

Table 9b : Tabulation of cv values from carbon isotope data for well N0CS 25/6-1

Depth unit of measure: m

Depth	Typ	Lithology	Saturated	Aromatic	cv value	Sample
2279.70	oil		-28.11	-26.34	0.99	0001-0B
2281.00	com	Composite sample	-29.92	-29.26	-0.91	0134-0B
2290.00	cut		-30.88	-29.74	0.45	0055-1L
2304.00	ccp		-28.68	-28.41	-2.16	0006-1L
2309.70	ccp		-29.34	-27.89	0.66	0007-1L
2314.00	cut		-28.30	-28.01	-2.23	0056-1L
2347.00	com	Composite sample	-27.81	-27.46	-2.25	0136-0B
2425.00	com	Composite sample	-27.95	-28.13	-3.39	0135-0B
2485.00	cut		-27.84	-27.94	-3.24	0075-2L

Table 10A: Variation in Triterpane Distribution (peak height) for Well N0CS 25/6-1

Depth unit of measure: m

Depth	Lithology	B/A	B/B+A	B		C/E	C/C+E	X/E	Z/E	Z/C	Z/Z+E	Q/E	E/E+F	C+D		J1		Sample
				B+E+F										C+D+E+F	D+F/C+E	J1+J2%		
2279.70	bulk	1.31	0.57	0.22	0.47	0.32	-	0.30	0.62	0.23	1.82	0.86	0.29	0.11	-		0001-0	
2281.00	bulk	7.40	0.88	0.25	0.61	0.38	0.05	0.16	0.26	0.13	0.07	0.76	0.40	0.38	39.50		0134-0	
2290.00	Sh/Clst	6.49	0.87	0.23	0.55	0.35	0.06	0.44	0.80	0.31	0.07	0.80	0.38	0.31	39.44		0055-1	
2304.00	Sh/Clst	28.96	0.97	0.29	0.77	0.43	0.03	0.02	0.03	0.02	0.02	0.71	0.45	0.47	33.15		0006-1	
2309.70	Sh/Clst	22.46	0.96	0.26	0.73	0.42	0.02	0.06	0.09	0.06	0.01	0.69	0.43	0.47	38.31		0007-1	
2314.00	Sh/Clst	6.69	0.87	0.26	0.66	0.40	0.04	0.48	0.74	0.33	0.18	0.77	0.42	0.35	37.04		0056-1	
2347.00	Sh/Clst	7.63	0.88	0.27	0.67	0.40	0.03	0.38	0.57	0.28	0.14	0.75	0.42	0.37	39.39		0136-0	
2425.00	bulk	19.14	0.95	0.31	0.64	0.39	0.02	0.17	0.26	0.14	0.18	0.80	0.41	0.29	38.13		0135-0	
2485.00	Sh/Clst	17.27	0.95	0.33	0.59	0.37	0.02	0.06	0.10	0.06	0.13	0.84	0.39	0.22	40.55		0075-2	

Table 10B: Variation in Sterane Distribution (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	Ratio1	Ratio2	Ratio3	Ratio4	Ratio5	Ratio6	Ratio7	Ratio8	Ratio9	Ratio10	Sample
2279.70	bulk	1.00	-	-	1.77	-	1.00	0.93	-	-	-	0001-0
2281.00	bulk	0.42	10.75	55.31	1.55	0.85	0.25	0.19	0.38	0.12	0.69	0134-0
2290.00	Sh/Clst	0.47	12.91	56.02	1.75	0.83	0.26	0.20	0.39	0.15	0.73	0055-1
2304.00	Sh/Clst	0.65	13.93	62.23	0.99	0.86	0.50	0.41	0.45	0.16	0.96	0006-1
2309.70	Sh/Clst	0.52	7.38	54.54	0.67	0.89	0.34	0.29	0.37	0.08	0.65	0007-1
2314.00	Sh/Clst	0.51	12.22	59.39	1.63	0.86	0.39	0.31	0.42	0.14	0.83	0056-1
2347.00	Sh/Clst	0.52	11.92	60.39	1.56	0.86	0.41	0.32	0.43	0.14	0.87	0136-0
2425.00	bulk	0.54	13.24	56.47	1.78	0.83	0.63	0.54	0.39	0.15	0.75	0135-0
2485.00	Sh/Clst	0.49	12.76	56.99	1.13	0.84	0.56	0.42	0.40	0.15	0.76	0075-2

Ratio1: $a / a + j$
Ratio2: $q / q + t * 100\%$
Ratio3: $2(r + s) / (q + t + 2(r + s)) * 100\%$
Ratio4: $a + b + c + d / h + k + l + n$
Ratio5: $r + s / r + s + q$

Ratio6: $u + v / u + v + q + r + s + t$
Ratio7: $u + v / u + v + i + m + n + q + r + s + t$
Ratio8: $r + s / q + r + s + t$
Ratio9: q / t
Ratio10: $r + s / t$

Table 10C: Variation in Triaromatic Sterane Distribution for Well N0CS 25/6-1

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>Sample</u>
2279.70	bulk	-	-	-	-	-	0001-0
2281.00	bulk	0.64	0.44	0.26	0.35	0.38	0134-0
2290.00	Sh/Clst	0.54	0.37	0.19	0.27	0.27	0055-1
2304.00	Sh/Clst	0.72	0.57	0.41	0.48	0.56	0006-1
2309.70	Sh/Clst	0.60	0.46	0.30	0.34	0.45	0007-1
2314.00	Sh/Clst	0.60	0.41	0.24	0.32	0.35	0056-1
2347.00	Sh/Clst	0.56	0.40	0.23	0.30	0.33	0136-0
2425.00	bulk	0.64	0.49	0.29	0.37	0.42	0135-0
2485.00	Sh/Clst	0.65	0.47	0.31	0.38	0.45	0075-2

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 10D: Variation in Monoaromatic Sterane Distribution for Well NOCS 25/6-1

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>
2279.70	bulk	0.61	0.39	0.41	0.35	0001-0
2281.00	bulk	0.19	0.11	0.11	0.09	0134-0
2290.00	Sh/Clst	0.20	0.12	0.12	0.09	0055-1
2304.00	Sh/Clst	0.45	0.33	0.29	0.24	0006-1
2309.70	Sh/Clst	0.43	0.32	0.25	0.22	0007-1
2314.00	Sh/Clst	0.21	0.17	0.12	0.11	0056-1
2347.00	Sh/Clst	0.27	0.15	0.16	0.13	0136-0
2425.00	bulk	0.26	0.15	0.16	0.13	0135-0
2485.00	Sh/Clst	0.23	0.13	0.14	0.11	0075-2

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 10E: Aromatisation of Steranes for Well NOCS 25/6-1

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Sample</u>
2279.70	bulk	1.00	-	0001-0
2281.00	bulk	0.91	0.20	0134-0
2290.00	Sh/Clst	0.90	0.22	0055-1
2304.00	Sh/Clst	0.84	0.41	0006-1
2309.70	Sh/Clst	0.75	0.58	0007-1
2314.00	Sh/Clst	0.91	0.24	0056-1
2347.00	Sh/Clst	0.87	0.34	0136-0
2425.00	bulk	0.88	0.31	0135-0
2485.00	Sh/Clst	0.90	0.30	0075-2

