

TABLE B-11: MUD MATERIAL CONSUMPTION

((((ooo) ----- Norsk Hydro	M u d c o n s u m p t i o n ----- System : BORE	Date 10/12-1990
	Well: 6407/10-2 Mud company: BAROID	13
		Actual used

Drilling of 36 " hole

BARITE	Kg	213000
BENTONITE	Kg	37000
CAUSTIC	Kg	950
SODA ASH	Kg	800

Drilling of 26 " hole

BARITE	Kg	70000
BENTONITE	Kg	57000
CAUSTIC	Kg	425
SODA ASH	Kg	1625

Drilling of 17 1/2" hole

BARITE	Kg	613000
BICARBONATE	Kg	725
CAUSTIC	Kg	175
DEXTRID	Kg	10322
EZ-MUD	Kg	960
PAC-L	Kg	3421
PAC-R	Kg	2746
SODA ASH	Kg	1075
THERMA THIN	Kg	1275
XCD	Kg	1922
KCL-BRINE	l	553000

Drilling of 12 1/4" hole

BARITE	Kg	380000
BICARBONATE	Kg	1425
DEXTRID	Kg	17411
EZ-MUD	Kg	3330
KCL	Kg	59650
KOH	Kg	2035
LIME	Kg	1475
PAC-L	Kg	4705
PAC-R	Kg	1454
SODA ASH	Kg	425
THERMA THIN	Kg	325
XCD	Kg	3426
KCL-BRINE	l	426000



Norsk Hydro a.s Bergen
E&P Research Centre

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Summary/Conclusion//Recommendation

Keywords

Source rocks, petroleum geochemistry
migrated hydrocarbons, biomarkers, maturity

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1. INTRODUCTION.

This report comprises the results from petroleum geochemical analysis of 65 DCs and 25 SWCs. Vitrinite reflectance has been measured by Geo-Optics (Newcastle upon Tyne, UK). stable isotope results are from Geochem (U.K.), GeolabNor and University of Bergen. All other analytical work, the interpretation of data and compilation of this report was undertaken by Norsk Hydro Research Center, Bergen Norway.

Table 2.1

SOURCE ROCK SCREENING DATA

Table 2.1. SOURCE ROCK SCREENING DATA WELL 6407/10-2



Depth (m)	%	Lithology	Sample	S1 Kg/t	S2 Kg/t	S3 Kg/t	TOC %	HI	OI	PI	Tmax Deg.c	Company
2290.00		CLYST	SWC	0.0	0.6		0.8	67		0.02	446	F-BERGEN
2295.00		BULK	DC	0.1	0.5		0.8	67		0.11	434	F-BERGEN
2305.00		BULK	DC	0.1	0.6		0.8	70		0.11	434	F-BERGEN
2320.00		CLYST	SWC	0.1	1.0		1.0	102		0.05	432	F-BERGEN
2395.00		CLYST	SWC	0.0	1.0		0.6	175		0.01	480	F-BERGEN
2405.00		CLYST	SWC	0.0	0.3		0.8	37		0.10	427	F-BERGEN
2807.00		BULK	DC	0.3	1.1		1.7	67		0.20	436	F-BERGEN
2814.00		CLYST	SWC	0.0	0.1		0.1	100		0.17	444	F-BERGEN
2815.00		BULK	DC	0.1	0.9		1.3	67		0.05	436	F-BERGEN
2817.00		BULK	DC	0.1	0.5		0.9	52		0.16	436	F-BERGEN
2817.00		LST	SWC	0.0	0.0		0.0	75		0.00	467	F-BERGEN
2820.00		BULK	DC	0.0	0.4		0.8	44		0.08	433	F-BERGEN
2822.00		BULK	DC	0.2	3.0		1.8	165		0.05	433	F-BERGEN
2822.00		CLYST	SWC	0.0	0.2		0.1	214		0.00	436	F-BERGEN
2823.00		CLYST	SWC	1.1	20.3		4.9	414		0.05	421	F-BERGEN
2824.00		CLYST	SWC	1.0	18.6		4.1	450		0.05	431	F-BERGEN
2825.00		BULK	DC	0.4	7.1		2.4	297		0.06	432	F-BERGEN
2825.00		SH/SLST	DC	0.5	10.1		3.4	297		0.05	432	F-BERGEN

