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Source rock evaluation of well 34/10-3

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SUMMARY

The whole analysed sequence is immature increasing to moderate mature towards the lower end of the well. On the basis of light hydrocarbons and TOC, the analysed sequence is divided into five zones:

A: 1630-1885 m. Fair potential as a source rock for gas (oil).
B: 1885-2100 m. Mainly sand. Migrated hydrocarbons.
C: 2100-2500 m. Upper part; sand with migrated hydrocarbons.
Lower part; silty claystone, fair to good potential as a source rock for gas (oil).
D: 2500-2700 m. Sand, no indication of migrated hydrocarbons.
E: 2700-2806 m. Poor potential as a source rock for gas (oil).

KEY WORDS

Source rock

EXPERIMENTAL

One ml. of the headspace gas from each of the cans was analysed gas chromatographically for light hydrocarbons. The results are shown in Table Ia. The canned samples were washed with temperated water on a 0.125 mm sieve to remove drilling mud and thereafter dried at 35^{o}C.

Light Hydrocarbons

Aliquotes of the samples were dried at room temperature after washing and sieving. The cuttings with a grain size between 1 and 2 mm were used for light hydrocarbon determination. These were treated with 6N HCl in a closed evacuated system, thereafter flushed with water and the released gas analysed gas chromatographically. The results are shown in Table Ib.

Total Organic Carbon (TOC)

The various selected samples were crushed on a centrifugal mill and sieved. The portions with a particle size between 0.125 mm and 0.063 mm were used in the further work. Aliquotes of the samples were treated with hot 6N HCl to remove carbonate and washed twice with distilled water to remove traces of HCl, then placed in a vacuum oven at 50^{o}C, evacuated to 20 mm Hg for 12 hrs. The samples were then analysed on a Leco E C 12 carbon determinator, to determine the total organic carbon (TOC).

Extractable Organic Matter (EOM)

From the TOC results samples were selected for extraction. Of the selected samples, approximately 100 gm of each was extracted on soxhlet apparatus for 48 hrs using dichloromethane (DCM) as solvent. The DCM used as solvent was distilled in an all glass apparatus to remove contaminants. The paper thimbles used in the soxhlet apparatus were previously washed with DCM on a large soxhlet apparatus for 48 hrs. to remove any soluble components.

Activated copper foil was used in the flasks to remove any free sulphur from the samples.

After extraction, the solvent was removed on a Buchi Rotavapor and transferred to a 50 ml flask. The rest of the solvent was then removed and the amount of extractable organic matter (EOM) determined.

Chromatographic Separation

The extractable organic matter (EOM) was separated on chromatographic columns, packed with silica, Riedel & Hähn, 0.063 mm, using the slurry method with hexane as solvent. On top of the silica, small amounts of alumina, approximately 2 cm, was added. The EOM, after it was "taken up" on alumina, was transferred to the top of the columns, which were then eluted with predistilled hexane, benzene and methanol using a ratio of 200 ml of each solvent pr. gm of EOM.

The various eluants were removed on a Buchi Rotavapor and the samples transferred to vials and dried at 40°C in a stream of dry nitrogen, and the amount of the various fractions, saturated, aromatic and NSO fraction (Nitrogen, Sulphur, Oxygen), determined. The saturated fractions were analysed gas chromatographically on a 25 m OV 101 glass capillary column with He as carrier gas (0.7 ml/min.) using the splitless injection technique. The glass capillary column was mounted in a Carlo Erba F V 2150 gas chromatograph.

Vitrinite Reflectance

Samples, taken at various intervals, were sent for vitrinite reflectance measurements at Geoconsultants, Newcastle-upon-Tyne. The samples were mounted in Bakelite resin blocks; care being taken during the setting of the plastic to avoid temperatures in excess of 100°C. The samples where then ground, initially on a diamond lap followed by two grades of corundum paper. All grinding and subsequent polishing stages in the preparation were carried out using isopropyl alcohol as lubricant, since water leads to the swelling and disintegration of the clay fraction of the samples.

Polishing of the samples was performed on Selvyt cloths using three grades of alumina, 5/20, 3/50 and Gamma, followed by careful cleaning of the surface.

Reflectance determinations were carried out on a Leitz M.P.V. microphotometer under oil immersion, R.I. 1.516 at a wavelength of 546 nm. The field measured was varied to suit the size of the organic particle, but was usually of the order of 2 micron diameter.

The surface of the polished block was searched by the operator for suitable areas of vitrinitic material in the sediment. The reflectance of the organic particle was determined relative to optical glass standards of known reflectance. Where possible, a minimum of twenty individual particles of vitrinite was measured, although in many cases this number could not be achieved.

Processing of Samples for Evaluation of Visual Kerogen

The rock samples were crushed and afterwards treated with hydrochloric and hydrofluoric acids to remove the minerals. A series of microscopic slides was mounted in glycerine jelly:

T-slide represents the total acid insoluble residue.
O-slide represents the residue screened through 15 sieves.
N-1,2,3 slides contain palynodebris remaining after flotation ($Zn\ Br_2$) to remove disturbing heavy minerals.
X-1,2,3 slides contain oxidized residues, when oxidizing is required due to high coalification or much sapropel.

T & O slides are necessary to evaluate kerogen composition/palynofacies which is closely related to sample lithology.

Screened slides are normally required to consentrate the larger fragments, and to study palynomorphs (pollen, spores and dinoflagellates) for paleo-dating and colour evaluation.

So far visual evaluations of kerogen have been undertaken from residues mounted in glycerine jelly, and studied by Leitz Dialux in normal light (halogene) using x10 and x40 objectives.

Rock-Eval Pyrolyses

100 mg crushed sample was put into a boat whose bottom and cover are made of sintered steal and analysed on a Rock-Eval pyrolyser.

RESULTS AND DISCUSSION

Light Hydrocarbons

As reported by telephone, a large number of the samples were in cans with open lids due to a faulty canning machine. Because of this there will be a large variation in the light, hydrocarbons both in amount and composition. It will therefore be difficult to divide the well into zones on the basis of light hydrocarbons only and the results from total organic carbon measurements (TOC) will be combined with the light hydrocarbon results in dividing the well into zones.

On the basis of this, the well will be divided into zones.

A: 1630-1885 m
B: 1885-2100 m
C: 2100-2500 m
D: 2500-2700 m
E: 2700-2806 m (T.D.)

A: 1630-1885 m:
Almost all the samples have an abundance of C_1 - C_4 hydrocarbons between 1.000 ppm and 10.000 ppm while there is a sharp increase in both wetness and C_{15}^+ hydrocarbons at approximately 1750 m. The iC_4/nC_4 ratio is relatively low at the top of the zone while it increases to approximately 1.0 from 1750 m.

B: 1885-2100 m:
The abundance of C_1 - C_4 hydrocarbons is approximately the same as in the zone above while there is a sharp increase both in the wetness of the gas and in the abundance of C_5^+ hydrocarbons. These high values decreases towards the lower end of the zone while the C_1 - C_4 hydrocarbons increases slightly.

C: 2100-2500 m:
A large amount of the samples in this zone were in cans with open lids. In the upper part of the zone the cans were sealed and these will give the most reliable results. The abundance of C_1 - C_4 hydrocarbons vary considerably

from sample to sample while the wetness of the gas and the iC_4/nC_4 ratio are rather constant. The lower part of the zone, which has a lithology different from the upper part, could may be be separated out. This is not done mainly because of the problems mentioned above.

D: 2500-2700 m:
Again a zone with a large variation in the abundance of the C1 - C_4 hydrocarbons from sample to sample. However, the most striking feature in the results is the very sharp drop in the wetness of the gas compared to the zones above, both for samples from tight sealed cans and open lid cans.

E: 2700-2806 m (T.D.):
The abundance of light hydrocarbons is very low for this zone, both for C_1 - C_4 and C_5 hydrocarbons. The gas is also found to be very dry.

Total Organic Carbon (TOC)

Large sequences of this well consist mainly of sand, and, as agreed upon, TOC was not measured on these samples.

A: 1630-1885 m:
This zone consist mainly of shales and the TOC values are very consistant of approximately 0.6% right through the zone.

B: 1885-2100 m:
This zone consists mainly of siltstone and sandstone with a coal sequence at approximately 1900 m. The measurements on the siltstone around 1900 m show higher TOC values than in the zone above, 1 - 2%, this might be due to contamination from the coal particles. On the whole, the very few samples analysed in this zone show a fair abundance of organic carbon.