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

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

Table 10F: Raw GCMS triterpane data (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	p		q		r		s		t		a		b		z		c		Sample
		x		d		e		f		g		h		i		j1				
		j2		k1		k2		l1		l2		m1		m2						
2279.70	bulk	10.66	0.00	6.34	0.00	1.44	3.49	1.64	0.00	0.00	0.70	0.88	0.56	1.15	0.00	1.03	0.00	1.65	0001-0	
		0.00		0.00		0.00		0.00		0.00		0.00		0.00						
2281.00	bulk	139.07	44.18	58.50	255.49	35.94	882.19	62.41	285.95	13.67	407.58	52.37	396.90	387.49	198.58	136.99	110.04	535.81	0134-0	
		168.51		78.02		129.41		48.97		83.70		67.05		140.39						
2290.00	Sh/Clst	103.00	42.09	43.72	156.62	34.76	671.94	50.38	165.87	15.69	255.54	38.46	293.32	249.44	118.05	294.97	95.72	367.44	0055-1	
		146.99		97.81		148.46		66.63		110.01		117.21		225.56						
2304.00	Sh/Clst	22.36	13.67	7.09	192.12	0.00	469.50	45.32	196.43	0.00	265.18	9.62	256.58	278.55	151.11	9.90	37.55	360.28	0006-1	
		75.73		6.89		17.12		2.73		5.12		0.00		0.00						
2309.70	Sh/Clst	23.31	12.06	7.61	216.23	0.00	588.39	57.37	259.44	0.00	338.44	13.15	312.73	295.39	183.42	38.03	52.39	429.98	0007-1	
		84.35		7.71		17.00		0.00		0.00		0.00		0.00						

Table 10F: Raw GCMS triterpane data (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	p	q	r	s	t	a	b	z	c	Sample
		x	d	e	f	g	h	i	j1		
		j2	k1	k2	l1	l2	m1	m2			
2314.00	Sh/Clst	143.95	56.10	26.61	38.74	10.64	20.73	138.63	146.69	199.46	0056-1
		13.24	85.08	303.62	89.76	130.89	128.00	64.97	27.20		
		46.24	16.58	30.34	8.46	17.81	14.73	30.10			
2347.00	Sh/Clst	109.54	39.81	20.66	33.46	8.95	17.95	136.97	107.41	189.92	0136-0
		8.02	80.77	281.56	92.11	142.47	135.81	64.54	27.12		
		41.73	9.98	17.80	4.97	10.71	8.05	16.62			
2425.00	bulk	39.25	12.21	3.10	6.30	0.00	1.96	37.51	11.02	42.22	0135-0
		1.16	14.99	66.24	17.00	32.06	29.41	9.72	4.16		
		6.75	2.16	2.46	0.68	1.05	1.34	1.94			
2485.00	Sh/Clst	19.27	6.20	2.37	3.77	0.00	1.62	27.98	2.86	28.42	0075-2
		1.09	7.57	47.96	9.01	16.48	12.16	4.21	2.34		
		3.43	0.98	1.33	0.53	0.96	0.41	0.87			

Table 10G: Raw GCMS sterane data (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	u	v	a	b	c	d	e	f	g	Sample	
		h	i	j	k	l	m	n	o			
		p	q	r	s	t						
2279.70	bulk	25.51	3.82	6.68	3.51	0.00	0.00	0.00	0.00	0.00	1.08	0001-0
		0.00	3.39	2.28	0.00	2.36	0.00	0.00	0.00	0.00		
		0.00	0.00	0.00	0.00	0.00						
2281.00	bulk	216.35	63.81	482.70	398.60	173.95	121.30	214.13	175.17	252.43		0134-0
		252.16	107.14	667.61	267.25	78.92	81.48	158.45	73.44			
		386.99	55.71	160.32	160.32	462.49						
2290.00	Sh/Clst	267.21	78.09	690.18	572.95	254.46	176.32	256.69	220.65	316.71		0055-1
		342.98	158.60	772.24	352.65	93.55	95.43	179.23	99.37			
		385.52	77.95	192.27	192.27	525.82						
2304.00	Sh/Clst	35.26	5.54	22.41	16.34	5.08	5.36	5.89	3.92	6.76		0006-1
		20.58	5.90	12.12	15.80	5.97	5.16	7.34	2.89			
		3.85	3.09	9.14	9.14	19.10						
2309.70	Sh/Clst	24.82	6.08	17.77	11.57	3.36	3.02	4.93	3.40	4.86		0007-1
		24.05	6.51	16.10	17.19	5.78	4.55	6.20	3.29			
		5.11	2.74	11.13	11.13	34.37						

Table 10G: Raw GCMS sterane data (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	u	v	a	b	c	d	e	f	g	Sample
		h	i	j	k	l	m	n	o		
		p	q	r	s	t					
2314.00	Sh/Clst	124.10	35.78	188.73	149.59	67.75	50.06	69.86	53.70	79.39	0056-1
		109.28	45.88	184.77	97.25	24.58	17.76	48.75	26.47		
		86.35	17.38	51.99	51.99	124.84					
2347.00	Sh/Clst	76.24	20.83	104.98	82.77	33.26	24.78	36.98	24.82	40.53	0136-0
		60.35	28.10	96.31	53.87	14.94	11.26	28.58	16.30		
		46.14	9.60	30.70	30.70	70.93					
2425.00	bulk	33.31	5.90	22.58	17.42	5.66	4.30	6.23	7.31	7.59	0135-0
		11.82	5.09	19.28	9.74	2.34	1.73	4.14	2.58		
		7.30	1.85	4.53	4.53	12.12					
2485.00	Sh/Clst	13.57	3.49	14.53	10.91	3.95	2.71	4.37	5.16	6.98	0075-2
		11.40	4.09	15.42	9.36	4.05	2.21	3.57	2.56		
		4.50	1.04	2.70	2.70	7.11					

Table 10H: Raw GCMS trioaromatic sterane data (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	Sample
2279.70	bulk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0001-0
2281.00	bulk	264.81	119.00	151.06	435.35	143.52	198.64	152.04	0134-0
2290.00	Sh/Clst	339.56	170.01	357.77	923.89	225.21	391.78	292.12	0055-1
2304.00	Sh/Clst	113.41	57.68	37.47	90.19	47.06	32.17	43.03	0006-1
2309.70	Sh/Clst	172.10	97.72	86.50	208.58	137.65	77.23	114.10	0007-1
2314.00	Sh/Clst	101.64	47.71	77.91	191.51	64.33	81.03	68.22	0056-1
2347.00	Sh/Clst	205.95	106.51	162.48	416.84	160.39	160.38	162.95	0136-0
2425.00	bulk	82.84	44.41	48.82	114.16	50.30	47.26	46.18	0135-0
2485.00	Sh/Clst	111.34	53.67	56.13	137.17	58.99	58.18	60.88	0075-2

Table 10I: Raw GCMS monoaromatic sterane data (peak height) for Well NOCS 25/6-1

Depth unit of measure: m

Depth	Lithology	a1	b1	c1	d1	e1	f1	g1	h1	i1	Sample
2279.70	bulk	317.37	132.46	84.42	68.34	206.60	44.22	250.88	136.14	30.21	0001-0
2281.00	bulk	780.07	435.32	970.09	1333.71	3364.71	339.75	2960.88	2047.11	594.14	0134-0
2290.00	Sh/Clst	1385.14	725.84	1856.08	2474.05	5449.37	548.17	5129.62	3628.20	1046.79	0055-1
2304.00	Sh/Clst	257.64	155.13	179.39	156.34	314.00	69.16	326.25	179.63	62.47	0006-1
2309.70	Sh/Clst	316.39	197.34	234.22	187.71	424.72	113.00	501.08	286.40	82.62	0007-1
2314.00	Sh/Clst	340.24	268.93	521.37	593.57	1317.84	141.08	1177.30	771.08	211.71	0056-1
2347.00	Sh/Clst	689.31	331.38	819.28	884.12	1865.47	225.93	1697.07	1058.28	319.07	0136-0
2425.00	bulk	233.62	118.23	256.15	292.57	659.54	93.43	575.59	360.99	101.80	0135-0
2485.00	Sh/Clst	271.38	135.59	356.39	375.94	906.25	132.74	816.38	506.13	140.55	0075-2

1. MATURITY

This account describes the results from a maturity study, using vitrinite reflectance, undertaken on well 25/6-1 offshore Norway. The study is carried out on sidewall core samples exclusively. This sampling procedure has been relatively successful yielding material of acceptable quality for vitrinite reflectance analysis throughout the well section.

