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Report

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Copy 1 S. Johnstad Copy 2-8 A.S.Lycke,Sa 8 Copy 9 G. C. Speers Copy 10 E. Roaldset Arch. Geol.Dept. Archive, Bg. gcs840809s	PETROLEUM GEOCHEMICAL STUDIES ON WELL 29/9-1 by Gordon C. Speers Work by: L. Aakvaag, B. Dahl, T. Bockelie and G. Soutter U-390	

Summary/Conclusion/Recommendation

Petroleum geochemical studies on Well 29/9-1 showed significant differences between maturity estimations by vitrinite reflectance and sporomorph colour determinations. High vitrinite values may be due to the difficulty of differentiating autochthonous and allochthonous components, and low SCI values to the oxidation/corrosion of sporomorphs. Other geochemical parameters supported a lower level of maturity than that indicated by vitrinite reflectance. The Kimmeridge Clay Fm. was a good source rock with an average TOC content of approx. 5% wt, an S_2 value of approx. 8 kg/tonne and an apparently good oil potential. The Heather Fm. was also a good source rock, but displayed a quality decrease with depth; hydrocarbon potential was mainly for gas. The Drake Fm. in the Lower Jurassic was the only other formation which displayed a significant residual gas potential.

Key words			Subject category
Organic Geochemistry, Petroleum Geochemistry, Hild Field			Petroleum Geochemistry
Division/Section/Dept. F-Bergen/Geology	Field/Block/Well Hild Field Well 29/9-1		Page 10 + 3 tables/3 figs Report ☒ Note ☐
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INTRODUCTION

Following the drilling of Well 29/9-1 wet cuttings samples, together with a number of sidewall cores, were selected for organic geochemical analyses. The latter consisted of determination of Rock Eval parameters, together with selected measurements of total organic carbon, pyrolysis-gas chromatography evaluations and maturity estimations by vitrinite reflectance and spore colouration indices.

SAMPLING AND TECHNIQUES

1) Sampling

Wet cuttings samples were washed free of drilling mud and collected on sieves in various size fractions. After drying at low temperature (40^{o}C), obvious adventitious contamination was removed from the fraction of size range 1-2 mm, and samples were picked corresponding to organic-rich material in the interval examined as described on the detailed well lithological log.

Sidewall cores were washed free of any obvious contamination and, after drying at 40^{o}C, were sampled from their interior sections.

2) Techniques

Screening analyses were carried out using a Rock Eval Mark 2 (No. 43) and noting S_1, S_2 and S_3 and T_{Max} values. Pyrolysis gas chromatography was carried out using a BP designed instrument made available to Norsk Hydro. TOC values were determined using a Perkin Elmer Elemental Analyser Model 240C. Samples for the latter determinations were decarbonated by a standard wet procedure using 2N HCl.

Vitrinite reflectance determinations were made on either coarsely crushed sediments or kerogen concentrates. Samples were mounted in Epoxy blocks (25 mm diam.), ground, polished, cleaned ultrasonically and washed in alcohol. Measurements were carried out with a Leitz MPV3 Microspectrophotometer at a wavelength of 546 nm under oil immersion. Attempts were made to scan a sufficient number of particles in order to provide statistically reliable results.

Kerogen concentrates were prepared by treatment of crushed sediment samples with HCl (10%) and HF (40%). If large amounts of clay minerals were present, sieving and separation in $ZnBr_2$ was undertaken. Residues were subsequently sieved and divided into fractions 15 - 100 µm and > 100 µm. The kerogen concentrates were dried and mounted in Elvasite 2044 on glass slides. Colour assessments (based mainly on palynomorphs) were made with a Zeiss photomicroscope I using a blue filter (BG12) and comparison with a set of standard SCI slides (RRI).

