

Table 11c: Raw triterpane data (peak height) m/z 191 SIR for Well NOCS 6406/2-6A

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	
5123.82	S/Sst	16329.9	6574.7	2546.5	9149.3	2859.7	1564.4	35589.6	1334.2	1602.4	0001-1
		100620.5	0.0	0.0	10489.1	0.0	140654.9	31237.3	32141.6	17685.3	
		12924.0	6466.8	4517.9	3445.2	2396.1	1410.0	1040.7	836.4	656.9	
5124.38	S/Sst	12521.9	5189.6	1963.1	7090.1	2209.4	1188.2	25342.9	861.5	1051.7	0002-1
		68503.1	0.0	0.0	6819.6	0.0	91089.2	19644.7	19437.5	10486.5	
		7506.4	3540.0	2408.0	1584.7	1060.4	573.5	336.9	227.5	201.0	

Table 11d: Raw sterane data (peak height) m/z 217 SIR for Well NOCS 6406/2-6A

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					
5123.82	S/Sst	2511.2	1799.9	2431.3	2353.0	633.5	552.8	905.1	976.3	6724.2	0001-1
		2649.4	1367.6	16799.2	1625.4	1239.4	3586.3	3377.4	2524.6		
		8308.8	3524.1	2892.4	1716.2	9830.8					
5124.38	S/Sst	1881.1	1371.3	1709.7	2424.6	377.7	351.7	660.8	717.4	3924.9	0002-1
		1791.0	892.3	11102.8	1110.4	826.5	2415.4	2292.3	1612.7		
		5680.4	2325.3	1854.5	1116.4	6327.8					

* 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 NOCS 6406/2-6A

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
5123.82	S/Sst	2961.0	1837.0	4308.1	3599.4	3296.2	2598.6	203.7	168.5	0001-1
5124.38	S/Sst	1987.3	1237.7	3003.3	2363.4	2023.3	1667.9	101.5	75.4	0002-1

Table 11f: Raw triterpane data (peak height) m/z 177 SIR for Well NOCS 6406/2-6A

Depth unit of measure: m

Depth	Lithology	25nor28a β	25nor30a β	Sample
5123.82	S/Sst	637.8	595.6	0001-1
5124.38	S/Sst	483.2	411.4	0002-1

Table 11q: Amount of triterpanes (ppb) m/z 191 SIR for Well NOCS 6406/2-6A

Depth unit of measure: m

Depth	Lithology	23/3	24/3	25/3	24/4	26/3	27Ts	27Tm	28aβ	25nor30aβ	Sample
		29aβ	29Ts	30d	29βa	300	30aβ	30βa	30G	31aβS	
		31aβR	32aβS	32aβR	33aβS	33aβR	34aβS	34aβR	35aβS	35aβR	
5123.82	S/Sst	5459.3	2198.0	851.3	3058.8	956.0	523.0	11898.2	446.0	535.7	0001-1
		33639.0	0.0	0.0	3506.7	0.0	47023.1	10443.1	10745.4	5912.4	
		4320.7	2161.9	1510.4	1151.8	801.0	471.4	347.9	279.6	219.6	
5124.38	S/Sst	4636.6	1921.6	726.9	2625.3	818.1	440.0	9383.9	319.0	389.4	0002-1
		25365.3	0.0	0.0	2525.2	0.0	33728.4	7274.0	7197.3	3882.9	
		2779.5	1310.8	891.6	586.8	392.7	212.3	124.7	84.2	74.4	

Table 11h: Amount of steranes (ppb) m/z 217 SIR for Well NOCS 6406/2-6A

Depth unit of measure: m

Depth	Lithology	21a	22a	27dβS	27dβR	27daR	27daS	28dβS	28dβR	28daR*	Sample
		29dβS*	28daS*	27aaR	29dβR	29daR	28aaS	29daS*	28ββS		
		28aaR	29aaS	29ββR	29ββS	29aaR					
5123.82	S/Sst	839.5	601.7	812.8	786.7	211.8	184.8	302.6	326.4	2248.0	0001-1
		885.7	457.2	5616.2	543.4	414.3	1199.0	1129.1	844.0		
		2777.8	1178.2	967.0	573.7	3286.6					
5124.38	S/Sst	696.5	507.8	633.1	897.8	139.8	130.2	244.7	265.6	1453.3	0002-1
		663.2	330.4	4111.2	411.2	306.0	894.4	848.8	597.1		
		2103.3	861.0	686.7	413.4	2343.0					