2. METHODICAL ASPECTS

2.1 General

The vitrinite reflectance method has proven to be an indispensable tool in organic geochemical studies, and particularly in source rock studies for the assessment of the hydrocarbon maturation potential. The method has also proven to be a useful tool in solving certain geological problems related to geothermal effects. It is when properly interpreted probably the best maturity indicator available today: It is discriminatory, measurements are carried out by photometry providing objective, accurate and highly reproducible data, it is useful over a very wide range of maturation and is particularly useful in the maturation range of interest in exploration for hydrocarbons, it is applicable to most sedimentary rock types, it has largely been standardized for the last 20 years, correlated with physical and chemical parameters of coals and hydrocarbon generation in source rocks, and thoroughly tested on an international scale to provide a high degree of accuracy and reproducibility. The method and various aspects have been described by McCartney and Ergun (1958, 1967), Kötter (1960), Murchison (1964), De Vries and Bokhoven (1968) and Teichmüller (1971). Various aspects of the application of vitrinite reflectance to vitrinitic material finely disseminated in clastic sediments have been thoroughly treated by Bostick (1971, 1979), Bostick and Foster (1975), Dow (1977), Robert (1980) and Teichmüller (1971). A paper by Bostick and Alpern (1977) explains the principles of sampling, preparation and constituent selection for vitrinite reflectance measurements.

The vitrinite reflectance method was originally designed for rank determinations on coals which offer the ultimate sample quality for such studies: coals, unless weathered, thermally affected or of very low rank, provide nearly always excellent and very reliable vitrinite reflectance data. When the method was extended from coals to finely

disseminated organic material in clastic sediments, a huge advance was made in the practical applicability of the method especially concerning source rock studies. This important extension, however, introduced certain limitations which it is important to be aware of when vitrinite reflectance data obtained from clastic sediments are to be interpreted. Vitrinite reflectance data of this type which are reliable and readily interpreted, are relatively rare, poor and even barren samples are very frequent. This is due to a number of factors including type of lithology selected for study, small particle size, poor particle quality, bitumen staining, low reflecting vitrinite, weathering, lack of vitrinite, difficult identification of vitrinite, high pyrite contents and cavings.

2.2 Techniques used in this study

Normal palynological preparation techniques were used to concentrate the organic matter from the sediments. Crushed samples were dissolved in hydrofluoric acid after any carbonates had been removed with hydrochloric acid and washing. The samples were not subjected to any oxidative or heating treatment. The remaining organic residues were then embedded in a cold setting epoxy resin to make briquettes, which were subsequently ground flat and polished.

Equipment used was a Zeiss MPM 03 photometermicroscope. Viewing and measurements were made through a Zeiss Epiplan-Neofluoar 40/0.90 oil objective using oil immersion with refractive index $n = 1.518$. Measurements were made through a green filter with peak transmission at 546 nm, and the photometer sensitive field was about 2.5 μm in diameter. For photometer calibration a Schott safir glass-standard with reflectance of $R_o = 0.588$ was used. The readings were carried out using a stationary stage. This has become more or less standard in vitrinite reflectance determinations on clastic samples. It is far less time consuming, permits smaller particles to be measured and the results obtained do not deviate significantly from those obtained using a rotating stage as long as the vitrinite reflectance values stay below $R_o = 1.4$ (De Vries and Bokhoven, 1968). None of the samples

analysed in this study exceeded this value. On each sample as many particles as possible up to 50 were measured. The readings were presented in histograms, a representative population was selected for each sample from observations made during measuring, and an arithmetically mean was calculated from this population and interpreted as the representative vitrinite reflectance value.

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WELL 25/6-1

VITRINITE REFLECTANCE

Sample code	Sample depth mRKB	Sample type	Lithology	Vitrinite reflectance Ro (N)	Preparation
SA 182	1052.0	swc	clst	0.24 (35)	HF
SA 183	1099.0	swc	clst	0.23 (50)+	HF
SA 184	1157.0	swc	clst	0.20 (21)	HF
SA 185	1209.0	swc	clst	0.22 (32)+	HF
SA 186	1277.5	swc	clst	-	HF
SA 187	1350.0	swc	clst	0.21 (43)+	HF
SA 188	1405.0	swc	clst	0.22 (47)+	HF
SA 189	1491.5	swc	clst	-	HF
SA 190	1563.0	swc	clst	0.34 (6)-	HF
SA 191	1621.5	swc	clst	0.31 (26)	HF
SA 192	1771.5	swc	clst	0.38 (50)+	HF
SA 193	1999.5	swc	clst	0.35 (37)-	HF
SA 194	2032.0	swc	clst	0.36 (4)-	HF
SA 195	2130.0	swc	clst	0.36 (15)	HF
SA 196	2221.0	swc	clst	-	HF
SA 197	2243.0	swc	clst	0.34 (13)-	HF
SA 198	2251.0	swc	clst	0.39 (2)	HF
SA 199	2264.0	swc	clst	0.39 (38)	HF
SA 200	2270.0	swc	clst	0.46 (13)-	HF
SA 201	2273.0	swc	clst	0.43 (9)-	HF
SA 202	2276.0	swc	clst	0.36 (43)	HF
SA 203	2277.0	swc	clst	0.32 (9)-	HF
SA 204	2310.0	swc	clst	0.40 (50)+	HF
SA 205	2320.0	swc	clst	0.41 (5)-	HF
SA 206	2340.0	swc	clst	0.38 (21)	HF
SA 207	2350.0	swc	clst	0.38 (25)	HF
SA 208	2410.0	swc	clst	0.42 (36)	HF
SA 209	2415.0	swc	clst	0.40 (48)	HF
SA 210	2441.5	swc	clst	0.47 (46)	HF
SA 211	2484.5	swc	clst	-	HF
SA 212	2488.0	swc	clst	0.40 (50)+	HF
SA 213	2500.0	swc	clst	0.41 (50)+	HF

swc = sidewall core
clst = claystone
HF = preparation with hydrofluoric acid
+ = very good sample
- = difficult sample

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TELEPHONE	+47 2 712560 - 713560	+47 31 83100	Private
TELEX	74 573 energ n	76 335 energ n	Confidential
TELEFAX	+47 2 715553		

