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Report type	Report number IFE/KR/F-2000/044	Date 2000-03-02	
	Report title Datareport on molecular and stable isotope composition of gas samples from well 6407/6-5 (IFE ref. no 3.1.021.00)	Date of last revision 2000-05-03	
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Summary Two gas samples from well 6407/6-5; 2382.5m and 2581.0m are analysed for gas and isotopic composition. Two bottles are received of both samples. On the samples C ₁ - C ₅ and CO ₂ are quantified. The δ ¹³ C value is measured on methane, ethane, propane, the butanes and CO ₂ . In addition the δD value is measured on methane. The work is done in accordance with "The Norwegian Industry Guide to Organic Geochemical Analyses", third edition 1993.		Distribution Statoil/GeolabNor (8) File (3)	
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1 Introduction

Two gas samples from well 6407/6-5; 2382.5m and 2581.0m are analysed for gas and isotopic composition. Two bottles are received of both samples.

On the samples C₁ - C₅ and CO₂ are quantified. The δ¹³C value is measured on methane, ethane, propane, the butanes and CO₂. In addition the δD value is measured on methane.

2 Analytical procedures

Aliquots of 0.2 ml are sampled with a syringe for analysis on a Porabond Q column connected with flame ionisation (FID) and thermal conductivity (TCD) detectors. The detection limit for the hydrocarbon gas components is 0.001 µl/ml, for CO₂ 0.05 µl/ml.

For the isotope analysis 5-10 ml of the gas 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 CO₂ and H₂O 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 analytical procedures are tested with a laboratory gas standard mixture. Based on repeated analysis of the gas standard, the reproducibility in the δ¹³C value is better than 0.5‰ PDB for all components. The reproducibility in the δD value is likewise better than 10‰.

3 Results

The normalised volume composition of the gas samples is shown in Table 1. The stable isotope composition is shown in Table 2.

The molecular composition related to the carbon isotope variations in methane from the samples are plotted in Figure 1 (Schoell, 1983), the carbon and hydrogen variations in methane are plotted in Figure 2 (Schoell, 1983) and the carbon isotope variation in ethane related to the carbon isotope variations in methane in Figure 3 (Schoell, 1983).

Table 1 Volume composition of gas samples (normalised values) from well 6407/6-5

Well	Sample depth m	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
Bottle 98-06	2382.5	20000054A	81.4	8.7	5.3	0.80	1.9	0.51	0.61	0.9	99.1	0.18	0.42
Bottle 98-11	2581.0	20000055A	79.6	10.8	5.9	0.72	1.5	0.33	0.42	0.8	99.2	0.20	0.47

Table 2 Isotopic composition of gas samples from well 6407/6-5

Well	Sample depth m	IFE no GEO	C ₁ δ ¹³ C ‰ PDB	C ₁ δ D ‰ 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
Bottle 98-06	2382.5	20000054A	-45.0	-233	-31.6	-30.4	-28.3	-30.4	-16.5	-7.0
Bottle 98-11	2581.0	20000055A	-47.7	-200	-32.6	-30.9	-	-30.5	-20.8	-7.1
Bottle 34	2581.0	20000055B	-45.9	-227	-31.8	-30.5	-29.2	-30.3	-17.1	-11.4

4 Literature

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

MUD SAMPLES

Appendix 1:

- 1. Analytical Program (See rocks Appendix 1)
- 8a-e. Bulk Solvent Extract Composition (MPLC)
- 11a-f. Gas Chromatography-Mass Spectrometry, Saturated Hydrocarbons

Appendix 2: GAS CHROMATOGRAMS

- I. EOM-Gas Chromatograms

**Appendix 3: GAS CHROMATOGRAPHY - MASS SPECTROMETRY,
FRAGMENTOGRAMS**

- I Saturated Hydrocarbon Fraction

Table 8a: MPLC Bulk Composition: Weight of EOM and Fraction for well MIKKEL 6407/6-5 MUDS

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
2560.00	mud	bulk	-	32.1	30.8	0.3	0.1	0.8	31.2	0.9	-	0002-0B

