35		80	TR	12.0		12.5	
12/2	3150	1.30	61	22	20	4	10	10.6	3.8	12.0	74k	0.30		80	TR	12.0		12.5	

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### 6.3 MUD REPORT

#### 36" Hole Section

Due to problems to stab in and land the 30" casing, cf. operation resume, this hole section had to be respudded and drilled three times. Finally the hole reached a depth of 324.5 m using seawater and pumping high viscosity pills at every connection. The hole was then displaced with 16 m<sup>3</sup> high viscous gel mud followed by 31 m<sup>3</sup> 1.14 r.d. high viscous mud.

Materials used: Barite, bentonite, caustic soda, lime and soda ash.

#### 26" Hole Section

A 17-1/2" pilot hole was drilled down to 900 m with return to surface using bentonite spud mud with 1.10 r.d. to 1.14 r.d. Opened the 17-1/2" hole to 26" hole without any problems. The mud weight was raised to 1.18 r.d during the final 30 meters of underreaming to compensate the loss of hydrostatic pressure when pulling the marine riser. The riser was then displaced to sea water and pulled.

A 26" bit was then run in the hole to ascertain having a full gauge hole. Due to 15 meters fill, reamed to bottom and spotted 44 m<sup>3</sup> 1.18 r.d. mud. Pulled out to 259 m and pumped in 50 m<sup>3</sup> 1.18 r.d. mud.

Materials used: Barite, bentonite, caustic soda and soda ash.

#### 17-1/2" Hole Section

After having drilled out of the 20" casing shoe and 19 meters new formation a leak off test was performed. The hole was then displaced with KCl polymer mud. The drilling of this hole section brought some hole problems. After having drilled to 1298 m a short trip to the 20" casing shoe was done. Had tight hole all the

way up, maximum overpull 733 kN. Ran back in the hole and reamed tight spots at 931 m, 960 m, 1044 m, 1075 m, 1195 m and 1234 m. Resumed drilling to 1402 meters and weighted up to 1.30 r.d. from it's initial weight of 1.15 r.d. to improve hole integrity over this interval. At 1402 meters 6.36 m<sup>3</sup> high viscosity mud was pumped and circulated one circulation around. Three stands were then pulled having 667 kN maximum overpull on the first stand and no overpull on the others. Continued drilling to 1822 meters where it was necessary to pull the bit. Pumped 4 m<sup>3</sup> to 6 m<sup>3</sup> high viscosity mud for each 100 m drilled. Had maximum 578 kN overpull at 1221 m when pulling out of the hole and had to wash from 1698 m to 1679 m and from 1650 m to 1622 m.

Had to ream from 1792 m to 1821 m while running to bottom with the new bit. Resumed drilling to 1918 meters and pumped 5.5 m<sup>3</sup> high viscosity mud and circulated for two hours before the bit was pulled to run Schlumberger logs. While pulling out of the hole a maximum of 667 kN overpull was experienced and had to wash from 1900 m to 1792 m and from 1726 m to 1698 m. Ran in the hole with the bit and reamed from 1698 m to 1734 m, from 1792 m to 1819 m and from 1887 m to 1918 m. The maximum weight on the bit was 133 kN. The mud was weighted up to 1.40 r.d. and the yield point was raised. Pulled out of hole with 70 kN overpull. Ran back in the hole conditioning the hole before running casing. Reamed from 1887 m to 1918 m, the last 4 meters was fill. After having waited on the weather, had to run back in the hole and reamed from 1887 m to 1918 m.

Materials used: Barite, bentonite, KCl, LF-5, CMC Lo-vis, XC-polymer, Drispac. Reg., Ancopol, caustic soda, soda ash, Drilling Detergent and Al. Stearate.

#### 12-1/4" Hole Section

The 13-3/8" casing had to be set at 1481 m due to bad weather. The mud program specified drilling out of the shoe using the KCl/polymer mud system used for the 17-1/2" section. However, the additions of KCl and Ancopol should be decreased gradually to zero.

However, as the open hole section below the casing shoe was drilled using KCl/polymer it was decided to continue using KCl/polymer mud to the total depth of this section. The KCl concentration was increased to above 40 ppb before starting drilling this section and was kept at minimum 40 ppb all the way down to 2652 m. From 2652 m to total depth the concentration was kept within the range of 37 ppb - 39 ppb. Whilst drilling this section, LF-5 and CMC Lo-vis was added to decrease the fluid loss to about 5 cc. XC-polymer and Drispac was added to maintain the yield point at around 8 - 9 MPa. At 2900 m the yeild point was raised to 10 MPa to combat experienced hole fill.

The mud weight was decreased from 1.4 r.d to 1.3 r.d. in the interval from 2100 m to 2430 m.

Materials used: Barite, LF-5, CMC-LV, XC-Polymer, ancopol, caustic soda, soda ash, KCl, Sodium bicarb, drispac reg.