REPORT TYPE	REPORT NO. IFE/KR/F-86/055	DATE 1986-05-06
	REPORT TITLE HEADSPACE GAS GEOCHEMISTRY ON SAMPLES FROM WELL 25/6-1	DATE OF LAST REV.
	CLIENT Saga Petroleum A/S	REV. NO.
	CLIENT REF. Arne Forsberg	NUMBER OF PAGES 5
		NUMBER OF ISSUES 15

SUMMARY	DISTRIBUTION
The gas components C_1-C_4 from headspace cans are quantified and the $\delta^{13}C$ value is measured when possible on CH_4 .	Saga (10) Andresen, B. Brevik, E.M. Råheim, A.
<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 0 auto;"> <p>86-5124-BA</p> <p>23 JUNI 1986</p> <p>REGISTRERT</p> <p>OLJEDIREKTORATET</p> </div>	

KEYWORDS		
NAME	DATE	SIGNATURE
PREPARED BY Bjørg Andresen Einar M. Brevik Arne Råheim	1986-05-06 1986-05-06 1986-05-06	Bjørg Andresen Einar Brevik Arne Råheim
REVIEWED BY		
APPROVED BY Karen Garder	1986-05-06	Karen Garder

1. INTRODUCTION

Headspace cans from well 25/6-1 were received March 1986 and were analyzed during April 1986.

C₁-C₄ are quantified and the $\delta^{13}\text{C}$ value is measured when possible on methane.

2. ANALYTICAL PROCEDURE

The headspace gas was quantified by a Perkin Elmer 3920 gas chromatograph equipped with a FID detector and a Porapak Q column. To be able to do the isotopic measurements the gases have been separated into the different gas components by a Carlo Erba 4200 instrument. This gas chromatograph is equipped with a special injection loop in order to concentrate the samples, in the case of low concentration of the gas components. The methane was oxidized in a CuO oven and the combustion products CO₂ and H₂O were frozen into collection vessels and separated.

The isotopic measurements were performed on a Finnigan Mat 251 mass spectrometer. Our $\delta^{13}\text{C}$ value on NBS 22 is $-29.77 \pm .06$ o/oo.

3. RESULTS

The composition and the stable isotope results of the headspace gas are given in Table 1. The results have been normalized.

The results are also shown graphically in Figure 1.

Table 1 Composition and stable isotope results of headspace gas from well 25/6-1. The results are normalized

Sample depth (m)	IFE no.	C ₁ %	C ₂ %	C ₃ %	i-C ₄ %	n-C ₄ %	Abundance		Wetness	i-C ₄ /n-C ₄	δ ¹³ C ₁ PDB
							ΣC ₁ -C ₄ ppm	ΣC ₂ -C ₄ ppm			
600	4683	99.95	0.05	-	-	-	28250	15	5 . 10 ⁻⁴	-	-67.3
750	4684	99.70	0.14	0.06	0.03	0.07	1605	5	3 . 10 ⁻³	0.4	-59.4 *
800	4685	99.98	0.01	1.2 . 10 ⁻³	1.9 . 10 ⁻³	0.6 . 10 ⁻³	16163	3	2 . 10 ⁻⁴	3.2	-76.3
900	4686	99.93	0.05	0.01	2.5 . 10 ⁻³	0.8 . 10 ⁻³	12008	8	7 . 10 ⁻⁴	3.1	-81.6
1000	4687	99.92	0.06	0.01	6.0 . 10 ⁻³	3.0 . 10 ⁻³	10008	8	8 . 10 ⁻⁴	2.0	-83.3
1050	4711	99.00	0.60	0.24	0.05	0.06	803	8	0.01	0.8	-70.7 *
1100	4688	87.3	6.3	2.3	1.7	1.8	71	9	0.13	0.9	*
1150	4712	89.9	5.9	2.1	1.0	0.78	129	13	0.10	1.3	*
1200	4689	80.0	12.0	4.0	2.0	2.0	15	3	0.20	1.0	*
1250	4713	90.5	7.9	0.61	0.81	0.30	953	91	0.10	2.7	-50.5 *
1300	4690	99.07	0.58	0.30	-	-	430	4	9 . 10 ⁻³	-	*
1350	4714	99.66	0.16	0.09	0.05	0.06	2328	8	3 . 10 ⁻³	0.8	-53.3 *
1400	4691	98.5	0.62	0.28	0.41	0.19	1015	15	0.01	2.2	-68.9 *
1500	4692	97.2	1.3	0.61	0.50	0.36	867	24	0.03	1.4	-61.1
1600	4693	98.6	0.49	0.45	0.27	0.23	2638	38	0.01	1.2	-58.7
1700	4694	96.5	1.6	1.2	0.38	0.35	1409	49	0.03	1.1	-66.1

cont.

Table 1 cont.

Sample depth (m)	IFE no.	C ₁ %	C ₂ %	C ₃ %	i-C ₄ %	n-C ₄ %	Abundance		Wetness	i-C ₄ /n-C ₄	δ ¹³ C ₁ PDB
							ΣC ₁ -C ₄ ppm	ΣC ₂ -C ₄ ppm			
1800	4695	91.5	3.7	3.3	0.91	0.67	2537	217	0.09	1.4	-59.2
1900	4696	90.3	3.6	4.3	0.90	0.83	277	27	0.10	1.1	-29.9 *
1950	4708	82.9	3.3	6.1	3.4	4.5	1075	185	0.17	0.8	-48.6
2000	4697	68.6	11.3	11.2	3.5	5.4	1341	421	0.31	0.6	-48.7
2050	4709	82.1	7.4	6.5	1.6	2.4	4530	810	0.18	0.7	-59.2
2150	4710	75.7	4.8	10.5	2.9	6.2	1744	424	0.24	0.5	-57.4
2200	4699	41.7	14.8	22.5	6.7	14.4	432	252	0.58	0.5	-45.3
2293	4700	22.8	35.6	29.7	4.0	8.0	18089	13969	0.77	0.5	-30.2 *
2383	4701	40.2	25.6	27.0	3.3	3.9	12923	7723	0.60	0.8	-41.8
2473	4702	38.1	33.3	21.9	2.3	4.3	5460	3379	0.62	0.5	-41.2
2563	4703	44.2	17.9	25.4	4.1	8.4	2934	1637	0.56	0.5	-36.2 *
2653	4704	65.2	6.8	11.2	5.2	11.8	161	56	0.35	0.4	-45.3
2743	4705	39.5	21.1	23.7	4.6	10.9	76	46	0.61	0.4	
2788	4947	40.0	10.9	32.0	5.4	12.0	175	105	0.60	0.5	
2833	4706	70.4	7.8	14.4	2.7	4.7	257	76	0.30	0.6	-40.4