Table 2.1. SOURCE ROCK SCREENING DATA WELL 6407/10-2 (cont'd)



Depth (m)	% Lithology	Sample	S1 Kg/t	S2 Kg/t	S3 Kg/t	TOC %	HI	OI	PI	Tmax Deg.c	Company
2827.00	BULK	DC	0.3	4.0		1.6	250		0.06	433	F-BERGEN
2830.00	BULK	DC	0.3	3.9		1.8	220		0.08	434	F-BERGEN
2832.00	BULK	DC	0.1	1.0		0.8	132		0.08	435	F-BERGEN
2835.00	BULK	DC	0.1	0.8		0.6	121		0.08	435	F-BERGEN
2837.00	BULK	DC	0.1	0.3		0.4	71		0.14	426	F-BERGEN
2840.00	BULK	DC	0.0	0.2		0.3	75		0.13	432	F-BERGEN
2842.00	BULK	DC	0.1	0.4		0.5	81		0.14	431	F-BERGEN
2845.00	BULK	DC	0.1	0.3		0.5	62		0.18	430	F-BERGEN
2847.00	BULK	DC	0.1	0.6		0.7	88		0.17	433	F-BERGEN
2850.00	BULK	DC	0.1	0.6		0.6	97		0.11	430	F-BERGEN
2915.00	BULK	DC	0.1	1.2		1.4	86		0.10	437	F-BERGEN
2917.00	BULK	DC	0.2	1.6		1.9	85		0.10	435	F-BERGEN
2920.00	BULK	DC	0.2	1.3		1.7	74		0.13	433	F-BERGEN
2920.00	CLYST	SWC	0.8	10.9		3.2	337		0.07	428	F-BERGEN
2920.00	SH/SLST	DC	0.5	4.7		3.9	119		0.10	437	F-BERGEN
2922.00	BULK	DC	0.1	0.9		1.4	60		0.13	434	F-BERGEN
2925.00	BULK	DC	0.1	0.7		1.2	57		0.12	432	F-BERGEN
2927.00	BULK	DC	0.1	1.1		1.8	60		0.11	432	F-BERGEN
2930.00	BULK	DC	0.1	1.0		1.6	63		0.08	437	F-BERGEN

Table 2.1. SOURCE ROCK SCREENING DATA WELL 6407/10-2 (cont'd)



Depth (m)	% Lithology	Sample	S1 Kg/t	S2 Kg/t	S3 Kg/t	TOC %	HI	OI	PI	Tmax Deg.c	Company
2932.00	BULK	DC	0.1	0.9		1.7	53		0.09	435	F-BERGEN
2935.00	BULK	DC	0.1	0.9		1.2	70		0.08	436	F-BERGEN
2937.00	BULK	DC	0.2	1.5		1.9	77		0.09	436	F-BERGEN
2942.00	BULK	DC	0.1	0.4		0.9	51		0.10	436	F-BERGEN
2945.00	BULK	DC	0.1	1.4		1.9	70		0.09	437	F-BERGEN
2947.00	BULK	DC	0.1	0.9		1.5	58		0.09	437	F-BERGEN
2952.00	BULK	DC	0.1	0.9		1.5	59		0.11	437	F-BERGEN
2955.00	BULK	DC	0.1	0.8		1.6	51		0.12	436	F-BERGEN
2957.00	BULK	DC	0.2	1.4		2.3	59		0.10	438	F-BERGEN
2960.00	BULK	DC	0.2	1.4		2.0	68		0.13	435	F-BERGEN
2962.00	BULK	DC	0.1	1.0		1.7	63		0.11	438	F-BERGEN
2965.00	CLYST	SWC	0.3	4.6		3.6	129		0.05	433	F-BERGEN
2967.00	BULK	DC	0.1	0.6		1.2	47		0.08	436	F-BERGEN
2970.00	BULK	DC	0.1	0.6		1.2	50		0.15	438	F-BERGEN
2977.00	BULK	DC	0.1	0.8		1.5	53		0.10	438	F-BERGEN
2980.00	BULK	DC	0.1	0.8		1.6	54		0.10	437	F-BERGEN
2980.00	CLYST	SWC	0.3	3.1		2.6	117		0.07	438	F-BERGEN
2982.00	BULK	DC	0.2	1.3		1.9	68		0.12	438	F-BERGEN
2985.00	BULK	DC	0.2	1.3		1.6	80		0.11	438	F-BERGEN

