

5.4 Modular Formation Dynamics Tester (MDT) Analysis

Tool type	Schlumberger MDT
Gauge	Quartz gauge BSG1
Resolution	0.040 PSI
RT	25m

Two MDT runs were performed, and 12 valid pre-test measurements taken, resulting in high quality pressure data. In the second MDT run two fluid samples were taken at 2492.1 mBRT (oil) and 2508.3 mBRT (water)

Resume of sample results:

A 2x1 gallon and 3 multisampler samples were taken at 2508.3 mBRT. Drawdown pressure was 2850 PSI which is around 60 PSI drawdown on formation. 22 litres were pumped out before opening the chambers. The Optical Fluid Analyser (OFA) indicated over 90% water during filling of the multisampler. The 2x1 gallon chamber was then filled with 1 gallon sample drained at surface showing 99% water.

A 1x1 gallon segregated sample (BB13) and 3 multisampler (AA-644) were taken at 2492.1 mBRT. Total volume pumped out was 27 litres before taking the sample. Sampling pressure was 2897.7 PSI. OFA indicate clean formation fluid (oil), PVT analysis confirmed the fluid was 75% formation oil and 25% oil phase filtrate. Exact mud contamination was difficult to determine, no clean oil was available for analysis. Anco Vert mud was used and the fingerprint analysis indicate between 20 to 25% mud filtrate in the sample.

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Wellbore MDI Summary								
BRT (m)		-25		MUD WT (g/cc)		1.29		
WATER DEPTH (m)		125		MUD TYPE		OBM		
AHN WITNESS		Wenche Skaget		HOLE SIZE		8 1/2"		
TIME	DEPTH		HP GAUGE PRESSURE		TEMP	EMW	MOBILITY	REMARKS
07.01.97	MDHRT	TVDSS	FORMATION	MUD HYDRO.				
HH:MM	M	M	PSIA	PSIA	DEG F	PPG	mD/CP	
2:05	2492	2078.15	-	4043.6		N/A	N/A	DRY TEST
2:15	2492	2078.21	-	4042.9		N/A	N/A	DRY TEST
2:25	2508	2088.20	-	4073.0		N/A	N/A	DRY TEST
2:45	2599	2144.29	2986.3	4196.3		8.19	610.3	GOOD TEST
2:50	2595	2141.82	2982.0	4185.0		8.19	83.3	GOOD TEST
3:05	2593	2140.58	2980.9	4179.5		8.19	57.8	GOOD TEST
3:20	2585	2135.32	2974.6	4162.0		8.19	0.88	GOOD TEST
4:00	2557	2117.98	-	4109.9		N/A	N/A	DRY TEST
5:05	2508	2088.26	3046.0	4051.5		N/A	N/A	SUPERCHARGED
5:40	2508	2088.01	-	4081.1		N/A	N/A	DRY TEST
5:50	2512	2090.61	2921.0	4088.4		N/A	N/A	SUPERCHARGED?
6:20	2516	2092.95	-	4086.4		N/A	N/A	DRY TEST
6:30	2516	2093.08	-	4084.6		N/A	N/A	DRY TEST
6:50	2516	2092.83	-	4081.8		N/A	N/A	DRY TEST
6:55	2531	2102.22	2927.4	4106.7		8.19	50.65	GOOD TEST
7:10	2544	2110.07	-	4121.4		N/A	N/A	DRY TEST
7:15	2544	2110.07	-	4119.3		N/A	N/A	DRY TEST
7:21	2544	2109.95	-	4117.7		N/A	N/A	DRY TEST
7:30	2549	2113.35	2942.7	4126.3		8.19	553.0	GOOD TEST
7:40	2552	2115.20	2945.6	4128.05		8.19	215.9	GOOD TEST
7:50	2557	2117.98	2949.6	4132.2		8.19	136.8	GOOD TEST
8:10	2595	2141.82	2984.6	4187.8		8.19	26.4	GOOD TEST
8:20	2585	2135.38	2974.9	4165.1		8.20	37.3	GOOD TEST
8:40	2508	2088.20	-	4047.2		N/A	N/A	DRY TEST
8:50	2508	2088.20	-	4052.1		N/A	N/A	DRY TEST
9:00	2509	2088.32	-	4055.0		N/A	N/A	DRY TEST
9:05	2509	2088.38	-	4057.2		N/A	N/A	DRY TEST
9:15	2508	2088.20	-	4055.7		N/A	N/A	DRY TEST
9:30	2508	2088.20	-	4057.9		N/A	N/A	DRY TEST
9:35	2508	2088.01	-	4060.0		N/A	N/A	DRY TEST
9:45	2492	2078.21	-	4032.8		N/A	N/A	DRY TEST
9:50	2492	2078.33	-	4034.8		N/A	N/A	DRY TEST
10:00	2492	2078.33	-	4037.3		N/A	N/A	DRY TEST
10:20	2495	2080.00	2932.8	4041.5		N/A	N/A	SUPERCHARGED
10:31	2498	2081.54	-	4047.2		N/A	N/A	DRY TEST
10:40	2504	2085.73	-	4061.5		N/A	N/A	DRY TEST
10:45	2509	2088.63	2944.0	4068.5		N/A	N/A	SUPERCHARGED
11:20	2508	2088.07	-	4060.7		N/A	N/A	DRY TEST
11:55	2512	2090.61	2916.3	4062.0		8.21	26.5	GOOD TEST
12:20	2512	2090.48	-	4070.8		N/A	N/A	DRY TEST
12:30	2512	2090.73	2916.3	4070.0		8.21	1.3	GOOD TEST
12:55	2512	2090.61	-	4065.2		N/A	N/A	DRY TEST
13:00	2508	2088.07	-	4057.8		N/A	N/A	DRY TEST