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KJELLER ADDRESS N-2007 Kjeller, Norway TELEPHONE +47 2 712560 - 713560 TELEX 74 573 energ n TELEFAX +47 2 715553		HALDEN N-1751 Halden, Norway +47 31 83100 76 335 energ n	AVAILABILITY Private Confidential
REPORT TYPE	REPORT NO. IFE/KR/F-86/070	DATE 1986-06-02	
	REPORT TITLE REPORT ON STABLE ISOTOPES ($\delta^{13}\text{C}$, δD) ON A NATURAL GAS FROM WELL 25/6-1	DATE OF LAST REV.	
	CLIENT Saga Petroleum A.S	REV. NO.	
	CLIENT REF. Arne Forsberg	NUMBER OF PAGES 5	
		NUMBER OF ISSUES 15	
SUMMARY The gas components C_1 - C_4 have been separated from the natural gas of well 25/6-1 and the $\delta^{13}\text{C}$ values of these components have been measured. The isotopic composition of hydrogen from CH_4 has also been measured.		DISTRIBUTION Saga (10) Andresen, B. Brevik, E.M. Råheim, A.	
<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: auto;"> <p>86 - 5763 - BA</p> <p>17 SEPT. 1986</p> <p>REGISTRERT</p> <p>OLJEDIREKTORATET</p> </div>			
KEYWORDS			
NAME		DATE	SIGNATURE
PREPARED BY Bjørg Andresen Einar Brevik Arne Råheim		1986-06-02 1986-06-02 1986-06-02	<i>Bjørg Andresen</i> <i>E. Brevik</i> <i>Arne Råheim</i>
REVIEWED BY			
APPROVED BY Karen Garder		1986-06-02	<i>Karen Garder</i>

1. ANALYTICAL PROCEDURE

The natural gas has been quantified and separated into the different gas components by a Carlo-Erba 4200 instrument. This gas chromatograph is equipped with a special injection loop in order to concentrate the samples, in the case of low concentration of the gas components. The hydrocarbon gas components were oxidized in separate CuO-ovens in order to prevent cross contamination. The combustion products CO₂ and H₂O were frozen into collection vessels and separated.

The water was reduced with zinc metal in a sealed tube to prepare hydrogen for isotopic analysis. The isotopic measurements were performed on a Finnigan Mat 251 mass spectrometer. Our $\delta^{13}\text{C}$ value on NBS-22 is $-29.77 \pm .06$ o/oo.

2. RESULTS

The composition of the samples are given in Table 1. The results have been normalized to 100%. The stable isotope results are given in Table 2.

Our uncertainty on the $\delta^{13}\text{C}$ value is estimated to be ± 0.3 o/oo and includes all the different analysis step. The uncertainty on the δD value is likewise estimated to be ± 5 o/oo.

Table 1 Composition of a natural gas from well 25/6-1

Sample	IFE no.	C ₁ %	C ₂ %	C ₃ %	i-C ₄ %	n-C ₄ %	CO ₂ %	EC ₁ -C ₄	$\frac{\text{EC}_2\text{-C}_4}{\text{EC}_1\text{-C}_4}$	$\frac{\text{i-C}_4}{\text{n-C}_4}$
25/6-1 A-14390	4986	66.5	14.0	13.0	1.9	2.9	1.7	98.3	0.32	0.65

Table 2 Isotopic composition of a natural gas from well 25/6-1

Sample	IFE no.	C ₁		C ₂	C ₃	i-C ₄	n-C ₄
		$\delta^{13}\text{C}$	δD SMOW	$\delta^{13}\text{C}$	$\delta^{13}\text{C}$	$\delta^{13}\text{C}$	$\delta^{13}\text{C}$
25/6-1 A-14390	4986	-48.9	-225	-29.9	-28.0	-25.6	-26.7

GEOCHEM LABORATORIES LIMITED

CHESTER STREET, CHESTER CH4 8RD, ENGLAND
phone (0244) 671121 · telex 61297 · cable Geochem Chester.

Prepared for

SAGA PETROLEUM A.S.

GEOCHEMICAL EVALUATION OF SAGA'S 25/6-1 WELL.

August 1986

GEOCHEM



**Petroleum
Geochemistry
Division**



INTRODUCTION

This report presents a geochemical evaluation of Saga Petroleum's 25/6-1 well.

The analytical format employed in this study was specified by Arne Forsberg and was designed to achieve the following objectives:-

- a) to investigate the hydrocarbon source potential of the section in terms of source richness, maturity and the potential for oil or gas
- b) to detect and characterise shows of migrated hydrocarbons
- c) to test the correlation between the condensate produced from 2279.8 metres and selected potential source rocks.

Detailed discussions of Organic Facies, Source Richness, Thermal Maturity, Show Detection, Show Characterisation and Oil Correlation are presented in the appropriate text chapters and have been integrated to form the Conclusions.

This project was authorised by Arne Forsberg, Saga Petroleum A.S., Høvik.

ANALYTICAL

Two hundred and seventy one (271) canned ditch cuttings samples were received from the interval 270-2881 metres. These samples were composited on an interval of ten (10) metres above 2230 metres and generally, over nine (9) metres below this depth. In addition thirty seven (37) sidewall cores were submitted from the gross interval 1052-2503 metres and four (4) core samples from 2299-2309.8 metres. Samples of the gas and condensate tested from 2279.8 metres (single flask FMT) were also included in this study. These samples were assigned the Geochem job number 1280.

Depths are reported relative to KB. Geochem were advised that casing shoes were set at 255 metres, 1013 metres, 2180 metres and 2355 metres.

Formation tops (see below) were supplied by Saga but no well logs were available for this study.

No significant contamination was observed during the sample preparation procedures.



Geochem were initially instructed to run the light hydrocarbon analysis every fifty (50) metres from 600-2230 metres and every eighteen (18) metres below this depth, with sample preparation and total organic carbon analyses upon every second sample below 2230 metres. These data were submitted to Saga who then selected the samples for further analysis and also specified total organic carbon analyses upon the remaining samples from 2230-2500 metres.

The total number of analyses performed in this study are tabulated below.

ANALYSIS	NUMBER OF ANALYSES			
	CUTTINGS	SWC	CORE	FLUID
Headspace and cuttings gas	70			
Sample preparation	53	37	4	
Total organic carbon	101	37	4	
Pyrolysis	31	37	4	
Vitrinite reflectance	0	0	0	
Kerogen type and spore colouration	16	10	1	
C ₁₅₊ extraction and chromatography	16	10	1	1
Capillary GC - paraffin-naphthenes	16	10	1	1
Capillary GC - aromatics	16	10	1	1
Capillary GC - whole oil				1
Pyrolysis-GC	16	10	1	
Carbon isotopes - extract fractions	22	4	1	5
Carbon isotopes - pyrolysate	10*	4*	1	
Carbon isotopes - gas				1
GC-MS biomarker analysis	14	10	1	1
Sulphur content				1
V-Ni contents				1

*including 5 samples for which insufficient liquid material even upon repeat analysis, 3 substitutes chosen.

Two (2) GC-MS biomarker analyses could not be run due to lack of sample material.