C) RESULTS AND DISCUSSION

1) Results

Table 1 gives the results of pyrolysis and TOC determinations. Values of S_1, S_2, T_{Max}, Production Index (PI), Hydrogen Index (HI) and TOC are also plotted on the Geochemical Log shown in Fig. 1. Vitrinite reflectance data is summarized in Table 2, and the variation with depth of $\ln R_o$ is shown in Fig. 2. Palynomorph colour indices are given in Table 3, and their variation with depth is shown in Fig. 3.

2) Discussion

As maturation can have a marked influence upon various geochemical parameters, especially those related to source rock evaluations, maturity variations will be examined first.

The major parameters used for maturity assessment in Well 29/9-1 were vitrinite reflectance and sporomorph colour index (SCI). Rock Eval parameters such as T_{Max} and Production Index were also examined to see if they were mainly reflecting maturity.

Vitrinite reflectance results are given in detail in Table 2, where it can be seen that 4 samples gave such poor results (too few readings and/or lack of vitrinite fragments) that it was not considered worthwhile including the data, and 2 other samples (2998 m and 3407 m) recorded less than 10 separate particles. However, the remaining sample distributions were acceptable, and the calculated regression line of $\ln R_o$ v. depth (Fig. 2) gave a satisfactory correlation coefficient. The samples from 2315 m and 2998 m showed some departure from this depth trend; the higher value of the sample from 2315 m was most likely the result of inclusion of allochthonous components within the autochthonous distribution as it was difficult to separate the two populations; the lower value of the sample from 2998 m may be the result of a limited number of readings, with a rather large spread of values, combined with the possible inclusion of "bituminite" values with the autochthonous vitrinite readings.

The trend shown in Fig. 2 suggests the following:

(a) no highly abnormal heat flow exists at depth in this well as the results still show a satisfactory linear correlation below 4000 m.

(b) no marked unconformity exists over the depth interval examined or, if present, its effect on the vitrinite reflectance trend has been subsequently eliminated by higher regional heat flow.

(c) sediments down to approx. 2800 m i.e. the top section of Upper Cretaceous Formation "D" are effectively immature.

(d) if oil-prone sediments are present, then significant liquid hydrocarbon generation would be occurring in the depth range 3000 - 3600 m.

(e) similarly, if gas-prone source rocks are present, then major gas generation would occur below approx. 3300 m i.e. deeper than the lower section of the Upper Cretaceous "D" Formation.

(f) sediments below approx. 4100 m i.e. Upper Jurassic down to top Statfjord Formation, are post mature.

The Sporomorph Colour Indices shown in Table 3 follow the same scheme of maturity levels used by Robertson Research viz:

SCI	Maturity
3.5- 5.5	Early mature
5.5- 7.0	Middle mature
7.0- 8.5	Late mature
8.5-10.0	Post mature

As the thermal degradation of sporopollenin is more related to the oil generation process in sediments, it would be expected that SCI variations would more accurately reflect the maturation changes of oil-prone kerogen. However, even allowing for the lower precision of SCI values, there are very considerable differences between the maturation levels indicated by vitrinite reflectance and SCI values in this well, with the latter suggesting a much lower overall level of maturity.

Rock Eval T_{Max} values are affected by kerogen type, and some of the erratic variations shown in Table 1 and Fig. 1 are probably due to this influence. Very low S_2 values also tend to result in anomalous T_{Max} values. However, although by no means unequivocal, the T_{Max} trend from Fig. 1 and Table 1 more closely supports the spore colour indications rather than the vitrinite maturation levels. Values of the Production Index (PI) show no very clear variations with depth and are probably influenced by migrated hydrocarbons and/or contamination. The generally high PI values shown in Fig. 1 are, therefore, of no use for assessing maturation trends with depth.

