(O-239)

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CONTINENTAL SHELF INSTITUTE

BA-80-85-1. Rec: 31.12.80 00.

REPORT TITLE

SOURCE ROCK ANALYSES OF WELL 2/7-15.

CLIENT

Phillips Petroleum Company Norway.

CLIENT's REF.:	REPORT NO.:
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	NO. OF PAGES	NO. OF ENCLOSURE
DEPARTMENT:	RESPONSIBLE SCIENTIST:	
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SUMMARY:

See next page

KEY WORDS

Source rock

SUMMARY

The analysed sequence of the well is divided into eleven zones with the following rating:

Zone A; 9510' - 9850': The zone is found to be immature with a fair potential as a source rock for gas.

Zone B; 9850' - 9970': The whole zone is found to be immature. The limestone has a fair to good potential as a source rock for oil and gas. Indications of migrated hydrocarbons.

Zone C; 9970' - 10090': The whole zone is immature. The claystone has a poor potential as a source rock.

Zone D; 10090' - 10430': The whole zone is immature. The limestone has a poor potential as a source rock while the claystone has a fair to good potential as a source rock for oil and gas. Indications of migrated hydrocarbons.

Zone E; 10450' - 11140': Immature. The limestone is similar to zone D while the claystone has a fair potential as a source rock for oil and gas.

Zone F; 11140' - 11330': Various shale lithologies which is immature. The zone has a poor potential as a source rock for gas. Indications of migrated hydrocarbons.

Zone G; 11330' - 11630': Immature with a good potential as a source rock for oil and gas.

Zone H; 11630' - 11750': Immature with a poor potential as a source rock for gas.

Zone I; 11750' - 13650': Immature down to approximately 12050', the rest of the zone is mature. The light grey claystone has a poor/fair potential as a

source rock for gas while the dark grey to black claystone has a rich potential as a source rock for oil and gas, becoming more gasprone towards the lower part of the zone.

Zone J; 13650' - 14360': Mature with a rich potential as a source rock for gas.

Zone K; 14360' - 14510': As zone J.

EXPERIMENTAL AND DESCRIPTION OF INTERPRETATION LEVELS

Total Organic Carbon (TOC)

Picked cuttings of the various lithologies in each sample were crushed in a centrifugal mill. Aliquotes of the samples where then weighed into Leco cruisibles and treated with hot 2N HCl to remove carbonate and washed twice with destilled water to remove traces of HCl. The cruisibles were then places in a vacuum oven at 50°C and 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 in a flow through system (Radke et al., 1978 (Anal. chem. 49, 663-665)) for 10 min. using dichloromethane (DCM) as solvent. The DCM used as solvent was distilled in an all glass apparatus to remove contaminants.

Activated copper filings were used 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 into saturated fraction, aromatic fraction and non hydrocarbon fraction using a MPLC system with hexane as eluant (Radke et al., Anal. Chem, 1980). The various fractions were evaluated on a Buchi Rotavator and transferred to glas-vials and dried in a stream of nitrogen. The various results are given in Table III-VI.

Gas chromatographic analyses

The saturated fraction was diluted with n-hexane and analysed on a HP 5730 A gaschromatograph, fitted with a 25 m OV101 glasscapillary

column and an automatic injection system. Hydrogen (0.7 ml/min.) was used as carrier gas and the injection was performed in the splitt mode (1:20).

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.

The samples were also analysed in UV light, and the colour of the fluoressing material determined. Below, a scale comparing the vitrinite reflectance measurements and the fluorescence measurements is given.

VITRINITE REFLECTANCE R.AVER. 546nm 1·516		0·20	0·30	0·40	0·50	0·60	0·70	0·80	0·90	1·00	1·10
% CARBON CONTENT D.A.F.		57	62	70	73	76	79	80·5	82·5	84	85·5
LIPTINITE FLUOR. EXC. 400nm BAR. 530nm	nm	725 750 790	820	840			860	890	940		
	COLOUR	G G/Y Y	Y/O	L.O.		M.O.		D.O.	O/R		R
	ZONE	1 2 3	4	5		6		7	8		9

NOTE LIPTINITE NM = NUMERICAL MEASUREMENT OF OVERALL SPORE COLOUR AND NOT PEAK FLUORESCENCE WAVELENGTH

RELATIONSHIP BETWEEN LIPTINITE FLUORESCENCE COLOUR, VITRINITE REFLECTANCE AND CARBON CONTENT IS VARIABLE WITH DEPOSITIONAL ENVIRONMENT AND CATAGENIC HISTORY. THE ABOVE IS ONLY A GUIDE. LIPTINITE WILL OFTEN APPEAR TO PROGRESS TO DEEP ORANGE COLOUR AND THEN FADE RATHER THAN DEVELOP O/R AND RED SHADE. TERMINATION OF FLUORESCENCE IS ALSO VARIABLE.

Processing of Samples and Evaluation of Visual Kerogen

Crushed rock samples were treated with hydrochloric and hydrofluoric acids to remove the minerals. A series of microscopic slides contain strew mounts of the residue:

T-slide represents the total acid insoluble residue.
N-slide represents a screened residue (15 meshes).
O-slide contains palynodebris remaining after flotation ($ZnBr_2$) to remove disturbing heavy minerals.
X-slides contain oxidized residues, (oxidizing may be required due to sapropel which embeds palynomorphs, or to high coalification preventing the identification of the various groups).

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

Screened or oxidized residues are normally required to consentrate the larger fragments, and to study palynomorphs (pollen, spores and dinoflagellates) and cuticles for paleodating 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 x63 objectives. By x63 magnification it is possible to distinguish single particles of diameters about 2 and, if wanted, to make a more refined classification of the screened residues (particles >15 µm).

The colour evaluation is based on colour tones of spores and pollen (preferably) with support from other types of kerogen (woody material, cuticles and sapropel). These colours are dependant upon the maturity, but also are under influence of the paleo-environment (lithology of the rock, oxidation and decay processes). The colours and the estimated colour index of an individual sample may therefore deviate from those of the neighbouring samples. The techniques in visual kerogen studies are adopted from Staplin (1969) and Burgess (1974).

In interpretation of the maturity from the estimated colour indices we follow a general scheme that is calibrated against vitrinite reflectance values (Ro).

Ro	0.45	0.6	0.9	1.0	1.3	
colour index	2-	2	2+	3-	3	3+
Maturity intervals	Mature mature	Mature (oil window)			Condensate window	

Rock-Eval Pyrolyses

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

RESULTS AND DISCUSSION

Based on lithological variation and total organic carbon measurements, the analysed sequence, 9510' - 12810' was divided into eleven zones:

A: 9510' - 9850'
B: 9850' - 9970'
C: 9970' - 10090'
D: 10090' - 10450'
E: 10450' - 11140'
F: 11140' - 11330'
G: 11330' - 11630'
H: 11630' - 11750'
I: 11750' - 13650'
J: 13650' - 14360'
K: 14360 - 14510

Total Organic Carbon

Zone A: 9510 - 9850': This zone consists mainly of claystone with a small percentage of another lithology, believed to be tuff in parts. The claystone has an overall fair abundance of organic carbon while the tuff? has a rich abundance of organic carbon.

If the lithological description of this is correct, this high organic carbon value would indicate this to contain migrated hydrocarbons or bitumen.

Zone B: 9850 - 9970': At 9850', the samples start containing limestone. There are very small differences in the organic carbon values for the claystone and the limestone in the samples, they both have organic carbon values around 1%. This high organic carbon value for the limestone is unusual, and could either indicate the limestone being a good sourcerock or that the samples are contaminated.

Zone C: 9970 - 10090': Again a zone with a mixture of limestone and claystone. The organic carbon values of the limestone drops gradually with increasing depth down to 10090 where it levels out at a low value, approximately 0.15%. This low value is normal for limestone in this area of

the North Sea. Some of the samples contain a light brown to brown claystone with a good abundance of organic carbon, quite different from the rest of the claystone in this zone.

Zone D: 10090 - 10450': This zone is separated from zone C due to the steady, low organic carbon values for the limestone in the samples. Otherwise the zone is fairly similar to zone C with two claystone lithologies; one greenish-grey claystone with a fair abundance of organic carbon and one brownish claystone with a good to rich abundance of organic carbon.

Zone E: 10450 - 11140': This zone is separated from zone D mainly due to the change in lithology. The greenish-grey and the brownish claystone are not found in these samples. Most of the samples consist of limestone with a poor abundance of organic carbon while some contain grey claystone also with a poor abundance of oganic carbon. There are a few samples with higher abundances of organic carbon, especially the one from 11050'.

Zone F: 11140 - 11330': At 11140' the lithology of the samples changes, and there is hardly any limestone left. This zone is kind of an intermediate zone between zone E and zone G, with very variable lithology and organic carbon abundance. This could ofcourse be due to cavings.

Zone G: 11330 - 11630': This zone consists mainly of three different claystone lithologies, grey, darkgrey to black and light brown to brown. The abundance of organic carbon is good to rich for most of the analysed samples in this zone.

Zone H: 11630 - 11750': The lithologies of this zone are almost identical to zone G, but with a far lower abundance of organic carbon, which is the reason it is separated out.

Zone I: 11750 - 13650': The upper part of this zone, down to 12140' consists of two lithologies, grey and dark grey to black claystone. The rest of the zone has only the dark grey to black claystone in the samples. It is not clear if the grey claystone is cavings or if the two claystone lithologies are interbedded. However, organic carbon was measured on both lithologies, but the upper part of the zone is most distinctive as a separate zone. The grey claystone has a fair abundance while the dark grey to black claystone has a rich abundance throughout the zone.

Zone J: 13650' - 14360': The claystone in this zone looked darker than in the zones above, almost black. The TOC values increases compared to zone K and is found to be very irregular throughout the zone, though is always high.

Zone K: 14360' - 14510': The claystone in this zone changes to brownish colour and the TOC increases compared to the samples in the lower part of zone J.

Extraction and Chromatographic Separation

A total of twentyone samples were extracted and chromatographically analysed. These samples cover the zones A-I and where possible enough material of the interesting lithologies have been picked for separate analyses. Where there was very small differences in the organic carbon values of various claystone lithologies and at the same time little material, bulk samples were analysed.

Zone A: One sample, the claystone from 9790' were extracted and found to have a poor abundance of extractable hydrocarbons, mainly aromatics. The gas chromatogram of the saturated fraction shows the sample to contain a large input in the nC_{15} - nC_{20} region compared to the heavy end. This would indicate an input mainly from amorphous material. The relatively large abundance of isoprenoids indicates the sample to the immature.