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Wellsite MDT Summary								
BRT (m)		-25		MUD WT (sg)		1.29		
WATER DEPTH (m)		125		MUD TYPE		OBM		
AHN WITNESS		Wenche Skaget		HOLE SIZE		8 1/2"		
TIME	DEPTH		HP GAUGE PRESSURE		TEMP	EMW	MOBILIT Y	REMARKS
HH:MM	M	M	PSIA	PSIA	DEG F	PPG	#D/CP	
07.02.97 3:35	2508	2088.20	2910.8	4107.0		N/A	63	GOOD TEST
6:55	2492	2078.21	2895.6	4081.0		N/A	421.6	GOOD TEST

Table 5.4.1 MDT Sample Data

Oil Base Drilling Fluids Properties, daily record

Well: 25/8-9A

Operator: Amerada Hess

Rig: Byford Dolphin

FSR no.	Date 1996	Depth m	MW sg	Flow Temp °C	F.Vls w/ct	VG-meter readings @ 50 C								AV cP	PV cP	YP Pa	Gel 10 sec cP	Gel 10 min cP	ES volts	HTHP ml	Mp	Excess Lime kg/m3	CaCl2 kg/m3	WFS activity	Solids vol %	Oil vol %	Water vol %	O/W RATIO vol %	HGS kg/m3	LGS kg/m3	Sand vol %	OOC g/kg	H2S mg/l
						600 rpm	300 rpm	200 rpm	100 rpm	60 rpm	30 rpm	6 rpm	3 rpm																				
24	28-01	1097	1,29	21	145	85	53	43	31	25	21	16	14	43	32	10,5	20,0	41,0	825	3,4	3,00	11,1	219	0,85	14,0	65,0	21,0	76-24	469	49	0,25	0	
25	28-01	1570	1,29	35	92	81	52	42	30	24	20	16	14	41	29	11,5	17,0	39,0	918	2,8	2,50	9,3	231	0,84	15,0	66,0	19,0	78-22	437	97	0,75	0	
26	30-01	2187	1,31	40	104	105	68	52	37	27	20	18	15	53	37	15,5	20,0	40,0	892	2,8	3,80	14,1	257	0,81	15,5	63,5	21,0	75-25	424	115	1,00	139	0
27	31-01	2494	1,31	44	92	82	55	42	30	24	19	15	13	41	27	14,0	14,0	35,0	860	2,8	3,00	11,1	278	0,79	16,0	64,0	20,0	76-24	408	139	0,75	108	0
28	01-02	2523	1,31	24	125	65	55	44	32	25	19	15	14	43	30	12,5	19,0	35,0	689	2,6	3,20	11,0	268	0,81	15,0	64,0	21,0	75-25	474	71	0,75	130	0
29	02-02	2603	1,32	115	115	93	61	46	33	26	20	16	14	47	32	14,5	18,0	36,0	800	3,0	3,10	11,5	268	0,81	18,0	61,0	21,0	74-26	333	237	0,75	142	0
30	03-02	2687	1,31	107	96	96	61	49	35	26	20	17	15	48	35	13,0	16,0	40,0	926	3,0	3,10	11,5	268	0,81	16,0	63,0	21,0	75-25	401	143	1,00	115	0
31	04-02	2687	1,31	17	115	98	62	48	35	25	18	16	14	49	36	13,0	15,0	38,0	895	3,0	3,00	11,1	273	0,79	16,0	63,0	21,0	75-25	401	143	0,75	0	
32	05-02	2687	1,31	17	140	106	68	54	39	25	19	18	17	53	38	15,0	16,0	40,0	895	3,0	3,00	11,1	257	0,81	15,5	63,5	21,0	75-25	424	115	0,75	0	
33	06-02	2687	1,31	17	140	100	65	52	39	25	18	18	16	50	35	15,0	15,0	39,0	871	3,0	3,20	11,8	268	0,80	16,0	63,0	21,0	75-25	427	127	0,75	0	

GEOCHEMICAL INTERPRETATION REPORT

GEOLAB NOR AS

PO Box 5740 Fossegrenda
N-7002 Trondheim
Norway

Tel: (47) 73 964000
Fax: (47) 73 965974
Tlx: 65706 geono n

Internet: firmapost@geolab-
nor.telemax no
X.400: S=firmapost, O=geolab-
nor, A=telemax, C=no

CLIENT:

**AMERADA HESS
NORGE**

REF(S)

Knut Bakken

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OLJEDIREKTORATET

TITLE

**Correlation of 25/8-9 (9A) Oils with Oils and
Condensate from blocks 25/5, 25/6, 25/7 and 25/8**

AUTHOR(S)

Peter Barry Hall

GEOLAB PROJECT NO.