* 28daR coel with 27aaS, 29dβS coel with 27ββR, 28daS coel with 27ββS, 29daS coel with 28ββR

Table 11i: Amount of standard and weight of sample for Well NOCS 6406/2-6A

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Standard</u>	<u>Amount</u>	<u>Weight</u>	<u>Sample</u>
5123.82	S/Sst	116973.9	1.400	35.8	0001-1
5124.38	S/Sst	201113.3	1.400	18.8	0002-1

1 Introduction

This report gives the result of routine vitrinite reflectance analyses of 9 samples from well 6406/2-6A offshore Norway.

2 Material

The material was provided from the client as 13 cuttings samples (DC) and 1 core chips (COCH). Information on stratigraphy in well 6406/2-6A was not provided from the client.

3 Analytical techniques

3.1 Preparation

The sample material was embedded in an epoxy resin to make briquettes, dried and then dry grounded to a flat surface. The sample surface was impregnated with a somewhat thinned epoxy, dried and finally polished using 0.25 micron diamond paste and magnesium oxide as the two final steps.

3.2 Analysis

The analytical equipment being used was a Zeiss MPM 03 photometer microscope equipped with an Epiplan-Neofluar 40/0.90 oil objective. The sensitive measuring spot was kept constant for all measurements at about 2.5 micron in diameter. The measurements were made through a green band pass filter (546 nm) and in oil immersion (refractive index 1.515 at 18°C). The readings were made without a polarizer and using a stationary stage. This procedure is called measurement of random reflectance (%R_m). The photometer is calibrated daily against a standard of known reflectance (%R_m= 0.588) and routinely (daily) checked against two other standards of significant different reflectances (%R_m=0.879 and 1.696). A deviation from these values of less than ±0.01 and ±0.02 respectively is considered as acceptable. The calibration is routinely checked during the course of measurements at least every hour, and a deviation of less than ±0.005 is considered as acceptable.

For each sample at least 20 points were measured if possible, and quality ratings are given to various important aspects which may affect the measurements. These aspects are abundance of vitrinite, uncertainties in the identification of indigenous vitrinite, type of vitrinite, particle size, particle surface quality and abundance of pyrite.

3.3 Presentation of results

The raw data from the measurements are presented in appendix for each sample both as tabulated data and histograms. A true vitrinite population is selected among the readings based on observations made during the measurements, and arithmetic mean values and standard deviation are calculated for this population and other populations. A quality rating is given to the true population. There is one data sheet with raw data for each sample. The results are listed in table 1. Figure 1 shows a vitrinite reflectance versus depth plot, both in linear and logarithmic scale.

4 Results

The samples were of low quality with a lot of staining and material poor in vitrinite content. Preparation of the samples were difficult. The vitrinite reflectance versus depth plot indicate a maturity trend. This should not be given too much weight due to low number of measurements in each sample.

Table 1. Vitrinite reflectance data table well 6406/2-6A

Analysis type:		Vitrinite reflectance							
Well:		6406/2-6A							
Number of samples:		9							
Time period for analysis:		oct 2000							
Analysis performed by:		K. Aasgaard, IFE							
Analysis ordered by:		Geolab Nor							
IFE sample code	Depth (m)	Sample type	Lithology	Vitr. refl. (%Rm)	Stand. dev.	Number of readings	Sample description	Sample quality	Sample prep.
20001681	2800	DC	clyst/sst	0.34	0.04	8	-±0-0	Pst	HF
20001683	3200	DC	clyst/sst	0.51	0.07	4	-00-0	Pst	HF
20001685	3600	DC	clyst/sst	0.75	0.04	4	-±0-0	Pst	HF
20001687	4000	DC	clyst/sst	0.83	0.07	5	-±0-0	Pst	HF
20001689	4400	DC	clyst/sst	1.13	0.08	8	-00-0	Pst	HF
20001691	4755	DC	clyst	1.35	0.12	17	-±0-+	Pst	HF
20001692	4935	DC	clyst/sst	1.29	0.15	22	000-0	Mst	HF
20001693	5103	DC	clyst/sst	1.49	0.14	18	000-0	Mst	HF
20001694	5134.88	COCH?	coal/clyst	1.48	0.10	23	000000	G	HF