Zone B: Two samples, the claystone and the limestone from 9910' were extracted, and both found to have a rich abundance of extractable hydrocarbons, especially the limestone. The organic carbon normalized values are very high for the limestone sample indicating this to be contaminated with free hydrocarbons. The gas chromatogram of the saturated hydrocarbon fraction of the claystone sample shows a large unresolved envelope in the nC_{15} - nC_{20} range together with a large abundance of n-alkanes in this range. This would indicate the sample either to contain diesel from the mud or condensate. The gas chromatogram of the saturated hydrocarbon fraction of the limestone sample in completely different. There are very little hydrocarbons below nC_{20} while nC_{20} - nC_{33} has a large abundance. This together with the unresolved envelope indicating weathering, could indicate that a large proportion of the organic material in this sample is from reworked material.

Zone C: One sample, the claystone from 10090' was extracted and found to have a poor abundance of extractable hydrocarbons, mainly saturated. The gaschromatogram of the saturated hydrocarbon fraction shows the sample to contain hardly any hydrocarbons below nC_{16}. The high pristane/nC17 ratio and the low pristane/phytane ratio show the sample to be immature. This is in good agreement with the high CPI values. The high abundance of high molecular weight n-alkanes together with the large abundance of steranes and triterpanes indicate an input of terrestrial material.

Zone D: One sample, 10390' was extracted and found to have a good abundance of extractable hydrocarbons, mainly aromatics. The gas chromatogram of the saturated hydrocarbon fraction is very similar to the one of the sample from 10090'.

Zone E: One sample, 11140' was extracted and found to have a rich abundance of extractable hydrocarbons. The organic carbon normalized values are very high indicating the sample to be contaminated with free hydrocarbons. The gas chromatogram of the saturated hydrocarbon fraction shows a large napthenic hump, and relatively high isoprenoids ratio. The n-alkane distribution is very front biased. There could be a number of explanations for this distribution, but the two most likely are either that the sample is partly biodegraded or that it is from a relatively immature napthenic rich source (kerogen type II). In this case we belive it might be a combination of the two possibilities.

Zone G: One sample, 11360' was extracted and found to have a rich abundance of extractable hydrocarbons. The organic carbon normalized values are very high indicating the sample to be contaminated with free hydrocarbons. The gas chromatogram of the saturated hydrocarbon fraction has a smooth unimodal distribution with a maximum at nC_{17} and low isoprenoid values, typical for well mature hydrocarbons. This would indicate the free hydrocarbons in the sample to be from migrated crude oil.

Zone I: Ten samples, all dark grey to black claystone, were extracted from this zone and all were found to have a rich abundance of extractable hydrocarbons. The ratio between saturated and aromatic hydrocarbons varies only slightly for all the samples and the gas chromatograms of the saturated hydrocarbon fractions are also very similar to each other with smooth unimodal front biased n-alkane distributions. The pristane/ phytane ratio is relatively

high for these samples compared to what is found for other samples in the North Sea. This could either be due to a relatively low maturity or to a strong reducing environment during deposition, which would favour the production of phytane compared with pristane.

The gas chromatogram of the saturated hydrocarbon fraction of the sample from 13410' shows a unimodal front biased n-alkane distribution typical for well mature hydrocarbons of amorphous origin. The gas chromatogram is strange with farnacane being the most dominant peak. The remainder of the isoprenoids show a normal abundance compared to the n-alkans. It is not presently known why farnacane is so abundant.

Zone J: Three samples from this zone were analysed, and all found to have a rich abundance of extractable hydrocarbons. The organic normalized values show the upper sample to have an extractability similar to the sample from 13410' while the remainder all show a rich extractability. The composition of hydrocarbons in the uppermost sample is similar to those from the zones above while the two other samples have a higher percentage of saturated hydrocarbons. The gas chromatograms of the saturated hydrocarbon fractions show a front biased unimodal distribution typical for well mature hydrocarbons of amorphous origin.

Zone K: One sample from this zone was extracted and found to have a rich abundance of extractable hydrocarbons with a composition similar to the lowermost samples from zone J. The gas chromatogram of the saturated hydrocarbon fraction shows a frontbiased unimodal distribution with a high concentration of farnacane.

Examination in Reflected Light

Twentyfour samples were examined in reflected light. Below, each sample is described, and other information from the analyses is given together with the vitrinite reflectance data.

Sample K 3648, 9510': Mixed shale lithologies, Ro = 0.35 (18) and Ro = 0.64(2).

A few of the cuttings show heavy bitumen staining and contain small particles of low reflectance vitrinite and reworked material. UV light shows a yellow/orange fluorescence from spore specks and a low exinite content.

Sample K 3676, 9790': Mixed shale lithologies, Ro = 0.38(12).
The sample has plentiful bitumen blebs and wisps in some lithologies, otherwise only a trace of organic material, mostly reworked particles. A couple of lignite particles are recorded together with a handful of vitrinite specks. UV light shows a light orange fluorescence from spores and a moderate exinite content.

Sample K 3691, 9940': Calcareous shale, Ro = 0.37 (7) and
Ro = 0.63 (2).
The sample has a low content of inertinite and reworked material. Only a trace of possibly true vitrinite and a light bitumen staining are recorded. UV light shows a strong carbonate fluorescence and hydrocarbon globules together with yellow/orange spores and a low exinite content.

Sample K 3706, 10090': Mixed shale lithologies, Ro = 0.39 (12).
A few cuttings in the sample are heavily bitumen stained and contain a low content of vitrinite particles and wisps. Inertinite and reworked material are dominant. UV light shows a yellow/orange fluorescence from spores and a trace of exinite.

Sample 3777, 10210': Mixed shale lithologies, Ro = 0.43(20).
The sample has an overall bitumen staining. Some of the cuttings are rich in pyrite and bitumen. These also contain a few vitrinite wispy particles and reworked particles. Most of the cuttings are barren. UV light shows a strong overall carbonate fluorescence and hydrocarbon impregnation and globules, together with a yellow/orange fluorescence from spores and a trace of exinite.

Sample K 3811, 11150': Calcareous shale, Ro = 0.29 (2) and
Ro = 0.66(2).
The sample has a low organic content and most of the cuttings are barren. A few cuttings contain extremely corroded particles of inertinite and reworked material. A few low reflectance particles of doubtful vitrinite are measured. UV light shows a yellow/orange fluorescence from spores and a low exinite content.

Sample K 3821, 11250': Mixed shale lithologies, Ro = 0.45 (19).
The sample has a moderate organic content, mostly inertinite and reworked particles. Only a few true vitrinite particles are recorded. There are signs

of oxidation in the sample. UV light shows a yellow/orange fluorescence from spores and hydrocarbon specks together with a trace of exinite.

Sample K 3829, 11330': Shale, Ro = 0.34(2) and Ro = 0.60 (1).
Many of the cuttings in the sample are barren while some contain plentiful amounts of very corroded particles of inertinite and reworked material. Bitumen wisps together with a couple of possibly true vitrinite particles are recorded. UV light shows a light orange fluorescence from spores in a few cuttings together with a low exinite content.

Sample K 3838, 11420': Carbonate and shale, Ro = 0.35 (9) and Ro = 0.56 (10).
The sample has a moderate organic content, mainly in the shale. Mostly reworked particles and inertinite are recorded together with a trace of true material. UV light shows a strong overall carbonate fluorescence and hydrocarbon globules. No exinite is recorded.

Sample K 3844, 11480': Shale, Ro = 0.53 (3).
The sample has a low organic content. Most of the cuttings are barren. A few contain very gnarled and corroded particles of inertinite and reworked material. Three vitrinite particles are located and measured. UV light shows fluoresence from hydrocarbon globules and no exinite.

Sample K 3856, 11600': Shaly limestone, Ro = 0.27 (1) and Ro = 0.54 (15).
The sample has a moderate organic content, mostly reworked particles with some inertinite. Subordinate vitrinite particles and wispy particles. UV light does not show any organic fluorescence.

Sample K 3865, 11690': Shale, Ro = 1.46 (5).
The sample has only a trace of organic material with a few bitumen wisps and occasional reworked and inertinite particles. No true vitrinite. UV light does not show any organic fluorescence.

Sample K 3874, 11780': Calcareous shale, Ro = 0.35 (1).
The sample has a low organic content restricted to a few cuttings. Small gnarled particles of inertinite and reworked material. A few bitumen wisps and one doubtful vitrinite particle are located. UV light shows a yellow/orange fluorescence from spores and hydrocarbon dissolving in the immersion oil together with a low exinite content.

Sample K 3880, 11840': Shale and carbonate, Ro = 0.42 (15).
The sample has a moderate organic content, mostly reworked particles. A few doubtful vitrinite particles together with some bitumen staining and wisps are recorded. UV light shows a light orange fluorescence from spores and a moderate exinite content.

Sample K 3895, 11990': Shale, Ro = 0.46 (3).
The sample has a low to moderate organic content, almost wholly reworked material and inertinite. Only three possibly true particles are recorded together with plentiful bitumen wisps. UV light shows a yellow/orange and light orange fluorescence from spores and a low-moderate exinite content.

Sample K 3901, 12080': Carbonate, shale and sandstone, Ro = 0.22 (2) and Ro = 0.52 (11).
The sample has a moderate organic content with a few vitrinite wispy particles, but mostly reworked material and inertinite. UV light shows a light orange fluorescence from spores and hydrocarbon specks together with a low exinite content.

Sample K 3904, 12110': Mixed shale lithologies, Ro = 0.39 (9).
The sample has a low organic content restricted to a few cuttings. Bitumen wisps and staining together with rather corroded inertinite and reworked particles are recorded. Only a trace of vitrinite particles. UV light shows a yellow/orange fluorescence from spores and a low exinite content.

Sample K 3910, 12170': Shale and subordinate carbonate, Ro = 0.33 (3) and Ro = 0.56 (8).
The sample has a moderate organic content, mostly reworked and inertinite particles. A few vitrinite particles and wispy particles are recorded. UV light shows a light orange fluorescence from spores and a moderate exinite content.

Sample K 3922, 12290': Calcareous shale, Ro = 0.59 (2).
The sample has a low organic content, mainly small inertinite and reworked particles. A slight bitumen staining and a couple of doubtful vitrinite particles are recorded. UV light shows a light orange fluorescence from spores and a trace of exinite.

Sample K 3940, 12470': Shale and carbonate, Ro = 0.23 (1) and Ro = 0.49 (15).
The sample has a moderate organic content with inertinite and reworked particles being dominant. A few vitrinite particles and bitumen traces are recorded. UV light shows a light orange fluorescence from spores and a moderate exinite content.