C: 2100-2500 m:
The silty claystone fractions of this zone were found to have TOC values between 1 and 2%, but with a relatively high variation from sample to sample. This might be due to a variation in lithology.

D: 2500-2700 m:
Only sandstone, no TOC measurements.

E: 2700-2800 m:
A shale sequence with very low TOC values, 0.3 - 0.6%.

Extractable Organic Matter (EOM) and Chromatographic Separation

A: 1630-1885 m:
Three samples from this zone were extracted and were all found to have a good abundance of extractable hydrocarbons. The gas chromatograms of the two upper samples contain very small amounts of n-alkanes from nC_{28} and up, while the napthenic fraction is very pronounced with a large sterane hump and with high CPI value of the C_{21}-C_{27} alkanes. This would then indicate an input from immature herbaceous material. The gas chromatogram of the saturated hydrocarbons of the lowermost analysed sample in this zone is very front biased. This could be due to contamination from diesel.

B: 1885-2100 m:
Two samples from the upper part of this zone were extracted, and they have a good and rich abundance of hydrocarbons respectively. The gas chromatograms of the saturated hydrocarbon fraction of both the samples show a pronounced sterane hump, but a large difference is found in the pristane/nC_{17} and pristane/phytane ratios in the two samples.

C: 2100-2500 m:
Ten samples fromt this zone were extracted, and most of these are found to have a good abundance of extractable hydrocarbons. The gas chromatograms of the saturated hydrocarbon fractions vary considerably from sample to sample. The uppermost sample, 2110-2125 m has a gas chromatogram very similar to the one in the zone above. The next sample has a very strange gas chromatogram with two distinct maxima at nC_{18} and nC_{24} and hardly any n-alkanes above nC_{25}. The latter maxima is probably due to an input of herbaceous material, but this should also give higher n-alkanes.

The next two samples are very similar to the uppermost sample in this zone while the sample from 2285-2300 m has the same strange gas chromatogram as the one from 2180-55 m with two distinct maxima. The rest of the samples from this zone have all large sterane humps and high CPI values but again a large variation is found for the pristane/nC_{17} and pristane/ phytane ratios.

D: 2500-2700 m:
No samples were analysed from this zone which mainly consist of sand.

E: 2700-2806 m:
No samples from this zone was extracted.

Vitrinite reflectance

Fifteen samples were analysed for vitrinite reflectance. In the following each sample is described, and together with the reflectance data, other information from the analyses will be given.

1630-60 m: Carbonate, sandgrains, shale traces. The carbonate lithology is very odd, not a normal limestone. Ro = 0.29(2), 0.56(4), 0.90(1).
The carbonate in the sample is barren, only a few loose vitrinite particles of variable reflectance and possible bitumen wisps in shale. UV light shows a yellow and yellow/orange fluorescence from spores and plentiful hydrocarbons, together with a low exinite content.

1750-65 m: Limestone, sand grains and shale traces. Ro = 0.47(3).
The sample is virtually barren with a few bitumen wisps and three poor vitrinite particles. UV light shows a yellow and yellow/orange fluorescence from spores and hydrocarbon traces together with a trace of exinite.

1870-85 m: Limestone, pyrite and shale traces. Ro = 0.53(3).
The sample contain very little true sediment, only a few particles of vitrinite with variable reflectance are recorded. UV light shows a yellow/ orange fluorescence from spores and hydrocarbon traces together with a trace of exinite. The sample is also found to contain iron oxides, glauconite and traces of igneous rock.

1900-15 m: Carbonate and coal fragments. Ro = 0.37(21).
The sample has a moderate organic content. The coal fragments have a rather variable reflectance, mostly fragmental material containing small particles of vitrinite and inertinite together with some tellinite material. UV light shows a yellow/orange fluorescence from spores and strong hydrocarbon traces in some cuttings together with a low exinite content.

2005-20 m: Calcareous, silty sandstone, Ro = 0.35(21).
The sample has a low to moderate organic content with bitumen and vitrinite wisps and particles together with a few coal fragments and only a trace of inertinite. UV light show a yellow/orange fluorescence from spores and hydrocarbon specks together with a low exinite content.

2140-55 m: Limestone, calcareous shale and pyrite. Ro = 0.39(20).
The sample has a moderate organic content with a few loose coal cuttings. The limestone contains only inertinite particles while the shale has a good content of inertinite particles and bitumen wisps together with some vitrinite as wispy particles. UV light shows a yellow/orange fluorescence from spores together with an overall carbonate fluorescence and a moderate exinite content.

2285-2300 m: Mixed lithologies. Ro = 0.35(20).
The sample has a low organic content with a few loose coal particles. Most of the organics are found as inertinite particles and bitumen wisps. A few vitrinite wisps and wispy particles are recorded. UV light shows a yellow/orange and light orange fluorescence from spore fragments and a moderate exinite content.

2345-60 m: Sand and shale fragments. Ro = 0.41(3).
A few of the shale fragments show bitumen staining and inertinite particles together with a couple of doubtful vitrinite particles. UV light shows a couple of mid orange fluorescing spores and a trace of vitrinite.

2375-90 m: Mixed lithologies. Ro = 0.47(22).
The organic matter is restricted to the shale where some bitumen wisps and a few good vitrinite particles. Only a trace of inertinite. UV light shows a yellow/orange and light orange fluorescence from spores and a moderate exinite content. Ingneous rock cuttings are seen in this sample.

2420-35 m: Mixed lithologies. Ro = 0.27(2), Ro = 0.49(4).
Only a trace of true organic material with a few loose particles of vitrinite of variable reflectance. UV light shows a dull, light/mid orange fluorescence from spores and a low to moderate exinite content.

2466-81 m: Shale, Ro = 0.45(22).
The sample has a moderate organic content, mostly inertinite and reworked material, but also a lot of bitumen wisps and vitrinite particles and wispy particles. UV light shows a light and mid orange fluorescence from spores and a moderate to rich exinite content.

2571-86 m: Sandstone and shale traces. Ro = 0.34(20).
The sample has a low organic content with a few loose and included particles of vitrinite, inertinite and coal fragments, mostly reworked material. UV light shows a yellow/orange fluorescence from spores and a low to moderate exinite content.

2706-21 m: Sandstone and shale. Ro = 0.41(11).
The sample which shows an overall haematite staining, has a low organic content with a few bitumen wisps in shale together with some vitrinite wispy particles and particles of inertinite. UV light shows a light to mid orange fluorescence from spores and hydrocarbon specks together with a low exinite content.

2766-81 m: Sandstone, siltstone and shale. Ro = 0.40(5) and Ro = 0.81(5).
The sample which has an overall haematite staining, is almost barren apart from a few cuttings of non-stained shale, mostly particles of reworked material and inertinite. A little bitumen as wisps and some wispy particles of vitrinite are recorded. UV light shows a light to mid orange fluorescence from spores and a low to moderate exinite content.

2796-2802 m: Sandstone and shale with haematite. Ro = 0.42(18).
The sample has a low organic content with a few wispy particles and wisps of vitrinite in unoxidized shale cuttings. Inertinite particles are dominant. Most of the sample is barren. UV light shows a yellow/orange fluorescence from spores and hydrocarbon traces together with a low exinite content.

Visual Evaluation of Kerogen

Fifteen samples from cuttings were investigated for kerogen analyses, and the results have been summarized in the enclosures. The colour index for the individual samples has been evaluated from palynomorphs with support from the dominant type of kerogen. All samples studied were represented by slides of the total acid insoluble residues as well as by slides containing particles larger than 15μ where remaining heavy minerals were removed by floatation ($ZnBr_2$).

The following interpretation has been used with the qualitative colour index for organic residues of this well:

Immature 2+ Moderate mature 3+ Oil window -4 Gascond.

Transferring colour into an index, however, also involves evaluation of possible control from lithology.

Interpretation of individual results was complicated by the low maturation throughout the well. However, it appears as if mud additives and downfallen material represent a minor problem for kerogen studies in this well.

The following categories are used to express the composition of the kerogen: sapropel, indeterminate herbaceous material, cuticles, wood remains (structured), coal particles, and dinoflagellates, pollen and spores. The composition is expressed as visually estimated percentages of the total acid insoluble organic residues.

