

4.10 Drilling fluid summary

Water base mud properties, daily record

Well: 24/12-3S

Operator: Statoil

Anchor/M-I Drilling Fluids

Rig: Deepsea Trym

FSR	Date	Depth	M.W.	F.	F.Vis	VG-meter readings @ 50 C								P.V.	Y.P.	Gel	Gel	pH	HTHP	API	PI	Mf	Cl-	TH	Ca++	Mg+	KCl	K+	Solids	Sand	MBT	HGS	LGS	Anco	208
no.	1995			Temp		600	300	200	100	60	30	6	3			10s	10 m						x 1000												
.	.	m	sg	oC	s/qt.	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	cP	Pa	Pa	Pa			ml	ml	ml	ml	kg/m3	mg/l	mg/l	mg/l	kg/m3	kg/m3	vol%	vol%	kg/m3	kg/m3	kg/m3	%
36 1/2" Section: Bentonite Spud mud																																			
1	27-06	203	1,20	20																															
17 1/2" Section: Bentonite Spud mud																																			
2	28-06	203	1,05		100									0	0,0																				
3	29-06	490	1,04		120	39	29	25	20	19	17	10	9	10	5,0					10															
4	30-06	1130	1,30		107	77	55	44	36	30	26	20	18	22	11,0	13	19	10																	
5	01-07	Run casing, mixing mud for 12 1/4" section.												0	0,0																				
6	02-07	Cementing casing, mixing mud for 12 1/4" section.												0	0,0																				
7	03-07	Testing BOP, mixing mud for 12 1/4" section.												0	0,0																				
12 1/4" Section: Anco 2000																																			
8	04-07	1130	1,40		88	45	29	20	13	10	7	4	3	16	8,0	3	7	9			5	0,1	0,5	80000				170	89	16	0	0	365	92	4
9	05-07	1324	1,40	22	60	56	38	31	22	17	12	6	5	18	9,0	3	4	8,8			3,1	0	0,5	80000	440	360		158	83	17	0	14	379	56	4
10	06-07	1832	1,40	39	65	59	41	34	25	20	15	7	6	18	9,0	3	4	8,1			2,6	0	0,3	78000	680	520		144	76	17,5	1,2	28	354	88	3,4
11	07-07	2230	1,40	48	67	64	46	38	28	23	17	8	7	18	9,0	3,5	6	7,9			3,1	0	0,6	79000	880	560		141	74	17,5	0,8	47	353	86	3
12	08-07	2230	1,40		67	64	46	38	28	23	17	8	7	18	9,0	3,5	6	7,9			3,1	0	0,6	79000	880	560		141	74	17,5	0,8	47	353	86	3
13	09-07	2367	1,40	41	67	67	49	41	31	25	19	10	8	18	9,0	4	6,5	7,9			3,1	0	0,6	78000	880	600		139	73	18	0,8	49	357	100	3
14	10-07	2367	1,40		67	67	49	41	31	25	19	10	8	18	9,0	4	6,5	7,9			3,1	0	0,6	78000	880	600		139	73	18	0,8	49	357	100	3
15	11-07	2367	1,40	14	86	68	49	41	31	25	19	10	8	19	9,5	4	7	7,9			3,2	0	0,6	79000	920	680		140	73	17,5	0,8	49	353	86	3
16	12-07	2367	1,40		86	66	48	39	29	24	18	9	7	18	9,0	3,5	6	7,9			3,3	0	0,6	79000	920	680		140	73	17,5	0,8	49	353	86	3
17	13-07	2367	1,40		86	70	49	38	27	21	16	7	5	21	10,5	3	6	8,2			3,3	0	0,6	76000	960	800		140	73	18	0,8	45	330	121	3

Water base mud properties, daily record

Well: 24/12-3S

Operator: Statoil Anchor/M-I Drilling Fluids Rig: Deepsea Trym

FSR no.	Date 1995	Depth m	M.W. sg	F. Temp oC	F.Vls s/qt	VG-meter readings @ 50 C								P.V. cP	Y.P. Pa	Gel 10s Pa	Gel 10 m Pa	pH	HTHP ml	API ml	PI ml	MI ml	CI- x 1000 kg/m3	TH mg/l	Ca++ mg/l	Mg+ mg/l	KCl kg/m3	K+ kg/m3	Solids vol%	Sand vol%	MBT kg/m3	HGS kg/m3	LGS kg/m3	Anco 208 %
8 1/2 Section: Anco 2000																																		
18	14-07	2367	1,20	32	80	49	34	27	18	14	10	6	4	15	7,5	2,5	3	9	8	3,8	0,3	1,4	72000	920	800		114	60	11	0,6	20	125	62	3
19	15-07	2367	1,21	39	82	49	34	29	21	16	13	7	4	15	7,5	2,5	3	9	8	3,8	0,3	1,4	76000	520	440		134	70	11	0,5	20	127	51	3
20	16-07	2456	1,21	38	81	62	45	38	22	17	12	9	7	17	8,5	3,5	5	8,9	8	3,1	0,2	1,3	77000	400	320		140	73	12	0,6	21	113	86	3,3
21	17-07	2608	1,21	38	75	50	36	30	22	18	14	7	5	14	7,0	3	3,5	8,9	8	2,9	0,1	1	74000	300	220		138	71	12	0,8	23	85	110	3,2
22	18-07	2891	1,20	39	72	54	39	33	24	20	15	8	6	15	7,5	3,5	4,5	8,9	9	3,2	0,1	1	76000	300	220		138	72	12,5	0,5	21	38	149	3,1
23	19-07	2956	1,20	39	75	50	36	30	22	18	14	7	5	14	7,0	3	3,5	8,9	8	2,9	0,1	1	74000	300	220		138	71	12	0,6	20	59	126	3,2
24	20-07	3040	1,20	39	75	52	37	31	23	19	15	8	6	15	7,5	3	3,5	8,4	8	2,9	0,05	0,95	76000	640	600		135	71	12,5	0,4	20	38	149	3
25	21-07	3058	1,20		84	52	37	31	23	19	15	8	6	15	7,5	3	3,5	8,4	8,4	3,2	0,05	0,95	76000	660	600		132	69	12,5	0,4	20	38	149	3
26	22-07	3058	1,20		84	52	37	31	23	19	15	8	6	15	7,5	3	3,5	8,4	8,4	3,2	0,05	0,95	76000	660	600		132	69	12,5	0,4	20	38	149	3
27	23-07	3058	1,20		84	52	37	31	23	19	15	8	6	15	7,5	3	4,5	8,4	8,4	3,2	0,1	0,9	76000	660	600		132	69	12,5	0,25	20	38	149	3
P&A Section: Anco 2000																																		
28	24-07	3058	1,20		84	53	36	29	20	15	10	5	4	17	8,5	3,5	8	12,2	8,8	2,9	0,2	1,1	78000	400	400		135	71	12,5	0,25	22	40	143	3,2
29	25-07	3058	1,20		84	53	36	29	20	15	10	5	4	17	8,5	3,5	8	12,2	8,8	2,9	0,2	1,1	78000	400	400		135	71	12,5	0,25	22	40	143	3,2
30	26-07	3058	1,40	20	79	49	35	26	17	14	10	5	4	14	7,0	3,5	8	11,7	8,8	3,7	0,2	1,1	75000	500	500		135	71	17,5	0,25	22	246	161	3
31	27-07	3058	1,36		64	46	38	28	22	16	8	6	4	8	4,0	4	9	11,8	8,4	3,6	0,2	1,2	78000	520	520		127	67	18	0,25	20	226	181	3
32	28-07	3058	1,4	20	79	64	46	38	28	22	16	8	6	18	9,0	4	8	11,8	8,8	3,7	0,2	1,1	78000	520	520		135	71	17,5	0,25	22	247	154	3