62426

DATE

03.04.98

PROJECT MANAGER

Peter Barry Hall, Snr. Scientist

Peter B. Hall

QA RESPONSIBLE

Sunil Bharati, Snr. Scientist

Sunil Bharati

REPORT NO./FILE

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Chapter 1

INTRODUCTION

1.1 General Comments

Two oils from 25/8-9 and 9A were analysed and the data have been compared with data for oils/condensates from wells in 25/5, 6, 7 and 8 blocks previously analysed for Amerada Hess Norge¹.

The following table gives basic data about all the oils (e.g. the respective DST sample numbering and the tested intervals, where available).

Oils (Locations and Types)

Well	Type	(depth in m)	DST/FIT/RFT	API
25/5-5	Oil		-	-
25/6-1	Condensate	(2277-2280)	DST 1	59.1
25/7-3	Oil	(2112)	FMT	36.8
25/8-5S	Oil	(2118-2149)	DST	37
25/8-8S	Oil	(2258-2267 RKB MD)	DST 1B	34.5
25/8-9	Oil	(2097.9) MD BRT	MDT	38.5
25/8-9A	Oil	(2492) MD BRT	MDT	37.5

Wells 25/8-9 and 9A were drilled with a mineral oil based mud ANCO 2000. This mud has also contaminated the oils analysed for this report.

¹Report entitled " Correlation of Recently Discovered Oil and Condensates from Blocks 25/5, 25/6, 25/7 and 25/8" in May 1996

Table 1A: Light Hydrocarbons from Whole Oil GC for 25/8-9 and 25/8-9A

Well	Description	iC4	nC4	iC5	nC5	2,2DMC4	2,3DMC4	2MC5	3MC5	nC6	MCyC5	Benz	Sample
25/8-9	2097.9m	-	-	-	-	0.13	-	-	-	4.70	2.61	0.04	084/0176
25/8-9A	2492m	-	-	-	-	0.09	-	-	-	4.20	1.97	0.06	085/0126

Table 1B: Light Hydrocarbons from Whole Oil GC for 25/8-9 and 25/8-9A

Well	Description	CyC6	2MC6	3MC6	1,3ci- DMCyC5	1,3tr- DMCyC5	1,2tr- DMCyC5	nC7	MCyC6	Tol	nC8	p/m- Xylene	Sample
25/8-9	2097.9m	3.82	2.70	1.89	0.74	0.69	1.44	6.33	10.79	0.13	7.10	0.74	084/0176
25/8-9A	2492m	2.61	2.69	1.92	0.70	0.64	1.43	6.89	10.09	0.14	8.64	0.40	085/0126

THOMPSON'S INDICES

$$A = \frac{\text{Benzene}}{nC6}$$

$$B = \frac{\text{Toluene}}{nC7}$$

$$X = \frac{\text{p/m-xylene}}{nC8}$$

$$W = \frac{\text{Benzene} * 10}{\text{CyC6}}$$

$$C = \frac{nC6 + nC7}{\text{CyC6} + \text{MCyC6}}$$

$$I = \frac{2\text{MC6} + 3\text{MC6}}{1,3\text{ciDMCyC5} + 1,3\text{trDMCyC5} + 1,2\text{trDMCyC5}}$$

$$F = \frac{nC7}{\text{MCyC6}}$$

$$H = \frac{nC7 * 100}{\text{CyC6} + 2\text{MC6} + 2,3\text{DMC4} + 3\text{MC6} + 1,3\text{ciDMCyC5} + 1,3\text{trDMCyC5} + 1,2\text{trDMCyC5} + nC7 + \text{MCyC6}}$$

$$U = \frac{\text{CyC6}}{\text{MCyC5}}$$

$$R = \frac{nC7}{2\text{MC6}}$$

$$S = \frac{nC6}{2,2\text{DMC4}}$$

Table 1C: Thompson's indices for 25/8-9 and 25/8-9A

Well	Description	A	B	X	W	C	I	F	H	U	R	S	Sample
25/8-9	2097.9m	0.01	0.02	0.10	0.10	0.75	1.60	0.59	22.29	1.46	2.34	36.15	O84/0176
25/8-9A	2492m	0.01	0.02	0.05	0.23	0.87	1.66	0.68	25.55	1.32	2.56	46.67	O85/0126

Table 2a: MPLC Bulk Composition: Weight of Oil and Fraction for 25/8-9 and 25/8-9A

Well	Description	Whole oil (mg)	Light (mg)	Topped (mg)	Sat (mg)	Aro (mg)	Asph (mg)	NSO (mg)	HC (mg)	Non-HC (mg)	Sample
25/8-9	2097.9m	78.5	4.6	73.9	59.0	9.5	1.1	4.4	68.4	5.5	O84/0176
25/8-9A	2492m	80.2	6.4	73.8	55.8	12.2	1.7	4.1	68.0	5.8	O85/0126

Table 2b: MPLC Bulk Composition: Comparison of topped oil (%) for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>Sat</u>	<u>Aro</u>	<u>Asph</u>	<u>NSO</u>	<u>Total</u>	<u>HC</u>	<u>Non-HC</u>	<u>Recov. MPLC</u>	<u>Recov. Asph</u>	<u>Sample</u>
25/8-9	2097.9m	79.78	12.83	1.49	5.90	100.00	92.61	7.39	-	0.01	O84/0176
25/8-9A	2492m	75.62	16.49	2.30	5.58	100.00	92.11	7.89	-	0.02	O85/0126