1630-60 m: A fairly small residue dominated by varied herbaceous material, with coal fragments as the dominant category. Dark coal fragments are also embedding lightcoloured palynomorphs. Approximately one third of the residue consists of light coloured sapropel including dinoflagellate cysts.
Colour index: -2/2

1750-65 m,
1870-85 m

Small residues, resembling that of 1630-60 m in containing dark coal fragments as dominant, and including about one third sapropel.

Colour index: -2/2

1900-15 m: The large residue is dominated by herbaceous material; half of it coal fragments of variable coalification, about one third indeterminate herbaceous cuticular fragments or woody structures. Sapropel is present but in small amounts.
Colour index: 2 (higher than for the abovelying interval)

2005-20 m: A fairly small residue where herbaceous material; pollen/spores, indeterminate remains, cuticular fragments, and woody structures dominate. About one third is amorphous material.
Colour index: 2, may be affected by oxidation.

2140-55 m)
2285-300 m
2345-60 m)
2375-90 m)

Normal sized residue where sapropel dominates, or is equally important with, varied material derived from land plants. A shallow marine deposition not far from coast is suggested. Coal particles are fairly frequent. Reworking of Triassic material is noted in the lowest sample.
Colour index: 2.

2420-35 m)
2466-81 m

Originally large residues in which sapropel dominates as in the abovelying samples. The samples contain varied land derived assemblages. Reworked Triassic material is present. Though amorphous material is present, dinoflagellate cysts are strikingly rare.
Colour index: 2/2+.

2571-81 m: The fairly small residue contains coal fragments and suggested mud additives beside finely dispersed amorphous material. The material seems oxidized.
Colour index: 2/2+

2706-21 m: The fairly small residue is dominated by amorphous, finely dispersed matter, but includes also a small portion of indeterminate herbaceous material and variably coalyfied coal fragments which partly might be fallen down from the abovelying interval.
Colour index: 2+ (may be based in reworked material)

2766-81 m) Two small residues where heavy minerals are prominant
2796-802 m) before separation. The organic residues are resembling those from interval 2420-2435 m and downwards, and may be derived from these deposits. In that case 2766-2802 m are nearly devoid of palynomorphs. Colour index: 2+ (may be based in reworked material).

Rock-Eval Pyrolysis

Twenty-one samples from various zones in the well were pyrolysed on a Rock-Eval instrument at EOG, Jülich. The conductivity detector was out of order and due to this the oxygen index could not be measured. The hydrogen index is, however, very low except for two samples, 2450-65 m and 2465-2480 m where the hydrogen index is slightly higher. The T_{max} values indicate immaturity or moderate mature for all the samples.

With the background in these results, all of the analysed samples are probably of type III kerogen.

CONCLUSION

On the background of the various analyses the following conclusion might be drawn:

The analysed section of the well can be divided into five zones. A: 1630-1885 m, B: 1885-2100 m, C: 2100-2500 m, D: 2500-2700 m and E: 2700-2806 m.

In our evaluation of the well, the richness rating is based on the abundance of light hydrocarbons, total organic carbon and extractable hydrocabons. The maturation rating is mainly based on the vitrinite reflectance and the colour of the kerogen, while the type of source rock estimation is based on the type of kerogen, with results both from the visual kerogen study and the Rock-Eval pyrolysis.

The whole analysed sequence of the well are found to be immature, possibly moderate mature towards the lower end of the well. On the basis of the various analyses the following rating will be given:

A: 1630-1885 m:
This zone has a fair potential as a source rock, mainly for gas. The maturity is, however, to low for any hydrocarbon production. Indications of migrated hydrocarbons in some of the analysed samples.

B: 1885-2100 m:
Mainly sand, with migrated hydrocarbons.

C: 2100-2500 m:
The upper part of the zone contains mainly sand. Some of the analyses indicate migrated hydrocarbons in this part. The lower part is mainly silty claystone. This has a fair to good potential as a source rock for gas and oil. The maturity is too low for any hydrocarbon production.

D: 2500-2700 m:
Mainly sand. The analyses does not indicate any migrated hydrocarbons.

E: 2700-2806 m (T.D.):
This zone has a poor potential as a source rock mainly for gas. The lower part might be moderate mature. It is, however, of a too low maturity for any production of hydrocarbons presently.

TABLE IA.

Consentration (l gas/kg rock) of C_1-C_7 hydrocarbons in cuttings (Headspace)

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	%wetness	iC_4/nC_4
K270	1630 - 1660	9328	1357	64	80	68	362	10896	1568	14.4	1.17
K271	1660 - 1690	14580	2891	104	117	97	100	17789	3209	18.0	1.16
K272	1690 - 1720	9318	554	46	93	73	332	10085	767	8.4	1.24
K273	1720 - 1735	OPEN LID									
K274	1735 - 1750	12763	989	155	228	215	1256	14350	1587	11.1	1.12
K275	1750 - 1765	OPEN LID									
K276	1765 - 1780	636	178	123	154	143	1068	1234	597	48.4	1.07
K277	1780 - 1795	7342	710	227	348	298	1612	8924	1582	17.7	1.17
K278	1795 - 1810	957	176	41	210	160	904	1544	587	35.9	1.31
K279	1810 - 1825	1572	509	435	908	768	261	4172	2601	62.3	1.18
K280	1825 - 1840	6919	628	267	387	359	1820	8557	1641	19.2	1.10
K281	1840 - 1855	71	20	8	38	26	204	163	92	56.5	1.16
K282	1855 - 1870	OPEN LID									
K283	1870 - 1885	OPEN LID									
K284	1885 - 1900	556	254	250	200	171	1872	1432	876	61.2	1.17
K285	1900 - 1915	8895	4131	1466	1101	1040	10232	16635	7738	46.5	1.06
K286	1915 - 1930	3724	1834	732	576	454	2643	7319	3595	49.1	1.27
K287	1930 - 1945	101	87	32	122	105	1105	448	347	77.5	1.16
K288	1945 - 1960	31	31	24	70	66	964	222	191	86.1	1.06
K289	1960 - 1975	941	667	423	732	586	7234	3349	2408	71.9	1.25
K290	1975 - 1990	OPEN LID									
K291	1990 - 2005	OPEN LID									
K292	2005 - 2020	OPEN LID									

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K350	2420 - 2435	825	433	363	7	5	2347	1633	808	49.5	1.25
K351	2435 - 2450	947	279	127	2	1	6112	1357	410	30.0	1.25
K352	2450 - 2466	OPEN LID									
K353	2466 - 2481	OPEN LID									
K354	2481 - 2496	OPEN LID									
K355	2496 - 2511	OPEN LID									
K400	2511 - 2526	OPEN LID									
K401	2526 - 2541	47966	11835	3023	385	262	793	63472	15506	24.4	1.47
K402	2541 - 2556	226	73	25	3	2	90	324	98	30.2	1.45
K403	2556 - 2571	5731	1695	476	4	3	40	7907	2176	27.5	1.40
K404	2571 - 2586	298	94	44	3	2	10	441	123	32.4	1.40
K405	2586 - 2601	OPEN LID									
K406	2601 - 2616	182	29	10	1	1	12	222	40	18.1	1.38
K407	2616 - 2631	434	97	32	1	1	13	565	131	23.1	1.32
K408	2631 - 2646	352	69	23	1	1	8	447	95	21.3	1.28
K409	2646 - 2661	3.0	5.8	27	3	2	14	91	88	96.9	1.34
K410	2661 - 2676	OPEN LID									
K411	2676 - 2691	179	0.31	13.5	1	1	16	193	14	7.4	1.00
K412	2691 - 2706	OPEN LID									
K413	2706 - 2721	244	38	24	5	7	12	318	74	23.2	0.68
K414	2721 - 2736	144	23	12	-	-	6	180	35	20.0	0.69
K415	2736 - 2751	272	20	4	-	-	14	296	24	8.1	0.74
K416	2751 - 2766	135	15.14	8	-	-	16	159	24	15.1	0.65
K417	2766 - 2781	243	19.3	9.1	-	-	12	272	29	10.6	0.66
K418	2781 - 2796	82	10	4.4	1	1	16	97	15	15.3	0.69
K419	2796 - 2802	454	69	26	1	1	8	551	96	17.5	0.67

T.D.

