GeoChem Laboratories (U.K.) Limited

GEOCHEMICAL SERVICE REPORT

Prepared for

STATOIL

GEOCHEMICAL EVALUATION OF STATOIL'S 34/10-21

GULLFAKS WELL

APPENDIX I

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GEOCHEMICAL EVALUATION OF STATOIL'S 34/10-21

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GEOCHEMICAL EVALUATION OF STATOIL'S 34/10-21 GULLFAKS WELL

SUMMARY

The section between 228 metres and 4005 metres (TD) has been analysed in 34/10-21.

The Tertiary and Cretaceous intervals consist almost exclusively of poor and uninteresting source rocks which are further limited by immaturity, although below 2750± metres, the interbedded mudstones and shales are effectively marginally mature (negligible hydrocarbon generation).

In contrast, the silty shales of the Draupne Formation (2920-3047± metres) represent a potentially rich source for gas and oil, and furthermore, significant hydrocarbon generation has been initiated from them on-structure. Reservoirs in communication with their mature equivalents should be very prospective.

Similarly rich and mature silty mudstones and shales dominate the Heather Formation (3047± metres to 3287± metres) above 3100± metres, while below this depth, the dominant shales and silty mudstones constitute a good or very good source for gas and associated condensate within which minor to significant or significant generation has occurred on-structure.

Within the Brent (3287-3550± metres), the coals represent a potentially extremely rich source for gas and condensate. However, they are effectively only marginally mature (minor hydrocarbon generation). The interbedded shales are variously fair to very good source rocks with a potential for gas and condensate. Minor to significant or at best, significant hydrocarbon generation has occurred in them.

In general, the shales and mudstones of the Dunlin Group (3550± metres to 4005 metres [TD]) are characterised by a poor or fair (above 3714± metres) potential for gas and associated condensate. Scattered good and very good dark grey shales for gas and condensate were observed between 3564± metres and 3714± metres, but they are believed to be caved (at least in part). Within this well,

the Dunlin sediments are mature (significant hydrocarbon generation, but not oil window), although sediments containing good quality organic matter would lie within the oil window of peak hydrocarbon generation.

Migrated hydrocarbons were detected throughout the analysed section below approximately 2665± metres. These occur frequently as traces of wet gas or condensate, although weak shows and shows of a product no heavier than a condensate occur within the Draupne Formation and between 3819-3894± metres in the Dunlin. Stronger shows, probably of a condensate with associated oil, were detected between 3894± metres and TD. No samples were received from the intervals 3279-3339± metres and 3354-3384± metres in this well. However, C_{15+} hydrocarbon data on core samples from the missing intervals have been provided by Statoil for integration into this report. These indicate strong shows, apparently of a medium to light gravity crude, between 3298-3323.7± metres, and a weak show of a lighter product at 3329.4± metres.

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INTRODUCTION

This report presents a geochemical evaluation of the section between 228 metres and 4005 metres in Statoil's 34/10-21 Gullfaks well.

The study was designed to investigate the hydrocarbon source potential of the sediments, and also to detect and characterise shows of migrated hydrocarbons.

This project was authorised by Mr. S. Ulvoeen, Statoil, Stavanger.

A. ANALYTICAL

A total of one hundred and ninety one (191) canned cuttings samples, composited over 30 metre intervals down to 1830 metres and over 15 metres below this depth, was received from the interval 228-4005 metres in 34/10-21. In addition, a sample of mud additive (fine nut husk) was received from 2370 metres. No samples were received from 2170-2185± metres, 2530-2545± metres, 3279-3339± metres, 3354-3384± metres or 3984-3999± metres, sample coverage being particularly poor at the top of the Brent. The samples were assigned the Geochem job number 972 and numbered separately from -001 to -192.

The sediments were screened using the light hydrocarbon (C_1-C_7), organic carbon and Rockeval pyrolysis analyses. Samples for further analysis were selected on the basis of the screen results. A total of one hundred and ninety two light hydrocarbon analyses, three hundred and twelve organic carbon determinations, one hundred and eighty Rockeval pyrolysis analyses, fifteen extractions with chromotography, fifteen high resolution paraffin-naphthene analyses, forty visual kerogen analyses, thirty nine vitrinite reflectance determinations, ten pyrolysis-GC analyses, twenty four carbon isotope determinations, one four-ion and ten eleven-ion mass fragmentograms was performed in this study.

The data are presented in tables 1 through 11 and graphically in figures 1 through 16. A brief description of the analytical techniques is included at the back of this report.

B. GENERAL INFORMATION

Ten (10) copies of this report together with the kerogen slides prepared for this study and an IBM magnetic tape of the data have been forwarded to

Mr. S. Ulvoeen in Stavanger. A copy of the data has been retained by Geochem for future consultation with authorised Statoil personnel.

The remaining sample material will be returned to Statoil.

The results of this study are proprietary to Statoil.

RESULTS AND INTERPRETATION

Each of the parameters relevant to the geochemical evaluation of the analysed section will be considered in turn and then combined to form the "Conclusions".

Formation tops were supplied by the client.

A. ZONATION

This zonation is based primarily on the biostratigraphy but also takes into account the light hydrocarbon (C_1-C_7) and lithological variations. Twelve (12) zones are recognised.

Zone A lies between 228 metres and the top of the Hordaland Group at 1053± metres. Clays dominate the interval above 440± metres, while the underlying section comprises sands interbedded with clay or mudstone. Significant basalt is frequently present above 780± metres. Minor glauconite was observed at 930-990± metres and shell fragments at 900-960± metres.

No fluorescence was detected in the sands.

These sediments generally contain fair abundances (1251-4490 ppm) of extremely dry gas (0.7-5.9% C_{2+} hydrocarbons), apart from a handful of leaner exceptions at 557-969 ppm. In contrast, the heavier gasoline fraction hydrocarbons are virtually absent (0-53 ppm). Isobutane to normal butane ratios fall within the range 0.15-1.51 (6.31).

Zone B 1053± metres to 1799± metres comprises sediments of the Hordaland Group. Yellowish grey to very light olive grey mudstones give way below approximately 1245± metres to olive grey shales and shaly mudstones. Sand dominates the sample at 1380-1410± metres and is present in significant amounts in the samples above 1380± metres and in the interval 1470-1560± metres.

No fluorescence was observed.

C_1-C_4 gas abundances decrease from 3415 ppm at 1050-1080± metres to 982 ppm at 1260-1290± metres and do not exceed 683 ppm below 1290± metres. The gases remain extremely dry or dry at 0.7-22.3% C_{2+} hydrocarbons, and their butane ratios, whilst falling within the limits 0.00-0.73(1.37), rarely exceed 0.30.

Zone C extends from 1799± metres to 2014± metres and thus corresponds to the shales and shaly mudstones of the Rogaland Group.

This interval is characterised by poor abundances of light hydrocarbons with 145-971 ppm and 6-135 ppm for the C_1-C_4 and C_5-C_7 fractions respectively. The gases are consistently extremely dry (2.5-5.8% C_{2+} hydrocarbons) and have isobutane to normal butane ratios of 0.70-2.66.

Zone D^1 2014± metres to 2665± metres comprises a sequence of medium light grey to light olive grey shales, medium grey shales and interbedded mudstones overlain above 2110± metres by medium grey to medium olive grey shaly mudstones. Thin interbeds of light grey silty mudstone are present between 2050-2095± metres. These sediments belong to the Shetland Group.

Abundances of C_1-C_4 gases (81-747[1223] ppm) and gasoline fraction hydrocarbons (16-381 ppm) are similar to those of the overlying zone, as are the butane ratios (0.69-3.04). The gases are dry above 2515± metres at 4.5-24.7% C_{2+} hydrocarbons, but become wetter (24.3-38.7% C_{2+} hydrocarbons) at greater depth.

Zone D^2 2665± metres to 2920± metres incorporates the remainder of the Shetland Group and (below 2900± metres) sediments of the Cromer Knoll Group. This is an interval of light grey mudstones and interbedded medium (dark) grey shales.

This zone is both richer and wetter than Zone D^1. The gases range from 500 ppm up to 1403 ppm and reach 4781 ppm at 2890-2905± metres. They are wet or occasionally marginally wet (44.6-58.3% C_{2+} hydrocarbons) above 2860± metres, and very wet

(65.4-76.7% C_{2+}) below this depth. The C_5-C_7 hydrocarbons are enhanced relative to the overlying zones at 399-2052 (3284) ppm.

Zone E lies between 2920± metres and 3047± metres (Draupne Formation) and is dominated by dark brownish grey silty shales with interbedded medium grey shales. Coal interbeds occur in the interval 2995-3025± metres.

The C_1-C_4 gases are relatively abundant at 6175-16418 ppm and are wet or extremely wet (56.5-77.1% C_{2+} hydrocarbons). Gasoline range hydrocarbons normally lie within the limits of 1992-6060 ppm but achieve 13179 ppm at 2920-2935± metres. Butane ratios do not exceed 0.48.

Zone F 3047± metres to 3287± metres encompasses shales and interbedded mudstones of the Heather Formation.

This zone is characterised by fair abundances ([496] 1014-6962 ppm) of wet gas (47.9-64.3% C_{2+} hydrocarbons). Values of 126-3819 ppm apply to the C_5-C_7 hydrocarbons.

Zone G^1 3287± metres to 3497± metres (Brent Group) consists of interbedded sandstones, dark grey silty shales and coals. It should be noted, however, that no samples were received from the intervals 3279-3339± metres and 3354-3384± metres.

No fluorescence was detected in the sandstones.

The gaseous hydrocarbons of this zone are commonly of fair abundance (1963-7129 ppm), although an improvement is evident between 3384-3414± metres (11456-17712 ppm). The gases are marginally wet to wet at 46.3-56.8% C_{2+} hydrocarbons and have isobutane to normal butane ratios of 0.76-1.21. C_5-C_7 hydrocarbons are sparse (70-499 ppm).

Zone G^2 3497± metres to 3550± metres is essentially a sandstone sequence (Brent). The coal observed at 3504-3519± metres is believed to be caved.

No fluorescence was observed in the sandstones.

These sediments contain 2639-4176 ppm of marginally wet to wet gas (46.8-50.5% C_{2+} hydrocarbons). The gasoline fraction is poor at 365-658 ppm.

Zone H^1 3550± metres to 3763± metres includes sediments of the Drake and Cook Formations (Dunlin Group). This section is dominated by medium (dark) grey to brownish grey silty shales, silty mudstones and shales. Interbeds of (medium) dark grey shale and sandstones above 3579± metres and between 3624-3714± metres are also present.

No fluorescence was observed.

The C_1-C_4 gases range from 1490 ppm up to 4987 ppm, while the heavier gasoline range hydrocarbons are of poor abundance (284-377 ppm) above 3624± metres, but are enhanced at (558) 992-4800 ppm below this depth. The gases are generally wet ([38.2] 48.6-60.7% C_{2+} hydrocarbons) and their isobutane to normal butane ratios rarely exceed 0.54.

Zone H^2 lies between 3763± metres and 3906± metres and thereby corresponds to the medium dark grey to brownish grey shales of the Amundsen Formation (Dunlin). Significant sand was observed in the sample at 3894-3909± metres.

The C_1-C_4 and C_5-C_7 hydrocarbon abundances vary between 1717-11488 ppm and 1195-8536 ppm respectively, with the richest interval occurring below 3819± metres. The gases are dry (15.3-27.6% C_{2+} hydrocarbons) within the interval 3819-3894± metres, but are otherwise marginally wet at 36.9-53.3% C_{2+} hydrocarbons. Butane ratios exhibit little variation (0.17-0.33 [0.43]).

Zone H^3 extends from 3906± metres down to 4005 metres (TD) and is characterised by interbedded sandstones and medium dark grey to brownish grey shales of the Statfjord Formation.

No fluorescence was detected in the sandstones.

The samples at 3924-3939± metres and 3954-3969± metres contain respectively 21413 ppm and 14349 ppm of C_1-C_4 gases, with values of 3681-7679 ppm applying to the remaining sediments. Gas wetness values are relatively uniform at 50.0-60.7% C_{2+} hydrocarbons, while butane ratios are consistently low (0.28-0.34).

B. AMOUNT AND TYPE OF ORGANIC MATTER

The amount of organic matter within a sediment is measured by its organic carbon content. Average shales contain approximately one percent organic carbon, and this is the standard to which these samples will be compared.

Organic matter type influences not only source richness but also the character of the hydrocarbon product (oil, gas) and the response of the organic matter to thermal maturation. Richness and oiliness decrease in the order: amorphous-algal-herbaceous-woody. Wood has a primary (but not exclusive) potential for gas whilst inertinitic (oxidised, mineral charcoal) material has only a limited hydrocarbon potential.

The sediments of Zone A generally have poor or fair organic carbon contents (0.32-0.67%), with the exception of the mudstones below 960± metres which are significantly richer at 1.31-1.57%. Their organic matter is dominantly woody with significant herbaceous material and inertinite.

The Zone B (Hordaland Group) mudstones and shales are comparable in terms of organic matter type and exhibit similar variations in richness. Hence, the mudstones and shales which dominate the interval above 1320± metres are of above-average richness at 1.06-1.38% organic carbon, while values do not exceed 0.57% in the shales below 1410± metres. Organic carbon contents of 0.77-0.97% apply to the olive grey shales from 1320-1410± metres.

Within Zone C (Rogaland Group) the shales and shaly mudstones contain 0.29-0.68% of organic matter that is woody-herbaceous with significant inertinite or mixed woody-herbaceous-inertinitic in type, although the olive grey shales from the interval 1890-1915± metres are enhanced at 0.91-0.98% organic carbon.

Organic carbon values of the mixed mudstones and shales of Zone D^1 (Shetland Group) fall within the range 0.33-0.69%. This leanness is further compounded by the character of the organic matter which consists chiefly of wood and inertinite with minor or significant herbaceous debris. The interbedded medium light grey mudstones and medium (dark) grey shales of Zone D^2 are characterised by fair abundances (0.64-1.03% organic carbon) of woody-inertinitic kerogen.

Zones E (Draupne) and F (Heather) exhibit significant variations. With the

exception of the coal interbeds at 2995-3025± metres (61.80-68.70% organic carbon), the richest sediments within this interval are the dark brownish grey silty shales present throughout Zone E (6.23-7.95% organic carbon), and the dark brownish grey to dark olive grey silty mudstones and shales (5.47-6.89% organic carbon) above 3100± metres in the underlying zone. Moreover, their organic assemblages are commonly mixed algal-inertinitic-woody-herbaceous in type, with the algal fraction undergoing sapropelisation, or even dominantly algal with significant proportions of inertinite, wood and amorphous material as in the shale at 2920-2935± metres. The (medium) dark grey shales which dominate the section between 3100-3234± metres are somewhat leaner at 1.79-3.68% organic carbon, but are essentially comparable in organic matter type, although the proportion of wood in the kerogens increases towards the base of this interval. Exceptionally, the silty mudstones below 3234± metres in the Heather contain very good abundances (2.41-2.73% organic carbon) of organic matter that is dominantly amorphous with significant wood, inertinite and algal debris. This amorphous material, however,is degraded and not of prime quality. The remaining sediments of these two zones vary between 0.45% and 1.61% organic carbon, apart from the poor medium light grey shale interbeds above 2965± metres with 0.17-0.13%.

The coals of Zone G^1 (Brent) are rich at 24.30-56.20% organic carbon and appear to consist chiefly of vitrinite (wood) with significant amorphous material and inertinite. Interbeds of dark grey shale containing good or very good abundances (1.68-3.27% organic carbon) of organic matter that is either dominantly woody with significant inertinite, herbaceous material and algal debris or mixed woody-inertinitic-herbaceous-algal-amorphous. In contrast, the dark grey shale at 3339-3354± metres is both richer at 5.10% organic carbon and yielded a kerogen consisting chiefly of amorphous material (degraded, not prime quality) with significant wood and inertinite.

In Zone H^1 the medium (dark) grey to brownish grey shales, silty shales and silty mudstones are of above-average richness at 1.24-2.14% organic carbon, apart from a handful of scattered leaner exceptions (0.85-0.91% organic carbon). These sediments contain organic assemblages comprising wood chiefly with significant inertinite and significant or minor herbaceous and algal material. In terms of richness, the dark grey (to medium dark grey) shales of this zone, at 1.81-3.85% organic carbon, resemble and may indeed be caved from, the Brent shales. The Amundsen Formation (Zone H^2) is dominated by shales with fair organic carbon contents (0.59-1.00%), although thin but richer

interbeds (1.14-1.76% organic carbon) are also present and are better developed in the Statfjord (Zone H^3). The organic matter in these richer shales is essentially woody with significant herbaceous material and inertinite.

C. LEVEL OF THERMAL MATURATION

The level of thermal maturity has been evaluated using the visual kerogen (spore colouration) and vitrinite reflectance techniques.

Although the organic matter within these sediments is reasonably well preserved, it proved difficult to make maturity assesments using the visual kerogen technique. The presence of caved material is suspected in many of the kerogens isolated from the Shetland samples (Zones D^1 and D^2), and in the case of the Dunlin sediments (Zones H^1 through H^3), abundant caving is clearly indicated. In consequence, the data do not possess the reliability normally associated with this technique. Nevertheless, it is suggested that a thermal index of 2- is achieved at a depth close to 2350± metres, while an index of 2 is reached at approximately 3450± metres.

The vitrinite reflectance data are problematical. In general, they indicate extensive reworking of the organic matter resulting in a considerable scatter of individual values and multiple populations, particularly above 2950± metres and below 3450± metres. In contrast, the sediments of the intervening section yielded one very dominant vitrinite population with a mean value of 0.53-0.72% Ro. Further examination of the data indicates a trend of increasing reflectivity with depth , with the best fit line through the least mature vitrinite populations reaching reflectivities of 0.45% at approximately 2200± metres and 0.53% at a depth of 3350± metres. Since these values normally correlate with thermal indices of 2- and 2 respectively, there is good agreement between the two methods, and indeed, a perfect correlation could be obtained. However, such a trend line ignores the apparently reliable data generated on sediments from the interval 2950-3450± metres, apart from the value of 0.53% at 3175-3190± metres. Furthermore, upward extension of this trend line reaches the surface at approximately 0.34% Ro. This value is higher than that more normally observed (0.20% Ro) and suggests a loss of section or a departure from linearity in the trend at shallower depth. This latter effect may be due to the presence of the sandy sequence above 1560± metres, and is a more likely explanation than the loss of 2000-2500± metres of section required by the former. In addition, this trend suggests that sediments would require burial to a depth in excess of 5000± metres in order to achieve the peak hydrocarbon generating conditions of the oil window. Ultimately, however, the most convincing argument against a best fit line through the <u>least</u> mature vitrinite populations, is that it must necessarily be based to some extent on

cavings which were readily identified during the determination of thermal indices using the visual kerogen technique.

An alternative trend is very heavily biased towards the single vitrinite populations on sediments (including coals) from the interval 2950-3450± metres, but also honours the values of 0.48-0.51% Ro between 2440± metres and 2740± metres. Such a trend reaches a reflectivity of 0.45% at 2300± metres, and is therefore in excellent agreement with the spore colouration date for this part of the section. However, values of 0.53% and 0.72%, corresponding to thermal indices of 2 and 2 to 2+ respectively, are achieved at depths of 2750± metres and 3500± metres, in contrast to the depths suggested by the visual kerogen data. Nevertheless, this vitrinite trend not only shows closer correlation with vitrinite data generated during previous studies of wells drilled in this area (personal communication, S. Ulvoeen), but also takes into account the (apparently) most reliable vitrinite reflectance data, including measurements on three coal samples. In addition, such a trend (by extension) intercepts the surface at a value close to 0.20 Ro.

For the reasons outlined above, this latter vitrinite trend is preferred to the one discussed originally, and is also believed to reflect levels of maturity more accurately than those defined by the spore colouration indices, with the attendant difficulties due to caving. Reflectivities of 0.45% (2300± metres), 0.53% (2750± metres) and 0.72% (3500± metres) have been used to establish zones of hydrocarbon generation within this well, the depths at which such values are achieved being shown in parentheses. Hence, the initiation of minor hydrocarbon generation from good quality organic assemblages is set at 0.45% Ro, while the values of 0.53% and 0.72% define respectively the top of the zone of significant generation and of the oil window of peak hydrocarbon generation. This zonation, however, applies only to good quality , i.e. amorphous, herbaceous ± algal organic matter, the corresponding values for woody and inertinitic kerogen being 0.53%, 0.72% and 0.90% Ro. In 34/10-21, therefore, it would appear that the sediments are immature or effectively immature down to 2750± metres, while the mudstones and shales of Zone D^2 below this depth are effectively marginally mature (negligible hydrocarbon generation) due to the abundance of wood and inertinite in the organic assemblages. Significant hydrocarbon generation, however, will have commenced from the dominant shales and mudstones of Zones E (Draupne) and F (Heather) above 3100± metres, and minor to significant or significant generation below this depth. Within the Brent, the coals are effectively only marginally mature (minor hydrocarbon

generation), with minor to significant or significant generation anticipated from the interbedded silty shales according to the character of their organic matter. The Dunlin sediments are mature (significant hydrocarbon generation, but not oil window), although sediments containing good quality, as opposed to woody and inertinitic, organic matter would lie within the oil window of peak hydrocarbon generation.

D. SOURCE RICHNESS

Preliminary assessments of present and potential source richness can be obtained from the light hydrocarbon and organic carbon abundances respectively.

The light hydrocarbon data suggest that Zones C and D^1 have a consistently poor source potential, while Zone B is fair above 1230± metres but poor below this depth. In contrast, zones E, H^2 and H^3 consist of interbedded fair and good source rocks. The remaining zones are rated as fair overall, although the interval 3369-3414± metres in Zone G^1 is apparently good. However, as migrated hydrocarbons are suspected below approximately 2665± metres, the light hydrocarbon abundances cannot reliably be used to assess source richness for this part of the section.

Organic carbon contents indicate that Zones A through D^1 are frequently poor or fair source units apart from the interval 960-1320± metres which is good. Zones D^2 and H^3 are generally fair, while Zone E is dominated by rich silty shales, although fair or occasionally poor, interbedded shales are also present. Zone F is essentially very good, and rich coals are interbedded with good or very good silty shales in Zone G^1. A good rating overall applies to Zones H^1 and H^3, despite the very good shale interbeds in Zone H^1. Assessments of source richness using this parameter, however, are likely to be optimistic in view of the abundance of woody organic matter in these sediments.

The abundance of <u>indigenous</u> C_{15+} hydrocarbons is normally related to source richness. Upon extraction, the sample at 2755-2770± metres yielded 108 ppm C_{15+} hydrocarbons. However, the presence of contamination (characterised by an unresolved baseline hump between nC_{16} and nC_{32}), suggested by the paraffin-naphthene chromatogram, indicates that the interbedded shale and mudstone from this depth represent a poor source. In contrast, C_{15+} hydrocarbon abundances of 1385-1426 ppm are compatible with a rich rating for the dark brownish grey silty shales of Zone E and the dark brownish grey to dark olive grey silty mudstones of Zone F above 3100± metres. A similar rating is applicable to the medium (dark) grey shale (910 ppm) at 2920-2935± metres in Zone E, even after making allowances for the possible traces of oil present at this depth, since this shale constitutes only twenty five per cent of the extracted sample, the remainder consisting of poor shales and a lean limestone. Values range between a fair 100 ppm at 3205-3219± metres to a good 441 ppm at

3264-3279± metres for the remainder of Zone F. Although the presence of drilling-introduced contamination is clearly indicated in the paraffin-naphthene chromatogram of this latter sample, immature source indigenous hydrocarbons (notably the prominent pristane peak, well developed odd carbon preference between nC_{23} and nC_{35} and the sterane/triterpane contribution) dominate the other paraffin-naphthene traces and are also readily apparent at 3264-3279± metres. The fair or good rating for the dominant shales and silty mudstones below 3100± metres in Zone F is therefore confirmed. Fewer than 100 ppm C_{15+} hydro- carbons were extracted from the Dunlin shales at 3744-3759± metres and 3834- 3849± metres suggesting a poor hydrocarbon potential, while the remaining samples are apparently good with 286-421 ppm. However, the chromatograms of their paraffin-naphthene fractions may be interpreted as containing traces of oil in addition to source indigenous hydrocarbons. Allowing for this enhancement, it would appear that these Dunlin sediments are probably only fair source rocks.

Hydrocarbon potential at optimum maturity is measured using the pyrolysis technique. On this basis, the entire analysed section down to the top of the Draupne Formation at 2930± metres, i.e. Zones A through D^2, must be rated a poor source, apart from the mudstones from 960-1110± metres which are potentially poor to fair, or at best, fair source rocks at 1.78-1.96 (2.75) mg/g S2 (pyrolysate). Otherwise, pyrolysate yields generally range between 0.03 mg/g and 0.71 mg/g, with only the mudstones and shaly mudstones from the interval 1110-1320± metres in Zone B (1.38-1.70 mg/g) and the olive grey shales at 1890-1915± metres (1.04-1.26 mg/g S2) generating in excess of 1.00 mg/g S2. In contrast, the dark brownish grey shales of Zone E (Draupne Formation) and the dark brownish grey to dark olive grey silty mudstones and shales of the Heather Formation (Zone F) represent consistently rich source units at 15.11-25.50 mg/g S2 and 11.76-21.97 mg/g S2 respectively. The interbedded coals from the interval 2995-3025± metres yielded 109.31 mg/g S2 and are therefore extremely rich source horizons, while the remaining sediments of these two zones are generally poor (0.46-1.76 mg/g S2), with the exception of the fair mudstone interbeds at 3070-3085± metres and 3175-3190± metres. Values of 2.75-5.57 mg/g S2 classify the dark grey silty shales of Zone G^1 (Brent) as variously fair to very good source rocks. These shales are interbedded with coals which are clearly potentially extremely rich with pyrolysate yields of 80.90-129.43 mg/g. Within Zone H^1, the dominant medium dark grey to brownish grey (silty) shales and mudstones vary between a poor and a fair rating (0.08-2.71 mg/g S2), while a very good source potential (3.95-5.50 mg/g

S2) is suggested for the dark grey (to medium dark grey) shales. Zones H^2 and H^3 constitute a poor source (0.04-1.67 mg/g S2).