FMT pressure measurements (Run 2A)

Depth, mMD RKB	Depth, mTVD MSL	Drawdown mobility, MD/CP	Mud pressure		Formation pressure, bar	Test type
			Before bar	After bar		
2381	2169.9	3.4	264.12	264.03	261.29	supercharged
2398.4	2184.5	26.6	265.75	265.74	221.2	good
2400	2185.8	92.5	265.93	221.31	221.31	good
2401	2186.7	596.9	266	266.07	221.37	good
2403	2188.3	46	266.25	221.56	221.56	good
2406	2190.8	53.9	266.55	266.55	221.81	good
2414	2197.5	18.2	267.33	267.31	222.45	good
2420	2202.4	29.6	267.92	267.91	222.95	good
2425	2206.6	29.1	268.43	268.46	223.38	good
2433	2213.1	33.4	269.28	269.34	224.07	good
2449	2226.1	10.8	270.89	270.89	225.43	good
2470	2243.2	25.9	272.89	272.88	227.12	good
2506	2272.2	36.6	276.38	276.28	230.04	good
2520	2283.6	21	277.72	277.71	231.19	good
2530	2291.7	633	278.72	278.7	232.02	good
2550	2308.1	35.9	280.68	280.67	233.69	good
2565	2320.2	69.9	282.14	282.15	234.92	good
2583	2334.9	385.5	283.91	283.91	236.42	good
2603	2351.3	74.1	285.88	285.87	237.71	good
2650	2389.5	225.93	290.42	290.52	241.56	good
2700.1	2430.2	49.6	295.47	295.45	245.5	good
2749	2470	57.7	300.4	300.29	249.36	good

Table 3.3.1

FMT segregated sample (Run 2B)

Measurements		Depth			
FMT run	Zone	mMD RKB	Chambers	Remarks	Opening pressure
2B	Heimdal	2398.4	30 litre chamber	160 litre gas, 8 litre oil, 20 litre water (mud filtrate)	6200 kPa
			4 litre chamber	Sample sent to PVT lab for analyses	1400 kPa

Table 3.3.2

3.4 Well Testing

No DST test was done in this well.

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SUMMARY

This report presents the results of a reservoir geochemical study of well 24/12-3S, located in the southern Viking Graben. The well was drilled with Anco 2000 drilling mud containing 3 % polyalkylene glycols, from 1130m to TD.

Mud sample

Rock Eval pyrolysis of the drilling mud sample in well 24/12-3S shows that it contributes mainly to the S1 fraction. The unexpected distribution of n-alkanes and biomarkers (Appendix) indicates the presence of trace oil in the mud, which is found not to be due to contamination by the reservoired petroleum in well 24/12-3S. According to Anchor Drilling Fluids (pers.comm.) the mud was composed for use in well 24/12-3S, and has not been transferred from another well. The source for the oil in the mud sample is therefore at present not known.

Unfortunately no mud sample was available from above the reservoir interval. The core samples in this well are sensitive to contamination by the drilling mud due to low amounts of migrated petroleum. A mud sample taken before entering the reservoir would have made it easier to distinguish between in situ petroleum in the core extracts and contamination from the drilling mud.

1 INTRODUCTION

This report presents the results of a reservoir geochemical study of well 24/12-3S, located in the southern Viking Graben (Figure 1). The well was drilled with Anco 2000 drilling mud containing 3% polyalkene glycols, from 1130m to TD.

Core samples and SWC's together with one FMT sample and one mud sample were analysed according to the following programme (see also Appendix):

ANALYSES	NUMBER OF SAMPLES					Total
	Cores	SWC	Oil	Mud	Gas	
Rock-Eval pyrolysis	19	13				32
Te-GC	7	6				13
Extraction	5					5
Asphaltene precipitation	5		1	1		7
Iatroscan separation	5		1	1		7
MPLC separation	5		1	1		7
GC whole oil/extract			1			1
GC saturated fraction	5		1	1		7
GC aromatic fraction	5		1	1		7
GC-MS saturated fraction	5		1	1		7
GC-MS aromatic fraction	5		1	1		7
$\delta^{13}\text{C}$ of whole oil/fractions	5		1	1		7
$\delta^{13}\text{C}$ of gas and gas composition					1	1

The analytical work was performed in accordance with the guidelines given in "The Norwegian Industry Guide to Organic Geochemical Analyses (1993)". The project was carried out at Geolab Nor, with the exception of the gas analysis, which was performed at IFE.

Table 1 Analytical Program

Sample Depth (metres) and Type	Fractions	HS & Occ Gas	Leco TOC	RockEval	Therm Ext GC	Pyrolysis GC	Extraction	MPLC & Deasp	Infrared	EOM GC	Sat GC Quant.	Aro GC	Sat GCMS Quant.	Aro GCMS	Bulk C Isot	Vis Kerogen	Vit Reflect
Table Nos:		2	5	5	-	6	8a-e	8a-e	8f-g	13	9	9	11	12	10	7	4
2392.00 sR	021L		x	x													
2393.80 sR	031L		x														
2395.30 sR	041L		x	x													
2396.60 pR	051L		x	x		x	x	x		x	x	x	x	x			
2397.00 pR	061L		x														
2397.60 pR	071L		x														
2398.12 pR	081L		x	x		x	x	x		x	x	x	x	x			
2398.60 pR	091L		x														
2399.02 pR	101L		x														
2399.53 pR	111L		x	x		x	x	x		x	x	x	x	x			
2400.08 pR	121L		x														
2400.59 pR	131L		x														
2401.03 pR	141L		x														
2401.58 pR	151L		x	x		x	x	x		x	x	x	x	x			
2402.03 pR	161L		x														
2402.64 pR	171L		x	x		x	x	x		x	x	x	x	x			
2403.03 pR	181L		x														
2403.50 pR	191L		x	x													
2404.03 pR	201L		x														
2404.50 pR	211L		x														
2405.05 pR	221L		x	x													
2405.99 pR	231L		x														
2407.50 sR	241L		x														
2413.70 sR	251L		x	x													
2431.00 sR	261L		x														
2480.00 sR	271L		x	x													
2532.70 sR	281L		x														
2576.50 sR	291L		x														
2667.00 sR	301L		x	x													
2728.00 sR	311L		x														
2758.50 sR	321L		x	x													
2989.50 sR	331L		x														
oil 2398.4 m	232					x	x	x	x	x	x	x	x	x			
slam 2406 m	341L		x			x	x	x	x	x	x	x	x	x			