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K293	2020 - 2035	2628	1420	271	179	163	1058	4662	2034	43.6	1.09
K294	2035 - 2050	4858	1734	129	56	44	728	6821	1963	28.8	1.18
K295	2050 - 2065	17025	1437	177	242	214	1462	19094	2070	10.8	1.18
K296	2065 - 2080	5005	860	123	320	270	174	6578	1572	23.9	1.18
K297	2080 - 2095	19043	2313	239	258	220	1462	22073	3030	13.7	1.17
K298	2095 - 2110	OPEN LID									
K299	2110 - 2125	OPEN LID									
K300	2125 - 2140	OPEN LID									
K301	2140 - 2155	OPEN LID									
K302	2155 - 2170	46124	6253	603	565	427	135	53973	7848	14.5	1.32
K303	2170 - 2195	10205	1571	171	172	144	957	12262	2057	16.8	1.19
K304	2195 - 2210	4740	688	71	57	47	251	5600	860	15.4	1.15
K305	2210 - 2225	13140	3663	284	119	101	363	17295	4155	24.0	1.18
K306	2225 - 2240	9243	1867	123	47	43	305	11323	2080	18.4	1.09
K307	2240 - 2255	3650	66	108	100	90	245	4014	364	9.1	1.11
K308	2255 - 2270	OPEN LID									
K309	2270 - 2285	18667	4095	1194	583	483	3558	24982	6315	25.3	1.17
K310	2285 - 2300	OPEN LID									
K311	2300 - 2315	OPEN LID									
K312	2315 - 2330	2579	699	327	442	379	473	4395	1817	41.3	1.17
K313	2330 - 2345	5145	196	88	111	92	1142	5632	487	8.7	1.20
K345	2345 - 2360	OPEN LID									
K346	2360 - 2375	OPEN LID									
K347	2375 - 2390	OPEN LID									
K348	2390 - 2405	OPEN LID									
K349	2405 - 2420	OPEN LID									

TABLE I b

Concentration (µl gas/kg. rock) of C_1 - C_7 hydrocarbons in cuttings.

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K270	1630 - 1660	173	140	128	46	75	152	562	389	69.22	0.72
K271	1660 - 1690	93	67	36	29	22	142	248	155	62.64	1.31
K272	1690 - 1720	55	38	40	37	32	56	202	146	72.51	1.18
K273	1720 - 1735	NOT ENOUGH SAMPLE									
K274	1735 - 1750	80	27	9	5	6	819	127	47	36.79	0.81
K275	1750 - 1765	320	93	73	40	33	556	559	239	42.71	1.20
K276	1765 - 1780	118	76	68	63	45	90	370	251	67.98	1.42
K277	1780 - 1795	NOT ENOUGH SAMPLE									
K278	1795 - 1810	87	49	69	54	32	203	289	203	69.97	1.66
K279	1810 - 1825	146	101	37	16	38	219	338	193	56.95	0.42
K280	1825 - 1840	NOT ENOUGH SAMPLE									
K281	1840 - 1855	243	120	110	98	60	1944	631	388	61.49	1.62
K282	1855 - 1870	293	191	93	55	36	814	668	375	56.11	1.54
K283	1870 - 1885	149	60	29	20	52	230	245	96	39.09	0.39
K284	1885 - 1900	634	542	472	210	179	5835	2057	1403	68.20	1.17
K285	1900 - 1915	99	128	195	267	374	5247	1062	963	90.70	0.71
K286	1915 - 1930	162	91	205	424	713	9814	1596	1433	89.79	0.59
K287	1930 - 1945	116	52	97	210	263	5021	738	622	84.23	0.80
K288	1945 - 1960	83	141	31	57	83	3267	395	312	78.98	0.69
K289	1960 - 1975	443	603	330	437	576	4846	2389	1946	81.45	0.76
K290	1975 - 1990	NOT ENOUGH SAMPLE									
K291	1990 - 2005	223	590	945	796	754	5679	3308	3085	93.25	1.05
K292	2005 - 2020	67	149	265	245	244	2572	970	904	93.11	1.00
K293	2020 - 2035	52	106	14	19	33	449	673	621	92.27	0.56
K294	2035 - 2050	194	422	409	304	300	734	1631	1[illegible]36	88.05	1.01

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K295	2050 - 2065	230	75	64	83	104	705	556	326	58.68	0.80
K296	2065 - 2080	NOT ENOUGH SAMPLE									
K297	2080 - 2095	140	68	16	12	20	216	256	116	45.40	0.60
K298	2095 - 2110	702	329	26	32	34	407	1123	421	37.48	0.95
K299	2110 - 2125	401	76	30	19	22	619	548	147	26.80	0.87
K300	2125 - 2140	357	443	647	356	262	616	2067	1709	82.73	1.35
K301	2140 - 2155	NOT ENOUGH SAMPLE									
K302	2155 - 2170	156	390	443	324	282	925	1595	1439	90.24	1.15
K303	2170 - 2195	42	106	51	63	72	710	334	292	87.46	0.87
K304	2195 - 2210	232	335	421	259	199	407	1446	1215	83.99	1.30
K305	2210 - 2225	263	106	610	211	204	299	1393	1130	81.12	1.04
K306	2225 - 2240	147	1503	1076	361	320	636	3406	3259	95.69	1.13
K307	2240 - 2255	258	328	293	240	194	511	1314	1056	80.36	1.24
K308	2255 - 2270	197	200	291	192	148	234	1028	831	80.87	1.29
K309	2270 - 2285	77	216	21	17	26	46630	357	280	78.49	0.67
K310	2285 - 2300	301	281	393	186	138	2190	1399	1098	76.49	1.34
K311	2300 - 2315	274	326	419	171	145	642	1334	1060	79.44	1.18
K312	2315 - 2330	201	150	142	595	838	330	636	434	68.33	0.71
K313	2330 - 2345	366	283	420	229	179	217	1477	1111	75.21	1.28
K345	2345 - 2360	299	153	177	320	188	145	1337	1038	77.63	1.70
K346	2360 - 2375	58	72	119	46	25	114	320	262	81.88	1.84
K347	2375 - 2390	26	52	55	20	25	73	180	153	85.26	0.80
K348	2390 - 2405	221	152	299	67	55	137	794	573	72.13	1.22
K349	2405 - 2420	629	305	553	178	955	251	2620	1991	75.98	1.86
K350	2420 - 2435	35	9	11	9	12	128	76	41	53.74	0.73
K351	2435 - 2450	565	250	345	159	105	223	1424	859	60.32	1.51
K352	2450 - 2466	603	580	486	156	105	179	1930	1327	68.74	1.48

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K353	2466 - 2481	15	21	5	5	8	70	54	39	72.32	0.65
K354	2481 - 2496	31	25	31	17	23	74	127	97	75.81	0.75
K355	2496 - 2511	79	229	249	60	51	118	667	588	88.16	1.16
K400	2511 - 2526	43	31	34	5	6	54	121	78	64.46	0.83
K401	2526 - 2541	101	138	124	16	12	54	393	291	74.10	1.30
K402	2541 - 2556	227	654	670	84	68	227	1805	1578	87.42	1.24
K403	2556 - 2571	228	459	477	63	95	72	1324	1095	82.73	0.67
K404	2571 - 2586	NO RESULTS AVAILABLE									
K405	2586 - 2601	40	2	2	0.3	0.2	149	46	5	11.56	1.74
K406	2601 - 2616	14	-	-	-	-	25	17	2	15.11	1.17
K407	2616 - 2631	60	0	0	1	0	359	61	1	-	-
K408	2631 - 2646	304	119	47	7	9	332	499	184	37.75	0.80
K409	2646 - 2661	205	26	0	1	2	322	236	30	13.00	0.43
K410	2661 - 2676	83	6	22	6	4	131	123	40	32.82	1.39
K411	2676 - 2691	266	52	8	0	4	203	328	61	18.70	-
K412	2691 - 2706	19	-	-	-	-	60	21	-	-	-
K413	2706 - 2721	131	52	17	10	9	33	218	87	40.00	1.19
K414	2721 - 2736	31	7	17	18	21	64	37	6	16.96	0.86
K415	2736 - 2751	112	21	0	8	0	231	134	22	16.41	-
K416	2751 - 2766	61	1	2	1	1	271	68	67	9.89	0.77
K417	2766 - 2781	121	21	10	0	0	240	153	32	21.13	-
K418	2781 - 2796	19	0	1	2	3	41	27	7	22.66	0.62
K419	2796 - 2802	102	22	0	2	0	226	127	24	19.19	-

TABLE IC

Total concentration (µl gas/kg rock) of C_1-C_7 hydrocarbons (IA + IB).