Table 8b: MPLC Bulk Composition: Concentration of EOM and Fraction (wt ppm rock) for well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
2560.00	mud	bulk	-	-	-	-	-	-	-	0002-0B

Table 8c: MPLC Bulk Composition: Concentration of EOM and Fraction (mg/g TOC(e)) for well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
2560.00	mud	bulk	-	-	-	-	-	-	-	0002-0B

Table 8d: MPLC Bulk Composition: Material extracted from the rock (%) for well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Typ	Lithology	Sat	Aro	Asph	NSO	Total	HC	Non-HC	Recov. MPLC	Recov. Asph	Sample
2560.00	mud	bulk	96.03	1.04	0.31	2.61	100.00	97.08	2.92	-	-	0002-0B

Table 8e: MPLC Bulk Composition: Ratios for well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Typ	Lithology	Sat	HC	Asp	Sample
			Aro	Non-HC	NSO	
2560.00	mud	bulk	92.00	33.23	0.12	0002-0B

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
2560.00	bulk	26.96	0.96	0.18	0.71	0.42	-	0.01	0.02	0.01	0.32	0.78	0.38	0.22	57.79	0002-0

List of Triterpane Distribution Ratios

Ratio 1: 27Tm / 27Ts

Ratio 2: 27Tm / 27Tm+27Ts

Ratio 3: 27Tm / 27Tm+30aβ+30βa

Ratio 4: 29aβ / 30aβ

Ratio 5: 29aβ / 29aβ+30aβ

Ratio 6: 30d / 30aβ

Ratio 7: 28aβ / 30aβ

Ratio 8: 28aβ / 29aβ

Ratio 9: 28aβ / 28aβ+30aβ

Ratio 10: 24/3 / 30aβ

Ratio 11: 30aβ / 30aβ+30βa

Ratio 12: 29aβ+29βa / 29aβ+29βa+30aβ+30βa

Ratio 13: 29βa+30βa / 29aβ+30aβ

Ratio 14: 32aβS / 32aβS+32aβR (%)

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</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>
2560.00	bulk	0.22	34.08	43.86	0.73	0.53	0.66	0.56	0.28	0.52	0.59	0002-0

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 11c: Raw triterpane data (peak height) m/z 191 SIR for Well MIKKEL 6407/6-5 MUDS

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	29Ba	300	30aß	30Ba	30G	31aßS	
		31aßR	32aßS	32aßR	33aßS	33aßR	34aßS	34aßR	35aßS	35aßR	
2560.00	bulk	9275.3	2259.3	479.0	1151.7	333.9	73.6	1983.7	81.1	0.0	0002-0
		5025.5	0.0	0.0	610.9	66.7	7076.8	2008.3	2175.6	1052.0	
		815.9	416.1	304.0	270.7	202.0	134.4	114.4	71.7	83.8	

Table 11d: Raw sterane data (peak height) m/z 217 SIR for Well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Lithology	21a	22a	27dßS	27dßR	27daR	27daS	28dßS	28dßR	28daR*	Sample
		29dßS*	28daS*	27aaR	29dßR	29daR	28aaS	29daS*	28ßßS		
		28aaR	29aaS	29ßßR	29ßßS	29aaR					
2560.00	bulk	1111.0	247.8	105.3	57.9	38.4	43.3	45.6	39.8	160.6	0002-0
		372.0	83.0	63.7	379.7	60.9	60.5	154.5	133.0	108.2	
			173.0	126.6	71.7	334.7					

* 28daR coel with 27aaS, 29dßS coel with 27ßßR, 28daS coel with 27ßßS, 29daS coel with 28ßßR

Table 11e: Raw sterane data (peak height) m/z 218 SIR for Well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Lithology	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
2560.00	bulk	96.0	69.9	211.6	202.5	176.9	147.6	0.0	0.0	0002-0

Table 11f: Raw triterpane data (peak height) m/z 177 SIR for Well MIKKEL 6407/6-5 MUDS

Depth unit of measure: m

Depth	Lithology	25nor28a β	25nor30a β	Sample
2560.00	bulk	0.0	0.0	0002-0