Table 2.1. SOURCE ROCK SCREENING DATA WELL 6407/10-2 (cont'd)

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HYDRO

Depth (m)	% Lithology	Sample	S1 Kg/t	S2 Kg/t	S3 Kg/t	TOC %	HI	OI	PI	Tmax Deg.c	Company
2987.00	BULK	DC	0.2	1.6		2.0	80		0.12	436	F-BERGEN
2990.00	BULK	DC	0.1	0.8		1.2	66		0.12	437	F-BERGEN
2992.00	BULK	DC	0.1	0.9		1.1	78		0.10	438	F-BERGEN
3000.00	BULK	DC	0.2	1.2		1.0	117		0.13	438	F-BERGEN
3010.00	CLYST	SWC	0.4	4.2		2.1	204		0.10	437	F-BERGEN
3020.00	BULK	DC	0.3	3.3		1.7	187		0.09	443	F-BERGEN
3025.00	CLYST/SLST	SWC	0.2	2.5		1.2	203		0.09	438	F-BERGEN
3040.00	BULK	DC	0.4	3.7		1.7	223		0.10	442	F-BERGEN
3050.00	BULK	DC	0.3	2.8		1.5	182		0.10	439	F-BERGEN
3060.00	BULK	DC	0.3	3.1		1.4	213		0.09	441	F-BERGEN
3070.00	BULK	DC	0.3	2.9		1.4	206		0.11	436	F-BERGEN
3070.00	CLYST	SWC	0.3	3.0		1.4	221		0.09	439	F-BERGEN
3080.00	BULK	DC	0.3	2.7		1.4	193		0.11	440	F-BERGEN
3100.00	BULK	DC	0.3	2.3		1.2	192		0.11	443	F-BERGEN
3120.00	BULK	DC	0.3	2.2		1.1	197		0.11	442	F-BERGEN
3140.00	BULK	DC	0.3	1.8		1.0	179		0.12	444	F-BERGEN
3160.00	BULK	DC	0.3	1.6		1.1	149		0.15	441	F-BERGEN
3180.00	BULK	DC	0.3	1.5		1.3	113		0.19	441	F-BERGEN
3200.00	BULK	DC	0.3	1.4		1.2	123		0.15	443	F-BERGEN

Table 2.1. SOURCE ROCK SCREENING DATA WELL 6407/10-2 (cont'd)

Petroleum Geochemistry Group
Research Center Bergen

Depth (m)	% Lithology	Sample	S1 Kg/t	S2 Kg/t	S3 Kg/t	TOC %	HI	OI	PI	Tmax Deg.c	Company
3220.00	BULK	DC	0.3	2.0		1.4	141		0.14	441	F-BERGEN
3220.00	CLYST	SWC	0.3	3.7		1.9	194		0.09	437	F-BERGEN
3235.00	CLYST	SWC	0.3	1.9		1.8	104		0.12	439	F-BERGEN
3240.00	BULK	DC	0.4	2.3		1.9	118		0.15	440	F-BERGEN
3250.00	CLYST	SWC	0.4	4.0		3.3	121		0.10	438	F-BERGEN
3260.00	BULK	DC	0.5	2.9		2.6	110		0.14	441	F-BERGEN
3265.00	CLYST	SWC	0.4	3.0		3.3	92		0.12	436	F-BERGEN
3280.00	BULK	DC	0.3	2.0		2.2	92		0.15	440	F-BERGEN
3300.00	BULK	DC	0.3	1.6		2.1	75		0.16	441	F-BERGEN
3320.00	BULK	DC	0.3	1.5		2.3	65		0.17	439	F-BERGEN
3340.00	BULK	DC	0.3	1.1		1.9	56		0.20	443	F-BERGEN
3394.00	CLYST	SWC	0.1	1.3		1.7	76		0.09	448	F-BERGEN
3409.00	CLYST	SWC	0.1	0.9		1.2	73		0.09	442	F-BERGEN
3421.00	CLYST	SWC	0.2	1.9		1.2	163		0.09	446	F-BERGEN
3665.00	CLYST	SWC	0.5	3.7		1.0	353		0.12	439	F-BERGEN
3676.00	CLYST	SWC	1.6	8.9		2.6	346		0.15	438	F-BERGEN
3680.00	CLYST/SST	SWC	0.6	1.9		1.0	187		0.23	443	F-BERGEN