It seems likely, taking into account the various maturation indicators together with the well location and geothermal gradients in this region of the North Sea, that the maturation trend is probably somewhat higher than that indicated by SCI values and lower than that suggested by vitrinite reflectance. Improved assessments of maturity could probably be obtained using a range of biomarker measurements based upon steranes and triterpanes. High vitrinite values could have resulted from the difficulty of separating the populations of autochthonous and allochthonous components. Some of the SCI values, especially those in the Cretaceous, could have been influenced by depositional conditions as many of the palynomorphs appear to be oxidised and corroded and this may have resulted in lighter colours and, hence, lower apparent maturity indications.

Before considering the influence of maturity on source rock evaluations, a comparison will be made between cuttings and sidewall core results on this well. It should be noted that the results given in Table 1 and Fig. 1 record the mean depth for cuttings samples. Down to 3155 m, these represent means of 30 m intervals whereas, below 3887.5 m, cuttings samples depths are means of 15 m intervals.

As a number of the sidewall cores were from the same intervals as the cuttings, it was useful to compare Rock Eval and TOC values on the different types of sample. This is particularly important when, in the normal absence of palaeontological control, considering the possible effects of cavings on samples from underlying formations. For example, the reasonably similar S_2 and TOC values for cuttings and SWC's from the Heather Fm. suggest that the picked cuttings are probably not greatly influenced by cavings from the overlying Kimmeridgian, and that the source rock quality decrease with depth in this Fm. is probably realistic. However, in the Drake Fm., the rather marked differences between S_2 values on cuttings and SWC's suggests a possible influence of cavings from overlying formations.

The results shown in Fig. 1 and Table 1 do not suggest any significant hydrocarbon potential in Tertiary or Cretaceous sediments. Generally, for examination of samples from these, and other, intervals, Rock Eval S_1 and S_2 measurements were used as the primary screening parameter, and only if $S_2 \geqslant 1.5$ kg/tonne, was it considered worthwhile making TOC measurements. This procedure is, of course, modified depending on sample maturity as the latter can have a marked effect upon S_2 values.

Although the Tertiary and Cretaceous appeared to have little source potential, the Production Indices (PI) suggested the presence of migrated hydrocarbons and/or contamination in these intervals. Some of the high PI values are, however, more likely the result of cumulative errors in measuring very low S_1 and S_2 values. This suggestion is supported by examination of results from the Upper Palaeocene, where higher and more accurately measurable P_2 values occur eg. samples from 2045 m, 2075 m, 2135 m and 2165 m, and where the PI values are quite normal for an immature sequence. Analysis of solvent extracts of the samples displaying high PI values would have provided additional indications of the presence of migrated hydrocarbons or contamination, but these were not undertaken. In the deeper, more mature, sequences high PI values are also present in both potential source and reservoir rocks. Results on the latter may well represent migrated hydrocarbons but, again, this was not verified by analysis of solvent extracts.

Within the Upper Jurassic, both the Kimmeridge Clay Fm. and the Heather Fm. are potential source rocks. As can be seen from Table 1 and Fig. 1, the Kimmeridgian has a high average organic carbon content (approx. 5% wt), high S_2 values (average approx. 8 kg/tonne), moderate production indices and relatively low T_{Max} values (average 434°C). These results do not, therefore, support vitrinite reflectance indications that this Fm. is highly mature and almost within the post-mature zone. Hydrogen indices suggest that the hydrocarbon potential of the Kimmeridgian is dominantly gas, but this is not supported by the results of pyrolysis-gas chromatography where low OGPI values indicate a good oil potential. A possible explanation for this discrepancy is that a large amount of allochthonous organic matter is present in these samples and that, consequently, the Hydrogen Index does not reflect the true sediment hydrocarbon potential. The low OGPI values also support a maturation level below that indicated by vitrinite reflectance, as high maturity would result in high OGPI values irrespective of kerogen type.