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Title

GEOCHEMICAL DATA REPORT FOR WELL 31/4-4

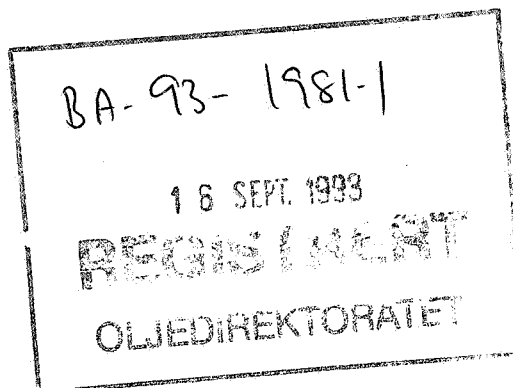
Authors(s)

IDAR HORSTAD

Abstract

Two samples from the cored interval in well 31/4-4 have been analysed by Iatroscan (TLC-FID) and the saturated hydrocarbon fractions from both samples were analysed by GC-FID and GC/MS.

NOT INCLUDED IN WELL TRADE.



Key Words

31/4-4, geochemistry, GC-FID, GC/MS

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Org. Unit	EUG			
Reviewed	<i>N. Mills</i>			
Accepted				
Approved	<i>T. Hagland</i>			

Hovedkontor/Head Office Oslo:

Adresse/Address: Kjerboveien 16, Postboks 490, N-1301 SANDVIKA  
 Telefon/Telephone: Nasjonalt 67 12 66 00, Intern. +47 67 12 66 00

Teleks/Telex: 78862 Saga n  
 Telefax: Nasjonalt 67 126666, Intern. +47 67 126666

Driftsdivisjon/Operations Division Stavanger:

Adresse/Address: Godesetdalen 8, Postboks 117, N-4003 FORUS  
 Telefon/Telephone: Nasjonalt 04 57 40 00, Intern. +47 4 57 40 00

Teleks/Telex: 33244 sagap n  
 Telefax: Nasjonalt 04 570261, Intern. +47 4 570261

## **1 Objectives**

The objective of this study was to characterise the extractable hydrocarbons in two core samples from well 31/4-4 to the north of the Brage Field, Norway.

## **2 General well information**

The well was drilled by Norsk Hydro as operator of licence 055 from 17/12-80 to 17/2-81 and reached a total depth of 3150 mRKB. The KB of the rig was 25 metres and the water depth was 214 metres.

## **3 Samples and analytical scheme**

Two samples were picked from the cored interval in the well on the 27th of April 1992 at NPD's store in Stavanger. Both samples (2490.2 and 2498.6 mRKB core depth) were analysed by Iatroscan (TLC-FID), and the saturated hydrocarbon fractions were analysed by GC-FID and GC/MS.

## **4 Vitrinite reflectance**

No samples were analysed.

## **5 TOC and Rock Eval**

No samples were analysed.

## **6 Iatroscan (TLC-FID)**

Two samples were analysed, and the results are tabulated in Table 1.

## **7 GC-FID**

The saturated hydrocarbon fractions from both samples (2490.2 and 2498.6 mRKB core depth) were analysed by GC-FID. Both samples have a uniform n-alkane distribution without any signs of biological degradation.

Since the evaporative loss has affected the relative concentration of individual compounds, no ratios were calculated.

The GC-FID chromatograms are shown in figure 1.

## **8 GC/MS**

The saturated hydrocarbon fractions of both samples were analysed by GC/MS and the mass chromatograms for m/z 191, 177, 217 and 218 are shown in figure 2.

Selected biological marker parameters are given in table 2.

## **9 Stable carbon isotopes**

No samples were analysed.



**Tab. 1**

0 WELL NAME	1 NATIONALITY	2 LABORATORY	3 U.DEPTH	4 L.DEPTH	5 SAMPLE TYPE	6 LITHOLOGY	7 EOM mg/g
1 31/4-4	NOR	SAGA	2490.20	2490.20	CCP	SST	0.00
2 31/4-4	NOR	SAGA	2498.60	2498.60	CCP	SST	0.00

0 WELL NAME	8 SAT (mg/g)	9 ARO (mg/g)	10 POL (mg/g)	11 SAT %	12 ARO %	13 POLARS %	14 SAT ARO	15 METHODS
1 31/4-4	0.00	0.00	0.00					GC, GC/MS
2 31/4-4	0.00	0.00	0.00					GC, GC/MS

**Tab. 2**

0 WELL NAME	1 CONS.	2 UPPER DEPTH	3 DEPTH	4 LITH	5 SAMPLE TYPE	6 Q/E	7 Ts/Tm	8 Z/C	9 ab/ab+ba
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1 31/4-4	SAGA	2090.20	2090.20	SST	CCP	0.21	1.06	0.57	0.90
2 31/4-4	SAGA	2498.60	2498.60	SST	CCP	0.22	1.03	0.56	0.90

0 WELL NAME	10 %22S	11 %20S	12 %bb	13 a/a+j	14 C27st	15 C28st	16 C29st
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1 31/4-4	0.59	0.58	0.53	0.82	32.97	34.05	32.97
2 31/4-4	0.57	0.55	0.56	0.82	32.81	32.98	34.21