Table 2c: MPLC Bulk Composition: Ratios in topped oil for 25/8-9 and 25/8-9A

Well	Description	Sat	HC	Asp	Sample
		Aro	Non-HC	NSO	
25/8-9	2097.9m	6.22	12.53	0.25	O84/0176
25/8-9A	2492m	4.58	11.68	0.41	O85/0126

Table 3: Saturated Hydrocarbon Ratios (peak area) for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>Pristane</u> <u>nC17</u>	<u>Pristane</u> <u>Phytane</u>	<u>Pristane/nC17</u> <u>Phytane/nC18</u>	<u>Phytane</u> <u>nC18</u>	<u>CPI1</u>	<u>nC17</u> <u>nC17+nC27</u>	<u>Sample</u>
25/8-9	2097.9m	0.59	2.21	1.78	0.33	1.07	0.95	O84/0176
25/8-9A	2492m	0.58	2.20	1.83	0.32	1.14	0.93	O85/0126

Table 4a: Aromatic Hydrocarbon Ratios (peak area) for 25/8-9 and 25/8-9A

Well	Description	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	Rc	DBT/P	4/1MDBT	(3+2) /1MDBT	Sample
25/8-9	2097.9m	1.83	3.63	0.23	2.17	1.66	2.35	1.40	-	-	-	O84/0176
25/8-9A	2492m	1.98	3.93	0.30	2.60	0.80	1.14	0.88	-	-	-	O85/0126

Table 4b: Aromatic Hydrocarbon Ratios (peak area) for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>F1</u>	<u>F2</u>	<u>Sample</u>
25/8-9	2097.9m	0.53	0.37	O84/0176
25/8-9A	2492m	0.52	0.37	O85/0126

Table 5A: Tabulation of carbon isotope data on oils for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Descript.</u>	<u>Whole oil</u>	<u>Topped oil</u>	<u>Saturated</u>	<u>Aromatic</u>	<u>NSO</u>	<u>Asphaltenes</u>	<u>Sample</u>
25/8-9	2097.9m	-	-27.76	-27.94	-27.09	-27.01	-26.73	O84/0176
25/8-9A	2492m	-	-27.80	-28.01	-26.95	-27.10	-26.97	O85/0126

Table 5B: Tabulation of cv values from carbon isotope data for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Descript.</u>	<u>Saturated</u>	<u>Aromatic</u>	<u>cv value</u>	<u>Sample</u>
25/8-9	2097.9m	-27.94	-27.09	-1.10	084/0176
25/8-9A	2492m	-28.01	-26.95	-0.61	085/0126

Table 6A : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

Well	Description	iC4	nC4	iC5	nC5	2,3DMC4	CyC5	2,3DMC4 +CyC5	2MC5	3MC5	nC6	Sample
25/8-9	2097.9m	-	-	-28.00	-28.70	-	-	-	-28.50	-28.50	-27.50	O84/0176
25/8-9A	2492m	-	-	-29.70	-29.30	-	-	-	-28.30	-29.00	-28.10	O85/0126

Table 6B : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>MCyC5</u>	<u>Benz</u>	<u>CyC6</u>	<u>2MC6</u>	<u>3MC6</u>	<u>1,3ciDMCyC5</u>	<u>1,3trDMCyC5</u>	<u>1,2trDMCyC5</u>	<u>Sample</u>
25/8-9	2097.9m	-25.80	-	-24.60	-27.90	-27.80	-	-	-26.10	O84/0176
25/8-9A	2492m	-26.30	-	-26.30	-28.30	-28.30	-	-	-27.30	O85/0126

Table 6C : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

Well	Description	nC7	MCyC6	Tol	2MC7	3MC7+1,2 3MCyC5	nC8	n-PrCyC5	1-cis-2 DMCyC6	1,1,3 TMCyC6	EtBenz	Sample
25/8-9	2097.9m	-27.70	-24.10	-	-25.60	-26.90	-25.60	-25.00	-	-	-	O84/0176
25/8-9A	2492m	-28.00	-25.00	-	-25.70	-27.30	-26.00	-25.80	-	-	-	O85/0126

Table 6D : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>p/m-Xyl</u>	<u>2+4MC8</u>	<u>3MC8</u>	<u>o-Xyl</u>	<u>nC9</u>	<u>TeBuCyC5</u>	<u>SeBUCyC5</u>	<u>n-PrCyC6</u>	<u>2MC9</u>	<u>Sample</u>
25/8-9	2097.9m	-	-27.40	-26.90	-	-26.30	-25.10	-27.60	-	-26.70	O84/0176
25/8-9A	2492m	-	-28.30	-27.60	-	-27.50	-25.90	-28.60	-28.10	-27.10	O85/0126

Table 6E : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>o-EtTol</u>	<u>3,6DMC8</u>	<u>iC10</u>	<u>nC10</u>	<u>4MC10</u>	<u>iC11</u>	<u>nC11</u>	<u>4MC11</u>	<u>iC12</u>	<u>Sample</u>
25/8-9	2097.9m	-25.70	-25.40	-27.80	-26.60	-27.30	-26.50	-27.20	-28.00	-26.60	O84/0176
25/8-9A	2492m	-26.50	-26.20	-28.60	-26.90	-27.40	-27.00	-27.70	-26.10	-27.20	O85/0126