Table 5A: Rock-Eval table for well NOCS 24/12-3S

Page: 1

Depth unit of measure: m

Depth	Typ	Form	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2392.00	swc		S/Sst	1.01	1.48	1.43	1.03	-	-	-	2.5	0.41	356	0002-1L
2393.80	swc		S/Sst	3.33	3.28	2.03	1.62	-	-	-	6.6	0.50	359	0003-1L
2395.30	swc		Sltst	1.45	2.15	1.46	1.47	-	-	-	3.6	0.40	356	0004-1L
2396.60	ccp		S/Sst	0.59	2.20	0.77	2.86	-	-	-	2.8	0.21	386	0005-1L
2397.00	ccp		S/Sst	13.03	3.67	0.93	3.95	-	-	-	16.7	0.78	430	0006-1L
2397.60	ccp		S/Sst	6.82	2.08	0.77	2.70	-	-	-	8.9	0.77	430	0007-1L
2398.12	ccp		S/Sst	11.77	8.07	0.89	9.07	-	-	-	19.8	0.59	338	0008-1L
2398.60	ccp		S/Sst	10.53	2.43	1.09	2.23	-	-	-	13.0	0.81	423	0009-1L
2399.02	ccp		S/Sst	7.06	6.57	1.12	5.87	-	-	-	13.6	0.52	346	0010-1L
2399.53	ccp		S/Sst	2.47	0.75	1.10	0.68	-	-	-	3.2	0.77	347	0011-1L
2400.08	ccp		S/Sst	2.83	0.89	1.95	0.46	-	-	-	3.7	0.76	351	0012-1L
2400.59	ccp		S/Sst	2.72	2.69	1.35	1.99	-	-	-	5.4	0.50	347	0013-1L
2401.03	ccp		S/Sst	4.76	13.38	1.34	9.99	-	-	-	18.1	0.26	344	0014-1L
2401.58	ccp		S/Sst	2.14	0.45	1.56	0.29	-	-	-	2.6	0.83	352	0015-1L
2402.03	ccp		S/Sst	3.93	1.29	1.85	0.70	-	-	-	5.2	0.75	349	0016-1L
2402.64	ccp		S/Sst	2.33	3.09	1.53	2.02	-	-	-	5.4	0.43	350	0017-1L

Table 5A: Rock-Eval table for well NOCS 24/12-3S

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Depth unit of measure: m

Depth	Typ	Form	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
2403.03	ccp		S/Sst	1.33	0.16	1.39	0.12	-	-	-	1.5	0.89	360	0018-1L
2403.50	ccp		S/Sst	1.29	0.26	1.44	0.18	-	-	-	1.5	0.83	356	0019-1L
2404.03	ccp		S/Sst	2.41	0.26	1.46	0.18	-	-	-	2.7	0.90	360	0020-1L
2404.50	ccp		S/Sst	1.34	0.19	1.61	0.12	-	-	-	1.5	0.88	356	0021-1L
2405.05	ccp		S/Sst	2.05	0.23	1.37	0.17	-	-	-	2.3	0.90	359	0022-1L
2405.99	ccp		S/Sst	0.16	0.50	0.50	1.00	-	-	-	0.7	0.24	347	0023-1L
2407.50	swc		S/Sst	1.28	0.30	1.95	0.15	-	-	-	1.6	0.81	341	0024-1L
2413.70	swc		S/Sst	2.21	0.25	2.15	0.12	-	-	-	2.5	0.90	343	0025-1L
2431.00	swc		S/Sst	1.21	0.16	1.93	0.08	-	-	-	1.4	0.88	333	0026-1L
2480.00	swc		S/Sst	1.42	0.27	1.98	0.14	-	-	-	1.7	0.84	334	0027-1L
2532.70	swc		S/Sst	1.20	0.19	1.72	0.11	-	-	-	1.4	0.86	340	0028-1L
2576.50	swc		S/Sst	1.23	0.27	1.95	0.14	-	-	-	1.5	0.82	338	0029-1L
2667.00	swc		S/Sst	0.93	0.35	1.56	0.22	-	-	-	1.3	0.73	342	0030-1L
2728.00	swc		S/Sst	1.52	1.05	2.07	0.51	-	-	-	2.6	0.59	343	0031-1L
2758.50	swc		S/Sst	1.14	0.24	1.71	0.14	-	-	-	1.4	0.83	338	0032-1L
2989.50	swc		S/Sst	1.39	0.26	2.05	0.13	-	-	-	1.6	0.84	340	0033-1L

Table 5B: Rock-Eval table for well RE,STD

Depth unit of measure: m

Depth	Typ	Form	Lithology	S1	S2	S3	S2/S3	TOC	HI	OI	PP	PI	Tmax	Sample
1.00	std		bulk	0.42	18.27	2.66	6.87	-	-	-	18.7	0.02	418	0088-0B
2.00	std		bulk	0.42	17.81	2.44	7.30	-	-	-	18.2	0.02	418	0089-0B

Table 8 a: MPLC Bulk Composition: Weight of EOM and Fraction for well NOCS 24/12-3S

Page: 1

Depth unit of measure: m

Depth	Typ	Lithology	Rock Extracted (g)	EOM (mg)	Sat (mg)	Aro (mg)	Asph (mg)	NSO (mg)	HC (mg)	Non-HC (mg)	TOC(e) (%)	Sample
2396.60	ccp	S/Sst	11.1	11.4	2.0	1.2	0.6	7.6	3.2	8.2	1.08	0005-1L
2398.12	ccp	S/Sst	15.6	175.8	107.8	29.7	4.6	33.7	137.6	38.2	0.80	0008-1L
2399.53	ccp	S/Sst	12.3	60.4	13.2	6.6	0.2	40.4	19.9	40.5	0.26	0011-1L
2401.58	ccp	S/Sst	13.0	29.6	2.2	1.4	0.4	25.6	3.6	26.0	0.10	0015-1L
2402.64	ccp	S/Sst	14.8	41.7	1.7	2.4	5.3	32.3	4.1	37.6	0.29	0017-1L

Table 8 b: MPLC Bulk Composition: Concentration of EOM and Fraction (wt ppm rock) for well NOCS 24/12-3S

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
2396.60	ccp	S/Sst	1024	184	105	52	682	289	735	0005-1L
2398.12	ccp	S/Sst	11247	6896	1903	293	2153	8800	2447	0008-1L
2399.53	ccp	S/Sst	4926	1079	539	12	3294	1619	3306	0011-1L
2401.58	ccp	S/Sst	2269	171	103	33	1960	275	1994	0015-1L
2402.64	ccp	S/Sst	2827	114	163	355	2193	277	2549	0017-1L