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-274 SWC	1052m	A 98% Sandstone, fine grained, clay matrix, often matrix supported, sl. banding, soft, non-calc., light yellowish grey	5Y8/2	0.62
1280-275 SWC	1099m	A 98% Sandstone, fine grained, clay matrix, soft, non-calc., light olive grey	5Y5/2	1.03
1280-276 SWC	1157m	A 98% Sandstone, fine grained, clay matrix, sl. micaceous, soft, non-calc., light olive grey	5Y5/2	1.52,1.48
1280-277 SWC	1209m	A 98% Claystone, sl. silty, subfissile, mod. soft, non-calc., olive grey	5Y4/1	1.43
1280-278 SWC	1277.5m	A 98% Claystone, as 1280-277A	5Y4/1	1.06
1280-279 SWC	1350m	A 98% Claystone, v. sl. silty, subfissile, mod. soft, non-calc., olive grey	5Y4/1	1.45
1280-280 SWC	1405m	A 98% Claystone, sl. silty, subfissile, mod. soft, non-calc., olive grey	5Y4/1	1.52
1280-281 SWC	1491.5m	A 98% Claystone, subfissile, mod. soft, non-calc., yellowish grey	5Y8/1	0.68
1280-282 SWC	1563m	A 98% Claystone, as 1280-281A	5Y8/1	0.49,0.50
1280-283 SWC	1621.5m	A 98% Claystone, as 1280-281A	5Y8/1	0.45
1280-284 SWC	1771.5m	A 98% Claystone, as 1280-281A	5Y8/1	1.85
1280-285 SWC	1918m	A 98% Claystone, subfissile, mod. soft, non-calc., olive grey to dark olive grey	5Y4/1- 5Y3/1	1.19
1280-286 SWC	1975m	A 98% Claystone, as 1280-285A	5Y4/1- 5Y3/1	2.68
1280-287 SWC	1999.5m	A 98% Claystone, as 1280-285A	5Y4/1- 5Y3/1	1.56
1280-288 SWC	2032m	A 98% Claystone, subfissile, mod. soft, non-calc., dark olive grey	5Y3/1	1.41,1.45
1280-289 SWC	2090m	A 98% Claystone, as 1280-288A	5Y3/1	0.36
1280-290 SWC	2130m	A 98% Claystone, as 1280-288A	5Y3/1	0.76
1280-291 SWC	2193m	A 98% Claystone, subfissile, mod. soft, non-calc., dark olive grey	5Y3/1	0.73

Abbreviations = arenaceous, argillaceous, calcareous, Cut, dolomitic, Fluorescence, foraminifera, fossiliferous
Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-292 SWC	2221m	A 98% Shaly claystone, fissile, mod. soft, non-calc., medium dark grey	N4	0.45
1280-200	2230m	A 45% Chalk, blocky, soft, white B 30% Shale, fissile to subfissile, mod. hard, sl. calc., light medium bluish grey C 25% Shaly mudstone, subfissile to sub-fissile, mod. hard, sl. calc., greyish red	N9 5B6/1 10R4/2	0.18 0.66 0.25
1280-201	2239m	A 90% Shale, fissile, mod. hard, non to sl. calc., dark grey to dark olive grey B 10% Shale, fissile to subfissile, mod. hard, sl. calc., medium light bluish grey	N3- 5Y3/1 5B6/1	7.88 0.37
1280-293 SWC	2243m	A 98% Shaly claystone, as 1280-292A	N4	8.08,8.16
1280-202	2248m	A 90% Shale, fissile, mod. hard, non to sl. calc., dark grey to dark olive grey B 10% Shale, as 1280-200B, caved Minor caved red shaly mudstone, chalk	N3- 5Y3/1 5B6/1	7.95,7.99
1280-294 SWC	2251m	A 98% Shale, fissile, mod. hard, non-calc., dark olive grey to dark grey	5Y3/1- N3	5.49
1280-295 SWC	2254m	A 98% Shale, as 1280-294A	5Y3/1- N3	3.06
1280-296 SWC	2256m	A 98% Shaly claystone, subfissile, mod. hard, non-calc., olive grey to dark olive grey	5Y4/1- 5Y3/1	4.16
1280-203	2257m	A 80% Shale, as 1280-201A B 10% Shale, as 1280-201B C 10% Shale, fissile to subfissile, mod. hard, sl. calc., greyish red	N3- 5Y3/1 5B6/1 10R4/2	7.28 0.29 0.28,0.31
1280-297 SWC	2258m	A 98% Shale, fissile, mod. hard, non-calc., dark grey to dark olive grey	N3- 5Y3/1	7.43
1280-298 SWC	2264.0m	A 98% Shale, as 1280-297A	N3- 5Y3/1	5.92
1280-299 SWC	2270m	A 98% Shaly mudstone, subfissile, mod. hard, non-calc., dark olive grey to olive grey	5Y3/1- 5Y4/1	2.33,2.37
1280-300 SWC	2273m	A 98% Shaly mudstone, as 1280-299A	5Y3/1- 5Y4/1	1.98
1280-204	2275m	A 98% Shale, as 1280-202A Minor caved red shale, grey chalk	N3- 5Y3/1	6.38

Abbreviations = arenaceous, argillaceous, calcareous, Cut, dolomitic, Fluorescence, foraminifera, fossiliferous
Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-301 SWC	2276m	A 98% Aren. mudstone, matrix supported, fine grained, massive, mod. hard, medium olive grey	5Y5/1	1.54
1280-205	2284m	A 85% Shale, as 1280-201A, sig. cavings B 15% Sandstone, often unconsolidated, fine grained, subangular, mod. sorted, poorly cemented, v. light grey to white Minor red and grey shales	N3- 5Y3/1 N8-9	6.59
1280-206	2293m	A 75% Shale, as 1280-202A, sig. cavings B 25% Sandstone, fine grained, sub-angular, mod. sorted, poorly cemented, white Minor caved red and grey shales	N3- 5Y3/1 N9	5.79
1280-302 CORE	2299m	A 98% Shale, fissile, mod. hard, non-calc., olive grey Minor sandstone	5Y4/1	1.14
1280-207	2302m	A 60% Shale, as 1280-201A, sig. cavings B 30% Sandstone, as 1280-205B C 10% Shale, fissile to subfissile, mod. hard, sl. to mod. calc., medium light bluish grey Minor red shale	N3- 5Y3/1 N8-9 5B6/1	6.63 0.25
1280-303 CORE	2302.8m	A 80% Shale, as 1280-302A B 20% Sandstone, v. fine grained, mod. sorted, occurring as thin bands in the shale, white	5Y4/1 N9	0.98
1280-304 CORE	2305.2m	A 80% Shale, fissile, mod. hard, non-calc., olive grey B 20% Sandstone, v. fine grained, mod. sorted, occurring as thin bands in the shale, white	5Y4/1 N9	1.01, 1.03
1280-305 CORE	2309.8m	A 98% Shale, fissile, mod. hard, non-calc., sl. micaceous, olive grey	5Y4/1	1.15
1280-306 SWC	2310.0m	A 98% Shaly claystone, fissile, mod. soft, non-calc., dark olive grey	5Y3/1	1.03

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Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-208	2311m	A 35% Chalk, blocky, soft, sig. cavings, white	N9	0.12
		B 20% Shale, fissile, mod. hard, sl. calc., sig. cavings, light medium bluish grey	5B6/1	0.32
		C 20% Shale, fissile, mod. hard, non to sl. calc., dark grey to dark olive grey	N3- 5Y3/1	6.59
		D 15% LCM - cement		
		E 10% Shale, fissile, mod. hard, sl. calc., sig. cavings, greyish red	10R4/2	0.14,0.16
1280-307 SWC	2320m	A 98% Shale, fissile, mod. soft, non-calc., micaceous, olive grey	5Y4/1	1.05
1280-209	2312m	A 50% Shale, fissile, mod. hard, non to sl. calc., sig. cavings, dark grey to dark olive grey	N3- 5Y3/1	6.81
		B 35% Sandstone, often unconsolidated, fine grained, subangular, mod. sorted, poorly cemented, v. light grey to white	N8-9	
		C 10% Shale, fissile to subfissile, mod. hard, sl. to mod. calc., medium light bluish grey	5B6/1	0.22,0.23
		D 5% Shale, fissile to subfissile, mod. hard, sl. calc., olive grey Minor red shale	5Y4/1	1.28
1280-210	2320m	A 60% Shale, fissile to subfissile, mod. hard, sl. calc., sl. silty, olive grey	5Y4/1	1.23
		B 20% Shale, as 1280-209A	N3- 5Y3/1	6.61
		C 20% Sandstone, as 1280-209B Minor grey and red shale, marl	N8-9	
1280-211	2329m	A 90% Shale, fissile, mod. hard, non-calc., olive grey	5Y4/1	1.31
		B 10% Sandstone, v. fine grained, mod. sorted, sl. calc. cement, white	N9	
1280-212	2338m	A 80% Shale, as 1280-210A	5Y4/1	1.08
		B 20% Sandstone, as 1280-209B	N8-9	
1280-308 SWC	2340m	A 98% Shale, as 1280-307A	5Y4/1	1.12
1280-213	2347m	A 75% Shale, as 1280-211A, sig. cavings	5Y4/1	1.03
		B 25% Sandstone, as 1280-211B	N9	
1280-309 SWC	2350m	A 98% Shaly claystone, subfissile, mod. soft, non-calc., olive grey	5Y4/1	1.42
1280-214	2356m	A 60% Shaly mudstone, subfissile to subplaty, mod. hard, sl. calc., medium olive grey	5Y5/1	1.31,1.33
		B 40% Sandstone, as 1280-209B	N8-9	