In view of the reasonable agreement between SWC and cuttings results, it has already been indicated that the organic-rich material from the Heather Fm. is probably not significantly affected by cavings. As indicated by S_1, S_2, and TOC values, the source rock quality of this Fm. decreases with depth. Although maturation is now also influencing these results, the trend within the Heather Fm. is considered realistic. TOC contents decrease fairly regularly from 6 - 7 % wt to approx. 2 % wt, and hydrocarbon yields, as shown by S_2 values, decrease much more rapidly with depth. OGPI values indicate some liquid hydrocarbon potential present near the top of this Fm., with the sediments becoming dominantly gas-prone with depth. The overall hydrocarbon potential of the Fm. is most likely for gas with some liquid (i.e. condensate). Low Hydrogen Indices do not support much liquid potential but, as in the Kimmeridgian, this is probably underestimated due to reworked components.

No significant source potential appears to exist in the Middle - Lower Jurassic other than in the Drake Fm. Maturation is undoubtedly having a significant effect on the results at this depth but, even so, some high S_2 values are still observed eg. 4472.5 m. Cavings from the Drake, and other, Formations are probably also influencing material selected for examination from deeper in the Lower Jurassic. The discrepancy between SWC and cuttings results is also much more evident in the samples from the Drake Fm., suggesting that cuttings indications are probably less reliable in this interval. Low Hydrogen Indices and high OGPI values confirm the marked present gas potential of this Fm.

D) CONCLUSIONS

(1) Significant differences exist between maturity determinations by vitrinite reflectance and spore colouration in Well 29/9-1. Vitrinite reflectance suggests a much higher level of maturity than that shown by SCI determinations.

(2) A possible explanation for high vitrinite values may be the difficulty of separating autochthonous and allochthonous components in the various distributions. Low SCI values may be the result of depositional conditions where oxidation and/or corrosion of sporomorphs results in lighter colours.

(3) Other geochemical parameters tend to support a lower level of maturity than that indicated by vitrinite reflectance. Improved estimations of maturity could be obtained by the use of a range of molecular parameters.

(4) No significant hydrocarbon potential was observed in the Tertiary or Cretaceous sediments examined. Most of the high Production Indices in these formations were most likely the results of errors in Rock Eval measurements of very low S_1 and S_2 values.

(5) The Kimmeridge Clay Fm. was a good source rock with an average TOC of approx. 5 % wt and residual hydrocarbon potential of approx. 8 kg/tonne. Despite low Hydrogen Indices, the samples examined by pyrolysis gas chromatography still had a high oil potential.

(6) The Heather Fm. was also a good source rock, but its quality decreased with depth. Insufficient samples were examined for estimation of an average TOC content, but the latter appeared to decrease from 6 - 7 % wt to approx. 2 % wt. The overall hydrocarbon potential of this Fm. was considered to be gas with some liquid hydrocarbons i.e. condensate.

(7) The Drake Fm. in the Lower Jurassic displayed a significant residual gas potential. Cuttings samples from this interval were probably more affected by cavings than those from the shallower source intervals.