Table 8 c: MPLC Bulk Composition: Concentration of EOM and Fraction (mg/g TOC(e)) for well NOCS 24/12-3S

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
2396.60	ccp	S/Sst	94.84	17.04	9.72	4.90	63.17	26.76	68.07	0005-1L
2398.12	ccp	S/Sst	1405.95	862.12	237.92	36.71	269.19	1100.05	305.90	0008-1L
2399.53	ccp	S/Sst	1894.84	415.36	207.68	4.71	1267.10	623.04	1271.80	0011-1L
2401.58	ccp	S/Sst	2269.94	171.78	103.53	33.74	1960.89	275.31	1994.63	0015-1L
2402.64	ccp	S/Sst	974.87	39.51	56.34	122.74	756.28	95.85	879.02	0017-1L

Table 8 d: MPLC Bulk Composition: Material extracted from the rock (%) for well NOCS 24/12-3S

Depth unit of measure: m

			Sat	Aro	Asph	NSO	HC	Non-HC	Sat	HC	Sample
			-----	-----	-----	-----	-----	-----	-----	-----	
Depth	Typ	Lithology	EOM	EOM	EOM	EOM	EOM	EOM	Aro	Non-HC	
2396.60	ccp	S/Sst	17.97	10.25	5.17	66.61	28.22	71.78	175.21	39.32	0005-1L
2398.12	ccp	S/Sst	61.32	16.92	2.61	19.15	78.24	21.76	362.35	359.61	0008-1L
2399.53	ccp	S/Sst	21.92	10.96	0.25	66.87	32.88	67.12	200.00	48.99	0011-1L
2401.58	ccp	S/Sst	7.57	4.56	1.49	86.39	12.13	87.87	165.93	13.80	0015-1L
2402.64	ccp	S/Sst	4.05	5.78	12.59	77.58	9.83	90.17	70.12	10.90	0017-1L

Table 8E: Iatroscan TLC Bulk Composition: Absolute yields in mg/g rock for well NOCS 24/12-3S

Depth unit of measure: m

<u>Depth</u>	<u>Typ</u>	<u>Lithology</u>	<u>EOM weighed</u>	<u>Sat HC</u>	<u>Aro HC</u>	<u>Resins</u>	<u>Asp</u>	<u>Tot HC</u>	<u>Tot Pol</u>	<u>EOM calcul.</u>	<u>Sample</u>
2396.60	ccp	S/Sst	1.07	0.02	0.02	0.03	0.75	0.04	0.78	0.82	0005-1L
2398.12	ccp	S/Sst	11.25	8.56	1.51	0.85	0.29	10.06	1.14	11.20	0008-1L
2399.53	ccp	S/Sst	4.93	1.81	0.30	0.86	0.01	2.11	0.88	2.98	0011-1L
2401.58	ccp	S/Sst	2.27	0.05	0.02	0.64	0.03	0.07	0.67	0.74	0015-1L
2402.64	ccp	S/Sst	2.83	0.04	0.01	0.71	0.36	0.05	1.06	1.11	0017-1L

Table 8F: Iatroscan TLC Bulk Composition: Rel. percentages of sep. fractions for well NOCS 24/12-3S

Depth unit of measure: m

<u>Depth</u>	<u>Typ</u>	<u>Lithology</u>	<u>Sat HC</u>	<u>Aro HC</u>	<u>Resins</u>	<u>Asp</u>	<u>Tot HC</u>	<u>Tot Pol</u>	<u>Sample</u>
2396.60	ccp	S/Sst	8.66	8.23	12.61	70.49	16.90	83.10	0005-1L
2398.12	ccp	S/Sst	76.40	13.44	7.55	2.61	89.84	10.16	0008-1L
2399.53	ccp	S/Sst	60.82	9.97	28.96	0.26	70.79	29.21	0011-1L
2401.58	ccp	S/Sst	7.42	2.29	88.82	1.47	9.71	90.29	0015-1L
2402.64	ccp	S/Sst	4.26	1.19	81.97	12.59	5.44	94.56	0017-1L

Table 9a: Quantitative Analysis of Saturated Fraction for well NOCS 24/12-3S.																							
sample	nC15 mg/g sat	nC16 mg/g sat	iC18 mg/g sat	nC17 mg/g sat	Pr mg/g sat	nC18 mg/g sat	Ph mg/g sat	nC19 mg/g sat	nC20 mg/g sat	nC21 mg/g sat	nC22 mg/g sat	nC23 mg/g sat	nC24 mg/g sat	nC25 mg/g sat	nC26 mg/g sat	nC27 mg/g sat	nC28 mg/g sat	nC29 mg/g sat	nC30 mg/g sat	nC31 mg/g sat	nC32 mg/g sat	nC33 mg/g sat	nC34 mg/g sat
2396.60m	5.98	0.00	3.68	6.89	4.79	6.66	3.35	4.95	4.21	3.45	2.59	2.06	1.99	1.43	1.33	1.20	1.45	1.26	0.58	0.56	0.00	0.00	0.00
2398.12m	17.32	17.21	9.13	16.69	8.32	14.94	6.21	13.98	11.96	8.81	7.98	6.12	5.00	4.18	3.10	2.23	1.63	1.57	1.26	0.98	0.75	0.72	0.80
2399.53m	18.03	2.08	11.03	19.26	11.32	16.36	7.59	14.18	11.88	8.45	7.09	5.11	3.99	3.27	2.07	1.58	1.19	1.01	0.71	0.52	0.34	0.40	0.00
2401.58m	2.11	4.51	3.28	6.59	3.61	6.25	2.69	6.14	4.83	3.37	2.65	1.89	1.58	1.40	0.91	0.72	0.56	0.51	0.38	0.00	0.00	0.00	0.00
2402.64m	0.30	0.67	0.41	0.93	0.87	1.06	0.59	0.99	0.93	0.72	0.60	0.47	0.41	0.30	0.23	0.20	0.17	0.12	0.11	0.00	0.00	0.00	0.00

Table 9B: Saturated Hydrocarbon Ratios (peak area) for well NOCS 24/12-3S

Depth unit of measure: m

			Pristane	Pristane	Pristane/nC17	Phytane		nC17	
Depth	Typ	Lithology	nC17	Phytane	Phytane/nC18	nC18	CPI1	nC17+nC27	Sample
2396.60	ccp	S/Sst	0.70	1.43	1.38	0.50	1.07	0.85	0005-1L
2398.12	ccp	S/Sst	0.50	1.34	1.20	0.42	1.07	0.88	0008-1L
2399.53	ccp	S/Sst	0.59	1.49	1.27	0.46	1.14	0.92	0011-1L
2401.58	ccp	S/Sst	0.55	1.34	1.27	0.43	1.09	0.90	0015-1L
2402.64	ccp	S/Sst	0.94	1.47	1.68	0.56	0.94	0.82	0017-1L