Chromatograms of the S2 (pyrolysate) fraction define whether a mature source rock will yield oil, gas or condensate. Oil-prone source rocks are characterised by chromatograms with a well defined series of normal alkene - alkane doublets which extend out to the heavy ends. If the doublets are restricted to the front ends, a potential for condensate is indicated, while in gas-prone sediments the doublets are (essentially) absent. The most oil-prone facies within the analysed section are represented by the rich shales and silty shales of Zone E (Draupne Formation) and the silty mudstones and shales that dominate Zone F (Heather) above 3100± metres. These sediments generated 'pyrograms' containing a well developed series of normal alkene - alkane doublets extending out to approximately nC_{30}, although the front ends are also prominent. Such sediments would if mature, yield oil and gas or gas and oil. The remaining samples selected for analysis are characterised by chromatograms restricted chiefly to the C_{15-} fraction, and in which alkene - alkane doublets are essentially absent. They represent potential source rocks for gas and condensate or gas with associated condensate.

in summary therefore:

- Zones A through D^2: consistently poor source apart from the poor to fair, or occasionally fair, mudstones for gas with associated condensate between 960-1110± metres.

- Zone E (Draupne): rich shales and silty shales with a potential for oil and gas or for gas and oil throughout. Interbeds of extremely rich coal at 2995-3025± metres and of poor medium grey shale.

- Zone F (Heather): essentially a rich potential source for gas and oil above 3100± metres. Dominated by shales and silty mudstones with a good or very good potential for gas and (associated) condensate below this depth. Interbeds of poor, or occasionally fair, mudstone and shale above 3195± metres.

- Zone G^1 (Brent): extremely rich coals interbedded with shales and silty shales that are variously fair to very good source rocks. Potential for gas and condensate.

- Zone G^2 (Brent): dominated by sandstones and therefore of minimal interest.

- Zone H^1 (Dunlin): generally a poor or fair source for gas with associated condensate. Good and very good dark grey shales with a potential for gas and condensate may be caved from the Heather or Brent.

- Zone H^2 and H^3 (Dunlin): poor source for gas with associated condensate.

E. MIGRATED HYDROCARBONS

No fluorescence was detected in any of the potential reservoir facies.

Gaseous hydrocarbons between 228-2665± metres are commonly dry and of poor or fair abundance. As a result, the presence of migrated hydrocarbons is not suspected within this interval.

Within Zone D^2, gas wetness values of 44.6-58.3% above 2860± metres and 65.4-76.7% C_{2+} below this depth suggest the presence of out of place hydrocarbons, the abundance and composition of the light hydrocarbons indicating the possibility of minor traces of an oil. The chromatogram of the paraffin-naphthenes extracted from the sample at 2755-2770± metres, however, appears to be dominated by a mixture of drilling-introduced contamination and source indigenous hydrocarbons, and does not provide any evidence of crude oil at this depth. The traces of migrated hydrocarbons in this zone are, therefore, likely to be of condensate at best.

The gases of Zone E (Draupne Formation) are wet but not very wet at 56.5-65.4(77.1)% C_{2+} hydrocarbons, and with the exception of the sample at 2920-2935± metres, the ratio of C_1-C_4 gases to gasoline fraction hydrocarbons suggests that the migrated product is no heavier than a condensate. Turning to the C_{15+} data, the paraffin-naphthene chromatograms are dominated by immature source indigenous hydrocarbons despite hydrocarbon to total extract ratios of 42.44-57.37%. However, the normal paraffin distribution at 2920-2950± metres suggests the possibility that oil could also be present within this interval.

Gas wetness values of 47.9-64.3% C_{2+} hydrocarbons for the sediments of the Heather Formation (Zone F) resemble those of Zones D^2 and E. The light hydrocarbon data indicate that migrated hydrocarbons are present as traces of wet gas/condensate between 3085-3205± metres and as minor traces of wet gas or wet gas and associated light liquids elsewhere in this zone. Such a conclusion is supported by the heavy C_{15+} fraction, which does not indicate the presence of crude oil in any of the analysed samples, even though hydrocarbons constitute 37.54-64.82% of the total extract. Instead, the paraffin-naphthene traces exhibit classic, immature source indigenous hydrocarbon characteristics, notably intense pristane and phytane peaks, a prominent sterane/triterpane contribution and normal paraffins which display a

pronounced odd carbon preference between nC_{23} and nC_{35}.

Although no samples were received from the intervals 3279-3339± metres and 3354-3384± metres in this well, the C_{15+} hydrocarbon data generated by Statoil on ten sandstone cores ranging in depth between 3298.05± metres and 3363.60± metres were made available for integration into this report. Yields of (843) 2972-7946 ppm C_{15+} hydrocarbons, with hydrocarbons constituting 85.98-98.67% of the total extract, and the paraffin-naphthene chromatograms clearly indicate strong shows of migrated hydrocarbons within the interval 3298-3323.7± metres. On the basis of the normal paraffin configurations, these strong shows are apparently of a medium to light gravity crude. In addition, the data suggest a weak show (188 ppm) of a lighter product at 3329.4± metres. Further inspection of the paraffin-naphthene traces reveals that the detailed isoparaffin fingerprints are essentially identical for the shows between 3298-3319± metres, and allowing for the poor quality of the chromatogram, the show at 3323.5± metres is probably of the same hydrocarbon product. In contrast, the weak show at 3329.4± metres is of a lighter product characterised by significantly higher isoprenoids. Moreover, the isoparaffin fingerprint at this depth shows a less convincing correlation with those of the other shows. C_{15+} hydrocarbon abundances of 3-22 ppm and the low proportion of hydrocarbons in the total extract (7.98-27.94%), indicate that source indigenous hydrocarbons dominate the remaining cores, although there is a suggestion of contamination at 3352.1± metres, while the paraffin-naphthene chromatogram at 3344.4± metres could be interpreted as a mixture of source indigenous hydrocarbons and (insignificantly minor traces of) a crude.

The presence of (minor) traces of marginally wet or wet is suggested by the light hydrocarbon data for the section below 3339± metres in the Brent and down to 3624± metres in Zone H^1 (Dunlin).

Traces of out of place liquids are suspected below 3624± metres in Zone H^1, especially below 3729± metres, and indeed, the paraffin-naphthene chromatogram from 3639-3654± metres could be interpreted as showing oil in addition to source indigenous hydrocarbons. In contrast, the shale at 3744-3759± metres yielded a miserly 29 ppm C_{15+} hydrocarbons, despite 4800 ppm of C_5-C_7 hydrocarbons and a light hydrocarbon distribution suggesting oil.

Zones H^2 (Amundsen Formation) and H^3 (Statfjord) are characterised by enhanced light hydrocarbon abundances, with the C_1-C_7 data suggesting shows

of condensate down to approximately 3894± metres and stronger shows of crude oil between 3894± metres and TD. The C_{15+} chromatograms lend some support to such a view, with the normal paraffin profile at 3924-3939± metres suggesting the presence of a crude. However, the relatively low proportion of C_{15+} material at this depth (286 ppm of C_{15+} hydrocarbons) may indicate that the shows below 3894± metres are best described as (strong) shows of condensate with associated oil rather than of crude oil.

Detailed correlations between shows of migrated hydrocarbons are possible from a comparison of the sterane and triterpane mass fragmentograms. In this well, the majority of the C_{15+} paraffin-naphthene chromatograms are dominated by source indigenous hydrocarbons ± contamination, although possible traces of crude may also be present at 2920-2950± metres and 3639-3654± metres. Further shows of condensate ± associated oil were detected in the Statfjord and Amundsen Formations (e.g. at 3834-3849± metres and 3924-3939± metres). The strongest shows within 34/10-21 apparently occur within the interval 3298-3323.7± metres (upper part of the Brent) with a further weak show of a lighter product at 3329.4± metres. Unfortunately, no samples were received from these intervals and no material was available for analysis. Examination of the triterpane fragmentograms (m/z 191) indicates little variation between the various shows analysed. In contrast, although the sterane fragmentograms (m/z 217, 218 and 259) indicate good correlation between the shows at 3639-3654± metres and 3924-3939± metres, that with the show at 3834-3849± metres is less satisfactory, and they differ markedly from the fragmentograms at 2935-2950± metres. The most satisfactory correlation between shows and potential source rocks is that between the Brent coals and the shows at 3639-3654± metres and 3924-3939± metres.

Stable carbon isotope determinations were carried out on the C_{15+} saturate and aromatic hydrocarbon fractions and also on a number of kerogens. The kerogens fall into two distinct groupings, with values of -25.20^{o}/oo to -25.44^{o}/oo characterising the rich silty shales and mudstones of the Draupne and Heather Formations and the Brent coals, while the rich shale at 2920-2935± metres, which contains a higher proportion of algal and amorphous material, is over 3 per mil. lighter at -28.67^{o}/oo. Carbon isotope values for the C_{15+} saturate and aromatic fractions fall respectively within the ranges -26.75^{o}/oo to -30.13^{o}/oo and -24.70^{o}/oo to -28.88^{o}/oo, and do not show any clearcut groupings. The majority of the extracted C_{15+} hydrocarbon fractions contain a high proportion of source indigenous species and do not correlate with any of

the kerogens. Interestingly, however, of the four fractions which could be interpreted as containing oil, three show satisfactory correlation with kerogens of the potential source rocks. Hence, there is a good correlation between the algal rich source at 2920-2935± metres and the possible shows at 2935-2950± metres and 3639-3654± metres, and also between the show at 3834-3849± metres and the remaining kerogens (representing rich source facies within the Draupne, Heather and Brent). The show of condensate with associated oil at 3924-3939± metres does not appear to correlate with any of the kerogens.

To summarise:

- traces of condensate are present throughout Zone D^2.

- weak shows and shows of a migrated product no heavier than a condensate were observed in Zone E (Draupne Formation), apart from the interval 2920-2950± metres where a crude oil may be present.

- traces of wet gas/condensate were detected between 3085-3205± metres in Zone F (Heather). Minor traces of wet gas or wet gas and associated light liquids are apparent elsewhere in this zone.

- no samples were received from the intervals 3279-3339± metres and 3354-3384± metres at the top of the Brent. However, C_{15+} hydrocarbon data provided by Statoil indicate strong shows, apparently of a medium to light gravity crude, within the interval 3298-3323.4± metres, and a weak show of a lighter product at 3329.4± metres. (Minor) traces of marginally wet or wet gas are present throughout the Brent below 3339± metres at least, and down to 3624± metres in the Dunlin.

- traces of migrated liquid hydrocarbons and a weak show at 3744-3759± metres are suspected below 3624± metres in Zone H^1. These are probably of condensate, although a crude may be present at 3639-3654± metres.

- shows of condensate are suggested between 3819± metres and 3894± metres in the Amundsen Formation, with stronger shows, possibly of condensate with associated oil, throughout the Statfjord Formation and up to 3894± metres in the Amundsen.

F. CONCLUSIONS

Twelve (12) zones are recognised between 228 metres and 4005 metres in 34/10-21.

Zone A lies between 228 metres and the top of the Hordaland Group at 1053± metres. Clays dominate the interval above 440± metres, while the underlying section comprises sands interbedded with clays or mudstones. These sediments are characterised by poor or fair organic carbon contents (0.32-0.67%), with the exception of the mudstones below 960± metres which are significantly richer at 1.31-1.57%. Their organic matter is dominantly woody with significant herbaceous material and inertinite. Apart from the mudstones below 960± metres which have a poor to fair or fair potential for gas and associated condensate, these sediments are poor and uninteresting source rocks which are further limited by immaturity.

Zone B 1053± metres to 1799± metres comprises mudstones, shaly mudstones and shales of the Hordaland Group. The mudstone and shales above 1320± metres are of above-average richness at 1.06-1.38% organic carbon, while values do not exceed 0.57% in the shales below 1410± metres. Organic carbon contents of 0.77-0.97% apply to the shales from 1320-1410± metres. These sediments are comparable to those of Zone A in terms of organic matter type. Despite the variations in richness, this interval constitutes a poor (poor to fair above 1110± metres), immature source.

The shales and shaly mudstones of Zone C (1799± metres to 2014± metres, Rogaland Group) contain 0.29-0.98% of organic matter that is woody-herbaceous with significant inertinite or mixed woody-herbaceous-inertinitic in type. These sediments are immature, but even if in a mature state, would only be poor source rocks.

Zone D^1 extends from 2014± metres to 2665± metres and therefore corresponds to the shaly mudstones, shales and (silty) mudstones of the Shetland Group. Organic carbon values of these sediments fall within the range 0.33-0.69%. This leanness is further compounded by the character of the organic matter which consists chiefly of wood and inertinite with minor or significant herbaceous material. As a result, the mixed mudstones and shales of this zone represent a poor and immature, or effectively immature, source unit.

Zone D^2 2665± metres to 2920± metres incorporates the remainder of the Shetland Group and, below 2900± metres, sediments of the Cromer Knoll Group. The interbedded mudstones and shales of this interval are characterised by fair abundances(0.64-1.03% organic carbon) of woody-inertinitic kerogen. They are consistently poor source rocks that are effectively immature above 2750± metres but marginally mature (negligible hydrocarbon generation) below this depth. Traces of condensate are present throughout this zone.

In contrast, the silty shales of the Draupne Formation (2920-3047± metres, Zone E) have high values of 6.23-7.95% organic carbon. This enhancement is also reflected in the quality of their organic matter which is mixed algal-inertinitic-woody-herbaceous, with the algal fraction undergoing sapropelisation, or dominantly algal with significant inertinite, wood and amorphous material as in the shale at 2920-2935± metres. These shales are potentially rich source rocks for oil and gas or gas and oil, and furthermore, significant hydrocarbon generation has already been initiated from them on-structure. Reservoirs in communication with their mature equivalents would be prospective. The interbedded medium grey shales (0.66-1.03% organic carbon) are poor, while the coals between 2995-3025± metres represent a potentially extremely rich, marginally mature source (minor hydrocarbon generation). Weak shows of a migrated product no heavier than a condensate were observed in this zone, apart from the interval 2920-2950± metres where a crude oil may be present.

Zone F 3047± metres to 3287± metres encompasses shales and interbedded mudstones of the Heather Formation. The silty mudstones and shales that dominate the section above 3100± metres resemble the rich shales of Zone E in terms of organic matter type, and are only marginally leaner at 5.47-6.89% organic carbon. They are rich and mature (significant hydrocarbon generation, but not oil window) source rocks for gas and oil. The (medium) dark grey shales occurring between 3100-3234± metres contain good or very good abundances (1.79-3.68% organic carbon) of organic matter that is mainly woody with significant herbaceous material, inertinite and algal debris. Exceptionally, the very good silty mudstones (2.41-2.73% organic carbon) below 3234± metres are characterised by organic assemblages dominated by amorphous material (degraded, not prime quality) with significant wood, inertinite and algal debris. The dominant shales and silty mudstones below 3100± metres constitute a good or very good source for gas and associated condensate within which minor to significant or at best significant generation has occurred on-structure. The

remaining mudstones and shales of this zone vary between 0.45% and 1.61% organic carbon, and are generally poor or occasionally fair source rocks. Traces of wet gas/condensate were detected between 3085-3205± metres. Minor traces of wet gas or wet gas and associated liquids are apparent elsewhere in this zone.

Zone G^1 3287± metres to 3497± metres consists of interbedded sandstones, silty shales and coals of the Brent Group. it should be noted, however, that no samples were received from the intervals 3279-3339± metres and 3354-3384± metres. The coals are rich at 24.30-56.20% organic carbon and consist chiefly of vitrinite (wood) with significant amorphous material and inertinite. They represent a potentially extremely rich source for gas and condensate. However, on-structure they are effectively only marginally mature (minor hydrocarbon generation). The silty shales interbeds contain 1.68-3.27% of organic matter that is either dominantly woody with significant inertinitic, herbaceous material and algal debris or mixed woody-inertinite-herbaceous-algal-amorphous. In contrast, the shale at 3339-3354± metres is both richer (5.10% organic carbon) and yielded a kerogen consisting chiefly of amorphous material (not prime quality) with significant wood and inertinite. The shales of this zone are variously fair to very good source rocks with a potential for gas and condensate, within which minor to significant or at best, significant hydrocarbon generation has occurred.

Zone G^2 3497± metres to 3550± metres is essentially a sandstone sequence (Brent), and is therefore of minimal exploration significance.
C_{15+} hydrocarbon data provided by Statoil for the missing intervals indicate strong shows, apparently of a medium to light gravity crude, between 3298-3323.7± metres, and a weak show of a lighter product at 3329.4± metres. (Minor) traces of marginally wet or wet gas are present throughout the Brent below 3339± metres at least, and down to 3624± metres in the Dunlin.

Zone H^1 3550± metres to 3763± metres includes sediments of the Dunlin Group. This section is dominated by medium (dark) grey to brownish grey silty mudstones, silty shales and shales. Interbeds of a darker shale and of sandstone are also frequently present. The principal lithologies are of above-average richness at 1.24-2.14% organic carbon, apart from scattered leaner exceptions (0.85-0.91% organic carbon). Their organic assemblages comprise wood chiefly with significant inertinite and minor or signlficant herbaceous and algal material. They are rated as interbedded poor and fair

(good at 3639-3654± metres) sources with a potential for gas and associated condensate. On-structure, they are mature (significant hydrocarbon generation, but not oil window), although sediments containing good quality organic matter would lie within the oil window of peak hydrocarbon generation. The darker shales (1.81-3.85% organic carbon) have a good or very good potential for gas and condensate, but it is possible that they are caved from the Brent or Heather. Traces of migrated liquid hydrocarbons are suspected below 3624± metres. These are probably of condensate, although a crude may be present at 3639-3654± metres.

The Amundsen Formation (3763± metres to 3906± metres, Zone H^2) is dominated by shales with fair organic carbon contents (0.59-1.00%), although thin but richer interbeds (1.14-1.76% organic carbon) are also present. Their organic matter is largely woody in type with significant proportions of herbaceous and inertinitic debris. This interval is a poor but marginally mature source (significant hydrocarbon generation) with a potential for gas and associated condensate. Shows of condensate are suggested between 3819± metres and 3894± metres.

Zone H^3 (Statfjord Formation) extends from 3906± metres down to 4005 metres (TD) and is characterised by interbedded sandstones and shales. The latter are comparable to the Amundsen shales in terms of organic matter type, but are of above-average richness at 1.14-1.45% organic carbon. Nevertheless, these sediments constitute a uniformly poor source for gas and associated condensate. Significant (but negligible) hydrocarbon generation has been initiated from them on-structure. (Strong) shows, probably of condensate with associated oil, are suspected throughout this zone and up to 3894± metres.

Rich source rocks are restricted to the Draupne and Heather Formations and to the Brent coals. There are, however, potentially good or very good source horizons below 3100± metres in the Heather and frequently within the Brent. The good and very good shales observed in the Dunlin are believed to be, at least in part, caved from the Brent or Heather. The most oil-prone sediments are those of the Draupne Formation and of the Heather above 3100± metres. However, these intervals are not classically oil-prone, although a potential for oil and gas is indicated.

It is believed that sediments containing good quality, as opposed to woody and inertinitic, organic matter would lie within the oil window of peak hydrocarbon generation below approximately 3500± metres.

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-001	228-260m	A 80% Clay?, blocky, soft, calc., glauconitic, rare carbonaceous (lignite?) flecks, light olive grey	5Y6/1	0.44
		B 20% Sand, unconsolidated, medium grained, subrounded to subangular, poorly sorted, clear, white Minor shell fragments	N9	
972-002	260-290m	A 90% Clay as 972-001A	5Y6/1	0.44
		B 10% Sand as 972-001B Minor limestone and igneous (basalt)	N9	
972-003	290-320m	A 80% Clay as 972-001A	5Y6/1	0.38
		B 10% Sandstone as 972-001B	N9	
		C 10% Basalt, blocky, hard, dark grey Minor shell fragments	N3	
972-004	320-350m	A 98% Clay, blocky, soft, sl. glauconitic Minor sand and basalt	5Y6/1	0.40
972-005	350-380m	A 95% Clay as 972-004A	5Y6/1	0.41
		B 5% Basalt as 972-003C Minor sand and shell fragments	N3	
972-006	380-410m	A 98% Clay as 972-004A Minor sand and basalt	5Y6/1	0.45,0.44
972-007	410-440m	A 90% Clay as 972-004A	5Y6/1	0.38
		B 10% Basalt, blocky, hard, dark grey Minor sand	N3	
972-008	440-470m	A 50% Sand, unconsolidated, medium grained, subrounded to subangular, fairly well sorted, clear, white	N9	
		B 25% Clay as 972-004A	5Y6/1	0.35
		C 15% Basalt as 972-007B	N3	
		D 10% Shell fragments		
972-009	470-500m	A 45% Sand as 972-008A	N9	
		B 30% Clay as 972-004A	5Y6/1	0.32
		C 15% Basalt as 972-007B	N3	
		D 10% Shell fragments		
972-010	500-530m	A 50% Sand as 972-008A	N9	
		B 35% Clay as 972-004A	5Y6/1	0.35
		C 15% Basalt as 972-007B Minor shell fragments	N3	
972-011	530-560m	A 45% Sand as 972-008A	N9	
		B 40% Clay as 972-004A	5Y6/1	0.35
		C 15% Basalt as 972-007B Minor shell fragments	N3	
972-012	560-590m	A 50% Sand as 972-008A	N9	
		B 30% Clay as 972-004A	5Y6/1	0.35
		C 20% Basalt as 972-007B Minor shell fragments	N3	

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-013	590-630m	A 40%	Sand, unconsolidated, medium grained, subrounded to subangular fairly well sorted, clear, white	N9	
		B 30%	Basalt, blocky, hard, dark grey Minor sand	N3	
		C 20%	Clay, blocky, soft, sl. glauconitic, light olive grey Minor sand and basalt	5Y6/1	0.37
		D 10%	Shell fragments		
972-014	630-660m	A 70%	Clay?, blocky, sl. silty, non-calc light olive grey	5Y6/1	0.37,0.37
		B 20%	Sand, unconsolidated, medium grained, subrounded, well sorted clear, white	N9	
		C 10%	Basalt, blocky, hard, dark grey Minor shell fragments LCM as cement	N3	
972-015	660-690m	A 70%	Clay as 972-014A	5Y6/1	0.42
		B 20%	Sand as 972-014B	N9	
		C 10%	Basalt as 972-014C Minor shell fragments	N3	
972-016	690-720m	A 75%	Mudstone, grading to claystone, blocky, sl. silty, non-calc.,light olive grey	5Y6/1	0.38
		B 15%	Sand as 972-014B	N9	
		C 10%	Basalt as 972-014C Minor shell fragments	N3	
972-017	720-750m	A 75%	Mudstone as 972-016A	5Y6/1	0.37
		B 15%	Sand as 972-014B	N9	
		C 10%	Basalt as 972-014C Minor shell fragments	N3	
972-018	750-780 m	A 75%	Mudstone as 972-016A	5Y6/1	0.39
		B 15%	Sand as 972-014B	N9	
		C 10%	Basalt as 972-014C Minor shell fragments	N3	
972-019	780-810m	A 85%	Mudstone as 972-016A	5Y6/1	0.50
		B 15%	Sand as 972-014B Minor basalt and shell	N9	
972-020	810-840 m	A 90%	Mudstone as 972-016A	5Y6/1	0.66
		B 10%	Sand as 972-014B Minor basalt and shell	N9	
972-021	840-870 m	A 85%	Mudstone as 972-016A	5Y6/1	0.67
		B 15%	Sand as 972-014B Minor basalt and shell	N9	
972-022	870-900 m	A 85%	Sand, unconsolidated, medium grained, subrounded, fairly well sorted, clear, white	N9	
		B 15%	Mudstone, blocky, silty, non-calc. light olive grey Minor cavings Minor shell fragments	5Y6/1	0.58,0.60