Table 2.2

SOURCE ROCK EXTRACTION DATA

Table 2.2. SOURCE ROCK EXTRACTION DATA I WELL 6407/10-2

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Depth(m)	EOM(mg)	EOM(%)	Hydrocarbons			Non Hydrocarbons		
			SAT(%)	ARO(%)	TOTAL(%)	NSO(%)	ASPH(%)	TOTAL(%)
2290.00	2.40	0.02	5	10	15	31	54	85
2824.00	39.00	0.43	10	23	33	28	39	67
2920.00	23.40	0.33	23	16	39	21	40	61
2945.00	14.30	0.14	6	12	18	25	57	82
2965.00	19.00	0.20	4	10	14	16	70	86
2980.00	14.70	0.17	4	12	16	15	69	84
3010.00	23.60	0.23	5	23	28	16	56	72
3070.00	8.60	0.12	11	21	32	20	48	68
3220.00	6.30	0.14	6	19	25	15	60	75
3265.00	11.70	0.19	3	16	19	13	68	81
3421.00	2.90	0.06	12	13	25	13	62	75
3676.00	25.80	0.47	25	32	57	24	19	43

Table 2.3

SOURCE ROCK EXTRACTION RATIOS

Table 2.3. SOURCE ROCK EXTRACTION DATA II WELL 6407/10-2



Depth(m)	TOC (%)	EOM(%) / TOC(%)	SAT(%) / TOC(%)	SAT(%) / ARO(%)	HC / non HC
2290.00	0.83	0.02	6.02	0.50	0.18
2824.00	4.12	0.10	2.43	0.43	0.49
2920.00	3.22	0.10	7.14	1.44	0.64
2945.00	1.93	0.07	3.11	0.50	0.22
2965.00	3.57	0.06	1.12	0.40	0.16
2980.00	2.63	0.06	1.52	0.33	0.19
3010.00	2.07	0.11	2.42	0.22	0.39
3070.00	1.35	0.09	8.15	0.52	0.47
3220.00	1.89	0.07	3.17	0.32	0.33
3265.00	3.27	0.06	0.92	0.19	0.23
3421.00	1.17	0.05	10.26	0.92	0.33
3676.00	2.59	0.18	9.65	0.78	1.33

Table 2.4

MOLECULAR RATIOS

Table 2.4. SATURATED FRAC., MOLECULAR RATIOS WELL 6407/10-2



Depth	Pr/n-C17	Pr/Ph	CPI-I	CPI-II	n-C15+/Total	n-C20/n-C25
2290.00	0.78	2.29	2.07			
2824.00	2.58	1.57	1.03			
2920.00	2.19	1.78	1.22			
2945.00	2.10	3.59	1.65			
2965.00	3.99	7.40	1.70			
2980.00	3.16	6.78	1.69			
3010.00	2.21	6.28	1.70			
3070.00	1.90	5.61	1.53			
3220.00	2.60	6.57	1.63			
3265.00	3.10	5.77	1.60			
3421.00	0.65	3.05	1.53			
3676.00	0.55	1.66	1.10			