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K270	1630 - 1660	9501	1497	194	126	143	514	11458	1957	17.1	0.88
K271	1660 - 1690	14673	2958	140	146	119	242	18037	3364	18.7	0.82
K272	1690 - 1720	9373	592	86	130	105	388	10287	913	8.9	1.24
K273+*	1720 - 1735										
K274	1735 - 1750	12843	1016	164	233	221	2075	14477	1634	11.3	1.05
K275*	1750 - 1765	320	93	73	40	33	556	559	239	42.8	1.21
K276	1765 - 1780	754	254	191	217	188	1158	1604	848	52.9	1.15
K277+	1780 - 1795	7342	710	227	348	298	1612	8924	1582	17.7	1.17
K278	1795 - 1810	1044	225	110	264	192	1107	1833	790	43.1	1.38
K279	1810 - 1825	1718	610	472	924	806	480	4510	2794	62.0	1.15
K280+	1825 - 1840	6919	628	267	387	359	1820	8557	1641	19.2	1.08
K281	1840 - 1855	314	140	118	136	86	2148	794	480	60.5	1.58
K282*	1855 - 1870	293	191	93	55	36	814	668	375	56.1	1.53
K283*	1870 - 1885	149	60	29	20	52	230	245	96	39.2	0.38
K284	1885 - 1900	1190	796	722	410	350	7707	3489	2279	65.3	1.17
K285	1900 - 1915	8994	4259	1661	1368	1414	15479	17697	8701	49.2	0.97
K286	1915 - 1930	3886	1925	937	1000	1167	12457	8915	5028	56.4	0.86
K287	1930 - 1945	217	139	129	332	368	6126	1186	969	81.7	0.90
K288	1945 - 1960	114	172	55	127	149	4231	617	503	81.5	0.85
K289	1960 - 1975	1384	1270	753	1169	1162	12080	5738	4354	75.9	1.01
K290+*	1975 - 1990										
K291*	1990 - 2005	223	590	945	796	754	5679	3308	3085	93.3	1.06
K292*	2005 - 2020	67	149	265	245	244	2572	970	904	93.2	1.00

+ Headspace only

* Cutting gas only

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	iC_5^+	C_1-C_4	C_2-C_4	% wetness	iC_4/nC_4
K293	2020 - 2035	2680	1526	285	198	196	1507	5335	2655	49.8	1.01
K294	2035 - 2050	5052	2156	538	360	344	1462	8452	3399	40.2	1.05
K295	2050 - 2065	17255	1512	241	325	318	2167	19650	2396	12.2	1.02
K296+	2065 - 2080	5005	860	123	320	270	174	6578	1572	23.9	1.19
K297	2080 - 2095	19183	2381	255	270	240	1678	22329	3146	14.1	1.13
K298*	2095 - 2110	702	329	26	32	34	407	1123	421	37.5	0.94
K299*	2110 - 2125	401	76	30	19	22	619	548	147	26.8	0.86
K300*	2125 - 2140	357	443	647	356	262	616	2067	1709	82.7	1.36
K301+*	2140 - 2155										
K302	2155 - 2170	46280	6643	1046	889	709	1060	55568	9287	16.7	1.25
K303	2170 - 2195	10247	1677	222	235	216	1667	12596	2349	18.6	1.09
K304	2195 - 2210	4972	1023	492	316	246	658	7046	2075	29.4	1.28
K305	2210 - 2225	3403	3769	894	330	305	662	18688	5285	28.3	1.08
K306	2225 - 2240	9390	3370	1199	408	363	941	14729	5339	36.2	1.12
K307	2240 - 2255	3908	394	401	340	284	756	5328	1420	26.7	1.20
K308*	2255 - 2270	197	200	291	192	148	234	1028	831	80.8	1.30
K309	2270 - 2285	18744	4311	1215	600	509	50188	25339	6595	26.0	1.18
K310*	2285 - 2300	301	281	393	186	138	2190	1399	1098	78.5	1.34
K311*	2300 - 2315	274	326	419	171	145	642	1334	1060	79.5	1.18
K312	2315 - 2330	2780	849	469	1037	1217	803	5031	2251	44.7	0.85
K313	2330 - 2345	5511	479	508	340	271	1359	7109	1598	22.5	1.25
K345*	2345 - 2360	299	153	177	320	188	145	1337	1038	77.6	1.70
K346*	2360 - 2375	58	72	119	46	25	114	320	262	81.9	1.84
K347*	2375 - 2390	26	52	55	20	25	73	180	153	85.0	0.80
K348*	2390 - 2405	221	152	299	67	55	137	794	573	72.2	1.22

+ Headspace only.

* Cutting gas only.

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K349*	2405 - 2420	629	305	553	178	955	251	2620	1991	76.0	0.19
K350	2420 - 2435	860	442	374	16	17	2475	1709	849	49.7	0.94
K351	2435 - 2450	1512	529	472	161	106	6335	2781	1269	45.6	1.52
K352*	2450 - 2466	603	580	486	156	105	179	1930	1327	68.8	1.49
K353*	2466 - 2481	15	21	5	5	8	70	54	39	72.2	0.63
K354*	2481 - 2496	31	25	31	17	23	74	127	97	76.4	0.74
K355*	2496 - 2511	79	229	249	60	51	118	667	588	88.2	1.18
K400*	2511 - 2526	43	31	34	5	6	54	121	78	64.5	0.83
K401	2526 - 2541	48067	11973	3147	401	274	847	63865	15797	24.7	1.46
K402	2541 - 2556	453	727	695	87	70	317	2129	1676	78.7	1.24
K403	2556 - 2571	5959	2154	953	67	98	112	9231	3271	35.4	0.68
K404+	2571 - 2586	298	94	44	3	2	10	441	123	27.9	1.50
K405*	2586 - 2601	40	2	2	-	-	149	46	5	10.9	1.50
K406	2601 - 2616	196	29	11	1	1	37	239	42	17.6	1.07
K407	2616 - 2631	494	97	32	2	1	372	626	132	21.1	1.32
K408	2631 - 2646	656	188	70	8	10	340	946	279	29.5	0.80
K409	2646 - 2661	208	31	27	4	4	336	327	118	36.1	1.00
K410*	2661 - 2676	83	6	22	6	4	131	123	40	32.5	1.50
K411	2676 - 2691	445	52	21	1	5	219	521	75	14.4	0.20
K412*	2691 - 2706	19	-	-	-	-	60	19	-	-	-
K413	2706 - 2721	375	90	41	15	16	45	536	161	30.0	0.94
K414	2721 - 2736	275	30	29	18	21	76	217	41	18.9	0.86
K415	2736 - 2751	384	41	4	8	0	245	430	46	10.7	-
K416	2751 - 2766	196	16	10	1	1	287	227	91	40.1	1.00

+ Headspace only.

* Cutting gas only.

Sample	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	C_5^+	ΣC_1-C_4	ΣC_2-C_4	% wetness	iC_4/nC_4
K417	2766 - 2781	364	40	19	0	0	252	225	61	27.1	0
K418	2781 - 2796	101	10	5	3	4	57	124	22	17.7	0.75
K419	2796 - 2802	556	91	26	2	1	234	678	120	17.7	0.75
T.D.											

+ Headspace only.

※ Cutting gas only.

TABLE II

Lithology of cuttings fraction 0.125 - 2 mm and Total Organic Carbon (TOC) Measurements.