Table 9Ca: Aromatic Hydrocarbon Ratios (peak area) for well NOCS 24/12-3S

Depth unit of measure: m

Depth	Typ	Lithology	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	Rc	DBT/P	4/1MDBT	(3+2) /1MDBT	Sample
2396.60	ccp	S/Sst	-	-	-	0.80	0.51	0.42	0.71	-	5.51	1.97	0005-1L
2398.12	ccp	S/Sst	-	1.47	-	0.82	0.45	0.42	0.67	-	-	-	0008-1L
2399.53	ccp	S/Sst	-	-	-	0.74	0.63	0.49	0.78	-	-	-	0011-1L
2401.58	ccp	S/Sst	-	-	-	-	0.51	1.01	0.70	-	-	-	0015-1L
2402.64	ccp	S/Sst	-	-	-	-	-	-	-	-	-	-	0017-1L

Table 9Cb: Aromatic Hydrocarbon Ratios (peak area) for well NOCS 24/12-3S

Depth unit of measure: m

Depth	Typ	Lithology	F1	F2	Sample
2396.60	ccp	S/Sst	0.43	0.18	0005-1L
2398.12	ccp	S/Sst	0.39	0.18	0008-1L
2399.53	ccp	S/Sst	0.44	0.17	0011-1L
2401.58	ccp	S/Sst	0.58	0.58	0015-1L
2402.64	ccp	S/Sst	-	-	0017-1L

Table 10A: Tabulation of carbon isotope data for EOM/EOM - fractions for well NOCS 24/12-3S

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Saturated	Aromatic	NSO	Asphaltenes	Kerogen	Sample
2396.60	ccp	S/Sst	-26.53	-28.98	-26.99	-26.72	-26.08	-	0005-1
2398.12	ccp	S/Sst	-29.52	-29.30	-29.00	-28.39	-27.66	-	0008-1
2399.53	ccp	S/Sst	-29.45	-28.71	-28.94	-28.57	-28.21	-	0011-1
2401.58	ccp	S/Sst	-28.65	-27.96	-27.62	-28.48	-27.03	-	0015-1
2402.64	ccp	S/Sst	-28.73	-26.94	-28.74	-28.61	-27.92	-	0017-1

Table 10B: Tabulation of cv values from carbon isotope data for well NOCS 24/12-3S

Depth unit of measure: m

Depth	Typ	Lithology	Saturated	Aromatic	cv value	Sample
2396.60	ccp	S/Sst	-28.98	-26.99	1.75	0005-1
2398.12	ccp	S/Sst	-29.30	-29.00	-1.90	0008-1
2399.53	ccp	S/Sst	-28.71	-28.94	-3.26	0011-1
2401.58	ccp	S/Sst	-27.96	-27.62	-2.23	0015-1
2402.64	ccp	S/Sst	-26.94	-28.74	-7.29	0017-1

Table 11a: Variation in Triterpane Distribution (peak height) SIR for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Rat.10	Rat.11	Rat.12	Rat.13	Rat.14	Sample
2396.60	S/Sst	0.76	0.43	0.23	0.76	0.43	0.26	3.55	4.70	0.78	0.38	0.73	0.41	0.33	41.03	0005-1
2398.12	S/Sst	0.12	0.11	0.24	0.96	0.49	1.15	-	-	-	2.25	1.00	0.49	-	-	0008-1
2399.53	S/Sst	0.13	0.12	0.33	0.63	0.39	1.57	-	-	-	2.66	1.00	0.39	-	-	0011-1
2401.58	S/Sst	0.60	0.38	0.21	0.87	0.47	-	0.38	0.44	0.28	0.53	1.00	0.47	-	100.00	0015-1
2402.64	S/Sst	-	-	-	0.85	0.46	-	-	-	-	1.08	1.00	0.46	-	100.00	0017-1

List of Triterpane Distribution Ratios

Ratio 1: $27Tm / 27Ts$

Ratio 2: $27Tm / 27Tm+27Ts$

Ratio 3: $27Tm / 27Tm+30a\beta+30\beta a$

Ratio 4: $29a\beta / 30a\beta$

Ratio 5: $29a\beta / 29a\beta+30a\beta$

Ratio 6: $30d / 30a\beta$

Ratio 7: $28a\beta / 30a\beta$

Ratio 8: $28a\beta / 29a\beta$

Ratio 9: $28a\beta / 28a\beta+30a\beta$

Ratio 10: $24/3 / 30a\beta$

Ratio 11: $30a\beta / 30a\beta+30\beta a$

Ratio 12: $29a\beta+29\beta a / 29a\beta+29\beta a+30a\beta+30\beta a$

Ratio 13: $29\beta a+30\beta a / 29a\beta+30a\beta$

Ratio 14: $32a\beta S / 32a\beta S+32a\beta R (\%)$

Table 11b: Variation in Sterane Distribution (peak height) SIR for Well NOCS 24/12-3S

Page: 1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Ratio10	Sample
2396.60	S/Sst	0.54	20.09	43.09	0.28	0.65	0.23	0.14	0.27	0.25	0.47	0005-1
2398.12	S/Sst	0.86	63.81	72.37	1.95	0.67	0.74	0.55	0.57	1.76	3.62	0008-1
2399.53	S/Sst	0.79	56.84	71.93	2.08	0.69	0.76	0.57	0.56	1.32	2.97	0011-1
2401.58	S/Sst	0.61	55.50	75.44	1.81	0.73	0.60	0.48	0.61	1.25	3.45	0015-1
2402.64	S/Sst	0.53	-	-	3.66	-	1.00	1.00	-	-	-	0017-1

List of Sterane Distribution Ratios

Ratio 1: $27\text{d}\beta\text{S} / 27\text{d}\beta\text{S} + 27\text{aaR}$

Ratio 2: $29\text{aaS} / 29\text{aaS} + 29\text{aaR} \text{ (%)}$

Ratio 3: $2 * (29\beta\beta\text{R} + 29\beta\beta\text{S}) / (29\text{aaS} + 29\text{aaR} + 2 * (29\beta\beta\text{R} + 29\beta\beta\text{S})) \text{ (%)}$

Ratio 4: $27\text{d}\beta\text{S} + 27\text{d}\beta\text{R} + 27\text{daR} + 27\text{daS} / 29\text{d}\beta\text{S} + 29\text{d}\beta\text{R} + 29\text{daR} + 29\text{daS}$

Ratio 5: $29\beta\beta\text{R} + 29\beta\beta\text{S} / 29\beta\beta\text{R} + 29\beta\beta\text{S} + 29\text{aaS}$

Ratio 6: $21\text{a} + 22\text{a} / 21\text{a} + 22\text{a} + 29\text{aaS} + 29\beta\beta\text{R} + 29\beta\beta\text{S} + 29\text{aaR}$

Ratio 7: $21\text{a} + 22\text{a} / 21\text{a} + 22\text{a} + 28\text{daS} + 28\text{aaS} + 29\text{daR} + 29\text{aaS} + 29\beta\beta\text{R} + 29\beta\beta\text{S} + 29\text{aaR}$