Sample K 3955, 12620': Shale, Ro = 0.50 (10).
The sample has a moderate organic content with particles of inertinite and reworked material being dominant. Only a trace of true vitrinite and plentiful bitumen wisps are recorded. UV light shows a yellow/orange and light orange fluorescence from spores together with a moderate exinite content.

Sample K 3967, 12740': Shale, Ro = 0.35 (4) and Ro = 0.70 (6).
The sample has a very low organic content with bitumen wisps and localized staining. Small particles of vitrinite and inertinite are recorded. UV light shows a light orange fluorescence from spores and a moderate exinite content.

Sample K 3974, 12810': Shale, Ro = 0.53 (8).
The sample has a low organic content with bitumen wisps and locallized staining. Particles, mostly of reworked material and inertinite together with a trace of true vitrinite are recorded. UV light shows a light/mid. orange fluorescence from spores and a moderate-rich exinite content.

Sample K 6433, 12890': Shale, Ro = 0.36 (18)
The sample has a low organic content with bitumen staining and wisps. A few inertinite and reworked particles with a trace of true vitrinite wisps. UV light shows a yellow/yellow orange and light orange fluorescence from spores together with a moderate to rich content of exinite.

Sample K 6441, 13130': Shale, Ro = 0.34 (20) and Ro = 0.55 (3).
The sample has a low to moderate organic content with inertinite and reworked particles being dominant but some good vitrinite and bitumen wisps with locallised bitumen staining. UV light shows a yellow to orange and light orange fluorescence from spores and a moderate exinite content.

Sample K 6447, 13320': Shale, Ro = 0.28 (9) and Ro = 0.53 (2).
The sample has an overall strong bitumen staining and wisps, otherwise a low content of inertinite and reworked particles with only a trace of vitrinite particles. UV light shows a yellow/orange fluorescence from spores and a moderate to rich exinite content.

Sample K 6457, 13620': Shale, Ro = 0.36 (20).
The sample has an overall strong bitumen staining and wisps. Otherwise a low content of small inertinite and reworked particles with vitrinite wisps. UV light shows a light orange fluorescence from spores and a moderate exinite content.

Sample K 6465, 13860': Shale, Ro = 0.42 (21).
The sample has an overall strong bitumen staining and wisps, otherwise a very low content of vitrinite/bitumen wisps with inertinite and reworked particles. UV light shows a yellow/orange and light orange fluorescence from spores and hydrocarbons dissolving in the immersion oil together with a low exinite content.

Sample K 6473, 14110': Shale, Ro = 0.31 (10) and Ro = 0.58 (2).
The sample has an overall strong bitumen staining, otherwise only a trace of small inertinite particles and a few vitrinite wisps. UV light shows a yellow/orange fluorescence from spores and hydrocarbons dissolving in immersion oil together with a low to moderate exinite content.

Sample K 6481, 14360': Shale, Ro = 0.31 (6) and Ro = 0.83 (1).
The sample has an overall light bitumen staining and frequent wisps, otherwise a very low content of small inertinite particles and a few vitrinite specks. UV light shows a yellow/orange and light orange fluorescence from spores together with a moderate exinite content.

Sample K 6487, 14510': Shale, Ro = 0.36 (5) and Ro = 0.73 (1).
The sample is saturated in bitumen, otherwise only a trace of phytoclasts, inertinite particles and a few doubtful vitrinite particles. UV light shows a light orange fluorescence from spores and a low exinite content.

Examination in Transmitted Light

The description of the acid insoluble material of this well is based on 25 cuttings samples from 9510' to 14510' on routine basis (with support from 4 more samples on project basis for the interval 11200' to 11390').

9510' to 13380': The finely dispersed residues with one exception were dominated by amorphous material, apparently true sapropel. The terrestrial element is subordinate. There is a strong tendency for sapropelic material sticking in aggregates. At sample level 11750' strongly sapropelized cuticles, indeterminated herbaceous and woody material dominate. Colour index: 1+ for the interval 9510' to 9790' (immature); 1+/2- for the interval 9940' to 10090'; 2- for the interval 10210' to 11050', and 2-/2 for the interval 11150' to 13320'.

The interval 9940' to 13320' has good prospects as a source for oil, but from the colour of the organic material it does not appear to have reached the oil window.

13380': This residue from the kerogen composition (amorphous material dominates) belongs to the interval above, but the preservation of the organic material and its colour indicate a closer relation to the interval below.

13380' to 14510': The residues contain 60 to 90% strongly sapropelized, fragmented cuticles, indeterminated herbaceous remains, and woody material. True amorphous material seems to form 10 to 40%, but the distinction is difficult due to the poor preservation. Colour index: 2 has been estimated as the general index for the lowest interval. Increased values, 2+, were noted for the level 13380' to 13860', possibly under control by the lithology.

The interval seems to contain mature organic material, in the upper part of the oil window, and there are possibilities for gas and oil.

Rock-Eval Pyrolyses.

A series of samples, mainly claystone were pyrolysed on a Rock-Eval instrument. Below, the results from the analyses are discussed zone by zone.

Zone A: Nine samples were analysed. The claystone samples mainly have low to medium hydrogen indices and high oxygen indices indicating kerogen type III. The limestone sample from 9850' has a high hydrogen index and a high oxygen index. This high oxygen index could be partly due to CO_2 from the carbonate, but also due to the low maturity of the sample ($T_{max} = 428^{o}$), and could therefore be type II kerogen. Some of the samples in this zone have a fair to good petroleum potential, while the majority have a poor petroleum potential. The whole zone is found to be immature.

Zone B: Two samples, both limestones, were analysed. The uppermost sample, 9910' is found to have results similar to the limestone from 9850', while the other analysed sample has results typical for kerogen type III. This indicates that at approximately 9880'-9910' there is a limestone sequence with kerogen type II going sharply into another limestone sequence at 9910' with kerogen type III.

Zone C: Only one sample from this zone was analysed and found to contain kerogen type III.

Zone D: Three samples, all claystones were analysed. The samples show an increasing hydrogen index with increasing depth. The oxygen index is, however, high for all three samples, and increasing with increasing depth. The samples are all immature. It is believed they contain a mixture of kerogen type II and III and with increasing proportion of kerogen type II with increasing depth. The very high oxygen index is probably due to CO_2 from inorganic sources.

Zone E: Four samples from this zone were analysed. Three of the samples were different lithologies from 11050'. The calcareous siltstone is found to contain kerogen type III while the limestone and the dark grey claystone contain kerogen type II with a rich petroleum index. All the samples are immature. The analysed sample from 11110' has very high oxygen index but the high hydrogen index indicates the sample to be a mixture of kerogen type II and III.

Zone F: Four samples were analysed, all with low hydrogen indices and high oxygen indices, typical for kerogen type III. The petroleum index is poor for this samples which is found to have a high T_{max}. This could indicate that most of the organic carbon is reworked.

Zone G: Eleven samples, some of different lithologies from the same depth were analysed. The claystones from 11360' are found to have similar results to the samples from zone F, i.e. kerogen type III, possibly reworked, while the claystones of various colours except the light brown from 11420' downwards have high hydrogen indices indicating these to contain kerogen type II. The light brown claystone often does not show any S_2 peak, and contains probably reworked material. The other claystones from this zone have a good to rich petroleum potential.

Zone H: One sample, a silty claystone from 11750' was analysed and found to be of kerogen type II with a rich petroleum potential .

Zone I: Fortyfive samples from this zone were analysed. Some of the samples are different lithologies from the same depth interval while most of the samples are just one lithology per depth interval. The grey to light grey claystone in the upper part of the zone, down to 12130' has low hydrogen indices and high oxygen indices, typical for kerogen type III while the dark grey to black claystone is found to have high hydrogen indices and low oxygen indices, typical for kerogen type II. The hydrogen index drops slightly from approximately 12170' which could indicate an influx of more type III kerogen. This part of the zone probably contains a mixture of type II and type III kerogen.

One of the samples, 13440', has a very high hydrogen index together with a large S_1 peak. We believe that asphaltenes in the sample pyrolysed and caused the very large S_2 peak. The petroleum index for the analysed samples from this zone varies greatly but they are found to have either a good or a rich potential for the lower part while the upper part has a fair potential. The T_{max} of the samples indicate a change from immature to mature at approximately 12050'.

Zone J: Eleven samples from this zone were analysed. Again most of the samples were found to have moderate hydrogen indices and oxygen indices, but some variation is seen. It is believed that the most of the zone has a mixture of kerogen type II and type III while some small lenses have kerogen type III. The petroleum index is again found to be good or rich. The T_{max} indicates the whole zone to be mature.

Zone K: Four samples from this zone were analysed and the results are very similar to those from zone J.

CONCLUSION

In the interpretation of the results, the maturity of the samples are based on vitrinite reflectance, fluorescence in UV light, colour of kerogen in transmitted light and the T_{max} from the Rock-Eval pyrolyses. The richness of the samples is based on the TOC measurements, the extractability of hydrocarbons and the petroleum index in the Rock-Eval pyrolyses while the source rock quality of the samples is based on the Rock-Eval pyrolyses, the visual kerogen examination in transmitted light and the quality of extract, mainly based on the gas chromatographic analyses. Below, each zone is described and source rock quality and maturity given.

Zone A: 9510' - 9850': This zone consists mainly of claystone and is found to be immature. The organic carbon values vary considerably throughout this zone, but on the whole it is found to have a fair potential as a source rock for gas. There is a discrepancy between the Rock-Eval kerogen evaluation and the visual kerogen evaluation. We believe this is due to sapropelization of the kerogen which makes it look amorphous, and therefore put more emphasise on the Rock-Eval pyrolyses data for this zone.

Zone B: 9850' - 9970': This zone consists of claystone and limestone. The claystone might be cavings from the zone above. The organic carbon values of the limestone is quite high and this is in agreement with the extraction and Rock-Eval data. There are indications of migrated hydrocarbons in the samples and this will of course distort the extraction data. Based on the various analyses, the limestone in this zone is found to be immature with a fair to good potential as a source rock for oil and gas.

Zone C: 9970' - 10090': Another zone with a mixture of limestone and claystone. The claystone here is different from that in zone B and is found to be immature with a poor potential as a source rock.

Zone D: 10090' - 10430': The limestone in this zone also has a poor potential as a source rock while the claystone has a fair to good potential as a source rock for oil and gas. The whole zone is immature. Indications of free hydrocarbons in samples throughout the zone.

Zone E: 10450' - 11140': Another zone with limestone and claystone. The limestone is similar to the one in zone D, with a poor potential as a source

rock. The claystone in the upper part of the zone has a far lower potential as a source rock than the claystone is zone D, while a few samples in the lower part have a good potential as a source rock for oil and gas. On the whole this zone is immature with a fair potential as a source rock for oil and gas.