Table 2.4

MOLECULAR RATIOS

MOLECULAR RATIOS
 NJORD OILS - SEDIMENT EXTRACTS

WELL	DEPTH m	SAMPLE	Pr/n-C17	Pr/Ph	CPI-I	DATE
6407/10-2	3676	SWC	0.6	1.7	1.1	Sept. 90
6407/7-2	2872	Reservoir	0.9	1.8	1.1	April 87
6407/7-1	...	DST 3	0.8	1.6	1.1	Sept. 90
6407/7-1	...	DST 4	0.8	1.5	1.2	Sept. 90

Table 2.5

BIOMARKER RATIOS

BIOMARKER RATIOS
TRITERPANE ISOMERISATION

DEPTH m	SAMPLE	Ts/Tm	NOR/ NOR+HOP	BNOR/ BNOR+NOR	MORET/ HOPAN	C32-22S %
2290	SWC	0.02	0.37	...	0.42	21
2824	SWC	0.35	0.29	0.35	0.39	58
2920	SWC	0.31	0.30	0.05	0.32	58
2945	DC	0.06	0.39	0.04	0.46	56
2965	SWC	0.03	0.42	0.05	0.52	57
2980	SWC	0.03	0.43	...	0.50	59
3010	SWC	0.07	0.44	...	0.41	58
3070	SWC	0.12	0.45	...	0.35	59
3220	SWC	0.05	0.54	...	0.42	63
3265	SWC	0.03	0.48	...	0.51	57
3421	SWC	0.05	0.49	...	0.49	60
3676	SWC	1.20	0.21	...	0.14	60
BIOMSTD.	OIL	1.20	0.35	0.40	0.12	61

BIOMARKER RATIOS
TRITERPANE ISOMERISATION

WELL	DEPTH m	SAMPLE	NOR/ NOR+HOP	BNOR/ BNOR+NOR	MORET/ HOPAN	C32-22S %	DATE
6407/10-2	3676	SWC	0.21	...	0.14	60	Sept. 90
6407/7-2	2872	Reservoir	0.31	0.26	0.17	57	April 87
6407/7-1	...	DST 3	0.35	0.31	0.12	67	Sept. 90
6407/7-1	...	DST 4	0.26	0.39	0.14	63	Sept. 90

BIOMARKER RATIOS
STERANE ISOMERISATION

DEPTH m	SAMPLE	C29-20S aaa %	C29-20S+R aBB %
2290	SWC	11	25
2824	SWC	25	25
2920	SWC	28	26
2945	DC	25	25
2965	SWC	26	25
2980	SWC	29	26
3010	SWC	31	32
3070	SWC	41	34
3220	SWC	49	35
3265	SWC	49	25
3421	SWC	53	37
3676	SWC	50	65
BIOMSTD.	OIL	48	61

BIOMARKER RATIOS
STERANE ISOMERISATION

WELL	DEPTH m	SAMPLE	C29-20S aaa %	C29-20S+R aBB %	DATE
6407/10-2	3676	SWC	50	65	Sept. 90
6407/7-2	2878	Reservoir	58	56	April 87
6407/7-1	...	DST 3	48	71	Sept. 90
6407/7-1	...	DST 4	55	67	Sept. 90

Table 3.1

VITRINITE REFLECTANCE

Table 3.1. VITRINITE REFLECTANCE DATA WELL 6407/10-2
Average values



Depth	Population I	Population II	Population III	SCI
1080.00	0.26			
1090.00	0.27			
1100.00	0.27			
1190.00	0.33			
1200.00	0.28			
1290.00	0.29			
1300.00	0.32			
1390.00	0.32			
1400.00	0.32			
1490.00	0.32			
1500.00	0.35			
1590.00	0.41			
1600.00	0.35			
1690.00	0.36			
1700.00	0.37			
1790.00	0.36			
1800.00	0.36			
1890.00	0.38			

Table 3.1. VITRINITE REFLECTANCE DATA WELL 6407/10-2 (cont'd)
Average values



Depth	Population I	Population II	Population III	SCI
1900.00	0.43			
1990.00	0.43			
2000.00	0.43			
2090.00	0.43			
2100.00	0.38			
2190.00	0.42			
2200.00	0.40			
2290.00	0.45			
2300.00	0.50			
2400.00	0.39			
2490.00	0.51			
2590.00	0.49			
2690.00	0.46			
2700.00	1.36			
2790.00	0.45			
2807.00	0.43			
2910.00	0.41			
2997.00	0.47			
3010.00	0.43			