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Pyrolysis Data

DEPTH m	SAMPLE TYPE	S1 kg/t	S2 kg/t	Tmax	PI S1/S1+S2	HI 100*S2/TOC	TOC %	S3 kg/t	OI 100*S3/TOC	OGPI
1715.00	DC	0.07	0.11	421	0.39			0.78		
1745.00	DC	0.11	0.12	417	0.48			0.56		
1775.00	DC	0.05	0.11	422	0.31			0.62		
1805.00	DC	0.15	0.32	426	0.32			0.71		
1835.00	DC	0.17	0.25	422	0.40			0.84		
1865.00	DC	0.08	0.25	422	0.24			0.61		
1895.00	DC	0.07	0.18	420	0.28			0.58		
1925.00	DC	0.10	0.22	423	0.31			0.78		
1955.00	DC	0.04	0.20	419	0.17			0.48		
1985.00	DC	0.04	0.18	421	0.18			0.80		
2015.00	DC	0.02	0.00		1.00					
2045.00	DC	0.07	1.51	429	0.04	122	1.24	0.63	51	
2075.00	DC	0.07	0.89	430	0.07			0.60		
2105.00	DC	0.02	0.17	421	0.11			0.52		
2135.00	DC	0.05	1.47	415	0.03			0.29		
2165.00	DC	0.05	0.83	427	0.06			0.44		
2195.00	DC	0.03	0.00		1.00			0.67		
2225.00	DC	0.02	0.02		0.50			0.94		
2255.00	DC	0.10	0.20	427	0.33			0.75		
2285.00	DC	0.05	0.19	426	0.21			0.66		
2315.00	DC	0.08	0.25	431	0.24			0.50		
2345.00	DC	0.03	0.13	429	0.19			0.76		
2465.00	DC	0.03	0.04	425	0.43			0.98		
2555.00	DC	0.09	0.16	426	0.36			1.05		
2675.00	DC	0.14	0.18	413	0.44			1.28		
2765.00	DC	0.16	0.14	412	0.53			0.53		
2855.00	DC	0.20	0.29	431	0.41			0.82		
2975.00	DC	0.18	0.47	433	0.28			0.64		
2998.00	SWC	0.08	0.39	433	0.17			0.52		
3065.00	DC	0.06	0.10	428	0.37			0.65		
3155.00	DC	0.09	0.07	423	0.56			0.71		
3203.00	SWC	0.04	0.09	369	0.31			0.49		
3407.00	SWC	0.08	0.07	375	0.53			0.39		
3603.00	SWC	0.06	0.04	348	0.60			0.62		
3802.00	SWC	0.14	0.11	471	0.56			0.68		
3887.50	DC	0.10	0.12	435	0.45			1.11		
3902.50	DC	0.12	0.13	419	0.48			1.15		
3917.50	DC	0.13	0.14	444	0.48			1.04		
3932.50	DC	0.30	0.53	440	0.36			1.26		
3947.50	DC	0.18	0.74	465	0.20			2.15		
3962.50	DC	0.17	0.24	462	0.41			0.74		
3977.50	DC	2.03	8.97	441	0.18	177	5.07	1.37	27	0.31
3992.50	DC	2.96	6.38	430	0.32	124	5.13	0.67	13	
3996.00	SWC	5.23	7.94	442	0.40	143	5.54	0.66	12	
4007.50	DC	6.01	10.76	431	0.36	145	7.40	0.76	10	0.30
4011.00	SWC	8.19	7.74	430	0.51	111	6.99	0.50	7	
4022.50	DC	3.96	5.43	432	0.42	107	5.09	1.27	25	
4037.50	DC	3.11	4.93	441	0.39	99	5.00	1.24	25	
4052.50	DC	3.08	6.00	447	0.34	96	6.25	1.40	22	
4053.00	SWC	2.83	5.50	452	0.34	104	5.29	0.39	7	
4067.50	DC	4.66	6.45	449	0.42	91	7.08	1.90	27	0.35
4082.50	DC	5.39	6.26	456	0.46	85	7.37	1.91	26	
4097.50	DC	0.77	1.51	455	0.34	71	2.13	1.37	64	