Zone F: 11140' - 11330': This zone has a large mixture of various shale lithologies. The whole zone is found to be immature. Some of the samples probably contain a large proportion of reworked material which distorts the organic carbon value. On the whole the zone has a poor potential as a source rock for gas. Indications of free hydrocarbons.

Zone G, 11330' - 11630': Some of the cuttings in this zone are probably cavings from the one above. The true claystone in this zone is found to be immature with a good potential as a source rock for oil and gas. Indications of free hydrocarbons.

Zone H, 11630' - 11750': Almost identical lithology to zone G, but with a far lower abundance of organic carbon. Based on the few analysed samples, this zone is found to be immature with a poor potential as a source rock for gas.

Zone I, 11750' - 13650': The upper part of this zone consists of two lithologies, a light grey claystone with a poor/fair potential as a source rock for gas and a dark grey to black claystone with a rich potential as a source rock for oil and gas. This lithology becomes more gasprone towards the lower part of the zone. The change does not happen sharply, but goes gently over a few hundred feet. From approximately 12050' the zone is found to be mature, mainly based on the Rock-Eval and fluorescence data. The vitrinite reflectance data were unstable for most of this zone. Free hydrocarbons are located in some of the samples in the zone.

Zone J: 13650' - 14360': This zone consists mainly of an almost black claystone. Vitrinite reflectance measurements show a low maturity for this zone while both Rock-Eval pyrolyses and visual kerogen examination show a far higher maturity. We believe this discrepancy in the various maturity parameters is due to bitumen staining lowering the reflectance values. The whole zone is found to have a rich potential as a source rock for gas.

Zone K: 14360' - 14510': The colour of the claystone change to brownish. The whole zone is found to be mature with a rich potential as a source rock for gas.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3648	9510'	0,87	100% Claystone, grey - light grey - greenish grey - pale green and greybrown - redbrown. The grey Claystone is partly fissile and micaceous. It contains varying amounts of Pyrite.
		0,74	Greenish grey Claystone (75%).
			sm.am. of Calcite often impregnated with Pyrite.
K-3649	9520'	0,74	100% Claystone, as above.
		0,63	Greenish grey Claystone (50%)
			sm.am. as above; Lignite (add).
K-3652	9550'	0,52	100% Claystone, mostly greenish grey. Some of the Claystone is laminated with pyritic lamina giving it a dark colour. It may be tuffaceous.
		0,27	Greenish grey Claystone (70%)
			sm.am. of secondary clear Calcite; Pyrite; Lignite (add).
K-3654	9570'	0,78	100% Claystone, as above.
		0,55	Greenish grey Claystone (70%)
			sm.am. as above; Quartz, subangular - subrounded.
K-3658	9610'		80% Claystone, as above
		0,43	Grey Claystone (60%)
		2,35	20% Tuffaceous Claystone
			sm.am. as above.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3655	9580'		100% Claystone, as above The pale green Claystone is very fine grained and mostly fissile.
		0,72	Greenish grey Claystone (70%)
			sm.am. as above.
K-3661	9640'	0,88	75% Claystone, grey, pale green, redbrown, as above
		4,65	20% Claystone, greybrown
			5% Tuff.
			sm.am. of Quartz, ?nodular Chert, medium - fine
K-3664	9670'	0,38	75% Claystone as above. The pale greenish Claystone often contains lamina of a pale brownish Claystone, Pyrite impregnated. A smaller amount of a redbrown Claystone, micaceous and more massive
		3,60	20% Claysone, greybrown
			5% Tuff
			sm.am. of nodular Chert (Radiolarians); brownish grey, Claystone with a flamy structure impregnated with Pyrite.
K-3667	9700'	0,27	98% Claystone, as above. Grey - green Claystone (70%).
			2% Tuff Abundant nodular chert
			sm.am. as above.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3670	9730'	0,80	100% Claystone, as above. Abundant. Tuff; nodular Chert. sm.am. Lignite (add).
K-3673	9760'	0,92	100% Claystone, as above, olivegreen Claystone in small amounts sm.am. nodular Chert; Tuff; Pyrite; secondary Calcite; Lignite (add).
K-3676	9790'	1,03	100% Claystone, as above sm.am. as above
K-3679	9820'	0,76	100% Claystone, as above sm.am. as above
K-3682	9850'	0,64 1,33 0,32 1,06	60% Claystone, mostly grey - pale greenish grey, some fissile, brownish red-grey (micaceous), dark grey Claystone green Claystone. 40% Limestone, very pale brown to white, soft, often weakly laminated sm.am. ob. Pyrite; secondary Calcite; Lignite (add).
K-3685	9880'	1,06 0,54	55% Limestone, as above 45% Claystone, as above sm.am. as above; Tuff.
K-3688	9910'	1,12 1,02	55% Limestone, as above 40% Claystone, as above 5% Mica (add). sm.am. Pyrite.

012/A/3/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3691	9940'	0,81 1,00	50% Claystone, as above 45% Limestone, as above 5% Mica (add). sm.am. clear Quartz, pyritic Tuff? (caved?)
K-3694	9970'	1,18 0,99	60% Claystone, as above 35% Limestone, as above 5% Mica (add). sm.am. as above.
K-3697	10000'	 0,45	70% Claystone, as above grey - light greenish grey grading to pale green, fissile, and redbrown - brown. 25% Limestone light brown - pale pink, microcrystalline 5% Mica (add); Drilling Mud.
K-3700	10030'	 0,31 1,93 0,34	80% Claystone, grey, slightly micaceous, some fissile, greenish grey - green, fissile, brownish grey Claystone, more massive, dark redbrown Claystone more fissile. Green Claystone (50%) Brownish grey Claystone (15%) 17% Limestone, as above 3% Mica (add). sm.am. Pyrite
K-3703	10060'	0,23 1,45 0,39	50% Limestone, as above 37% Claystone, as above 10% Claystone, brownish grey Greenish grey Claystone (30%) 3% Mica (add.) sm.am. Pyrite.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3706	10090'	0,39	40% Claystone, grey - greyish green
		1,75	20% Claystone, brownish grey-brown
		0,19	40% Limestone, as above
			1% Mica (add).
			sm.am. fibrous Calcite; Pyrite; Tuff?
K-3708	10120'	0,39	55% Claystone, as above. Mainly grey - greenish grey
		0,18	43% Limestone, as above
			2% Mica (add).
K-3711	10150'	0,46	60% Claystone, as above and some brownish grey, brownish red Claystone, partly fissile
		0,18	39% Limestone, as above
			1% Mica (add).
			sm.am. Pyrite, fibrous Calcite.
K-3714	10180'	0,12	48% Limestone, as above
		0,48	52% Claystone, as above
			sm.am. Mica (add).
K-3717	10210'	0,17	50% Limestone, white - pale pink, microcrystaline, slightly fissile, soft.
			50% Claystone, grey, light brownish grey, brown, brownish red.
		0,47	Grey Claystone
		1,93	Light brownish grey Claystone
			sm.am. Mica (add.)
K-3723	10270'	0,19	40% Limestone, white, some pink.
		0,55	60% Claystone, brownish grey to greybrown, greenish to light green, some redbrown and dark grey.

012/A/5/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC		Lithology
K-3726	10300'	0,15	40%	Limestone, as above
		0,72	60%	Claystone, brownish grey to greybrown, greenish to light green, some grey and brown.
K-3729	10330'	0,16	35%	Limestone, as above
		0,68	40%	Claystone, grey to greenish grey
		3,36	15%	Claystone, light brown
K-3732	10360'	0,15	25%	Limestone
		0,64	60%	Claystone, grey to greenish grey
		2,32	15%	Claystone, silty, light brown
K3735	10390'	0,22	30%	Limestone
		0,52	55%	Claystone, grey (brownish) to greenish grey
		2,37	15%	Claystone, silty, light brown
K-3738	10420'	0,20	25%	Limestone
		0,63	65%	Claystone, grey - greenish grey
		1,92	10%	Claystone, light brown
K-3741	10450'		10%	Limestone
		1,26	55%	Claystone, light brown
		0,35	35%	Claystone, grey - greenish grey
K-3744	10480'	0,16	40%	Limestone
			10%	Claystone
			50%	Cement
K-3747	10510'	0,25	80%	Limestone, white
			20%	Cement

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3750	10540'	0,18	100% Limestone
K-3753	10570'	0,66	15% Limestone 10% Claystone 75% Cement
K-3756	10600'	0,22 0,43	55% Limestone, white 15% Claystone, grey, light brownish grey 30% Cement
K-3759	10630'	0,17 0,17	85% Limestone, white - some light grey 15% Claystone, grey to light grey greenish grey, very calcareous
K-3762	10660'	0,16	100% Limestone, white - light grey
K-3765	10690'	0,16 0,30	90% Limestone, as above 10% Claystone, light grey - grey and greenish
K-3768	10720'	0,16 0,27	90% Limestone, as above 10% Claystone, as above
K-3771	10750'	0,20 0,35	75% Limestone, white 25% Claystone, light grey - grey and greenish, very calcareous
K-3774	10780'	0,18 0,27	85% Limestone, white 15% Claystone, as above
K-7377	10810'	0,24	90% Limestone, white 10% Claystone, grey, very calcareous

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3780	10840'	0,23	90% Limestone 10% Claystone, pale bluish grey
K-3783	10870'	0,20	95% Limestone, white 5% Claystone
K-3786	10900'	0,30	95% Limestone, white 5% Claystone
K-3789	10930'	0,17	98% Limestone, white - very pale pink, mostly microcrystalline, some cryptocrystalline, spherulitic texture, soft. Contains small fragments of ?volcanic glass. 1% Siltstone - Silty Claystone, calcareous with small dark spots. 1% Claystone, dark grey - grey - bluish grey, some fissile, weak - strong calcareous. sm.am. A tuff-like claystone.
K-3792	10960'	0,11	97% Limestone, as above 2% Siltstone, as above 1% Claystone, as above sm.am. Tuff.
K-3795	10990	0,21	97% Limestone, as above, but somewhat harder. 3% Claystone, as above. The darkest claystone is some calcareous. Abundant. Mica (add). sm.am. Tuff; Siltstone, as above

012/A/8/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3798	11020'	0,28	95% Limestone, white microcrystalline cryptocrystalline, some mottled, contains occasionally Glauconite, Pyrite and Chert, hard - grading to a light brown and somewhat coarser silty Limestone. 5% Claystone, grey - bluish grey - greenish grey. The bluish grey Claystone often contains dark laminae. The Claystone is partly fissile, contains occasionally Pyrite and it is slightly - very calcareous. The darkest Claystone is micaceous, calcareous and fissile. sm.am. Mica (add).
K-3801	11050'	3,90 0,53 6,05	70% Siltstone, brown -light brown, mottled, calcareous - very calcareous. 15% Limestone, white, micro - cryptocrystalline, small amounts of pyrite, abundant spheruler. 10% Claystone, dark grey - black, occ. white mottled, non-calcareous. Often pyritic. It is partly interlaminated with grey Claystone. It may be tuffaceous. 5% Claystone, light grey - greenish grey, some fissile, some calcareous to slightly calcareous. sm.am. Chert.
K-3804	11080'	0,33	95% Limestone, white - pale pink, microcrystalline, soft, spherulitic texture, it contains often small amounts of pyrite. 5% Claystone, dark grey, greenish grey, grey, and white.