Ratio 8: $29\beta\beta\text{R} + 29\beta\beta\text{S} / 29\text{aaS} + 29\beta\beta\text{R} + 29\beta\beta\text{S} + 29\text{aaR}$

Ratio 9: $29\text{aaS} / 29\text{aaR}$

Ratio 10: $29\beta\beta\text{R} + 29\beta\beta\text{S} / 29\text{aaR}$

Table 11c: Raw triterpane data (peak height) m/z 191 SIR for Well NOCS 24/12-3S

Page: 1

Depth unit of measure: m

Depth	Lithology	23/3	24/3	25/3	24/4	26/3	27Ts	27Tm	28aß	25nor30aß	Sample
		29aß	29Ts	30d	29ßa	30O	30aß	30ßa	30G	31aßS	
		31aßR	32aßS	32aßR	33aßS	33aßR	34aßS	34aßR	35aßS	35aßR	
2396.60	S/Sst	211.1 212.2 120.0	105.5 86.5 61.1	0.0 73.6 87.8	109.9 56.6 48.3	0.0 0.0 52.1	152.3 280.8 0.0	115.7 105.1 0.0	997.1 0.0 0.0	177.0 93.0 0.0	0005-1
2398.12	S/Sst	871.7 253.0 0.0	591.5 0.0 0.0	258.0 302.2 0.0	380.0 0.0 0.0	154.7 0.0 0.0	699.5 262.6 0.0	84.0 0.0 0.0	0.0 0.0 0.0	0.0 114.1 0.0	0008-1
2399.53	S/Sst	396.6 78.3 0.0	332.6 180.9 0.0	143.4 195.6 0.0	97.6 0.0 0.0	99.4 0.0 0.0	457.1 124.8 0.0	61.3 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0011-1
2401.58	S/Sst	133.4 122.3 53.3	73.8 48.2 60.9	41.7 0.0 0.0	37.5 0.0 37.3	0.0 0.0 0.0	63.7 140.2 35.1	38.4 0.0 35.5	53.6 0.0 0.0	33.8 74.6 0.0	0015-1
2402.64	S/Sst	50.3 32.5 0.0	41.3 19.2 18.2	0.0 0.0 0.0	0.0 0.0 18.7	0.0 0.0 18.0	27.8 38.3 0.0	0.0 0.0 0.0	0.0 0.0 0.0	18.5 25.2 0.0	0017-1

Table 11d: Raw sterane data (peak height) m/z 217 SIR for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	21a	22a	27dBS	27dBR	27daR	27daS	28dBS	28dBR	28daR*	Sample
		29dBS*	28daS*	27aaR	29dBR	29daR	28aaS	29daS*	28BS		
		28aaR	29aaS	29BR	29BS	29aaR					
2396.60	S/Sst	163.2 557.2 70.7	70.2 252.2 114.7	198.7 170.7 216.1	134.1 537.7 0.0	63.9 333.3 456.2	76.8 124.1	88.4 256.5	74.6 56.7	202.5	0005-1
2398.12	S/Sst	1276.9 812.6 0.0	330.2 305.3 154.6	1947.1 306.8 163.1	981.8 614.2 154.1	547.2 214.9 87.7	386.0 100.9	633.3 334.2	472.2 160.0	361.5	0008-1
2399.53	S/Sst	776.9 499.5 0.0	194.2 179.6 78.4	1185.0 322.5 98.8	673.5 363.9 77.9	298.7 114.9 59.5	255.9 63.5	359.2 182.2	296.1 88.5	304.8	0011-1
2401.58	S/Sst	104.2 44.0 0.0	41.4 38.1 21.6	82.0 52.9 32.5	65.0 44.5 27.2	28.0 0.0 17.3	26.9 0.0	35.9 22.8	23.6 24.9	40.0	0015-1
2402.64	S/Sst	32.5 0.0	17.6 0.0	34.2 0.0	38.3 0.0	0.0 0.0	0.0 0.0	18.3 0.0	0.0 0.0	0.0 0.0	0.0 0017-1

* 28daR coel with 27aaS, 29dBS coel with 27BR, 28daS coel with 27BS, 29daS coel with 28BR

Table 11e: Raw sterane data (peak height) m/z 218 SIR for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	27 β β R	27 β β S	28 β β R	28 β β S	29 β β R	29 β β S	30 β β R	30 β β S	Sample
2396.60	S/Sst	196.8	77.1	62.7	61.2	89.9	86.7	0.0	0.0	0005-1
2398.12	S/Sst	310.4	275.7	235.5	231.0	201.7	206.3	85.7	102.7	0008-1
2399.53	S/Sst	194.9	108.5	137.1	113.0	119.1	131.8	0.0	0.0	0011-1
2401.58	S/Sst	39.5	27.3	34.7	42.4	30.5	38.0	0.0	0.0	0015-1
2402.64	S/Sst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0017-1

Table 11f: Raw triterpane data (peak height) m/z 177 SIR for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	25nor28aß	25nor30aß	Sample
2396.60	S/Sst	1538.2	133.2	0005-1
2398.12	S/Sst	0.0	0.0	0008-1
2399.53	S/Sst	0.0	0.0	0011-1
2401.58	S/Sst	109.1	0.0	0015-1
2402.64	S/Sst	33.7	0.0	0017-1

Table 11g: Amount of triterpanes (ppb) m/z 191 SIR for Well NOCS 24/12-3S

Page: 1

Depth unit of measure: m

Depth	Lithology	23/3	24/3	25/3	24/4	26/3	27Ts	27Tm	28aß	25nor30aß	Sample
		29aß	29Ts	30d	29ßa	300	30aß	30ßa	30G	31aßS	
		31aßR	32aßS	32aßR	33aßS	33aßR	34aßS	34aßR	35aßS	35aßR	
2396.60	S/Sst	53134.4 53423.2 30213.0	26564.3 21770.4 15379.4	0.0 18515.6 22105.9	27671.7 14238.9 12167.2	0.0 0.0 13114.2	38337.0 70699.9 0.0	29114.6 26448.7 0.0	250997.5 0.0 0.0	44551.0 23400.5 0.0	0005-1
2398.12	S/Sst	36929.9 10718.9 0.0	25058.9 0.0 0.0	10930.2 12804.7 0.0	16099.8 0.0 0.0	6552.3 0.0 0.0	29634.6 11124.8 0.0	3559.9 0.0 0.0	0.0 0.0 0.0	0.0 4836.0 0.0	0008-1
2399.53	S/Sst	34066.7 6723.4 0.0	28564.6 15535.3 0.0	12320.1 16803.2 0.0	8386.1 0.0 0.0	8535.6 0.0 0.0	39259.2 10723.1 0.0	5267.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0011-1
2401.58	S/Sst	22352.9 20484.7 8937.9	12371.9 8073.4 10196.9	6984.2 0.0 0.0	6288.2 0.0 6254.1	0.0 0.0 0.0	10677.8 23498.3 5880.3	6427.5 0.0 5948.9	8973.4 0.0 0.0	5667.9 12499.8 0.0	0015-1
2402.64	S/Sst	15133.3 9762.4 0.0	12424.2 5780.3 5480.3	0.0 0.0 0.0	0.0 0.0 5611.8	0.0 0.0 5425.1	8366.2 11533.5 0.0	0.0 0.0 0.0	0.0 0.0 0.0	5559.7 7571.3 0.0	0017-1