Table 6F : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>nC12</u>	<u>iC13</u>	<u>iC14</u>	<u>nC13</u>	<u>iC15</u>	<u>nC14</u>	<u>iC16</u>	<u>nC15</u>	<u>nC16</u>	<u>iC18</u>	<u>Sample</u>
25/8-9	2097.9m	-27.80	-27.40	-26.70	-28.30	-27.70	-27.90	-26.90	-27.60	-28.00	-28.70	084/0176
25/8-9A	2492m	-28.20	-27.80	-27.50	-28.50	-27.80	-28.50	-27.40	-27.90	-28.30	-29.60	085/0126

Table 6G : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>nC17</u>	<u>Pristane</u>	<u>nC18</u>	<u>Phytane</u>	<u>nC19</u>	<u>nC20</u>	<u>nC21</u>	<u>nC22</u>	<u>nC23</u>	<u>nC24</u>	<u>Sample</u>
25/8-9	2097.9m	-28.20	-27.60	-27.80	-26.70	-28.00	-27.70	-27.60	-27.60	-27.60	-27.80	084/0176
25/8-9A	2492m	-28.70	-28.10	-28.40	-27.70	-28.50	-28.00	-28.00	-27.70	-27.90	-28.00	085/0126

Table 6H : Isotope GC of Whole Oil for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Description</u>	<u>nC25</u>	<u>nC26</u>	<u>nC27</u>	<u>nC28</u>	<u>nC29</u>	<u>nC30</u>	<u>nC31</u>	<u>nC32</u>	<u>nC33</u>	<u>nC34</u>	<u>Sample</u>
25/8-9	2097.9m	-28.10	-28.20	-29.40	-30.00	-30.30	-31.10	-32.10	-	-	-	O84/0176
25/8-9A	2492m	-28.20	-28.40	-29.40	-30.00	-30.40	-31.00	-31.90	-32.70	-	-	O85/0126

Table 7a: Variation in Triterpane Distribution (peak height) SIR for 25/8-9 and 25/8-9A

Well	Descript.	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Rat.10	Rat.11	Rat.12	Rat.13	Rat.14	Sample
25/8-9	2097.9m	0.49	0.33	0.08	0.35	0.26	0.12	0.03	0.09	0.03	0.07	0.95	0.26	0.05	62.12	O84/0176
25/8-9A	2492m	0.50	0.33	0.09	0.36	0.26	0.12	0.04	0.11	0.04	0.06	0.95	0.27	0.06	63.09	O85/0126

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 7b: Variation in Sterane Distribution (peak height) SIR for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Descript.</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Ratio5</u>	<u>Ratio6</u>	<u>Ratio7</u>	<u>Ratio8</u>	<u>Ratio9</u>	<u>Ratio10</u>	<u>Sample</u>
25/8-9	2097.9m	0.86	48.26	82.64	1.26	0.83	0.61	0.46	0.70	0.93	4.60	O84/0176
25/8-9A	2492m	0.86	46.59	81.92	1.22	0.83	0.57	0.41	0.69	0.87	4.24	O85/0126

List of Sterane Distribution Ratios

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

Ratio 2: $29aaS / 29aaS + 29aaR$ (%)

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

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

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

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

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

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

Ratio 9: $29aaS / 29aaR$

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

Table 7c: Raw triterpane data (peak height) m/z 191 SIR for 25/8-9 and 25/8-9A

Well	Descript.	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	
25/8-9	2097.9m	566.7	353.0	81.3	303.8	54.0	1000.3	490.4	172.0	44.7	084/0176
		1863.6	964.0	639.1	101.5	0.0	5263.2	255.2	0.0	1551.4	
		771.1	719.0	438.4	311.8	167.9	103.7	63.2	57.1	31.4	
25/8-9A	2492m	672.5	406.3	103.4	399.6	72.2	1392.4	698.6	259.1	66.2	085/0126
		2385.3	1279.2	834.7	183.2	0.0	6688.4	335.2	0.0	2026.8	
		1096.1	953.2	557.6	382.2	199.3	132.6	72.5	62.7	31.7	

Table 7d: Raw sterane data (peak height) m/z 217 SIR for 25/8-9 and 25/8-9A

Well	Descript.	21a	22a	27dBS	27dBR	27daR	27daS	28dBS	28dBR	28daR*	Sample
		29dBS*	28daS*	27aaR	29dBR	29daR	28aaS	29daS*	28BS		
		28aaR	29aaS	29BR	29BS	29aaR					
25/8-9	2097.9m	1537.4	285.9	1370.3	730.6	187.5	235.9	362.8	165.3	188.8	084/0175
		1005.2	708.7	220.2	660.5	134.5	110.7	206.3	426.6		
		76.1	163.9	453.1	355.4	175.7					
25/8-9A	2492m	1740.2	353.6	1862.0	1028.4	254.3	334.1	492.3	259.2	291.8	085/0126
		1410.8	964.2	308.2	960.3	188.9	167.8	298.3	589.3		
		107.6	223.9	611.3	477.7	256.7					

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

Table 7e: Raw sterane data (peak height) m/z 218 SIR for 25/8-9 and 25/8-9A

Well	Descript.	27 β BR	27 β BS	28 β BR	28 β BS	29 β BR	29 β BS	30 β BR	30 β BS	Sample
25/8-9	2097.9m	786.7	864.6	294.3	559.6	716.7	597.9	50.4	55.9	084/0176
25/8-9A	2492m	1054.0	1199.0	438.8	816.3	932.7	851.1	83.2	80.5	085/0126