012/A/9/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
			sm.am. of Chert, pale bluish grey; Mica (add.).
K-3807	11110'	0,27	80% Limestone, mocrocrystalline - cryptocrystalline, white - pale pink, some spherulitic texture, slightly pyritic.
		1,07	15% Claystone, as above, often laminated.
			5% Siltstone, light brown calcareous grading to a silty Limestone
			obs Chert.
K-3810	11140'	0,19	50% Limestone, silty, white - pale pink, microcrystalline, spherulitic texture, ?volcanic glass fragments
		1,04	35% Claystone, grey - greenish grey, calcareous - very calcareous, partly fissile.
			5% Claystone, dark grey - black, non calcareous.
			5% Siltstone, light brown, slightly calcareous, mottled.
			5% Silty claystone, reddish brown, calcareous.
			sm.am. Chert.
K-3811	11150'	0,81	60% Claystone, grey - light grey - greenish grey. Calcareous - very calcareous, mottled, contains small spherules, partly fissile.
		0,23	30% Limestone, white - greyish white, often grading to a silty Limestone.
			5% Claystone, black - dark grey, non calcareous.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
			5% Claystone - silty Claystone, reddish brown, calcareous. sm.am. Pyrite; Mica (add.); Chert.
K-3813	11170'	0,72	90% Claystone, grey (some dark grey), light grey, greenish grey, partly fissile, calcareous - very calcareous. 7% Limestone, as above, hard. 3% Claystone, silty, reddish brown, calcareous. sm.am. Pyrite; Mica (add); Tuff observed.
K-3816	11200'	0,33	90% Claystone, as above 10% Limestone, as above, stylolitic structures observed. sm.am. Pyrite; Chert; Calcite; Mica (add).
K-3817	11210'	0,61	70% Claystone, as above. 30% Limestone, as above, stylolites observed.
K-3818	11220'		60% Claystone, as above. 35% Limestone, as above, mostly white. 5% Silty limestone, light brown, hard. Stylolites observed with ?kerogen sm.am. Pyrite; Calcite; Mica (add.).
K-3819	11230'		60% Claystone, mainly grey, greenish grey and bluish grey. The greenish grey claystone is soft and fissile, some slightly micaceous. 40% Limestone, as above. sm.am. black claystone, non calcareous, Pyrite.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology	
K-3821	11250'	0,38	90%	Claystone, grey
		1,43	10%	Claystone, dark grey
K-3823	11270'	0,43	90%	Claystone, light grey - grey
		1,79	10%	Claystone, dark grey.
K-3826	11300'	0,86	70%	Claystone, light grey, grey - greenish grey, dark grey, redbrown.
			20%	Limestone, white, hard.
			10%	Claystone, redbrown.
K-3829	11330'	3,38	10%	Siltstone/Marl, light brown.
		2,03	10%	Claystone, dark grey.
		0,55	10%	Claystone, redbrown.
		0,66	50%	Claystone, grey - greenish grey.
			20%	Limestone, white.
K-3832	11360'	2,44	60%	Siltstone/Marl, light brown.
		1,40	40%	Claystone, grey.
K-3835	11390'	1,92	60%	Siltstone/Marl, light brown.
		2,25	10%	Claystone, dark grey.
		1,26	25%	Claystone, light grey - grey.
K-3838	11420'	2,65	80%	Siltstone/Marl, light brown.
		1,66	20%	Claystone, light grey to grey and dark grey.
K-3841	11450'	2,28	10%	Siltstone/Marl, light brown.
		2,87	10%	Claystone, dark grey.
		0,96	60%	Claystone, grey.

012/A/12/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC		Lithology
K-3844	11480'	1,65	15%	Siltstone/Marl, light brown.
		0,60	60%	Claystone, light grey to grey.
		2,93	7%	Claystone, dark grey.
K-3847	11510'	1,97	10%	Siltstone/Marl, light brown
		0,30	90%	Claystone, light grey/grey, very calcareous.
K-3850	11540'		15%	Siltstone/Marl, light brown
		0,46	80%	Claystone, light grey, grey.
K-3856	11600'	0,34	83%	Claystone, light grey.
		2,24	7%	Claystone, dark grey.
		1,65	10%	Siltstone/Marl, light brown.
K-3859	11630'	1,59	10%	Siltstone/Marl, light brown.
		0,42	25%	Claystone, light grey.
		1,14	65%	Claystone, grey.
K-3862	11660'	0,31	15%	Claystone, redbrown.
		0,36	50%	Claystone, light grey.
		0,28	35%	Claystone, olive-grey.
K-3865	11690'	0,35	10%	Claystone, redbrown.
		0,35	35%	Claystone, olive-grey.
		0,29	55%	Claystone, grey.
K-3868	11720'	0,32	15%	Claystone, redbrown.
		0,38	60%	Claystone, olive grey.
		0,68	25%	Claystone, grey - dark grey.
K-3871	11750'	7,61	20%	Silty Claystone with sandstone laminae, dark grey to black.
		0,42	80%	Claystone, grey - olive grey, calcareous.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3874	11780'	4,18	10% Claystone - silty Claystone, dark grey to black.
		0,48	85% Claystone, grey - light grey, very calcareous
		2,13	5% Siltstone/Marl, light brown.
K-3877	11810'	4,81	35% Claystone, dark grey - black.
		0,36	65% Claystone, grey - light grey, as above.
K-3880	11840'	4,11	35% Claystone, dark grey.
		0,35	65% Claystone, grey - light grey, calcareous.
K-3883	11870'	2,98	80% Claystone, dark grey - grey
		0,51	20% Claystone, grey - light grey, calcareous.
K-3886	11900'	3,48	85% Claystone, dark grey - grey.
		0,46	15% Claystone, light grey to grey, white, brownish, some redbrown calcareous.
K-3889	11930'	2,88	90% Claystone, dark grey - grey
			10% Claystone, as above.
K-3892	11960'	3,39	80% Claystone, dark grey to grey.
		0,50	20% Claystone, as above.
K-3895	11990'	5,32	80% Claystone, dark grey to grey.
		0,38	20% Claystone, grey light grey to white and grey, calcareous.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3898	12050'	5,27 0,63	40% Claystone, dark grey to grey. 10% Claystone, as above. 50% Additives (Nut shells, Mica).
K-3901	12080	3,65 0,50	15% Claystone, dark grey to grey. 5% Claystone, as above. 80% Additives (Mica, Nut shells).
K-3904	12110'	2,24	20% Claystone, dark grey to grey, some calcareous. 80% Additives.
K-3906	12130'	4,68	20% Claystone, dark grey - grey, some calcareous. 80% Additives. sm.am. Claystone, grey.
K-3910	12170'	2,06	50% Claystone, grey. 50% Additives.
K-3913	12200'	2,29	sm.am. Claystone, grey/dark grey. 100% Additives.
K-3916	12230'	2,02	5% Claystone, some fissile, dark grey grading to grey (occasionally brownish). 95% Additives.
K-3919	12260'	1,89	10% Claystone, as above. 90% Additives.
K-3922	12290'	1,83	25% Claystone, as above. 75% Additives.

012/A/15/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3925	12320'	1,83	55% Claystone, dark grey to grey (sligthly (brownish)). sm.am. Sandstone, fine, calcareous. 20% Dolomite, dark grey, hard. 25% Additives.
K-3928	12350'	1,87	60% Claystone, dark grey, grading to grey. 40% Additives. sm.am. Claystone, light grey, very calcareous.
K-3931	12380'	2,29	100% Claystone, dark grey to grey (some sligthly brownish), partly slightly calcareous, some fissile.
K-3934	12410'	2,29	100% Claystone, as above. sm.am. Dolomite, dark grey.
K-3937	12440	2,38	100% Claystone, as above. sm.am. Sandstone, very fine, wh, calcareous.
K-3940	12470'	2,03	100% Claystone, as above, partly some calcareous.
K-3943	12500'	2,01	100% Claystone, as above.
K-3946	12530'	2,76	100% Claystone, partly silty, dark grey - grey, as above.
K-3949	12560'	1,95	100% Claystone, as above, sm.am. Claystone, calcareous, light grey; siltstone.

012/A/16/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-3952	12590'	2,36	100% Claystone, as above.
K-3955	12620'		100% Claystone, dark grey, grading to grey.
K-3958	12650'	2,16	100% Claystone, as above.
K-3961	12680'	2,37	100% Claystone, as above, some calcareous.
K-3964	12710'	2,79	95% Claystone, dark grey to grey, some calcareous, partly silty. 5% Dolomite, dark grey, hard.
K-3967	12740'	2,24	100% Claystone, as above.
K-3969	12760'	2,20	100% Claystone, as above.
K-3971	12780'	2,36	100% Claystone, as above. obs. Glauconite.
K-3974	12810'	2,05	100% Claystone, as above.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-6564	12830'	2.49	100% Claystone, grey to dark grey, some fissile, partly some calcareous. sm.am. Claystone, light grey, calcareous to very calcareous; Sandstone, fine, slightly glauconitic, calcareous; clear secondary Calcite, fibrous, filling of fissures; dark grey Dolomite.
K-6432	12860'	2.87	100% Claystone, as above, obs fragments with lamina of light grey irregular material.
K-6433	12890'	2.05	100% Claystone, grey to dark grey, obs slickensided, occasionally slightly calcareous, some fissile. sm.am. Sandstone, silty, very fine, slightly glauconitic and calcareous, browngrey.
K-6434	12920'	2.22	100% Claystone, grey to dark grey, some fissile, occasionally some calcareous, slightly micromicaceous.
K-6435	12950'	2.07	100% Claystone, grey to dark grey, as above, some lamina of Sandstone/ Siltstone brownish sm.am. Calcite, secondary, white.
K-6436	12980'	2.45	100% Claystone, as above.
K-6437	13010'	3.73	100% Claystone, as above.
K-6438	13030'	2.24	100% Claystone, grey to dark grey, some fissile, occasionally some calcareous, slightly micromicaceous. sm.am. Sandstone, silty, very fine, light browngrey, slightly glauconitic.