Depth (m)	TOC		Lithology
1630 -60	0.64	100%	Claystone, silty, light grey to grey, partly brownish, greenish
		Sm.am.	Limestone, white; Pyrite
1660-90	0.62	100%	Claystone, partly silty, light grey to grey and greenish, brownish
		Sm.am.	Limestone, white, brown
1690-1720	0.50	100%	Claystone, light grey to grey, greenish and some green, some brownish, partly calcareous
		Sm.am.	Pyrite; Calcite; Dolomite; Siltstone, brown, calcareous, ?grains consisting of Dolomite
1720-35	0.54	100%	Claystone, light grey to grey, greenish and some green, partly calcareous.
		Sm.am.	Dolomite; Siltstone, brownish; Limestone
1735-50	0.48	97%	Claystone, as above
		2%	Quartz Sand, clear
		1%	Forams, mainly arenaceous
		Sm.am.	Pyrite; Dolomite; Forams
1750-65	0.48	99%	Claystone, partly silty, light grey to grey, greenish and some green
		1%	Quartz Sand; arenaceous Forams
		Sm.am.	Pyrite; Limestone, light; Forams; Dolomite,
		Obs.	Glauconite
1765-80	0.54	97%	Claystone, partly silty, as above
		3%	Limestone, white to light
		Sm.am.	Siltstone, calcareous; Pyrite; Quartz Sand; Forams

Depth (m)	TOC		Lithology
1780-95	0.69	89%	Claystone, grey, greenish and some green
		8%	Sand, consisting of planctonic and benthonic arenaceous and calcareous Forams
		3%	Limestone
		Sm.am.	Quartz Sand
1795-1810	0.52	77%	Claystone, as above
		20%	Sand consisting of Forams, as above
		3%	Limestone, as above
1810-25	0.57	96%	Claystone, greenish grey and grey
		3%	Limestone, white to light grey
		1%	Quartz Sand
		Sm.am.	Pyrite; Sand/Siltstone; Forams; Dolomite
1825-40	0.57	100%	Clay/Siltstone, sandy, white to light, with dark grains of coarse Silt/very fine Sand
		Sm.am.	Limestone, as above; Crystalline rock fragments, dark; Pyrite; Silt/Sandstone
1840-55	0.81	100%	Siltstone to Claystone, calcareous, light to light grey, partly brownish, some green and grey
		Sm.am.	Limestone; Quartz
1855-70	0.74	93%	Siltstone to Claystone, calcareous, light to grey, partly brownish
		7%	Limestone, grey, brownish
		Sm.am.	Sand/Siltstone; Limestone, white; Pyrite
1870-85	0.73	98%	Claystone to Siltstone, light to light grey, partly brownish, some grey and green, calcareous
		2%	Quartz Sand; arenaceous Forams
		Sm.am	Pyrite
		Obs:	Glauconite

Depth (m)	TOC		Lithology
1885-1900		53%	Sand, fine to coarse, consisting of Quartz and arenaceous Forams, light grey
		20%	Coal
	0.76	20%	Siltstone to Claystone, as above
		5%	Limestone, grey
		2%	Sandstone, very fine to fine
		Sm.am	Pyrite; Limestone, light
1900-15		50%	Coal
	0.48	44%	Siltstone to Claystone, as above
		5%	Sand, as above
		1%	Sandstone, very fine to fine
		Sm.am.	Limestone; Pyrite
1915-30	1.10	98%	Siltstone, clayey and sandy, to Claystone, light to light grey, partly brownish, some grey and green, calcareous
		2%	Coal
		Sm.am.	Limestone; Sandstone; Pyrite; Quartz; Claystone, dark grey; crystalline rock fragments
1930-45		64%	Quartz Sand, fine to coarse, angular to subrounded, light, Glauconite observed
	1.48	30%	Siltstone to Claystone, light, light grey, partly brownish, calcareous
		5%	Claystone, green
		1%	Coal
		Sm.am.	Claystone, dark grey; Limestone
1945-60	1.69	94%	Silt/Claystone, light, some brownish, calcareous, with sand
		3%	Coal
		3%	Claystone, green, some grey
		Sm.am.	Limestone

Depth (m)	TOC		Lithology
1960-75		67%	Quartz Sand, as above
		30%	Clayey Siltstone to Claystone, light, light brown, calcareous
		3%	Claystone, green
		Sm.am.	Coal; Limestone; Sandstone
1975-90		86%	Quartz Sand, as above
		10%	Claystone to clayey Siltstone, light, partly slightly brownish, light grey, calcareous
		2%	Claystone, dark grey to dark brown
		2%	Coal
		Sm.am.	Claystone, green;Siltstone, brownish
1990-2005		89%	Quartz Sand, medium to coarse, angular to subrounded, Glauconite observed
		8%	Claystone to clayey Siltstone, as above
		3%	Coal
		Sm.am.	Claystone, dark grey, green
2005-20	0.63	98%	Siltstone to silty Claystone, sandy, light, calcareous
		2%	Quartz Sand
		Sm.am.	Siltstone; Sandstone; Coal; Claystone, green
2020-35		70%	Sandstone, very fine to fine, light, Glauconite observed, cemented by calcite
	0.70	30%	Silt/Claystone, light, sometimes brownish, calcareous, with Sand
		Sm am.	Claystone, dark grey; Coal; Quartz Sand, fine to coarse
2035-50		94%	Sandstone, very fine to fine, light, cemented by calcite
		5%	Silt/Claystone, as above, sandy
		1%	Coal
		Sm.am.	Claystone, dark grey, green, brown; Pyrite
		Obs.	Glauconite

Depth (m)	TOC		Lithology
2050-65		99%	Sandstone, as above
		1%	Coal
		Sm.am.	Clay/Siltstone, as above; Claystone, dark grey, green
2065-80		92%	Sandstone, as above , sometimes silty and very calcitic, grey observed
		8%	Silt/Claystone, sandy, light
		Sm.am.	Coal; Quartz Sand, medium to coarse
2080-95		100%	Quartz Sand, coarse/very coarse, medium, angular /subangular, sm.am. Muscovite
		Sm.am.	Coal; Silt/Claystone
2095-2110		100%	Quartz Sand, as above, but also some subrounded
		Sm.am.	Coal; Siltstone/silty Claystone; Pyrite
2110-25		65%	Quartz Sand, coarse/very coarse, medium, sub-angular/subrounded
	2.72	30%	Claystone to Siltstone, grey,calcareous
		5%	Clay/Siltstone, light, light grey, brownish, calcareous
		Sm.am.	Pyrite; Sandstone
		Obs.	Coal
2125-40	2.46	95%	Claystone to Siltstone, grey, Coalparticles observed, muscovitic
		5%	Clay/Siltstone, brownish, light, with Sand
		Sm.am.	Quartz Sand; Pyrite; Sandstone, light; Limestone, white
2140-55	1.76	62%	Claystone to Siltstone, grey, as above
		20%	Clay/Siltstone, brownish, light
		15%	Quartz Sand, fine to coarse
		3%	Pyrite
		Sm.am.	Limestone, grey
		Obs.	Glauconite

Depth (m)	TOC		Lithology
2155-70	1.51	100%	Claystone to Siltstone, as above
		Sm.am.	Quartz Sand; calcareous Silt/Claystone; Pyrite
2170-95	1.68	100%	Silt/Claystone, grey, muscovitic, coal particles/ stringers, Glauconite observed
		Sm.am.	Quartz Sand; Pyrite; Clay/Siltstone, light brown, light
2195-2210		77%	Quartz Sand, fine to medium, coarse,angular/ subangular, light, some muscovite
	2.28	15%	Silt/Claystone, grey, as above
		5%	Plant remains, brown
		3%	Clay/Siltstone,light brown, light
2210-25		100%	Quartz Sand, as above
		Sm.am.	Plant remains, brown; Pyrite; Claystone to Siltstone, grey
2225-40		100%	Quartz Sand/Sandstone, as above
		Sm.am.	Clay/Siltstone, light, light brown, grey; Plant remains
2240-55		100%	Quartz Sand/Sandstone, very fine to medium, coarse, angular/subangular, light, some muscovite; Sand-stone cemented by calcite
		Sm.am.	Clay/Siltstone, dark grey, muscovitic; Coal; Pyrite
2255-70		100%	Quartz Sand and calcareous Sandstone (very fine to fine), very fine to medium, coarse, angular/sub-angular, some muscovite, Glauconite observed, light
		Sm.am.	Silt/Claystone, sandy, light, calcareous; Coal; Pyrite; Clay/Siltstone, grey
2270-85		95%	Quartz Sand and calcareous Sandstone, as above
	1.65	5%	Clayey Siltstone, (brownish) grey, muscovitic
		Sm.am.	Clay/Siltstone, light, calcareous; Plant remains brown; Pyrite