Table 7f: Raw triterpane data (peak height) m/z 177 SIR for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Descript.</u>	<u>25nor28aß</u>	<u>25nor30aß</u>	<u>Sample</u>
25/8-9	2097.9m	29.7	19.4	O84/0176
25/8-9A	2492m	62.6	36.4	O85/0126

Table 8a: Variation in Triaromatic Sterane Distribution (peak height) for 25/8-9 and 25/8-9A

Well	Descript.	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
25/8-9	2097.9m	0.46	0.47	0.24	0.23	0.29	084/0176
25/8-9A	2492m	0.47	0.45	0.25	0.24	0.32	085/0126

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 8b: Variation in Monoaromatic Sterane Distribution (peak height) for 25/8-9 and 25/8-9A

<u>Well</u>	<u>Descript.</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Sample</u>
25/8-9	2097.9m	0.54	0.28	0.34	0.29	O84/0176
25/8-9A	2492m	0.47	0.29	0.29	0.28	O85/0126

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 8c: Aromatisation of Steranes (peak height) for 25/8-9 and 25/8-9A

Well	Descript.	Ratio1	Ratio2	Sample
25/8-9	2097.9m	0.13	0.99	O84/0176
25/8-9A	2492m	0.15	0.99	O85/0126

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

$$\text{Ratio2: } \text{g1} / \text{g1} + \text{I1}$$

Table 8d: Raw triaromatic sterane data (peak height) m/z 231 for 25/8-9 and 25/8-9A

Well	Descript.	a1	b1	c1	d1	e1	f1	g1	Sample
25/8-9	2097.9m	527.9	541.5	236.0	1308.0	666.7	500.6	612.6	O84/0176
25/8-9A	2492m	591.7	555.8	233.1	1280.7	713.2	528.0	666.7	O85/0126

Table 8e: Raw monoaromatic sterane data (peak height) m/z 253 for 25/8-9 and 25/8-9A

Well	Descript.	A1	B1	C1	D1	E1	F1	G1	H1	I1	Sample
25/8-9	2097.9m	157.3	51.9	66.1	34.7	133.2	13.6	172.1	72.3	9.0	084/0176
25/8-9A	2492m	154.7	70.5	57.8	38.8	173.1	12.9	212.8	76.7	8.2	085/0126

GEOCHEMICAL INTERPRETATION REPORT:

GEOLAB NOR AS

PO Box 5740 Fossegrenda
N-7002 Trondheim
Norway

Tel: (47) 73 964000
Fax: (47) 73 968728
Tlx: 65706 geono n

Internet: firmapost@geolab-
nor.telemax no
X.400: S=firmapost, O=geolab-
nor, A=telemax, C=no

CLIENT:

AMERADA HESS NORGE

REF(S)
Contract No. AHN/CO/94/018
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Geochemical report on NOCS 25/8-9A

AUTHOR(S)

Peter Barry Hall

GEOLAB PROJECT NO.

62324

DATE

3.06.97

PROJECT MANAGER

Peter Barry Hall, Snr. Scientist

QA RESPONSIBLE

Kjell Arne Bakken, Snr. Scientist

REPORT NO./FILE

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Chapter 1

INTRODUCTION

The well NOCS 25/8-9A was drilled (25/8-9 spudded in January 1997) by Amerada Hess Norge in the area south-east of the Heimdal field (block 25/4) and north-east of Balder field (blocks 25/10 and 25/11) in the Jotun Field area (Figure 1). The water depth was 125 m and the rotary table (RT) was 150 m above the sea floor and 25 m above sea level. All depths are given relative to RT unless otherwise specified.

Samples, including canned cuttings samples, side-wall cores and conventional cores, were supplied by Amerada Hess together with samples of mud and the mineral oil additive to the drill-mud to Geolab Nor's laboratory in Trondheim.

The analytical program included both screening and follow-up analysis, where samples were selected for the latter programme after agreement with Knut Bakken, Amerada Hess.

The report is divided into chapters according to the applied analytical methods. The results are generally discussed in a (descending) stratigraphic context.

1.1 General Well Information

The samples were received as canned cuttings samples, side-wall cores and conventional core samples. The sample quality was generally good, and with sufficient amounts of sample material for analysis (both screening and follow-up analysis). Any superficial contamination was removed from the core and side-wall core samples. Use of the mineral oil drilling mud has caused some analytical problems, due to contamination of the extractable hydrocarbons, particularly in cuttings samples and all samples with low concentrations of in-situ hydrocarbons.

1.2 Analytical Program

The analytical program for 25/8-9A including analysis type and number of samples per analysis type are presented below, together with respective figure numbers and table numbers. All data for 25/8-9A can be found at the back of this report.