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-6439	13070'	2.56	100% Claystone, as above.
K-6440	13100'	1.94	100% Claystone, as above, lamina of very fine Sandstone light grey slightly glauconitic. sm.am. Dolomite, dark grey, hard.
K-6441	13130'	2.49	100% Claystone, as above.
K-6442	13160'	2.58	100% Claystone, grey to dark grey, slightly calcareous to non-calcareous, subfissile, partly silty and partly slightly micromicaceous.
K-6443	13190'	2.28	100% Claystone, as above sm.am. Calcite, white and grey, secondary, fibrous (fissures).
K-6444	13210'	2.91	100% Claystone, grey, grading to dark grey, as above. sm.am. Sandstone, as above; Calcite, as above.
K-6445	13260'	2.91	100% Claystone, partly silty, grey to dark grey, browngrey, some fissile, slightly micromicaceous.
K-6446	13290'	2.21	100% Claystone, as above.
K-6447	13320'	2.83	100% Claystone, some silty, dark grey (some fissile) to grey, partly some calcareous, slightly micromicaceous.
K-6448	13350'	2.40	100% Claystone, as above. sm.am. Sandstone, as above.

012/A/19/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology	
K-6458	13650'	2.43	100%	Claystone, as above, slightly micaceous.
K-6459	13680'	6.16	100%	Claystone, as above.
K-6460	13710'	10.31	100%	Claystone, dark grey (some fissile) to grey, very slightly micromicaceous, very slightly calcareous to very calcareous.
K-6461	13740'	3.69	100%	Claystone, as above, some dark grey to black.
K-6462	13770'	10.22	100%	Claystone, dark grey (slightly brownish) grading to black, some grey (10%), some brownish light grey silty, some calcareous, subfissile.
K-6463	13800'	10.06	100% obs	Claystone, as above. Pyrite; fine light grey calcareous Sandstone, loose.
K-6464	13830'	10.14	100%	Claystone, as above.
K-6465	13860'	10.88	100%	Claystone, dark grey (slightly brownish) grading to black, some calcareous, some sub-fissile.
K-6466	13890'	4.11	100%	Claystone, dark grey grading to black (60%) and dark grey (40%), some grey silty.

012/A/21/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-6467	13920'	16.95	100% Claystone, dark grey grading to black (slightly brownish), slightly calcareous.
K-6468	13950'	4.72	60% Claystone, dark grey grading to black. 40% Claystone, dark grey to grey.
K-6469	13990'	7.97	100% Claystone, dark grey grading to black (slightly brownish), calcareous, subordinated dark grey to grey.
K-6470	14020'	3.27	100% Claystone, as above.
K-6471	14050'	3.56	100% Claystone, dark grey grading to black and grey sm.am. Sandstone, fine, brownish light grey, slightly glauconitic, calcareous; Dolomite, dark grey obs with white rim.
K-6472	14080'	3.54	100% Claystone, silty, dark grey, some grading to grey, obs black. obs. Calcite, light grey/clear, filling in Claystone fissures.
K-6473	14110'	3.05	100% Claystone, slightly brownish dark grey.
K-6474	14140'	2.61	100% Claystone, silty, dark grey, some grading to grey.
K-6475	14170'	3.71	100% Claystone, as above.

012/A/22/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-6476	14200'	2.51	100% Claystone, grey to dark grey, partly silty, slightly calcareous to calcareous sm.am. Dolomite, brownish dark grey.
K-6477	14230'	2.84	100% Claystone, as above sm.am. Sandstone, white, fine, pyritic, calcareous.
K-6478	14260'	2.65	100% Claystone, partly silty, grey to dark grey, some slightly brownish sm.am. Sandstone, brown, silty, very fine to fine, non-calcareous.
K-6479	14290'	2.47	100% Claystone, dark grey, grey.
K-6480	14320'	3.57	100% Claystone, dark grey (partly slightly brownish) partly grading to black.
K-6481	14360'	3.75	75% Claystone, grey grading to dark grey. 25% Claystone, slightly brownish dark grey grading to black.
K-6482	14390'	8.67	100% Claystone, slightly brownish dark grey (grading to black), some grey.
K-6483	14420'	7.96	100% Claystone, dark grey (slightly brownish) grading to black, some grey.

012/A/23/mk

IKU

TABLE NO.: I

WELL NO.: 2/7-15

Sample	Depth	TOC	Lithology
K-6484	14450'	3.67	100% Claystone, slightly brownish dark grey (some grading to black), some grey.
K-6485	14480'	3.74	100% Claystone, as above.
K-6566	14510'	11.55	100% Claystone, slightly brownish dark grey grading to black, obs. grey, slightly calcareous.

012/A/24/mk

IKU

T A B L E : II

WEIGHT OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKU-No	DEPTH (feet)	Rock Extr. (g)	EOM (mg)	Sat. (mg)	Aro. (mg)	HC (mg)	Non HC (mg)	TOC (%)
K-3676	9790	32.2	56.5	3.6	2.6	6.2	50.3	1.4
K-3688 LIMESTONE	9910	16.2	190.1	41.9	27.6	69.5	120.6	1.6
K-3688 CLAYSTONE	9910	24.0	137.3	8.9	7.1	16.0	121.3	1.4
K-3706	10090	28.7	1.6	1.1	.2	1.3	.3	1.3
K-3735	10390	19.8	10.6	1.4	4.9	6.3	4.3	2.3
K-3810	11140	7.2	16.3	4.2	1.9	6.1	10.2	.7
K-3832	11360	82.2	1942.9	339.5	51.9	391.4	1551.3	1.9
K-3883	11870	39.5	439.7	73.9	28.1	102.0	337.7	3.1
K-3892	11960	16.5	101.9	30.1	21.8	51.9	50.0	2.5
K-3898	12050	10.8	83.2	25.6	15.8	41.4	41.8	4.0
K-3910	12170	73.2	353.6	62.1	37.2	99.3	254.3	4.1
K-3937	12440	100.2	1357.6	42.4	25.7	68.1	1289.5	2.5
K-3952	12590	93.0	380.8	134.8	48.5	183.3	197.5	2.6
K-3971	12780	38.3	181.8	67.3	26.6	93.9	87.9	2.6
K-6437	13010	73.1	368.1	135.7	64.1	199.8	168.3	3.7
K-6447	13320	87.3	245.9	78.9	40.3	119.2	126.7	2.8
K-6450	13410	100.3	1112.5	278.9	192.6	471.5	641.0	1.5
K-6460	13710	52.8	166.3	48.8	27.6	76.4	89.9	10.3
K-6469	13990	91.5	1037.4	337.8	166.9	504.7	532.7	8.0
K-6479	14290	47.5	450.2	157.9	62.1	220.0	230.2	2.5
K-6486	14500	72.2	935.8	373.5	135.0	508.5	427.3	11.6

IKU

T A B L E : III

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm of rock)

IKU-No	DEPTH (feet)	EOM	Sat.	Aro.	HC	Non HC
K-3676	9790	1755	112	81	193	1562
K-3688]LIMESTONE	9910	11735	2586	1704	4290	7444
K-3688]CLAYSTONE	9910	5721	371	296	667	5054
K-3706	10090	56	38	7	45	10
K-3735	10390	535	71	247	318	217
K-3810	11140	2264	583	264	847	1417
K-3832	11360	23636	4130	631	4762	18875
K-3883	11870	11132	1871	711	2582	8549
K-3892	11960	6176	1824	1321	3145	3030
K-3898	12050	7704	2370	1463	3833	3870
K-3910	12170	4831	848	508	1357	3474
K-3937	12440	13549	423	256	680	12869
K-3952	12590	4095	1449	522	1971	2124
K-3971	12780	4747	1757	695	2452	2295
K-6437	13010	5036	1856	877	2733	2302
K-6447	13320	2817	904	462	1365	1451
K-6450	13410	11092	2781	1920	4701	6391
K-6460	13710	3150	924	523	1447	1703
K-6469	13990	11338	3692	1824	5516	5822
K-6479	14290	9478	3324	1307	4632	4846
K-6486	14500	12961	5173	1870	7043	5918

IKU

T A B L E : IV

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

IKU-No	DEPTH (feet)	EOM	Sat.	Aro.	HC	Non HC
K-3676	9790	126.2	8.0	5.8	13.9	112.4
K-3688 LIMESTONE	9910	733.4	161.7	106.5	268.1	465.3
K-3688 CLAYSTONE	9910	414.6	26.9	21.4	48.3	366.2
K-3706	10090	4.4	3.0	.6	3.6	.8
K-3735	10390	22.9	3.0	10.6	13.6	9.3
K-3810	11140	305.9	78.8	35.7	114.5	191.4
K-3832	11360	1244.0	217.4	33.2	250.6	993.4
K-3883	11870	365.0	61.3	23.3	84.7	280.3
K-3892	11960	247.0	73.0	52.8	125.8	121.2
K-3898	12050	193.1	59.4	36.7	96.1	97.0
K-3910	12170	116.7	20.5	12.3	32.8	83.9
K-3937	12440	548.5	17.1	10.4	27.5	521.0
K-3952	12590	159.9	56.6	20.4	77.0	83.0
K-3971	12780	183.3	67.8	26.8	94.7	88.6
K-6437	13010	136.1	50.2	23.7	73.9	62.2
K-6447	13320	100.6	32.3	16.5	48.8	51.8
K-6450	13410	734.6	184.1	127.2	311.3	423.2
K-6460	13710	30.6	9.0	5.1	14.0	16.5
K-6469	13990	142.3	46.3	22.9	69.2	73.0
K-6479	14290	383.7	134.6	52.9	187.5	196.2
K-6486	14500	111.7	44.6	16.1	60.7	51.0