Abbreviations = arenaceous, argillaceous, calcareous, Cut, dolomitic, Fluorescence, foraminifera, fossiliferous
Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-215	2365m	A 60% Sandstone, v. fine grained, mod. sorted, sl. calc. cement, white	N9	
		B 40% Shale, fissile, mod. hard, non-calc., olive grey	5Y4/1	1.06
1280-216	2374m	A 80% Shaly mudstone, subfissile to subplaty, mod. hard, sl. calc., medium olive grey	5Y5/1	1.24
		B 20% Sandstone, often unconsolidated, fine grained, subangular, mod. sorted, poorly cemented, v. light grey to white	N8-9	
1280-217	2383m	A 60% Sandstone, v. fine grained, mod. sorted, sl. calc. cement, white	N9	
		B 40% Shale, fissile, mod. hard, non-calc., olive grey	5Y4/1	1.25
1280-218	2392m	A 85% Shaly mudstone, subfissile to subplaty, mod. hard, sl. calc., medium olive grey	5Y5/1	1.00
		B 15% Sandstone, often unconsolidated, fine grained, subangular, mod. sorted, poorly cemented, v. light grey to white	N8-9	
1280-219	2401m	A 65% Sandstone, v. fine grained, mod. sorted, sl. calc. cement, white	N9	
		B 35% Shale, fissile, mod. hard, non-calc., olive grey	5Y4/1	1.06,1.07
1280-310 SWC	2410m	A 98% Shaly claystone, subfissile, mod. soft, non-calc., olive grey	5Y4/1	0.86,0.82
1280-220	2410m	A 90% Shaly mudstone, as 1280-218A	5Y5/1	1.02
		B 10% Sandstone, as 1280-218B	N8-9	
1280-221	2419m	A 75% Shale, fissile, mod. hard, sl. calc., medium dark grey to olive grey	N4- 5Y4/1	1.01
		B 25% Sandstone, as 1280-219A Minor limestones	N9	
1280-222	2428m	A 55% Shale, fissile to subfissile, mod. hard, sl. calc., medium dark grey to olive grey	N4- 5Y4/1	3.73
		B 30% Sand, medium grained, subrounded to rounded, white	N9	
		C 15% Sandstone, fine grained, subangular, mod. to fairly well sorted, v. light grey to white Minor red and grey shales	N8-9	
1280-223	2437m	A 65% Shale, fissile, mod. hard, sl. calc., sig. cavings, medium dark grey to olive grey	N4- 5Y4/1	3.63
		B 35% Sandstone, generally unconsolidated, fine to medium grained, subangular, mod. to fairly well sorted, white	N9	

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Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-311 SWC	2441.5m	A 98% Carb. shale, subfissile, mod. soft, greyish black	N2	22.00
1280-224	2446m	A 45% Shale, fissile to subfissile, mod. hard, sl. calc., medium dark grey to olive grey B 30% Sand, medium grained, subrounded to rounded, white C 15% Coal, sl. arg., platy, brittle, greyish black D 10% Sandstone, fine grained, subangular, mod. to fairly well sorted, v. light grey to white	N4- 5Y4/1 N9 N2 N8-9	1.38 51.60,52.10
1280-225	2455m	A 65% Shale, fissile, mod. hard, sl. calc., sig. cavings, medium dark grey to olive grey B 30% Sandstone, generally unconsolidated, fine to medium grained, subangular, mod. to fairly well sorted, white C 5% Coal, sl. arg., platy, brittle, greyish black	N4- 5Y4/1 N9 N2	2.84 39.30
1280-226	2464m	A 55% Sand, medium grained, subrounded to rounded, white B 30% Shale, fissile to subfissile, mod. hard, sl. calc., medium dark grey to olive grey C 10% Sandstone, fine grained, subangular, mod. to fairly well sorted, v. light grey to white D 5% Coal, sl. arg., platy, brittle, greyish black	N9 N4- 5Y4/1 N8-9 N2	1.94 28.50
1280-227	2473m	A 50% Sand, medium grained, well rounded, pinkish grey B 40% Shale, as 1280-223A, abundant cavings C 10% Sandstone, as 1280-223B Minor other shale	5YR8/1 N4- 5Y4/1 N9	2.50
1280-228	2482m	A 60% Shale, as 1280-226B B 30% Sand, medium grained, well rounded, pinkish grey C 10% Coal, as 1280-226D Minor sandstone	N4- 5Y4/1 5YR8/1 N2	2.40 32.80
1280-312 SWC	2484.5m	A 98% Shaly claystone, subfissile, mod. hard, non-calc., olive grey	5Y4/1	0.26
1280-313 SWC	2488m	A 98% Shale, aren. in part, fissile, mod. hard, non-calc., medium olive grey	5Y5/1	2.32

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Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-229	2491m	A 55% Shale, subfissile, mod. hard, non-calc., dusky yellowish brown	10YR2/2	0.55
		B 30% Sand, medium grained, well rounded, pinkish grey	5YR8/1	
		C 15% Coal, sl. arg., platy, brittle, greyish black	N2	38.00
1280-230	2500m	A 80% Shale, fissile, mod. hard, non-calc., dark olive grey	5Y3/1	0.52,0.53
		B 20% Sand, medium grained, well rounded, pinkish grey Minor coal, purple shale	5YR8/1	
1280-314 SWC	2503m	A 98% Shaly claystone, subfissile, mod. soft, non-calc., sl. silty, olive grey	5Y4/1	0.17
1280-231	2509m	A 65% Sand, fine to medium grained, subangular to subrounded, fairly well sorted, white	N9	
		B 30% Shale, as 1280-229A, sig. cavings	10YR2/2	0.43
		C 5% Coal, as 1280-229C, caved	N2	
1280-233	2527m	A 70% Shale, as 1280-229A, sig. cavings	10YR2/2	0.55
		B 30% Shale, fissile to subfissile, mod. hard, non-calc., greyish red Minor sandstone, sand	5R4/2	0.11
1280-235	2545m	A 90% Shale, fissile to subfissile, mod. hard, non-calc., greyish red	5R4/2	0.12,0.13
		B 10% Sandstone, v. fine grained, mod. hard, calc. matrix, light greenish grey Minor caved other shale	5G8/1	
1280-237	2563m	A 60% Shale, as 1280-235A, sig. cavings	5R4/2	0.17
		B 25% Shale, subfissile, mod. hard, non-calc., medium dark grey to olive grey	N4- 5Y4/1	1.00
		C 15% Sandstone, as 1280-235B	5G8/1	
1280-239	2581m	A 65% Shale, as 1280-235A, sig. cavings	5R4/2	0.15
		B 20% Shale, as 1280-237B, sig. cavings	N4- 5Y4/1	4.13
		C 15% Sandstone, as 1280-235B	5G8/1	
1280-241	2599m	A 50% Shale, fissile to subfissile, mod. hard, non-calc., sig. cavings, greyish red	5R4/2	0.17
		B 50% Sand, fine to medium grained, sub-angular, fairly well sorted, white Minor other shale	N9	