Table 1 Analytical Program for condensate and gas for well NOCS 6406/2-6A

Sample Depth (m)	Sample Type	Sample Code	Lithology Description	Picking for screening	Prøvepreparering (Kjemematriale)	Prøvepreparering (Løsningsmiddel-Ekstraksjon)	Leco TOC	RockEval	GHM Pyrolysis-GC	Picking for Extraction	Topping	Iatroscan	SOXTEC Extraction	MPLC & Deasphaltene	EOM GC	Whole Oil GC	Sat GC (Q or non-Q)	Aro GC (Non Quantitative)	Sat GCMS (Q or non-Q)	Aro GCMS (Non-Q)	Isotope of EOM/fractions §	API Gravity (Westlab)	Vitrinite Reflectance	Visual Kerogen	Gas composition and isotopes (IFE)	
Table nos			3				5	5				8	8	8		13	9	9	11	12	10	17	4	7	14	
5105	o	T99/0001									x	x		x		x	x	x	x	x	x					
5105	g	T99/0002																							x	
Total											1	1		1		1	1	1	1	1	1				1	
Sample type key c = Cuttings s = SWC p = Conv core/ plug o=oil g= gas m=mud																										
§ Isotope analysis on topped oil and sat, aro, NSO and asphaltene fractions												Q=quantitative, non-Q = not quantitative														

Table 8a: MPLC Bulk Composition: Weight of Oil and Fraction for 6406/2-6A

Well	Description	Whole oil (mg)	Light (mg)	Topped (mg)	Sat (mg)	Aro (mg)	Asph (mg)	NSO (mg)	HC (mg)	Non-HC (mg)	Sample
6406/2-6A	PVT-0021	93.8	33.5	60.3	46.8	10.9	0.3	2.4	57.6	2.7	T99/0001

Table 8b: MPLC Bulk Composition: Comparison of topped oil (%) for 6406/2-6A

Well	Description	Sat	Aro	Asph	NSO	Total	HC	Non-HC	Recov. MPLC	Recov. Asph	Sample
6406/2-6A	PVT-0021	77.56	18.02	0.50	3.92	100.00	95.59	4.41	1.02	0.84	T99/0001

Table 8c: MPLC Bulk Composition: Ratios in topped oil for 6406/2-6A

Well	Description	Sat Aro	HC Non-HC	Asp NSO	Sample
6406/2-6A	PVT-0021	4.30	21.65	0.13	T99/0001

Table 8f. Iatroscan TLC Bulk Composition: Rel. percentages of sep. fractions for 6406/2-6A

<u>Well</u>	<u>Description</u>	<u>Sat HC</u>	<u>Aro HC</u>	<u>NSO</u>	<u>Asp</u>	<u>Total</u>	<u>HC</u>	<u>Non-HC</u>	<u>Recov. Iatr.</u>	<u>Recov. Asp</u>	<u>Sample</u>
6406/2-6A	PVT-0021	82.44	16.02	1.04	0.50	100.00	98.46	1.54	0.63	0.84	T99/0001

Tab 9a¹ Peak areas Saturated Hydrocarbon G. Data

Depth (m)	Desc	nC15	nC16	Norpristane	nC17	Pristane	nC18	Phytane	nC19	nC20	nC21	nC22	nC23	nC24
5105	PVT-0021	5431932	5451175	616078	5678536	1377451	5696172	430235	5604610	5138247	4683693	4503415	4454955	3938390

Depth (m)	Desc	nC25	nC26	nC27	nC28	nC29	nC30	nC31	nC32	nC33	nC34	Sample number
5105	PVT-0021	3799796	3070450	2703348	1899792	1510068	904851	687134	408184	381428	134665	T99/0001-0

Table 9a: Quantitative Analysis of Saturated Fraction for 6406/2-6A

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
PVT - 0021	23.73	23.82	2.69	24.81	6.02	24.89	1.88	24.49	22.45	20.46	19.68	19.46	17.21	16.60	13.42	11.81	8.30	6.60	3.95	3.00	1.78	1.67	0.59