Table 1: WELL 29/9-1
Pyrolysis Data

DEPTH m	SAMPLE TYPE	S1 kg/t	S2 kg/t	Tmax	PI S1/S1+S2	HI 100*S2/TOC	TOC %	S3 kg/t	OI 100*S3/TOC	OGPI
4112.50	DC	2.83	5.91	451	0.32	116	5.10	1.35	26	
4127.50	DC	2.42	6.22	453	0.28	131	4.75	1.16	24	0.43
4142.50	DC	1.60	3.17	447	0.34			1.15		
4157.50	DC	2.39	4.34	450	0.36	106	4.08	1.19	29	
4172.50	DC	2.01	2.98	448	0.40			1.35		
4187.50	DC	1.67	4.15	448	0.29	131	3.18	1.03	32	
4202.50	DC	1.66	4.22	447	0.28	139	3.03	1.09	36	0.56
4217.50	DC	2.16	3.40	440	0.39			1.08		
4232.50	DC	2.23	3.14	445	0.42	111	2.83	1.20	42	
4235.00	SWC	1.05	1.29	456	0.45	73	1.76	0.78	44	
4247.50	DC	1.76	2.22	447	0.44			1.28		
4262.50	DC	1.43	1.16	437	0.55			1.02		
4277.50	DC	1.00	0.74	445	0.57			1.04		
4292.50	DC	0.82	0.44	445	0.65			1.37		
4307.50	DC	1.08	0.77	450	0.58			1.26		
4322.50	DC	1.19	0.75	450	0.61			1.21		
4337.50	DC	1.20	1.00	451	0.55			1.05		
4340.00	SWC	0.65	0.74	457	0.47	38	1.96	0.65	33	
4352.50	DC	1.07	0.58	450	0.65			0.96		
4367.50	DC	1.77	1.48	452	0.54			1.26		
4382.50	DC	1.38	2.79	453	0.33			1.05		0.75
4397.50	DC	1.16	2.27	473	0.34			0.99		
4412.50	DC	1.00	2.15	473	0.32			0.26		
4423.50	CC	0.29	0.55	477	0.35	37	1.49	1.09	73	
4425.00	CC	0.27	0.47	480	0.36			0.53		
4427.50	DC	1.13	2.03	484	0.36			1.06		
4432.15	CC	0.17	0.23	482	0.43			0.06		
4442.50	DC	1.12	2.12	457	0.35			0.37		
4448.00	SWC	0.21	0.38	472	0.36			0.78		
4457.50	DC	1.33	3.54	471	0.27	55	6.40	0.55	9	
4472.50	DC	1.88	6.49	474	0.22	66	9.87	0.70	7	0.87
4487.50	DC	1.27	3.35	472	0.27	56	5.93	0.45	8	
4502.50	DC	1.10	2.99	473	0.27	49	6.05	0.64	11	
4517.50	DC	0.96	2.33	472	0.29			0.22		
4532.50	DC	0.87	1.80	470	0.33			0.29		
4547.50	DC	0.81	2.09	472	0.28			0.54		
4562.50	DC	0.65	1.19	469	0.35			0.41		
4577.50	DC	0.63	0.99	472	0.39			0.38		
4592.50	DC	0.70	1.45	470	0.33			0.44		
4607.50	DC Sst	0.50	0.78	464	0.39			0.30		
4622.50	DC	0.99	2.77	470	0.26	62	4.50	0.47	10	
4637.50	DC	0.78	1.46	470	0.35			0.24		
4652.50	DC Sst	0.59	0.79	469	0.43			0.23		
4667.50	DC Sst	0.54	0.57	466	0.49			0.00		
4682.50	DC	1.41	6.35	477	0.18	66	9.62	0.73	8	0.77
4697.00	DC sh/Sst	0.71	1.89	474	0.27			0.32		

Table 2.