Depth (m)	TOC		Lithology
2285-2300	1.71	50%	Silt/Claystone, grey, muscovitic, Glauconite observed
		50%	Quartz Sand/Sandstone, as above
		Sm.am.	Calcareous Silt/Claystone, light; Plant remains; Pyrite
2300-15	1.18	40%	Clay/Siltstone, light brown, calcareous
	0.79	35%	Silt/Claystone, grey, muscovitic
		25%	Quartz Sand, fine to medium
2315-30	0.66	73%	Silt/Claystone, grey, light grey, muscovitic
		20%	Clay/Siltstone, light brown, calcareous,
		7%	Quartz Sand
		Sm.am.	Pyrite
2330-45		70%	Quartz Sand/Sandstone, fine to medium, coarse, angular/subangular, light
	2.26	28%	Silty Claystone grading to clayey Siltstone, grey, light grey, with Muscovite and Coal
		2%	Clay/Siltstone, light brown, calcareous
2345-60	0.97	100%	Clayey Siltstone, with Sand, light to light grey, with dark grains, calcareous
		Sm.am.	Clay/Siltstone, dark grey, micaceous, Quartz Sand
2360-75	1.21	95%	Clayey Siltstone, as above
		5%	Clay/Siltstone, grey, partly sandy, with Coal fragments
		Sm.am.	Quartz Sand; Forams; Clay/Siltstone, light brown
2375-90	1.37	90%	Clayey Siltstone, as above
		7%	Clay/Siltstone, grey
		3%	Clay/Siltstone, light brown
		Sm.am.	Quartz Sand; Claystone, silty, redbrown; Sandstone
		Obs.	Crystalline fragments

Depth (m)	TOC		Lithology
2390-2405	1.18	50%	Clayey Siltstone, as above
	1.05	40%	Clay/Siltstone, grey to light grey, with Coal, Sand
		5%	Clay/Siltstone, light brown
		5%	Claystone, redbrown
		Sm.am.	Quartz Sand; Siltstone, light; Pyrite; Limestone
		Obs.	Shale, black
2405-20	1.24	60%	Clayey Siltstone, as above
	1.29	35%	Clay/Siltstone, grey to light grey, micaceous
		5%	Claystone, redbrown, with scattered sand grains
		Sm.am.	Silt/Claystone, light brown; Pyrite
		Obs.	Shale, black
2420-35	1.69	80%	Clayey Siltstone, as above
		15%	Clay/Siltstone, grey to light grey, with Coal
		3%	Claystone, redbrown
		2%	Silt/Claystone,light brown
2435-50	1.07	85%	Claystone, silty, grey, some dark, muscovitic
		15%	Clayey Siltstone, as above
		Sm.am.	Claystone, redbrown; Silt/Claystone, light brown; Quartz Sand
2450-66	1.39	93%	Claystone, silty, grey, muscovitic
		7%	Clayey Siltstone, as above
		Sm.am.	Claystone, redbrown; Silt/Claystone, light brown; Quartz Sand
2466-81	1.69	94%	Silty Claystone, as above, with Coal, Sand grains observed
		6%	Clayey Siltstone, as above
		Sm.am.	Claystone, redbrown; Silt/Claystone, light brown; Quartz Sand

Depth (m)	TOC		Lithology
2481-96	1.35	85%	Silty Claystone, grey, muscovitic
		15%	Sandstone, very fine to fine, light, calcareous cement
		Sm.am.	Quartz Sand; clayey Siltstone, as above; Pyrite;
			Claystone, dark grey/black
2496-2511		84%	Quartz Sand/Sandstone, fine to very coarse,
			angular, light
		15%	Silty Claystone, as above
		1%	Coal
2511-26		90%	Quarts Sand, medium to coarse, very coarse,
			angular to subangular, light , with Mica.
		Sm.am.	Mica
		7%	Silty Claystone, grey, green observed, with
			sm.am. Coal
		3%	Coal
2526-41		87%	Quartz Sand, as above,
		10%	Coal
		3%	Silty Claystone, grading to Siltstone, grey,
			green, micaceous.
		Sm.am.	Calcareous Sandstone, very fine to fine
2541-56		92%	Quartz Sand, fine to coarse, very coarse, as above
		6%	Coal
		2%	Silty Claystone, as above
		Sm.am.	Sandstone, fine to very fine, calcareous
		Obs.	Limestone, light
2556-71		98%	Quartz Sand, fine to medium, coarse, very coarse,
			angular to subangular, light
		2%	Coal
		Sm.am.	Silty Claystone, grey
2571-86		75%	Quartz Sand, fine to coarse, very coarse, angular,
			light
		25%	Claystone, silty, grey, partly slightly brownish

Depth (m)	TOC		Lithology
2586-2601		80%	Quartz Sand, fine to very coarse, Angular, light
		20%	Claystone, as above
2601-16		85%	Quartz Sand, as above
		15%	Claystone,(brownish) light grey to grey, some redbrown and green
2616-31		85%	Quartz Sand, as above
		15%	Claystone, as above
2631-46		92%	Quartz Sand, fine to very coarse, angular to subrounded, light
		8%	Claystone, grey to light grey, redbrown, some green and yellowish
2646-61		85%	Quarts Sand, as above
		15%	Claystone, (brownish) light grey to grey, redbrown, some green very chloritic fragments
2661-76		85%	Quartz Sand, as above
		15%	Claystone, light grey (partly slightly brownish) to grey, redbrown, some green (very chloritic), yellow and violet
2676-91		55%	Quartz Sand, as above
		45%	Claystone, greenish light grey, redbrown, violet, yellow,grey
2691-2706		75%	Quartz Sand, as above
		25%	Claystone, as above
2706-21	0.41	95%	Claystone, light grey to light green, grey, redbrown, yellow, green (sandy)
		5%	Quartz Sand
		Obs.	Carbonate, white

Depth (m)	TOC		Lithology
2721-36	0.40	100%	Claystone, redbrown (silty), light greengrey, light grey to grey, redviolet, yellow
		Sm.am.	Sand/Siltstone; Quartz Sand; Limestone, white
2736-51	0.47	100%	Claystone, redbrown (silty), light grey to grey, yellow
		Sm.am.	Sand
		Obs.	Clayey Siltstone, sandy, light; Limestone, white
2751-66	0.42	85%	Claystone, silty, redbrown, yellow, light grey to grey and greengrey, green, redviolet, partly muscovitic
		15%	Quartz Sand/Sandstone, very fine to coarse, calcareous cemented, light, green observed (chloritic)
		Sm.am.	Limestone, white
		Obs.	Pyrite
2766-81	0.42	75%	Claystone, silty, redbrown, light grey to grey and green, yellow redviolet, grey and redbrown sometimes grading to siltstone (micaceous)
		25%	Quartz Sand/Sandstone, very fine to medium, coarse, calcareous cemented, light
		Sm.am.	Limestone, white
2781-96	0.60	88%	Claystone, partly grading to Siltstone, light grey to grey and greenish, yellow, redviolet
		12%	Sand/Sandstone, as above, green(chloritic) observed
		Sm.am.	Limestone, white
2796-2802	0.32	55%	Claystone, as above, sandy redbrown Claystone observed
		45%	Quartz Sand/Sandstone, as above

Table III

Weight (mg) of EOM and Chromatografic fractions.

Sample Nr.	Depth (m)	Rock extr.	EOM	Sat.	Aro	Hydro-carbon	non hydrocarb.	TOC
K270	1630 - 1660	16.8	70.2	1.9	1.9	3.8	3.1	0.64
K277	1780 - 1795	28.4	40.1	3.8	8.2	12.0	9.1	0.69
K281	1840 - 1855	76.12	55.6	12.4	12.0	24.4	9.0	0.81
K284	1885 - 1900	24.48	33.6	4.3	5.6	9.9	5.1	0.76
K288	1945 - 1960	84.46	245.4	75.0	68.0	143.0	32.8	1.69
K300	2110 - 2125	27.63	34.2	3.9	6.0	9.9	6.7	2.72
K302	2140 - 2155	2.22	16.9	1.3	1.6	2.9	4.6	1.76
K304	2170 - 2195	52.76	26.9	3.5	5.6	9.1	7.9	1.68
K305	2195 - 2210	76.23	62.8	5.6	13.0	18.6	21.8	2.28
K311	2285 - 2300	17.87	21.3	1.9	2.1	4.0	6.5	1.65
K312	2300 - 2315	19.79	34.0	4.3	6.4	10.7	8.6	1.71
K314	2330 - 2345	41.07	317.4	1.6	41.7	43.3	7.7	2.26
K347	2375 - 2390	33.38	8.6	1.9	1.5	3.4	1.9	1.37
K351	2435 - 2450	54.16	82.3	14.7	24.6	39.3	16.4	1.69
K354	2481 - 2496	67.20	46.1	17.0	16.3	33.3	7.9	1.35

TABLE IV

Concentration of EOM and chromatografic fractions (Weight ppm of fock).