Table 9b: Saturated Hydrocarbon Ratios (peak area) for 6406/2-6A

Well	Description	$\frac{\text{Pristane}}{\text{nC17}}$	$\frac{\text{Pristane}}{\text{Phytane}}$	$\frac{\text{Pristane/nC17}}{\text{Phytane/nC18}}$	$\frac{\text{Phytane}}{\text{nC18}}$	CPI1	$\frac{\text{nC17}}{\text{nC17+nC27}}$	Sample
6406/2-6A	PVT-0021	0.24	3.20	3.21	0.08	1.14	0.68	T99/0001

Table 9ca¹ Peak areas Aromatic Hydrocarbon GC data

Depth (m)	Desc	2MN	1MN	BPh	2EN	1EN	2.6+2.7DMN	1.6DMN	1.5DMN	1.3.7TMN	1.3.6TMN	1.3.5TMN	1.4.6+2.3.6TMN
5105	PVT-0021	327515	141866	789175	334027	165084	678550	345650	0	225918	315212	250786	289652

Depth (m)	Desc	P	3MP	2MP	9MP	1MP	DBT	4MDBT	2+3MDBT	1MDBT	Sample number
5105	PVT-0021	428516	354445	495866	184693	136051	0	0	0	0	T99/0001-0

Table 9ca: Aromatic Hydrocarbon Ratios (peak area) for 6406/2-6A

Well	Description	MNR	DMNR	BPhR	2/1MP	MPI1	MPI2	Rc	DBT/P	4/1MDBT	(3+2) /1MDBT	Sample
6406/2-6A	PVT-0021	2.31	-	2.28	3.64	1.70	1.99	1.42	-	-	-	T99/0001

Table 9cb: Aromatic Hydrocarbon Ratios (peak area) for 6406/2-6A

Well	Description	F1	F2	Sample
6406/2-6A	PVT-0021	0.73	0.42	T99/0001

Table 10a: Tabulation of carbon isotope data on oils for 6406/2-6A

Well	Descript.	Whole oil	Topped oil	Saturated	Aromatic	NSO	Asphaltenes	Sample
6406/2-6A	PVT-0021	-	-29.07	-30.49	-25.98	-27.11	-28.34	T99/0001

Table 10b: Tabulation of cv values from carbon isotope data for 6406/2-6A

Well	Descript.	Saturated	Aromatic	cv value	Interpretation	Sample
6406/2-6A	PVT-0021	-30.49	-25.98	7.81	Terrigenous	T99/0001

Well	Descript.	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Rat.10	Rat.11	Rat.12	Rat.13	Rat.14	Sample
6406/2-6A	PVT-0021	-	-	-	0.53	0.35	0.63	-	-	-	-	0.79	0.30	0.17	42.54	T99/0001

List of Triterpane Distribution Ratios

Ratio 1: 27Tm / 27Ts

Ratio 2: 27Tm / 27Tm+27Ts

Ratio 3: 27Tm / 27Tm+30a β +30 β a

Ratio 4: 29a β / 30a β

Ratio 5: 29a β / 29a β +30a β

Ratio 6: 30d / 30a β

Ratio 7: 28a β / 30a β

Ratio 8: 28a β / 29a β

Ratio 9: 28a β / 28a β +30a β

Ratio 10: 24/3 / 30a β

Ratio 11: 30a β / 30a β +30 β a

Ratio 12: 29a β +29 β a / 29a β +29 β a+30a β +30 β a

Ratio 13: 29 β a+30 β a / 29a β +30a β

Ratio 14: 32a β S / 32a β S+32a β R (%)

Table 1 : Variation in Sterane Distribution (peak height) SIR for 6406/2-6A

Well	Descript.	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Ratio10	Sample
6406/2-6A	PVT-0021	0.27	35.78	75.85	0.33	0.81	0.28	0.21	0.61	0.56	2.45	T99/0001

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 6406/2-6A

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	
6406/2-6A	PVT-0021	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T99/0001
		1964.6	0.0	2317.0	0.0	0.0	3694.9	985.3	1010.9	984.7	
		726.4	529.2	715.0	0.0	0.0	0.0	0.0	0.0	0.0	