IKU

T A B L E : V

COMPOSITION IN % OF THE MATERIAL EXTRACTED FROM THE ROCK

IKU-No	DEPTH (feet)	Sat / EOM	Aro / EOM	HC / EOM	Sat / Aro	Non HC / EOM	HC / Non HC
K-3676	9790	6.4	4.6	11.0	138.5	89.0	12.3
K-3688]LIMESTONE	9910	22.0	14.5	36.6	151.8	63.4	57.6
K-3688 CLAYSTONE	9910	6.5	5.2	11.7	125.4	88.3	13.2
K-3706	10090	68.8	12.5	81.3	550.0	18.7	433.3
K-3735	10390	13.2	46.2	59.4	28.6	40.6	146.5
K-3810	11140	25.8	11.7	37.4	221.1	62.6	59.8
K-3832	11360	17.5	2.7	20.1	654.1	79.9	25.2
K-3883	11870	16.8	6.4	23.2	263.0	76.8	30.2
K-3892	11960	29.5	21.4	50.9	138.1	49.1	103.8
K-3898	12050	30.8	19.0	49.8	162.0	50.2	99.0
K-3910	12170	17.6	10.5	28.1	166.9	71.9	39.0
K-3937	12440	3.1	1.9	5.0	165.0	95.0	5.3
K-3952	12590	35.4	12.7	48.1	277.9	51.9	92.8
K-3971	12780	37.0	14.6	51.7	253.0	48.3	106.8
K-6437	13010	36.9	17.4	54.3	211.7	45.7	118.7
K-6447	13320	32.1	16.4	48.5	195.8	51.5	94.1
K-6450	13410	25.1	17.3	42.4	144.8	57.6	73.6
K-6460	13710	29.3	16.6	45.9	176.8	54.1	85.0
K-6469	13990	32.6	16.1	48.7	202.4	51.3	94.7
K-6479	14290	35.1	13.8	48.9	254.3	51.1	95.6
K-6486	14500	39.9	14.4	54.3	276.7	45.7	119.0

IKU

TABLE NO.: VI

WELL NO.: 2/7-15

TABULATION OF DATAS FROM THE GASCHROMATOGRAMS

Sample	Depth	Pristane/nC_{17}	Pristane/Phytane	CPI
K 3676	9790'	1.2	2.4	1.3
K 3688	9910'	0.7	1.1	1.0
Limestone				
K 3688	9910'	0.6	1.4	0.9
Claystone				
K 3706	10090'	1.7	1.6	1.4
K 3735	10390'	1.1	1.3	1.3
K 3810	11140'	0.6	1.4	1.0
K 3832	11360'	0.4	1.3	1.0
K 3883	11870'	0.5	1.2	1.0
K 3892	11960'	0.5	1.3	1.0
K 3910	12170'	0.6	1.2	1.0
K 3937	12440'	0.5	1.4	1.1
K 3952	12590'	0.4	1.3	1.0
K 3971	12780'	0.5	1.2	1.0
K 6437	13010'	.6	1.1	1.1
K 6447	13320	.5	1.4	1.4
K 6450	13410'	.5	1.2	1.0
K 6460	13710'	.5	1.3	1.0
K 6469	13990'	.4	1.5	1.0
K 6479	14290'	.4	1.5	1.0
K 6486	14500'	.4	1.2	1.0

IKU

TABLE NO.: VII

VITRINITE REFLECTANCE MEASUREMENTS

WELL NO.: 2/7-15

Sample	Depth	Vitrinite reflectance	Fluorescence in UV light	Exinite content
K-3648	9510'	0.35(18), 0.64(2)	Yellow/orange	Low
K-3676	9790'	0.38(12)	Light orange	Moderate
K-3691	9940'	0.37(7), 0.63(2)	Yellow/orange	Low
K-3706	10090'	0.39(12)	Yellow/orange	Trace
K-3717	10210'	0.43(20)	Yellow/orange	Low
K-3801	11050'	0.46(9)	Yellow/orange	Trace
K-3811	11150'	0.29(2), 0.66(2)	Yellow/orange	Low
K-3821	11250'	0.45(19)	Yellow/orange	Trace
K-3829	11330'	0.34(2), 0.60(1)	Light orange	Low
K-3838	11420'	0.35(9), 0.56(10)		Nil
K-3844	11480'	0.53(3)		Nil
K-3856	11600'	0.27(1), 0.54(15)		Nil
K-3865	11690'	1.46(5)		Nil
K-3874	11780'	0.35(1)	Yellow/orange	Low
K-3880	11840'	0.42(15)	Light orange	Moderate
K-3895	11990'	0.46(3)	Yellow/orange and light orange	Low-Moderate
K-3901	12080'	0.22(2), 0.52(11)	Light orange	Low
K-3904	12110'	0.39(9)	Yellow/orange	Low
K-3910	12170'	0.33(3), 0.56(8)	Light orange	Moderate
K-3922	12290'	0.59(2)	Light orange	Trace
K-3940	12470'	0.23(1), 0.49(15)	Light orange	Moderate
K-3955	12620'	0.50(10)	Yellow/orange and light orange	Moderate
K-3967	12740'	0.35(4), 0.70(6)	Light orange	Moderate
K-3974	12810'	0.53(8)	Light/Mid. orange	Moderate-Rich

IKU

TABLE NO.: VII

VITRINITE REFLECTANCE MEASUREMENTS

WELL NO.: 2/7-15

Sample	Depth	Vitrinite reflectance	Fluorescence in UV light	Exinite content
K-6433	12890'	0.36(18)	Yellow/orange + Light orange	Moderate-rich
K 6441	13130'	0.34(20),0.55(3)	Yellow/orange + Light orange	Moderate
K-6447	13320'	0.28(9),0.53(2)	Yellow/orange	Moderate-rich
K-6457	13620'	0.36(20)	Light orange	Moderate
K-6465	13860'	0.42(21)	Yellow/orange + Light orange	Low
K-6473	14110'	0.31(10),0.58(2)	Yellow/orange	Low-moderate.
K-6481	14360'	0.31(6),0.83(1)	Yellow/orange + Light orange	Moderate
K-6565	14510'	0.36(5),0.73(1)	Light orange	Low

IKU

TABLE NO.: VIII a

VISUAL KEROGEN ANALYSIS

WELL NO.: 2/7-15

Sample	Depth	Composition of residue	Particle size	Preservation - palynomorphs	Thermal maturation index	Remarks
	9510'	Am,Cy/He,P,S	FM	Good	1+	Pyrite is present in all samples. Amorphous material tend to form aggregates.
	9790'	Am,Cy/He,P,S	FM	Good	1+	
	9940'	Am,Cy/He,P	F-M-L	Fair	1+/2-	Richer in organic material.
	10090'	Am,Cy/He,P	F-M	Fair	1+/2-	
	10210'	Am,Cy/He,P,S	F-M	Fair	2-	Variable preservation.
	11050'	Am,Cy/He,P	F	Good and poor	2-	Mud additives suspected.
	11150'	Am,Cy/He,W,P	F-M	Good to fair	2	
	11200'	Am,Cy/He,W,P	F	Good to fair	2	
	11390'	Am,Cy/He,W,P,S	F	Fair to poor	2-/2	Richer in organic material.

ABBREVATIONS

Am	amorphous	Cy	cysts, algae	W	woody material	F	fine
He	herbaceous	P	pollen grains	C	coal	M	medium
Cut	cuticles	S	spores	R!	reworked	L	large

IKU

TABLE NO.: VIII b

VISUAL KEROGEN ANALYSIS

WELL NO.: 2/7-15

Sample	Depth	Composition of residue	Particle size	Preservation - palynomorphs	Thermal maturation index	Remarks
	11630'	Am,Cy/W,He,P	F-M	Fair to poor	2-/2	Pollen and spores from 10210' to 14510' generally of very poor preservation. Cysts are fairly well to poor pres.
	11750'	He,Cut,W,P/Am,Cy	F-M-L	Poor and fair	2-	
	11770'	Am,Cy/He,P,Cut,S	F	Poor and fair	2-/2	
	11990'	Am,Cy/He,P,Cut,S	F-M	Poor and fair	2-/2	
	12190'	Am,Cy/He,Cut,W,P	F-M	Poor and fair	2-/2	
	12530'	Am,Cy/Cut,He,W,P	F-M-L	Poor and fair	2-/2	
	12760'	Am,Cy/W,He,Cut,P	F-M	Poor	2-/2	
	12890'	Am,Cy/He,P,W	F-M	Poor and fair	2-/2	
	13130'	Am,Cy/He,W,P	F-M	Poor	2	

ABBREVATIONS

Am	amorphous	Cy	cysts, algae	W	woody material	F	fine
He	herbaceous	P	pollen grains	C	coal	M	medium
Cut	cuticles	S	spores	R!	reworked	L	large

IKU

TABLE NO.: VIII c

VISUAL KEROGEN ANALYSIS

WELL NO.: 2/7-15

Sample	Depth	Composition of residue	Particle size	Preservation - palynomorphs	Thermal maturation index	Remarks
	13320'	Am,Cy/He,Cut,W,P	F-M-L	Poor	2-/2	Very poorly preserved material below 13320'. Increase in coalification from 13380'.
	13380'	Am,Cy/He,Cut,W,P	F-M-L	Poor	2+	
	13620'	He,Cut,W,P,S/Am,Cy	F-M	Poor	2+	
	13860'	He,Cut,W,P,S/Am,Cy	F-M	Poor	2+	
	14110'	He,Cut,W,P,S/Am,Cy	F	Poor	2	
	14360'	Am,Cy/He,Cut,W,P	F-M	Poor	2	
	14510'	He,Cut,W,P/Am,Cy	F-M	Poor	2	

ABBREVATIONS

Am	amorphous	Cy	cysts, algae	W	woody material	F	fine
He	herbaceous	P	pollen grains	C	coal	M	medium
Cut	cuticles	S	spores	R!	reworked	L	large

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Bulk										
K 3648	9510'	0.24	1.21	1.24	0.65	186.15	190.77	1.45	0.17	434°
Bulk										
K 3654	9570'	0.30	0.97	1.13	0.55	54.55	205.45	1.27	0.24	434°
K 3658	9610'	0.80	4.00	1.26	2.35	170.21	53.62	5.26	0.15	431°
Brown clayst.										
K 3661	9640'	0.29	8.35	4.36	4.65	6.24	93.76	8.64	0.03	429°
Grey claystone										
K 3661	9640'	0.08	0.61	1.11	0.88	69.32	126.14	0.69	0.12	431°
K 3670	9730'	0.09	0.48	1.37	0.80	60.00	171.25	0.57	0.16	438°
K 3676	9790'	0.06	0.66	1.96	1.03	64.08	190.29	0.72	0.08	437°
Limestone										
K 3682	9850'	2.94	2.71	2.16	1.06	255.66	203.77	5.65	0.52	428°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Dark grey claystone										
K 3682	9850'	0.41	1.07	1.42	1.33	80.45	106.77	1.48	0.28	439°
Limestone										
K 3688	9910'	3.68	2.99	1.87	1.12	266.96	166.96	6.67	0.55	422°
Claystone										
K 3688	9910'	1.15	0.66	0.66	1.02	64.71	64.71	1.81	0.64	429°
K 3700	10030'	0.12	2.76	2.29	1.93	143.01	118.65	2.88	0.04	426°
K 3717	10210'	0.10	2.49	2.49	1.93	129.02	129.02	2.59	0.04	428°
Red brown claystone										
K 3729	10330'	0.08	4.73	3.43	3.36	140.77	102.08	4.81	0.02	432°
Light brown claystone										
K 3735	10390'	0.15	5.02	2.74	2.37	211.81	115.61	5.17	0.03	427°