Sample No.	Depth (m)	EOM	Sat	Aro	Total hydrocarb.	Non hydrocarb.
K270	1630 - 1660	4178	113	113	226	184
K277	1780 - 1795	1411	133	288	422	320
K281	1840 - 1855	730	162	157	320	118
K284	1885 - 1900	1372	175	228	404	208
K288	1945 - 1960	2905	887	805	1693	388
K300	2110 - 2125	1237	141	217	358	242
K302	2140 - 2155	7612	58	720	1306	2072
K304	2170 - 2195	509	66	106	172	149
K305	2195 - 2210	823	73	170	244	285
K311	2285 - 2210	1191	106	117	223	363
K312	2300 - 2315	1718	217	323	540	434
K314	2330 - 2345	7728	38	1015	1054	187
K347	2375 - 2390	257	56	44	101	56
K351	2435 - 2450	1519	271	454	725	302
K354	2481 - 2496	686	252	242	495	117

TABLE V

Concentration of EOM chromatografic (mg/gTOC).

Sample Nr.	Depth (m)	EOM	SAT	Aro	Total hydrocarb.	Non hydrocarb.
K270	1630 - 1660	652	17	17	35	28
K277	1780 - 1795	204	19	41	61	46
K281	1840 - 1855	90	20	19	39	14
K284	1885 - 1900	180	23	30	53	27
K288	1945 - 1960	171	52	47	100	22
K300	2110 - 2125	45	5	7	13	8
K302	2140 - 2155	432	33	40	74	117
K304	2170 - 2195	30	3	6	10	8
K305	2195 - 2210	36	3	7	10	12
K311	2285 - 2300	72	6	7	13	22
K312	2300 - 2315	100	12	18	31	25
K314	2330 - 2345	341	1	44	46	8
K347	2375 - 2390	18	4	3	7	4
K351	2435 - 2450	89	16	26	42	17
K354	2481 - 2496	50	18	17	36	8

TABLE VI

Composition in % of the material extracted from the rock.

Sample No.	Depth (m)	Sat/EOM	Aro/EOM	HC/EOM	Sat/Aro	Non HC/EOM	HC/Non HC
K270	1630 - 1660	2	2	5	100	4	122
K277	1780 - 1795	9	20	29	46	22	131
K281	1840 - 1855	22	21	43	103	16	271
K284	1885 - 1900	12	16	29	76	15	194
K288	1945 - 1960	30	27	58	110	13	435
K300	2110 - 2125	11	17	28	65	19	147
K302	2140 - 2155	7	9	17	81	27	63
K304	2170 - 2195	13	20	33	62	29	115
K305	2195 - 2210	8	20	29	43	34	85
K311	2285 - 2300	8	9	18	90	30	61
K312	2300 - 2315	12	18	31	67	25	124
K314	2330 - 2345	0	13	13	3	2	562
K347	2375 - 2390	22	17	39	126	22	178
K351	2435 - 2450	17	29	47	59	19	239
K354	2481 - 2496	36	35	72	104	17	421

TABLE VII

Tabulation of datas from the gaschromatograms.

Sample No.	Depth (m)	Pristane/nC_{17}	Pristane/Phytane	CPI
K270	1630 - 1660	0.60	0.84	1.45
K277	1780 - 1795	0.52	1.00	1.04
K281	1840 - 1855	0.18	1.19	1.03
K284	1885 - 1900	0.31	1.32	1.03
K288	1945 - 1960	1.49	1.33	1.05
K300	2110 - 2125	0.58	1.22	1.12
K302	2140 - 2155	0.46	1.16	1.18
K304	2170 - 2195	0.53	1.02	1.20
K305	2195 - 2210	0.87	1.21	1.04
K311	2285 - 2300	0.47	1.49	1.12
K312	2300 - 2315	0.43	1.10	1.02
K314	2330 - 2345	0.87	0.80	1.39
K347	2375 - 2390	0.50	0.87	1.40
K351	2435 - 2450	0.47	1.12	1.40
K357	2481 - 2496	0.46	1.11	1.42

TABLE VIII

Vitrinite reflectance and visual kerogen measurements

Depth (m)	Vitrinite reflectance				Colour index	Type of organic matter
1630 - 1660	0.29 (2)	0.56 (4)	0.90 (1)		-2/2	Am, Cysts/Coal, Poll/Spor, He, W
1750 - 1765		0.47 (3)			-2/2	Am, Cysts/Coal, Poll-spor, He, W
1870 - 1885		0.53 (3)			-2/2	Coal, He, W/Am, Cysts
1900 - 1915		0.37 (21)			2	Coal, He, Cut, W; R!Coal/Am
2005 - 2020		0.35 (21)			2	He, Cut, Poll-spor, W, R!Coal/Am
2140 - 2155		0.39 (20)			2	Am/Cut, Coal, R!Coal, W, Poll-spor
2285 - 2300		0.35 (20)			2	Am/R!Coal, Coal, W, Cut, He, Poll-spor
2345 - 2360		0.41 (3)			2	Am, Cysts/He, R!Coal, Coal
2375 - 2390		0.47 (22)		R!	2	Am, Cysts/R!Coal, Cut, He, W, Coal
2420 - 2435	0.27 (2)	0.49 (4)			2/2+	Am, Cysts/Poll-spor, He, Cut, W, R!Coal
2466 - 2481		0.45 (22)			2/2+	Am, Cysts/Poll-spor, Cut, W, Coal, R!Coal
2571 - 2586		0.34 (20)		R!	2/2+	Am/Coal, R!Coal
2706 - 2721		0.41 (11)		R!	2+	Am/He, Coal, R!Coal
2766 - 2781		0.40 (5)	0.81 (5)	R!	2+	Poll-spor, He, W, Coal/Am
2796 - 2802		0.42 (18)		R!	2+	Poll-spor, Cut, He, W, Coal/Am

Table IX ROCK-EVAL RESULTS

Sample	Depth	C_{org} (%)	S_1 (mg/g of rock)	Genetic Potential $S_1 + S_2$ (mg/g of rock)	Hydrogen Index I_H	Oxygen Index I_O	Transformation Ratio $\frac{S_1}{S_1 + S_2}$	T_{Max} (^oC)
K 276	1765-80	0.54	0.10	0.59	91	-	0.17	-
K 279	1810-25	0.57	0.11	0.59	85	-	0.18	-
K 283	1870-85	0.73	0.09	0.56	64	-	0.16	-
K 288	1945-60	1.69	0.35	1.50	68	-	0.23	416
K 301	2095-2110	1.72	0.13	1.01	51	-	0.13	421
K 302	2110-25	1.76	0.15	1.80	94	-	0.08	421
K 303	2125-40	1.51	0.09	1.00	62	-	0.09	423
K 304	2140-55	1.68	0.08	1.20	68	-	0.07	423
K 311	2285-2300	1.65	0.13	1.60	90	-	0.08	428
K 312	2300-15	1.71	0.10	1.50	81	-	0.07	426
K 345	2345-60	0.97	0.15	0.7	62	-	0.20	433
K 346	2360-75	1.21	0.18	1.0	68	-	0.18	438
K 347	2375-90	1.37	0.13	0.8	50	-	0.16	442
K 350	2420-35	1.51	0.17	0.7	36	-	0.23	-
K 351	2435-50	1.69	0.14	1.4	77	-	0.10	438
K 352	2450-66	1.07	0.14	1.5	126	-	0.10	440
K 353	2466-81	1.69	0.33	2.7	143	-	0.12	442
K 354	2481-96	1.35	0.15	1.0	66	-	0.15	442

Sample	Depth	C_{org} (%)	S_1 (mg/g of rock)	Genetic Potential $S_1 + S_2$ (mg/g of rock)	Hydrogen Index I_H	Oxygen Index I_O	Transformation Ratio $\frac{S_1}{S_1 + S_2}$	T_{Max} (^oC)
K 413	2706-21	0.41	0.08	0.5	97	-	0.16	-
K 415	2736-51	0.47	0.07	0.4	75	-	0.17	-
K 418	2781-96	0.60	0.07	0.5	66	-	0.16	-