Table 11d: Raw sterane data (peak height) m/z 217 SIR for 6406/2-6A

Well	Descript.	21a	22a	27dßS	27dßR	27daR	27daS	28dßS	28dßR	28daR*	Sample
		29dßS*	28daS*	27aaR	29dßR	29daR	28aaS	29daS*	28ßßS		
		28aaR	29aaS	29ßßR	29ßßS	29aaR					
6406/2-6A	PVT-0021	1137.4	466.7	658.8	671.8	337.1	395.3	1137.4	454.0	897.7	T99/0001
		2718.5	843.2	1788.2	2512.4	562.6	447.2	553.5	1151.3		
		401.5	571.0	1072.5	1432.9	1024.6					

* 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 6406/2-6A

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
6406/2-6A	PVT-0021	1119.4	629.8	869.1	1309.6	1674.2	1967.3	34.5	40.8	T99/0001

Table 11f: Raw triterpane data (peak height) m/z 177 SIR for 6406/2-6A

Well	Descript.	25nor28a β	25nor30a β	Sample
6406/2-6A	PVT-0021	0.0	0.0	T99/0001

Table 11g: Amount of triterpanes (ppb) m/z 191 SIR for 6406/2-6A

Well	Descript.	23/3	24/3	25/3	24/4	26/3	27Ts	27Tm	28a β	25nor30a β	Sample
		29a β	29Ts	30d	29 β a	300	30a β	30 β a	30G	31a β S	
		31a β R	32a β S	32a β R	33a β S	33a β R	34a β S	34a β R	35a β S	35a β R	
6406/2-6A	PVT-0021	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T99/0001
		6194.4	0.0	7305.5	0.0	0.0	11649.8	3106.6	3187.4	3104.8	
		2290.4	1668.6	2254.3	0.0	0.0	0.0	0.0	0.0	0.0	

Table 11h: Amount of steranes (ppb) m/z 217 SIR for 6406/2-6A

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					
6406/2-6A	PVT-0021	3586.1	1471.5	2077.2	2118.1	1062.9	1246.3	3586.0	1431.4	2830.4	T99/0001
		8571.3	2658.5	5638.1	7921.6	1774.0	1410.1	1745.3	3630.0		
		1266.0	1800.2	3381.7	4517.9	3230.4					

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

Table 11i: Amount of standard and weight of sample for 6406/2-6A

Well	Descript.	Standard	Amount	Weight	Sample
6406/2-6A	PVT-0021	22425.7	1.400	19.8	T99/0001

Table 12a: Variation in Triaromatic Sterane Distribution (peak height) for 6406/2-6A

Well	Descript.	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Sample
6406/2-6A	PVT-0021	-	-	-	-	-	T99/0001

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 6406/2-6A

Well	Descript.	Ratio1	Ratio2	Ratio3	Ratio4	Sample
6406/2-6A	PVT-0021	0.52	0.70	0.32	0.37	T99/0001

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 6406/2-6A

Well	Descript.	Ratio1	Ratio2	Sample
6406/2-6A	PVT-0021	1.00	-	T99/0001

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

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

Table 12d: Raw triaromatic sterane data (peak height) m/z 231 for 6406/2-6A

Well	Descript.	a1	b1	c1	d1	e1	f1	g1	Sample
6406/2-6A	PVT-0021	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T99/0001

Table 12e: Raw monoaromatic sterane data (peak height) m/z 253 for 6406/2-6A

Well	Descript.	A1	B1	C1	D1	E1	F1	G1	H1	I1	Sample
6406/2-6A	PVT-0021	754.9	1603.8	309.7	994.4	683.3	410.7	897.2	604.2	171.4	T99/0001

Table 13A: Light Hydrocarbons from Whole Oil GC for 6406/2-6A

Well	Description	2,2DMC4	2,3DMC4	nC6	MCyC5	Benz	Sample
6406/2-6A	PVT-0021	0.14	0.21	3.48	3.48	1.14	T99/0001

Table 13B: Light Hydrocarbons from Whole Oil GC for 6406/2-6A

Well	Description	CyC6	2MC6	3MC6	1,3ci- DMCyC5	1,3tr- DMCyC5	1,2tr- DMCyC5	nC7	MCyC6	Tol	nC8	p/m- Xylene	Sample
6406/2-6A	PVT-0021	3.93	2.77	2.04	0.88	0.86	1.42	4.52	13.98	5.66	5.46	5.95	T99/0001