IKU

TABLE NO.: IX

WELL NO.:2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Light brown claystone										
K 3741	10450'	0.07	5.02	2.74	1.26	398.41	217.46	5.09	0.01	436°
Limestone										
K 3801	11050'	1.24	0.71	1.44	0.53	133.96	271.70	1.95	0.64	422°
Siltstone										
K 3801	11050'	18.17	18.19	2.02	3.09	466.41	51.79	36.36	0.50	430°
Dark grey claystone										
K 3801	11050'	8.37	15.99	1.61	6.05	264.30	26.61	24.36	0.34	427°
Claystone										
K 3807	11110'	0.23	2.43	1.66	1.07	227.10	155.14	2.66	0.09	432°
Claystone										
K 3813	11170'	0.19	0.24	1.65	0.72	33.33	229.17	0.43	0.44	441°
Dark grey claystone										
K 3821	11250'	0.03	-	1.43	1.43	-	100.00	-	-	-

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Dark grey claystone										
K 3829	11330'	0.58	0.33	0.44	2.03	23.08	21.67	0.91	0.64	443°
Light brown claystone										
K 3829	11330'	0.11	0.07	0.07	3.38	2.07	2.07	0.18	0.61	428°
Light brown claystone										
K 3832	11360'	2.03	1.83	0.71	2.44	75.00	29.10	3.86	0.53	430°
Grey claystone										
K 3832	11360'	1.83	-	1.69	1.40	-	120.71	-	-	-
Light brown claystone										
K 3838	11420'	11.78	5.83	0.31	2.65	220.00	11.70	17.61	0.67	428°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Grey greenish grey claystone										
K 3838	11420'	12.24	5.67	2.03	1.66	341.57	122.29	17.91	0.68	430°
Light brown claystone										
K 3844	11480'	5.30	4.74	2.04	1.65	287.27	123.64	10.04	0.53	430°
Grey claystone										
K 3844	11480'	1.33	-	1.70	0.60	-	283.33	-	-	-
Dark grey claystone										
K 3844	11480'	3.43	3.67	2.21	2.93	125.26	75.43	7.10	0.48	441°
Dark grey claystone										
K 3856	11600'	1.55	1.98	1.42	2.24	224.00	63.39	3.53	0.44	439°
Light brown claystone										
K 3856	11600'	6.28	5.12	1.52	1.65	310.30	92.12	11.40	0.55	428°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Light brown claystone K 3859	11630'	4.94	8.04	2.16	1.59	505.66	135.85	12.98	0.38	433°
Grey claystone K 3859	11630'	0.30	0.36	1.30	1.14	31.58	114.04	0.66	0.45	446°
Silty claystone K 3871	11750'	5.91	33.54	1.44	7.61	440.74	18.92	39.45	0.15	434°
Black claystone K 3880	11840'	2.12	14.21	1.39	4.11	345.74	33.82	16.33	0.13	438°
Dark grey claystone K 3883	11870'	2.15	7.85	1.32	2.98	263.42	44.30	10.00	0.22	440°
Grey claystone K 3883	11870'	0.10	-	1.24	0.51	-	243.14	-	-	-

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Dark grey, black claystone										
K 3886	11900'	2.45	9.93	0.58	3.48	285.34	16.67	12.38	0.20	441°
Grey-light grey clayst										
K 3886	11900'	0.68	0.07	1.16	0.46	15.22	252.17	0.75	0.91	436°
K 3889	11930'	1.98	7.24	1.17	2.88	251.39	40.63	9.22	0.21	442°
Black dark grey clayst										
K 3892	11960'	2.18	11.17	1.04	3.39	329.50	30.68	13.35	0.16	442°
Grey light grey clayst										
K 3892	11960'	0.10	0.18	0.92	0.50	36.00	184.00	0.28	0.36	398°
Black dark grey clayst										
K 3895	11990'	5.64	16.57	0.62	5.32	311.47	11.65	22.21	0.25	434°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
Grey claystone										
K 3895	11990'	0.15	0.04	1.68	0.38	10.53	442.11	0.19	0.79	431°
Black dark grey clayst										
K 3898	12050'	4.46	19.93	0.97	5.27	378.18	18.41	24.39	0.18	436°
Grey claystone										
K 3898	12050'	0.11	0.08	1.07	0.63	12.70	169.84	0.19	0.58	437°
Black dark grey clayst										
K 3901	12080'	3.48	9.74	1.22	3.65	266.85	33.42	13.22	0.26	439°
Silty claystone										
K 3901	12080'	0.96	0.58	1.48	0.50	116.00	296.00	1.54	0.62	429°
Grey claystone										
K 3901	12080'	0.32	0.07	1.12	0.52	13.46	215.38	0.39	0.82	448°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
K 3904 Dark grey claystone	12110'	1.42	5.45	0.88	2.24	243.30	39.29	6.87	0.21	442°
K 3906 Grey claystone	12130'	2.08	13.71	2.69	4.68	292.95	57.48	15.79	0.13	442°
K 3906	12130'	0.27	0.03	1.26	0.61	4.92	206.56	0.30	0.90	438°
K 3910	12170'	0.08	3.81	1.13	2.06	184.95	54.85	2.89	0.03	441°
K 3913	12200'	1.53	4.44	1.31	2.29	193.89	57.21	5.97	0.26	440°
K 3916	12230'	1.35	3.31	1.46	2.02	163.86	72.28	4.66	0.29	441°
K 3919	12260'	1.18	2.94	0.69	1.89	155.56	36.51	4.12	0.29	440°
K 3922	12290'	0.95	2.56	1.49	1.83	139.89	81.42	3.51	0.27	441°
K 3925	12320'	0.32	2.18	1.28	1.83	119.13	69.95	2.50	0.13	443°
K 3928	12350'	0.77	3.96	1.11	1.87	211.76	59.36	4.73	0.16	442°
K 3931	12380'	0.84	2.77	1.26	2.29	120.96	55.02	3.61	0.23	441°
K 3934	12410'	0.75	3.86	1.16	2.29	168.56	50.66	4.61	0.16	437°
K 3937	12440'	0.68	3.65	1.14	2.38	153.36	47.90	4.33	0.16	440°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
K 3940	12470'	0.64	2.87	1.26	2.03	141.38	62.07	3.51	0.18	440°
K 3943	12500'	0.65	3.02	1.25	2.01	150.25	62.19	3.67	0.18	440°
K 3946	12530'	1.05	5.09	1.31	2.76	184.42	47.46	6.14	0.17	441°
K 3949	12590'	0.62	2.88	1.10	1.95	147.69	56.41	3.50	0.18	438°
K 3952	12620'	0.71	3.23	1.07	2.36	136.86	45.34	3.94	0.18	440°
K 3958	12650'	0.69	3.53	1.08	2.16	163.43	50.00	4.22	0.16	442°
K 3961	12680'	0.74	3.85	2.31	2.37	162.45	97.47	4.59	0.16	443°
K 3964	12710'	1.05	6.62	2.57	2.79	237.28	92.11	7.67	0.14	444°
K 3967	12740'	0.64	4.43	2.70	2.24	197.77	120.54	5.07	0.13	441°
K 3969	12760'	0.78	3.52	2.93	2.20	160.00	133.18	4.30	0.18	443°
K 3971	12780'	0.84	4.07	2.53	2.36	172.46	107.20	4.91	0.17	437°
K 3974	12810'	0.58	3.12	2.95	2.05	152.20	143.90	3.70	0.16	441°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
K 6434	12920	.89	5.72	4.91	2.22	258	221	6.61	.13	441°
K 6437	13010	1.96	7.15	.78	3.73	192	21	9.11	.22	436°
K 6439	13070	1.71	6.67	.81	2.56	261	32	8.39	.20	445°
K 6442	13160	2.49	7.38	1.37	2.58	286	53	9.87	.25	441°
K 6445	13260	2.44	8.79	.57	2.93	300	19	11.24	.22	444°
K 6447	13320	.93	5.28	.86	2.83	186	30	6.20	.15	445°
K 6449	13380	2.21	7.28	.42	12.54	58	3	9.49	.23	444°
K 6450	13410	5.78	26.74	.71	20.63	130	3	32.52	.18	466°
K 6451	13440	11.96	77.31	.51	6.70	1154	8	89.27	.13	452°
K 6454	13530	2.04	7.54	1.78	4.05	186	44	9.58	.21	446°
K 6457	13620	1.24	4.54	1.29	2.40	189	54	5.78	.22	445°
K 6460	13710	1.43	6.67	2.58	10.31	65	25	8.10	.18	445°
K 6462	13770	10.55	22.40	1.78	10.22	219	17	32.95	.32	447°
K 6464	13830	10.55	15.78	1.78	10.40	152	17	26.33	.40	446°
K 6466	13890	3.55	8.22	4.11	4.11	200	100	11.77	.30	436°
K 6467	13920	12.23	40.58	2.00	16.95	239	12	52.81	.23	459°

IKU

TABLE NO.: IX

WELL NO.: 2/7-15

ROCK – EVAL PYROLYSES

Sample	Depth	S_1	S_2	S_3	C_{org}	Hydrogen Index	Oxygen Index	Petroleum potential (S_1+S_2)	Production Index S_1/S_1-S_2	T_{max} °C
K 6469	13990	6.17	14.12	1.77	7.97	177	22	20.29	.30	449°
K 6472	14080	1.69	5.21	1.97	5.09	102	39	6.90	.24	446°
K 6474	14140	3.57	8.00	1.65	5.12	156	32	11.58	.31	445°
K 6477	14230	1.54	6.25	1.73	2.84	220	61	7.79	.20	442°
K 6479	14290	1.99	4.91	1.65	8.42	58	20	6.90	.29	439°
K 6481	14360	1.85	9.72	1.62	8.25	118	20	11.56	.16	446°
K 6483	14420	8.56	15.97	.68	7.96	201	9	24.53	.35	451°
K 6484	14450	5.28	11.94	2.18	3.67	325	59	17.22	.31	450°
K 6485	14480	2.12	8.97	1.84	10.26	87	18	11.09	.19	447°
K 6486	14500	8.48	14.07	2.22	11.55	122	19	22.55	.38	450°