Table 11h: Amount of steranes (ppb) m/z 217 SIR for Well NOCS 24/12-3S

Page: 1

Depth unit of measure: m

Depth	Lithology	21a	22a	27dBS	27dBR	27daR	27daS	28dBS	28dBR	28daR*	Sample
		29dBS*	28daS*	27aaR	29dBR	29daR	28aaS	29daS*	28BSR		
		28aaR	29aaS	29BSR	29BS	29aaR					
2396.60	S/Sst	41078.5 140262.7 17797.0	17677.0 63498.5 28870.3	50027.2 42981.6 54406.8	33753.3 135362.7 0.0	16075.1 83897.2 114850.3	19329.1 31233.2	22241.6 64583.7	18790.0 14265.9	50968.7	0005-1
2398.12	S/Sst	54098.2 34426.2 0.0	13990.6 12935.3 6550.3	82493.5 12998.9 6910.6	41596.5 26022.8 6529.9	23184.8 9105.3 3714.2	16353.3 4275.6	26828.7 14159.9	20004.7 6776.6	15315.2	0008-1
2399.53	S/Sst	66729.4 42899.7 0.0	16678.0 15426.9 6731.8	101777.5 27696.3 8482.8	57844.7 31250.9 6689.4	25652.2 9867.3 5110.9	21975.7 5457.7	30848.9 15649.0	25434.7 7603.0	26178.1	0011-1
2401.58	S/Sst	17464.3 7374.6 0.0	6941.1 6383.9 3613.1	13742.0 8860.4 5440.6	10884.0 7459.1 4559.3	4691.6 0.0 2896.9	4511.5 0.0	6019.7 0.0	3957.0 3820.5	6694.8 4172.6	0015-1
2402.64	S/Sst	9780.9 0.0 0.0	5290.0 0.0 0.0	10301.2 0.0 0.0	11528.1 8974.4 0.0	0.0 5962.2 0.0	0.0 0.0 0.0	0.0 0.0 0.0	5517.8 0.0 0.0	0.0 0.0 0.0	0.0 0017-1

* 28daR coel with 27aaS, 29dBS coel with 27BSR, 28daS coel with 27BS, 29daS coel with 28BSR

Table 11i: Amount of standard and weight of sample for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	Standard	Amount	Weight	Sample
2396.60	S/Sst	3972.4	0.700	0.7	0005-1
2398.12	S/Sst	731.1	0.700	22.6	0008-1
2399.53	S/Sst	2037.5	0.700	4.0	0011-1
2401.58	S/Sst	4177.7	0.700	1.0	0015-1
2402.64	S/Sst	3324.5	0.700	0.7	0017-1

Table 12a: Variation in Triaromatic Sterane Distribution (peak height) for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
2396.60	S/Sst	-	0.55	0.21	-	-	0005-1
2398.12	S/Sst	0.90	0.88	0.73	0.77	0.80	0008-1
2399.53	S/Sst	0.88	0.85	0.69	0.73	0.80	0011-1
2401.58	S/Sst	1.00	1.00	1.00	1.00	1.00	0015-1
2402.64	S/Sst	0.58	0.53	0.32	0.31	0.47	0017-1

Ratio1: $a1 / a1 + g1$
Ratio2: $b1 / b1 + g1$
Ratio3: $a1 + b1 / a1 + b1 + c1 + d1 + e1 + f1 + g1$

Ratio4: $a1 / a1 + e1 + f1 + g1$
Ratio5: $a1 / a1 + d1$

Table 12b: Variation in Monoaromatic Sterane Distribution (peak height) for Well NOCS 24/12-3S

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Sample</u>
2396.60	S/Sst	0.31	0.29	0.14	0.13	0005-1
2398.12	S/Sst	0.77	0.58	0.65	0.51	0008-1
2399.53	S/Sst	0.74	0.55	0.63	0.48	0011-1
2401.58	S/Sst	0.60	0.39	0.44	0.33	0015-1
2402.64	S/Sst	0.57	0.41	0.43	0.37	0017-1

Ratio1: A1 / A1 + E1
Ratio2: B1 / B1 + E1

Ratio3: A1 / A1 + E1 + G1
Ratio4: A1+B1 / A1+B1+C1+D1+E1+F1+G1+H1+I1

Table 12c: Aromatisation of Steranes (peak height) for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Sample
2396.60	S/Sst	0.81	0.29	0005-1
2398.12	S/Sst	0.60	0.70	0008-1
2399.53	S/Sst	0.57	0.67	0011-1
2401.58	S/Sst	1.00	-	0015-1
2402.64	S/Sst	0.41	1.00	0017-1

Ratio1:
$$\frac{C1+D1+E1+F1+G1+H1+I1}{C1+D1+E1+F1+G1+H1+I1 + c1+d1+e1+f1+g1}$$

Ratio2: $g1 / g1 + I1$

Table 12d: Raw triaromatic sterane data (peak height) m/z 231 for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	Sample
2396.60	S/Sst	0.0	379.2	191.1	429.0	284.8	224.7	314.7	0005-1
2398.12	S/Sst	3133.5	2449.8	333.4	769.7	369.6	233.5	347.1	0008-1
2399.53	S/Sst	2432.3	1755.0	375.3	620.9	290.6	270.1	317.0	0011-1
2401.58	S/Sst	128.9	127.9	0.0	0.0	0.0	0.0	0.0	0015-1
2402.64	S/Sst	221.9	184.6	110.4	250.0	221.7	110.7	161.3	0017-1

Table 12e: Raw monoaromatic sterane data (peak height) m/z 253 for Well NOCS 24/12-3S

Depth unit of measure: m

Depth	Lithology	A1	B1	C1	D1	E1	F1	G1	H1	I1	Sample
2396.60	S/Sst	503.0	443.0	219.6	216.8	1095.6	157.3	1925.4	1720.8	765.9	0005-1
2398.12	S/Sst	2269.8	963.0	536.2	408.1	696.0	319.7	547.6	462.8	147.5	0008-1
2399.53	S/Sst	1656.8	717.7	385.6	279.9	577.7	314.9	407.3	401.7	158.2	0011-1
2401.58	S/Sst	161.7	67.7	62.3	58.9	106.9	0.0	101.0	102.7	36.8	0015-1
2402.64	S/Sst	229.7	116.1	65.0	80.5	170.0	47.3	135.4	99.3	0.0	0017-1



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SUMMARY One gas sample, FMT, is analysed for gas and isotopic composition. The work is done in accordance with the "The Norwegian Industry Guide to Organic Geochemical Analyses", Third Edition 1993.				DISTRIBUTION Geolab Nor/Statoil (3) Andresen, B. Johansen, H. Sieglé, S. File (2)
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1 Introduction

One gas sample from well 24/12-3S, FMT, is analysed for gas and isotopic composition.