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS



GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-243	2617m	A 55% Shale, fissile to subfissile, mod. hard, non-calc., sig. cavings, greyish red B 45% Sandstone, dominantly unconsolidated, N9 fine to medium grained, subangular, fairly well sorted, calc. matrix, white	5R4/2	0.11
1280-245	2635m	A 55% Sandstone, as 1280-243B B 45% Shale, as 1280-243A, sig. cavings	N9 5R4/2	0.09
1280-247	2653m	A 65% Shale, as 1280-243A, sig. cavings B 35% Sandstone, as 1280-243B	5Y4/2 N9	0.10
1280-249	2671m	A 70% Shale, fissile to subfissile, mod. hard, non-calc., greyish red B 25% Sandstone, as 1280-243B C 5% Shale, fissile, mod. hard, sl. calc., greenish grey	10R4/2 N9 5G6/1	0.10 0.11
1280-251	2689m	A 80% Shale, as 1280-249A B 20% Sandstone, as 1280-243B	10R4/2 N9	0.11, 0.12
1280-253	2707m	A 90% Shale, as 1280-249A B 10% Sandstone, fine to medium grained, subangular, mod. sorted, white Minor other shale	10R4/2 N9	0.11
1280-255	2725m	A 70% Shale, as 1280-249A, sig. cavings B 30% Sandstone, as 1280-253B	10R4/2 N9	0.09
1280-257	2743m	A 70% Shale, fissile to subfissile, mod. hard, non-calc., greyish red B 25% Sandstone, fine to medium grained, subangular, mod. sorted, white C 5% Shale, subfissile, mod. hard, sl. calc., greenish grey	10R4/2 N9 5G6/1	0.10 0.12
1280-259	2761m	A 80% Shale, as 1280-257A, sig. cavings B 20% Sandstone, as 1280-257B Minor other shale	10R4/2 N9	0.12
1280-261	2779m	A 85% Shale, as 1280-257A, sig. cavings B 15% Sandstone, as 1280-257B Minor other shale	10R4/2 N9	0.10
1280-263	2797m	A 60% Shale, as 1280-257A B 20% Sandstone, v. fine grained, fairly well sorted, moderate reddish brown C 20% Sandstone, as 1280-257B Minor other shale	10R4/2 10R4/6 N9	0.10
1280-265	2815m	A 65% Shale, fissile to subfissile, mod. hard, greyish red B 25% Sandstone, v. fine grained, fairly well sorted, moderate reddish brown C 10% Sandstone, fine to medium grained, subangular, mod. sorted, white	10R4/2 10R4/6 N9	0.12

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Lost Circulation Material, moderately, occasionally, slightly, very



TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
1280-267	2833m	A 80% Shale, fissile to subfissile, mod. hard, greyish red	10R4/2	0.17
		B 10% Sandstone, v. fine grained, fairly well sorted, moderate reddish brown	10R4/6	
		C 10% Sandstone, fine to medium grained, subangular, mod. sorted, white	N9	
1280-269	2851m	A 50% Sandstone, as 1280-267C	N9	0.20
		B 40% Shale, as 1280-267A, sig. cavings	10R4/2	
		C 10% Sandstone, as 1280-267B	10R4/6	
1280-271	2869m	A 90% Igneous, coarse grained, granitic, white/moderate reddish orange	N9/ 10R6/6	0.12, 0.12
		B 10% Shale, as 1280-267A, abundant cavings Minor sandstone	10R4/2	
1280-273	2881m	A 90% Igneous, as 1280-271A	N9/ 10R6/6	
		B 10% Shale, fissile to subfissile, mod. hard, greyish red Minor other caved shale	10R4/2	

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 2A
CONCENTRATION (VOL. PPM OF ROCK) OF C₁ - C₇ HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C ₁ Methane	C ₂ Ethane	C ₃ Propane	iC ₄ Isobutane	nC ₄ Butane	TOTAL C ₁ - C ₄	TOTAL C ₂ - C ₄	% GAS WETNESS	TOTAL C ₅ - C ₇	$\frac{iC_4}{nC_4}$
1280-037	600	1799	21	6	1	2	1830	31	1.7	21	0.62
1280-042	650	2590	10	11	1	3	2615	26	1.0	15	0.35
1280-047	700	2075	17	7	1	2	2102	27	1.3	9	0.53
1280-052	750	11483	36	6	1	3	11529	46	0.4	49	0.29
1280-057	800	2101	10	3	0	1	2116	15	0.7	31	0.31
1280-062	850	4469	20	3	0	1	4493	25	0.5	29	0.20
1280-067	900	5371	30	7	2	4	5414	43	0.8	1	0.48
1280-072	950	3973	14	3	0	1	3991	18	0.5	9	0.23
1280-077	1000	3704	18	4	1	1	3729	24	0.7	8	0.40
1280-082	1050	504	5	1	0	0	511	6	1.2	10	0.10
1280-087	1100	22	1	0	0	0	24	2	7.6	5	0.20
1280-092	1150	13	1	1	0	0	15	2	12.3	6	0.24
1280-097	1200	42	11	4	0	1	58	17	28.5	170	0.23
1280-102	1250	29	112	4	1	3	149	120	80.6	35	0.50
1280-107	1300	59	5	2	0	1	67	8	11.6	18	0.30
1280-112	1350	11	1	1	0	0	13	2	17.5	5	0.39
1280-117	1400	236	3	1	0	1	241	4	1.8	5	0.23
1280-122	1450	1036	18	11	5	7	1077	41	3.8	57	0.73
1280-127	1500	1577	20	12	8	7	1624	47	2.9	40	1.11
1280-132	1550	1161	13	5	3	1	1184	23	1.9	6	1.91
1280-137	1600	696	9	5	2	1	713	18	2.5	11	1.73
1280-142	1650	991	13	8	3	2	1017	26	2.5	14	1.86
1280-147	1700	2135	31	22	6	5	2199	64	2.9	18	1.34
1280-152	1750	1323	18	11	3	2	1356	34	2.5	4	1.15
1280-157	1800	1118	29	20	6	4	1176	59	5.0	14	1.42
1280-162	1850	853	23	14	4	3	897	44	4.9	7	1.31
1280-167	1900	441	13	15	8	8	486	45	9.2	32	0.95
1280-172	1950	817	40	38	15	20	930	112	12.1	86	0.77
1280-177	2000	2178	168	132	36	49	2563	386	15.0	132	0.74
1280-182	2050	1125	157	84	20	26	1413	288	20.4	84	0.77