Analytical Program for NOCS well 25/8-9A

Analysis type	No of samples	Figures	Tables
Headspace and occluded gas	60	2a-e	1
$\delta^{13}\text{C}$ Headspace gas ($\text{C}_1\text{-C}_4$) and CO_2	5	3a-b	2
Lithology description	65	2,4	3
TOC	12	4a	3,4
Rock-Eval pyrolysis	12	4b-e	4a-b
Thermal extraction GC (GHM, S_1)	5	5a-b	
Pyrolysis GC (GHM, S_2)	5	6a-b,7	5
Soxtec Extraction of organic matter	1		6a
Deasphalting	1		
MPLC separation	1		6b-d
Saturated hydrocarbon GC	1	8	7
Aromatic hydrocarbon GC	1	9	8a-b
Vitrinite reflectance	0	-	9
Visual kerogen microscopy	0	-	9,10
Isotope composition C_{15+} fractions	1	12a-b	11a-b
GC - MS of saturated HC	1	13a-c	12-a-f
GC - MS of aromatic HC	1	14a-b	13a-f

The well was drilled using an oil based drilling mud - Ancovert Oil-based Mud (OBM). This is composed mainly of mineral oil with < 5% aromatics, water and barite and and emulgant with

minor amounts of monmorillonite and other inorganic additives. The mineral oil caused considerable problems due to heavy contamination of cuttings.

Table 1 : C1 to C7 hydrocarbons in HEADSPACE gas
(µl gas/kg rock)



Project: NOCS 25/8-9

Well: NOCS 25/8-9A

Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 --- nC4
1140.00	4841	4	3			2	4848	7	0.1	0.49
1180.00	382	3	3	-	-	-	388	6	1.6	-
1220.00	4545	13	10	-	-	-	4569	23	0.5	-
1260.00	11138	5	4	-	-	-	11147	9	0.1	-
1300.00	9651	4	1			3	9657	5	0.1	0.20
1340.00	35146	14	5	-	-	-	35166	19	0.1	-
1380.00	5287	6	1	-	-	-	5294	7	0.1	-
1420.00	1887	7	4	-	-	3	1898	11	0.6	-
1460.00	1067	7	3	1	1	5	1078	11	1.1	0.92
1500.00	2964	27	8	3	-	5	3001	37	1.2	-
1540.00	2166	27	10	3	-	4	2207	40	1.8	-
1580.00	3456	47	18	6	5	5	3531	76	2.1	1.13
1620.00	13					4	14	1	7.2	0.86
1660.00	50	4	4	3	2	6	63	14	21.4	1.27
1700.00	36	2	2	-	1	4	40	4	9.8	-
1740.00	1780	25	5	2		2	1812	32	1.8	5.51
1780.00	3846	73	15	6	1	4	3941	95	2.4	4.09
1820.00	2228	57	12	5	2	2	2305	77	3.3	2.97
1860.00	3836	95	15	5	1	4	3953	117	2.9	4.71
1900.00	7312	207	37	13	3	6	7571	259	3.4	4.48
1940.00	4122	106	33	11	3	5	4275	153	3.6	3.38
1980.00	5466	121	37	10	4	3	5638	172	3.0	2.54
2020.00	3812	166	66	18	7	7	4071	258	6.3	2.56
2060.00	4844	151	69	18	11	3	5093	250	4.9	1.57
2100.00	2353	83	37	9	5	5	2487	134	5.4	1.82
2140.00	4981	141	54	12	10	-	5198	217	4.2	1.24
2180.00	7282	465	244	57	43	30	8091	809	10.0	1.32

Table 1: C1 to C7 hydrocarbons in HEADSPACE gas
(µl gas/kg rock)



Project: NOCS 25/8-9

Well: NOCS 25/8-9A

Depth unit of measure: m

* Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 --- nC4
2220.00	4962	315	143	33	29	22	5481	519	9.5	1.16
2260.00	5684	294	116	23	23	20	6140	457	7.4	1.00
2300.00	1753	147	76	18	16	14	2011	258	12.8	1.13
2340.00	7522	433	150	31	34	28	8170	648	7.9	0.90
2380.00	12600	1140	491	115	125	99	14471	1871	12.9	0.91
2391.00	7963	698	300	74	84	81	9118	1155	12.7	0.88
2400.00	15088	1635	718	169	188	154	17797	2710	15.2	0.90
2409.00	20540	2715	1314	313	356	310	25238	4697	18.6	0.88
2418.00	9672	1130	467	97	118	98	11484	1812	15.8	0.82
2427.00	13364	2432	1309	305	373	355	17782	4418	24.8	0.82
2436.00	8622	1610	921	220	269	270	11643	3021	25.9	0.82
2445.00	6470	1302	665	137	178	181	8753	2282	26.1	0.77
2454.00	2082	394	229	47	71	63	2823	742	26.3	0.67
2463.00	49	1	10	5	13	44	78	28	36.4	0.36
2472.00	1079	127	85	17	32	31	1340	261	19.5	0.54
2481.00	142	55	79	22	35	67	333	191	57.4	0.63
2490.00	130	59	107	37	49	97	382	252	65.9	0.76
2526.00	37	3	3	1	2	4	47	9	19.8	0.53
2553.00	63	6	5	1	2	2	77	14	18.6	0.56
2562.00	7	2	3	1	2	4	13	7	51.2	0.48
2571.00	2473	734	465	50	63	22	3786	1312	34.7	0.80
2580.00	1656	346	185	17	22	10	2226	570	25.6	0.76
2589.00	639	124	74	8	10	4	855	216	25.3	0.79
2598.00	209	29	15	2	2	1	256	48	18.6	0.81
2607.00	236	48	29	4	4	1	321	85	26.3	0.93
2616.00	225	53	35	4	5	2	321	96	29.9	0.85
2625.00	2009	437	269	29	34	14	2777	768	27.7	0.86