On the sample C_1 - C_5 and CO_2 are quantified. The $\delta^{13}C$ value is measured on methane, ethane, propane, the butanes and CO_2 . In addition the δD value is measured on methane.

2 Analytical procedures

1.0 ml of the gas sample is sampled with a syringe for analysis on a Porapak Q column connected with flame ionisation (FID) and thermal conductivity (TCD) detectors. The detection limit for the hydrocarbon gas components is 0.01 $\mu\text{l/ml}$ and for CO_2 0.2 $\mu\text{l/ml}$.

For the isotope analysis about 5 ml is sampled with a syringe and then separated into the different gas components by a Carlo Erba 4200 gas chromatograph. The hydrocarbon gas components are oxidised in separate CuO-ovens in order to prevent cross contamination. The combustion products CO_2 and H_2O are frozen into collection vessels and separated.

The combustion water is reduced with zinc metal in sealed quartz tubes to prepare hydrogen for isotopic analysis. The isotopic measurements are performed on a Finnigan MAT 251 and a Finnigan Delta mass spectrometer.

IFEs value on NBS 22 is $-29.77 \pm .06\text{‰}$ PDB.

The uncertainty in the $\delta^{13}C$ value is estimated to be $\pm 0.3\text{‰}$ PDB and includes all the different analytical steps. The estimate is based on repeated analysis of a laboratory standard gas mixture. The uncertainty in the δD value is likewise estimated to be $\pm 5\text{‰}$.

3 Results

The volume composition of the gas sample is shown in Table 1 (normalised composition), and the stable isotope composition is shown in Table 2.

Table 1 Volume composition (normalised values) of a gas sample from well 24/12-3S

Sample	IFE no GEO	C ₁ %	C ₂ %	C ₃ %	iC ₄ %	nC ₄ %	iC ₅ %	nC ₅ %	CO ₂ %	ΣC ₁ -C ₅ %	Wet- ness	iC ₄ / nC ₄
FMT	960958	83.8	5.5	2.9	1.4	2.2	1.6	2.2	0.4	99.6	0.16	0.63

Table 2 Isotopic composition of a gas sample from well 24/12-3S

Sample	IFE no GEO	C ₁ δ ¹³ C ‰PDB	C ₁ δD ‰ SMOW	C ₂ δ ¹³ C ‰PDB	C ₃ δ ¹³ C ‰PDB	iC ₄ δ ¹³ C ‰PDB	nC ₄ δ ¹³ C ‰PDB	CO ₂ δ ¹³ C ‰PDB	CO ₂ δ ¹⁸ O ‰PDB
FMT	960958	-55.9	-214	-29.2	-28.2	-30.6	-30.1	-24.2	-11.9

4 Literature

James, A.T. (1983). Correlation of natural gas by use of carbon isotopic distribution between hydrocarbon components. *The American Association of Petroleum Geologists Bulletin*, **67**, 1176-1191

Robert, P. (1985). Methods and means of paleothermal analysis. *Organic Methamorphism and Geothermal History*, Elf-Aquitaine and D. Reidel Publishing Company.

Schoell, M. (1983). Genetic characterisation of natural gases. *The American Association of Petroleum Geologists Bulletin*, **67**, 2225-2238.

Table 8a: MPLC Bulk Composition: Weight of Oil and Fraction for NOCS 24/12-3S Reservoir Study

Well	Description	Whole oil (mg)	Light (mg)	Topped (mg)	Sat (mg)	Aro (mg)	Asph (mg)	NSO (mg)	HC (mg)	Non-HC (mg)	Sample
24/12-3S	OIL 2398.4	103.5	13.5	90.0	63.3	14.7	0.1	11.9	78.0	11.9	O21/0002

Table 8b: MPLC Bulk Composition: Oil fraction (%) for NOCS 24/12-3S Reservoir Study

Well	Description	Sat	Aro	Asph	NSO	HC	Non-HC	Sat	HC	Sample
		T.Oil	T.Oil	T.Oil	T.Oil	T.Oil	T.Oil	Aro	Non-HC	
24/12-3S	OIL 2398.4	70.37	16.34	0.11	13.17	86.71	13.29	430.61	652.72	O21/0002

Table 8E: Iatroscan TLC Bulk Composition: Absolute yields in mg/g rock for well 24/12-3 OIL

Depth unit of measure: m

<u>Well</u>	<u>Description</u>	<u>EOM weighed</u>	<u>Sat HC</u>	<u>Aro HC</u>	<u>Resins</u>	<u>Asp</u>	<u>Tot HC</u>	<u>Tot Pol</u>	<u>EOM calcul.</u>	<u>Sample</u>
24/12-3S	OIL 2398.4	101.20	92.89	16.82	4.14	0.10	109.71	4.24	113.95	0002-0B

Table 8F: Iatroscan TLC Bulk Composition: Rel. percentages of sep. fractions for NOCS 24/12-3S Reservoir Study

<u>Well</u>	<u>Description</u>	<u>Sat HC</u>	<u>Aro HC</u>	<u>Resins</u>	<u>Asp</u>	<u>Tot HC</u>	<u>Tot Pol</u>	<u>Sample</u>
24/12-3S	OIL 2398.4	81.51	14.76	3.63	0.10	96.27	3.73	O21/0002

Table 9a: Quantitative Analysis of Saturated Fraction for well NOCS 24/12-3S OIL.																							
sample	nC15 mg/g sat	nC16 mg/g sat	iC18 mg/g sat	nC17 mg/g sat	Pr mg/g sat	nC18 mg/g sat	Ph mg/g sat	nC19 mg/g sat	nC20 mg/g sat	nC21 mg/g sat	nC22 mg/g sat	nC23 mg/g sat	nC24 mg/g sat	nC25 mg/g sat	nC26 mg/g sat	nC27 mg/g sat	nC28 mg/g sat	nC29 mg/g sat	nC30 mg/g sat	nC31 mg/g sat	nC32 mg/g sat	nC33 mg/g sat	nC34 mg/g sat
2398.40m, oil	14.14	12.59	6.15	11.31	5.42	9.26	3.83	9.03	7.01	5.59	4.64	3.82	3.53	2.54	1.95	1.45	1.15	0.93	0.70	0.47	0.34	0.32	0.39

Table 9B: Saturated Hydrocarbon Ratios (peak area) for NOCS 24/12-3S Reservoir Study

Well	Description	Pristane	Pristane	Pristane/nC17	Phytane	CPI1	nC17	Sample
		nC17	Phytane	Phytane/nC18	nC18		nC17+nC27	
24/12-3S	OIL 2398.4	0.48	1.41	1.16	0.41	1.02	0.89	O21/0002