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

TABLE 1

ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-023	900-930 m	A 70%	Sand, unconsolidated, medium grained, subrounded, fairly well sorted, clear, white	N9	
		B 15%	Mudstone, blocky, silty, non-calc. light olive grey Minor cavings	5Y6/1	0.61
		C 15%	Shell fragments		
972-024	930-960m	A 75%	Sand as 972-023A	N9	
		B 15%	Shell fragments		
		C 5%	Mudstone as 972-023B, minor cavings	5Y6/1	0.52
		D 5%	Glauconite, blocky, soft, medium dark greenish grey	5GY5/1	
972-025	960-990m	A 60%	Mudstone, blocky, soft, non-calc. sl. silty, minor cavings, yellowish grey to very light olive grey	5Y8/1-5Y7/1	1.57
		B 30%	Sand as 972-023A	N9	
		C 5%	LCM as cement		
		D 5%	Glauconite as 972-024D, medium dark greenish grey	5GY5/1	
972-026	990-1020m	A 98%	Mudstone as 972-025A, minor to significant caving, minor sand	5Y8/1-5Y7/1	1.32
972-027	1-1050m	A 80%	Mudstone, as 972-025A, minor to significant cavings	5Y8/1-5Y7/1	1.31
		B 15%	Sand, unconsolidated, medium grained, subrounded, well sorted clear, white	N9	
		C 5%	Glauconite, blocky, soft, medium dark greenish grey	5GY5/1	
972-028	1080m	A 75%	Mudstone as 972-025A, minor caving	5Y8/1-5Y7/1	1.29
		B 20%	Sand as 972-027B	N9	
		C 5%	Glauconite as 972-027C Minor shell fragments	5GY5/1	
972-029	1110m	A 65%	Mudstone as 972-025A, minor to sig. caving	5Y8/1-5Y7/1	
		B 25%	Sand as 972-027B	N9	
		C 10%	Glauconite as 972-027C Minor basalt	5GY5/1	
972-030	1140m	A 90%	Mudstone as 972-025A, minor caving	5Y8/1-5Y7/1	
		B 5%	Sand as 972-027B	N9	
		C 5%	Glauconite as 972-027C Minor other mudstone	5GY5/1	
972-031	170m	A 75%	Mudstone as 972-025A, sig. caving	5Y8/1-5Y7/1	
		B 20%	Sand as 972-027B	N9	
		C 5%	Glauconite as 972-027C	5GY5/1	

Abbreviations: argillaceous, calcareous, Cut, dolomitic, Fluorescence, foraminifera, fossiliferous
Lost Circulation, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-023	900-930 m	A 70%	Sand, unconsolidated, medium grained, subrounded, fairly well sorted, clear, white	N9	
		B 15%	Mudstone, blocky, silty, non-calc. light olive grey Minor cavings	5Y6/1	0.61
		C 15%	Shell fragments		
972-024	930-960m	A 75%	Sand as 972-023A	N9	
		B 15%	Shell fragments		
		C 5%	Mudstone as 972-023B, minor cavings	5Y6/1	0.52
		D 5%	Glauconite, blocky, soft, medium dark greenish grey	5GY5/1	
972-025	960-990m	A 60%	Mudstone, blocky, soft, non-calc. sl. silty, minor cavings, yellowish grey to very light olive grey	5Y8/1-5Y7/1	1.57
		B 30%	Sand as 972-023A	N9	
		C 5%	LCM as cement		
		D 5%	Glauconite as 972-024D, medium dark greenish grey	5GY5/1	
972-026	990-1020m	A 98%	Mudstone as 972-025A, minor to significant caving, minor sand	5Y8/1-5Y7/1	1.32
972-027	1020-1050m	A 80%	Mudstone, as 972-025A, minor to significant cavings	5Y8/1-5Y7/1	1.31
		B 15%	Sand, unconsolidated, medium grained, subrounded, well sorted clear, white	N9	
		C 5%	Glauconite, blocky, soft, medium dark greenish grey	5GY5/1	
972-028	1050-1080m	A 75%	Mudstone as 972-025A, minor caving	5Y8/1-	1.29
		B 20%	Sand as 972-027B	N9	
		C 5%	Glauconite as 972-027C Minor shell fragments	5GY5/1	
972-029	1080-1110m	A 65%	Mudstone as 972-025A, minor to sig. caving	5Y8/1-5Y7/1	
		B 25%	Sand as 972-027B	N9	
		C 10%	Glauconite as 972-027C Minor basalt	5GY5/1	
972-030	1110-1140m	A 90%	Mudstone as 972-025A, minor caving	5Y8/1-5Y7/1	
		B 5%	Sand as 972-027B	N9	
		C 5%	Glauconite as 972-027C Minor other mudstone	5GY5/1	
972-031	1140-1170m	A 75%	Mudstone as 972-025A, sig. caving	5Y8/1-5Y7/1	
		B 20%	Sand as 972-027B	N9	
		C 5%	Glauconite as 972-027C	5GY5/1	

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION		G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-032	1170-1200m	A 75%	Mudstone, blocky, soft to mod. hard, non-calc	5Y7/1-5Y8/1	1.09
		B 15%	Sand, unconsolidated, medium grained, well sorted, clear, white	N9	
		C 10%	Glauconite, blocky, soft, medium dark greenish grey	5GY5/1	
972-033	1200-1230m	A 95%	Mudstone as 972-032A, minor to significant cavings	5Y7/1-5Y8/1	1.08
		B 5%	Sand as 972-032B	N9	
			Minor glauconite		
972-034	1230-1260m	A 35%	Mudstone, as 972-032A	5Y7/1-5Y8/1	1.06
			Significant cavings		
		B 35%	Sand as 972-032B	N9	
		C 30%	Shaly mudstone, subfissile, soft to mod. hard, non-calc., minor cavings, olive grey	5Y4/1	1.38
			Minor glauconite		
972-035	1260-1290m	A 55%	Shaly mudstone as 972-034C, minor to sig. cavings, olive grey	5Y4/1	1.30
		B 35%	Sand as 972-032B	N9	
		C 10%	Mudstone as 972-032A, dominant cavings	5Y7/1-5Y8/1	
972-036	1290-1320m	A 80%	Shale, grading to shaly mudstone, subfissile, soft to mod. hard, non-calc., minor to sig. cavings, olive grey	5Y4/1	1.24
		B 15%	Sand as 972-032B	N9	
		C 5%	Mudstone as 972-032A, caved	5Y7/1-5Y8/1	
			Minor igneous		
972-037	1320-1350m	A 85%	Shale as 972-036A, minor cavings olive grey	5Y4/1	0.97
		B 15%	Sand as 972-032B	N9	
			Minor caved mudstone		
972-038	1350-1380m	A 85%	Shale as 972-036A, minor caving	5Y4/1	0.77,0.79
		B 15%	Sand as 972-032B	N9	
			Minor caved mudstone		
972-039	1380-1410m	A 85%	Sand as 972-032B	N9	
		B 15%	Shale, platy to subfissile, olive grey occ. medium olive grey soft to mod. hard, non-calc. sig. caving	5Y4/1 5Y5/1	0.80
972-040	1410-1440m	A 98%	Shale as 972-039B, olive grey to medium olive grey, minor to sig. cavings,	5Y4/1 5Y5/1	0.59
			Minor sand		
972-041	1440-1470m	A 98%	Shale as 972-039B, minor to sig. caving, minor sand and glauconite olive grey to occ. medium olive grey	5Y4/1 5Y5/1	0.56

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION		GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-042	1470-1500m	A 90%	Shale, platy to subfissile, mod. hard, non-calc. minor to sig. caving, olive grey to medium dark greenish grey	5Y4/1-5GY5/1	0.47
		B 10%	Sand, unconsolidated, medium grained, subrounded to subangular, fairly well sorted, clear, white Minor glauconite	N9	
972-043	1500-1530m	A 50%	Shale as 972-042A, sig. caving	5Y4/1-5GY5/1	0.30
		B 50%	Sand as 972-042B Minor glauconite	N9	
972-044	1530-1560m	A 70%	Shale as 972-042A, minor to sig. caving	5Y4/1-5GY5/1	0.40
		B 30%	Sand as 972-042B Minor glauconite	N9	
972-045	1560-1590m	A 98%	Shale as 972-042A, minor to sig. caving Minor sand	5Y4/1-	0.42,0.41
972-046	1590-1620m	A 90%	Shale, platy to subfissile, soft to mod. hard, non-calc.,minor to sig. caving, olive grey to medium olive grey	5Y4/1-5Y5/1	0.34
		B 10%	Sand, unconsolidated, medium grained, subrounded to subangular, fairly well sorted, clear, white	N9	
972-047	1620-1650m	A 95%	Shale as 972-046A, sig. caving	5Y4/1-5Y5/1	0.37
		B 5%	Sand as 972-046B	N9	
972-048	1650-1680m	A 98%	Shale as 972-046A, sig. caving Minor sand	5Y4/1-	0.35
972-049	1680-1710m	A 98%	Shale as 972-046A, sig. caving	5Y4/1-5Y5/1	0.27
972-050	1710-1740m	A 98%	Shale, subfissile to platy, soft to mod. hard, non-calc.,minor to sig. caving, olive grey to medium olive grey	5Y4/1-5Y5/1	0.43
972-051	1740-1770m	A 98%	Shale as 972-050A, minor to sig. caving Minor other shale	5Y4/1-5Y5/1	0.54
972-052	1770-1800m	A 70%	Shale, subfissile to blocky, soft to mod. hard, v. sl. calc.,minor cavings, medium greyish brown	5YR4/2	0.11,0.12
		B 30%	Shale as 972-050A, sig. caving	5Y4/1-5Y5/1	0.32
972-053	1800-1830m	A 85%	Shale, platy to subfissile, soft to mod. hard, non-calc., minor to sig. caving, medium olive grey	5Y5/1	0.35

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TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-053	1800-1830m	B 15% Shale, subfissile to blocky, soft to mod. hard, v. sl. calc., minor caving, medium greyish brown	5YR4/2	0.11
972-054	1830-1845m	A 98% Shale, platy to subfissile, soft, non-calc.,minor cavings, medium dark greenish grey to olive grey Minor sand and other mudstone	5Y5/1-5Y4/1	0.64
972-055	1845-1860m	A 98% Shale as 972-054A, sig. caving, Minor ther shale	5Y5/1-	0.49,0.50
972-056	1860-1875m	A 95% Shale,grading to shaly mudstone, subfissile to blocky, soft to mod. hard, non-calc.,minor to sig. caving, olive grey	5Y4/1	0.32
		B 5% Shale, subfissile, mod. hard, non-calc.,minor cavings, brownish grey to medium dark greenish grey Minor sand and siltstone	5YR4/1-5Y5/1	0.13
972-057	1875-1890m	A 98% Shale as 972-056A, minor caving olive grey Minor other shale and sand	5Y4/1	0.68
972-058	1890-1905m	A 98% Shale as 972-056A, minor caving olive grey Minor other shale	5Y4/1	0.91
972-059	1905-1915m	A 98% Shale as 972-056A, minor caving olive grey Minor other shale	5Y4/1	0.97,0.98
972-060	1915-1930m	A 85% Shaly mudstone, grading to shale, subfissile, soft to mod. hard, non-calc. minor caving, light olive grey	5Y6/1	0.29
		B 15% LCM as cement Minor other mudstone		
972-061	1930-1945m	A 95% Shaly mudstone, subfissile, soft to mod. hard, non-calc.,minor caving, light olive grey to brownish grey	5Y6/1-5YR4/1	0.29
		B 5% LCM as cement		
972-062	1945-1960m	A 98% Shaly mudstone as 972-061A, minor caving Minor other mudstone Minor LCM	5Y6/1-5YR4/1	0.35
972-063	1960-1975m	A 98% Shaly mudstone as 972-061A, minor caving Minor other mudstone and sand	5Y6/1	0.33
972-064	1975-1990m	A 90% Shaly mudstone, subfissile to blocky, soft to mod. hard, non-calc, minor caving, medium olive grey to medium brownish grey	5Y5/1-5YR5/1	0.38,0.37

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-064	1975-1900m	B 10%	Sand, unconsolidated, fine-coarse, grained, subrounded to subangular, poorly sorted, clear, white	N9	
972-065	1990-2005m	A 95%	Shaly mudstone, subfissile to blocky, soft to mod. hard, non-calc. minor caving, medium olive grey to medium brownish grey	5Y5/1-5YR5/1	0.37
		B 5%	Sand, unconsolidated, fine-coarse grained, subrounded to subangular, poorly sorted, clear, white Minor other mudstone	N9	
972-066	2005-2020m	A 98%	Shaly mudstone, subfissile to blocky, soft to mod. hard, non-calc., minor to sig. caving, medium olive grey to medium brownish grey Minor calcite and sand	5Y5/1-5YR5/1	0.44
972-067	2020-2035m	A 98%	Shaly mudstone, platy to subfissile soft to mod. hard, sl. silty, non-calc., minor caving, medium grey to medium olive grey Minor sand and other mudstone	N5-5Y5/1	0.37
972-068	2035-2050m	A 98%	Shaly mudstone, as 972-067A, Minor to sig. caving Minor sand and glauconite	N5-5Y5/1	0.35
972-069	2050-2065m	A 85%	Shaly mudstone, as 972-067A, minor to sig. caving	N5-5Y5/1	0.35,0.34
		B 15%	Silty mudstone, blocky, soft, non-calc. light grey	N7	0.34
972-070	2065-2080m	A 95%	Shaly mudstone, as 972-067A, minor to sig. caving	N5-5Y5/1	0.38
		B 5%	Silty mudstone as 972-069B Minor other mudstone	N7	0.49
972-071	2080-2095m	A 95%	Shaly mudstone as 972-067A, minor to sig. caving	N5-5Y5/1	0.39
		B 5%	Silty mudstone as 972-069B Minor other mudstone	N7	0.33,0.36
972-072	2095-2110m	A 98%	Shaly mudstone as 972-067A Sig. to abundant caving Minor other mudstone	N5-5Y5/1	0.47
972-073	2110-2125m	A 98%	Shale, subfissile to platy, soft to mod. hard, non-calc. light olive grey to light grey Minor other shale	5Y6/1-N7	0.39
972-074	2125-2140m	A 98%	Shale as 972-073A, minor caving Minor other shale	5Y6/1-N7	0.43

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-075	2140-2155m	A 98%	Shale grading to shaly mudstone, subfissile, soft to mod. hard, v. sl. calc.,minor caving, medium light grey to light olive grey Minor other shale	N6-5Y6/1	0.42
972-076	2155-2170m	A 98%	Shale as 972-075A, minor caving Minor other shale	N6-5Y6/1	0.46,0.43
972-077	2185-2200m	A 98%	Shale as 972-075A, minor to sig. caving Minor other shale	N6-5Y6/1	0.49
972-078	2200-2215m	A 80%	Shale as 972-075A, sig. caving	N6-5Y6/1	0.48
		B 20%	Mudstone, blocky, soft, sl. calc., light grey Minor caving	N7	0.39
972-079	2215-2230m	A 65%	Shale as 972-075A, sig. caving	N6-5Y6/1	0.50
		B 35%	Mudstone as 972-078B, minor caving	N7	0.43
972-080	2230-2245m	A 60%	Shale, platy to subfissile, mod. hard, non-calc. to sl. calc.,sig. caving, medium grey to medium olive grey	N5-5Y5/1	0.54
		B 40%	Mudstone, blocky, soft, calc., light grey to very light olive grey Minor to sig. caving	N7-5Y7/1	0.47,0.47
972-081	2245-2260m	A 65%	Shale as 972-080A, sig. caving	N5-5Y5/1	0.52
		B 35%	Mudstone as 972-080B, minor to sig. caving	N7-5Y7/1	0.47
972-082	2260-2275m	A 85%	Shale as 972-080A, minor caving	N5-5Y5/1	0.54
		B 15%	Mudstone as 972-080B, minor caving	N7-5Y7/1	0.45
972-082	2275-2290m	A 80%	Shale as 972-080A, minor to sig. caving	N5-5Y5/1	0.56,0.55
		B 20%	Mudstone as972-080B, minor caving	N7-5Y7/1	0.50
972-084	2290-2305m	A 85%	Shale, platy to thinly fissile, soft to mod. hard, non-calc., minor caving, medium grey	N5	0.59
		B 15%	Mudstone, blocky, soft, calc., minor caving, medium grey to medium olive grey	N5-5Y5/1	0.47
972-085	2305-2320m	A 90%	Shale as 972-084A, minor caving	N5	0.60
		B 10%	Mudstone as 972-084B, sig. caving	N5-	0.48-0.49
972-086	2320-2335m	A 85%	Shale as 972-084A, minor caving	N5	0.61
		B 15%	Mudstone as 972-084B, minor to sig. caving	N5-5Y5/1	0.50

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TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-087	2335-2350m	A 95%	Shale, platy to thinly fissile, soft to mod. hard, non-calc., minor cavings, medium grey	N5	0.54
		B 5%	Mudstone, blocky, soft, calc. sig. cavings, medium grey to medium olive grey	N5-5Y5/1	0.54
972-088	2350-2365m	A 85%	Shale as 972-087A, sig. caving	N5	0.56,0.55
		B 15%	Mudstone as 972-084B, sig. caving	N5-5Y5/1	0.51
972-089	2370m	A 98%	LCM - nut husk		
972-090	2365-2380m	A 85%	Shale, platy, mod. hard, non-calc., sig. caving, medium grey	N5	0.54
		B 10%	Mudstone, blocky, soft to mod. hard, sl. calc. ,medium light grey to light olive grey	N6-5Y6/1	0.55
		C 5%	LCM as nut husk		
972-091	2380-2395m	A 85%	Shale as 972-090A, minor to sig. caving	N5	0.53
		B 10%	Mudstone as 972-090B, sig. caving	N6-5Y6/1	0.50,0.50
		C 5%	LCM as nut husk		
972-092	2395-2410m	A 90%	Shale, platy, mod. hard, non-calc., minor caving, medium grey	N5	0.59
		B 5%	Mudstone as 972-090B, sig. caving	N6-5Y6/1	0.50
		C 5%	LCM as nut husk		
972-093	2410-2425m	A 98%	Shale as 972-0 92A, minor caving Minor mudstone LCM as nut husk	N5	0.55
972-094	2425-2440m	A 98%	Shale as 972-0 92A, abundant caving Minor caved mudstone LCM as nut husk	N5	0.55
972-095	2440-2455m	A 90%	Shale as 972-092A, minor caving	N5	0.51,0.51
		B 10%	Mudstone, blocky, soft to sl. calc. minor caving, light grey	N7	0.49
972-096	2455-2470m	A 90%	Shale as 972-0 92A minor caving	N5	0.56
		B 10%	Mudstone as 972-0 95B, minor caving	N7	0.54
972-097	2470-2485m	A 90%	Shale, platy, mod. hard, non-calc. minor caving, medium grey	N5	0.54
		B 10%	Mudstone as 972-095B, minor caving	N7	0.48,0.48
972-098	2485-2500m	A 90%	Shale as 972-097A, minor to sig. caving	N5	0.47
		B 10%	Mudstone as 972-095B, minor caving	N7	0.46
972-099	2500-2515m	A 95%	Shale as 972-097A, minor caving	N5	0.49
		B 5%	Mudstone as 972-095B, sig. caving		
972-100	2515-2530m	A 90%	Shale as 972-097A, minor caving	N5	0.59,0.58
		B 10%	Mudstone as 972-095B, sig. caving	N7	0.35

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Lost Circulation Material, moderately, occasionally, slightly, very

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-101	2545-2560m	A 85%	Shale, subfissile to platy, soft to mod. hard, non-calc., sig. caving, medium grey	N5	0.55
		B 15%	Mudstone, blocky, soft to mod. hard, v. sl. calc. to non-calc., sig. cavings, light grey to v. light olive grey	N7-5Y7/1	0.39
972-102	2560-2575m	A 90%	Shale as 972-101A, minor to sig. caving	N5	0.55
		B 10%	Mudstone as 972-101B, minor caving	N7-5Y7/1	0.51,0.49
972-103	2575-2590m	A 90%	Shale as 972-101A, minor caving	N5	0.58
		B 10%	Mudstone as 972-101B, minor caving	N7-5Y7/1	0.48
972-104	2590-2605m	A 90%	Shale as 972-101A, minor to sig. caving	N5	0.57
		B 10%	Mudstone as 972-101B, minor caving Minor LCM as nut husk	N7-5Y7/1	0.47
972-105	2605-2620m	A 90%	Shale as 972-101A, sig. caving	N5	0.62,0.62
		B 10%	Mudstone as 972-101B, minor caving Minor LCM as nut husk	N7-5Y7/1	0.44
972-106	2620-2635m	A 85%	Shale as 972-101A, minor to sig. caving	N5	0.60
		B 15%	Mudstone as 972-101B, minor caving	N7-5Y7/1	0.69
972-107	2635-2650m	A 80%	Shale, platy, mod. hard, non-calc., medium grey, minor caving	N5	0.62,0.62
		B 20%	Mudstone, blocky, soft, sl. calc., minor caving, medium light grey	N6	0.55
972-108	2650-2665m	A 75%	Shale as 972-107A, minor caving	N5	0.66
		B 25%	Mudstone as 972-107B, minor caving	N6	0.49
972-109	2665-2680m	A 80%	Shale as 972-107A, sig caving	N5	0.67
		B 20%	Mudstone as 972-107B, minor caving	N6	0.58,0.58
972-110	2680-2695m	A 75%	Shale as 972-107A, dominant caving	N5	0.79
		B 25%	Mudstone as 972-107B, sig. to abundant caving	N6	0.67
972-111	2695-2710m	A 70%	Shale as 972-107A, dominant caving	N5	0.71
		B 30%	Mudstone as 972-107B, sig. caving	N6	0.68
972-112	2710-2725m	A 65%	Mudstone, blocky, soft to mod. hard, non-calc., minor caving	N6	0.81,0.80
		B 35%	Shale, subfissile, mod. hard, non-calc., dominant caving, medium dark grey to medium grey	N4-5	0.96
972-113	2725-2740m	A 85%	Mudstone as 972-112A, minor caving	N6	0.95
		B 15%	Shale as 972-112B, dominant caving	N4-5	0.96
972-114	2740-2755m	A 75%	Mudstone, blocky, soft to mod. hard non-calc, minor caving, medium grey	N5	0.95
		B 25%	Shale, platy, mod. hard, non-calc. sig. caving, medium dark grey	N4	1.03,1.01

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TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-115	2755-2770m	A 60%	Shale, platy, mod. hard, non-calc., dominant caving, medium dark grey	N4	0.72
		B 40%	Mudstone, blocky, soft to mod. hard, non-calc., minor caving, medium grey	N5	0.82
972-116	2770-2785m	A 70%	Mudstone as 972-115B, minor caving	N5	0.81
		B 30%	Shale as 972-115A, sig. caving	N4	
972-117	2785-2800m	A 65%	Mudstone as 972-115B, minor caving	N5	0.88,0.88
		B 35%	Shale, platy, mod. hard, non-calc., minor caving, medium dark grey	N4	0.87
972-118	2800-2815m	A 50%	Shale, platy to thinly fissile, mod. hard, non-calc. minor to sig. Caving, medium dark grey	N4	0.78
		B 50%	Mudstone, blocky, soft, sl. calc., minor caving, medium grey	N5	0.98
972-119	2815-2830m	A 60%	Shale as 972-118A, minor to sig. caving	N4	0.81
		B 40%	Mudstone as 972-118B, minor caving	N5	0.92,0.90
972-120	2830-2845m	A 60%	Shale as 972-118A, minor caving	N4	0.88
		B 40%	Mudstone as 972-118B, minor caving	N5	0.92
972-121	2845-2860m	A 60%	Mudstone as 972-118B, sig. caving	N5	0.64
		B 40%	Shale as 972-118A, sig. caving Minor other shale	N4	0.84
972-122	2860-2875m	A 55%	Mudstone, blocky, soft to mod. hard, sl. calc., minor caving, medium grey to medium light grey	N5-6	0.78
		B 45%	Shale, platy, mod. hard, non-calc., sig. to abundant caving, medium dark grey	N4	0.90
972-123	2875-2890m	A 60%	Mudstone as 972-122A, minor to sig. caving	N5-6	0.80,0.80
		B 40%	Shale as 972-122B, sig. to abundant caving	N4	0.94
972-124	2890-2905m	A 70%	Mudstone as 972-122A, minor caving	N5-6	0.72
		B 30%	Shale as 972-122B, sig. caving Minor red mudstone and pyrites	N4	0.81
972-125	2905-2920m	A 50%	Shale as 972-122B, sig. cavings	N4	0.65
		B 40%	Mudstone as 972-122A, minor caving	N5-6	0.78,0.77
		C 10%	Limestone, chalky, blocky, soft, white Minor red mudstone	N9	0.16
972-126	2920-2935m	A 40%	Shale. platy to subfissile, mod. hard, non-calc., minor to sig. caving, medium grey	N5	0.69

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH	GROSS LITHOLOGIC DESCRIPTION		GSA Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-126	2920-2935m	B 25%	Shale, subfissile, soft to mod. hard, sl. silty, non-calc., minor caving, dark grey to medium dark grey	N3-4	6.60
		C 15%	Shale, subfissile, soft to mod. hard, sl.calc., medium light grey to greenish grey	N6-5G6/1	0.17
		D 15%	Limestone, chalky, blocky, soft, white	N9	0.13,0.14
			Minor red mudstone		
		E 5%	Shale, subfissile, soft to mod. hard, non-calc., greyish brown	5YR3/2	0.12
			Minor pyrites and other shale		
972-127	2935-2950m	A 45%	Silty, shale, subfissile, soft to mod. hard, non-calc., minor caving dark brownish grey	5YR3/1	7.95
		B 35%	Shale as 972-126A, sig. caving	N3-4	0.66
		C 15%	Shale as 972-126C	N6-5G6/1	0.19
		D 5%	Shale as 972-126E, sig caving	5YR3/2	0.12,0.12
			Minor limestone and pyrites		
972-128	2950-2965m	A 50%	Silty shale as 972-127A, sig. caving	5YR3/1	7.08
		B 40%	Shale as 972-126A, sig. caving	N3-4	0.89
		C 10%	Shale as 972-126C, minor to sig. caving	N6-5G6/1	0.23
			Minor limestone and other shale		
972-129	2965-2980m	A 80%	Silty shale as 972-127A, sig. caving	5YR3/1	7.20
		B 20%	Shale as 972-126A, sig. caving	N3-4	0.74
			Minor other shale		
972-130	2980-2995m	A 85%	Silty shale, blocky to subfissile, soft to mod. hard, non-calc. minor to sig. caving	5YR3/1	7.04,7.03
		B 15%	Shale, platy, mod. hard, non-calc., sig. caving, medium grey	N5	0.74
			Minor other shale and pyrites		
972-131	2995-3010m	A 70%	Silty shale, subfissile, soft to mod. hard, non-calc., minor to sig. caving, dark brownish grey to dark olive grey	5YR3/1-5Y3/1	7.90
		B 15%	Coal, blocky, brittle, greyish black	N2	68.70
		C 15%	Shale as 972-130B, sig. caving	N5	1.03
972-132	3010-3025m	A 75%	Silty shale as 972-131A, sig. caving	5YR3/1	7.20,7.14
		B 15%	Shale as 972-130B, sig. caving	N5	0.68
		C 10%	Coal as 972-131B	N2	61.80
			Minor other shale and limestone		
972-133	3025-3040m	A 85%	Silty shale as 972-131A, abundant caving	5YR3/1-5Y3/1	6.23