VITRINITE REFLECTANCE : 29/9-1

		1895m	2195m	2315m	2998m	3203.5m	3407m	3603.5m	3802m	3917m	3962.5m	3996m	4011m	4053m	4235m	4340m	4382.5m	4423.5m	4425m
1	Ro	0.28	0.40	0.56	0.49		0.70			1.13	1.06		0.82	0.94	0.97	1.52	1.27	1.61	1.51
2	Ro	0.28	0.39	0.40	0.54		0.72			1.00	1.13		0.93	1.07	1.26	1.48	1.28	1.68	1.47
3	Ro	0.28	0.42	0.48	0.47		0.70			1.19	1.12		0.78	1.27	1.35	1.54	1.28	1.43	1.52
4	Ro	0.30	0.42	0.42	0.67		0.71			1.27	1.08		0.75	1.03	1.03	1.42	1.29	1.69	1.68
5	Ro	0.31	0.47	0.43	0.50		0.90			0.94	0.94		0.91	1.19	0.91	1.46	1.30	1.59	1.60
6	Ro	0.32	0.42	0.45	0.43					1.10	1.15		0.87	1.02	1.22	1.49	1.30	1.54	1.43
7	Ro	0.32	0.37	0.56	0.33					1.09	1.14		0.85	1.15	1.20	1.38	1.32	1.65	1.42
8	Ro	0.34	0.40	0.55						0.81	1.08		1.30	1.19	0.90	1.53	1.34	1.60	1.42
9	Ro	0.34	0.41	0.53						0.99	1.10		1.10	0.95	1.10	1.46	1.34	1.57	1.64
10	Ro	0.35	0.41	0.58						0.93	1.15		0.82	0.77	1.23	1.48	1.36	1.50	1.65
11	Ro	0.35	0.42	0.56							1.30		1.20	1.46	1.15	1.45	1.38	1.64	1.50
12	Ro	0.35	0.47	0.52							1.26			1.26	1.36	1.38	1.38	1.49	1.60
13	Ro	0.37	0.46	0.58							1.30			1.26	1.27	1.27	1.39	1.58	1.62
14	Ro	0.37	0.46	0.50							1.18			0.91	1.08	1.29	1.39	1.52	1.66
15	Ro	0.42	0.30											1.14	1.28	1.33	1.39	1.52	1.52
16	Ro		0.35											1.56	1.42	1.32	1.41	1.44	1.50
17	Ro		0.35											1.55	1.27	1.47	1.41	1.61	1.51
18	Ro		0.30											1.04	1.53	1.46	1.42	1.61	1.58
19	Ro		0.37											1.37	1.57	1.46	1.42		1.55
20	Ro		0.33											1.12	1.34	1.38	1.42		1.57
21	Ro		0.33											1.54	1.47	1.40	1.44		1.61
22	Ro		0.38											1.22	1.43	1.44	1.46		1.46
23	Ro		0.37											1.37	1.44	1.40	1.46		1.68
24	Ro													1.54	1.56	1.38	1.46		1.61
25	Ro													1.22	1.46	1.39	1.46		1.49
26	Ro													1.37		1.40	1.47		1.60
27	Ro													1.54		1.34	1.47		1.60
28	Ro													1.22			1.48		1.37
29	Ro													1.37			1.50		1.55
30	Ro																1.50		1.49
31	Ro																1.52		
32	Ro																1.53		
33	Ro																1.55		
34	Ro																		
35	--																		
36	MEAN	0.33	0.39	0.51	0.49		0.75			1.05	1.14		0.94	1.23	1.27	1.42	1.41	1.57	1.55
37	StDev	0.04	0.05	0.06	0.10		0.09			0.14	0.09		0.18	0.22	0.19	0.07	0.08	0.08	0.08
38	--																		
39	SAMPLE	DC	DC	DC	SWC	SWC	SWC	SWC	SWC	DC	DC	SWC	SWC	SWC	SWC	DC	DC	CC	CC

Ro=reflectivity in oil. Missing points imply poor data. DC=drill cutting. CC=Core cutting. SWC=sidewall core.

PALYNOMORPH COLOUR
WELL 29/9-1

	DEPTH IN M	SCI	SAMPLE TYPE
1	1895.00	2.5	DC
2	2195.00	2.5	DC
3	2315.00	3.0	DC
4	2998.00	3.0	SWC
5	3407.00	3.5	SWC
6	3802.00	4.0	SWC
7	3962.50	6.5	DC
8	3996.00	6.5	SWC
9	4011.00	7.0	SWC
10	4053.00	6.5	SWC
11	4235.00	6.5	SWC
12	4340.00	8.0	DC
13	4423.50	8.0	CC
14	4425.00	8.5	CC
15	4432.15	9.0	CC
16	4448.00	8.5	SWC
17	4562.50	8.5	DC

SCI: Spore Colour Index (Robertson Research Int. standard).