Table 3.1. VITRINITE REFLECTANCE DATA WELL 6407/10-2 (cont'd)
Average values



Depth	Population I	Population II	Population III	SCI
3050.00	0.45			
3070.00	0.47			
3110.00	0.41			
3135.00	0.51			
3210.00	0.46			
3260.00	0.51			
3310.00	0.55			
3345.00	0.49			
3410.00	0.54			
3437.00	0.70			
3442.00	0.64			
3470.00	0.69			
3540.00	0.54			
3570.00	0.66			
3650.00	0.56			
3675.00	0.55			
3697.00	0.62			
3725.00	0.59			
3750.00	0.57			

Table 3.1. VITRINITE REFLECTANCE DATA WELL 6407/10-2 (cont'd)
Average values



Depth	Population I	Population II	Population III	SCI
3790.00	0.59			
3802.00	0.62			
3805.00	0.55			

Table 4.1

CARBON ISOTOPE COMPOSITION

TABLE 4.1 - $\delta^{13}\text{C}$ OF OILS AND SEDIMENT EXTRACTS.

DATO	COMPANY	WELL	DEPTH (m)	SAT ppm	ARO ppm	NSO ppm	ASPH ppm	EOM/OIL ppm
8/86	UiB	6407/7-1	DST#2	-29.75	-28.70	-28.90		
			DST#3	-29.80	-28.74	-28.60		
			DST#4	-29.70	-29.00	-29.10		
			DST#5	-29.06		-27.9		
9/90	Geochem	6407/10-2	2824	-31.82	-32.66	-30.72	-29.59	-31.17
			2920	-32.12	-31.40	-29.64	-28.30	-30.01
			3676	-31.39	-35.99	-31.19	-30.94	-31.45
10/90	Geolab Nor	6407/10-2	2823/24	-32.20	-31.34 -31.42	-30.30	-28.92	-30.99
			3676	-32.21	-31.35	-31.27	-30.82	-31.70

GEOCHEMISTRY WELL 6407/10-2

IDENTIFICATION OF BIOLOGICAL MARKERS

Triterpanes (m/z 191):

Numbers from 18 to 35 corresponds to the carbon number of the molecule, the following capital letter identifies the stereochemistry and/or the number of rings.

- A 17 α (H)-hopanes (I) 22S
- B 17 α (H)-hopanes 22R
- C 17 β (H)-moretanes (II) 22S
- D 17 β (H)-moretanes 22R
- E 17 β (H)-hopanes (III)
- F Neohopanes (IV)
- G Gammacerane (V)
- H $\Delta^{13,18}$ -hopenes (VI)
- I 25-norhopanes (VII)
- L Lupane (VIII)
- O 18 α (H)-oleanane (IX)
- X Tetracyclic terpanes (X)
- Y Tricyclic terpanes (XI)

Steranes (m/z 217):

Numbers from 20 to 30 corresponds to the carbon number of the molecules, the following small letter identifies the stereochemistry.

- a 13 β (H),17 α (H)-diasteranes 20S (1)
- b 13 β (H),17 α (H)-diasteranes 20R (2)
- c 13 α (H),17 β (H)-diasteranes 20S (3)
- d 13 α (H),17 β (H)-diasteranes 20R (4)
- e 5 α (H),14 α (H),17 α (H)-steranes 20S (5)
- f 5 α (H),14 β (H),17 β (H)-steranes 20R (6)
- g 5 α (H),14 β (H),17 β (H)-steranes 20S (7)
- h 5 α (H),14 α (H),17 α (H)-steranes 20R (8)
- i 5 β (H),14 α (H),17 α (H)-steranes (9)
- k 4-methylsteranes (10)

Examples: 31B corresponds to 17 α (H)-homohopane 22R
29e corresponds to $\alpha\alpha\alpha$ -ethylcholestane 20S