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-133	3025-3040m	B 15%	Shale, platy, mod. hard, non-calc., sig. caving, medium grey Minor coal and other shale	N5	0.76,0.77
972-134	3040-3055m	A 90%	Silty mudstone, grading to shale, subfissile to blocky, soft to mod. hard, non-calc.,minor to sig. caving, dark brownish grey to dark olive grey	5YR3/1-5Y3/1	7.68
		B 10%	Shale as 972-133B, sig. caving Minor coal and other shale	N5	0.86
972-135	3055-3070m	A 85%	Silty mudstone as 972-134A, minor to sig. caving	5YR3/1-5Y3/1	5.47 5.50
		B 15%	Shale as 972-133B, sig. caving Minor other mudstone	N5	1.09
972-136	3070-3085m	A 70%	Shale, subfissile to platy, sl. silty, mod. hard, non-calc.,minor to sig. caving, dark brownish grey to dark olive grey	5YR3/1-5Y3/1	6.89
		B 20%	Shale, platy, mod. hard, non-calc., minor caving, medium dark grey to medium grey	N4-5	0.75
		C 10%	Mudstone, blocky, soft, non-calc., minor other shale, medium grey to medium brownish grey	N5-5YR5/1	1.61
972-137	3085-3100m	A 50%	Shale as 972-136A, sig. caving	5YR3/1-5Y3/1	5.65
		B 30%	Mudstone as 972-136C, minor caving	N5-5YR5/1	1.47
		C 20%	Shale as 972-136B, sig. caving Minor pyrites and other shale	N4-5	1.33
972-138	3100-3115m	A 40%	Shale, subfissile, mod. hard, non-calc.,patchy pearly lustre, abundant caving, dark grey	N3	3.12
		B 30%	Shale as 972-136B, abundant caving	N4-5	1.20,1.22
		C 30%	Mudstone as 972-136C, sig. caving	N5-5YR5/1	1.45
972-139	3115-3130m	A 65%	Shale as 972-138A, abundant caving	N3	3.15
		B 20%	Mudstone as 972-136C, sig. caving	N5-5YR5/1	1.29
		C 15%	Shale as 972-136B, sig. to abundant caving, Minor pyrite and other shale	N4-5	0.89
972-140	3130-3145m	A 75%	Shale, subfissile, soft to mod. hard, sl. silty, non-calc, sig. caving, medium dark grey to brownish grey	N4-5YR4/1	3.62,3.68
		B 15%	Shale, platy, mod. hard, non-calc., sig. caving, medium dark grey to medium grey	N4-5	1.05
		C 10%	Mudstone, blocky, soft, non-calc. , minor caving, medium light grey	N6	0.45
972-141	3145-3160m	A 80%	Shale as 972-140A, sig. to abundant caving	N4-5YR4/1	2.29

Abbreviations = **a**renaceous, **a**rgillaceous, **c**alcareous, **C**ut, **d**olomitic, **F**luorescence, **f**oraminifera, **f**ossiliferous
Lost **C**irculation **M**aterial, **m**oderately, **o**ccasionally, **s**lightly, **v**ery

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-141	3145-3160m	B 20%	Shale, platy, mod. hard, non-calc. abundant caving, medium dark grey to medium grey Minor mudstone	N4-5	0.79
972-142	3160-3175m	A 90%	Shale, subfissile, soft to mod. hard, non-calc., pearly lustre, sig. to abundant caving, dark grey	N3	2.07,2.06
		B 10%	Mudstone, blocky, soft, sl. calc. Minor caving, medium grey	N5	1.02
972-143	3175-3190m	A 70%	Shale as 972-142A, sig. caving	N3	3.29
		B 30%	Mudstone as 972-142B, sig. caving Minor other shale	N5	1.40
972-144	3190-3195m	A 75%	Shale as 972-142A, sig. caving	N3	2.23
		B 25%	Mudstone as 972-142B, minor caving Minor other shale	N5	1.39,1.40
972-145	3196-3205m	A 95%	Shale, subfissile to platy, silty in part, soft to mod. hard, non-calc., medium dark grey Minor caving	N4	2.05
		B 5%	LCM as cement		
972-146	3205-3219m	A 95%	Shale as 972-145A, sig to abundant caving	N4	1.79
		B 5%	LCM as cement		
972-147	3219-3234m	A 90%	Shale as 972-145A, sig. caving	N4	2.05
		B 10%	LCM as cement		
972-148	3234-3249m	A 98%	Silty, mudstone, subfissile to blocky, soft to mod. hard, non-calc., minor to sig. caving, medium dark grey to brownish grey Minor shale and LCM	N4-5YR4/1	2.73
972-149	3249-3264m	A 98%	Silty mudstone as 972-148A, sig. caving Minor shale and LCM	N4-5YR4/1	2.45,2.48
972-150	3264-3279m	A 98%	Silty mudstone as 972-148A, sig. Minor shale	N4-5YR4/1	2.41
972-151	3339-3354m	A 90%	Silty sandstone, blocky, v. fine grained, non-calc. matrix, turbodrilled?, v. pale milky cut, white to pinkish grey	N9-5YR8/1	
		B 10%	Shale, subfissile, soft to mod. hard, non-calc. sig. caving, dark grey	N3	5.10
972-152	3384-3399m	A 45%	Silty shale, subfissile, mod. hard, non-calc., sig. caving	N4-5YR4/1	3.00
		B 40%	Sandstone, blocky, v. fine grained, subangular, well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-152	3384-3399m	C 15%	Coal, subfissile, mod. hard, brittle, pearly lustre, greyish black	N2	40.70
972-153	3399-3414m	A 40%	Coal as 972-152C, sig. caving	N2	56.20,55.45
		B 35%	Shale, subfissile, mod. hard, non-calc.,sig. caving, medium dark grey to brownish grey	N4-5YR4/1	2.44
		C 25%	Sandstone, blocky, v. fine grained, subangular, well sorted, non-calc. matrix, v. pale milky cut, pinkish grey	5YR8/1	
972-154	3414-3429m	A 50%	Silty shale as 972-153B, sig. caving	N4-5YR4/1	2.01
		B 40%	Sandstone as 972-153C, minor caving, v. pale milky cut	5YR8/1	
		C 10%	Coal as 972-153A, sig. caving	N2	24.30
972-155	3429-3444m	A 55%	Sandstone, blocky, v. fine grained subangular, well sorted, non-calc. matrix, minor caving, pinkish grey	5YR8/1	
		B 35%	Silty shale as 972-153B, minor caving	N4-5YR4/1	2.03
		C 10%	Coal as 972-153A, sig. caving	N2	28.65,28.30
972-156	3444-3459m	A 55%	Sandstone as 972-155A, minor caving	5YR8/1	
		B 30%	Coal, blocky to subfissile, brittle sig. caving, dark grey	N3	47.80
		C 15%	Silty shale, subfissile, mod. hard, non-calc. minor caving, medium dark grey to brownish grey	N4-5YR4/1	1.95
972-157	3459-3474m	A 45%	Silty shale as 972-156C, minor caving	N4-5YR4/1	3.27
		B 30%	Coal as 972-156B, sig. caving	N3	49.60
		C 25%	Sandstone as 972-156A, minor caving	5YR8/1	
972-158	3474-3489m	A 45%	Sandstone as 972-156A, minor caving	5YR8/1	
		B 30%	Silty shale as 972-156C, minor	N4-5YR4/1	1.68,1.68
		C 25%	Coal as 972-156B, sig. caving	N3	48.60
972-159	3489-3504m	A 85%	Sandstone, becoming unconsolidated, fine grained, subangular, well sorted, non-calc. matrix, pinkish grey	5YR8/1	
		B 10%	Coal as 974-156B, sig. caving	N3	30.60
		C 5%	Silty shale as 972-156C, sig. caving	N4-5YR4/1	1.99
972-160	3504-3519m	A 90%	Sandstone as 972-159A, minor caving	5YR8/1	
		B 5%	Silty shale as 972-156C, sig. caving	N4-5YR4/1	1.43
		C 5%	coal as 972-156B, abundant caving	N3	11.90
972-161	3519-3534m	A 98%	Sandstone, fine grained, subangular well sorted, non-calc. matrix, pinkish grey, minor caving	5YR8/1	
			Minor coal and shale - caved		

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-162	3534-3549m	A 95%	Sandstone, fine grained, subangular, well sorted, non-calc. matrix, pinkish grey Minor caving Minor coal and shale-caved	5YR8/1	
		B 5%	Shale, subfissile to platy, mod. hard, non-calc.,sig. caving, medium dark grey to brownish grey Minor caved coal	N4-5YR4/1	2.03,2.07
972-163	3549-3564m	A 65%	Silty shale, subfissile to platy, soft, non-calc.,sig. caving, medium dark grey to brownish grey	N4-5YR4/1	1.73
		B 35%	Sandstone as 972-162A, minor caving Minor caved coal	5YR8/1	
972-164	3564-3579m	A 75%	Silty shale as 972-163A, sig. caving	N4-5YR4/1	1.30
		B 15%	Shale, platy, mod. hard, pearly lustre, non-calc.,minor caving, dark grey	N3	3.09
		C 10%	Sandstone as 972-162A, sig. caving	5YR8/1	
972-165	3579-3594m	A 90%	Silty shale as 972-163A, sig. caving	N4-5YR4/1	1.42
		B 10%	Shale as 972-164B, sig. caving Minor caved sandstone	N3	2.39,2.41
972-166	3594-3609m	A 95%	Silty mudstone, subfissile, soft, non-calc. medium grey to medium brownish grey	N5-5YR5/1	1.45
		B 5%	Shale, platy, mod. hard, sl. carb? in part, non-calc, minor caving, medium dark grey to dark grey Minor coal	N4-3	2.11
972-167	3609-3624m	A 75%	Silty mudstone as 972-166A, minor caving	N5-5YR5/1	1.41
		B 25%	Shale as 972-166B, sig. caving	N4-3	1.98
972-168	3624-3639m	A 70%	Silty mudstone as 972-166A, minor caving	N5-5YR5/1	1.41,1.41
		B 20%	Shale as 972-166B, sig. caving	N4-3	2.00
		C 10%	Sandstone, blocky, fine grained, subangular, fairly well sorted, non-calc.,matrix, white	N9	
972-169	3639-3654m	A 45%	Silty mudstone as 972-166A, minor to sig. caving	N5-5YR5/1	1.70
		B 35%	Shale as 972-166B, sig. caving	N4-3	3.05
		C 20%	Sandstone as 972-168C, minor caving	N9	
972-170	3654-3669m	A 45%	Silty shale, platy to subfissile, mod. hard, non-calc.,minor caving medium dark grey to brownish grey	N4-5YR4/1	1.52
		B 35%	Sandstone, blocky, fine grained, subangular, well sorted, non-calc. matrix, white to pinkish grey	N9-5YR8/1	

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-170	3654-3669m	C 20%	Shale, subfissile, soft to mod. hard, non-calc. ,pearly lustre, minor caving, dark grey	N3	3.85,3.83
972-171	3669-3684m	A 60%	Silty shale, platy to subfissile, mod. hard, non-calc. ,minor caving, medium dark grey to brownish grey	N4-5YR4/1	1.83
		B 30%	Sandstone, blocky, fine grained, subangular, well sorted, non-calc. matrix, minor caving, white to pinkish grey	N9-5YR8/1	
		C 10%	Shale as 972-170C, dominant caving Minor coal	N3	2.24
972-172	3684-3699m	A 65%	Shale, subfissile to platy, mod. hard, sl. calc. minor caving, medium dark grey to brownish grey	N4-5YR4/1	1.70
		B 35%	Sandstone as 972-171B, minor caving Minor other shale and coal	N9-5YR8/1	
972-173	3699-3714m	A 90%	Shale as 972-172A, minor to sig. caving	N4-5YR4/1	2.14
		B 10%	Sandstone as 972-171B, minor caving Minor coal	N9-5YR8/1	
972-174	3714-3729m	A 85%	Shale, blocky, mod. hard, sl. silty non-calc. ,turbodrilled, medium dark grey to brownish grey	N4-5YR4/1	0.88,0.91
		B 15%	Shale. platy, mod. hard, non-calc., sig. caving, dark grey to medium dark grey Minor sandstone	N3-4	3.07
972-175	3729-3744m	A 90%	Shale as 972-174A, turbodrilled	N4-5YR4/1	1.24
		B 10%	Shale as 972-174B, sig. caving	N3-4	2.45
972-176	3744-3759m	A 95%	Shale as 972-174A, turbodrilled	N4-5YR4/1	0.85
		B 5%	Shale as 972-174B, sig. caving	N3-4	1.82,1.81
972-177	3759-3774m	A 98%	Shale as 972-174A, turbodrilled minor other shale	N4-5YR4/1	0.94
972-178	3774-3789m	A 90%	Shale, blocky, mod. hard, sl. silty, non-calc. ,turbodrilled, medium dark grey to brownish grey	N4-5YR4/1	0.95
		B 10%	Shale, platy, mod. hard, non-calc., medium dark grey to brownish grey sig. caving	N4-5YR4/1	1.44
972-179	3789-3804m	A 85%	Shale as 972-178A, turbodrilled	N4-5YR4/1	0.97
		B 15%	Shale as 972-178B, minor caving	N4-5YR4/1	1.40,1.40
972-180	3804-3819m	A 95%	Shale as 972-178A, turbodrilled	N4-5YR4/1	0.99
		B 5%	Shale as 972-178B, minor caving	N4-5YR4/1	1.37
972-181	3819-3834m	A 90%	Shale as 972-178A, turbodrilled	N4-5YR4/1	1.00
		B 10%	Shale as 972-178B, minor caving	N4-5YR4/1	1.27
972-182	3834-3849m	A 90%	Shale as 972-178A, turbodrilled	N4-5YR4/1	0.96-0.97
		B 10%	Shale as 972-178B, minor caving	N4-5YR4/1	1.34

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

TABLE 1
ORGANIC CARBON RESULTS AND GROSS LITHOLOGIC DESCRIPTIONS

GEOCHEM SAMPLE NUMBER	DEPTH		GROSS LITHOLOGIC DESCRIPTION	G S A Colour Code	TOTAL ORGANIC CARBON (Wt. % of Rock)
972-183	3849-3864m	A 98%	Shale, blocky, mod. hard, sl.silty non-calc.,turbodrilled, medium dark grey to brownish grey Minor other shale	N4-5YR4/1	0.80
972-184	3864-3879m	A 98%	Shale as 972-183A, turbodrilled Minor other shale	N4-5YR4/1	0.61,0.61
972-185	3879-3894m	A 85%	Shale as 972-183A, turbodrilled	N4-5YR4/1	0.79
		B 15%	Shale, platy, mod. hard, non-calc., sig. caving, medium dark grey to brownish grey	N4-5YR4/1	1.76
972-186	3894-3909m	A 55%	Shale, platy, mod. hard, non-calc., minor to sig. caving, medium dark grey to brownish grey	N4-5YR4/1	1.37
		B 30%	Quartzite/sand, unconsolidated, medium grained, clear, white	N9	
		C 15%	Shale as 972-183A, turbodrilled	N4-5YR4/1	0.59
972-187	3909-3924m	A 55%	Shale as 972-186A, minor caving	N4-5YR4/1	1.24,1.26
		B 45%	Quartzite/sand, as 972-186B Minor coal and other shale	N9	
972-188	3924-3939m	A 80%	Shale as 972-186A, minor to sig. caving	N4-5YR4/1	1.35
		B 20%	Quartzite/sand, as 972-186B Minor coal and other shale	N9	
972-189	3939-3954m	A 65%	Sandstone, blocky, fine grained, non-calc. matrix, white to moderate orange pink	N9-5YR8/4	
		B 35%	Shale as 972-186A, minor to sig. caving Minor coal and other shale	N4-5YR4/1	1.23
972-190	3954-3969m	A 55%	Sandstone as 972-189A	N9-5YR8/4	
		B 45%	Shale as 972-186A, sig. caving Minor coal and other shale	N4-5YR4/1	1.14
972-191	3969-3984m	A 75%	Shale as 972-186A, sig. to abundant caving	N4-5YR4/1	1.45
		B 25%	LCM as metal and paint Minor sandstone		
972-192	3999-4005m	A 90%	Sandstone, blocky, v. fine grained, well sorted, non-calc. matrix, moderate orange pink	5YR8/4	
		B 10%	Shale as 972-186A, abundant caving	N4-5YR4/1	1.30

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

TABLE 2A

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-001	228-260	5	1	1	1	2	9	4	44.9	2	0.41
972-002	260-290	6	0	0	0	0	8	1	14.0	1	0.43
972-003	290-320	2135	109	1	0	1	2246	111	4.9	3	0.41
972-004	320-350	2168	34	1	0	0	2204	35	1.6	3	0.12
972-005	350-380	13	1	0	0	0	13	1	6.3	1	1.93
972-006	380-410	1071	5	1	0	0	1077	6	0.5	1	0.00
972-007	410-440	955	2	1	0	0	958	3	0.3	1	8.06
972-008	440-470	1001	5	1	0	0	1007	6	0.6	1	2.39
972-009	470-500	2562	10	2	0	0	2574	12	0.5	1	0.55
972-010	500-530	1744	4	1	0	0	1749	5	0.3	1	0.32
972-011	530-560	2282	7	1	0	0	2291	8	0.4	2	0.97
972-012	560-590	84	5	1	0	0	90	6	6.7	1	0.97
972-013	590-630	1607	6	1	0	0	1614	7	0.5	1	1.93
972-014	630-660	1250	6	1	1	0	1258	8	0.6	1	1.12
972-015	660-690	1468	5	1	0	1	1474	6	0.4	4	0.22
972-016	690-720	1972	7	1	0	0	1980	8	0.4	2	0.48
972-017	720-750	1600	8	1	0	0	1610	10	0.6	0	1.40
972-018	750-780	1601	11	2	1	0	1615	14	0.9	0	0.00
972-019	780-810	941	4	1	1	0	947	6	0.6	0	*.**
972-020	810-840	785	6	1	1	0	793	8	1.1	0	7.61
972-021	840-870	1267	6	2	1	0	1276	9	0.7	1	*.**
972-022	870-900	784	4	1	0	0	789	5	0.7	0	*.**
972-023	900-930	901	4	1	0	0	906	4	0.5	0	2.78
972-024	930-960	1049	4	1	0	0	1053	4	0.4	0	1.23
972-025	960-990	224	2	1	0	0	227	3	1.2	0	0.62
972-026	990-1020	1644	9	3	0	1	1657	13	0.8	0	0.76
972-027	1020-1050	3265	13	3	0	0	3281	16	0.5	0	0.41
972-028	1050-1080	2770	7	3	0	0	2780	10	0.4	0	1.43
972-029	1080-1110	2015	6	2	0	0	2024	9	0.4	1	1.09
972-030	1110-1140	2190	7	2	0	0	2198	8	0.4	1	0.00

TABLE 2A
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-031	1140-1170	1487	6	2	0	0	1495	7	0.5	0	0.95
972-032	1170-1200	1584	4	1	0	0	1590	6	0.4	1	0.32
972-033	1200-1230	1039	6	1	0	0	1047	7	0.7	0	0.48
972-034	1230-1260	394	1	0	0	0	396	2	0.4	0	0.32
972-035	1260-1290	400	1	0	0	0	402	2	0.5	0	0.29
972-036	1290-1320	404	18	1	0	0	424	20	4.7	0	0.15
972-037	1320-1350	251	4	1	0	0	256	4	1.7	0	0.00
972-038	1350-1380	193	1	0	0	0	195	2	1.0	0	0.00
972-039	1380-1410	129	1	0	0	0	132	2	1.6	0	0.00
972-040	1410-1440	143	1	0	0	0	145	2	1.1	0	0.27
972-041	1440-1470	50	0	0	0	0	51	0	0.9	0	0.00
972-042	1470-1500	88	1	0	0	0	89	2	1.8	0	0.00
972-043	1500-1530	130	1	1	0	0	132	2	1.9	2	0.00
972-044	1530-1560	66	6	2	0	0	75	8	11.0	5	0.00
972-045	1560-1590	100	12	2	0	1	114	14	12.5	6	0.00
972-046	1590-1620	119	4	1	0	0	124	5	4.0	1	0.16
972-047	1620-1650	92	3	1	0	0	96	4	3.8	2	0.37
972-048	1650-1680	96	2	1	0	0	100	4	3.9	3	0.00
972-049	1680-1710	124	4	1	0	0	129	5	3.8	1	0.63
972-050	1710-1740	9	1	1	1	1	14	5	33.1	2	0.45
972-051	1740-1770	209	3	1	1	1	215	6	2.7	2	1.73
972-052	1770-1800	224	2	1	1	0	227	3	1.4	2	1.74
972-053	1800-1830	287	4	1	1	0	294	6	2.1	3	2.52
972-054	1830-1845	200	5	1	0	0	206	6	3.1	6	2.38
972-055	1845-1860	302	8	1	0	0	312	10	3.2	5	1.76
972-056	1860-1875	419	12	1	1	1	434	15	3.4	18	1.46
972-057	1875-1890	460	10	1	0	0	471	11	2.4	8	2.39
972-058	1890-1905	634	13	1	1	0	648	15	2.3	10	2.74
972-059	1905-1915	504	9	1	1	0	514	10	2.0	11	2.60
972-060	1915-1930	88	2	1	0	0	91	3	3.7	5	1.23

TABLE 2A
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-061	1930-1945	276	3	1	1	0	283	6	2.3	3	2.74
972-062	1945-1960	368	5	2	2	1	377	9	2.4	4	2.73
972-063	1960-1975	415	7	3	2	1	429	14	3.3	10	2.34
972-064	1975-1990	544	6	3	3	1	556	12	2.2	11	2.77
972-065	1990-2005	449	6	2	2	1	459	10	2.2	11	2.40
972-066	2005-2020	426	6	2	2	1	436	11	2.5	8	2.89
972-067	2020-2035	157	5	4	3	3	172	15	8.7	10	0.83
972-068	2035-2050	339	5	3	3	2	351	12	3.4	17	1.47
972-069	2050-2065	332	4	2	2	1	342	9	2.7	11	1.83
972-070	2065-2080	205	3	2	1	1	212	7	3.4	16	1.47
972-071	2080-2095	211	5	3	2	1	221	10	4.5	16	1.77
972-072	2095-2110	162	3	2	1	1	169	7	3.9	11	2.02
972-073	2110-2125	142	2	1	1	0	146	4	2.6	3	2.32
972-074	2125-2140	158	2	1	1	0	163	4	2.7	4	2.30
972-075	2140-2155	221	3	2	2	1	228	7	3.3	6	1.63
972-076	2155-2170	193	3	2	1	1	200	7	3.6	4	1.55
972-077	2185-2200	260	4	2	2	1	270	10	3.6	3	2.05
972-078	2200-2215	276	4	2	2	1	285	9	3.3	6	2.14
972-079	2215-2230	187	4	3	2	2	199	12	5.8	7	1.30
972-080	2230-2245	251	9	5	6	4	275	24	8.7	26	1.62
972-081	2245-2260	176	5	5	4	3	193	17	8.8	19	1.61
972-082	2260-2275	133	3	2	2	1	140	8	5.5	5	2.07
972-083	2275-2290	115	3	2	2	1	123	8	6.7	8	1.89
972-084	2290-2305	91	4	1	2	1	98	8	7.8	6	1.69
972-085	2305-2320	122	3	2	2	1	129	7	5.6	8	1.92
972-086	2320-2335	137	2	2	2	1	143	7	4.6	7	2.78
972-087	2335-2350	1049	23	18	20	9	1119	70	6.2	67	2.23
972-088	2350-2365	142	7	7	6	4	165	23	13.9	39	1.52
972-090	2365-2380	138	8	9	8	6	169	31	18.4	51	1.32
972-089	2370	5	0	0	0	0	5	0	0.0	0	0.00