Table 13C: Thompson's indices for 6406/2-6A

Well	Description	A	B	X	W	C	I	F	H	U	R	S	Sample
6406/2-6A	PVT-0021	0.33	1.25	1.09	2.90	0.45	1.52	0.32	14.77	1.13	1.63	24.86	T99/0001

THOMPSON'S INDICES

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

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

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

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

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

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

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

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

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

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

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

Table 14A: Volume Composition of Gas Samples from well NOCS 6406/2-6A

Depth unit of measure: m

Depth	Typ	Lithology	C1	C2	C3	iC4	nC4	iC5	nC5	CO2	sum C1-C5	wet- ness	iC4/ nC4	Sample
5105.00	gas	bulk	91.90	4.60	1.30	0.27	0.27	0.13	0.07	1.40	98.5	0.07	1.00	0002-0B

Table 14B: Isotopic Composition of Gas Samples from well NOCS 6406/2-6A

Depth unit of measure: m

Depth	Typ	Lithology	C1 d13C	C1 dD	C2 d13C	C3 d13C	iC4 d13C	nC4 d13C	CO2 d13C	CO2 d18O	Sample
5105.00	gas	bulk	-39.9	-189.0	-30.1	-28.8	-30.0	-27.3	-10.0	-14.1	0002-0B



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Report type	Report number IFE/KR/F-2000/115	Date 2000-08-23	
	Report title Datareport on molecular and stable isotope composition of a gas sample from well 6406/2-6A (IFE ref. no 3.1.133.00)	Date of last revision	
	Client Statoil / GeolabNor	Revision number	
	Client reference Ordre 2000-34	Number of pages 5	
		Number of issues 14	
Summary One gas sample from well 6406/2-6A, 5105m MD is analysed for gas and isotopic composition. On the sample 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) Andresen, B. Johansen, H. Sieglé, S. File (3)	
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1 Introduction

One gas sample from well 6406/2-6A, 5105m MD is analysed for gas and isotopic composition.

On the sample 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 a sealed quartz tube 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 sample 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 a gas sample (normalised values) from well 6406/2-6A

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
6406/2-6A	5105	20001273	91.9	4.6	1.3	0.27	0.27	0.13	0.07	1.4	98.6	0.07	1.00

Table 2 Isotopic composition of a gas sample from well 6406/2-6A

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
6406/2-6A	5105	20001273	-39.9	-189	-30.1	-28.8	-30.0	-27.3	-10.0	-14.1

4 Literature

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

Table 1 Analytical Program for Muds for NOCS well 6-5/2-6A

Sample Depth (m)	Sample Type	Sample Code	Lithology Description	Picking for screening	Prøvepreparering (Kjemematriale)	Prøvepreparering (Løsningsmiddel-Ekstraksjon)	Leco TOC	RockEval	GHM Pyrolysis-GC	Picking for Extraction	Topping	Iatroscan	SOXTEC Extraction	MPLC & Deasphaltene	EOM GC	Whole Oil GC	Sat GC (non-Q)	Aro GC (Non Quantitative)	Sat GCMS (Q or non-Q)	Aro GCMS (Non-Q)	Isotope of EOM/fractions	API Gravity (Westlab)	Virinite Reflectance	Visual Kerogen	Gas composition and isotopes (IFE)
Table nos				3			5	5				8	8	8		13	9	9	11	12	10	17	4	7	14
4602	m	U20/0001											x		x										
4857	m	U20/0002											x	x	x		x		x						
5207	m	U20/0003											x		x										
Total													3	1	3		1		1						

Sample type key c = Cuttings s = SWC p = Conv core/ plug o=oil g= gas m=mud

Table 8a: MPLC Bulk Composition: Weight of EOM and Fraction for well 6406/2-6A 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
4857.00	mud	bulk	-	58.6	55.1	0.4	0.6	2.4	55.6	3.0	-	0002-0B

Table 8b: MPLC Bulk Composition: Concentration of EOM and Fraction (wt ppm rock) for well 6406/2-6A MUDS