Table 1. C1 to C7 hydrocarbons in HEADSPACE gas
(μ l gas/kg rock)

Project: NOCS 25/8-9

Well: NOCS 25/8-9A

Depth unit of measure: m

* Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 --- nC4
2634.00	2820	599	355	38	50	18	3862	1042	27.0	0.77
2643.00	761	174	123	14	18	9	1091	330	30.2	0.79
2652.00	628	161	134	17	21	8	961	334	34.7	0.79
2661.00	598	113	85	11	14	5	820	223	27.2	0.81
2670.00	502	84	55	1	7	5	647	145	22.5	0.11
2679.00	461	77	48	6	7	3	599	139	23.1	0.80

Table 1-: C1 to C7 hydrocarbons in CUTTINGS gas
(μ l gas/kg rock)

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Project: NOCS 25/8-9

Well: NOCS 25/8-9A

Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 --- nC4
1140.00	8					1	9	1	9.9	0.26
1180.00	4					1	5	1	18.7	0.29
1220.00	7	1				1	8	1	14.5	0.39
1260.00	22	2	1			1	25	4	15.0	0.32
1300.00	17	1	1			1	19	2	10.6	0.38
1340.00	21	1				1	22	1	5.6	0.23
1380.00	10	1	1	-	-		11	2	15.2	-
1420.00	6	1				1	7	1	15.8	0.32
1460.00	6	1				1	7	1	18.9	0.52
1500.00	12	2	1	-			15	3	20.1	-
1540.00	5					1	6	1	18.2	0.89
1580.00	8	1	1			3	10	2	23.5	0.95
1620.00	12	2	1			2	14	2	17.3	0.52
1660.00	6	1	1			2	9	2	26.4	0.64
1700.00	7	1				1	9	2	18.7	0.41
1740.00	14	2	1			4	17	3	19.2	0.72
1780.00	11	2	1			3	14	3	20.8	1.17
1820.00	11	1	1	1		1	14	4	24.7	1.55
1860.00	15	2	1	1		8	19	4	22.4	1.81
1900.00	15	3	2	1	1	6	22	7	33.0	2.28
1940.00	12	2	1	1		2	16	4	23.8	1.34
1980.00	15	2	2	1	1	3	22	6	29.5	1.77
2020.00	9	1	2	1	1	2	13	4	32.9	1.02
2060.00	11	1	1			2	15	3	21.8	0.83
2100.00	13	2	1			-	16	3	19.4	1.84
2140.00	8	1	1			1	11	3	25.0	0.62
2180.00	25	4	4	2	3	10	39	14	35.4	0.63

Table 1: C1 to C7 hydrocarbons in CUTTINGS gas
(µl gas/kg rock)



Project: NOCS 25/8-9

Well: NOCS 25/8-9A

Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 nC4
2220.00	28	7	9	3	4	9	50	23	45.3	0.81
2260.00	26	5	7	2	3	7	44	18	40.1	0.71
2300.00	22	5	6	2	3	5	38	17	43.5	0.67
2340.00	39	14	18	7	10	14	88	49	56.1	0.67
2380.00	20	8	11	5	7	15	51	31	61.4	0.67
2391.00	19	9	12	5	8	17	53	34	64.1	0.67
2400.00	16	7	11	6	9	20	49	34	68.0	0.65
2409.00	11	6	15	9	17	49	58	48	81.4	0.53
2418.00	16	12	17	6	11	20	63	46	73.8	0.57
2427.00	8	1	3	3	7	20	23	15	63.9	0.46
2436.00	11	2	5	3	7	16	28	17	59.9	0.46
2445.00	15	2	3	3	6	21	28	14	48.8	0.45
2454.00	12	2	2	1	2	6	18	6	31.2	0.48
2463.00	17	2	1		1	5	21	4	19.4	0.35
2472.00	3	1	1		1	3	6	3	44.7	0.53
2481.00	15	2	1		1	2	18	4	19.7	0.02
2490.00	2	-			1	5	3	1	41.2	0.46
2526.00	12	1				2	14	2	12.8	0.37
2553.00	7	1				1	8	2	19.1	0.48
2562.00	19	3	4	1	1	2	28	9	32.0	0.69
2571.00	15	3	5	1	2	2	26	12	44.0	0.60
2580.00	14	6	10	2	3	3	34	20	59.5	0.65
2589.00	20	5	8	1	2	3	37	17	45.5	0.62
2598.00	24	3	3		1	1	31	7	23.3	0.48
2607.00	14	1	1			1	18	3	18.1	0.67
2616.00	13	3	5	1	2	2	24	11	47.0	0.68
2625.00	15	4	8	2	3	3	32	16	51.7	0.70

Table 10: C1 to C7 hydrocarbons in CUTTINGS gas
(ul gas/kg rock)

Project: NOCS 25/8-9

Well: NOCS 25/8-9A

Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 --- nC4
2634.00	16	6	13	3	4	4	43	27	61.8	0.68
2643.00	23	4	5	1	2	2	35	12	34.8	0.69
2652.00	16	2	5	1	2	2	26	10	39.1	0.68
2661.00	13	3	6	1	2	2	26	12	48.0	0.62
2670.00	13	2	3	1	1	2	20	7	34.8	0.62
2679.00	20	4	6	1	2	1	32	13	38.9	0.64