TABLE 2A

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-091	2380-2395	45	2	2	2	1	52	7	14.2	6	2.17
972-092	2395-2410	56	2	2	2	1	63	6	10.0	7	2.51
972-093	2410-2425	86	3	3	3	1	96	10	10.5	7	2.94
972-094	2425-2440	70	4	6	6	2	88	18	20.7	21	2.56
972-095	2440-2455	149	4	4	3	1	161	12	7.3	9	2.44
972-096	2455-2470	78	3	3	3	1	88	10	11.8	17	2.38
972-097	2470-2485	82	3	4	4	2	95	13	13.3	16	2.66
972-098	2485-2500	144	9	12	12	6	182	38	20.8	84	2.14
972-099	2500-2515	168	8	10	10	5	200	32	16.2	76	1.88
972-100	2515-2530	147	8	12	14	4	186	38	20.7	18	3.60
972-101	2545-2560	185	14	19	19	8	246	61	24.8	73	2.30
972-102	2560-2575	146	11	15	15	5	191	45	23.6	51	3.17
972-103	2575-2590	203	16	21	23	9	271	69	25.4	59	2.51
972-104	2590-2605	188	16	21	22	9	257	69	26.8	56	2.37
972-105	2605-2620	24	2	3	3	1	34	10	28.9	12	2.38
972-106	2620-2635	443	26	43	56	16	584	141	24.2	49	3.48
972-107	2635-2650	360	20	34	47	12	473	113	23.9	46	3.85
972-108	2650-2665	364	21	35	45	13	479	115	24.0	52	3.49
972-109	2665-2680	169	25	53	61	26	335	166	49.5	189	2.33
972-110	2680-2695	385	63	116	108	34	708	323	45.6	90	3.15
972-111	2695-2710	498	92	143	128	41	903	405	44.8	160	3.12
972-112	2710-2725	145	24	60	60	21	310	166	53.3	152	2.90
972-113	2725-2740	262	21	43	46	12	383	121	31.6	60	3.94
972-114	2740-2755	298	28	72	80	26	506	207	41.0	209	3.05
972-115	2755-2770	294	49	121	133	47	644	350	54.4	363	2.82
972-116	2770-2785	287	42	119	114	41	603	315	52.3	219	2.81
972-117	2785-2800	288	31	89	99	30	537	248	46.3	126	3.30
972-118	2800-2815	407	35	94	96	32	664	257	38.7	122	2.98
972-119	2815-2830	276	24	63	65	22	449	173	38.5	79	2.96
972-120	2830-2845	351	35	107	116	46	654	303	46.3	169	2.50

TABLE 2A
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-121	2845-2860	422	141	241	137	71	1012	589	58.3	607	1.93
972-122	2860-2875	33	12	28	19	10	102	69	67.6	493	1.92
972-123	2875-2890	185	57	196	109	96	643	457	71.2	523	1.13
972-124	2890-2905	1655	854	926	439	907	4781	3126	65.4	3284	0.48
972-125	2905-2920	88	29	115	63	81	376	289	76.7	669	0.78
972-126	2920-2935	6436	2499	4253	960	2270	16418	9981	60.8	13179	0.42
972-127	2935-2950	2195	1133	1229	582	1203	6341	4146	65.4	4355	0.48
972-128	2950-2965	5200	2532	2434	644	1628	12437	7237	58.2	5403	0.40
972-129	2965-2980	9	3	6	1	4	23	14	59.4	86	0.25
972-130	2980-2995	3153	1647	1712	497	1466	8475	5322	62.8	5175	0.34
972-131	2995-3010	5955	2930	2589	601	1689	13765	7809	56.7	6060	0.36
972-132	3010-3025	1857	859	904	209	4270	8099	6242	77.1	1992	0.05
972-133	3025-3040	2683	1255	1062	330	845	6175	3491	56.5	3044	0.39
972-134	3040-3055	310	41	52	7	18	429	118	27.7	112	0.40
972-135	3055-3070	880	372	455	89	172	1967	1087	55.3	539	0.52
972-136	3070-3085	756	338	422	95	197	1808	1052	58.2	666	0.48
972-137	3085-3100	1617	818	1098	268	559	4359	2742	62.9	1515	0.48
972-138	3100-3115	3263	1415	1583	215	486	6962	3699	53.1	1899	0.44
972-139	3115-3130	3301	1001	1503	247	598	6650	3349	50.4	3546	0.41
972-140	3130-3145	1146	467	599	116	253	2581	1435	55.6	1147	0.46
972-141	3145-3160	3237	1421	1700	281	735	7375	4138	56.1	3819	0.38
972-142	3160-3175	2093	1113	1230	299	695	5431	3338	61.5	2076	0.43
972-143	3175-3190	599	282	455	70	181	1588	988	62.2	934	0.39
972-144	3190-3195	2431	1166	1829	331	769	6526	4095	62.8	3039	0.43
972-145	3196-3205	177	108	141	19	50	496	319	64.3	587	0.38
972-146	3205-3219	1078	628	657	177	322	2863	1785	62.3	746	0.55
972-147	3219-3234	1578	914	983	149	298	3922	2344	59.8	756	0.50
972-148	3234-3249	1492	869	855	110	208	3534	2042	57.8	405	0.53
972-149	3249-3264	528	250	184	16	36	1014	486	47.9	126	0.45
972-150	3264-3279	1362	908	881	128	210	3489	2127	61.0	401	0.61

TABLE 2A
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-151	3339-3354	866	574	445	52	69	2006	1140	56.8	301	0.76
972-152	3384-3399	6284	2861	1907	198	206	11456	5172	45.1	481	0.96
972-153	3399-3414	9531	4297	3140	364	379	17712	8181	46.2	499	0.96
972-154	3414-3429	1260	619	476	99	96	2550	1291	50.6	250	1.04
972-155	3429-3444	1416	668	495	70	72	2722	1305	48.0	205	0.98
972-156	3444-3459	2743	1279	950	136	115	5224	2481	47.5	128	1.18
972-157	3459-3474	3780	1667	1305	207	171	7129	3349	47.0	187	1.21
972-158	3474-3489	1055	462	347	53	46	1963	909	46.3	70	1.17
972-159	3489-3504	1643	778	609	129	129	3288	1645	50.0	147	1.00
972-160	3504-3519	2065	1092	768	79	172	4176	2111	50.5	658	0.46
972-161	3519-3534	1403	714	409	48	66	2639	1237	46.8	365	0.73
972-162	3534-3549	1499	760	563	73	112	3006	1508	50.1	455	0.65
972-163	3549-3564	1074	573	561	91	129	2428	1354	55.8	336	0.71
972-164	3564-3579	1396	644	482	58	108	2686	1291	48.0	377	0.54
972-165	3564-3579	961	503	507	57	122	2151	1190	55.3	376	0.47
972-166	3594-3609	148	12	21	3	6	191	42	22.2	19	0.51
972-167	3609-3624	1058	472	385	49	94	2058	1001	48.6	284	0.53
972-168	3624-3639	2171	1109	1075	144	419	4918	2747	55.9	2960	0.34
972-169	3639-3654	2029	1027	944	192	450	4642	2613	56.3	2582	0.43
972-170	3654-3669	654	344	319	58	114	1490	835	56.1	558	0.51
972-171	3669-3684	964	520	535	129	304	2452	1488	60.7	1533	0.42
972-172	3684-3699	3081	882	727	79	218	4987	1906	38.2	1497	0.36
972-173	3699-3714	1399	703	577	185	196	3060	1661	54.3	992	0.95
972-174	3714-3729	1115	542	460	76	150	2344	1228	52.4	1255	0.51
972-175	3729-3744	821	428	311	48	141	1749	928	53.1	1631	0.34
972-176	3744-3759	1964	1072	624	69	281	4011	2046	51.0	4800	0.25
972-177	3759-3774	1903	501	382	42	186	3014	1111	36.9	3747	0.23
972-178	3774-3789	949	362	272	30	105	1717	768	44.7	1195	0.29
972-179	3789-3804	1120	594	487	60	138	2399	1279	53.3	1093	0.43
972-180	3804-3819	3252	1015	635	62	258	5222	1970	37.7	3210	0.24

TABLE 2A
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN AIR SPACE GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-181	3819-3834	372	121	121	15	78	706	334	47.3	1916	0.19
972-182	3834-3849	1689	671	376	39	146	2921	1232	42.2	1902	0.26
972-183	3849-3864	419	81	71	9	30	611	191	31.3	516	0.31
972-184	3864-3879	1037	200	170	20	72	1499	462	30.8	1355	0.28
972-185	3879-3894	1638	477	466	47	146	2774	1136	41.0	1402	0.32
972-186	3894-3909	2350	786	712	78	164	4091	1740	42.5	1157	0.48
972-187	3909-3924	1246	674	716	119	261	3015	1769	58.7	1509	0.45
972-188	3924-3939	7374	2317	2139	250	647	12727	5354	42.1	6949	0.39
972-189	3939-3954	608	195	159	21	46	1028	420	40.9	569	0.46
972-190	3954-3969	613	289	271	45	102	1320	707	53.6	634	0.44
972-191	3969-3984	1266	490	432	50	132	2371	1105	46.6	952	0.38
972-192	3999-4005	1502	153	146	16	41	1858	356	19.2	2008	0.40

TABLE 2B
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-001	228-260	519	15	6	2	6	548	29	5.2	29	0.26
972-002	260-290	931	18	8	2	3	962	31	3.2	36	0.66
972-003	290-320	618	14	5	1	4	642	24	3.7	37	0.22
972-004	320-350	663	12	5	0	1	682	19	2.7	8	0.28
972-005	350-380	1619	17	6	4	0	1646	26	1.6	30	0.00
972-006	380-410	967	14	6	2	1	989	23	2.3	15	1.38
972-007	410-440	1302	13	5	1	3	1324	22	1.6	34	0.23
972-008	440-470	1454	13	6	0	3	1476	22	1.5	52	0.07
972-009	470-500	1184	12	4	1	2	1203	19	1.6	15	0.32
972-010	500-530	757	10	3	1	1	772	15	1.9	6	0.59
972-011	530-560	635	11	4	0	1	651	16	2.4	5	0.00
972-012	560-590	739	8	2	0	0	750	11	1.5	3	0.39
972-013	590-630	917	10	4	0	0	931	14	1.5	1	0.00
972-014	630-660	1131	16	5	0	1	1153	21	1.8	1	0.10
972-015	660-690	876	12	4	1	3	897	21	2.3	14	0.24
972-016	690-720	570	8	3	0	1	582	12	2.1	9	0.81
972-017	720-750	935	9	2	0	1	947	12	1.3	4	0.21
972-018	750-780	1580	16	5	0	2	1602	23	1.4	20	0.21
972-019	780-810	1370	9	3	1	1	1384	14	1.0	3	0.69
972-020	810-840	1712	11	4	1	2	1731	19	1.1	5	0.75
972-021	840-870	844	7	3	0	0	854	10	1.2	3	1.93
972-022	870-900	451	8	2	0	1	462	11	2.4	1	0.32
972-023	900-930	967	15	4	2	2	990	23	2.3	4	1.05
972-024	930-960	720	14	4	1	3	743	23	3.0	13	0.48
972-025	960-990	1757	13	8	1	4	1782	25	1.4	2	0.28
972-026	990-1020	1100	7	3	0	2	1112	12	1.1	0	0.19
972-027	1020-1050	1192	11	4	1	1	1209	17	1.4	4	0.69
972-028	1050-1080	623	6	3	1	2	635	12	1.9	2	0.48
972-029	1080-1110	874	13	5	0	0	892	18	2.0	1	0.00
972-030	1110-1140	507	6	3	1	1	517	11	2.1	1	0.64

TABLE 2B
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-031	1140-1170	1041	24	10	1	5	1082	40	3.7	15	0.27
972-032	1170-1200	645	12	5	1	3	665	20	3.0	1	0.20
972-033	1200-1230	1390	22	8	1	4	1426	36	2.5	2	0.21
972-034	1230-1260	1069	15	6	1	3	1093	24	2.2	2	0.29
972-035	1260-1290	546	22	7	1	4	580	34	5.8	1	0.25
972-036	1290-1320	222	25	6	1	5	259	37	14.3	2	0.21
972-037	1320-1350	126	13	4	0	1	144	17	12.0	3	0.00
972-038	1350-1380	91	7	2	0	1	102	11	10.5	1	0.09
972-039	1380-1410	274	16	7	1	5	303	29	9.6	7	0.21
972-040	1410-1440	66	5	2	0	1	74	8	10.5	5	0.00
972-041	1440-1470	118	11	5	1	4	138	20	14.6	24	0.27
972-042	1470-1500	36	1	1	0	0	38	3	6.9	3	0.32
972-043	1500-1530	104	20	9	0	5	139	35	25.3	10	0.07
972-044	1530-1560	44	8	3	0	1	56	12	22.0	15	0.00
972-045	1560-1590	52	9	3	0	1	65	13	19.6	21	0.15
972-046	1590-1620	21	2	1	0	0	25	3	12.9	11	0.38
972-047	1620-1650	91	9	4	0	3	106	15	14.1	12	0.00
972-048	1650-1680	36	4	2	0	1	42	6	14.8	16	0.19
972-049	1680-1710	52	3	2	0	1	58	6	10.4	14	0.17
972-050	1710-1740	64	6	4	3	3	80	16	20.5	32	0.85
972-051	1740-1770	56	3	2	1	1	64	8	11.9	22	1.17
972-052	1770-1800	94	4	1	0	1	100	7	6.7	15	0.28
972-053	1800-1830	104	6	2	1	2	115	11	9.6	18	0.55
972-054	1830-1845	98	5	2	1	1	107	9	8.2	20	0.64
972-055	1845-1860	225	15	4	1	2	248	22	9.0	59	0.57
972-056	1860-1875	279	19	4	2	2	306	27	8.8	118	0.86
972-057	1875-1890	450	20	4	1	2	477	27	5.7	110	0.63
972-058	1890-1905	299	16	4	2	2	322	24	7.3	107	0.92
972-059	1905-1915	290	8	2	0	0	300	10	3.4	86	1.84
972-060	1915-1930	49	3	1	0	1	54	5	9.0	37	0.53

TABLE 2B

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-061	1930-1945	150	7	2	1	1	161	11	7.1	65	0.87
972-062	1945-1960	82	3	1	1	1	88	5	6.2	2	0.82
972-063	1960-1975	78	5	2	1	1	87	9	10.2	22	1.08
972-064	1975-1990	83	3	1	1	1	88	6	6.4	24	1.27
972-065	1990-2005	110	5	1	1	1	117	8	6.5	28	1.27
972-066	2005-2020	45	2	1	1	0	49	4	8.8	23	2.31
972-067	2020-2035	79	5	3	1	3	91	13	13.8	25	0.52
972-068	2035-2050	36	3	2	1	2	45	9	20.2	16	0.62
972-069	2050-2065	77	4	2	2	2	87	10	11.6	37	1.09
972-070	2065-2080	59	3	2	1	1	67	8	11.6	42	0.72
972-071	2080-2095	91	6	2	1	1	102	11	10.9	42	1.20
972-072	2095-2110	64	4	2	1	1	72	8	11.4	36	0.99
972-073	2110-2125	311	27	8	4	5	355	44	12.4	79	0.72
972-074	2125-2140	93	5	2	2	1	102	9	9.2	13	2.48
972-075	2140-2155	160	9	3	2	3	177	17	9.4	19	0.76
972-076	2155-2170	75	4	2	2	1	83	9	10.3	17	2.21
972-077	2185-2200	108	5	2	1	2	118	10	8.4	27	0.73
972-078	2200-2215	112	6	3	4	3	128	16	12.8	45	1.19
972-079	2215-2230	64	4	3	2	3	76	12	16.2	45	0.88
972-080	2230-2245	64	5	3	3	4	80	16	19.8	50	0.85
972-081	2245-2260	143	11	5	5	5	169	26	15.1	66	0.93
972-082	2260-2275	67	4	2	3	3	79	12	15.7	58	1.07
972-083	2275-2290	77	7	3	3	3	92	16	17.0	76	0.96
972-084	2290-2305	43	4	2	2	2	52	9	18.1	56	1.25
972-085	2305-2320	79	5	2	2	2	89	10	11.4	48	1.15
972-086	2320-2335	45	3	2	1	1	52	7	13.1	44	0.96
972-087	2335-2350	89	8	3	2	2	104	16	15.2	72	1.21
972-088	2350-2365	49	4	3	3	3	63	14	22.6	59	1.05
972-090	2365-2380	64	4	2	2	2	73	10	13.5	73	0.76

TABLE 2B
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-091	2380-2395	58	4	3	2	1	68	10	15.3	68	2.19
972-092	2395-2410	35	4	2	1	1	43	8	19.6	52	1.09
972-093	2410-2425	66	6	4	6	5	87	21	24.4	132	1.15
972-094	2425-2440	24	3	2	3	2	34	11	31.4	125	1.20
972-095	2440-2455	37	3	2	2	2	46	9	18.7	70	1.35
972-096	2455-2470	45	4	4	4	2	58	13	22.4	180	1.82
972-097	2470-2485	49	5	4	4	3	65	16	24.6	184	1.46
972-098	2485-2500	32	4	5	6	5	52	20	38.5	280	1.38
972-099	2500-2515	104	9	11	14	5	143	38	26.9	254	2.50
972-100	2515-2530	86	10	17	19	13	145	59	40.9	195	1.54
972-101	2545-2560	61	7	10	13	9	100	38	38.5	217	1.44
972-102	2560-2575	20	1	2	3	2	29	8	28.8	143	1.31
972-103	2575-2590	35	2	6	7	5	55	21	37.1	124	1.45
972-104	2590-2605	86	11	21	25	14	157	70	45.0	169	1.80
972-105	2605-2620	26	3	6	8	5	47	22	45.8	86	1.54
972-106	2620-2635	52	8	13	14	12	99	47	47.3	219	1.17
972-107	2635-2650	38	5	8	10	7	67	29	43.6	120	1.53
972-108	2650-2665	134	19	39	46	31	268	134	50.2	335	1.50
972-109	2665-2680	76	14	23	37	14	165	89	53.9	210	2.69
972-110	2680-2695	247	57	126	117	82	629	382	60.7	758	1.42
972-111	2695-2710	157	37	89	93	64	440	283	64.2	947	1.46
972-112	2710-2725	264	48	118	139	80	650	386	59.4	1309	1.74
972-113	2725-2740	306	68	146	162	96	778	472	60.6	1731	1.70
972-114	2740-2755	232	46	60	70	44	452	219	48.6	1388	1.58
972-115	2755-2770	195	43	69	79	72	457	262	57.4	1673	1.10
972-116	2770-2785	216	44	116	136	78	589	373	63.4	1126	1.74
972-117	2785-2800	159	32	94	105	68	458	299	65.2	1560	1.55
972-118	2800-2815	142	25	72	84	50	373	231	62.0	1125	1.69
972-119	2815-2830	159	29	92	94	68	443	283	64.0	1165	1.37
972-120	2830-2845	264	54	157	155	118	748	485	64.7	1883	1.32

TABLE 2B
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-121	2845-2860	182	81	259	186	168	876	694	79.2	3695	1.11
972-122	2860-2875	332	144	488	290	315	1570	1238	78.9	3464	0.92
972-123	2875-2890	154	62	299	174	268	957	803	83.9	3655	0.65
972-124	2890-2905	834	221	516	147	396	2114	1280	60.5	6066	0.37
972-125	2905-2920	152	44	124	61	129	511	359	70.2	4158	0.47
972-126	2920-2935	2507	2760	7477	3522	9331	25598	23091	90.2	72160	0.38
972-127	2935-2950	6110	3402	7570	3403	4653	25138	19028	75.7	69189	0.73
972-128	2950-2965	6742	5203	8474	3884	10326	34628	27886	80.5	56031	0.38
972-129	2965-2980	582	496	2214	459	1829	5581	4999	89.6	9607	0.25
972-130	2980-2995	998	1371	4450	948	3532	11299	10301	91.2	12903	0.27
972-131	2995-3010	5910	3864	5379	1231	3942	20326	14416	70.9	14899	0.31
972-132	3010-3025	6597	2720	4464	875	3119	17775	11178	62.9	17125	0.28
972-133	3025-3040	5294	3603	5332	1236	3991	19456	14162	72.8	14418	0.31
972-134	3040-3055	2268	1669	4151	759	2660	11506	9238	80.3	10919	0.29
972-135	3055-3070	1960	696	1838	320	878	5692	3732	65.6	5442	0.36
972-136	3070-3085	1442	1011	2878	500	1929	7761	6319	81.4	9930	0.26
972-137	3085-3100	1401	658	1898	397	1600	5954	4553	76.5	9341	0.25
972-138	3100-3115	938	641	1928	374	1269	5150	4211	81.8	6372	0.30
972-139	3115-3130	1071	387	1300	309	1169	4236	3165	74.7	10102	0.26
972-140	3130-3145	834	585	1956	430	1652	5457	4623	84.7	12758	0.26
972-141	3145-3160	4611	3372	5379	1799	5469	20631	16020	77.6	28875	0.33
972-142	3160-3175	2972	3103	4759	1314	4493	16641	13669	82.1	19964	0.29
972-143	3175-3190	2385	1869	4524	1114	4024	13916	11530	82.9	23157	0.28
972-144	3190-3195	527	526	2493	544	2124	6215	5688	91.5	14761	0.26
972-145	3196-3205	2356	1691	3911	660	2356	10974	8618	78.5	12466	0.28
972-146	3205-3219	1458	1242	2186	305	1167	6359	4900	77.1	7317	0.26
972-147	3219-3234	2322	2078	3689	556	2062	10706	8385	78.3	8815	0.27
972-148	3234-3249	2531	3890	4863	663	2149	14096	11565	82.0	5460	0.31
972-149	3249-3264	3286	4126	5041	725	2404	15581	12296	78.9	5653	0.30
972-150	3264-3279	1702	3578	4258	438	1568	11543	9842	85.3	3973	0.28

TABLE 2B
CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-151	3339-3354	4711	3335	2216	212	680	11154	6443	57.8	4384	0.31
972-152	3384-3399	11864	7620	6423	1520	2719	30146	18282	60.6	6925	0.56
972-153	3399-3414	10427	6643	5436	790	1325	24622	14195	57.7	2921	0.60
972-154	3414-3429	6835	4061	2578	238	626	14338	7503	52.3	2832	0.38
972-155	3429-3444	8989	4162	1998	172	396	15717	6728	42.8	1972	0.43
972-156	3444-3459	11018	6825	5831	1025	1503	26201	15183	57.9	2181	0.68
972-157	3459-3474	10238	6263	5464	948	1503	24416	14178	58.1	2315	0.63
972-158	3474-3489	8707	4598	3537	321	706	17869	9162	51.3	2141	0.45
972-159	3489-3504	7072	3507	563	212	531	11885	4813	40.5	2140	0.40
972-160	3504-3519	2032	1400	1175	121	335	5063	3030	59.9	1626	0.36
972-161	3519-3534	1572	747	673	89	214	3295	1723	52.3	2393	0.41
972-162	3534-3549	1282	999	1056	136	416	3889	2607	67.0	2763	0.33
972-163	3549-3564	3432	1833	2311	315	1093	8984	5552	61.8	4738	0.29
972-164	3564-3579	2056	936	1168	147	562	4869	2813	57.8	2646	0.26
972-165	3564-3579	916	497	931	120	500	2963	2048	69.1	2828	0.24
972-166	3594-3609	1281	548	774	93	436	3133	1851	59.1	2918	0.21
972-167	3609-3624	6454	2884	1864	183	653	12037	5583	46.4	3508	0.28
972-168	3624-3639	2796	2210	3489	459	1865	10820	8023	74.2	20902	0.25
972-169	3639-3654	6751	4138	4584	729	2710	18911	12160	64.3	27782	0.27
972-170	3654-3669	4120	2190	2482	307	1157	10256	6136	59.8	12667	0.27
972-171	3669-3684	2202	1233	2321	338	1594	7687	5485	71.4	19452	0.21
972-172	3684-3699	4403	1646	1747	239	969	9004	4601	51.1	11187	0.25
972-173	3699-3714	8293	4362	3600	538	1147	17939	9646	53.8	8997	0.47
972-174	3714-3729	6040	1513	866	104	474	8997	2957	32.9	13447	0.22
972-175	3729-3744	6870	2356	1096	121	698	11142	4272	38.3	27168	0.17
972-176	3744-3759	6487	2090	858	86	484	10005	3518	35.2	16871	0.18
972-177	3759-3774	7327	2011	787	80	475	10681	3354	31.4	27185	0.17
972-178	3774-3789	6813	1585	654	64	251	9368	2554	27.3	11380	0.25
972-179	3789-3804	8218	2526	895	87	441	12167	3949	32.5	12001	0.20
972-180	3804-3819	8058	2560	792	72	442	11923	3865	32.4	13070	0.16

TABLE 2B

CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS IN CUTTING GAS

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-181	3819-3834	7517	1816	470	33	210	10047	2530	25.2	4802	0.16
972-182	3834-3849	6630	1273	405	37	221	8567	1936	22.6	5006	0.17
972-183	3849-3864	5274	506	198	21	114	6113	839	13.7	4280	0.18
972-184	3864-3879	5817	660	198	23	116	6815	997	14.6	4509	0.19
972-185	3879-3894	6103	685	390	54	239	7470	1368	18.3	6328	0.23
972-186	3894-3909	2522	664	814	107	401	4508	1986	44.1	7379	0.27
972-187	3909-3924	2232	777	1007	137	511	4664	2432	52.1	9496	0.27
972-188	3924-3939	3337	1663	2229	348	1109	8686	5349	61.6	11150	0.31
972-189	3939-3954	916	537	715	104	381	2652	1737	65.5	7987	0.27
972-190	3954-3969	6058	3456	2187	314	1014	13029	6971	53.5	13087	0.31
972-191	3969-3984	1613	779	1356	250	955	4954	3341	67.4	14699	0.26
972-192	3999-4005	187	92	175	39	165	657	470	71.5	7512	0.23