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
4857.00	mud	bulk	-	-	-	-	-	-	-	0002-0B

Table 8c: MPLC Bulk Composition: Concentration of EOM and Fraction (mg/g TOC (e)) for well 6406/2-6A MUDS

Depth unit of measure: m

Depth	Typ	Lithology	EOM	Sat	Aro	Asph	NSO	HC	Non-HC	Sample
4857.00	mud	bulk	-	-	-	-	-	-	-	0002-0B

Table 8d: MPLC Bulk Composition: Material extracted from the rock (%) for well 6406/2-6A MUDS

Depth unit of measure: m

Depth	Typ	Lithology	Sat	Aro	Asph	NSO	Total	HC	Non-HC	Recov. MPLC	Recov. Asph	Sample
4857.00	mud	bulk	94.08	0.75	1.02	4.14	100.00	94.84	5.16	1.04	0.88	0002-0B

Table 8e: MPLC Bulk Composition: Ratios for well 6406/2-6A MUDS

Depth unit of measure: m

Depth	Typ	Lithology	Sat Aro	HC Non-HC	Asp NSO	Sample
4857.00	mud	bulk	125.00	18.37	0.25	0002-0B

Table 9a¹ Peak areas Saturated Hydrocarbon GC data

Depth (m)	Sample type	nC15	nC16	Norpristane	nC17	Pristane	nC18	Phytane	nC19	nC20	nC21	nC22	nC23	nC24	nC25	nC26	nC27
4857	mud	2174740	857376	374829	668323	274330	435036	140051	241812	146026	74747	45997	25568	14548	5975	7704	0

Depth (m)	Sample type	nC28	nC29	nC30	nC31	nC32	nC33	nC34	Sample number
4857	mud	0	0	0	0	0	0	0	U20/0002-0

Table 9b: Saturated Hydrocarbon Ratios (peak area) for well 6406/2-6A MUDS

Depth unit of measure: m

Depth	Typ	Lithology	$\frac{\text{Pristane}}{\text{nC17}}$	$\frac{\text{Pristane}}{\text{Phytane}}$	$\frac{\text{Pristane/nC17}}{\text{Phytane/nC18}}$	$\frac{\text{Phytane}}{\text{nC18}}$	CPI1	$\frac{\text{nC17}}{\text{nC17+nC27}}$	Sample
4857.00	mud	bulk	0.41	1.96	1.28	0.32	0.52	1.00	0002-0B

Table 11a: Variation in Triterpane Distribution (peak height) SIR for Well 6406/2-6A MUDS

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
4857.00	bulk	25.19	0.96	0.19	0.72	0.42	-	-	-	-	0.07	0.80	0.39	0.19	57.29	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 (%)

Table 11b: Variation in Sterane Distribution (peak height) SIR for Well 6406/2-6A MUDS

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>
4857.00	bulk	0.30	28.88	46.39	0.75	0.60	0.24	0.18	0.30	0.41	0.61	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 6406/2-6A 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	29ßa	300	30aß	30ßa	30G	31aßS	
		31aßR	32aßS	32aßR	33aßS	33aßR	34aßS	34aßR	35aßS	35aßR	
4857.00	bulk	590.4	231.3	63.8	301.9	96.8	38.5	970.2	0.0	0.0	0002-0
		2391.9	67.4	0.0	257.6	18.0	3306.3	847.3	908.8	494.8	
		359.8	186.4	139.0	130.1	99.2	84.1	54.1	69.7	66.3	

Table 11d: Raw sterane data (peak height) m/z 217 SIR for Well 6406/2-6A 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					
4857.00	bulk	87.1	54.2	60.9	38.3	20.9	33.3	30.1	23.2	53.3	0002-0
		197.0	60.7	43.0	141.6	32.8	27.1	91.5	84.9	61.0	
			89.1	87.1	46.4	219.5					

* 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 6406/2-6A MUDS

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
4857.00	bulk	70.9	58.2	115.3	94.9	88.8	64.5	0.0	0.0	0002-0

Table 11f: Raw triterpane data (peak height) m/z 177 SIR for Well 6406/2-6A MUDS

Depth unit of measure: m

Depth	Lithology	25nor28a β	25nor30a β	Sample
4857.00	bulk	0.0	0.0	0002-0