TABLE 2 C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-001	228-260	524	16	7	2	8	557	33	5.9	31	0.29
972-002	260-290	938	18	9	2	3	969	32	3.3	36	0.64
972-003	290-320	2753	123	6	1	5	2887	135	4.7	39	0.26
972-004	320-350	2832	46	6	0	2	2886	54	1.9	10	0.24
972-005	350-380	1632	17	6	4	0	1659	27	1.6	31	*.**
972-006	380-410	2038	19	6	2	1	2067	29	1.4	15	1.51
972-007	410-440	2257	15	6	1	3	2282	25	1.1	35	0.30
972-008	440-470	2455	18	6	1	4	2483	28	1.1	53	0.16
972-009	470-500	3746	22	6	1	3	3777	31	0.8	16	0.35
972-010	500-530	2501	14	4	1	1	2520	19	0.8	7	0.54
972-011	530-560	2917	17	5	0	1	2941	24	0.8	7	0.15
972-012	560-590	823	13	3	0	0	840	17	2.0	4	0.43
972-013	590-630	2524	16	5	0	0	2546	22	0.8	2	0.28
972-014	630-660	2381	22	6	1	1	2411	29	1.2	1	0.47
972-015	660-690	2344	17	5	1	4	2371	27	1.1	18	0.23
972-016	690-720	2542	15	4	0	1	2562	20	0.8	11	0.76
972-017	720-750	2535	17	3	0	1	2557	22	0.9	4	0.38
972-018	750-780	3181	27	7	1	2	3217	37	1.1	20	0.58
972-019	780-810	2311	13	4	1	1	2330	20	0.8	4	1.13
972-020	810-840	2497	17	6	2	2	2524	27	1.1	5	1.23
972-021	840-870	2111	13	4	1	0	2130	19	0.9	3	6.31
972-022	870-900	1235	13	3	0	1	1251	17	1.3	1	0.76
972-023	900-930	1869	18	5	2	2	1896	28	1.5	4	1.11
972-024	930-960	1769	18	5	1	3	1796	27	1.5	13	0.52
972-025	960-990	1981	15	8	1	4	2009	28	1.4	2	0.29
972-026	990-1020	2745	16	6	1	2	2770	25	0.9	0	0.33
972-027	1020-1050	4457	24	7	1	1	4490	33	0.7	4	0.60
972-028	1050-1080	3393	14	6	1	2	3415	22	0.7	2	0.62
972-029	1080-1110	2889	19	7	0	1	2916	27	0.9	2	0.71
972-030	1110-1140	2696	13	5	1	1	2715	19	0.7	1	0.64

TABLE 2 C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-031	1140-1170	2529	30	11	1	5	2576	48	1.9	16	0.27
972-032	1170-1200	2229	16	7	1	3	2255	26	1.2	2	0.21
972-033	1200-1230	2429	28	10	1	5	2472	43	1.7	2	0.22
972-034	1230-1260	1463	17	6	1	3	1489	26	1.7	2	0.29
972-035	1260-1290	946	23	7	1	4	982	36	3.6	1	0.25
972-036	1290-1320	626	43	7	1	5	683	57	8.3	2	0.21
972-037	1320-1350	378	16	4	0	1	399	22	5.4	3	0.00
972-038	1350-1380	285	9	3	0	1	297	13	4.3	1	0.07
972-039	1380-1410	403	17	7	1	5	434	31	7.2	8	0.20
972-040	1410-1440	209	6	2	0	1	218	9	4.3	5	0.04
972-041	1440-1470	169	11	5	1	4	189	21	10.9	25	0.26
972-042	1470-1500	123	2	1	0	0	127	4	3.3	4	0.23
972-043	1500-1530	234	22	10	0	5	271	38	13.9	12	0.06
972-044	1530-1560	110	14	5	0	1	131	21	15.7	20	0.00
972-045	1560-1590	152	21	5	0	2	180	27	15.1	27	0.10
972-046	1590-1620	141	6	2	0	1	149	8	5.4	11	0.30
972-047	1620-1650	183	11	4	0	3	202	19	9.2	14	0.03
972-048	1650-1680	132	6	3	0	1	143	10	7.2	18	0.12
972-049	1680-1710	176	7	2	0	1	187	11	5.8	15	0.28
972-050	1710-1740	73	8	5	3	5	94	21	22.3	34	0.73
972-051	1740-1770	265	6	3	3	2	279	13	4.8	24	1.37
972-052	1770-1800	317	6	2	1	1	327	10	3.0	17	0.61
972-053	1800-1830	391	10	3	2	2	408	17	4.2	20	0.81
972-054	1830-1845	298	10	2	1	1	313	15	4.8	26	0.88
972-055	1845-1860	527	23	5	2	3	559	33	5.8	64	0.70
972-056	1860-1875	698	31	5	3	3	739	42	5.6	135	0.97
972-057	1875-1890	910	30	4	2	2	949	38	4.0	118	0.78
972-058	1890-1905	932	29	5	3	2	971	38	3.9	117	1.15
972-059	1905-1915	794	16	3	1	0	815	21	2.5	98	2.30
972-060	1915-1930	137	5	2	1	1	145	8	5.7	42	0.81

TABLE 2 C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-061	1930-1945	426	10	3	3	2	444	18	4.0	68	1.37
972-062	1945-1960	450	8	3	2	1	465	14	3.1	6	1.75
972-063	1960-1975	493	12	5	4	2	516	23	4.5	32	1.74
972-064	1975-1990	626	9	4	3	2	644	18	2.8	36	2.15
972-065	1990-2005	558	10	3	3	1	576	18	3.1	39	1.90
972-066	2005-2020	470	8	3	3	1	485	15	3.1	30	2.66
972-067	2020-2035	236	10	7	4	6	263	28	10.5	35	0.69
972-068	2035-2050	376	8	5	4	4	397	21	5.3	34	0.99
972-069	2050-2065	409	8	4	4	3	428	19	4.5	48	1.38
972-070	2065-2080	264	7	4	2	2	279	15	5.3	58	1.01
972-071	2080-2095	301	11	5	3	2	323	21	6.5	57	1.46
972-072	2095-2110	226	7	3	2	2	241	15	6.1	47	1.37
972-073	2110-2125	453	28	9	5	6	501	48	9.5	82	0.83
972-074	2125-2140	251	8	3	3	1	265	14	5.2	16	2.41
972-075	2140-2155	381	12	5	4	4	405	24	5.9	25	1.00
972-076	2155-2170	267	7	4	3	2	283	16	5.5	21	1.86
972-077	2185-2200	368	9	4	4	3	387	19	5.0	30	1.21
972-078	2200-2215	387	10	6	6	4	413	26	6.2	51	1.45
972-079	2215-2230	251	9	6	5	5	275	24	8.7	52	1.05
972-080	2230-2245	316	14	9	9	8	355	40	11.2	76	1.22
972-081	2245-2260	319	16	9	9	8	361	42	11.7	86	1.17
972-082	2260-2275	199	7	4	5	4	220	20	9.1	63	1.34
972-083	2275-2290	192	10	5	5	4	216	24	11.1	85	1.24
972-084	2290-2305	133	8	3	4	3	151	17	11.3	62	1.41
972-085	2305-2320	200	7	4	4	3	218	17	8.0	56	1.44
972-086	2320-2335	182	5	3	3	2	196	13	6.9	50	1.61
972-087	2335-2350	1137	31	21	23	11	1223	86	7.0	138	2.04
972-088	2350-2365	191	11	10	9	7	228	37	16.3	98	1.30
972-090	2365-2380	202	12	11	10	8	243	41	16.9	124	1.18
972-089	2370	5	0	0	0	0	5	0	0.0	0	0.00

TABLE 2 C

TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-091	2380-2395	102	6	5	5	2	120	18	14.8	73	2.18
972-092	2395-2410	91	6	4	3	2	106	15	13.9	59	1.62
972-093	2410-2425	152	8	7	9	6	183	31	17.1	139	1.47
972-094	2425-2440	94	7	9	9	5	123	29	23.7	146	1.86
972-095	2440-2455	187	7	6	5	3	207	20	9.8	79	1.81
972-096	2455-2470	123	6	7	7	3	147	23	16.0	196	2.04
972-097	2470-2485	131	8	8	8	4	160	29	17.9	200	1.88
972-098	2485-2500	177	13	17	18	10	235	58	24.7	364	1.79
972-099	2500-2515	272	16	20	24	11	343	71	20.7	330	2.20
972-100	2515-2530	233	18	29	34	17	331	98	29.6	213	2.04
972-101	2545-2560	247	21	29	32	17	346	99	28.7	290	1.86
972-102	2560-2575	166	12	17	18	7	220	53	24.3	194	2.60
972-103	2575-2590	237	18	27	30	14	327	89	27.4	183	2.12
972-104	2590-2605	274	27	42	47	23	414	139	33.7	225	2.03
972-105	2605-2620	50	5	9	11	6	81	31	38.7	98	1.72
972-106	2620-2635	495	35	56	69	27	683	188	27.5	268	2.51
972-107	2635-2650	398	25	42	57	19	540	142	26.3	166	3.04
972-108	2650-2665	498	41	74	91	44	747	249	33.4	387	2.09
972-109	2665-2680	245	40	76	99	40	500	255	50.9	399	2.45
972-110	2680-2695	633	120	242	225	117	1337	705	52.7	848	1.93
972-111	2695-2710	656	129	232	221	105	1343	687	51.2	1107	2.11
972-112	2710-2725	409	72	178	199	101	960	551	57.4	1461	1.97
972-113	2725-2740	568	89	188	208	107	1161	593	51.1	1791	1.94
972-114	2740-2755	531	74	132	150	70	957	427	44.6	1597	2.13
972-115	2755-2770	489	91	190	212	119	1102	613	55.6	2037	1.79
972-116	2770-2785	503	85	235	250	119	1191	688	57.8	1345	2.10
972-117	2785-2800	448	63	183	204	98	995	547	55.0	1686	2.09
972-118	2800-2815	549	60	166	180	82	1037	488	47.1	1247	2.20
972-119	2815-2830	436	53	155	158	90	892	456	51.2	1244	1.76
972-120	2830-2845	615	89	264	271	164	1403	787	56.1	2052	1.65

TABLE 2 C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-121	2845-2860	422	141	241	137	71	1012	589	58.3	607	1.93
972-122	2860-2875	33	12	28	19	10	102	69	67.6	493	1.92
972-123	2875-2890	185	57	196	109	96	643	457	71.2	523	1.13
972-124	2890-2905	1655	854	926	439	907	4781	3126	65.4	3284	0.48
972-125	2905-2920	88	29	115	63	81	376	289	76.7	669	0.78
972-126	2920-2935	6436	2499	4253	960	2270	16418	9981	60.8	13179	0.42
972-127	2935-2950	2195	1133	1229	582	1203	6341	4146	65.4	4355	0.48
972-128	2950-2965	5200	2532	2434	644	1628	12437	7237	58.2	5403	0.40
972-129	2965-2980	9	3	6	1	4	23	14	59.4	86	0.25
972-130	2980-2995	3153	1647	1712	497	1466	8475	5322	62.8	5175	0.34
972-131	2995-3010	5955	2930	2589	601	1689	13765	7809	56.7	6060	0.36
972-132	3010-3025	1857	859	904	209	4270	8099	6242	77.1	1992	0.05
972-133	3025-3040	2683	1255	1062	330	845	6175	3491	56.5	3044	0.39
972-134	3040-3055	310	41	52	7	18	429	118	27.7	112	0.40
972-135	3055-3070	880	372	455	89	172	1967	1087	55.3	539	0.52
972-136	3070-3085	756	338	422	95	197	1808	1052	58.2	666	0.48
972-137	3085-3100	1617	818	1098	268	559	4359	2742	62.9	1515	0.48
972-138	3100-3115	3263	1415	1583	215	486	6962	3699	53.1	1899	0.44
972-139	3115-3130	3301	1001	1503	247	598	6650	3349	50.4	3546	0.41
972-140	3130-3145	1146	467	599	116	253	2581	1435	55.6	1147	0.46
972-141	3145-3160	3237	1421	1700	281	735	7375	4138	56.1	3819	0.38
972-142	3160-3175	2093	1113	1230	299	695	5431	3338	61.5	2076	0.43
972-143	3175-3190	599	282	455	70	181	1588	988	62.2	934	0.39
972-144	3190-3195	2431	1166	1829	331	769	6526	4095	62.8	3039	0.43
972-145	3196-3205	177	108	141	19	50	496	319	64.3	587	0.38
972-146	3205-3219	1078	628	657	177	322	2863	1785	62.3	746	0.55
972-147	3219-3234	1578	914	983	149	298	3922	2344	59.8	756	0.50
972-148	3234-3249	1492	869	855	110	208	3534	2042	57.8	405	0.53
972-149	3249-3264	528	250	184	16	36	1014	486	47.9	126	0.45
972-150	3264-3279	1362	908	881	128	210	3489	2127	61.0	401	0.61

TABLE 2 C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-151	3339-3354	866	574	445	52	69	2006	1140	56.8	301	0.76
972-152	3384-3399	6284	2861	1907	198	206	11456	5172	45.1	481	0.96
972-153	3399-3414	9531	4297	3140	364	379	17712	8181	46.2	499	0.96
972-154	3414-3429	1260	619	476	99	96	2550	1291	50.6	250	1.04
972-155	3429-3444	1416	668	495	70	72	2722	1305	48.0	205	0.98
972-156	3444-3459	2743	1279	950	136	115	5224	2481	47.5	128	1.18
972-157	3459-3474	3780	1667	1305	207	171	7129	3349	47.0	187	1.21
972-158	3474-3489	1055	462	347	53	46	1963	909	46.3	70	1.17
972-159	3489-3504	1643	778	609	129	129	3288	1645	50.0	147	1.00
972-160	3504-3519	2065	1092	768	79	172	4176	2111	50.5	658	0.46
972-161	3519-3534	1403	714	409	48	66	2639	1237	46.8	365	0.73
972-162	3534-3549	1499	760	563	73	112	3006	1508	50.1	455	0.65
972-163	3549-3564	1074	573	561	91	129	2428	1354	55.8	336	0.71
972-164	3564-3579	1396	644	482	58	108	2686	1291	48.0	377	0.54
972-165	3564-3579	961	503	507	57	122	2151	1190	55.3	376	0.47
972-166	3594-3609	148	12	21	3	6	191	42	22.2	19	0.51
972-167	3609-3624	1058	472	385	49	94	2058	1001	48.6	284	0.53
972-168	3624-3639	2171	1109	1075	144	419	4918	2747	55.9	2960	0.34
972-169	3639-3654	2029	1027	944	192	450	4642	2613	56.3	2582	0.43
972-170	3654-3669	654	344	319	58	114	1490	835	56.1	558	0.51
972-171	3669-3684	964	520	535	129	304	2452	1488	60.7	1533	0.42
972-172	3684-3699	3081	882	727	79	218	4987	1906	38.2	1497	0.36
972-173	3699-3714	1399	703	577	185	196	3060	1661	54.3	992	0.95
972-174	3714-3729	1115	542	460	76	150	2344	1228	52.4	1255	0.51
972-175	3729-3744	821	428	311	48	141	1749	928	53.1	1631	0.34
972-176	3744-3759	1964	1072	624	69	281	4011	2046	51.0	4800	0.25
972-177	3759-3774	1903	501	382	42	186	3014	1111	36.9	3747	0.23
972-178	3774-3789	949	362	272	30	105	1717	768	44.7	1195	0.29
972-179	3789-3804	1120	594	487	60	138	2399	1279	53.3	1093	0.43
972-180	3804-3819	3252	1015	635	62	258	5222	1970	37.7	3210	0.24

TABLE 2 C
TOTAL CONCENTRATION (VOL. PPM OF ROCK) OF C_1 - C_7 HYDROCARBONS (2A + 2B)

GEOCHEM SAMPLE NUMBER	DEPTH	C_1 Methane	C_2 Ethane	C_3 Propane	iC_4 Isobutane	nC_4 Butane	TOTAL C_1 - C_4	TOTAL C_2 - C_4	% GAS WETNESS	TOTAL C_5 - C_7	$\frac{iC_4}{nC_4}$
972-181	3819-3834	7889	1936	591	48	288	10753	2864	26.6	6718	0.17
972-182	3834-3849	8319	1944	782	75	368	11488	3168	27.6	6908	0.21
972-183	3849-3864	5693	587	269	30	145	6723	1030	15.3	4796	0.21
972-184	3864-3879	6855	860	368	43	188	8314	1459	17.6	5864	0.23
972-185	3879-3894	7740	1162	856	101	385	10244	2504	24.4	7730	0.26
972-186	3894-3909	4873	1450	1527	185	565	8599	3726	43.3	8536	0.33
972-187	3909-3924	3478	1450	1723	256	772	7679	4201	54.7	11005	0.33
972-188	3924-3939	10711	3981	4368	598	1756	21413	10702	50.0	18099	0.34
972-189	3939-3954	1523	731	874	125	427	3681	2157	58.6	8556	0.29
972-190	3954-3969	6671	3745	2458	359	1115	14349	7678	53.5	13721	0.32
972-191	3969-3984	2879	1269	1789	301	1087	7325	4446	60.7	15651	0.28
972-192	3999-4005	1689	245	320	55	206	2515	826	32.8	9520	0.27

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES 40%; 10-40%; 10%	REMARKS	RE-WORKED (%)	PARTICLE SIZE	PRESERV-ATION	INDEX	1 – 10 SCALE
972-019A	780-810m	W;H-I;Al-Am	significant material at 2-	40	F-M	F	1+ to 2-	
972-025A	960-990m	W;H-I;Al-Am	H at 1+ to 2- and 2-	25	F-C	F	1+	
972-028A	1050-1080m	W;H-Al-I;Am		20	F-C	F	1+	
972-032A	1170-1200m	W;H;I-Al	contamination	25	F-M	P-F	1+(?)	
972-037A	1320-1350m	W;I-Al-H;Am	contamination, H at 2-		F-M	P-F	1+ to 2-	
972-040A	1410-1440m	W;I-H;Al	lean, unreliable - contamination	40	F-M	P-F	1+ to 2-	
972-045A	1560-1590m	I;W;H-Al	abundant Am-like contamination	90	F	P	2-(?)	
972-051A	1740-1770m	W;I-H-Al;Am	extremely lean, unreliable dominant H at 2-	50	F-M	P-F	1+ to 2-(?)	
972-054A	1830-1845m	W-H;I;Al-Am	lean, unreliable. H at 2- contamination	50	F-M	P-F	1+ to 2-	
972-059A	1905-1915m	-;W-H-I;Al-Am	frequent marginally mature H	50	F-M	P-F	1+ to 2-	
972-066A	2005-2020m	W-I;-;H-Al	lean, abundant contamination H at 2-	80	F-M	F	1+ to 2-	
972-072A	2095-2110m	W;I;H-Al	minor H at 1+ to 2-	80	F-M	F	1+ to 2-(?)	
972-080A	2230-2245m	W;I-H;Al	H at 1+ to 2- and 2- to 2	85	F-M	F	2-(?)	
972-084A	2290-2305m	W;I-H;Al		80	F-M	F-G	1+ to 2-(?)	
972-090A	2365-2380m	W-I;H;Al	contamination. H at 2- to 2	80	F-M	F	2-	
972-095A	2440-2455m	W-I;-;H-Al		85	F-M	F	2-(?)	
972-100A	2515-2530m	I-W;-;H-Al		90	F-M	F	2-	
972-103A	2575-2590m	W-I;-;H-Al	caving	90	F-M	F	2-	
972-107A	2635-2650m	I-W;-;H-Al	minor H at 1+ to 2- and 2- to 2	85	F-M	F	2-	

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

postscript = coarse, cuticle, cysts, degraded, fine, other,. structured, spore-pollen, thick-walled, unstructured

Dominant, Major, Significant, Minor

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES 40%; 10-40%; 10%	REMARKS	RE-WORKED (%)	PARTICLE SIZE	PRESERV-ATION	INDEX	1 – 10 SCALE
972-113A	2725-2740m	W-I;-;H-Al-Am	**variable between 1+ to 2- and 2- to 2	85	F-M	F-G	**	
972-118B	2800-2815m	W-I;-;H-Al	good H at 1+ to 2-, material at 2- to 2	85	F-M	F	2-(?)	
972-123A	2875-2890m	W-I;-;H-Al	H at 2. Contamination	90	F-M	F	2- to 2	
972-126B	2920-2935m	Al**;I-W-Am*;H	**frequently passing to Am *includes Al passing to Am	40	F-C	F	2- to 2	
972-128A	2950-2965m	-;Al-I-W-H;Am	sapropelisation	50	F-C	F	2- to 2	
972-131A	2995-3010m	-;I-Al-W-H;Am	sapropelisation	55	F-C	F	2- to 2	
972-135A	3055-3070m	-;I-Al-W-H;Am	sapropelisation	55	F-M/C	F	2- to 2	
972-138A	3100-3115m	-;I-W-Al**-H;Am**	H at 2. **includes Al passing to Am	55	F-M/C	F	2- to 2	
972-143A	3175-3190m	W;H-I-Al;Am	differentiation difficult frequent H at 2- or less	55	F-M	F-G	2- to 2(?)	
972-148A	3134-3249m	Am**;W-I-Al;H	**degraded, not prime quality	40	F-C	F	2- to 2	
972-151B	3339-3354m	Am**;W-I;H-Al	**as 148A	40	F-C	F	2- to 2	
972-154A	3414-3429m	W;I-H-Al;Am	Am-like contamination. H at 2	60	F-M	F	2- to 2/2	
972-157A	3459-3474m	-;W-I-H-Al-Am;-	frequent Am-like contamination - differentiation difficult. H at 2	55	F-M	F	2- to 2	
972-159B	3489-3504m	W;Am-I;H-Al		-	F-VC	F-G	2 max (?)	
972-163A	3549-3564m	W;I-H-Al;Am	frequent dark Am-like contamination H at 2- to 2 and 2 to 2+	60	F-M	F	2(?)	
972-166A	3594-3609m	W;I;H-Al	abundant caving, minor H at 2	80	F-M	F-G	2- to 2(?)	
972-170A	3654-3669m	W;H-I-Al;-	good H at 2 to 2+, significant contamination. Abundant caving	60	F-M	F	2	
972-174A	3714-3729m	W;I-H;Al	Am-like contamination, caving	70	F-M	F	2(?)	

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

postscript = coarse, cuticle, cysts, degraded, fine, other,. structured, spore-pollen, thick-walled, unstructured

Dominant, Major, Significant, Minor

TABLE 3

KEROGEN TYPE AND MATURATION

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC MATTER DESCRIPTION					THERMAL MATURATION	
		TYPES 40%; 10-40%; 10%	REMARKS	RE-WORKED (%)	PARTICLE SIZE	PRESERV-ATION	INDEX	1 – 10 SCALE
972-178A	3774-3789m	W;I-H;Al	chiefly disseminated Am-like contamination	70	F-M	F	2- to 2(?)	
972-186A	3894-3909m	W;H-I;Al-Am	abundant caving	50	F-M	F-G	2 (?)	
972-191A	3969-3984m	W;H-I;Al-Am	caving	55	F-M/C	F-G	2	

Algal, Amorphous, Herbaceous, Inertinite, Resin, Wood

postscript = coarse, cuticle, cysts, degraded, fine, other,. structured, spore-pollen, thick-walled, unstructured

Dominant, Major, Significant, Minor

TABLE 4
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)			REMARKS
			1	2	3	
972-006A	380-410m	WR	0.41(5)	0.84(2)	1.08(2)	
972-019A	780-810m	WR	0.45(5) 1.14(3)	0.59(2)	0.91(3)	
972-021A	840-870m	WR	0.41(10)	0.94(7)	-	
972-025A	960-990m	WR	0.44(3)	0.92(2)	1.27(1)	
972-028A	1050-1080m	WR	1.13(2)	-	-	
972-032A	1170-1200m	WR	0.43(4)	0.52(3)	1.01(5)	
972-054A	1830-1845m	WR	0.92(1)	1.16(1)	-	
972-059A	1905-1915m	WR	0.50(2)	0.62(1)	1.14(4)	
972-066A	2005-2020m	WR	0.50(5)	1.02(3)	-	
972-072A	2095-2110m	WR	0.46(3)	0.89(2)	1.13(2)	
972-080A	2230-2245m	WR	0.45(2)	0.53(2)	1.04(7)	
972-084A	2290-2305m	WR	0.55(13)	-	-	
972-090A	2365-2380m	WR	0.64(4)	0.97(2)	1.29(3)	
972-095A	2440-2455m	WR	0.53(1)	0.95(3)	1.28(1)	
972-100A	2515-2530m	WR	0.48(9)	1.04(7)	-	
972-103A	2575-2590m	WR	0.50(7)	0.92(9)	1.23(2)	
972-107A	2635-2650m	WR	0.45(1) 1.61(1)	0.66(7)	1.10(5)	
972-113A	2725-2740m	WR	0.51(2)	0.60(8)	1.01(12)	
972-118B	2800-2815m	WR	0.48(12)	1.07(4)	1.42(1)	
972-123A	2875-2890m	KC	0.47(2) 1.25(3)	0.67(3)	0.99(16)	
972-126B	2920-2935m	KC	0.43(3)	0.73(3)	1.09(3)	
972-128A	2950-2965m	KC	0.50(2)	0.61(8)	-	
972-131B	2995-3010m	WR	0.58(30)	-	-	
972-135A	3055-3070m	KC	0.60(30)	-	-	
972-138A	3100-3115m	WR	0.61(20)	-	-	
972-143A	3175-3190m	WR	0.53(18)	-	-	
972-148A	3234-3249m	KC	0.63(30)	-	-	
972-151B	3339-3354m	KC	0.63(30)	-	-	
972-153A	3399-3414m	WR	0.68(40)	-	-	
972-157A	3459-3474m	KC	0.60(11)	-	-	
972-159B	3489-3504m	KC	0.72(30)	-	-	
972-163A	3549-3564m	WR	0.64(14)	0.93(8)	1.16(8)	
972-166A	3594-3609m	WR	0.67(27)	1.00(2)	1.37(1)	
972-170A	3654-3669m	WR	0.45(7)	0.57(8)	1.18(5)	
972-174A	3714-3729m	WR	0.70(13)	0.92(12)	-	

CT—ditch cuttings; CO—core; WR—whole rock; KC—kerogen concentrate. Colours – spore fluorescence. *Reworked

TABLE 4
VITRINITE REFLECTANCE DATA

GEOCHEM SAMPLE NUMBER	DEPTH	SAMPLE TYPE	AVERAGE REFLECTIVITY Ro (%), (NUMBER OF PARTICLES)			REMARKS
			1	2	3	
972-178A	3774-3789m	WR	0.55(4)	0.84(5)	1.04(6)	
972-182A	3834-3849m	WR	0.56(18)	0.71(1)	-	
972-186A	3894-3909m	WR	0.55(31)	-	-	
972-191A	3969-3984m	WR	0.61(26)	0.73(4)	-	

CT—ditch cuttings; CO—core; WR—whole rock; KC—kerogen concentrate. Colours — spore fluorescence. *Reworked

TABLE 5a

CONCENTRATION (PPM) OF EXTRACTED C_{15+} MATERIAL IN ROCK

GEOCHEM SAMPLE NUMBER	DEPTH	TOTAL EXTRACT	HYDROCARBONS			NON HYDROCARBONS			
			Paraffin Naphthenes	Aromatics	TOTAL	Precipt'd. Asphaltenes	Eluted NSO's	Non-eluted NSO's	Sulphur
972-115	2755-2770	479	17	91	108	128	137	77	28
972-127	2935-2950	2136	312	598	910	500	497	195	35
972-131A	2995-3010	3264	493	892	1385	821	657	401	0
972-134A	3040-3055	2487	614	812	1426	390	416	236	19
972-139	3115-3130	444	79	87	167	107	89	74	8
972-142	3160-3175	572	170	169	339	118	97	18	0
972-146	3205-3219	226	43	57	100	78	34	5	9
972-150A	3264-3279	680	319	122	441	117	74	11	36
972-153	3399-3414	1613	438	703	1141	70	225	154	22
972-160A	3504-3519	177	37	12	49	67	28	23	11
972-169	3639-3654	767	180	241	421	218	102	27	0
972-176A	3744-3759	265	12	17	29	178	28	26	3
972-182	3834-3849	226	40	60	99	37	41	32	17
972-188A	3924-3939	617	141	145	286	117	124	67	22

TABLE 5a(S)

Statoil sample number	Depth m RKB	Total extract (ppm)	Aliphatics (ppm)	Aromatics (ppm)	Non-hydrocarbons (ppm)
S404I	3298.05-30	2972	2299	465	207
S405I	3309.10-39	5362	4374	917	71
S406I	3314.41-70	982	709	135	138
S410I	3319.10-20	4082	3259	562	261
S411I	3323.50-65	7946	6165	1116	664
S412I	3392.40-55	252	148	40	64
S407I	3344.36-63	96	13	9	74
S413I	3352.10-15	62	12	6	44
S408I	3354.72-85	70	5	7	58
S409I	3363.46-60	27	2	1	24

TABLE 5b

COMPOSITION (NORMALISED %) OF C_{15+} MATERIAL EXTRACTED FROM ROCK

GEOCHEM SAMPLE NUMBER	DEPTH	HYDROCARBONS		NON HYDROCARBONS			
		Paraffin – Naphthenes	Aromatics	Preciptd. Asphaltenes	Eluted NSO's	Non eluted NSO's	Sulphur
972-115	2755-2770	3.57	19.05	26.79	28.57	16.07	5.95
972-127	2935-2950	14.59	28.00	23.41	23.26	9.11	1.63
972-131A	2995-3010	15.11	27.32	25.15	20.12	12.29	0.00
972-134A	3040-3055	24.69	32.67	15.67	16.71	9.48	0.77
972-139	3115-3130	17.85	19.69	24.15	20.00	16.62	1.69
972-142	3160-3175	29.74	29.49	20.60	17.01	3.16	0.00
972-146	3205-3219	19.11	25.33	34.67	14.89	2.00	4.00
972-150A	3264-3279	46.90	17.92	17.26	10.90	1.65	5.37
972-153	3399-3414	27.16	43.60	4.34	13.97	9.55	1.38
972-160A	3504-3519	20.96	6.59	37.72	15.57	13.17	5.99
972-169	3639-3654	23.42	31.44	28.38	13.31	3.46	0.00
972-176A	3744-3759	4.50	6.35	67.46	10.58	9.79	1.32
972-182	3834-3849	17.56	26.46	16.28	18.32	13.99	7.38
972-188A	3924-3939	22.87	23.55	18.94	20.14	10.92	3.58

TABLE 5b(S)

Statoil sample number	Depth m RKB	% aliphatics	% aromatics	% non HC incl.asph.	% asphaltenes
S404I	3298.05-30	77.37	15.66	6.97	0.69
S405I	3309.10-39	81.57	17.10	1.33	0.49
S406I	3314.41-70	72.20	13.78	14.02	4.83
S410I	3319.10-20	79.83	13.79	6.39	0.89
S411I	3323.50-65	77.59	14.05	8.36	0.58
S412I	3329.40-55	58.60	16.07	25.33	9.38
S407I	3344.36-63	13.28	9.49	77.23	41.19
S413I	3352.10-15	18.86	9.08	72.06	47.62
S408I	3354.72-85	7.05	9.99	82.96	57.40
S409I	3363.46-60	5.63	2.35	92.02	43.70

TABLE 6

SIGNIFICANT RATIOS (%) OF C_{15+} FRACTIONS AND ORGANIC CARBON

GEOCHEM SAMPLE NUMBER	DEPTH	ORGANIC CARBON (wt. %)	HYDROCARBONS / TOTAL EXTRACT	HYDROCARBONS / ORG. CARBON	TOTAL EXTRACT / ORG. CARBON	P-NAPHTHENES / AROMATICS
972-115	2755-2770	0.78	22.62	1.39	6.14	0.19
972-127	2935-2950	2.62	42.59	3.47	8.15	0.52
972-131A	2995-3010	6.43	42.44	2.15	5.08	0.55
972-134A	3040-3055	7.09	57.37	2.01	3.51	0.76
972-139	3115-3130	1.72	37.54	0.97	2.58	0.91
972-142	3160-3175	1.88	59.23	1.80	3.04	1.01
972-146	3205-3219	1.61	44.44	0.62	1.40	0.75
972-150A	3264-3279	1.54	64.82	2.86	4.41	2.62
972-153	3399-3414	17.70	70.76	0.64	0.91	0.62
972-160A	3504-3519	0.17	27.54	2.87	10.43	3.18
972-169	3639-3654	1.51	54.86	2.79	5.08	0.74
972-176A	3744-3759	0.91	10.85	0.32	2.91	0.71
972-182	3834-3849	1.03	44.02	0.96	2.19	0.66
972-188A	3924-3939	1.32	46.42	2.17	4.67	0.97

TABLE 7

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HYDROGEN INDEX	PRODUCTION INDEX	Tmax (°C)
972-001A	228-260m	0.02	0.19	0.59	43.18	0.09	414
972-004A	320-350m	0.02	0.17	1.62	42.50	0.10	425
972-006A	380-410m	0.02	0.22	1.70	48.88	0.08	426
972-007A	410-440m	0.03	0.24	0.89	63.15	0.11	414
972-011B	530-560m	0.05	0.30	0.73	85.71	0.14	410
972-014A	630-660m	0.02	0.28	0.66	75.67	0.07	419
972-016A	690-720m	0.03	0.33	0.66	86.84	0.08	422
972-018A	750-780m	0.01	0.24	0.81	61.53	0.04	428
972-019A	780-810m	0.03	0.50	0.90	100.00	0.06	420
972-020A	810-840m	0.04	0.63	0.81	63.66	0.06	423
972-021A	840-870m	0.04	0.61	0.98	91.04	0.06	422
972-025A	960-990m	0.14	2.75	1.24	175.16	0.05	418
972-026A	990-1020m	0.12	1.78	0.79	134.85	0.06	413
972-027A	1020-1050m	0.14	1.96	0.93	149.62	0.07	414
972-028A	1050-1080m	0.13	1.95	0.94	151.16	0.06	415
972-029A	1080-1110m	0.15	1.90	1.01	153.23	0.07	420
972-030A	1110-1140m	0.15	1.57	1.07	136.52	0.09	416
972-031A	1140-1170m	0.16	1.70	1.15	155.44	0.09	414
972-032A	1170-1200m	0.11	1.47	1.06	134.86	0.07	416
972-033A	1200-1230m	0.10	1.48	1.13	137.04	0.06	410
972-034A	1230-1260m	0.15	1.38	0.95	130.19	0.10	412
972-035A	1260-1290m	0.16	1.55	1.34	119.23	0.09	423
972-036A	1290-1320m	0.07	0.95	0.92	76.61	0.07	420
972-037A	1320-1350m	0.05	0.52	1.09	53.61	0.09	418
972-038A	1350-1380m	0.16	0.61	1.15	79.22	0.21	356
972-040A	1410-1440m	0.05	0.24	1.41	40.68	0.17	380
972-041A	1440-1470m	0.03	0.19	0.86	33.93	0.14	391
972-042A	1470-1500m	0.03	0.17	0.62	36.17	0.15	385
972-044A	1530-1560m	0.07	0.19	1.41	47.50	0.27	371
972-045A	1560-1590m	0.11	0.19	1.20	45.24	0.37	368
972-047A	1620-1650m	0.07	0.16	0.98	43.23	0.30	371
972-048A	1650-1680m	0.07	0.12	1.17	34.28	0.37	361
972-050A	1710-1740m	0.05	0.19	0.68	44.18	0.20	419
972-051A	1740-1770m	0.03	0.19	0.60	35.19	0.13	420
972-054A	1830-1845m	0.05	0.27	0.41	42.19	0.15	416
972-055A	1845-1860m	0.03	0.28	0.37	57.14	0.09	421
972-056A	1860-1875m	0.02	0.05	0.36	15.62	0.29	339
972-057A	1875-1890m	0.05	0.48	0.40	70.59	0.10	420
972-058A	1890-1905m	0.04	1.04	0.44	114.29	0.04	423
972-059A	1905-1915m	0.08	1.26	0.45	129.90	0.06	427
972-062A	1945-1960m	0.04	0.03	0.88	8.57	0.57	420
972-064A	1975-1990m	0.04	0.08	0.41	21.05	0.33	339
972-066A	2005-2020m	0.05	0.10	0.38	22.73	0.33	391
972-068A	2035-2050m	0.04	0.10	0.45	28.57	0.29	415
972-070A	2065-2080m	0.03	0.11	0.36	28.95	0.21	379
972-072A	2095-2110m	0.04	0.13	0.45	27.66	0.24	412
972-074A	2125-2140m	0.04	0.12	0.37	27.91	0.25	346
972-075A	2140-2155m	0.04	0.08	0.32	19.05	0.33	310
972-076A	2155-2170m	0.05	0.10	0.43	21.74	0.33	261
972-077A	2185-2200m	0.05	0.13	0.33	26.53	0.28	377

TABLE 7

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HYDROGEN INDEX	PRODUCTION INDEX	Tmax (°C)
972-078A	2200-2215m	0.04	0.14	0.37	33.33	0.22	420
972-079A	2215-2230m	0.05	0.19	0.57	38.00	0.21	387
972-080A	2230-2245m	0.04	0.21	0.36	38.89	0.16	349
972-081A	2245-2260m	0.04	0.18	0.37	34.62	0.18	421
972-082A	2260-2275m	0.02	0.15	0.26	27.78	0.12	421
972-083A	2275-2290m	0.06	0.20	0.33	35.71	0.23	347
972-084A	2290-2305m	0.05	0.26	0.35	44.07	0.16	421
972-085A	2305-2320m	0.04	0.25	0.40	41.67	0.14	423
972-086A	2320-2335m	0.07	0.28	0.37	45.90	0.20	420
972-087A	2335-2350m	0.05	0.19	0.34	35.19	0.21	414
972-088A	2350-2365m	0.06	0.25	0.36	44.64	0.19	339
972-090A	2365-2380m	0.02	0.11	0.30	20.37	0.15	336
972-091A	2380-2395m	0.06	0.19	0.31	35.85	0.24	412
972-092A	2395-2410m	0.08	0.24	0.22	40.68	0.25	412
972-093A	2410-2425m	0.05	0.19	0.21	34.55	0.21	423
972-094A	2425-2440m	0.06	0.19	0.19	34.55	0.24	422
972-095A	2440-2455m	0.04	0.12	0.24	23.53	0.24	219
972-096A	2455-2470m	0.08	0.28	0.31	50.00	0.22	429
972-097A	2470-2485m	0.10	0.35	0.35	64.81	0.22	432
972-098A	2485-2500m	0.10	0.18	0.37	38.30	0.36	327
972-099A	2500-2515m	0.11	0.23	0.87	46.94	0.32	350
972-100A	2515-2530m	0.11	0.29	0.39	49.15	0.28	360
972-101A	2545-2560m	0.08	0.26	0.39	47.27	0.24	367
972-102A	2560-2575m	0.12	0.31	0.34	56.36	0.28	359
972-103A	2575-2590m	0.14	0.34	0.31	58.62	0.29	361
972-104A	2590-2605m	0.13	0.33	0.35	57.89	0.28	361
972-105A	2605-2620m	0.06	0.19	0.54	30.65	0.24	380
972-106A	2620-2635m	0.08	0.26	0.37	43.33	0.23	303
972-106B	2620-2635m	0.06	0.28	0.59	40.58	0.18	430
972-107A	2635-2650m	0.06	0.18	0.26	29.03	0.25	376
972-108A	2650-2665m	0.05	0.35	0.32	53.03	0.13	375
972-109A	2665-2680m	0.05	0.21	0.23	31.34	0.19	422
972-110A	2680-2695m	0.03	0.35	0.30	44.30	0.08	428
972-111A	2695-2710m	0.01	0.24	0.33	33.80	0.04	428
972-111B	2695-2710m	0.01	0.22	0.27	32.35	0.04	425
972-112A	2710-2725m	0.07	0.42	0.44	51.85	0.14	426
972-112B	2710-2725m	0.04	0.63	0.43	65.63	0.06	429
972-113A	2725-2740m	0.06	0.59	0.36	59.95	0.09	430
972-114A	2740-2755m	0.06	0.64	0.42	67.37	0.09	429
972-114B	2740-2755m	0.05	0.71	0.47	68.93	0.07	441
972-115A	2755-2770m	0.04	0.31	0.30	43.06	0.11	424
972-116A	2770-2785m	0.03	0.30	0.36	37.03	0.09	425
972-117A	2785-2800m	0.05	0.49	0.32	55.68	0.09	429
972-118A	2800-2815m	0.06	0.32	0.36	41.02	0.16	428
972-118B	2800-2815m	0.07	0.63	0.72	64.28	0.10	431
972-119A	2815-2830m	0.03	0.27	0.29	33.33	0.10	427
972-120A	2830-2845m	0.05	0.33	0.30	37.50	0.13	426
972-120B	2830-2845m	0.05	0.42	0.42	45.65	0.10	428
972-121A	2845-2860m	0.03	0.23	0.29	37.70	0.11	428
972-122A	2860-2875m	0.02	0.24	0.35	30.77	0.08	428

TABLE 7

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HYDROGEN INDEX	PRODUCTION INDEX	Tmax (°C)
972-122B	2860-2875m	0.05	0.41	0.31	45.56	0.10	430
972-123A	2875-2890m	0.03	0.33	0.36	41.25	0.08	429
972-124A	2890-2905m	0.02	0.15	0.40	20.83	0.11	422
972-125A	2905-2920m	0.02	0.17	0.37	26.15	0.10	423
972-125B	2905-2920m	0.04	0.33	0.37	42.31	0.11	426
972-126B	2920-2935m	1.01	25.50	0.93	340.91	0.04	426
972-127A	2935-2950m	1.39	21.11	1.27	265.53	0.06	420
972-128A	2950-2965m	1.00	18.11	1.27	255.80	0.05	422
972-128B	2950-2965m	0.05	0.46	0.34	51.69	0.10	426
972-129A	2965-2980m	1.06	20.00	1.06	277.78	0.05	424
972-130A	2980-2995m	0.94	15.11	1.01	214.63	0.06	424
972-131A	2995-3010m	1.61	23.78	1.42	301.01	0.06	424
972-131B	2995-3010m	11.89	109.31	8.44	159.11	0.10	434
972-132A	3010-3025m	1.52	21.48	1.76	298.33	0.07	422
972-133A	3025-3040m	1.07	17.53	1.27	281.38	0.06	421
972-134A	3040-3055m	2.74	21.97	1.61	286.33	0.11	420
972-135A	3055-3070m	0.93	14.12	1.06	258.13	0.06	423
972-136A	3070-3085m	1.31	20.38	1.25	295.80	0.06	424
972-136C	3070-3085m	0.17	2.32	0.98	144.10	0.07	428
972-137A	3085-3100m	0.80	11.76	1.43	208.14	0.06	427
972-137B	3085-3100m	0.10	1.01	0.82	68.71	0.09	433
972-138A	3100-3115m	0.29	4.40	0.66	141.03	0.06	432
972-138C	3100-3115m	0.17	1.76	0.58	121.38	0.09	432
972-139B	3115-3130m	0.13	1.21	0.29	93.80	0.10	430
972-140A	3130-3145m	0.58	8.43	0.53	232.87	0.06	425
972-140B	3130-3145m	0.07	0.75	0.28	71.43	0.09	427
972-141A	3145-3160m	0.27	4.40	0.35	192.14	0.06	433
972-142A	3160-3175m	0.24	6.49	0.23	313.53	0.04	439
972-143A	3175-3190m	0.42	9.41	0.38	286.02	0.04	434
972-143B	3175-3190m	0.15	2.44	0.44	174.29	0.06	434
972-144A	3190-3195m	0.29	6.39	0.27	286.55	0.15	432
972-145A	3196-3205m	0.25	5.45	0.40	265.85	0.04	434
972-146A	3205-3219m	0.17	3.18	0.37	177.65	0.05	434
972-147A	3219-3234m	0.23	4.68	0.39	228.29	0.05	435
972-148A	3234-3249m	0.32	5.20	0.54	190.48	0.06	433
972-149A	3249-3264m	0.21	41.6	0.56	169.80	0.05	435
972-150A	3264-3279m	0.24	4.12	0.90	170.95	0.06	432
972-151B	3339-3354m	0.61	5.57	0.88	109.22	0.10	439
972-152A	3384-3399m	0.32	4.00	0.44	133.33	0.07	436
972-152C	3384-3399m	5.40	80.90	3.42	198.77	0.06	439
972-153A	3399-3414m	9.01	129.43	5.91	230.30	0.07	440
972-154A	3414-3429m	0.28	4.74	0.53	235.82	0.05	433
972-155B	3429-3444m	0.21	2.75	0.59	135.47	0.07	437
972-156B	3444-3459m	4.91	96.27	5.42	201.40	0.05	443
972-157A	3459-3474m	0.35	5.36	0.53	163.91	0.06	436
972-158B	3474-3489m	0.14	2.83	0.32	168.45	0.05	440
972-158C	3474-3489m	4.42	105.08	3.60	216.21	0.04	439
972-159B	3489-3504m	4.52	82.82	2.39	270.65	0.05	440
972-163A	3549-3564m	0.21	2.56	0.50	147.98	0.08	436
972-164A	3564-3579m	0.18	2.00	0.44	153.85	0.08	438

TABLE 7

ROCKEVAL PYROLYSIS DATA

GEOCHEM SAMPLE NUMBER	DEPTH	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	HYDROGEN INDEX	PRODUCTION INDEX	Tmax (°C)
972-164B	3564-3579m	0.40	5.50	0.57	177.99	0.07	439
972-165A	3579-3594m	0.18	1.94	0.42	136.62	0.08	438
972-166A	3594-3609m	0.17	1.47	0.47	101.38	0.10	436
972-167A	3609-3624m	0.22	1.70	0.31	120.56	0.11	439
972-168A	3624-3639m	0.21	2.26	0.41	160.28	0.09	438
972-169A	3639-3654m	0.22	3.79	0.20	222.94	0.05	439
972-169B	3639-3654m	0.32	3.95	0.34	129.51	0.07	438
972-170A	3654-3669m	0.15	1.88	0.23	123.68	0.07	440
972-171A	3669-3684m	0.13	1.80	0.28	98.36	0.07	440
972-172A	3684-3699m	0.20	2.01	0.25	118.24	0.09	438
972-173A	3699-3714m	0.25	2.71	0.29	126.64	0.08	440
972-174A	3714-3729m	0.14	0.06	0.42	6.82	0.70	419
972-175A	3729-3744m	0.14	0.36	0.32	29.03	0.28	439
972-176A	3766-3759m	0.12	0.08	0.29	9.41	0.60	398
972-177A	3754-3774m	0.11	0.14	0.26	14.89	0.44	403
972-178A	3774-3789m	0.07	0.09	0.22	9.47	0.43	380
972-179A	3789-3804m	0.12	0.15	0.27	15.46	0.44	403
972-180A	3804-3819m	0.11	0.09	0.26	9.09	0.55	363
972-181A	3819-3834m	0.06	0.04	0.24	4.00	0.60	311
972-182A	3834-3849m	0.08	0.06	0.20	6.25	0.57	295
972-183A	3849-3864m	0.06	0.05	0.24	6.25	0.54	388
972-184A	3864-3879m	0.04	0.11	0.27	18.03	0.26	446
972-185A	3879-3894m	0.11	0.73	0.49	119.67	0.13	396
972-186A	3894-3909m	0.16	1.58	0.29	115.33	0.21	441
972-187A	3909-3924m	0.21	1.67	0.28	134.67	0.11	440
972-185A	3924-3939m	0.18	1.67	0.30	123.70	0.09	440
972-189B	3939-3954m	0.19	1.67	0.20	135.77	0.22	440
972-190B	3954-3969m	0.17	1.45	0.21	127.19	0.10	441

TABLE 8a(S)

Statoil sample number	Depth m RKB	Pristane/ Phytane	Pristane/ n-C17	Phytane/ n-C18	CPI
S404I	3298.05-30	3.17	0.46	0.15	1.08
S405I	3309.10-39	3.06	0.44	0.15	1.11
S406I	3314.41-70	3.25	0.48	0.16	1.13
S410I	3319.10-20	2.91	0.47	0.16	1.11
S411I	3323.50-65	3.00	0.46	0.32	1.08
S412I	3329.40-55	4.33	0.82	0.23	1.18
S407I	3344.36-63	2.56	0.51	0.21	1.09
S413I	3352.10-15	2.49	0.62	0.31	1.10
S408I	3354.72-85	2.85	0.80	0.38	1.07
S409I	3363.46-60	3.09	0.86	0.30	1.06

TABLE 8

COMPOSITION (NORMALISED %) OF C_{15+} PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-089	-115	-127A	-131A	-134A	-139	-142	-146
DEPTH	2370m	2755-2770m	2935-2950m	2995-3010m	3040-3055m	3115-3130m	3160-3175m	3205-3219m
SAMPLE TYPE								
nC_{15}	0.48	0.10	1.46	2.13	9.55	1.49	1.39	0.19
nC_{16}	2.08	0.61	2.19	2.38	9.70	1.22	4.22	2.23
nC_{17}	2.14	1.80	5.85	6.89	9.96	4.37	7.65	4.27
nC_{18}	3.24	4.71	8.21	7.69	8.32	6.07	7.36	6.78
nC_{19}	5.47	8.26	7.76	8.93	8.51	7.19	8.76	8.45
nC_{20}	6.08	12.22	9.67	8.83	6.36	6.95	7.10	8.45
nC_{21}	7.17	8.42	8.10	8.28	5.32	6.07	6.82	8.40
nC_{22}	9.75	10.15	7.54	7.04	4.52	6.15	6.61	8.31
nC_{23}	10.32	9.38	6.24	7.39	4.25	6.07	6.73	8.54
nC_{24}	11.40	9.59	5.74	6.35	3.92	6.23	5.52	7.80
nC_{25}	11.57	11.48	6.19	6.75	5.14	6.66	6.45	8.91
nC_{26}	5.72	8.51	5.06	4.96	5.02	5.03	5.20	5.15
nC_{27}	6.30	5.59	5.17	5.46	4.61	7.67	6.90	6.73
nC_{28}	5.50	2.66	4.72	4.32	3.46	5.96	4.47	3.85
nC_{29}	2.14	1.17	4.05	5.51	3.73	7.83	4.95	4.41
nC_{30}	3.27	0.66	2.64	1.79	1.77	3.91	2.17	1.76
nC_{31}	3.88	2.34	2.14	1.64	1.82	4.07	2.79	1.81
nC_{32}	2.57	1.54	1.24	0.74	0.79	2.24	1.31	0.51
nC_{33}	0.57	0.42	1.57	0.64	1.03	2.24	1.77	1.35
nC_{34}	0.31	0.30	2.08	0.74	1.08	1.22	1.11	0.88
nC_{35}	0.04	0.11	2.36	1.54	1.14	1.36	0.74	1.21
PARAFFIN	8.56	22.59	39.96	17.84	20.13	22.62	32.65	29.25
ISOPRENOID	0.39	1.36	9.91	4.12	7.00	3.01	4.41	3.53
NAPHTHENE	91.05	76.07	50.13	78.04	72.87	74.37	62.94	67.22
CPI INDEX A	1.08	0.99	1.02	1.13	1.06	1.11	1.17	1.20
CPI INDEX B	1.16	1.25	1.12	1.37	1.23	1.39	1.41	1.56
PRISTANE/PHYTANE	0.65	0.45	0.74	1.12	2.01	1.36	2.60	2.61
PRISTANE/nC_{17}	0.85	1.04	1.81	1.77	2.33	1.76	1.28	2.04

TABLE 8

COMPOSITION (NORMALISED %) OF C_{15+} PARAFFIN – NAPHTHENE HYDROCARBONS

GEOCHEM SAMPLE NUMBER	-150A	-153	-160A	-169	-176A	-182	-188A
DEPTH	3264-3279m	3399-3414m	3504-3519m	3639-3654m	3744-3759m	3834-3849m	3924-3939m
SAMPLE TYPE							
nC_{15}	1.05	1.30	0.09	6.27	0.23	1.42	0.72
nC_{16}	3.35	2.73	0.87	8.47	1.92	3.61	2.83
nC_{17}	6.49	4.47	3.61	9.95	4.68	7.84	5.66
nC_{18}	8.30	5.95	6.76	4.62	9.09	9.95	7.78
nC_{19}	9.21	7.82	9.80	8.78	11.50	10.15	9.61
nC_{20}	7.47	7.10	9.62	7.82	10.90	10.56	8.83
nC_{21}	6.31	7.94	7.78	7.28	10.33	9.66	9.09
nC_{22}	5.50	8.05	8.86	6.63	10.32	9.22	8.55
nC_{23}	6.09	9.71	9.03	6.14	8.62	8.44	8.60
nC_{24}	4.75	8.39	9.63	5.40	7.81	7.55	7.70
nC_{25}	7.34	10.37	10.65	5.13	8.26	6.90	7.94
nC_{26}	4.29	6.09	7.50	4.04	5.17	4.47	5.36
nC_{27}	5.18	6.33	6.31	3.85	4.11	4.02	5.28
nC_{28}	2.98	3.70	2.96	3.00	2.78	2.07	3.44
nC_{29}	4.51	3.41	1.49	3.46	1.57	1.46	3.01
nC_{30}	2.80	1.64	1.34	2.25	0.74	0.53	1.71
nC_{31}	2.99	1.65	1.25	2.16	0.25	0.73	1.24
nC_{32}	1.11	0.86	0.70	1.36	0.28	0.28	0.88
nC_{33}	3.40	1.36	0.49	1.50	0.26	0.49	0.83
nC_{34}	3.44	0.74	0.42	0.92	0.63	0.12	0.59
nC_{35}	3.44	0.39	0.84	0.95	0.54	0.53	0.34
PARAFFIN	10.84	52.04	25.13	22.08	26.41	29.33	48.40
ISOPRENOID	1.64	6.91	1.73	2.77	1.60	2.01	2.43
NAPHTHENE	87.52	41.05	73.14	75.15	71.99	68.66	49.17
CPI INDEX A	1.28	1.23	1.06	1.06	1.06	1.08	1.12
CPI INDEX B	1.57	1.43	1.25	1.18	1.22	1.34	1.25
PRISTANE/PHYTANE	1.89	5.82	1.12	3.12	0.96	1.73	1.56
PRISTANE/nC_{17}	1.52	2.53	1.01	0.96	0.63	0.55	0.54

TABLE 9

METHYL PHENANTHRENE INDEX

GEOCHEM SAMPLE NUMBER	DEPTH	MPI HEIGHT	MPI (AREA)
972-089	2370m	0.56	0.60
972-115	2755-2770m	1.24	0.84
972-127A	2935-2950m	0.32	0.42
972-131A	2995-3010m	0.49	0.55
972-134A	3040-3055m	0.56	0.41
972-139	3115-3130m	0.69	0.39
972-142	3160-3175m	0.48	0.56
972-146	3205-3219m	1.20	0.59
972-150A	3264-3279m	1.14	0.78
972-153	3399-3414m	0.64	0.69
972-160A	3504-3519m	0.58	0.62
972-169	3639-3654m	1.04	0.77
972-176A	3744-3759m	0.62	0.65
972-182	3834-3849m	0.57	0.64
972-188A	3924-3939m	0.60	0.65

TABLE 10

MOLECULAR MATURATION PARAMETERS

GEOCHEM SAMPLE NO.	DEPTH	STERANES M/Z 217 (259)			TERPANES M/Z 191					
		$\frac{C_{29}\ 20S}{C_{29}\ 20R}$	$\frac{C_{29}\ 20R}{C_{29}\ 20R}$	$\frac{C_{27}\ (20S)\ \text{Diasteranes}}{C_{27}\ (20R)\ \text{Diasteranes}}$	$\frac{Tm}{Ts}$	$\frac{C_{30}\ \text{Moretane}}{C_{30}\ \text{Hopane}}$	$\frac{C_{29}\ \text{normoretane}}{C_{29}\ \text{norhopane} + C_{29}\ \text{normoretane}}$	$\frac{\text{Bisnorhopane } (C_{28})}{Tm + \text{Bisnorhopane} + C_{29}\ \text{norhopane}}$	$\frac{C_{31}\ (20S)}{C_{31}\ (20S) + C_{31}\ (20R)}$ x 100	
972-127	2935-2950m	1.36	0.42	0.32	5.1	0.17	0.14	-	58%	
972-131	2995-3010m	1.39	0.37	0.37	5.68	0.23	0.17	0.64	60%	
972-134	3040-3055m	1.38	0.46	0.46	8.7	0.26	0.17	0.62	60%	
972-139	3115-3130m	1.41	0.41	0.36	7.3	0.32	0.21	0.36	59%	
972-142	3160-3175m	1.36	0.50	0.46	4.7	0.25	0.16	0.08	58%	
972-146	3205-3219m	1.44	0.52	0.54	9.1	0.31	0.20	0.04	58%	
972-150	3264-3279m	1.38	0.62	0.59	2.75	0.14	0.14	0.19	62%	
972-153	3399-3414m	2.4	0.74	0.75	?	0.19	0.09	-	58%	
972-169	3639-3654m	1.54	0.71	0.83	3.85	0.14	0.09	-	60%	
972-182	3834-3849m	1.53	0.41	0.82	2.1	0.14	0.06	0.12	59%	
972-188	3924-3939m	1.37	0.70	0.74	2.75	0.17	0.06	0.08	58%	

TABLE 11

CARBON ISOTOPE RESULTS

$^{o}/_{oo}$PDB

GEOCHEM SAMPLE NUMBER	DEPTH	PARAFFIN-NAPHTHENE	AROMATICS	KEROGEN
972-126	2920-2935m	-	-	-28.67
972-127A	2935-2950m	-	-28.88	-
972-128	2950-2965m	-	-	-25.44
972-131A	2995-3010m	-30.13	-27.83	-
972-134A	3040-3055m	-29.25	-27.36	-
972-135	3055-3070m	-	-	-25.20
972-139A	3115-3130m	-26.75*	-26.78	-
972-142	3160-3175m	-28.46	-27.23	-
972-146A	3205-3219m	-27.05	-24.70	-
972-150A	3264-3279m	-28.10	-26.36	-
972-153A	3399-3414m	-27.38	-25.36	-25.20
972-169A	3639-3654m	-29.89	-28.59	-
972-182A	3834-3849m	-	-25.79	-
972-188A	3924-3939m	-29.30*	-26.50	-

* Extremely small sample size, treat data with caution.

BRIEF DESCRIPTION OF THE ANALYSES PERFORMED BY GEOCHEM

"Screen Analyses" are described in sections A, C and D, "Sample Preparation" in section B, "Follow-up Analyses" in sections E through K and "Correlation Studies" in section L. The analyses can be run on either core or cuttings material with the proviso that samples must be canned for the C_1-C_7 analysis and should be canned (or at least wet) for the C_4-C_7 analysis. The other analyses can be run on both canned and bagged samples.

A) C_1-C_7 LIGHT HYDROCARBON ANALYSIS

The abundance and composition of the C_1-C_7 hydrocarbons in sediments reflects their source richness, maturity and the character of the hydrocarbons they can yield. Most importantly, it is extremely sensitive to the presence of migrated hydrocarbons and is an excellent method for their detection. As it provides the information on most of the critical parameters and is also economical, this analysis is excellent for screening samples to decide which of them merit further analysis.

During the time which elapses between the collection of the sample at the wellsite and its analysis in the laboratory, a fraction of the total gas passes from the rock to the air space at the top of the can. For this reason, both the air space and the cuttings are analysed.

The analysis involves the gas chromatographic separation of the individual C_1-C_4 gaseous hydrocarbons (methane, ethane, propane, isobutane and normal butane) and a partial resolution of the C_5-C_7 gasoline-range hydrocarbons (for their complete resolution see Section E). The ppm abundance of the five gases and of the total C_5-C_7 hydrocarbons are calculated from their electronically integrated peak areas (not from peak height) by comparison with a standard.

In the report, the following data are tabulated: the abundance and composition of the air space gas, of the cuttings gas and of the combined air space and cuttings gases. The combined results are also presented graphically.

B) SAMPLE WASHING AND HAND PICKING

All of the analyses described in subsequent sections are run on washed and hand picked samples.

Cuttings are washed to remove the drilling mud, care being taken not to remove soft clays and fine sand during the washing procedure. Using the C_1-C_7 hydrocarbon data profile of the well, or the organic carbon profile (if this analysis is used for screening), electric logs (if supplied) and the appearance of the cuttings under the binocular microscope, samples are selected to represent the lithological and geochemical zones penetrated by the well. These samples are then carefully hand picked and the lithology of the uncaved material is described. It is these samples which are submitted for further analysis.

Sample material remaining after analysis is retained for six months. Unless instructions are received to the contrary, Geochem Laboratories may then destroy the samples.

Our reports incorporate a gross lithological description of all the samples which have been analysed and litho percentage logs. As screen analyses are recommended at narrow intervals, a complete lithological profile is obtained.

C) ORGANIC CARBON ANLYSIS

The organic carbon content of a rock is a measure of its total organic richness. Combined with the visual kerogen, C_1-C_7, C_4-C_7, pyrolysis and C_{15+} analyses, the organic carbon content is used to evaluate the potential (not necessarily actual) hydrocarbon source richness of the sediment. This analysis is an integral part of a total evaluation and it can also be used as an economical screen analysis for dry samples (when the C_1-C_7 analysis cannot be used).

Hand picked samples are dried, crushed and then acidised to remove the inorganic calcium and magnesium carbonates. The actual analysis involves combustion in a Leco carbon analyser. Blanks, standards and duplicates are run routinely for purposes of quality control at no extra cost to the client.

The data are tabulated and presented diagramatically in our reports in a manner which facilitates comparison with the gross lithology (see Section B) of the samples.

D) MINI-PYROLYSIS

An ideal screen analysis which provides a definitive measure of potential source richness upon those samples whose organic carbon contents suggest fair or good source potential. This is described in detail in section K.

E) DETAILED C_4-C_7 HYDROCARBON ANALYSIS

The abundance and composition of the C_4-C_7 gasoline-range hydrocarbons in sediments reflects their source quality, level of thermal maturation and organic facies. In addition, the data also reveal the present of migrated hydrocarbons and can be used for crude oil-parent source rock correlation studies.

This powerful analysis, performed upon hand picked lithologies, is employed as a follow-up to confirm the potential of samples which have been selected using the initial screen analysis. It is used in conjunction with the organic carbon, visual kerogen and C_{15+} analyses.

The individual normal paraffins, isoparaffins, naphthenes and aromatics with between four and seven carbon atoms in the molecule (but also including toluene) are resolved by capillary gas chromatography and their peak areas electronically integrated.

Normalised compositions, selected ratios and the ppm abundance of the total gasoline-range fraction are tabulated in the report and also presented graphically.

F) KEROGEN TYPE AND MATURATION

Kerogen is the insoluble organic matter in rocks. Visual examination of the kerogen gives a direct measure of thermal maturity and of the composition of the organic matter (organic facies) and indicates the source quality of the sediment - which is confirmed using the organic carbon, light hydrocarbon, pyrolysis and C_{15+} analyses.

The type of hydrocarbon (oil or gas) generated by a source rock is a function of the types and level of thermal maturation of the organic matter which are present. Both of these parameters are measured directly by this method.

Kerogen is separated from the inorganic rock matrix by acid digestion and flotation methods which avoid oxidation of the organic matter. It is then mounted on a glass slide and examined at high and low magnifications with a Leitz microscope. Chemical methods measure the total kerogen population but, with this technique, individual particles can be selected for examination and spurious material identified. This is particularly valuable in reworked, contaminated and turbodrilled sediments.

The following data are generated: the types of the organic matter present and their relative abundances, an estimate of the proportion of reworked material, preservation state, the thermal maturity of the non-reworked organic matter using the spore colouration technique.

Our maturation scale has been developed to digitise small but recognisable changes in organic matter colouration resulting from increasing maturity and to place particular emphasis upon the immature to mature transition. In the absence of a universal colouration scale, the most significant points on our scale have been calibrated against equivalent vitrinite reflectance values. The following maturation stages are recognised at the low end of the scale:-

a) immature; thermal index less than 2- (0.45% Ro)
b) marginally mature; indices between 2- and 2.
Minor hydrocarbon generation from amorphous and herbaceous (± algal) organic matter
c) mature; indices between 2 (0.53% Ro) and 2 to 2+ (0.72% Ro), significant generation from amorphous, algal and herbaceous organic matter but wood only marginally mature
d) oil window; indices of 2 to 2+ (0.72% Ro) through to 3 (1.2% Ro). Peak hydrocarbon generation.

The condensate zone starts at a thermal index of 3 whilst indices of 3+ (2.0% Ro) and higher indicate the eometamorphic dry gas stage.

A total of fourteen types of organic matter are sought based upon the major categories of algal, amorphous, herbaceous (spore, pollen, cuticle), wood, inertinite and resin. This detail is essential for a proper understanding of hydrocarbon source potential as the different sub-groups within each category have different properties.

Upon completion of the study, the kerogen slides are sent to the client.

G) VITRINITE REFLECTANCE

Vitrinite reflectance is an alternative/confirmatory method for evaluating thermal maturation which is used in conjection with the visual kerogen analysis. The reflectivity of vitrinite macerals increases in response to thermal alteration and is used to define maturation levels and, by projection, to predict maturity at depth or the thicknesses of section removed by erosion.

Measurements are made upon kerogen separations in conjunction with polished whole rock samples. In general, this analysis is performed upon the same samples as the visual kerogen analysis, thus facilitating a direct comparison of the two sets of results.

If possible, forty to fifty measurements are taken per sample - unless the sediments are organically lean, vitrinite is sparse or only a single uniform population is present. The data are plotted in a histogram which

distinguishes the indigenous vitrinite from possible reworked or caved material. Averages are calculated for each population. Comments upon exinite fluorescence and upon the character of the phytoclasts are noted on the histograms. The reports contain the tabulated data, histograms and the reflectivities plotted against depth.

The vitrinite and visual kerogen techniques provide mutually complementary information upon maturity, organic matter type and diagenesis.

H) C_{15+} EXTRACTION, DEASPHALTENING AND CHROMATOGRAPHIC SEPARATION

Sections "A" and "E" dealt with analyses covering the light end of the hydrocarbon spectrum. This section is concerned with the solvent extractable oranic material in the rock with more than fourteen carbon atoms in the molecule (i.e. the heavy end). The amount and composition of this extract indicates source richness and type, the level of thermal maturation and the possible presence of migrated hydrocarbons.

These results are integrated with those derived from the pyrolysis, visual kerogen, organic carbon and light hydrocarbon analyses.

The techniques involved in this analysis employ pure solvents and have been designed to give reproducible results. Hand picked samples are ground and then solvent extracted in a soxhlet apparatus, or by blending, with dichloromethane (the solvent system can be adapted to client's specifications). After asphaltene precipitation, the total extract is separated by column chromatography or high pressure liquid chromatography into the following fractions: paraffin-naphthene hydrocarbons, aromatic hydrocarbons, eluted NSO's (nitrogen-, sulphur-, and oxygen- containing non-hydrocarbons) and non-eluted NSO's. Note that the non-hydrocarbons are split into three fractions and not reported as a gross value. These fractions can be submitted for further analyses (carbon isotopes, gas chromatography, mass spectroscopy) including correlation studies.

For convenience and thoroughness, the data are reported in three formats: the weights of the fractions, ppm abundances and normalised percentage compositions. The data are also presented diagramatically.

J) GC ANALYSIS OF C_{15+} PARAFFIN-NAPHTHENE HYDROCARBONS

The gas chromatographic configurations of the heavy C_{15+} paraffin-naphthene hydrocarbons reflect source type, the degree of thermal maturation and the presence and character of migrated hydrocarbons or contamination.

Not only is this analysis an integral part of any source rocks study but it also provides a fingerprint for correlation purposes and helps to define the geochemical/palynological environmental character of the source rocks from which crude oils were derived.

The paraffin-naphthene hydrocarbons obtained by column chromatography are separated by high resolution capillary chromatography. Excellent resolution of the individual normal paraffins, isoprenoids and significant individual isoparaffins and naphthenes is achieved. Runs are normally terminated at nC_{35}. A powerful in-house microprocessor system is being introduced to correct for the change in response factor with chain length.

The normal paraffin carbon preference indices (C.P.I.) indicate if odd (values in excess of 1) or even (values less thanl) normal paraffins are dominant.

Strong odd preferences (± strong pristane peaks) are characteristic of immature land plant organic matter whilst even preferences (± strong phytane peaks) suggest a reducing environment of deposition. With increasing maturity, values approach 1.0 and oils are typically close to 1.0. The indices are calculated using the following formulae:

$$C.P.I_A = \frac{\frac{C_{21} + C_{23} + C_{25} + C_{27}}{C_{20} + C_{22} + C_{24} + C_{26}} + \frac{C_{21} + C_{23} + C_{25} + C_{27}}{C_{22} + C_{24} + C_{26} + C_{28}}}{2}$$

$$C.P.I_B = \frac{\frac{C_{25} + C_{27} + C_{29} + C_{31}}{C_{24} + C_{26} + C_{28} + C_{30}} + \frac{C_{25} + C_{27} + C_{29} + C_{31}}{C_{26} + C_{28} + C_{30} + C_{32}}}{2}$$

Chromatograms are reproduced in the report for use as visual fingerprints and in addition, the following data are tabulated: normalised normal paraffin distributions; proportions of paraffins, isoprenoids and naphthenes in the total paraffin-naphthene fraction; $C.P.I_A$ and $C.P.I_B$; pristane to phytane ratio; pristane to nC_{17} ratio.

K) PYROLYSIS

The process of thermal maturation can be simulated in the laboratory by pyrolysis, which involves heating the sample under specified conditions and measuring the oil-like material which is freed/generated from the rock. With this analysis, the potential richness of immature sediments can be determined and, by coupling the pyrolysis unit to a gas chromatograph, the liberated material can be characterised. These results are correlated with those obtained from the organic carbon, kerogen and C_{15+} analyses.

Small amounts of powdered sample are heated in helium to release the thermal bitumen (up to 340°C) and pyrolysate (340-550°C). The thermal bitumen correlates with the solvent extractable material (see above) whilst the pyrolysate fraction does not exist in a "free" state but is generated from the kerogen, thus simulating maturation in the subsurface. Abundances (weight ppm of rock) are measured with a flame ionisation detector against a standard. Thermal bitumen includes source indigenous, contaminant and migrated hydrocarbons but the pyrolysate abundance is a measure of ultimate source richness. The capillary gas chromatogram of the pyrolysate is used to evaluate the character of the parent organic matter and whether it is oil or gas prone. Peak temperature(s) of pyrolysate evolution is recorded. Carbon dioxide can be measured if requested but is normally ignored as the separation of the organic and inorganic species has been found to be artificial and unreliable.

Pyrolysate yields provide a definitive measure of potential source richness which avoids the ambiguities of the organic carbon data and the problem of contamination. This analysis is also used to evaluate the quality and character of the organic matter and the degree to which it has realised its ultimate hydrocarbon potential. Geochem does not employ the pyrolysis technique to evaluate maturation, preferring the kerogen and vitrinite reflectance analyses which avoid the problem of reworking and hence, are more reliable.

Capillary chromatograms produced for the pyrolysate hydrocarbons range from C_1 (methane) out towards C_{35} but exhibit considerable variations. They are used to define whether a source rock will yield oil, condensate or gas. With this new technique, it is now possible to complete the evaluation of a source rock.

The data are tabulated and presented graphically. MINI-PYROLYSIS includes ppm thermal bitumen and ppm pyrolysate. PYROLYSIS also provides the above together with the temperature of peak pyrolysate evolution. The capillary chromatograms of the pyrolysate obtained by PYROLYSIS-GC are reproduced in the report. The Mini-Pyrolysis analysis is recommended as a screening technique.

L) CORRELATION STUDY ANALYSES

Oil to oil and oil to parent source rock correlation studies require high resolution analytical techniques. This requirement is satisfied by some of the analyses discussed above but others have been selected specifically for correlation work. Many of these analyses also provide information upon the character of the environment of deposition of the parent source rocks.

- detailed C_4-C_7 hydrocarbon (gasoline range) analysis. See Section E. Although these hydrocarbons can be affected by migrational/alteration processes, they commonly provide a very useful correlation parameter.

- capillary gas chromatography of the C_{15+} paraffin-naphthenes. See section J. The branched:normal paraffin distributions are used to "fingerprint" the samples.

- capillary chromatograms of whole oils and of the C_{4+} fraction of source rocks.

- capillary gas chromatography of C_{15+} aromatic hydrocarbons. Separate chromatograms of the hydrocarbons and of the sulphur-bearing species are reproduced.

- high pressure liquid chromatograms.

- mass spectrometric carbon isotope analyses of crude oil and rock extract fractions and of kerogen separations. A powerful tool for comparing hydrocarbons and correlating hydrocarbons to organic matter. With this technique the problem of source rock contamination can be avoided. The data are recorded on x-y or Galimov plots.

- mass fragmentograms (mass chromatograms) of fragment ions characteristic of selected hydrocarbon groups such as the steranes and terpanes. The fragmentograms provide a convenient and simple means of presenting detailed mass spectrometric data and are used as a sophisticated fingerprinting technique. This provides the ultimate resolution for correlating hydrocarbons and facilitates the examination of hydrocarbon classes.

- vanadium and nickel contents.

Suites of (rather than single) analyses are employed in correlation studies, the actual selection depending upon the complexity of the problem. See also section N.

M) ANALYSES FOR SPECIAL CASES

M-1) ELEMENTAL KEROGEN ANALYSIS

This analysis evaluates source quality, whether the sediments are oil or gas prone, the character of the organic matter and its level of thermal maturation. It is the chemical equivalent of the visual kerogen analysis. The pyrolysis analysis is generally preferred to this technique, both methods providing similar information.

M-2) SULPHUR ANALYSIS

The abundance of sulphur in source rocks and crude oils.

M-3) CARBONATE CONTENT

The mineral carbonate content of sediments is determined by acid treatment. These data are particularly useful when used in conjunction with organic carbon contents as a screening technique.

M-4) NORMAL PARAFFIN ANALYSIS

Following the removal of the branched paraffins and naphthenes from the total paraffin-naphthene fraction, a chromatogram of the normal paraffins is obtained. The resulting less complicated chromatogram facilitates the examination of normal paraffin distributions.

M-5 SOLID BITUMEN EVALUATION

Residual solid bitumen after crude oil is generated by three prime processes; the action of waters, gas deasphalting, thermal alteration. Thus it provides a means of determining the reservoir history of a crude and of evaluating whether adjacent traps will or will not be prospective for oil. In carbonate sections, where organic matter is sometimes sparse, this technique is also used to evaluate thermal maturation levels.

The analysis involves the determination of the solubility (in CS_2) of the solid bitumen and of the atomic hydrogen to carbon ratio of the insoluble fraction.

N) CRUDE OIL ANALYSIS

N-1) API GRAVITY

This can be performed upon large (hydrometer) and small (SG bottle, pycnometer) samples and even upon stains extracted from sediments (refractive index).

N-2) SULPHUR CONTENTS (ASTM E30-47)

N-3) POUR POINT (ASTM D97-66, IP15/67)

N-4) VISCOSITY (ASTM D445-72, IP71/75)

N-5) FRACTIONAL DISTILLATION

Graph of cumulative distillation yield against temperature. Five percent cuts taken for further analysis. Mass spectrometric studies of these fractions provide a detailed picture of the distribution of paraffins and of the various naphthene and aromatic groups within a crude, which is useful both for correlation and for refinery evaluation purposes.